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SEMICONDUCTOR

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Inquiries on product

<http://www.lapis-semi.com/en/inquiry/index.html>

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Catalog No.56V6724E 10.2013

2014 SHORT FORM CATALOG

# 2014 SHORT FORM CATALOG

LAPIS Semiconductor Co., Ltd.

LAPIS Semiconductor Co., Ltd.

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We appreciate your patronage of our semiconductor devices and other electronic devices.

We appreciate your patronage of our semiconductor devices. The application field of semiconductors is diversified and varied, demanding higher performance and functionality as well as segmentation and higher density. We therefore present this comprehensive catalog, which has been compiled for the purpose of selecting optimal varieties for given applications. We will be pleased if you can make use of this catalog. In addition to the catalog, we also provide data sheets, manuals and other information on a per-product basis in response to our customers' requests. If you need any of these, please contact us.

LAPIS Semiconductor Co., Ltd.

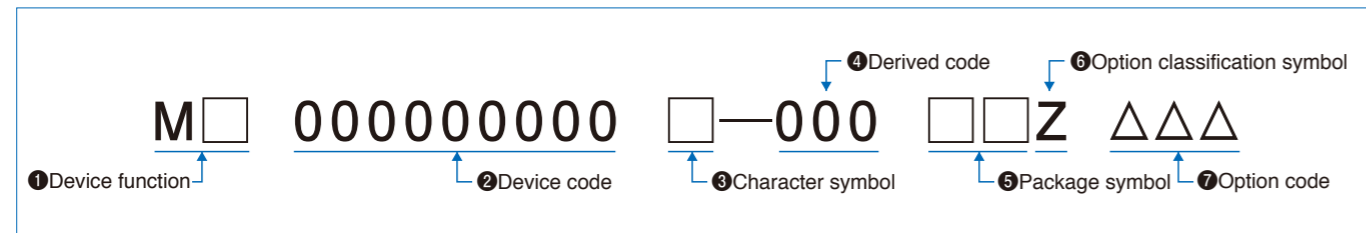
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# 2014 SHORT FORM CATALOG



Product names are assigned to our semiconductor devices using the following convention, starting with the character "M".

## Structure of Product Name



## Assignment of Symbols

### 1 Device function

The device functions are classified as follows:

- MD: DRAM
- MR: P2ROM™, OTPROM
- MS: SRAM
- MG: Gate array, standard cell
- ML: Logic
- MK: Module, chip set
- MT: Driver

### 2 Device code

The device code expresses a function specific to a device using a combination of numbers and alphanumeric characters.

### 3 Character symbol

The character symbol is added to indicate the modification of an existing product, to emphasize a specification that differs from the standard specification of an existing product, or to indicate a design standard.

### 4 Derived code

The derived code indicates the speed ranking for DRAM products and is used as a derived code for logic products.

### 5 Package symbol

The package symbol expresses the type and lead bending profile of a package in two digits.

### 6 Option classification symbol

The option classification symbol is used to distinguish between the option symbol and the package symbol.

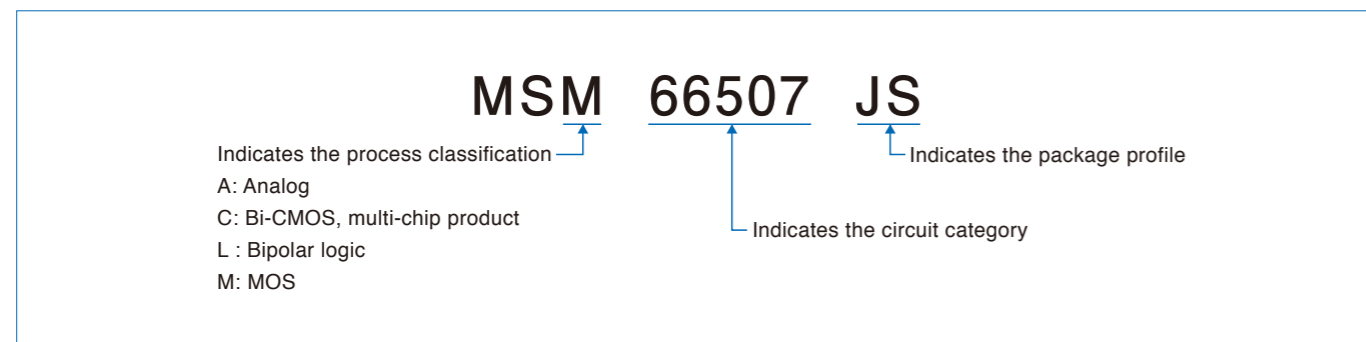
### 7 Option code

The option code indicates a symbol that identifies the specification of a product with an option.

\* Items from 1 "Device function", to 4, "Derived code", are indicated in this catalog.

The following shows the convention of item name assignment for conventional products.

## Product Name of Conventional Products



- A: Analog
- C: Bi-CMOS, multi-chip product
- L: Bipolar logic
- M: MOS

\* The actual package profile is not shown here.

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### Product Overview

This is a Communication LSI to connect and to be connected.

- Suitable for a range of applications, from toys and consumer devices to industrial equipment and automotive systems.
- Broad lineup utilizing a number of technologies.
- Offers multiple development tools that provide complete support.

#### OFDM Technology

• Reception of Digital Terrestrial Broadcasting

#### CODEC Technology

• VoIP CODEC • PCM CODEC  
• ADPCM CODEC

#### MODEM Technology

• Tele-control IC

#### Abundant Market Achievement

Home Electronics/Consumer Electronics/  
Car Electronics/Industrial Electronics/Toy...



#### CMOS-RF Technology

• IEEE 802.15.4  
• Specified low power radio  
• Bluetooth® Low Energy  
• Reception of Digital Terrestrial Broadcasting

#### Network Technology

• ZigBee®  
• ZigBee® RF4CE  
• Simple NWK

#### Customer Support

• Provide development tools  
• Provide advice based on rich experiences

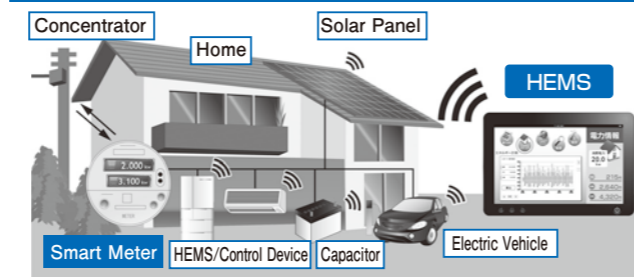
### Application Examples

This is a "Communication" LSI to be connected to anyone in any time and anywhere.

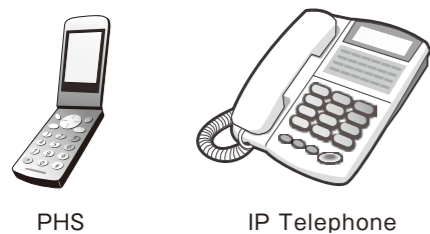
#### Bluetooth® Low Energy ▶ Health care/Fitness Equipment



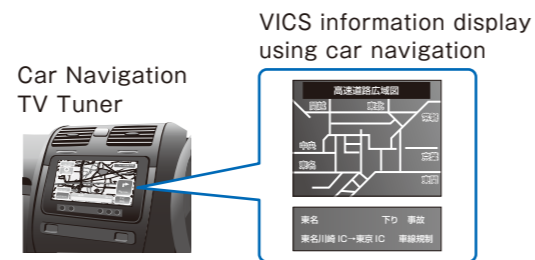
#### Special low power wireless communication ▶ Consumer electronics, housing facilities



#### VoIP LSI/PHS LSI ▶ Communication Devices



#### Digital Terrestrial Broadcasting Reception LSI/FM Data Broadcasting Reception LSI ▶ On-Vehicle Devices



Applied to Digital Terrestrial Broadcasting Reception/Remote Controller/Data Communication/Voice Communication

※ ZigBee® is a registered trademark of ZigBee® Alliance.  
※ Bluetooth® is a registered trademark of Bluetooth® SIG.

### Product Line-up

A variety of functions provide support for your applications.

#### Digital terrestrial broadcasting reception LSI

LSIs for Full-Segment/One-Segment broadcasting reception suitable for portable devices and car devices with superior mobile reception features, and LSIs for Chinese-standard digital terrestrial broadcasting reception with highly stable reception performance and low power consumption.

ML7147  
ML7138  
ML7109S

#### Wireless communication LSI

LSIs suitable for various applications including IEEE802.15.4/ZigBee®, Bluetooth® Low Energy and specified low-power radio system. Module products that can be easily integrated into applications are also available.

ML7105-00x ML7386x MK71050-02  
ML7275 ML7396x MK72750A-01  
ML7344x ML7406

#### VoIP LSI

This is a multifunctional LSI, suitable for VoIP phones and broadband routers with built-in VoIP functions.

ML7204-003  
ML7234-021  
ML7304-0x2

#### Echo Canceller LSI

This product is suitable for hands-free communication in mobile phones and door phones.

ML7037-003  
ML7247-001  
ML7202-001

#### PHS LSI

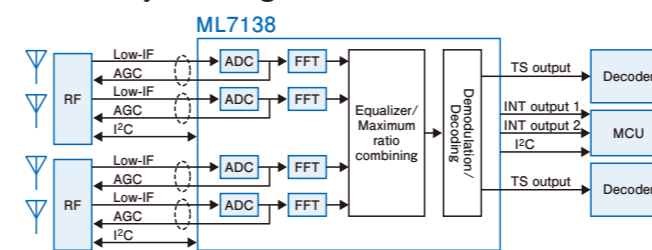
Reliable market achievement

The products are limited for the user who has the development experience in the PHS devices.  
For details, please inquire to the sales (ROHM Co., Ltd.).

This product list shows main products of communication LSI.

### Applied Circuit

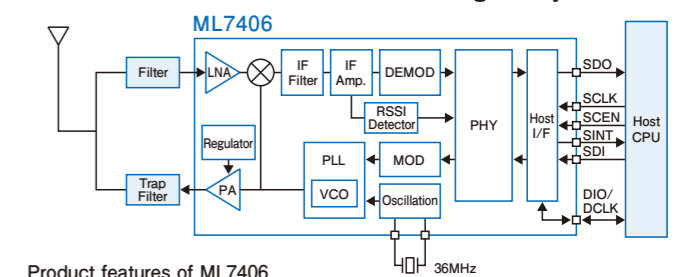
#### 4 Diversity/Full Segment OFDM Demodulation LSI



Product features of ML7138

- High sensitive reception with 4 diversity reception
- 2 diversity x 2CH reception (2TS output) supported
- Low Power Consumption, small size
- Noise canceller function available

#### Transceiver LSI for the Smart metering Utility Network



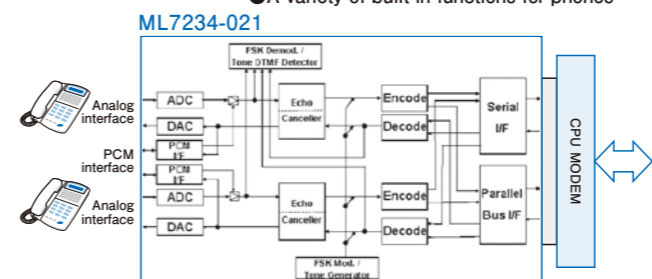
Product features of ML7406

- EN300-220 and EN13575-4:2011(Wireless M-bus) compliant
- Built-in packet handler for Wireless M-bus and general purpose
- High-speed carrier checking function

#### VoIP LSI

Product features of ML7234-021

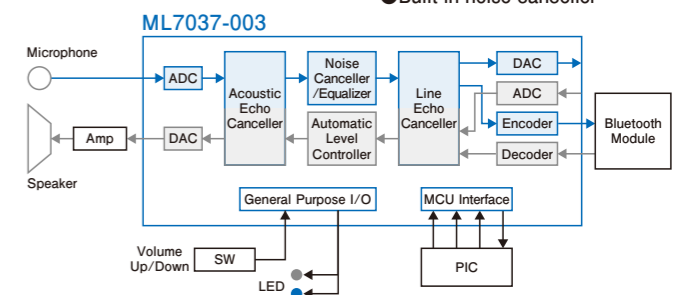
- Superior sound quality CODEC for 2ch VoIP
- A variety of built-in functions for phones



#### Echo Canceller LSI

Product features of ML7037-003

- Two systems of echo canceller
- Built-in noise canceller



## Digital terrestrial broadcasting reception LSI

### Japanese System (ISDB-T)

Description	Part Number
RF tuner + OFDM demodulator for 1 segment digital terrestrial broadcasting	ML7147
4 diversity/Full segment OFDM demodulation digital terrestrial broadcasting	ML7138 <b>NEW</b>

### Chinese System (DTMB)

Description	Part Number
Demodulator for Chinese digital terrestrial broadcasting	ML7109S

## Digital terrestrial broadcasting reception LSI

### Japanese System (ISDB-T)

Part Number	Transmission Standard	Package	Feature	Supply Voltage (V)	Power Consumption	Operating Temperature (°C)
ML7147	ISDB-T	WQFN80	Compliant to One-Seg broadcasting of ISDB-T(ARIB STD-B31) digital terrestrial television broadcasting. RF tuner, OFDM demodulate, error correction function. Serial, parallel TS output.	2.7~3.0 1.5~3.6 1.1~1.3	70mW (at 1seg reception, include RF)	-40~+90
ML7138 <b>NEW</b>	ISDB-T	TFBGA144	Support for reception of Full-Segment/ One-Segment broadcasting of ISDB-T (ARIB STD-B31) digital terrestrial television broadcasting. 4 diversity × 1CH or 2 diversity × 2CH reception. OFDM demodulate, error correction function, 2TS output function.	3.0~3.6 2.7~3.6 1.1~1.3	234mW (4 diversity full segment reception)	-40~+85

### Chinese System (DTMB)

2TS output function

Part Number	Transmission Standard	Package	Feature	Supply Voltage (V)	Power Consumption	Operating Temperature (°C)
ML7109S	GB20600-2006	WQFN64	China's national digital terrestrial broadcasting standard GB20600-2006 (DTMB) compliant demodulation. Built-in SDRAM for de-interleave. MPEG-2 serial/parallel TS output.	3.0~3.6 1.1~1.3	270mW (at reception)	-20~+85

## Wireless communication LSI

### IEEE802.15.4/ZigBee® LSI

Description	Part Number
USB interface transceiver LSI	ML7246
Serial interface transceiver LSI (NOT support AES function)	ML7265
Serial interface transceiver LSI (Support AES function)	ML7266
Serial interface transceiver LSI (Supports RF4CE)	ML7275

### Bluetooth® Low Energy LSI

Description	Part Number
Serial interface transceiver LSI	ML7105-00x <b>NEW</b>

### Specified low power radio(Sub-GHz band radio)

Description	Part Number
UHF Transmitter LSI	ML7066
UHF Transmitter LSI	ML7386
	ML7386B
UHF Transmitter LSI	ML7396B
	ML7396A
	ML7396E
	ML7344J <b>NEW</b>
	ML7344C (Under development)
	ML7344E (Under development)
	ML7406 <b>NEW</b>

## Wireless communication LSI

### IEEE802.15.4/ZigBee® LSI

Part Number	Support Standard	Package	Frequency Band	Supply Voltage (V)	Modulation Method	Encryption	Control I/F	Transmission Rate	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (°C)
ML7246	IEEE 802.15.4	WQFN48	2.4GHz ISM Band	3.0~3.6 (Connect USB)	O-QPSK	AES128	USB2.0	250kbps	0dBm	-92dBm (*1)	-40~+85
ML7265				2.1~3.6			Synchronous serial		-40 to 0 dBm (4 step)		
ML7266				1.8~3.6			Synchronous serial or UART		-45 to 0 dBm (3 step)		
ML7275	IEEE802.15.4 ZigBee®RF4CE	WQFN40									

\*1: PER(Packet Error Rate)<1%

### Bluetooth® Low Energy LSI

Part Number	Support Standard	Package	Frequency Band	Supply Voltage (V)	Modulation Method	Encryption	Control I/F	Transmission Rate	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (°C)
ML7105-00x <b>NEW</b>	Bluetooth® Core Spec v4.0 (Single mode)	WQFN32	2.4GHz ISM band	1.6~3.6	GFSK	AES128	Synchronous serial or UART	1Mbps	0/-6/-12/-18dBm	-86dBm	-20~+70

### Specified low power radio(Sub-GHz band radio)

Part Number	Support Standard	Package	Frequency Band	Supply Voltage (V)	Modulation Method	FEC Mode	Control I/F	Transmission Rate	Transmission Output (dBm)	Reception Sensitivity	Operating Temperature (°C)
ML7066	ARIB STD-T67, RCR/STD-30	WQFN48	426MHz band 429MHz band	2.1~3.6	2-FSK	—	Synchronous serial (Control) DI(DATA)	1.2kbps, 2.4kbps, 4.8kbps [NRZ] (3-step setting function)	1mW/10mW	-116dBm [BER<1%](*2)	-25~+65
ML7386	—	WQFN28	350~450MHz	1.8~3.6	2-FSK MSK	—	Synchronous serial (Control) DI(DATA)	2.4kbps, 4.8kbps [NRZ]	10mW typ.	—	-25~+85
ML7386B									1mW/10mW typ.		
ML7396B	ARIB STD-T108	WQFN40	750~1000MHz	1.8~3.6	2-(G)FSK (G)MSK	IEEE 802.15.4g compliant	Synchronous serial (Control) DI(O)DI(DATA)	~50kbps	1mW/10mW/20mW	-106dBm [100kbps BER=0.1%](*2)	-40~+85
ML7396A	FCC part15.247/249										
ML7396E	EN300-220										
ML7344J <b>NEW</b>	ARIB STD-T67, RCR/STD-30										
ML7344C (Under development)	Q/GDW347.3	WQFN32	168~510MHz	1.8~3.6	2-(G)FSK (G)MSK	—	Synchronous serial (Control) DI(DATA)	1.2kbps to 15kbps	1mW/10mW/20mW/100mW	-117dBm [4.8kbps BER=0.1%](*2)	-40~+85
ML7344E (Under development)	EN300-220										
ML7406 <b>NEW</b>	EN300-220 EN13575-4 (Wireless M-bus)	WQFN32	750~1000MHz	1.8~3.6	2-(G)FSK (G)MSK	—	Synchronous serial (Control) DI(DATA)	~500kbps	1mW/10mW/20mW	-106dBm [100kbps BER=0.1%](*2)	-40~+85

\*2: BER means Bit Error Rate.

# Communication LSI

## Wireless communication module

### IEEE802.15.4 ZigBee®

Description	Part Number
2.4GHz wireless communication module	MK72220-01
	MK72660-01
	MK72750A-01

### Bluetooth® Low Energy

Description	Part Number
2.4GHz wireless communication module	MK71050-02 (Under development)

## VoIP LSI

### VoIP CODEC

Description	Part Number
VoIP Codec	ML7074-003
	ML7074-004
	ML7204-003
2ch VoIP Codec	ML7214A-001
4ch VoIP Codec	ML7224A-001
2ch VoIP Codec	ML7234-021

### VoIP Processor

Description	Part Number
VoIP Processor	ML7304-0x2

## Echo Canceller LSI

### Echo Canceller

Description	Part Number
Dual echo canceller + ADPCM transcoder	ML7202-001

### Echo Canceller / Noise Canceller

Description	Part Number
Dual echo canceller/ Noise canceller with dual Codec	ML7037-003
Echo canceller/ Noise canceller with dual wide-band codec	ML7247-001 <b>NEW</b>

※ZigBee® is a registered trademark of ZigBee® Alliance.  
 ※Bluetooth® is a registered trademark of Bluetooth® SIG.

## Wireless communication module

### IEEE802.15.4 ZigBee®

Part Number	Support Standard	Size	Frequency Band	Supply Voltage(V)	Transmission Output	Reception Sensitivity	Control I/F	Type	Operating Temperature (°C)	Note
MK72220-01	IEEE802.15.4	21.5×32.8×2.1mm	2.4GHz ISM Band	2.7~3.6	0dBm	-92dBm(*1)	UART	Connector	-20~+60	Built-in LAPIS Semiconductor's original network
MK72660-01	IEEE802.15.4	30.0×32.0×3.1mm		2.1~3.6	0dBm	-92dBm(*1)	Synchronous serial	Connector	-20~+70	—
MK72750A-01	IEEE802.15.4 ZigBee® RF4CE	20.0×31.0×2.7mm		1.8~3.6	0dBm (3steps)	-92dBm(*1)	UART	Connector	-40~+85	Built-in ZigBee® RF4CE network

\*1: PER(Packet Error Rate)<1%

### Bluetooth® Low Energy

Part Number	Transmission Standard	Size	Frequency Band	Supply Voltage(V)	Transmission Output	Reception Sensitivity	Control I/F	Type	Operating Temperature (°C)	Note
MK71050-02 (Under development)	Bluetooth® Core Spec v4.0 (Single mode)	11x13x1.60mm	2.4GHz ISM Band	1.6~3.6	0/-6/-12/-18 dBm	-86dBm	Synchronous serial or UART	SMT	-20~+70	Bluetooth® certified Radio Act, CE mark

## VoIP LSI

### VoIP CODEC

Part Number	Package	Speech Compression Method	Operating Frequency	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (°C)
ML7074-003	QFP64	G.729.A/G.726/G.711	4.096MHz	3.0~3.6	65mA	-20~+60
ML7074-004	QFP64	G.729.A/G.711	4.096MHz	3.0~3.6	65mA	
ML7204-003	QFP64	G.729.A/G.711	12.288MHz	3.0~3.6	65mA	
ML7214A-001	TQFP100	G.711	12.288MHz	3.0~3.6	65mA	
ML7224A-001	LQFP176	G.711	12.288MHz	3.0~3.6	125mA	
ML7234-021	TQFP100	G.711/G.722	12.288MHz	3.0~3.6	120mA	

### VoIP Processor

Part Number	Package	Speech Compression Method	Operating Frequency	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (°C)
ML7304-0x2	QFP208	G.729.A/G.711/G.722	12.288MHz	3.0~3.6	210mA	-20~+60

## Echo Canceller LSI

### Echo Canceller

Part Number	Package	Cancelable Echo Delay Time	Voice Signal Interface	Supply Voltage (V)	Operating Frequency	Notes
ML7202-001	TQFP64	64ms/channel	μ-law, A-law	3.0~3.6	19.2MHz	Tone Gen/Det., VOX, Gain Control, Time Slot Assignment, etc.

### Echo Canceller / Noise Canceller

Part Number	Package	Cancelable Echo Delay Time	Voice Signal Interface	Supply Voltage (V)	Operating Frequency	Notes
ML7037-003	TQFP64	Acoustic side 64ms, Line side 20ms	Acoustic side : analog, Line side : analog, 16-bit linear, μ-law PCM	3.0~3.6	12.288MHz	Noise cancellation = 6~18dB
ML7247-001 <b>NEW</b>	TQFP64	Acoustic side 64ms	Acoustic side : analog, Line side : analog, 16-bit linear	3.0~3.6	12.288MHz	Noise cancellation = 1~45dB Sampling frequency = 8kHz or 16kHz

## CODEC LSI

### PCM CODEC

Description	Part Number
Multifunction 2ch PCM CODEC	ML7033-01
3V linear PCM Codec	ML7041
	MSM7732A
3V PCM CODEC	MSM7717-01
3V 2ch PCM CODEC	MSM7704-01
5V PCM CODEC	MSM7578V
5V 2ch PCM CODEC	MSM7533V

### ADPCM CODEC

Description	Part Number
ADPCM Codec compliant with G.726	ML7029

## CODEC LSI

### PCM CODEC

Part Number	Package	PCM sign			Channel Number	Supply Voltage (V)	PCM Synchronous Type		Analog Output			Notes
		$\mu$ -law	A-law	14-bit linear			long	short	full swing	output load	differential	
ML7033-01	QFP64	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2	4.75~5.25	<input type="checkbox"/>	<input type="checkbox"/>	3.4Vpp	20k $\Omega$		
ML7041	TQFP48	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	2.4~3.3	<input type="checkbox"/>	<input type="checkbox"/>	2.6Vpp	8 $\Omega$	<input type="checkbox"/>	With tone generators, regulators, and I <sup>2</sup> C I/F
MSM7732A	TQFP48/BGA48	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1	2.4~3.3	<input type="checkbox"/>	<input type="checkbox"/>	3.0Vpp	32 $\Omega$	<input type="checkbox"/>	With tone generators
MSM7717-01	SSOP20	<input type="checkbox"/>	<input type="checkbox"/>		1	2.7~3.8	<input type="checkbox"/>		2.0Vpp	600 $\Omega$	<input type="checkbox"/>	
MSM7704-01	SOP24	<input type="checkbox"/>	<input type="checkbox"/>		2	2.7~3.8	<input type="checkbox"/>		2.0Vpp	1.2k $\Omega$		
MSM7578V	SOP24/SSOP20	<input type="checkbox"/>	<input type="checkbox"/>		1	4.75~5.25	<input type="checkbox"/>		2.4Vpp	600 $\Omega$		
MSM7533V	SOP24	<input type="checkbox"/>	<input type="checkbox"/>		2	4.75~5.25	<input type="checkbox"/>		3.4Vpp	600 $\Omega$		

### ADPCM CODEC

Part Number	Package	PCM Interface	Operating Frequency	Supply Voltage (V)	Analog Output	Supply Current (Max.)	Operating Temperature (°C)
ML7029	SSOP30	$\mu$ -Law	10.368MHz	2.7~3.6	1.3Vpp, 20k $\Omega$	12mA	-25~+70

## Modem LSI

### Tele-control IC

Description	Part Number
1200bps, HDX modem,DTMF transceiver, CPT	ML7020
DTMF transceiver	ML7005
2400bps single chip full duplex data modem with protocol	ML7012-06

## Modem LSI

### Tele-control IC

Part Number	Package	Standard	Supply Voltage (V)	Supply Current (Max.)	Operating Temperature (°C)
ML7020	SSOP32	ITU-T V.23	4.5~5.5	5mA	-40~+85
ML7005	SSOP32		2.7~5.5	5mA	-30~+85
ML7012-06	QFP64	ITU-T V.22bis, V.22, V.21	2.7~3.6	35mA	-20~+70

## PHS LSI

### Baseband IC for PHS

Description	Part Number
Baseband for PHS	ML7098C-01
	ML7207-01
Baseband for PHS supporting W-OAM	ML7257-01

## PHS LSI

### Baseband IC for PHS

Part Number	Package	CPU Performance	SLOT	Built-in Memory	Supply Voltage (V)
ML7098C-01	BGA208	19.2MHz	2	16KB	3.0V/2.5V
ML7207-01	BGA208		4	128KB	
ML7257-01	BGA208	57.6MHz			32KB

\*The products are limited for the user who has the development experience in the PHS devices. For details, please inquire to the sales (ROHM Co., Ltd.).

### PHS modem transcoder




Description	Part Number
$\pi/4$ shift QPSK modem	MSM7582B
4ch ADPCM transcoder	MSM7581

### PHS modem transcoder

Part Number	Package	Feature	Supply Voltage (V)	Supply Current	Operating Temperature (°C)
MSM7582B	TSOP(I)32	$\pi/4$ shift QPSK modem	2.7~3.6	14mA	-25~+70
MSM7581	TQFP100	4ch ADPCM transcoder	2.7~5.5	5mA	-30~+80

## Car communication LSI

### FM data broadcast reception LSI

Description	Part Number
FM data reception tuner	ML7114B  (Under development)
	ML7174 (Under development)
FM multiplexing demodulate for VICS	MSM9565 
	ML9574 
FM multiplexing demodulate for DARC	MSM9563

: This LSI is limited to the market in Japan.

### FM data broadcast reception LSI

Part Number	Feature	Package	Supply Voltage (V)	Operating Temperature (°C)	Supply Current (Max.)
ML7114B (Under development)	FM VICS®/DARC® tuner	WQFN32	3.0~3.6V	-40~+85°C	TBD
ML7174 (Under development)	FM VICS®/DARC® tuner, FM multiplexing demodulate LSI for VICS®(DARC®), Built-in BPF, frame memory, and VICS® descrambler, Frames A,B,C, SPI slave	WQFN64	3.0~3.6V	-40~+85°C	TBD
MSM9565	FM multiplexing demodulate LSI for VICS®(DARC®), Built-in BPF, frame memory, and VICS® descrambler, Frames A,B,C, 8bit bus interface	QFP44	3.0~3.6V	-40~+85°C	28mA
ML9574	FM multiplexing demodulate LSI for VICS®(DARC®), Built-in BPF, frame memory, and VICS® descrambler, Frames A,B,C, 16bit bus interface	TQFP64	3.0~3.6V	-40~+85°C	35mA
MSM9563	FM multiplexing demodulate LSI for DARC®, Built-in BPF and frame memory, Frames A,B,C, 8bit bus interface	QFP44	3.0~3.6V	-40~+85°C	28mA

# Microcontroller

## 8-bit Microcontroller Overview

### Product Overview

LAPIS Semiconductor's 8-bit microcontroller series products with our onboard RISC-based original 8-bit CPU "UA Core" provide industry-leading\* low power consumption with special features including Flash memory that enables reading at only 1V and technology that can minimize leakage current in high-temperature operation.

Our 8-bit microcontroller series products include; ML610400 series, which can run for 10 years using a single battery; ML610300 series for audio output applications with its built-in one-chip high-quality sound playback and high-output speaker amplifier functions; ML610100 series for appliances such as rice cookers, LED lighting controller and motor controller applications; and ML610790 family that can provide integrated control for smartphone sensors with low-power consumption. Our wide range of products is suitable for various applications ranging from battery-driven small devices to industrial equipment.

\* Based on LAPIS Semiconductor's data

### Application Examples

Series	Type	Applications
ML610400 Series	Standard type	Electronic Shelf Label, Remote Controller for Lighting, Various Remote Controllers, Controller for TV
	Built-in LCD Driver Dot Matrix Type	Pedometer with graph, Performance Weather Station, Electronic Sports (Multifunction) Watch, Electronic Wristwatch, Bicycle meter, Temperature logger
	Built-in LCD Driver Segment Type	Clock, Thermostat, Pedometer, Electronic Shelf Label, Digital Thermometer, Token Machine
ML610300 Series	Speech Output Function Type	Hot-Water Remote Controller, Home Bakery, Indoor Fire Alarm
ML610100 Series	5V Driven Type	Rice Cooker, LED Light, Electric Drill
ML610790 Family	Sensor Control Type	Smartphone, Mobile Phone, Mobile Phone Accessory, Sensor Network Module

### Product Line-up

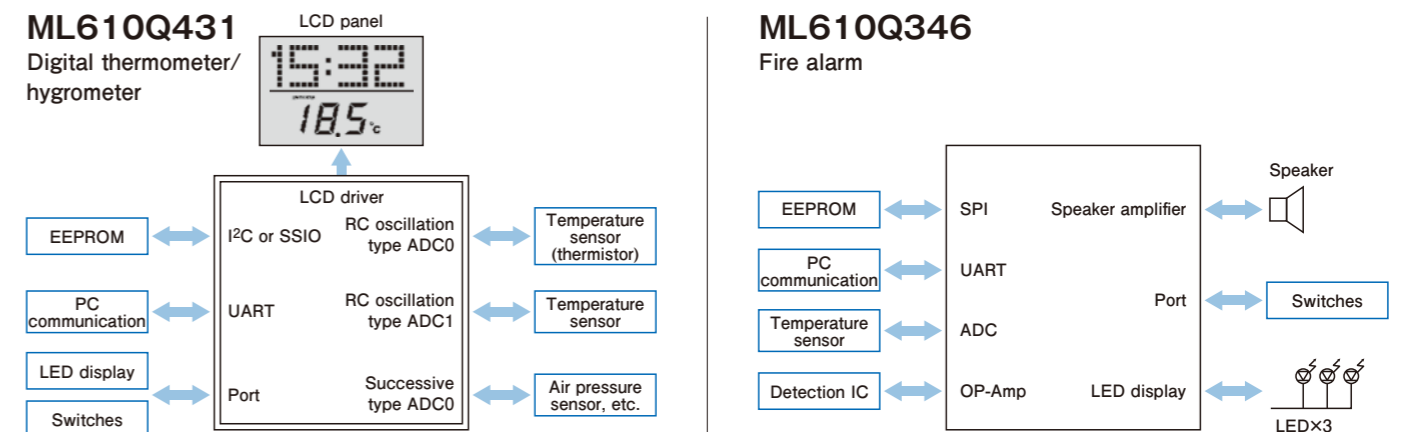
ROM Capacity (Byte)	Standard type	Built-in LCD Driver Dot Matrix Type	Built-in LCD Driver Segment Type	Speech Output Function Type	5V Driven Type	Sensor Control Type
160K				ML610Q360 ML610Q359		
128K				ML610(Q)347 ML610(Q)346 ML610Q173 ML610Q172	ML610Q385 ML610Q384 ML610Q383 ML610Q380	ML610Q439(P) ML610Q438(P)
96K		ML610Q304	ML610(Q)340		ML610Q178	ML610Q436 ML610Q435
88K				ML610Q355	ML610Q356	
64K				ML610Q794G ML610Q793 ML610(Q)482(P)		ML610Q419(P) ML610Q419(P)C
48K				ML610Q488(P)		ML610(Q)429(P) ML610(Q)428(P)
40K					ML610(Q)426(P) ML610(Q)426(P)C	
32K			ML610Q112	ML610Q486(P) ML610(Q)485(P)		ML610(Q)422(P) ML610(Q)421(P)
24K	ML610Q111				ML610(Q)479(P) ML610(Q)478(P) ML610(Q)477(P)	
16K		ML610Q484(P)			ML610Q463(P) ML610Q462(P) ML610Q461(P)	ML610(Q)476 ML610(Q)475 ML610(Q)408(P) ML610(Q)407(P)
8K				ML610(Q)473(P) <sup>(*)</sup> ML610(Q)472(P) <sup>(*)</sup> ML610(Q)471(P) <sup>(*)</sup>	ML610(Q)478 ML610(Q)475 ML610(Q)406(P) ML610(Q)405(P) ML610Q404(P)	
6K	ML610Q102			ML610Q403(P) ML610Q402(P) ML610Q401(P)		
4K	ML610Q101					

Package (number of pins): 16pin, 20pin, 28pin, 30pin, 32pin, 48pin, 64pin, 80pin, 100pin, 120pin, 128pin, 144pin

ML610QXXX  
Code with Q: Flash ROM Version  
Code without Q: Mask ROM Version  
Code with P: Temperature Extension Version

\*1: 48pin and 64 pin types are available for ML610(Q)471(P)/ML610(Q)472(P)/ML610(Q)473(P)

### Applied Circuit











# Microcontroller

## ARM-Based 32-bit Microcontroller Specifications

Description	Part Number	Built-in Memory			CPU Core	Operating Frequency (Max.)	Operating Condition			Peripherals							Package														
		ROM /Flash	RAM	Cash			Supply Voltage (V)	Operating Temperature (°C)	Supply Current (Typ.)	General-purpose Ports	Timer	PWM	WDT	A/D	Serial Ports	Interrupt Internal/External		Additional Peripheral Functions													
For General-purpose Applications	ML674000	—	8KByte	—	ARM7TDMI	33MHz	I/O:3.0~3.6 core:2.25~2.75	-40~85	55mA (Operating at 16MHz)	32	7	16bit×2	16bit×1	10bit A/D 8ch	UART 2ch	19/5	DMA controller 2ch External memory controller [ROM(Flash), SRAM, DRAM(EDO/SDRAM), IO] STOP mode	TQFP128 LFBGA144													
	ML674001		32KByte	8KByte unified		60MHz			52mA(33MHz, when using external ROM) 92mA(60MHz, when using external ROM)					42			10bit A/D 4ch		UART 2ch SSIO 2ch I <sup>2</sup> C 1ch	DMA controller 2ch/External memory controller [ROM(Flash), SRAM, DRAM(EDO/SDRAM), IO] STOP mode											
	ML675001																														
For Space Saving Applications	ML67Q4050	64KByte(Flash)	16KByte	—	ARM7TDMI	33MHz	I/O:3.0~3.6 core:2.25~2.75	-40~85	70mA (Operating at 33MHz)	108	7 (6 share the circuit with PWM as multi-functional timer)	8 (6 share the circuit with timer as multi-functional timer)	16bit×1	10bit A/D 4ch	UART 3ch I <sup>2</sup> C 1ch SPI 2ch	35/5	DMA controller 2ch External memory controller [ROM(Flash), SRAM, IO] RTC, I <sup>2</sup> S(send, receive) 1ch STOP mode	LQFP144 LFBGA144													
	ML67Q4051	128KByte(Flash)																													
	ML67Q4060	64KByte(Flash)																													
	ML67Q4061	128KByte(Flash)																													
For Amusement	ML675011	—	64KByte	8KByte unified	ARM7TDMI	60MHz	I/O:3.0~3.6 core:1.35~1.65	0~70	126mA (60MHz, when using external ROM)	26	7	16bit×2	16bit×1	—	UART 1ch SSIO 1ch	18/5	DMA controller 2ch External memory controller [ROM(Flash), SRAM, DRAM(EDO/SDRAM), IO]	LQFP144													
	ML675013	—	64KByte	8KByte unified	ARM7TDMI	56MHz	I/O:3.0~3.6 core:1.35~1.65	0~70	160mA (56MHz, Output load is a load of the LSI tester.)	34	7 (6 share the circuit with PWM as multi-functional timer)	8 (6 share the circuit with timer as multi-functional timer)	16bit×1	—	UART 3ch SPI 2ch I <sup>2</sup> C 2ch SSIO 1ch SBTX (*1) 6ch	39/5	DMA controller 10ch (2ch compatible with ML675011) External memory controller [ROM(Flash), SRAM, DRAM(SDRAM), IO]	LQFP144													

\*1: SBTX is a serial bus dedicated for output.

## Low-power consumption solar power generator control LSI specifications

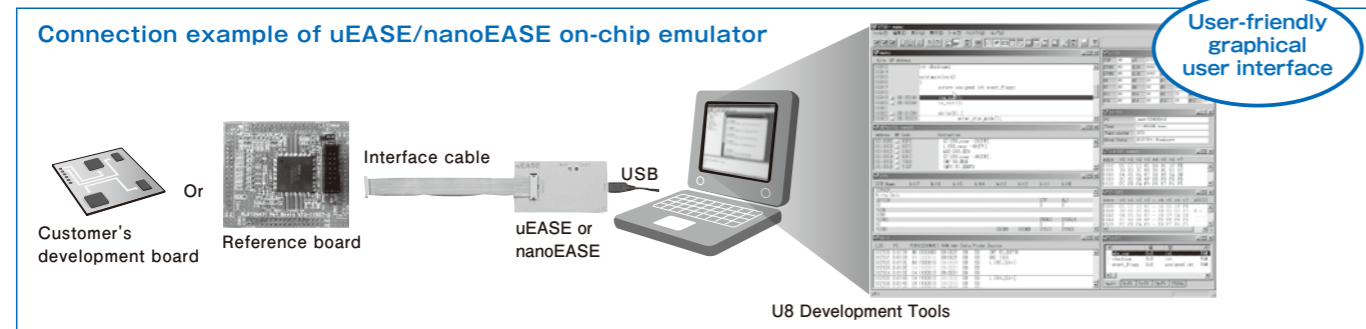
Part Number	Operating Condition				Function/Feature			
	Operating Voltage VBAT(V)	Operating Voltage VSC(V)	Current Consumption (A) at VBAT	Operating Temperature (°C)	VBAT-VDO Output Impedance	VSC-VBAT Secondary Battery Recharge Potential Difference	Overcharge Protection Voltage VLD (V)	Low Voltage Detection Voltage VTBOT (V)
ML9077	0.0~3.2	0.0~3.6	80n	-20~+70	50mV/20mA @VBAT≥1.8V	0.1V/1mA @VSC≥2V	2.6/3.1	1.15/1.8

Part Number	Operating Condition				Function/Feature		
	Operating Voltage VBAT(V)	Operating Voltage VSC(V)	Current Consumption (A) at VBAT	Operating Temperature (°C)	VBAT-VDO Output Impedance	VSC-VDO Input impedance	Regulator voltage (V)
ML9078-001	1.1~3.6	0.0~4.0	80n	-20~+70	150mV/2mA@VBAT≥2V	130mV/2mA@VBAT≥2V	3.3/1.65
ML9078-002	1.1~3.6	0.0~4.0	80n	-20~+70	150mV/2mA@VBAT≥2V	130mV/2mA@VBAT≥2V	3.0/1.5
ML9078-003	1.1~3.6	0.0~4.0	80n	-20~+70	150mV/2mA@VBAT≥2V	130mV/2mA@VBAT≥2V	VBAT

# Microcontroller

## 8-bit Microcontroller Program Development Support System

### Development Support System's Tool Screen and Connection Example



#### On-chip debug emulator uEASE/nanoEASE

This compact, cost-saving emulator supports onboard debugging and writing to Flash memory by utilizing on-chip debugging functions when connected to the actual device.

#### U8 Development Tools

This software suite consists of project management tools, build tools, debug tools and Flash programming tools and provides effective support for program development. Users can smoothly perform programming to debug process using the package's intuitive graphical user interface.

#### Reference board with built-in microcomputer

This is a board with a built-in microcomputer and minimum essential components. Users can connect this board to uEASE/nanoEASE to test operation of ML610400/ML610300/ML610100 series products as well as ML610790 family products. Users also can develop software and process Flash writing using this board.

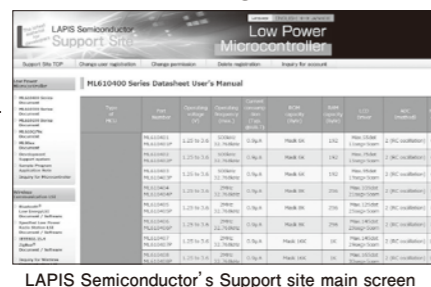
#### On-chip Emulator uEASE/nanoEASE Specification Overview

	uEASE	nanoEASE
Support device	Microcomputer with on-chip debug functions	Microcomputer with built-in single power Flash memory and on-chip debug functions
Operating voltage	VTref=1.55V~5.5V(Input voltage to VTref signal)	3.3V (Input voltage to VTref signal)
Emulation	Real-time emulation, step emulation Step in/Step out/Step over	
Break	Go to Cursor / Break point Address path count Path count: 1 to 65,536 RAM data match 1 point Conditions: Mask setting - Address and data, Access method - Read, write, Access unit: Byte, Word Establishment conditions: Equal, Not Equal, Path count: 1 to 65,536	
Display/change	Program space/Data space/SFR/Register	
Run time measurement	Unit: 100μs Maximum measurement time: 119 hours (free run)	
Flash writing function	Functions for downloading programs to the Flash memory built in the target microcomputer (when using a microcomputer with a built-in Flash memory)	
Host interface	USB2.0 High-Speed	USB2.0 Full-Speed
Supply voltage	+5V, 500mA (Supplied by USB VBUS on the HOST PC)	
Outside dimension	50.0(D)90.0(W)17.0(H)[mm]	50.0(D)60.0(W)7.0(H)[mm]
Weight	50g	15g

### About LAPIS Semiconductor's Support on the Web

LAPIS Semiconductor provides latest information on a dedicated Web site for registered users. Registered users can receive the following benefits:

- Downloading latest data sheets/users manuals including preliminary versions.
- Downloading latest software tools.
- Receiving e-mail regarding product update information from LAPIS Semiconductor



To access to the support page, users are required to register for obtaining an ID and password. Open the support page from the LAPIS Semiconductor's Web site or enter the following URL and click [New Registration] button. Support page URL <https://www.lapis-semi.com/cgi-bin/MyLAPIS/regi/login.cgi>



### Product Line-up

Product	Main Contents	Support Microcontrollers
uEASE	<p>On-chip emulator uEASE (main unit) U8 Development Tools USB cable</p> <p>uEASE Interface cable</p> <p>uEASE is a general on-chip emulator and support all the 8bit Flash microcomputers. "U8 Development Tools" software suit is included. This suit provides program build, debug and Flash writing functions.</p>	<p>uEASE main unit uEASE interface cable USB cable</p> <p>U8 Development Tools(*) ·Project management tool ·Build tool ·Debug tool ·Flash programming tool (FWuEASE Flash writer) ·LcdAtU8LCD image tool ·ROM code generation tool for code entry ·Each tool's user's manuals</p> <p>ML610400/ ML610300/ ML610100 Series, and ML610790 Family</p> <p>&lt;U8 Development Tools operating environment&gt; ·Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported.</p>
nanoEASE	<p>On-chip emulator nanoEASE (main unit) U8 Development Tools USB cable</p> <p>nanoEASE Interface cable</p> <p>nanoEASE an on-chip emulator and supports 8-bit Flash microcomputers that is operated with a single power supply (voltage developed internally). "U8 Development Tools" software suit is included. This suit provides program build, debug and Flash writing functions.</p>	<p>nanoEASE main unit nanoEASE interface cable USB cable</p> <p>U8 Development Tools(*) ·Project management tool ·Build tool ·Debug tool ·Flash programming tool (FWuEASE Flash writer) ·LcdAtU8LCD image tool ·ROM code generation tool for code entry ·Each tool's user's manuals</p> <p>Please contact LAPIS Semiconductor for applicable microcontrollers.</p> <p>&lt;U8 Development Tools operating environment&gt; ·Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported.</p>
Reference Board	<p>Reference board with built-in microcomputer</p> <p>This is a board with a built-in microcomputer and minimum essential components. Users can test operation of microcomputers. Users also can develop software and process Flash writing using this board.</p>	<p>Reference board main unit User's manual (*)</p> <p>Please contact LAPIS Semiconductor for details.</p>
ML610400 Series Demo kit	<p>ML610Q431 Reference board + ML610400 Series Demo board Sample Peripheral drivers</p> <p>This demo kit includes "ML610Q431 Reference Board", which consists of various additional devices including on-board temperature and humidity sensors as a standard component. If you need to use another reference board other than "ML610Q431 Reference Board", please purchase a necessary reference board and components.</p>	<p>ML610Q431 Reference board + ML610400 Series Demo board Sample peripheral drivers (*) API manual, AP note, manuals for each board</p> <p>ML610400 Series</p>
MWuEASE	<p>MWuEASE Flash multi writer</p> <p>MWuEASE Flash multi writer can write program files to multiple Flash memory units (maximum 32 units) of a single type. If you use MWuEASE, please purchase corresponding number of uEASE units.</p>	<p>MWuEASE Flash multi writer (*) ·Flash programming tool ·User's manual</p> <p>ML610400/ ML610300/ ML610100 Series, and ML610790 Family</p>
Speech LSI Utility	<p>Speech synthesis utility tool Speech LSI Utility</p> <p>This tool enables users to convert a WAV format file to LAPIS Semiconductor's original ADPCM2 format and to edit phrases. In addition, users can easily manipulate voice data such as sound clipping/connection and fade-in/fade-out.</p>	<p>Speech LSI Utility (*) ·Speech synthesis utility tool ·User's manual</p> <p>ML610300 Series</p> <p>&lt;Speech LSI Utility operating environment&gt; ·Windows XP, Windows Vista*, Windows 7* *32bit(x86)/64bit(x64) are supported. ·Windows compatible 16-bit or higher sound card and speaker</p>

\* Software and manuals can be downloaded from member's Web site "LAPIS Semiconductor Low Power Microcontroller Support Page"

# Speech synthesis LSI

## Speech synthesis LSI Overview

### Product Overview

Playbacks "human voice" and "sound effect" in clear sound

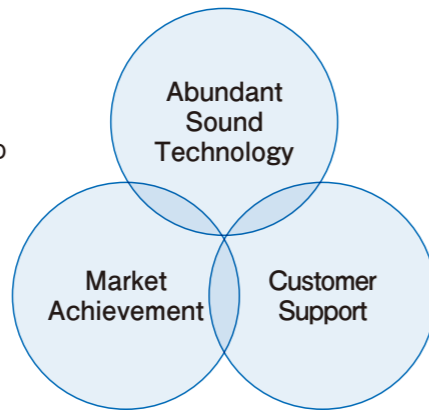
- Abundant Market Achievement: This product has been used in a variety of applications, such as toys and cars, for around 30 years.
- We offer a wide selection of products, focusing on superior sound quality ADPCM method.
- We provide a wide range of customer support covering recording and sample creation

#### Peripheral Technology

- Ultra low power
- P2ROM™/Flash/Mask ROM
- High-output speaker amplifier class AB/class D
- 8bit RISC CPU

#### Abundant Market Achievement

Home Electronics/Consumer electronics/  
Car Electronics/Industrial Electronics/  
Toy/Communication Device/Security...



#### Sound Technology

- ADPCM2/Non-linear PCM/HQ-ADPCM
- High frequency compensation filter
- Speech speed conversion/pitch conversion

#### Customer Support

- Contract Narrator with rich experience in LSI processing
- Recording support/Voice analysis, Editing/Sound effect creation

### Application Examples

This is a "Speech LSI" which has superior features in reproducing and recording natural sound.

#### Home Electronics

The current room temperature is 25°C.  
Please clean the filter.  
Your rice is ready.

#### Car Electronics

The fare is 1300 yen.  
Click, click. Please fasten your seat belt.  
Next stop is xxxx.

#### House Equipment

Please check the pot's location.  
Heating power is reduced to medium.  
There is a fire!

#### Consumer Electronics/IT

Copy is completed.  
Please insert a card.  
Fax transmission is completed.

#### Industrial Electronics

Ding dong. 4th floor.  
There is an intruder!  
Beep-beep.  
Ping pong

#### Toy

Coo-coo.

This product is used in voice guidance, sound effect, and melody functions.

### Product Line-up

A variety of functions provide support for your applications. We also offer products for universal design.

#### Speech synthesis LSI with built-in large-capacity P2ROM™

This product can be used in a variety of applications, including home and industrial electronics.

ML228xxSeries  
ML227xxSeries

#### Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

Suitable for applications that need short sounds or sound effects, such as security alarms and toys.

ML2256xSeries  
ML223xxSeries

#### Speech synthesis LSI for automotive

Suitable for in-vehicle applications, such as indicator sound, ETC, and meter panel.

ML2257xSeries  
ML223xxSeries

#### 8-bit microcontroller with speech function

Suitable for security alarms, toys, etc. Simple control and high-quality speech playback functions are integrated on a single chip.

ML61034xSeries  
ML61035xSeries  
ML61038xSeries

#### Speech synthesis LSI with external memory

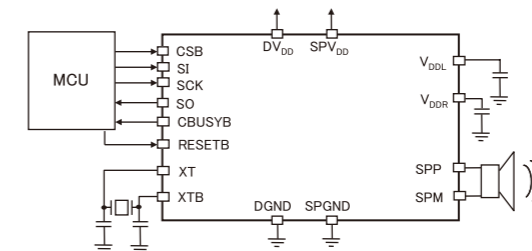
Memory of 128M bits with a built-in speaker amplifier can be connected for long-time playback.

ML224xxSeries

This product list shows main products of speech synthesis LSI.

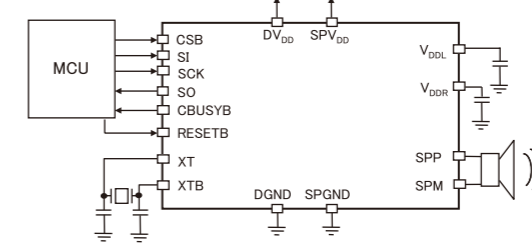
### Applied Circuit

Speech synthesis LSI with built-in large-capacity P2ROM™



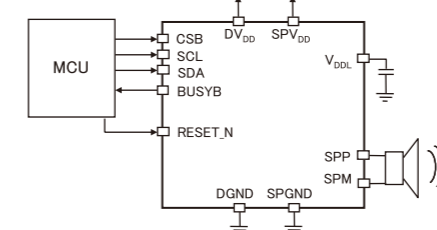
- Product features of ML2282x
- Built-in speaker amplifier 0.7W AB-class (at 5.0V)
  - Various products for different CPU I/Fs  
SPI : ML2282x  
I<sup>2</sup>C : ML2286x
  - Wide selection of P2ROM™ memory capacity 4 Mbit/8 Mbit/16 Mbit

Speech synthesis LSI for automotive



- Product features of ML22Q5xx
- Built-in speaker amplifier 1.0W AB-class (at 5.0V)
  - Rated operating temperature -40°C ~ +105°C
  - High quality speech playback Built-in HQ-ADPCM

Speech synthesis LSI with built-in medium/small-capacity Flash ROM



- Product features of ML22Q3x4
- Built-in speaker amplifier 1.0W D-class (at 5.0V)
  - Various products for different CPU I/Fs  
SPI: ML22Q374  
I<sup>2</sup>C: ML22Q394
  - Reduced mounting space/parts Small pin PKG (SSOP16)/built-in oscillator

# Speech synthesis LSI

## Speech synthesis LSI with built-in large-capacity P2ROM™

Description	Part Number
I <sup>2</sup> C interface 2ch simultaneous playback/ speaker amplifier installed	ML22863
	ML22864
	ML22865
I <sup>2</sup> C interface Speech-speed and pitch conversion function installed/speaker amplifier installed	ML22763
	ML22764
	ML22765
Clock synchronous serial interface 2ch simultaneous playback/ speaker amplifier installed	ML22823
	ML22824
	ML22825
Clock synchronous serial interface Speech-speed and pitch conversion function installed/speaker amplifier installed	ML22723
	ML22724
	ML22725
Clock synchronous serial interface Built-in P2ROM/OTP	ML22802/ML22P802
	ML22804/ML22P804
	ML22808/ML22P808

## Speech synthesis LSI with built-in large-capacity P2ROM™

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)(*)	CPU I/F	SP Amp Output (W)/Class	Number of Mixing (Internal)	DAC	Others	Package
ML22863	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096 (*2)	258	I <sup>2</sup> C	0.7/AB-class	2ch	16bit	—	SSOP30
ML22864	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096 (*2)	520	I <sup>2</sup> C	0.7/AB-class	2ch	16bit	—	SSOP30
ML22865	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096 (*2)	1044	I <sup>2</sup> C	0.7/AB-class	2ch	16bit	—	SSOP30
ML22763	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096 (*2)	258	I <sup>2</sup> C	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22764	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096 (*2)	520	I <sup>2</sup> C	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22765	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096 (*2)	1044	I <sup>2</sup> C	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22823	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096 (*2)	258	Clock synchronous serial	0.7/AB-class	2ch	16bit	—	SSOP30
ML22824	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096 (*2)	520	Clock synchronous serial	0.7/AB-class	2ch	16bit	—	SSOP30
ML22825	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096 (*2)	1044	Clock synchronous serial	0.7/AB-class	2ch	16bit	—	SSOP30
ML22723	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 4M	4096 (*2)	258	Clock synchronous serial	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22724	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 8M	4096 (*2)	520	Clock synchronous serial	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22725	2.7~3.6 or 4.5~5.5	4.096MHz	-40~+85	P2ROM™ 16M	4096 (*2)	1044	Clock synchronous serial	0.7/AB-class	1ch	16bit	Speech-speed and pitch conversion	SSOP30
ML22802/ML22P802	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 2M	512 (*3)	131	Clock synchronous serial	—	1ch	12bit	—	SSOP30
ML22804/ML22P804	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 4M	1024 (*4)	262	Clock synchronous serial	—	1ch	12bit	—	SSOP30
ML22808/ML22P808	2.7~3.6	4.096MHz	-20~+85	P2ROM™ /OTP 8M	1024 (*4)	524	Clock synchronous serial	—	1ch	12bit	—	SSOP30

\*1 : Maximum playback time when the sampling frequency is 4kHz in ADPCM2.

\*2: 1024 phrases (1 bank) × 4 banks

\*3: 256 phrases (1 bank) × 2 banks

\*4: 256 phrases (1 bank) × 4 banks

## Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

Description	Part Number
Clock synchronous serial interface type Built-in Mask ROM	ML22562
Clock synchronous serial interface type Built-in Flash/Mask ROM	ML22563/ML22Q563
	ML22331/ML22Q331
	ML22321/ML22Q321
Clock synchronous serial interface type Built-in Flash ROM	ML22Q374
I <sup>2</sup> C interface type Built-in Flash ROM	ML22Q394
Stand alone type Built-in Flash ROM	ML22341/ML22Q341

## Speech synthesis LSI with built-in medium/small-capacity Flash/Mask ROM

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)	CPU I/F	SP Amp Output (W)/Class	Number of Mixing (Internal)	DAC	Others	Package
ML22562	2.7~5.5	4.096MHz	-40~+85	Mask 2M	1024	98 (*1)	Clock synchronization Serial	1.0/AB-class	4ch	16bit	Fail safe	SSOP30
ML22563/ML22Q563	2.7~5.5	4.096MHz	-40~+85	Mask/Flash 4M	1024	201 (*1)	Clock synchronization Serial	1.0/AB-class	4ch	16bit	Fail safe	SSOP30
ML22331/ML22Q331	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Clock synchronization Serial	1.0/AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22321/ML22Q321	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	62	43 (*1)	Clock synchronization Serial	1.0/AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22Q374	2.0~5.5	4.096MHz (Built-in)	-40~+85	Mask/Flash 692K	30	27 (*2)	Clock synchronization Serial	1.0/D-class	1ch	—	Disconnection/Short circuit detection Built-in oscillator	SSOP16
ML22Q394	2.0~5.5	4.096MHz (Built-in)	-40~+85	Mask/Flash 692K	30	27 (*2)	I <sup>2</sup> C	1.0/D-class	1ch	—	Disconnection/Short circuit detection Built-in oscillator	SSOP16
ML22341/ML22Q341	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Stand alone	1.0/AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30

\*1 : Maximum playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

\*2 : Maximum playback time when the sampling frequency is 6.4kHz in ADPCM2.

## Speech synthesis LSI with external memory

Description	Part Number
4ch simultaneous playback Serial external memory	ML22460
	ML22420
	ML22594 <b>NEW</b>

## Speech synthesis LSI with external memory

Part Number	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrase	Maximum Playback Time	CPU I/F	SP Amp Output (W)/Class	Number of Mixing (Internal)	DAC	Others	Package
ML22460	4.096MHz	-40~+85	External maximum 128M	1024	139min (*1)	I <sup>2</sup> C	0.7/AB-class	4ch	16bit	—	SSOP30
ML22420	4.096MHz	-40~+85	External maximum 128M	1024	139min (*1)	Clock synchronization Serial	0.7/AB-class	4ch	16bit	—	SSOP30
ML22594 <b>NEW</b>	4.096MHz	-40~+105	Mask 6M (*4) External maximum 128M	1024 (*5) (Built-in 512 External 512)	Built-in 303sec (*2) External 109min (*3)	Clock synchronization Serial	1.0/AB-class	4ch	16bit	Speaker terminal short circuit detection function	SSOP30

\*1 : Maximum playback time when the sampling frequency is 4kHz in ADPCM2.

\*2 : Maximum playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

\*3 : With an external memory module (Max. 128Mbit). Maximum playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

\*4 : Mask's built-in ROM is 6Mbit and an external memory module (Max. 128Mbit) can be connected.

\*5 : Total of mask's internal 512 phrases and external memory's 512 phrases.

# Speech synthesis LSI

## Speech synthesis LSI for automotive

Description	Part Number
Support for 105°C, 4ch simultaneous playback, Built-in Mask ROM+serial external memory	ML22594 <b>NEW</b>
Support for 105°C, 4ch simultaneous playback, Built-in Mask ROM	ML22572
Support for 105°C, 4ch simultaneous playback, built-in Flash/Mask ROM	ML22573/ML22Q573
Support for 105°C, 4ch simultaneous playback, built-in Flash ROM	ML22Q553
Support for 85°C, built-in Flash/Mask ROM	ML22331/ML22Q331
	ML22321/ML22Q321
	ML22341/ML22Q341
Support for 85°C, built-in Flash ROM	ML22Q374
	ML22Q394

## Speech synthesis LSI for automotive

Part Number	Operating Voltage(V)	Operating Frequency	Operating Temperature (°C)	ROM Capacity(bit)	Number of Phrases	Maximum Playback Time(sec)	CPU I/F	SP Amp Output (W)/Class	Number of Mixing (Internal)	DAC	Others	Package
ML22594 <b>NEW</b>	4.5~5.5	4.096MHz	-40~+105	Mask 6M (*4) External maximum 128M	1024 (*5) (Built-in 512, External 512)	Built-in 303sec (*1) External 109min (*3)	Clock synchronization Serial	1.0/ AB-class	4ch	16bit	Speaker terminal short circuit detection function	SSOP30
ML22572	2.7~5.5	4.096MHz	-40~+105	Mask 2M	1024	98 (*1)	Clock synchronization Serial	1.0/ AB-class	4ch	16bit	Fail safe	SSOP30
ML22573/ML22Q573	2.7~5.5	4.096MHz	-40~+105	Mask/Flash 4M	1024	201 (*1)	Clock synchronization Serial	1.0/ AB-class	4ch	16bit	Fail safe	SSOP30
ML22Q553	4.5~5.5	4.096MHz	-40~+105	Flash 4M	1024	201 (*1)	Clock synchronization Serial	1.0/ AB-class	4ch	16bit	Speaker terminal short circuit detection function	SSOP30
ML22331/ML22Q331	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Clock synchronization Serial	1.0/ AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22321/ML22Q321	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	62	43 (*1)	Clock synchronization Serial	1.0/ AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22341/ML22Q341	2.3~5.5	4.096MHz	-40~+85	Mask/Flash 896K	30	43 (*1)	Stand alone	1.0/ AB-class	1ch	16bit	Disconnection detection Temperature protection circuit	SSOP30
ML22Q374	2.0~5.5	4.096MHz (Built-in)	-40~+85	Mask/Flash 692K	30	27 (*2)	Clock synchronization Serial	1.0/ D-class	1ch	—	Built-in disconnection/short circuit detection oscillation	SSOP16
ML22Q394	2.0~5.5	4.096MHz (Built-in)	-40~+85	Mask/Flash 692K	30	27 (*2)	I2C	1.0/ D-class	1ch	—	Built-in disconnection/short circuit detection oscillation	SSOP16

\*1 : Maximum playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

\*2 : Maximum playback time when the sampling frequency is 6.4kHz in ADPCM2.

\*3 : With an external memory module (Max. 128Mbit). Maximum playback time when the sampling frequency is 6.4kHz in HQ-ADPCM.

\*4 : Mask's built-in ROM is 6Mbit and an external memory module (Max. 128Mbit) can be connected.

\*5 : Total of mask's internal 512 phrases and external memory's 512 phrases.

## 8-bit microcontroller with speech function

Description	Part Number
Onboard 10-bit ADC 3ch Built-in Flash ROM	ML610Q304 <b>NEW</b>
Built-in Flash/Mask ROM	ML610340/ML610Q340
OP amplifier and 12-bit ADC 3ch installed Built-in Flash/Mask ROM	ML610346/ML610Q346
12-bit ADC 12ch installed Built-in Flash/Mask ROM	ML610347/ML610Q347
OP amplifier, 12-bit ADC 4ch installed Flash memory, Self-rewritable Built-in Flash memory	ML610Q355
	ML610Q356
12-bit ADC 4ch installed Flash memory, Self-rewritable Built-in Flash memory	ML610Q359
	ML610Q360
10-bit ADC 8ch, onboard LCD Driver Built-in Flash ROM	ML610Q380
	ML610Q383
	ML610Q384
	ML610Q385

◆Speech synthesis method: 4-bit ADPCM2, HQ-ADPCM, 8-bit NL PCM, 8-/16-bit PCM (No onboard HQ-ADPCM on ML610340, Q340, Q355, Q356, Q359, Q360, Q380, Q383, Q384, Q385, Q304)

## 8-bit microcontroller with speech function

Part Number	Operating Condition			ROM/RAM			Function/Feature						SP Amp Output (W)/Class	Package		
	Operating Voltage(V)	Operating Frequency	Current (*9) Consumption (Typ.@HALT)	Operating Temperature (°C)	ROM Capacity (Byte)	P2ROM Capacity for speech (bit)	RAM Capacity (Byte)	PWM	ADC (Method)	LCD Driver	OP Amplifier	Serial I2C			SSIO(*14) UART	
ML610Q304 <b>NEW</b>	2.2 (*15) ~5.5	8.192MHz(*5) 32.768kHz(*4)	1.7μA	-40 ~+85	Flash 96K+2K(*10) (Self-rewrite area)	—	1K	—	10bit×3ch (Successful)	—	—	1	2	1	1.0(*16) /D-class	QFP28
ML610340/ML610Q340	2.2 (*1) ~5.5	4.096MHz(*3)	—	-40 ~+85	Mask/Flash(*10) 96K	—	512	—	—	—	—	1	—	—	1.0(*16) /AB-class	SSOP30
ML610346/ML610Q346	2.2 (*1) ~5.5	4.096MHz(*3) 32kHz(*4)	1.2μA(*17) 1.5μA(*18)	-40 ~+85	Mask/Flash(*10) 128K	—	1K	—	12bit×3ch (Successful)	—	3	—	1	1	1.0(*16) /AB-class	TQFP64
ML610347/ML610Q347	2.2 (*1) ~5.5	4.096MHz(*3) 32kHz(*4)	1.2μA(*17) 1.5μA(*18)	-40 ~+85	Mask/Flash(*10) 128K	—	1K	—	12bit×12ch (Successful)	—	—	—	1	1	1.0(*16) /AB-class	TQFP64
ML610Q355	2.2 ~3.6	8MHz(*5) 4kHz(*4)	1.2μA	-40 ~+85	Flash 88K+1K(*11) (Self-rewrite area)	—	1K	—	12bit×4ch (Successful)	—	3	—	2	2	0.5(*16) /AB-class	TQFP48
ML610Q356	2.2 ~3.6	8MHz(*5) 4kHz(*4)	1.2μA	-40 ~+85	Flash 88K+1K(*11) (Self-rewrite area)	—	2K	—	12bit×4ch (Successful)	—	3	—	2	2	0.5(*16) /AB-class	TQFP64
ML610Q359	2.2 ~3.6	8.192MHz(*5) 32.768kHz(*6)	1.7μA	-40 ~+85	Flash 160K+3K(*11) (Self-rewrite area)	—	2K	—	12bit×4ch (Successful)	—	—	—	2	2	0.5(*16) /AB-class	TQFP64
ML610Q360	2.2 ~3.6	8.192MHz(*5) 32.768kHz(*6)	1.7μA	-40 ~+85	Flash 160K+3K(*11) (Self-rewrite area)	16M	2K	—	12bit×4ch (Successful)	—	—	—	2	2	0.5(*16) /AB-class	TQFP64
ML610Q380	2.2 (*2) ~5.5	8.192MHz(*7) 32.768kHz(*8)	2.0μA	-40 ~+70	Flash(*10) 128K	—	2K	16bit(*12) ×2	10bit×8 (Successful)	4Com× 24Seg	—	1(*13)	2	2	0.6(*16) /AB-class	QFP80
ML610Q383	2.2 (*2) ~5.5	8.192MHz(*7) 32.768kHz(*8)	2.0μA	-40 ~+70	Flash(*10) 128K	4M	2K	16bit(*12) ×2	10bit×8 (Successful)	4Com× 24Seg	—	1(*13)	1	1	0.6(*16) /AB-class	QFP80
ML610Q384	2.2 (*2) ~5.5	8.192MHz(*7) 32.768kHz(*8)	2.0μA	-40 ~+70	Flash(*10) 128K	8M	2K	16bit(*12) ×2	10bit×8 (Successful)	4Com× 24Seg	—	1(*13)	1	1	0.6(*16) /AB-class	QFP80
ML610Q385	2.2 (*2) ~5.5	8.192MHz(*7) 32.768kHz(*8)	2.0μA	-40 ~+70	Flash(*10) 128K	16M	2K	16bit(*12) ×2	10bit×8 (Successful)	4Com× 24Seg	—	1(*13)	1	1	0.6(*16) /AB-class	QFP80

\*1: For speech playback function, the operating voltage range is 2.3V to 5.5V.

\*2: For ADC and speech playback function, the operating voltage range is 4.5V to 5.5V.

\*3: Crystal/ceramic oscillation is supported.

\*4: Built-in RC oscillation is supported.

\*5: Built-in PLL oscillation is supported.

\*6: Crystal oscillation is supported.

\*7: Built-in PLL/crystal/ceramic oscillation is supported.

\*8: Built-in RC/crystal oscillation is supported.

\*9: Current consumption at HALT Mode via low-speed oscillation

\*10: 1Kbyte for the testing area is included.

\*11: 544Kbyte for the testing area is included.

\*12: IGBT control can be supported.

\*13: Master function only. Fast mode (400kbps)/standard mode (100kbps) can be supported.

\*14: 8-bit/16-bit SPI compatible chip select signal is not available.

\*15: The operating voltage range during ADC operation and 8.192 MHz operation is 2.2V to 5.5V.

\*16: 304/340/346/347/380/383/384/385: At the operating voltage of 5V, 355/356/359/360: At the operating voltage of 3V.

\*17: Built-in Mask ROM

\*18: Built-in Flash ROM

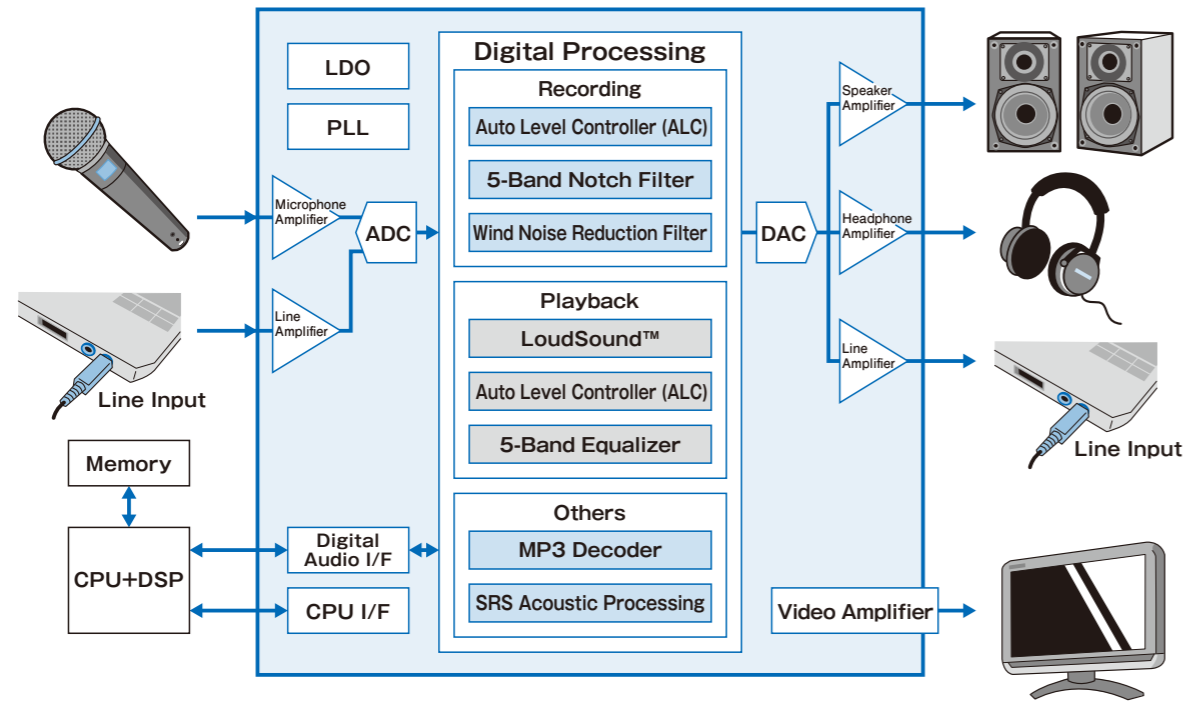


# Audio LSI for Portable Devices

## Audio LSI for Portable Devices Overview

### Product Overview

LAPIS Semiconductor's Audio LSI series for portable devices allows audio analog circuits that cannot be mounted on the increasingly high-speed and small-sized CPU and DSP, to all be integrated on a single chip. A range of acoustic technologies suited for your application can also be integrated on a single chip to deliver superior sound quality for your device.



### Product Line-up

Part Number	AD/DA Channel	Number of Microphone Inputs	Speaker Output		Effect					Other Function
			Type	Output(W)	Loud Sound™	EQ	Wind Cut	Notch	ALC	
ML26128HB	2/2	6	Monaural Class AB	0.5	○	○	○ (Auto)	○	○ (Fast)	VIDEO, LDO
ML26121AHB	2/2	4	Monaural Class AB	0.5	○	○	○	○	○	—
ML26127HB	1/1	1	Monaural Class AB	0.5	○	○	○ (Auto)	○	○ (Fast)	VIDEO, LDO
ML26125HB	1/1	1	Monaural Class AB	0.5	○	○	○	○	○	VIDEO, LDO
ML26124-00HB	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	VIDEO, LDO
ML26124-02GD	1/1	2	Monaural Class AB	0.5	—	○	○	○	○	VIDEO, LDO
ML2612GD	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	—
ML2614HB	1/1	1	Monaural Class AB	0.5	—	○	○	○	○	—
ML26211EGD	0/1	—	Monaural Class D	2	○	○	—	—	○	—
ML26211DHB	0/1	—	Monaural Class D	2	○	○	—	—	○	—
ML2611GD	0/2	—	Stereo Class AB	0.8	—	○	—	—	—	SRS
ML2611HB	0/2	—	Stereo Class AB	0.8	—	○	—	—	—	SRS
ML2620GD	0/0	—	Monaural Class AB	0.8	○	○	—	—	○	—
ML2620HP	0/0	—	Monaural Class AB	0.8	○	○	—	—	○	—
ML2011GD	0/2	—	Monaural Class AB	0.8	—	—	—	—	—	LowPower MP3 Decoder
ML2011HB	0/2	—	Monaural Class AB	0.8	—	—	—	—	—	LowPower MP3 Decoder

### Application Examples

#### DSC/DVC

#### Mobile Phone

#### Home electronics, Toys

#### Portable Navigation Device

### Example of Acoustic Processing Technology

#### LoudSound™

A small speaker plays back loud sound

#### Power supply noise reduction ratio (PSRR)

Improved power supply noise reduction

#### Programmable EQ

Provides a free filter features

#### ALC

Loud sound (from a large input signal) / Soft sound (from a small input signal)

#### Automatic background noise reduction

The gain of low frequency sound is controlled according to the level difference between low frequency sound and high frequency sound.

# Audio LSI for Portable Devices

## High performance audio CODEC

Description	Part Number
Stereo CODEC WCSP type with automatic wind noise reduction filter and LoudSound™	ML26128HB
Ultra compact stereo CODEC WCSP type	ML26121AHB
Monaural CODEC WCSP type with automatic wind noise reduction filter and LoudSound™	ML26127HB
Monaural CODEC WCSP type with noise tolerance/LoudSound™	ML26125HB
Monaural CODEC WCSP type with noise tolerance	ML26124-00HB
Monaural CODEC with noise tolerance	ML26124-02GD
Ultra compact monaural CODEC	ML2612GD
Ultra compact monaural CODEC WCSP type	ML2614HB

## High performance audio CODEC

Part Number	Supply Voltage (V)	ADC		DAC		Full/Half Duplex	Microphone Input Type	Number of Inputs	Speaker Output Type	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect				Other Function	Operating Temperature (°C)	Package	Size (mm×mm)	
		Number of Channels	S/N (dB)	Number of Channels	S/N (dB)										Loud Sound™	EQ	Wind Cut	Notch					ALC
ML26128HB	2.7-3.6	2	92	2	95	Full	Single Differential	6	Class AB	Monaural	500mW	Stereo	Stereo	i2C/SPI	i2S, DSP, L.J, R.J, a-low, μ-low	○	○	○ (Auto)	○ (Fast)	VIDEO LDO	-20 ~ +85	WCSP34	2.96 × 2.96
ML26121AHB	HVDD 2.7-3.6 LVDD 1.65-2.75	2	92	2	95	Full	Single Differential	4	Class AB	Monaural	500mW	Stereo	Stereo	i2C/SPI	i2S, DSP, L.J, R.J, a-low, μ-low	○	○	○	○	—	-20 ~ +85	WCSP34	2.96 × 2.96
ML26127HB	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	i2S, DSP, L.J, R.J, a-low, μ-low	○	○	○ (Auto)	○ (Fast)	VIDEO LDO	-20 ~ +85	WCSP34	2.48 × 2.48
ML26125HB	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	i2S, DSP, L.J, R.J, a-low, μ-low	○	○	○	○	VIDEO LDO	-20 ~ +85	WCSP25	2.58 × 2.48
ML26124-00HB	2.7-3.6	1	92	1	95	Full	Single	1	Class AB	Monaural	500mW	Monaural	—	SPI	i2S, DSP, L.J, R.J, a-low, μ-low	—	○	○	○	VIDEO LDO	-20 ~ +85	WCSP25	2.56 × 2.46
ML26124-02GD	2.7-3.6	1	92	1	95	Full	Single Differential Digital	2	Class AB	Monaural	500mW	Monaural	—	i2C/SPI	i2S, DSP, L.J, R.J, a-low, μ-low	—	○	○	○	VIDEO LDO	-20 ~ +85	WQFN32	5.0 × 5.0
ML2612GD	HVDD 2.7-3.6 LVDD 1.65-2.75	1	92	1	95	Half	Single Differential	1	Class AB	Monaural	500mW	—	—	i2C/SPI	i2S, DSP, L.J, R.J	—	○	○	○	—	-20 ~ +85	WQFN24	4.0 × 4.0
ML2614HB	HVDD 2.7-3.6 LVDD 1.65-2.75	1	92	1	95	Half	Single	1	Class AB	Monaural	500mW	—	—	SPI	i2S, DSP, L.J, R.J	—	○	○	○	—	-20 ~ +85	WCSP20	2.46 × 1.96

## Audio DAC/Speaker amplifier

Description	Part Number
DAC + filterless class D monaural speaker amplifier	ML26211EGD
DAC + filterless class D monaural speaker amplifier WCSP type	ML26211DHB
DAC + class AB stereo speaker amplifier with SRS acoustic processing	ML2611GD
DAC + class AB stereo speaker amplifier WCSP type with SRS acoustic processing	ML2611HB
Class AB monaural speaker amplifier with LoudSound™	ML2620GD
Class AB monaural speaker amplifier with LoudSound™, WCSP type	ML2620HP

## Audio DAC/Speaker amplifier

Part Number	Supply Voltage (V)	ADC		DAC		Full/Half Duplex	Microphone Input Type	Number of Inputs	Speaker Output Type	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect				Other Function	Operating Temperature (°C)	Package	Size (mm×mm)	
		Number of Channels	S/N (dB)	Number of Channels	S/N (dB)										Loud Sound™	EQ	Notch	ALC					
ML26211EGD	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	1	95	—	—	—	Class D	Monaural	2W	—	—	i2C/SPI	i2S, DSP, L.J, R.J	○	○	—	○	—	-20 ~ +85	WQFN24	4.0 × 4.0
ML26211DHB	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	1	95	—	—	—	Class D	Monaural	2W	—	—	i2C	i2S, DSP, L.J, R.J	○	○	—	○	—	-20 ~ +85	WCSP20	2.46 × 1.96
ML2611GD	SPVDD 2.7-4.5 HVDD 2.7-3.6 LVDD 2.25-2.75	—	—	2	90	—	—	—	Class AB	Stereo	800mW	Stereo	Stereo	i2C	i2S, DSP, L.J, R.J	—	○	—	—	SRS	-20 ~ +75	WQFN36	6.0 × 6.0
ML2611HB	SPVDD 2.7-4.5 HVDD 2.7-3.6 LVDD 2.25-2.75	—	—	2	90	—	—	—	Class AB	Stereo	800mW	Stereo	Stereo	i2C	i2S, DSP, L.J, R.J	—	○	—	—	SRS	-20 ~ +75	WCSP36	3.16 × 2.96
ML2620GD	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	—	—	—	—	—	Class AB	Monaural	800mW	—	—	i2C/SPI	—	○	○	—	○	—	-20 ~ +85	WQFN20	4.0 × 4.0
ML2620HP	SPVDD 2.7-5.5 IOVDD 1.65-3.6 Other 2.25-2.75	—	—	—	—	—	—	—	Class AB	Monaural	800mW	—	—	i2C/SPI	—	○	○	—	○	—	-20 ~ +85	WCSP20	2.42 × 2.54

## Audio MP3 decoder

Description	Part Number
Low power MP3 decoder	ML2011GD
Low power MP3 decoder WCSP type	ML2011HB

## Audio MP3 decoder

Part Number	Supply Voltage (V)	ADC		DAC		Full/Half Duplex	Microphone Input Type	Number of Inputs	Speaker Output Type	Maximum Output	Line Output	Head phone Output	CPU I/F	Serial Audio I/F	Effect				Other Function	Operating Temperature (°C)	Package	Size (mm×mm)
		Number of Channels	S/N (dB)	Number of Channels	S/N (dB)										Loud Sound™	EQ	Notch	ALC				
ML2011GD	SPVDD 2.7-4.5 Other 2.7-3.6	—	—	2	90	—	—	—	Class AB	Monaural	800mW	Stereo	—	SPI/8bit	—	—	—	—	Low power 2KB FIFO	-20 ~ +85	WQFN32	5.0 × 6.0
ML2011HB	SPVDD 2.7-4.5 Other 2.7-3.6	—	—	2	90	—	—	—	Class AB	Monaural	800mW	Stereo	—	SPI/8bit	—	—	—	—	Low power 2KB FIFO	-20 ~ +85	WCSP35	3.56 × 4.17

# Video LSI

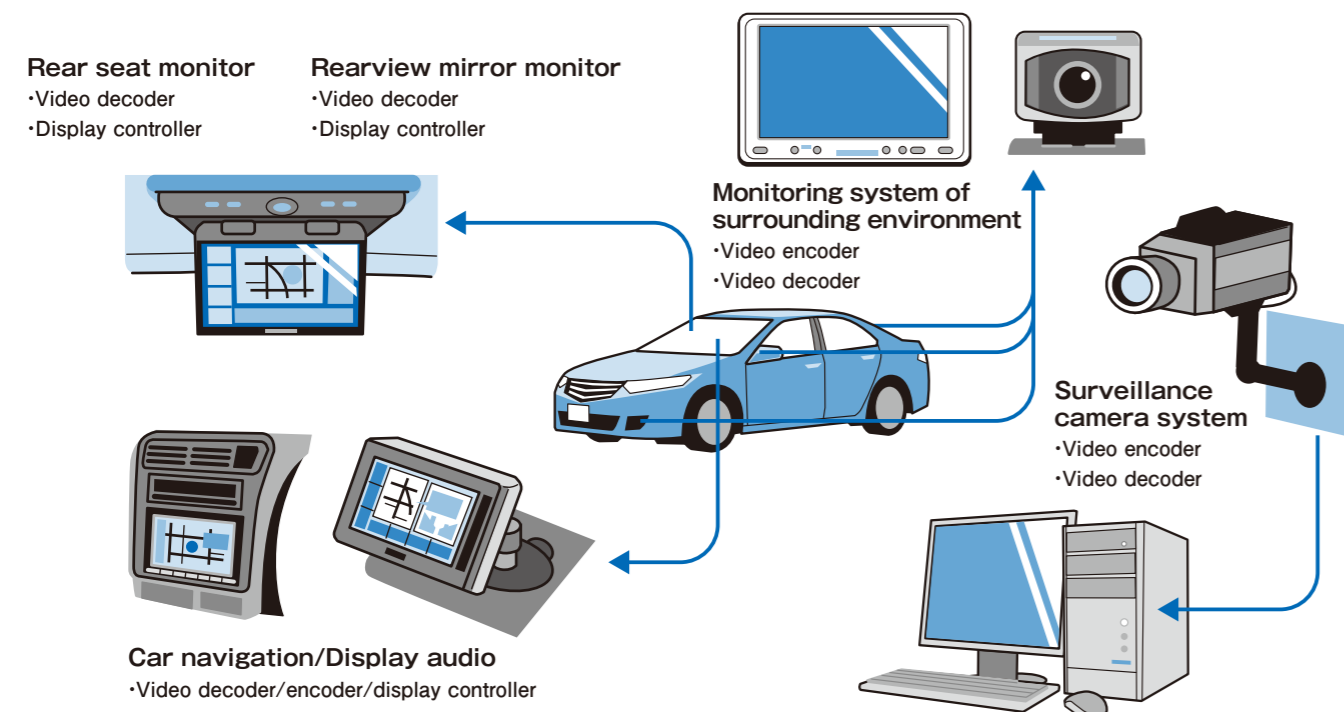
## Video LSI Overview

### Product Overview

Video LSI is used in a variety of applications including on-vehicle accessory products such as car navigation system, display audio and rear-seat monitor as well as surveillance camera and portable gaming consoles. Based on the signal processing technology for video and display, along with the excellent reliability, we will offer a further selection of products.

- Video Decoder Series
- Video Encoder Series
- Video Interface Series
- Display Controller Series for Small to Medium-Sized TFT LCD
- Evaluation board support

### Application Examples



### Product Line-up

#### ● Video Decoder Series

Composite supported	ML86V76655	ML86V76652/3
Composite/S-video/supported	ML86101A	ML86V7668A
Composite/S-video/Component supported	ML86V7675	

#### ● Video Encoder Series

ML86V76580	ML86V7655
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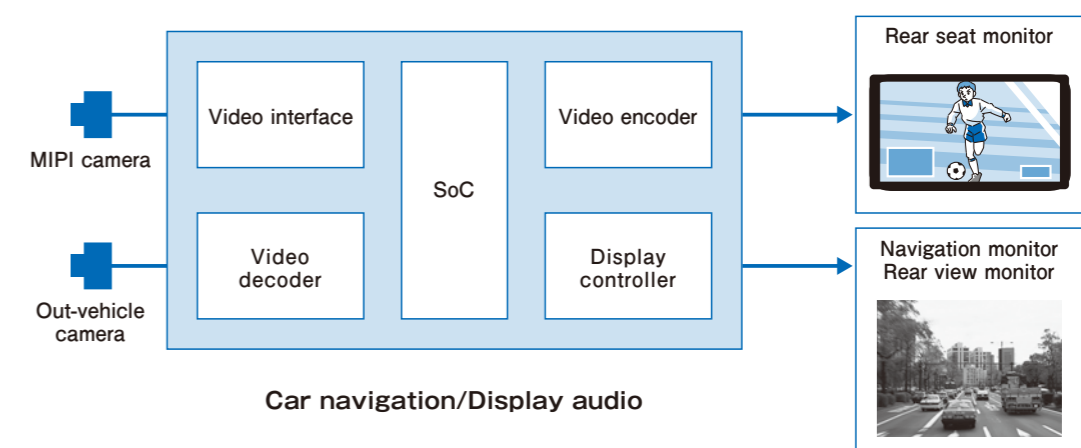
#### ● Video Interface Series

<sup>NEW</sup> ML86790
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#### ● Display Controller Series for Small to Medium-Sized TFT LCD

ML86V8101	ML86V8102			
ML86V8201	ML86V8202C	ML86V8207	ML86V8209	ML86V8401

### Application Examples



# Video LSI

## Video Decoder Series

Input Format	Part Number
CVBS	ML86V76655
	ML86V76652
	ML86V76653
CVBS or S-video	ML86101A
	ML86V7668A
CVBS&S-video&Component&RGB	ML86V7675

## Video Decoder Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Video Format	Output Format	Pixel Frequency	Sampling Frequency	Crystal Oscillator supported	Feature	Package
ML86V76655	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz, 12.272727MHz, 14.75MHz, 14.318182MHz	27MHz, 24.545454MHz, 29.5MHz, 28.6363MHz	—	CVBS detection function Dither	WCSP36
ML86V76652	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz, 12.272727MHz, 14.75MHz	27MHz, 24.545454MHz, 29.5MHz	○	Small Low power consumption	WCSP36
ML86V76653	I/O 3.3 or 1.8 Core 1.8	-40~+85	CVBS×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz, 12.272727MHz, 14.75MHz, 14.318182MHz	27MHz, 24.545454MHz, 29.5MHz, 28.6363MHz	○	Dither	TQFP48
ML86101A	I/O 3.3 Core 1.5	-40~+85	CVBS×4 or CVBS×2 +S-video×1 or S-video×2	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	13.5MHz, 12.272727MHz, 14.75MHz, 14.318182MHz	27MHz, 24.545454MHz, 29.5MHz, 28.6363MHz	○	Dither AEC-Q100 supported	TQFP48
ML86V7668A	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×1 +S-video×3	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16bit or RGB 18bit	13.5MHz, 12.272727MHz	27MHz, 24.545454MHz	—	RGB output	TQFP100
ML86V7675	I/O 3.3 Core 1.5	-40~+85	CVBS×4+ Component×2 or CVBS×4+S-video×1 +Component×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8bit	7.99300MHz ~ 33.333MHz	7.99300MHz ~ 33.333MHz	○	WVGA sampling component input	TQFP64

## Video Encoder Series

Output Format	Part Number
CVBS	ML86V76580
CVBS/S-video/Component or RGB	ML86V7655

## Video Encoder Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Video Format	Output Format	Pixel Frequency	Sampling Frequency	Crystal Oscillator supported	Feature	Package
ML86V76580	I/O 3.3 or 1.8 Core 1.8	-40~+85	ITU-R.BT.656 or YCbCr 8bit	NTSC PAL	CVBS	13.5MHz, 12.272727MHz, 14.75MHz, 14.318182MHz	27MHz, 24.545454MHz, 29.5MHz, 28.6363MHz	—	No need of LPF	TQFP48 WCSP25
ML86V7655	I/O 3.3 Core 2.5	-40~+85	ITU-R.BT.656 or YCbCr 8/16/24bit or RGB 24bit	NTSC PAL	CVBS+ S-video+ Component	13.5MHz, 12.272727MHz, 14.75MHz, 14.318182MHz, 18MHz	27MHz, 24.545454MHz, 29.5MHz, 28.6363MHz, 36MHz	—	I/P, P/I conversion	TQFP100

## Video Interface Series

Description	Part Number
MIPI→MIPI/LVTTL Video Interface	ML86790

## Video Interface Series

Part Number	Supply Voltage(V)	Operating Temperature (°C)	Input Format	Output Format (LVTTTL)	Output Format (MIPI)	Feature	Package
ML86790	I/O 3.3 or 1.8 Core 1.5	-20~+85	MIPI/CSI-2 (2Lane) YUV422 8bit, JPEG 650Mbps/Lane max	YCbCr 16bit (4:2:2) 81MHz (typ)	MIPI/CSI-2 (2Lane) YUV422 8bit, JPEG 650Mbps/Lane max	MIPI/CSI-2 receiver/ transmitter, MIPI to LVTTTL translate	WCSP63

# Video LSI

## Display Controller Series for Small to Medium-Sized TFT LCD

Description	Part Number
TCON, Image adjustment functions included	ML86V8101
	ML86V8102
T-CON, Video decoder included	ML86V8201
	ML86V8202C
	ML86V8207
	ML86V8209
Built-in video decoder and microcomputer	ML86V8401

## Display Controller Series for Small to Medium-Sized TFT LCD

Part Number	Supply Voltage (V)		Analog Video Input		Digital Video Input	Digital Video Output	Resolution	OSD	MCU	Feature	Package
			Terminal	Type							
ML86V8101	3.3	-40~+85	—	—	RGB 18bit	RGB 18bit	QVGA ~QHD	—	—	Built-in image quality adjustment function (digital input only)	TQFP64
ML86V8102	3.3	-40~+85	—	—	RGB 18/24bit	RGB 18/24bit	QVGA ~QHD	—	—	RGB 24 bits supported image quality adjustment function	TQFP80
ML86V8201	I/O 3.3 Core 1.5	-40~+85	CVBS×2 or S-video×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	(ITU-R BT.656 or YCbCr 8bit) +RGB 18/24bit	QVGA ~WVGA	Line	—	Rear camera supported	TQFP100
ML86V8202C	I/O 3.3 Core 1.8	-40~+85	CVBS×2 + Component×2 or CVBS×2 + S-video×1 + Component×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	ITU-R BT.656 style or YCbCr 8/16/24bit or RGB 18/24bit	QVGA ~WVGA	—	—	Component input supported	TQFP100
ML86V8207	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×3+(Component or S-video)×1 or CVBS×2 + S-video×1 +(Component or S-video)×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	RGB 18/24bit	QVGA ~WVGA	Text Line	—	Built-in OSD function, such as text and icon	LQFP144
ML86V8209	I/O 3.3 Core 2.5	-40~+85	CVBS×4 or CVBS×3+(Comp or S-video)×1 or CVBS×2 + S-video×1 +(Comp or S-video)×1 or CVBS×1 + S-video×2 +(Comp or S-video)×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	RGB 18/24bit	QVGA ~XGA	Text Line	—	Built-in Picture In Picture function for video synthesis	LQFP176
ML86V8401	I/O 3.3 Core 1.8	-40~+85	CVBS×3 or CVBS×2 + S-video×1	NTSC PAL SECAM	ITU-R BT.656 or YCbCr 8/16/24bit or RGB 18/24bit	ITU-R BT.656 or YCbCr 8/16bit or RGB 18/24bit	QVGA ~WVGA	Text	8051 (8bit)	System control MCU installed	TQFP100

## Evaluation board support

Description	Part Number	Contents	Notes
Video Decoder	ML86V76655 Evaluation Board ML86V76652/3 Evaluation Board ML86101A Evaluation Board ML86V7668A Evaluation Board ML86V7675 Evaluation Board	<ul style="list-style-type: none"> <li>•Evaluation board x 1</li> <li>•Power cable x 1</li> <li>•Serial cable x 1</li> <li>•CD-ROM x 1</li> </ul> (VAsudio (LSI control software), evaluation board manual, evaluation board circuit diagram)	Lending Please contact the sales. (ROHM Co., Ltd.)
Video Encoder	ML86V76580 Evaluation Board ML86V7655 Evaluation Board	<ul style="list-style-type: none"> <li>•Evaluation board x 1</li> <li>•CD-ROM x 1</li> </ul> (Evaluation board manual, evaluation board circuit diagram)	
Display Controller	ML86V8101 Evaluation Board ML86V8102 Evaluation Board ML86V8201 Evaluation Board ML86V8202C Evaluation Board ML86V8207 Evaluation Board ML86V8209 Evaluation Board ML86V8401 Evaluation Board	<ul style="list-style-type: none"> <li>•Evaluation board x 1</li> <li>•AC adapter x 1</li> <li>•USB cable x 1</li> <li>•CD-ROM x 1</li> </ul> (VAsudio (LSI control software), OSDBuilder (OSD data development support tool) (ML86V8401 only) Evaluation board manual, evaluation board circuit diagram)	

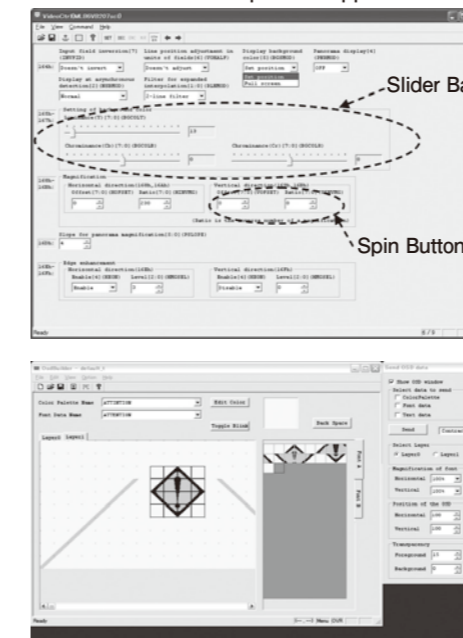
## Evaluation Board Example (ML86V8401 Evaluation Board)

### Features:

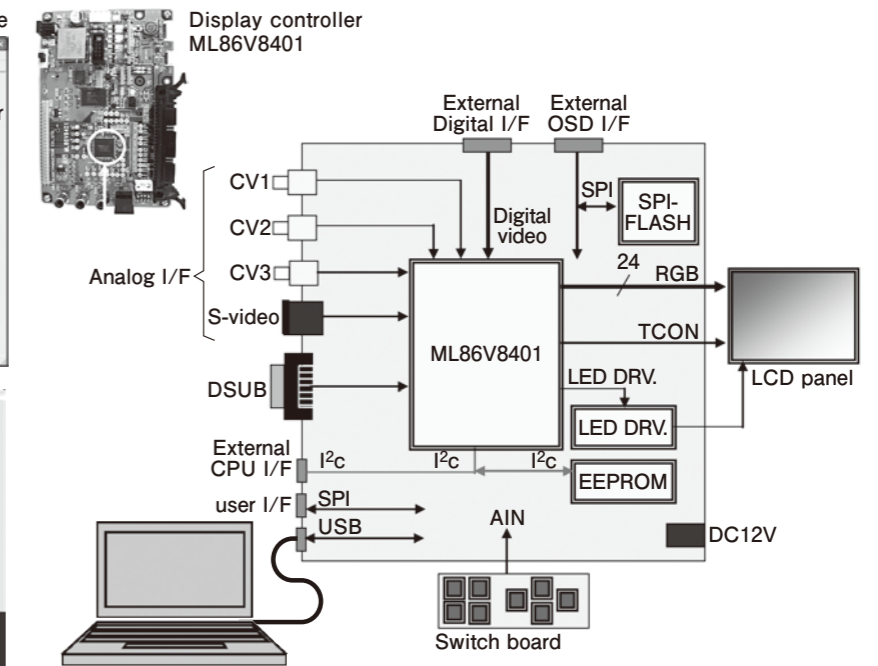
- ML86V8401 evaluation board is an evaluation board for the display controller ML86V8401.
- Video signals can be displayed on the LCD panel via the ML86V8401.
- Video signal inputs can be applied to NTSC/PAL composite or S-video and digital video signals.
- The function to display still images from the external FLASH memory and data input/output to the SPI-FLASH memory is enabled.
- Functions of the LED backlight control in the external LCD panel can be checked.
- The panel interface provides two types of connectors for 50 pins and 40 pins.
- The interface has connectors for SPI, I<sup>2</sup>C, and UART.
- A PC can be used to change registers in the ML86V8401 on the development support software screen.
- The OSD (On-Screen Display) can be easily generated using the development support software.

### ML86V8401 Evaluation Board Configuration

#### Main Screen of Development Support Software



Characters can be easily placed and checked.



## P2ROM™ Overview

### Features

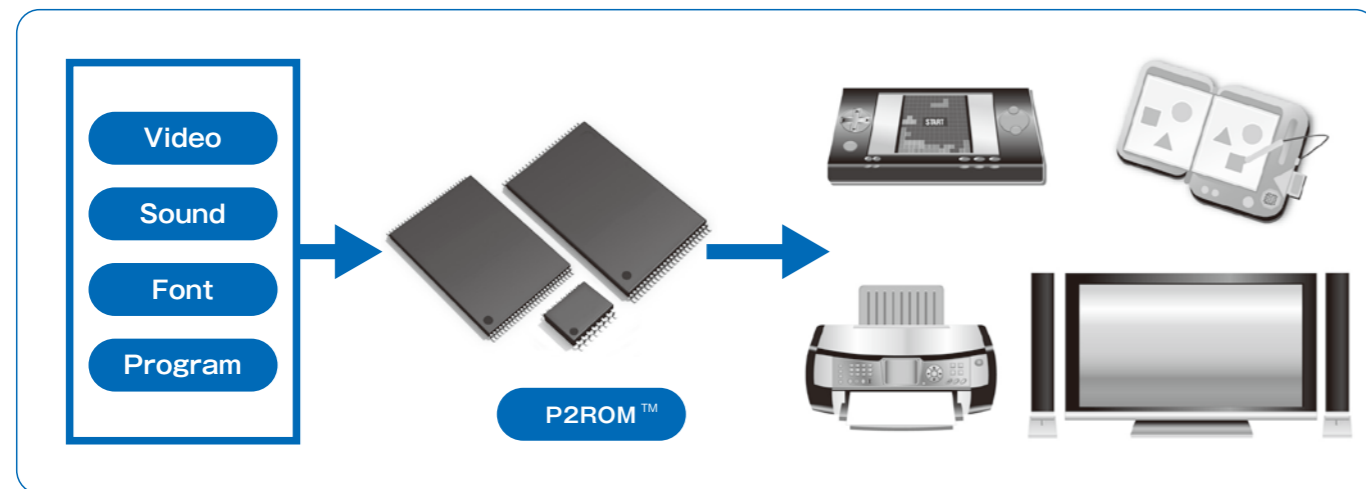
- Short lead time ..... Minimizes lead time from code programming to product shipment.
- Stock free for customers ..... The customer does not need to store the unprogrammed memory.
- No additional programming costs ..... Programming costs - required for OTP and Flash memory - are eliminated.
- No mask charging ..... No mask charging for P2ROM™.
- Support special markings ..... Similar to mask ROM, special markings can be placed on the package.
- Compatible with NOR Flash memory ..... Compatible package available, TSOP(I)56 and TSOP(I)48.

### Packages

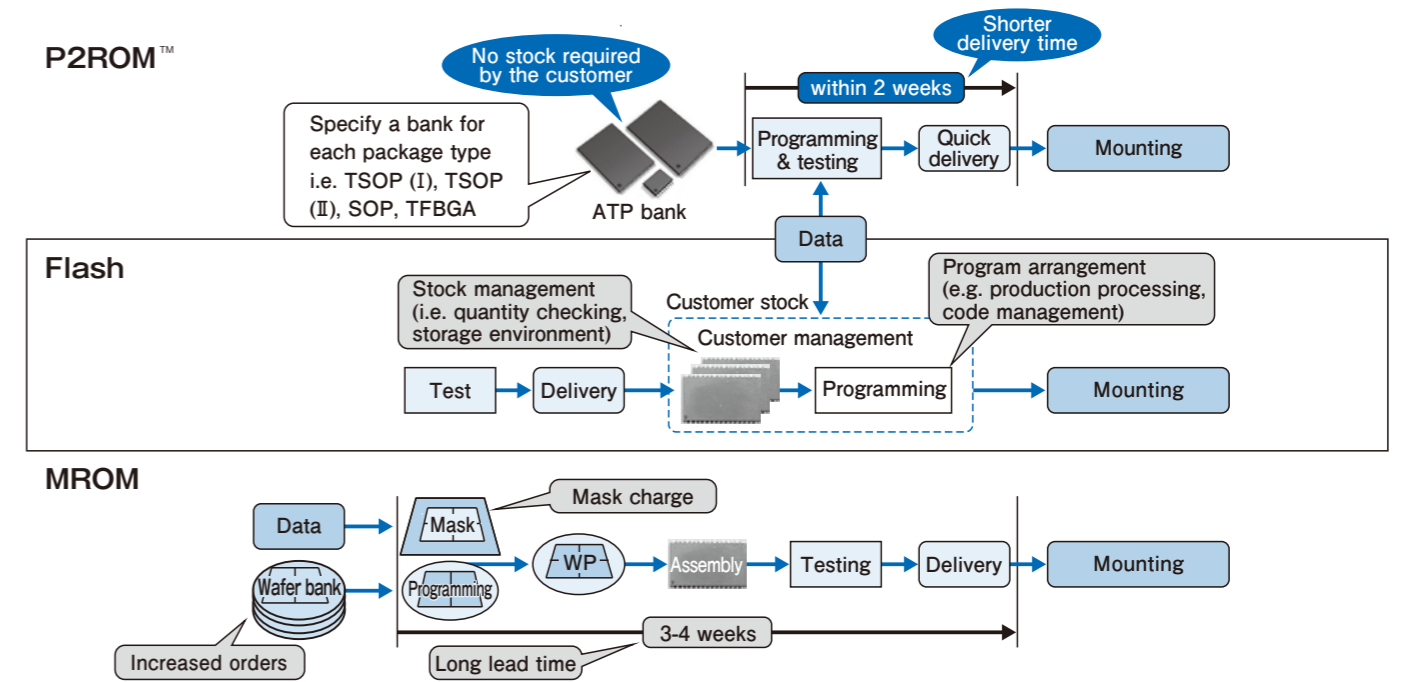
- SOP44
- SOP16
- SSOP70
- TSOP(I)56
- TSOP(I)48
- TSOP(II)50
- TFBGA48
- LGA140

### Applications

- Consumer Electronics (Game, Toy, Educational Toy, Amusement, Electric Musical Instrument, TV, STB, etc.)
- Information equipment (Printer, etc.)

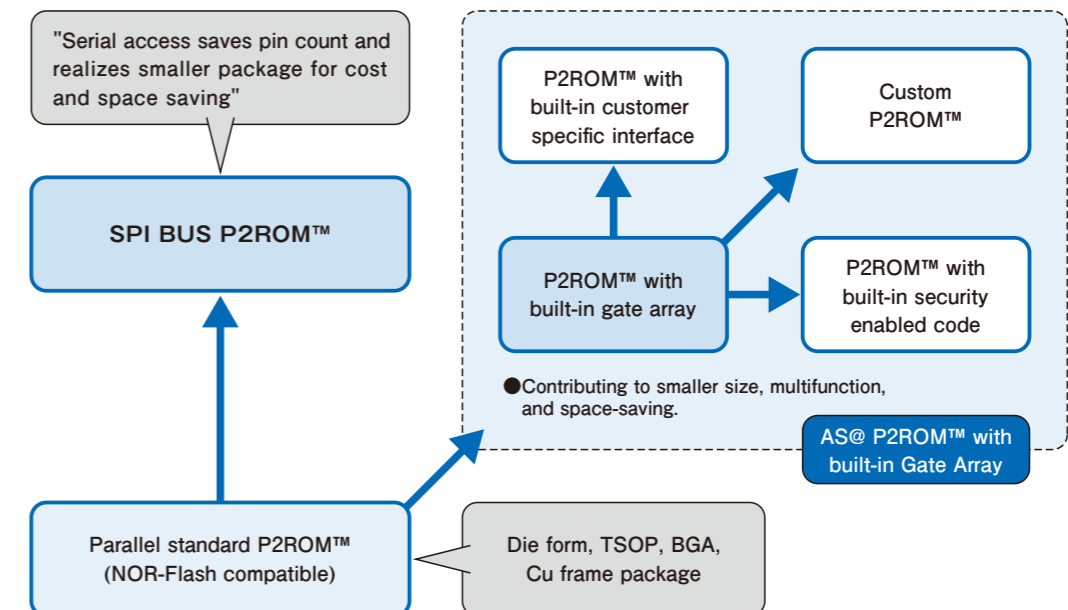


### Comparison of Production Processes between P2ROM™ and Flash/MROM



### Product Series of P2ROM™

Based on technology of large capacity and high speed, we provide space-saving and multifunction products on a constant basis.



# P2ROM™

## AS@ P2ROM™ Series with built-in Gate Array

MR35V□□□□□□	256M~1Gbit
MR25T□□□□□□	16M~128Mbps

Equipped with Gate Array of 30K/25K gate typ.  
Supply Voltage : 3.0V~3.6V / 2.7V~3.6V  
Operating Temperature : 0°C~+70°C

Density (bit)	Part Number	Supply Voltage (V)
1G	MR35V01G7xB	3.0~3.6
512M	MR35V5127xB	3.0~3.6
256M	MR35V2567xB	3.0~3.6
128M	MR25T1287xL	2.7~3.6
64M	MR25T647xL	2.7~3.6
16M	MR25T167xL	2.7~3.6
	MR25T1671L	2.7~3.6

## AS@ P2ROM™ Series with built-in Gate Array

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Feature	Access Time Random/Page (ns)	Standby current consumption (Max.)	Operating Temperature (°C)	Package
1G	MR35V01G7xB	128M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 3 input & 8 inout	920/320	10μA	0~+70	TSOP(I)48
512M	MR35V5127xB	64M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 26 input & 8 inout	240/25	10μA	0~+70	TSOP(II)44
256M	MR35V2567xB	32M×8	3.0~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 3 input & 8 inout	920/320	50μA	0~+70	TSOP(II)44
128M	MR25T1287xL	8M×16 16M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 26 input & 16 inout	80~100/25	10μA	0~+70	TSOP(I)48 TSOP(II)44
64M	MR25T647xL	4M×16 8M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 26 input & 16 inout	80~100/25	10μA	0~+70	TSOP(I)48 TSOP(II)44
16M	MR25T167xL	1M×16 2M×8	2.7~3.6	Embedded Gate Array of 30K Gate typ. <sup>(*)</sup> 26 input & 16 inout	70~100/25	50μA	0~+70	TSOP(I)48 TSOP(II)44
	MR25T1671L	1M×16 2M×8	2.7~3.6	Password authentication	70/25	50μA	0~+70	TSOP(I)48

\*1: The design interface of gate array supports any of spec., RTL, and Netlist.

## Parallel Standard P2ROM™ Series

MR26T□□□□□□	512Mbit
MR37T□□□□□□	256Mbit
MR27T□□□□□□	8M~256Mbit
MR27V□□□□□□	8M~128Mbit

Supply Voltage : 3.0V~3.6V / 2.7V~3.6V  
Operating Temperature : 0°C~+70°C

Density (bit)	Part Number	Supply Voltage (V)
512M	MR26T51203L	3.0~3.6
		2.7~3.6
256M	MR27T25603L	3.0~3.6
		2.7~3.6
128M	MR27T12800L	2.7~3.6
		3.0~3.6
		2.7~3.6
64M	MR27T6402L	3.0~3.6
		2.7~3.6
32M	MR27T3202L	3.0~3.6
		2.7~3.6
16M	MR27T1602L	2.7~3.6
		3.0~3.6
8M	MR27T802F	2.7~3.6
		3.0~3.6

## Parallel Standard P2ROM™ Series

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Access Time (ns)	Current Consumption (Max.)		Operating Temperature (°C)	Package	Socket mounting package	Package Frame
					Operating	Standby				
512M	MR26T51203L	32M×16/ 64M×8	3.0~3.6	100	35mA	10μA	0~+70	TSOP(II)50	—	—
			2.7~3.6	120						
256M	MR27T25603L	16M×16/ 32M×8	3.0~3.6	100	35mA	10μA	0~+70	TSOP(II)50	—	—
			2.7~3.6	120						
128M	MR27T12800L	8M×16/ 16M×8	2.7~3.6	90	25mA	10μA	0~+70	TSOP(I)48	—	—
		8M×16/ 16M×8	3.0~3.6	80	25mA	10μA	0~+70	TSOP(II)56	—	—
			2.7~3.6	90						
64M	MR27T6402L	4M×16/ 8M×8	3.0~3.6	70	20mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	Cu/ TSOP(I)48
			2.7~3.6	90						
			3.0~3.6	80	20mA	10μA	-40~+85	TSOP(I)48		
			2.7~3.6	90						
32M	MR27T3202L	2M×16/ 4M×8	3.0~3.6	70	20mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	—
			2.7~3.6	90						
			3.0~3.6	80	20mA	10μA	-40~+85	TSOP(I)48		
			2.7~3.6	90						
16M	MR27T1602L	1M×16/ 2M×8	2.7~3.6	70	16mA	10μA	0~+70	SOP44/TSOP(I)48/ TFBGA48	CG/ SOP44	Cu/ TSOP(I)48
			3.0~3.6	70	16mA	10μA	0~+70	Chip		
			3.0~3.6	70	16mA	10μA	0~+70	Chip		
8M	MR27T802F	512K×16/ 1M×8	2.7~3.6	80	18mA	5μA	0~+70	SOP44/TSOP(I)48		
			3.0~3.6	70	18mA	5μA	0~+70	SOP44/TSOP(I)48		
			3.0~3.6	90	18mA	5μA	0~+70	Chip		



## Parallel Page Mode P2ROM™ Series

MR36V□□□□□□	1G~8Gbit
MR37V□□□□□□	64Mbit~256Mbit
MR26V□□□□□□	64M~2Gbit
MR27V□□□□□□	16M~256Mbit

Page Size : 8-word×16 / 8-word×32  
 Supply Voltage : 3.0V~3.6V  
 Operating Temperature : 0°C~+70°C

Density (bit)	Part Number	Supply Voltage (V)
16G	MR36V16G56C	3.0~3.6
8G	MR36V08G57C	3.0~3.6
	MR36V08G87C	3.0~3.6
4G	MR36V04G54B	3.0~3.6
	MR36V04G54S	3.0~3.6
2G	MR36V02G54B	3.0~3.6
	MR26V02G54R	3.0~3.6
1G	MR36V01G52B	3.0~3.6
	MR26V01G53L	3.0~3.6
512M	MR26V51252R	3.0~3.6
	MR26V51253L	3.0~3.6
256M	MR37V25653T	3.0~3.6
	MR37V25652T	3.0~3.6
	MR27V25653L	3.0~3.6
128M	MR37V12852B	3.0~3.6
	MR27V12852L	3.0~3.6
	MR27V12852R (Under development)	3.0~3.6
	MR27V12850L	3.0~3.6
64M	MR37V6452B	3.0~3.6
	MR27V6452L	3.0~3.6
	MR27V6452R	3.0~3.6
	MR26V6455J	3.0~3.6
32M	MR27V3252J	3.0~3.6
	MR27V3252R (Under development)	3.0~3.6
16M	MR27V1652L	3.0~3.6

## Parallel Page Mode P2ROM™ Series

Density (bit)	Part Number	Configuration (word×bit)	Mode	Page Size	Supply Voltage(V)	Access Time (Address/Page) (ns)	Current Consumption (Max.)		Operating Temperature (°C)	Package	Socket mounting package	Package Frame
							Operating	Standby				
16G	MR36V16G56C	256M×64	LVN	endless	3.0~3.6	1000/40	360mA	85mA	0~+70	LGA140 (*1)	CG/LGA140	—
8G	MR36V08G57C	256M×32	LVN	endless	3.0~3.6	1000/40	180mA	60mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
	MR36V08G87C	256M×32 (*2)	NOR	16-word×32	3.0~3.6	1000/40 450/40	180mA 150mA	40mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
4G	MR36V04G54B	128M×32/ 256M×16	NOR	8-word×32	3.0~3.6	105/25	100mA	85mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
	MR36V04G54S	128M×32/ 256M×16	NOR	8-word×32	3.0~3.6	130/25	100mA	85mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
2G	MR36V02G54B	64M×32/ 128M×16	NOR	8-word×32	3.0~3.6	105/25	100mA	50mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
	MR26V02G54R	64M×32/ 128M×16	NOR	8-word×32	3.0~3.6	105/25	100mA	45mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
1G	MR36V01G52B	64M×16/ 128M×8	NOR	8-word×16	3.0~3.6	105/25	100mA	25mA	0~+70	TSOP(I)56	—	—
	MR26V01G53L	64M×16/ 128M×8	NOR	8-word×16	3.0~3.6	105/25	100mA	10mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
512M	MR26V51252R	32M×16/ 64M×8	NOR	8-word×16	3.0~3.6	105/25	50mA	4mA	0~+70	TSOP(I)56	—	—
	MR26V51253L	32M×16/ 64M×8	NOR	8-word×16	3.0~3.6	100/35	80mA	5mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
256M	MR37V25653T	16M×16/ 32M×8	NOR	8-word×16	3.0~3.6	100/25	35mA	5mA	0~+70	SSOP70 (*1)	CG/SSOP70	—
	MR37V25652T	16M×16/ 32M×8	NOR	8-word×16	3.0~3.6	100/25	35mA	20μA	0~+70	TSOP(I)56	—	—
	MR27V25653L	16M×16/ 32M×8	NOR	8-word×16	3.0~3.6	100/35	60mA	5mA	0~+70	SSOP70/ (*1) Chip	CG/SSOP70	—
128M	MR37V12852B	8M×16/ 16M×8	NOR	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	TSOP(I)56	—	—
	MR27V12852L	8M×16/ 16M×8	NOR	8-word×16	3.0~3.6	85/30	50mA	10μA	0~+70	TSOP(I)56	—	—
	MR27V12852R (Under development)	8M×16/ 16M×8	NOR	8-word×16	3.0~3.6	80/25	40mA	10μA	-40~+85	TSOP(I)56	—	—
	MR27V12850L	8M×16/ 16M×8	NOR	8-word×16	3.0~3.6	85/30	50mA	10μA	0~+70	TSOP(I)48/ Chip	—	—
64M	MR37V6452B	4M×16/ 8M×8	NOR	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	TSOP(I)48/ TSOP(I)56	—	—
	MR27V6452L	4M×16/ 8M×8	NOR	8-word×16	3.0~3.6	90/30	50mA	10μA	0~+70	SOP44/TSOP(I)48/ TSOP(I)56/Chip	CG/SOP44	—
	MR27V6452R	4M×16/ 8M×8	NOR	8-word×16	3.0~3.6	80/25	40mA	10μA	-40~+85	TSOP(I)48/ TSOP(I)56	—	—
	MR26V6455J	4M×16/ 8M×8	NOR	8-word×32	3.0~3.6	100/30	100mA	20μA	0~+70	SSOP70	—	—
32M	MR27V3252J	2M×16/ 4M×8	NOR	8-word×16	3.0~3.6	70/25	50mA	10μA	0~+70	SOP44/TSOP(I)48	CG/SOP44	—
	MR27V3252R (Under development)	2M×16/ 4M×8	NOR	8-word×16	3.0~3.6	80/25	40mA	10μA	-40~+85	TSOP(I)48	—	—
16M	MR27V1652L	1M×16/ 2M×8	NOR	8-word×16	3.0~3.6	80/25	60mA	10μA	0~+70	SOP44/TSOP(I)48/ Chip	CG/SOP44	—

\*1: For sockets. Package is not suitable for reflow soldering. \*2: Boot-ROM space (128-page×16-word×32-bit) is included.

# P2ROM™

## SPI BUS P2ROM™ Series

MR37T□□□□□□ 64M~128Mbit  
 MR37V□□□□□□ 128Mbit  
 MR27V□□□□□□ 16M~64Mbit

Supply Voltage : 3.0V~3.6V / 2.7V~3.6V  
 Operating Temperature : 0°C~+70°C

Density (bit)	Part Number	Supply Voltage (V)
128M	MR37T12841B (Under development)	3.0~3.6
	MR37T12843B <b>NEW</b>	3.0~3.6
	MR37V12841A	3.0~3.6
64M	MR37T6441B (Under development)	3.0~3.6
	MR37T6443B (Under development)	3.0~3.6
	MR27V6441L	3.0~3.6
32M	MR27V3241L	3.0~3.6
16M	MR27V1641L	3.0~3.6

## SPI BUS P2ROM™ シリーズ

Density (bit)	Part Number	Configuration (word×bit)	Supply Voltage (V)	Operating Frequency(MHz)		Current Consumption(Max.)		Operating Temperature (°C)	Package
				FAST-READ	READ	Operating (*3)	Standby		
128M	MR37T12841B (Under development)	128M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
	MR37T12843B <b>NEW</b>	128M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
		64M×2		80/68	50	30mA/20mA (*3)			
		32M×4		80/68	50	40mA/20mA (*3)			
64M	MR37V12841A	128M×1	3.0~3.6	33	20	30mA/20mA (*3)	50μA	0~+70	SOP16
	MR37T6441B (Under development)	64M×1	3.0~3.6	86	50	30mA/20mA (*3)	10μA	0~+70	SOP16
	MR37T6443B (Under development)	64M×1	3.0~3.6	80/68	50	30mA/20mA (*3)			
		32M×2		80/68	50	40mA/20mA (*3)			
	16M×4			80/68	50	40mA/20mA (*3)			
	MR27V6441L	64M×1	3.0~3.6	33	20	30mA/20mA (*3)	50μA	0~+70	SOP16/Chip
32M	MR27V3241L	32M×1	3.0~3.6	33	20	40mA/20mA (*3)	50μA	0~+70	SOP16/Chip
16M	MR27V1641L	16M×1	3.0~3.6	30	20	25mA/20mA (*3)	50μA	0~+70	SOP16/Chip

\*3 : FAST-READ/READ

# NOR Flash Memory

※B4-Flash is a registered trademark of Incorporated company GENUSION.

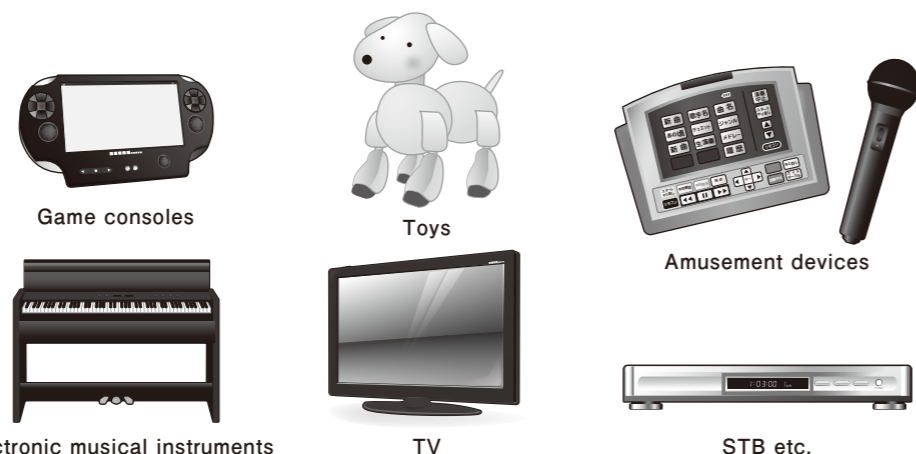
## NOR Flash Memory Overview

### Product Overview

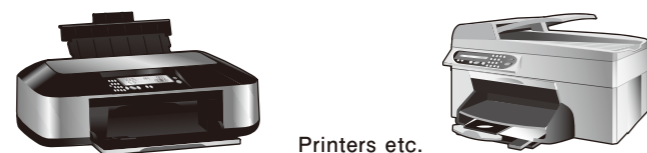
- Secure data storage feature after rewriting ...  
P-type memory cell maintains data for 20 years after 10,000 rewriting.
- Fast writing process ...  
B4-HE injection writing increases writing process speed by three times compared to the existing NOR-Flash.
- Fast erasing process  
Channel FN erasing increases erasing process speed by 40 times compared to the existing NOR-Flash

### Application Examples

#### <Consumer Products>



#### <IT>

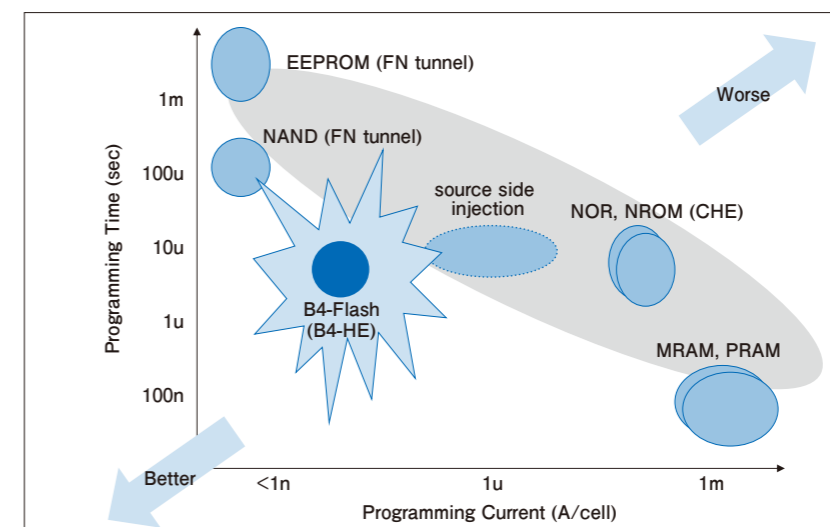


### Feature

GENUSION's "B4-Flash" technology (P-type memory cell, original "B4-HE injection" writing method\*) provides fast and high-quality rewriting.

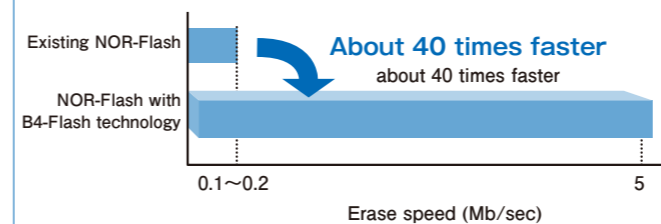
\*Back Bias assisted Band to Band tunneling (B4) - Hot Electron Injection

B4-Flash guarantees high speed writing.

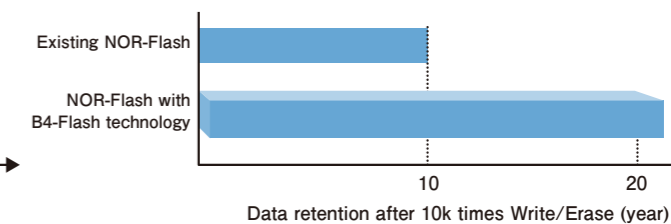


B4-HE injection method's low current consumption during writing process realizes concurrent writing of memory cells.

B4-Flash guarantees high speed erasing.



B4-Flash guarantees secure data storage.



### Product Line-up

Device Name	Product Name
256M NOR Flash	MR29V25652A (Under development)
128M NOR Flash	MR29V12852A (Under development)
64M NOR Flash	MR29V06452A (Under development)
32M NOR Flash	MR29V03252A (Under development)

### NOR Flash Memory Series

Product Name	Operating Voltage(V)	Memory Capacity (bit)	Memory Configuration (word×bit)	Mode	Pagesize	Access time (Address/Page) (ns)	Current Consumption (Max.)		Operating Temperature Ta (°C)	Package	Onboard socket support package	Package frame
							Operation	Stand-by				
MR29V25652A (Under development)	2.7~3.6	256M	16M×16	NOR	16-word×16	TBA	TBA	TBA	-40~+85	TSOP(I)56	—	—
MR29V12852A (Under development)	2.7~3.6	128M	8M×16	NOR	16-word×16	70/25	25mA	100uA	-40~+85	TSOP(I)56	—	—
MR29V06452A (Under development)	2.7~3.6	64M	4M×16	NOR	16-word×16	80/25	20mA	30uA	-40~+85	TSOP(I)56/TSOP(I)48	—	—
MR29V03252A (Under development)	2.7~3.6	32M	2M×16	NOR	16-word×16	80/25	15mA	30uA	-40~+85	TSOP(I)56/TSOP(I)48	—	—

# DRAM

## Legacy DRAM Overview

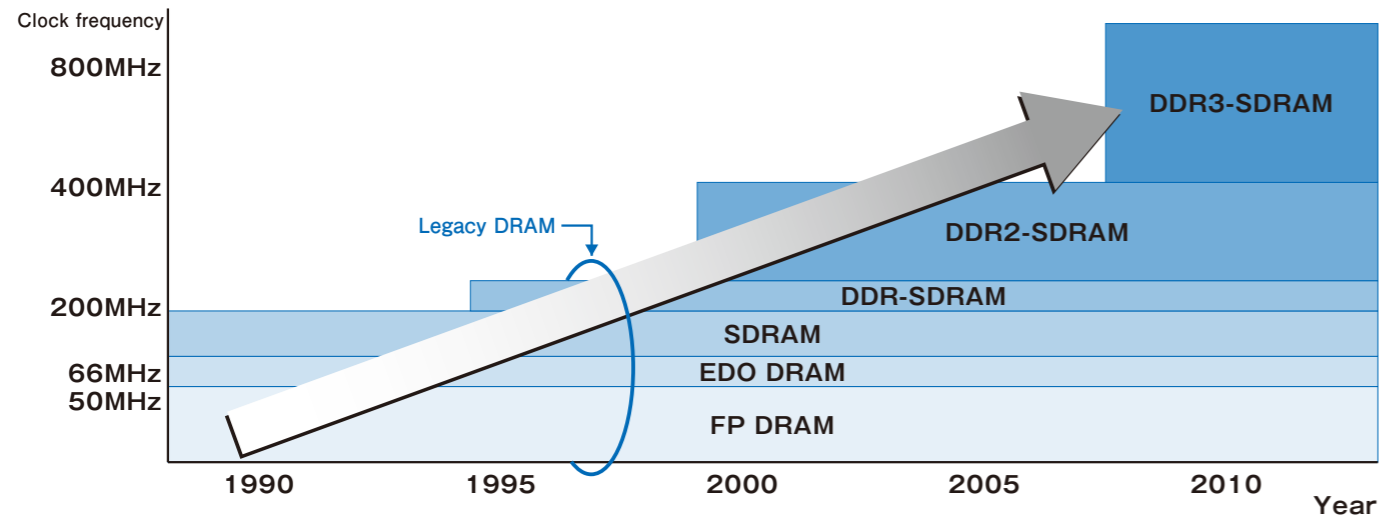
### Types of DRAM

#### Asynchronous clock DRAM

- FP DRAM (Fast Page mode)
- EDO DRAM (Extended Data Out)

#### Synchronous clock DRAM

- SDRAM (synchronous DRAM)
- DDR-SDRAM (Double-Data-Rate SDRAM)
- DDR2-SDRAM
- DDR3-SDRAM



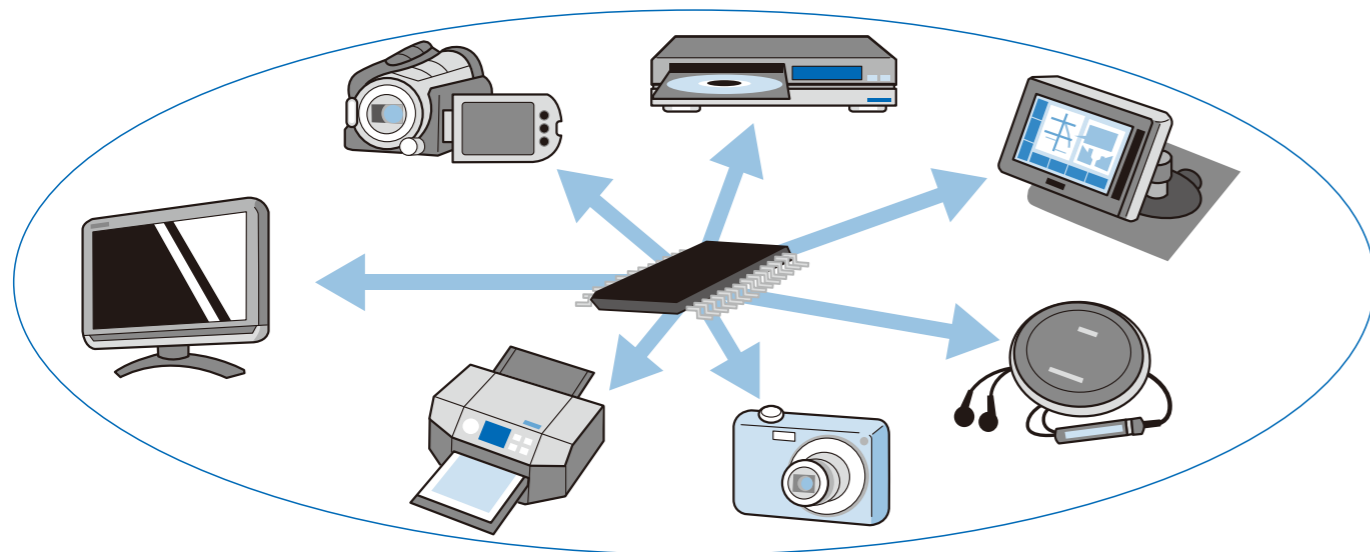
In addition, memories specifically designed for image processing are standardized.

We supply legacy DRAM and SDRAM for SiP on a long-term stable basis.

### Application Examples

- AV Electronics: LCD TV, DVD player, digital camera, etc.
- IT Device: printer, hard disk drive, optical disk drive, etc.
- Car Electronics: car audio and navigation system
- Communication Device: router, FAX, etc.

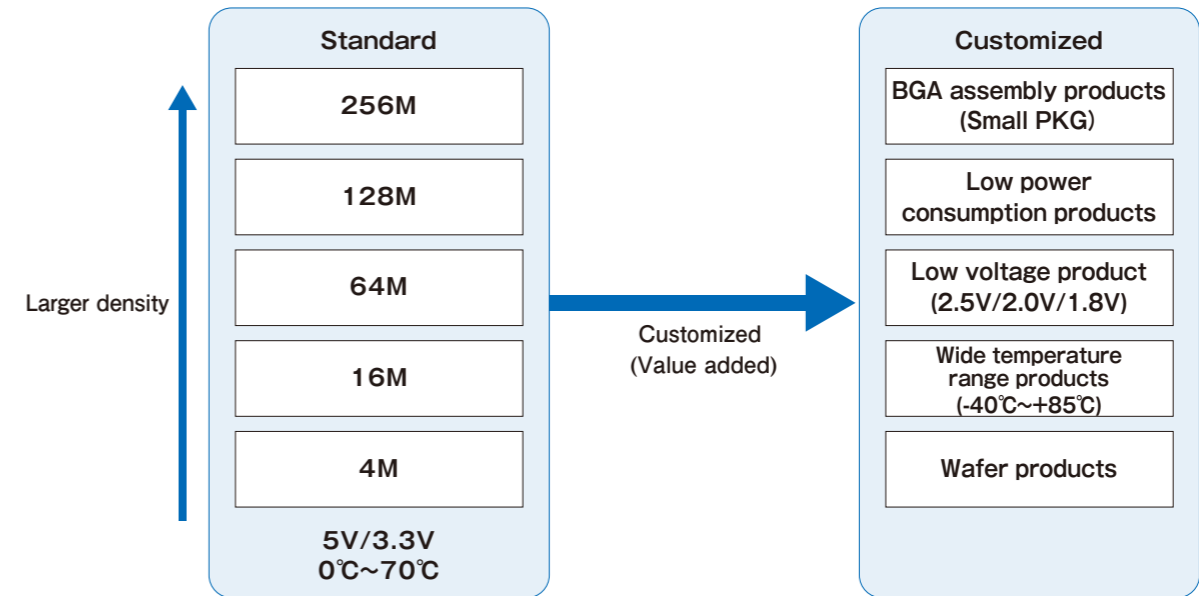
This product is also used in many other applications.



### Product Line-up

#### Legacy DRAM

While larger and faster DRAM occupies a larger market share, we provide smaller DRAM, which is difficult to obtain in these days, on a long-term stable basis. We provide not only standard products, which feature a wider range of operating temperatures and a smaller package, but also customized products in accordance with requirements by customers.



# DRAM

## Legacy DRAM FP/EDO

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number	
<b>Standard</b>					
5.0	4M	×4	1K	MSM514400E	
				MSM514800E	
				MSM514800ESL	
		×16	512	MSM514260E	
				MSM514265E	
				MSM5416258B	
	16M	×4	4K	MSM5116400F	
				MSM5117400F	
				MSM5117405F	
				MSM5117800F	
				MSM5117805F	
				MSM5116160F	
		×8	2K	MSM5117405F	
				MSM5117800F	
				MSM5117805F	
				MSM5116160F	
				MSM5118160F	
				MSM5118165F	
3.3	4M	×4	1K	MSM51V4400E	
				MSM51V4800E	
				MSM54V16258B	
		×16	512	MD54V16258BSL	
				MSM51V4265E	
				MSM51V16400F	
	16M	×4	4K	MSM51V16405F	
				MSM51V17400F	
				MSM51V17405F	
				MSM51V17800F	
				MSM51V17805F	
				MSM51V16160F	
		×8	2K	MSM51V17405F	
				MSM51V17800F	
				MSM51V17805F	
				MSM51V16160F	
				MSM51V16165F	
				MSM51V18160F	
×16	4K	1K	MSM51V18165F		
			MSM51V18160F		
			MSM51V18165F		
	4K	4K	MD51V65165E		
			<b>Automotive grade</b>		
			5.0	4M	×4
MSM514400DP					
MSM514400EP					
×16	512	MSM514260EP			
		MSM5118160FP			
		MSM5118165FP			
16M	×4	1K	MSM51V4400EP		
			MSM54V16258BP		
			MSM51V4265EP		
	×16	512	MSM51V17400FP		
			MSM51V17405FP		
			MSM51V18165FP		

## Legacy DRAM FP/EDO

Part Number	Supply Voltage(V)	Density (bit)	Configuration (word×bit)	Circuit function	Access Time (ns)	Cycle Time (cycles/ms)	Operating Temperature Ta (°C)	Package		
<b>Standard</b>										
MSM514400E	5.0±0.5	4M	1M×4	Fast Page Mode	60/70	1024/16	0~+70	TSOP(II)26/20Cu		
MSM514800E										
MSM514800ESL			512K×8	Fast Page Mode	60/70	1024/16		TSOP(II)28		
MSM514260E										
MSM514265E			256K×16	Fast Page Mode	60/70	512/8		TSOP(II)44/40		
MSM5416258B										
MSM5116400F		16M	4M×4	Fast Page Mode	60	4096/64		2048/32	TSOP(II)26/24Cu	
MSM5117400F										
MSM5117405F										
MSM5117800F			2M×8	Fast Page Mode	60	4096/64			TSOP(II)28	
MSM5117805F										
MSM5116160F										
MSM5118160F		1M×16	Fast Page Mode	60	4096/64	1024/16		TSOP(II)50/44		
MSM5118165F										
MSM51V4400E		3.3±0.3	4M	1M×4	Fast Page Mode	70/100		1024/16	-40~+85	TSOP(II)26/20Cu
MSM51V4800E										
MSM54V16258B				512K×8	Fast Page Mode	70		512/64		TSOP(II)28
MD54V16258BSL										
MSM51V4265E	256K×16			EDO	40/45/50	512/8	TSOP(II)44/40			
MSM51V16400F										
MSM51V16405F	16M		4M×4	Fast Page Mode	60	4096/64	2048/32	TSOP(II)26/24Cu		
MSM51V17400F										
MSM51V17405F										
MSM51V17800F			2M×8	Fast Page Mode	60	4096/64		TSOP(II)28		
MSM51V17805F										
MSM51V16160F										
MSM51V16165F	1M×16		Fast Page Mode	60	4096/64	1024/16	TSOP(II)50/44			
MSM51V18160F										
MSM51V18165F	4M×16		EDO	50/60	4096/54	TSOP(II)50				
MD51V65165E										
<b>Automotive grade</b>										
MSM514400DP	5.0±0.5		4M	1M×4	Fast Page Mode	60/70	1024/16	-40~+85		TSOP(II)26/20Cu
MSM514400EP										
MSM514260EP		256K×16		Fast Page Mode	60/70	512/8	TSOP(II)44/40			
MSM5118160FP										
MSM5118165FP		16M	1M×16	Fast Page Mode	60	1024/16	TSOP(II)50/44			
MSM51V4400EP										
MSM54V16258BP										
MSM51V4265EP	4M	256K×16	Fast Page Mode	70/100	1024/16	TSOP(II)26/20Cu				
MSM51V16258BP										
MSM51V4265EP		EDO	40/45/50	512/64	512/8		TSOP(II)44/40			
MSM51V17400FP										
MSM51V17405FP	16M	4M×4	Fast Page Mode	60	2048/32	TSOP(II)26/24Cu				
MSM51V18165FP										
MSM51V18165FP	1M×16	EDO	60	1024/16						

# DRAM

## Legacy DRAM SDRAM

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Data Rate Type	Part Number
<b>Standard</b>					
3.3±0.3	16M	×8	4K	SDR	MSM56V16800F
					MSM56V16160F
		×16			MSM56V16160K
					MSM56V16161K <small>NEW</small>
	64M	×16			MD56V62160E
					MD56V62160M
					MD56V62161M <small>NEW</small>
					MD56V72160C <small>NEW</small>
					MD56V72161C (Under development)
					MD56V82160A <small>NEW</small>
256M	×16	8K	MD56V82160A <small>NEW</small>		
			MD58W82160A (Under development)		
2.5±0.2	256M	×16	8K	DDR	MD58W82160A (Under development)
<b>Industrial</b>					
3.3±0.3	16M	×16	4K	SDR	MSM56V16161KP <small>NEW</small>
					MD56V62161M-xxTAP <small>NEW</small>
	128M				MD56V72161C-xxTAP (Under development)
	256M				MD56V82160A-xxTAP <small>NEW</small>
<b>Automotive grade</b>					
3.3±0.3	16M	×16	4K	SDR	MSM56V16160FP
					MSM56V16160KP
	64M				MD56V62160E-xxTAP
					MD56V62160M-xxTAP
					MD56V72160C-xxTAP <small>NEW</small>
					MD56V82160A-xxTAP <small>NEW</small>
128M	×16				
256M	×16	8K			

## Legacy DRAM SDRAM

Part Number	Supply Voltage(V)	Density (bit)	Configuration (bank×word×bit)	Max. Operating Frequency(MHz)	Refresh Cycle (cycles/ms)	Cycle Time (ns)	Operating Temperature Ta (°C)	Package	Function	
<b>Standard</b>										
MSM56V16800F	3.3±0.3	16M	2×1M×8	125	4096/64	8/10	0~+70	TSOP(II)44	—	
MSM56V16160F	125			8/10		TSOP(II)50		—		
MSM56V16160K	3.3±0.3		2×512K×16	166	4096/64	6/7/7.5/8/10		TSOP(II)50Cu	Drivability adjustment function	
MSM56V16161K <small>NEW</small>	143			7/7.5/8/10		TSOP(II)50Cu		Drivability adjustment function		
MD56V62160E	3.3±0.3		64M	4×1M×16	100	4096/64		10	TSOP(II)54	—
MD56V62160M					143			7/7.5/10	TSOP(II)54Cu	Drivability adjustment function
MD56V62161M <small>NEW</small>					143			7/7.5/10	TSOP(II)54Cu	Drivability adjustment function
MD56V72160C <small>NEW</small>					166			6/7/7.5/10	TSOP(II)54Cu	Drivability adjustment function
MD56V72161C (Under development)					166			6/7/7.5/10	TSOP(II)54Cu	Drivability adjustment function
MD56V82160A <small>NEW</small>					166			6/7/7.5/10	TSOP(II)54Cu	Drivability adjustment function
MD58W82160A (Under development)	3.3±0.3	256M	4×4M×16	166	8192/64	6/7/7.5/10	TSOP(II)54Cu	Drivability adjustment function		
MD58W82160A (Under development)	2.5±0.2	256M	4×4M×16	200	8192/64	5/6/10	TSOP(II)66Cu	Drivability adjustment function		
<b>Industrial</b>										
MSM56V16161KP <small>NEW</small>	3.3±0.3	16M	2×512K×16	143	4096/64	7/7.5/8/10	-40~+85	TSOP(II)50Cu	Drivability adjustment function	
MD56V62161M-xxTAP <small>NEW</small>		64M	4×1M×16	143		7/7.5/10		TSOP(II)54Cu		
MD56V72161C-xxTAP (Under development)		128M	4×2M×16	166		6/7/7.5/10		TSOP(II)54Cu		
MD56V82160A-xxTAP <small>NEW</small>		256M	4×4M×16	166		8192/64		6/7/7.5/10		TSOP(II)54Cu
<b>Automotive grade</b>										
MSM56V16160FP	3.3±0.3	16M	2×512K×16	100	4096/64	10	-40~+85	TSOP(II)50	—	
MSM56V16160KP				166		6/8/10		TSOP(II)50Cu	Drivability adjustment function	
MD56V62160E-xxTAP	3.3±0.3	64M	4×1M×16	100	4096/64	10	-40~+85	TSOP(II)54	—	
MD56V62160M-xxTAP				143		7/7.5/10		TSOP(II)54Cu	Drivability adjustment function	
MD56V72160C-xxTAP <small>NEW</small>				166		6/8/10		TSOP(II)54Cu	Drivability adjustment function	
MD56V82160A-xxTAP <small>NEW</small>				166		8192/64		6/7/7.5/10	TSOP(II)54Cu	Drivability adjustment function

SDR: Single Data Rate Synchronous DRAM, DDR: Double Data Rate Synchronous DRAM

## SDRAM for SiP (chip product)

Supply Voltage(V)	Density (bit)	Number of data bits	Refresh Cycle	Part Number
<b>Standard</b>				
3.3	16M	×16	4K	MSM56V16160K
	64M			MD56V62160M
<b>Automotive grade</b>				
3.3	16M	×16	4K	MSM56V16160K
	64M			MD56V62160M

## SDRAM for SiP (chip product)

Part Number	Supply Voltage(V)	Density (bit)	Configuration (bank×word×bit)	Max. Operating Frequency(MHz)	Refresh Cycle (cycles/ms)	Cycle Time (ns)	Operating Temperature Tj (°C)	Notes	Feature
<b>Standard</b>									
MSM56V16160K	3.3±0.3	16M	2×512K×16	166	4096/32	6/7/7.5/8/10	-40~+125	—	KGD
MD56V62160M	3.3±0.3	64M	4×1M×16	166	4096/32	6/7/7.5/8/10	-40~+125	—	KGD
<b>Automotive grade</b>									
MSM56V16160K	3.3±0.3	16M	2×512K×16	166	4096/32	6/8/10	-40~+125	—	KGD
MD56V62160M	3.3±0.3	64M	4×1M×16	166	4096/32	6/8/10	-40~+125	—	KGD

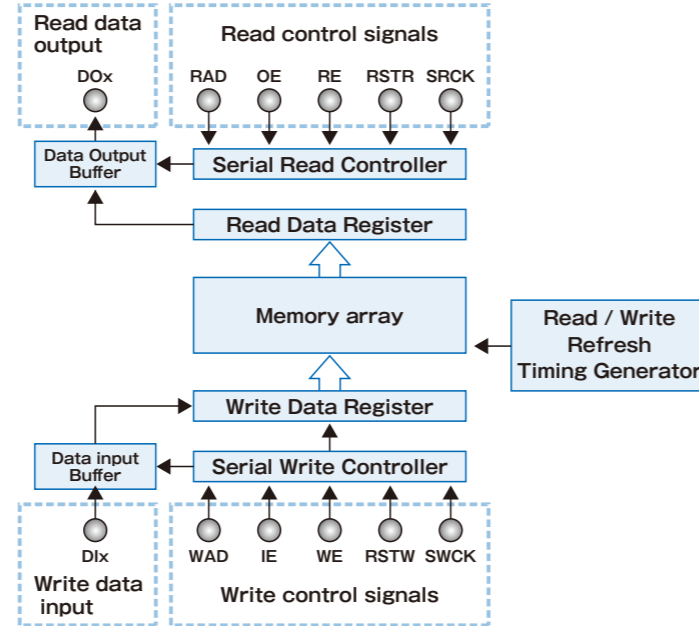
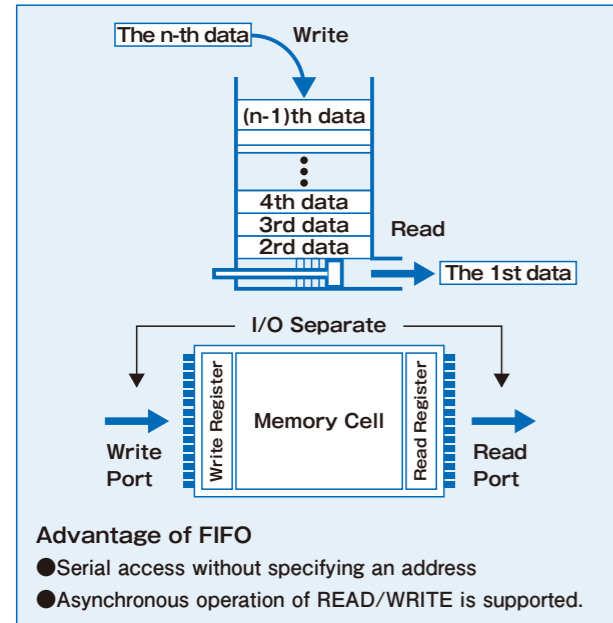
# DRAM

## Video Memory Overview

### Product Overview

FIFO memory is suitable if frame delay or multi-line delay is required for image processing.

#### What is First In First Out memory?



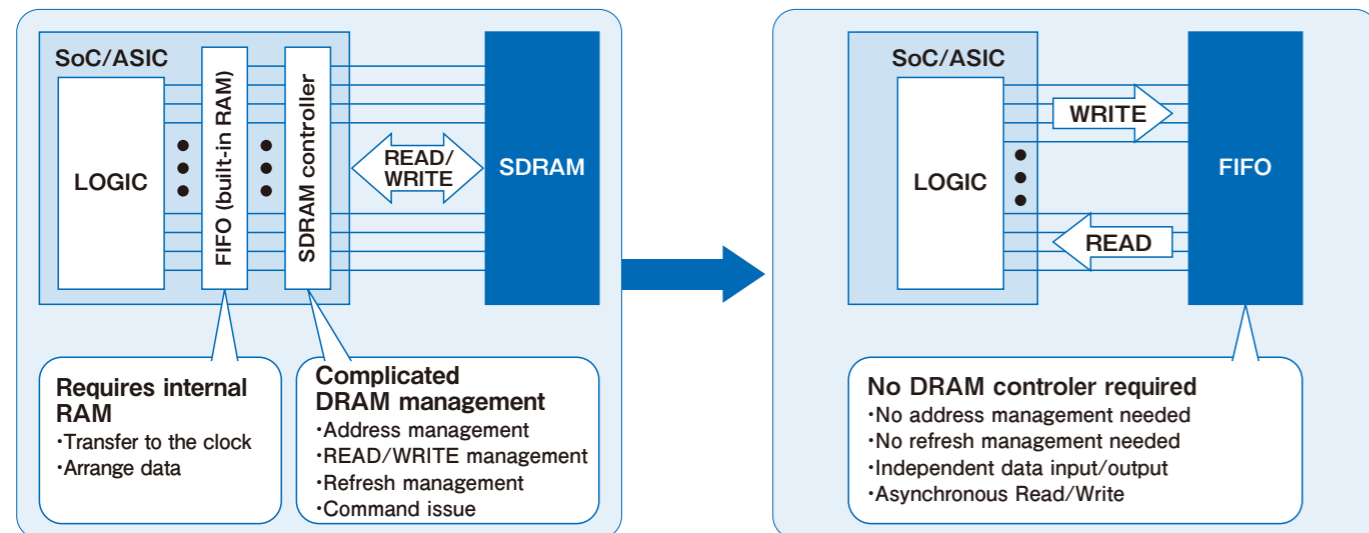
### Benefits

#### ① Cost-Saving

- Elimination of SDRAM controller and FIFO (built-in RAM) in the controller (SoC, ASIC, and FPGA) results in a smaller area/size of a circuit.
- With the independent I/O port, the same data transmission rate as DDR SDRAM can be achieved at a lower clock frequency, thus eliminating costly multi-layered board.

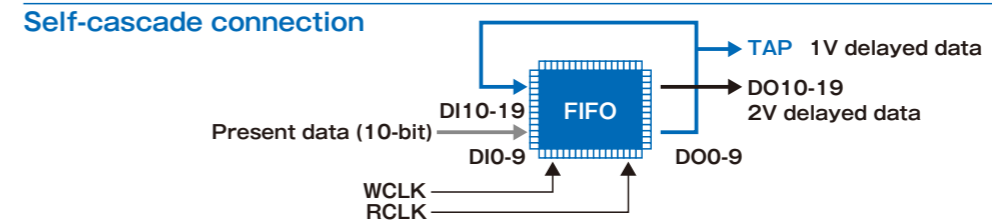
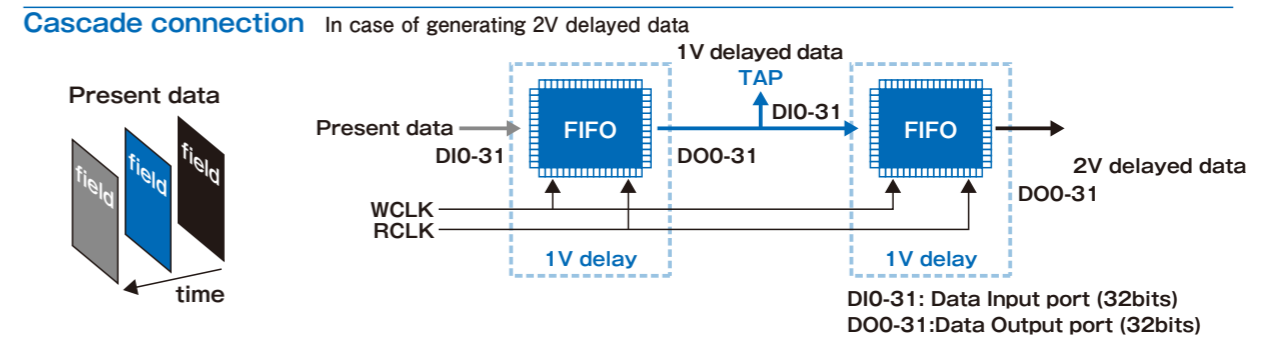
#### ② Shorter Development Time

- No need of time for designing complicated SDRAM controller, such as Read/Write arbitration.
- It can be operated at a clock frequency lower than DDR SDRAM, thus simplifying the board designing and shortening the board designing time.



### Example of Usage

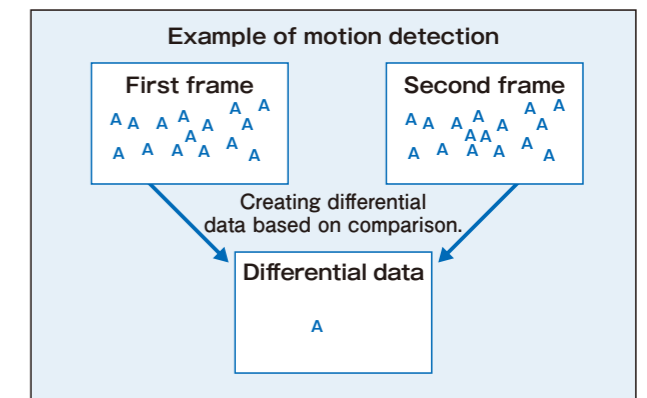
- If delayed data of multi-frame is required, it can be easily obtained by cascade connection.
- If a large-capacity is required, a large-capacity FIFO memory can also be obtained by cascade connection.



### Application Examples

The memory provides the following functions for flat-panel display, surveillance camera, video camera, video capture, digital still camera, graphic data transmission system, graphic conversion system, etc.

- 3-D Y/C separation
- Compensation between frames
- LVDS transmission buffer
- Frame synchronizer
- Noise reduction
- Data compression/expansion
- Motion detection
- On-screen display
- IP conversion



# DRAM

## Video Memory

Supply Voltage(V)	Density (bit)	Number of data bits	Part Number
<b>Standard</b>			
5.0	3M	×12	MSM5412222B
	4M	×16	MS8104160A
3.3	3M	×12	MSM54V12222B
			MS81V03120
	4M	×16	MS81V04160A
			MS81V04166A
	5M	×10	MS81V05200
	6M	×16	MS81V06160
	10M		MS81V10160
26M	×24	MS81V26000	
<b>Automotive grade</b>			
3.3	4M	×16	MS81V04160AP
	26M	×24	MS81V26000-25TPZP3

## Video Memory

Part Number	Supply Voltage(V)	Density (bit)	Configuration (word×bit)×port	Max. Operating Frequency(MHz)	Access Time(ns)	Cycle Time(ns)	Power Consumption(mW)		Operating Temperature Ta (°C)	Package	Notes
							Operating	Standby			
<b>Standard</b>											
MSM5412222B	5.0±0.5	3M	262,214×12	40	23/25	25/30	330	27.5	0~+70	TSOP(II)44	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS8104160A	5.0±0.5	4M	(262,214×8)×2	50	18/23	20/25	935	27.5	0~+70	QFP100	Asynchronous serial read/write, Write mask function, Output data control, Cascade, Two-port, 2 common WCLK ports
MSM54V12222B	3.3±0.3	3M	262,214×12	50	18/23	20/25	216	10.8	0~+70	TSOP(II)44	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS81V03120	3.3±0.3	3M	262,214×12	100	7.5/8	10/12	360	14.4	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS81V04160A	3.3±0.3	4M	(262,214×8)×2	50	18/23	20/25	288	10.8	0~+70	QFP100	Asynchronous serial read/write, Write mask function, Output data control, Cascade, Two-port, 2 common WCLK ports
MS81V04166A											Asynchronous serial read/write, Write mask function, Output data control, Cascade, Two-port, 2 independent WCLK ports
MS81V05200	3.3±0.3	5M	583,680×10	77	8	13	780	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS81V06160	3.3±0.3	6M	401,408×16	83	9/12	12/15	756/612	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS81V10160	3.3±0.3	10M	664,320×16	83	9/12	12/15	756/612	21.6	0~+70	TSOP(II)70	Asynchronous serial read/write, Write mask function, Output data control, Cascade
MS81V26000	3.3±0.3	26M	1,114,112×24	100	8/9	10/12	648/576	18	0~+70	QFP100	Asynchronous serial read/write, Write mask function, Output data control, Cascade, The top address can be specified
<b>Automotive grade</b>											
MS81V04160AP	3.3±0.3	4M	(262,214×8)×2	50	18/23	20/25	288	10.8	-40~+85	QFP100	Asynchronous serial read/write, Write mask function, Output data control, Cascade, Two-port, 2 common WCLK ports
MS81V26000-25TPZP3	3.3±0.3	26M	1,114,112×24	40	12	25	576	18	-40~+85	TQFP100Cu	Asynchronous serial read/write, Write mask function, Output data control, Cascade, The top address can be specified



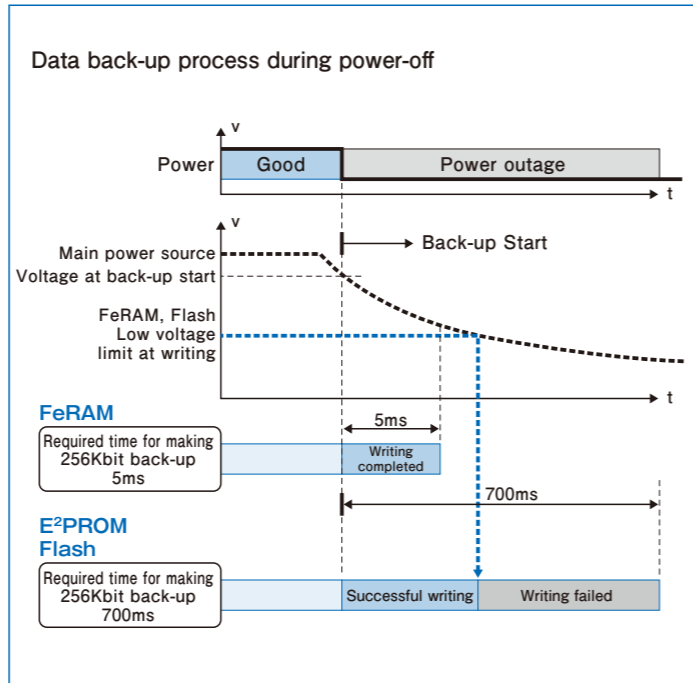
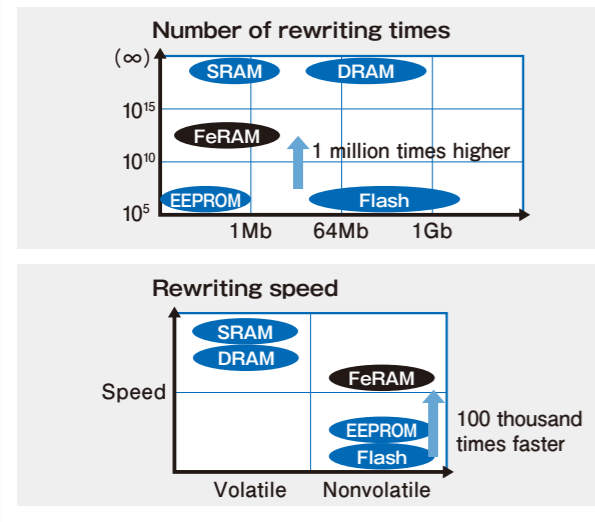
# FeRAM

## Ferroelectric Memory Overview

### Product Overview

- High-speed random read/write (read/write cycle: 150ns)
- High read/write tolerance:  $10^{12}$  times (1 trillion times)
- Data storage guarantee: 10 years


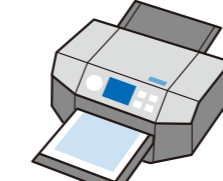
Comparison with FLASH  
 1 million times higher rewriting tolerance  
 FeRAM's rewriting tolerance 1 trillion ( $10^{12}$ )  
 100 thousand faster rewriting speed  
 FeRAM's rewriting speed 150ns



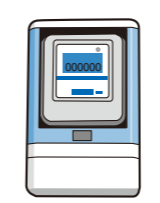
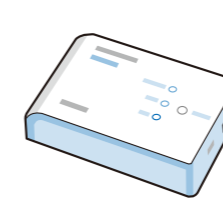
### Application Examples

Suitable for continuous log data recording or emergency backup

**Industrial devices**  
(Accounting information)





Multi-functional equipment    Printer





Electricity meter    PLC

**On-vehicle equipment**  
(Resume information)

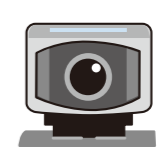



Car Navigation


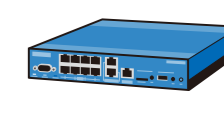


Car Audio

**Communication devices**  
(Error log information)

TV conference system    Professional video camera

POS System    Router

### Product Line-up

Supply Voltage(V)	Memory Capacity (bit)	Number of data bits	I/F	Part Number
3.3	32k	×8	SPI	MR45V032A
	64k	×8	I <sup>2</sup> C	MR44V064A
	256k	×8	SPI	MR45V256A
	256k	×8	Parallel	MR48V256C (under development)
	2M	×8	SPI	MR45V200A (under development)

Part Number	Supply Voltage (V)	Memory Capacity (bit)	Memory Configuration (word×bit)	Max. Operating Frequency(MHz)	Read/Write Tolerance (time)	Data Storage Duration (years)	Operating Temperature Ta (°C)	Package
MR45V032A	2.7~3.6	32k	4k×8	fclk=15MHz	$10^{12}$	10	-40~+85	SOP8
MR44V064A	2.5~3.6	64k	8k×8	fclk=3.4MHz	$10^{12}$	10	-40~+85	SOP8
MR45V256A	3.0~3.6	256k	32k×8	fclk=15MHz	$10^{12}$	10	-40~+85	SOP8
MR48V256C (under development)	2.7~3.6	256k	32k×8	tRC=150ns	$10^{12}$	10	-40~+85	TSOP(1)28
MR45V200A (under development)	2.7~3.6	2M	256k×8	fclk=34MHz	$10^{12}$	10	-40~+85	8pinDIP

# Display Driver

## Display Driver Overview

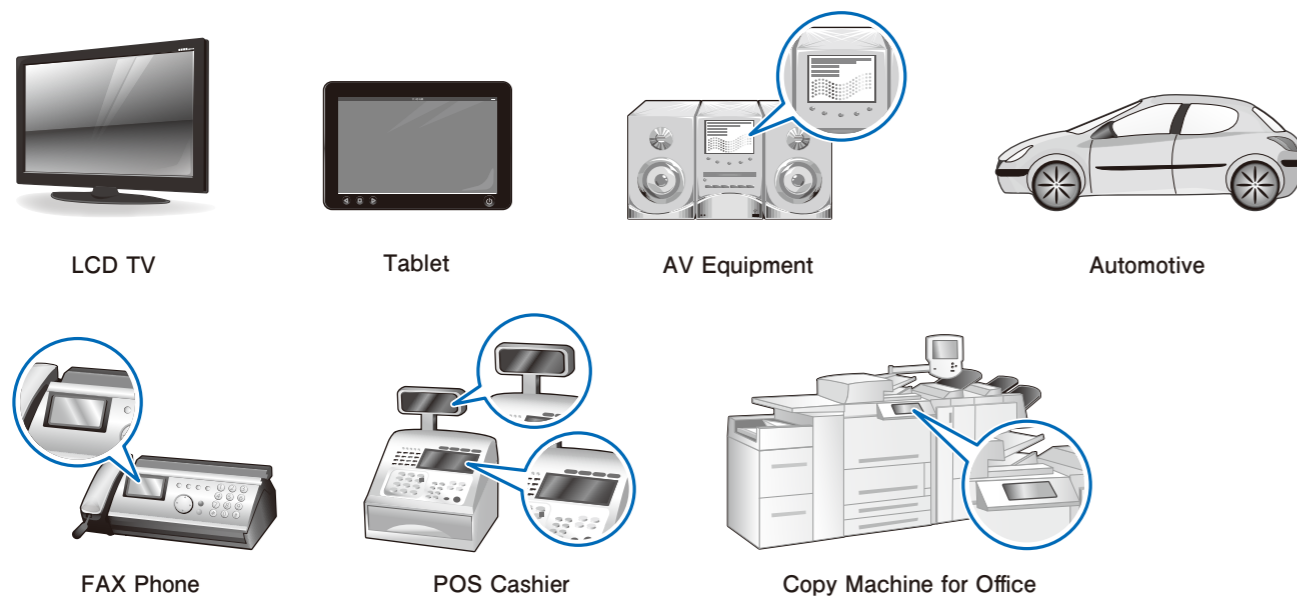
### Product Overview

Our display drivers have been adopted in a wide range of applications, from large-screen TVs, PC monitors, and laptop PCs to electronic dictionaries/calculators, instrument displays in automotive systems, and industrial equipment. A broad lineup is offered to meet virtually any need, including large and small TFT-LCDs, vacuum fluorescent displays (VFDs), and organic electroluminescence displays (OLEDs).

- TFT Driver Series
- TN/STN LCD Driver Series
- VFD Driver Series
- OLED Driver Series
- Car Clock Drivers

### Application Examples

#### Display Driver



### Product Line-up

#### TFT Driver Series

- Driver for large TFT-LCD : The driver for large TFT-LCD is mostly for custom applications. For details, please inquire to the sales (ROHM Co., Ltd.).
- Driver for small-medium TFT-LCD : ML98xx Series

#### TN/STN LCD Driver Series

- Common/Segment driver for matrix LCD : ML946x Series
- Controller driver for graphic LCD : ML90xx Series
- Controller driver for character LCD : ML90xx Series
- Controller driver for low Duty LCD : ML947x Series

#### VFD Driver Series

- Anode/Grid driver for VFD : ML92xx Series
- Controller driver for character VFD : ML92xx Series
- Controller driver for low duty VFD : ML921x Series

#### OLED Driver Series

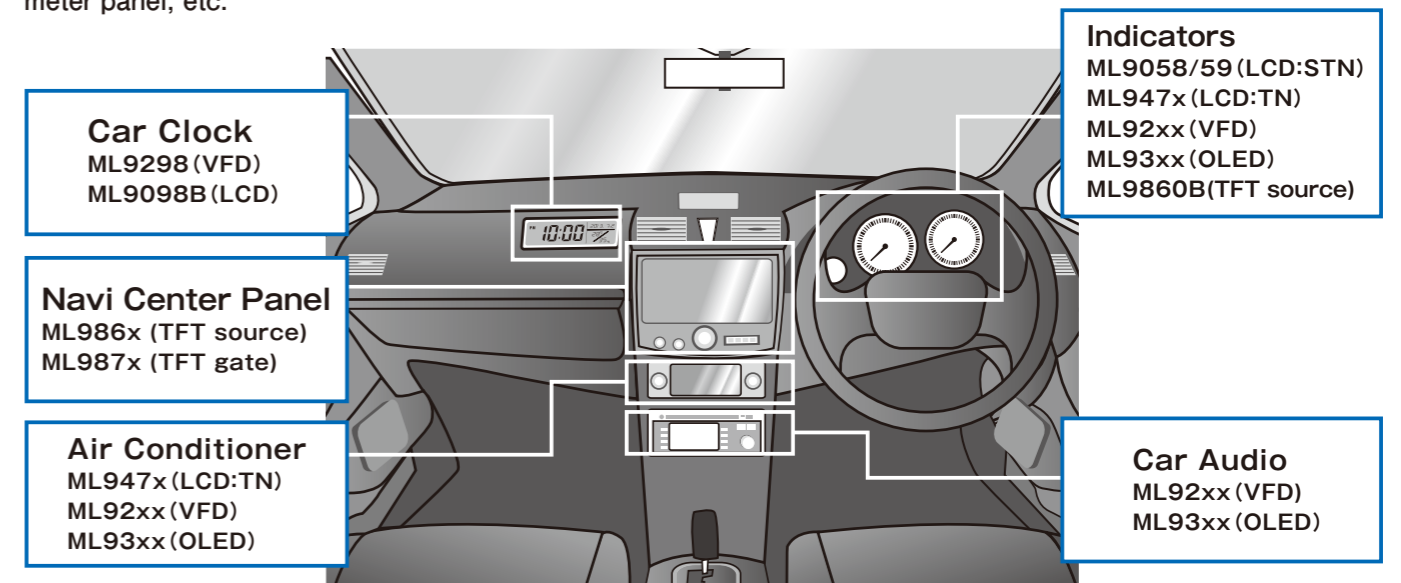
- Driver for OLED : ML93xx Series

#### Car Clock Drivers

- Car Clock Drivers : ML9298 (VFD), ML9098B (LCD)

### Application Examples in a Car

LAPIS Semiconductor meets customers' needs for every automotive display to be used in Car Clock, meter panel, etc.



# Display Driver

## TFT Driver Series

### Drivers for small to medium-sized TFT LCD

Description	Part Number
TFT-LCD driver	ML9860B
	ML9863A
	ML9870

### Drivers for small to medium-sized TFT LCD

Part Number	Feature	Package	Logic Supply Voltage(V)	LCD Voltage(V)	Operating Temperature(°C)	Number of Driver Outputs	I/F
ML9860B	TFT LCD source driver (480outputs)	Au bump chip	2.1~3.6	10.0~14.6	-40 ~ +95	480	RSDS
ML9863A	TFT LCD source driver (960outputs)	Au bump chip	2.4~3.6	8.0~14.6	-40 ~ +95	960/804/792/768	CMOS/RSDS
ML9870	TFT LCD gate driver (540outputs)	Au bump chip	2.7~3.6	~40	-40 ~ +95	540/480/400/384/360/300/240	CMOS

## TN/STN LCD Driver Series

### Common/Segment driver for dot matrix LCD

Description	Part Number
LCD driver	ML9460
	ML9461B

### Common/Segment driver for dot matrix LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Max. Driving Display size	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9460	240	—	320×240 (QVGA)	2.5~5.5	~43	-30~+75	Output change 240/200/160/120	Au bump chip
ML9461B	—	320		2.5~5.5	2.6~5.5	-30~+75	Output change 320/240/200	Au bump chip

### Controller driver for graphic LCD

Description	Part Number
LCD controller driver	ML9058E
	ML9059E
	ML9445
	ML9092-01
	ML9092-02 ML9092-03 ML9092-04

### Controller driver for graphic LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Max. Driving Display size	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9058E	65	132	132×65 dot	3.7~5.5	6~18	-40~+85	Integrated RAM/Boost circuit	Au bump chip
ML9059E	49	132	132×49 dot	3.7~5.5	6~18	-40~+85	Integrated RAM/Boost circuit	Au bump chip
ML9445	65	180	180×65 dot	2.7~5.5	6~18.5	-40~+105	Integrated RAM/Boost circuit	Au bump chip
ML9092-01	8/9/10	56	56×10 dot	4.5~5.5	4.5~16.5	-40~+85	Integrated RAM/Boost circuit	TQFP100
ML9092-02 ML9092-03 ML9092-04	8/9/10	60	60×10 dot	4.5~5.5	4.5~16.5	-40~+85	Integrated RAM/Boost circuit	TQFP100

### Controller driver for character LCD

Description	Part Number
LCD controller driver	ML9042-0x
	ML9042-1x
	ML9042-2x

### Controller driver for character LCD

Part Number	Max. No. of Common Outputs	Max. No. of Segment Outputs	Digits/Lines	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
ML9042-0x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 2KΩ	Au bump chip
ML9042-1x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 4KΩ	Au bump chip
ML9042-2x	17	100	5×8 dots, 20 characters×2 lines	2.7~5.5	2.7~5.5	-40~+85	Built-in bias register 10KΩ	Au bump chip

### Controller driver for low duty LCD

Description	Part Number
LCD controller driver (Package product)	ML9470-12
	ML9471
	ML9472
	ML9473
	ML9475
	ML9476
	ML9477
LCD controller driver (Gold bump product)	ML9480
	ML9478C
	ML9479E
	ML9488 <small>NEW</small>
	ML9489 <small>NEW</small>

### Controller driver for low duty LCD

Part Number	Max. No. of Segment Outputs	Max. No. of Driving Segments					Internal Oscillation Frame Frequency (Hz)	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Operating Temperature(°C)	Feature	Package
		static	1/2	1/3	1/4	1/5						
ML9470-12	80	80	160	—	—	—	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	QFP100
ML9471	80	—	—	240	320	400	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	TQFP100
ML9472	60	60	120	—	—	—	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	P-TQFP80-1212-0.50
ML9473	60	—	—	180	240	300	—	3.0~5.5 (single)	—	-40~+105	Supports external clock input	P-TQFP80-1212-0.50
ML9475	40	—	—	120	160	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	QFP56
ML9476	16	—	—	48	64	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	TQFP48
ML9477	32	—	—	96	128	—	—	2.7~5.5	3.5~5.5	-40~+105	Supports external clock input Bias generator built in	TQFP48
ML9480	40	40	80	120	160	—	65/75/85/95/130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9478C	80	80	160	240	320	—	65/75/85/95/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9479E	160	160	320	480	640	—	65/75/85/95/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9488 <small>NEW</small>	80	80	160	240	320	—	130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip
ML9489 <small>NEW</small>	160	160	320	480	640	—	130/150/170/190/Command switching	2.7~5.5	4.5~5.5	-40~+105	Supports external clock input Bias generator built in	Au bump chip

# Display Driver

## VFD Driver Series

### Anode/Grid driver for VFD

Description	Part Number
VFD driver	ML9270-xx
	ML9271
	ML9272

### Anode/Grid driver for VFD

Part Number	Driving target	VFD Driving Voltage (V)	Power Supply Type	Operating Temperature (°C)	Feature	Package
ML9270-xx	Anode/Grid	18	Positive supply	-40~+105	Cascade connection	QFP44
ML9271	Anode/Grid	18	Positive supply	-40~+105	Cascade connection	QFP64-P-1414-0.80
ML9272	Anode/Grid	65	Positive supply	-40~+105	Cascade connection	SSOP60

### Controller driver for character VFD

Description	Part Number
VFD controller driver	ML9208-xx
	ML9208A-xx
	ML9209-xx
	ML9289-xx
	ML9286-xx

### Controller driver for character VFD

Part Number	Display pixels	VFD Driving Voltage (V)	Power Supply Type	Operating Temperature (°C)	Feature	Package
ML9208-xx	5×7 dots	VDD-42	Negative supply	-40~+85	3-bit gradation	P-QFP64-1414-0.80, SSOP64
ML9208A-xx	5×7 dots	VDD-42	Negative supply	-40~+85	4-bit gradation	P-QFP64-1414-0.80, TQFP64
ML9209-xx	16 segs	VDD-42	Negative supply	-40~+85	4-bit gradation	QFP44
ML9289-xx	16 segs	42	Positive supply	-40~+85	4-bit gradation	QFP44, TQFP48
ML9286-xx	5×7 dots	80	Positive supply	-40~+105	Multigrid function, 8-bit gradation, Cascade connection	TQFP80-P-1212-0.50

### Controller driver for low duty VFD

Description	Part Number
VFD controller driver	ML9212GA
	ML9213GP

### Controller driver for low duty VFD

Part Number	Max. No. of Driving Segments	VFD Driving Voltage (V)	Power Supply Type	Operating Temperature (°C)	Feature	Package
ML9212GA	64 (1/2Duty), 96 (1/3Duty)	18	Positive supply	-40~+85	10-bit gradation, Cascade connection	QFP56
ML9213GP	112 (1/2Duty), 168 (1/3Duty)	18	Positive supply	-40~+85	10-bit gradation, Cascade connection	P-QFP80-1414-0.65

## OLED Driver Series

### Controller driver with internal RAM

Description	Part Number
Controller Driver with Internal RAM	ML9351A
	ML9353A

### Controller driver with internal RAM

Part Number	Max. No. of Driver Outputs		Gradation	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Output Current (mA)		Guaranteed Operating Temperature Tj(°C)	Feature	Package
	Anode	Cathode				Anode	Cathode			
ML9351A	156(52RGB)	38	4Gray PWM	2.7~3.3	12~20	0.3	50	-40~+125	Integrated RAM, 2-bit gradation	Au bump chip
ML9353A	132	64	16Gray PWM	4.5~5.5	10~24	0.98	129	-40~+125	Integrated RAM, 4-bit gradation, Sequence-free power ON	Au bump chip

### Anode/Cathode drivers

Description	Part Number
Anode/Cathode Driver	ML9362A
	ML9372A

### Anode/Cathode drivers

Part Number	Max. No. of Driver Outputs		Gradation	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Output Current (mA)		Guaranteed Operating Temperature Tj(°C)	Feature	Package
	Anode	Cathode				Anode	Cathode			
ML9362A	258(86RGB)	—	32Gray PWM	2.7~5.5	8~20	0.4	150	-40~+125	Cascade connection, 5-bit gradation, Sequence-free power ON	Au bump chip
ML9372A	—	64	—	2.7~5.5	8~20	0.4	150	-40~+125	Cascade connection	Au bump chip

### Segment drivers

Description	Part Number
Segment Driver	ML9380B

### Segment drivers

Part Number	Max. No. of Driver Outputs		Gradation	Logic Supply Voltage(V)	Driver Supply Voltage(V)	Output Current (mA)		Guaranteed Operating Temperature Tj(°C)	Feature	Package
	Anode	Cathode				Anode	Cathode			
ML9380B	96	1	PAM	3.0~5.5	8~20	0.4	100	-40~+125	Pulse amplitude modulation 6-bit gradation, Sequence-free power ON	Au bump chip

## Car Clock Drivers

Description	Part Number
Car clock	ML9298
	ML9098B

## Car Clock Drivers

Part Number	Package	Display Duty	VFD Driving Voltage (V)	Logic Supply Voltage (V)	Operating Temperature(°C)	Supply Current (Max.)	No. of Digit
ML9298	SSOP32	1/2	4.0~18	No need	-40~+85	0.6mA	4digits×1line and col.
ML9098B	TQFP48	Static, 1/2	3.0~5.5	3.0~5.5	-40~+105	0.6mA	4digits×1line and col. AM, PM

# Battery Monitoring LSI

## Battery Monitoring LSI Overview

### Product Overview

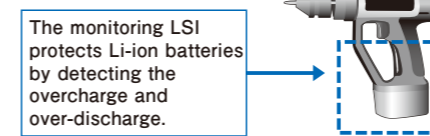
This product is designed to monitor voltage of Lithium-ion batteries with high accuracy and prevent overcharge or over-discharge by controlling the charge and the discharge in order to ensuring battery safety and longevity.

- Support to multi-cell series-connected Lithium-ion battery packs.  
Support maximum of 16 series coupling cell battery packs
- A highly accurate voltage detection circuit to each cell ensures overcharge / over-discharge.
- Include cell balancing function  
Built-in bypass switches for the cell-balancing function to reduce connection pins.
- Low power consumption.
- Built-in driving circuit of external FET for charge / discharge control.
- System protection functions if irregularities occur.
  - Short detection and protection
  - Abnormal operation detection and protection with using watch dog timer.
- Temperature detection function
- Internal regulator acts as power supply to an external MCU.
- On-board LED driver for displaying battery balance

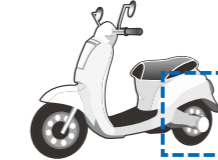
Products line-up includes stand-alone type/chipset (AFE + dedicated controller)

### Application Examples

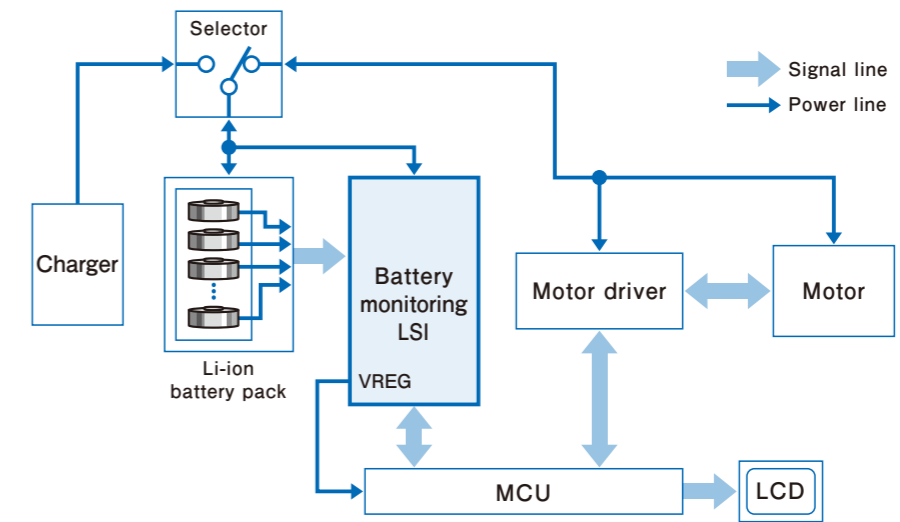
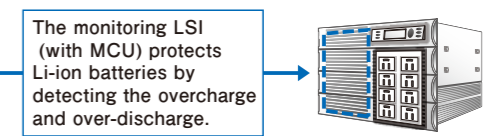
Lithium-ion Battery Monitoring LSI for Power Tools



Lithium-ion Battery Monitoring LSI for Electrically Assisted Bicycles



Lithium-ion Battery Monitoring LSI for Uninterruptible Power Supply (UPS)



### Product Line-up

Description	Part Number
Battery Monitoring LSIs for Power Tools, Electric bicycles, Uninterruptible Power Supply (UPS)	ML5203 <b>NEW</b>
	ML5235
	ML5238 <b>NEW</b>
	ML5208

Description	Part Number
Dedicated controller	ML610Q486P <b>NEW</b>
	ML5227

Part Number	Description	Supply Voltage	Voltage Measurement Error (typ)*	FET Driver for Charge-Discharge Control	Current Consumption		Package
					Operating	Power-down	
ML5203 <b>NEW</b>	4 to 7 cells supported battery monitoring LSI, Stand-alone type	+5V~+42V	±10mV	N-MOS	30μA	0.1μA	SSOP30
ML5235	5 to 13 cells supported battery monitoring LSI, Stand-alone type	+7V~+80V	±10mV	N-MOS	25μA	0.1μA	SSOP30
ML5238 <b>NEW</b>	5 to 16 cells supported battery monitoring LSI, Chipset type	+7V~+80V	±10mV	N-MOS	50μA	0.1μA	QFP44
ML5208	5 to 13 cells supported battery monitoring LSI, Chipset type	+7V~+80V	±10mV	N-MOS	150μA	50μA	QFP44

\*:The voltage measurement error of ML5207,ML5208 and ML5238 were measured using a dedicated controller for each device.

Part Number	Description	Supply Voltage		AD Converter	Current Consumption			Package
		VDD	AVDD		Operating	Suspended (HALT)	Shutdown	
ML610Q486P <b>NEW</b>	Microcontroller for ML5238 only	1.6V~3.6V	2.2V~3.6V	12bit	400μA	15μA	0.2μA	TQFP48
ML5227	Microcontroller for ML5208 only	1.6V~3.6V	2.2V~3.6V	12bit	400μA	15μA	0.2μA	TQFP48

# Companion Chip for Intel® Atom™ Processor E600

## Input/Output Hub (IOH) LSI Overview

### Product Overview

As a companion chip necessary to make up a system using the Intel® Atom™ Processor "E600" for embedded use, we offer three types of Input/Output Hub LSIs for In-Vehicle Infotainment, IP Mediaphone, and general embedded systems.

#### ●ML7213 In-Vehicle Infotainment Input/Output Hub LSIs

- Connects to the E600 via PCI Express® x1
- Converts SDVO to digital RGB
- Multiple audio interfaces: 6 x I2S + 2 x TDM
- Supports video input for camera connection
- Wide operating temperature range meets automotive requirements

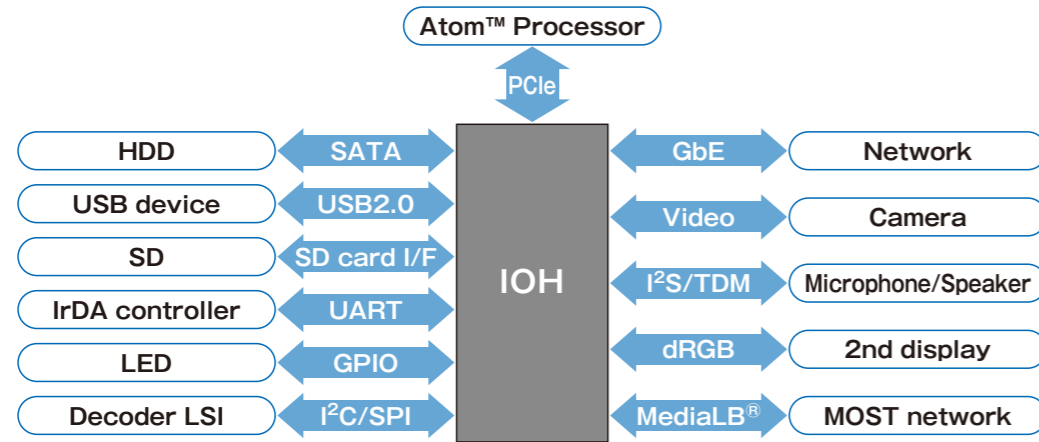
#### ●ML7223(V) IP Media Phone Input/Output Hub LSIs

- Connects to the E600 via 2 lines of PCI Express® x1 with network-related functions utilizing secure QoS
- Supports Gigabit Ether MAC and IPsec hardware accelerators
- Compatible with video input for camera connection
- V version (ML7223V) provides echo and noise cancellers for hands-free communication

#### ●ML7831 Cost-Optimized Input/Output Hub LSIs

- Connects to E600 via PCI Express® x1
- Pin-compatible with Intel's® EG20T Platform Controller Hub LSI
- Compatible device drivers (except for vendor IDs)
- Supports temperature ranges required for industrial applications

### IOHs with a wide variety of interfaces (Input/Output Hub)



We offer wide selection of IOHs with built-in I/F suitable for applications.

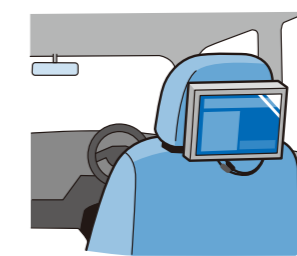
### Application Examples



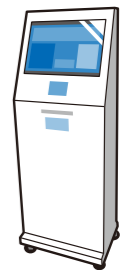
IP Mediaphone



Car Navigation System



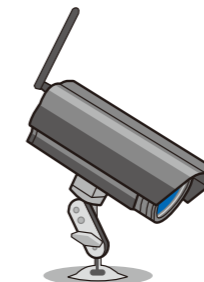
In-Vehicle Infotainment



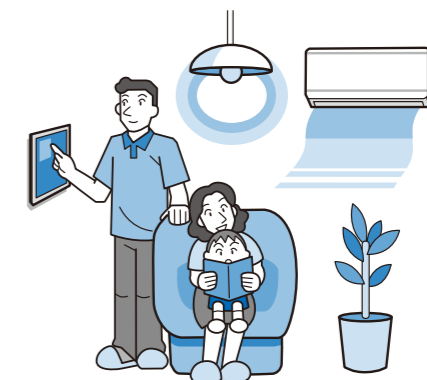
Digital Signage



Cash Register



IP Camera



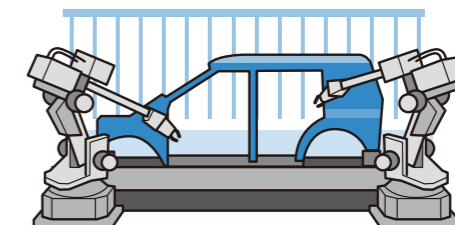
Home Energy Management



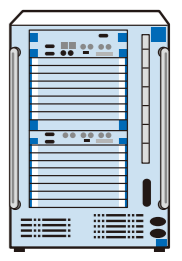
Thin Client



Medical Terminal Instrument



Industrial Electronics



Test & Measurement

### IOH Companion Chip for Intel® Atom™ Processor E600 (Input/Output Hub LSI)

Part Number	Supply Voltage (V)			Operating Temperature (°C)	Package	Interface Type																Remarks		
						Bus		Storage				Communication		Security	Video		Audio	Others						
						PCI Express®	USB Host	USB Device	USB Host /Device	SATA	SD Host	GbE (MAC)	MediaLB®	Security	Video input (BT656/RAW)	SDVO-Video output (dRGB)	Echo/Noise Canceller	SPI	UART	I²C	TDM		I²S	GPIO
ML7213	1.14~1.26	2.3~2.7	3.0~3.6	-40~85	PBGA404	○	○	—	○	○	○	—	○	—	○	○	—	○	○	○	○	○	○	A platform is easily built by using this IOH in combination with the Power Management LSI BD959x Series and Clock Generator LSI BU733x Series that are manufactured by ROHM Co, Ltd.
ML7223	1.14~1.26	2.3~2.7	3.0~3.6	-40~85	PBGA404	○	○	—	—	○	○	—	—	○	○	—	—	○	○	○	○	○	○	
ML7223V	1.14~1.26	2.3~2.7	3.0~3.6	-40~85	PBGA404	○	○	—	—	○	○	—	—	○	○	—	○	○	○	○	○	○	○	
ML7831	1.14~1.26	2.3~2.7	3.0~3.6	-40~85	PBGA376	○	○	○	—	○	○	—	—	—	—	—	—	○	○	○	—	—	○	

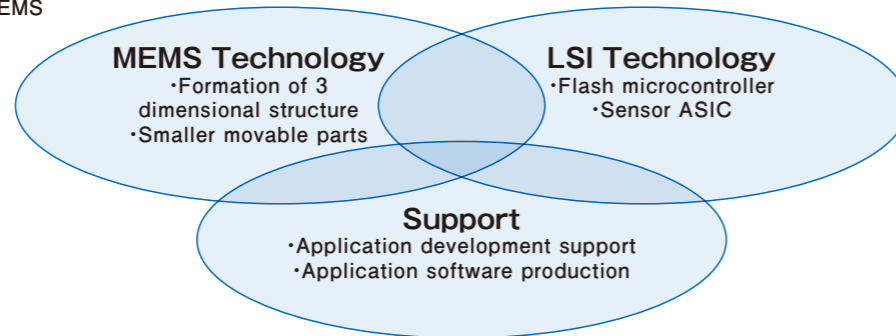
# MEMS/Sensor

## MEMS Acceleration Sensor Overview

### Product Overview

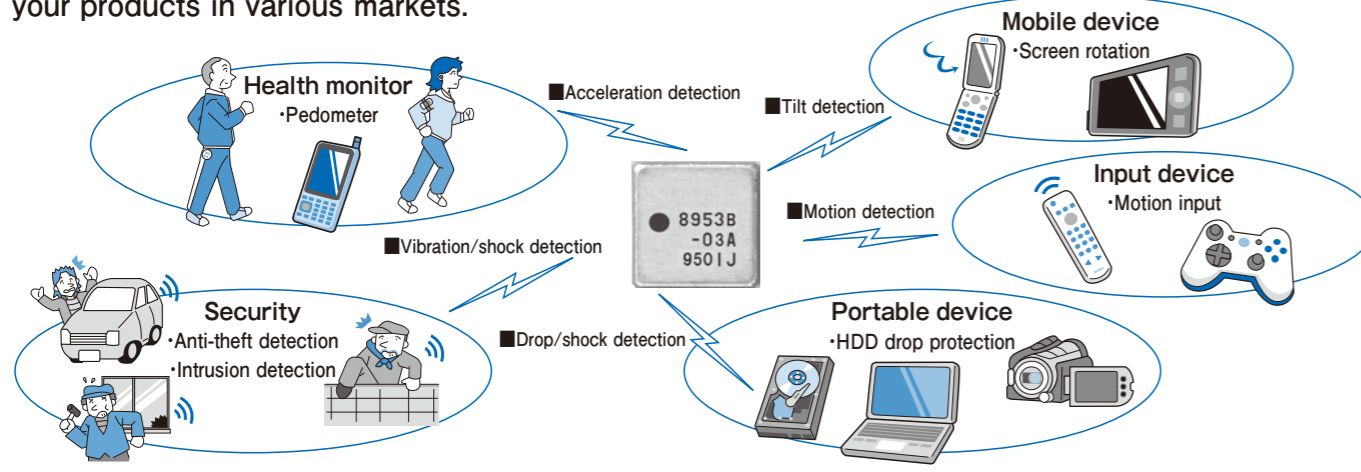
This product can precisely detect the movement and position of every device.

- Provides versatile functions by converging MEMS (Micro-Electro-Mechanical-Systems) and LSI technologies.
- Has a built-in flash microcontroller. Thus, application programs can be installed.
- We help you to create a motion application.



### Application Examples

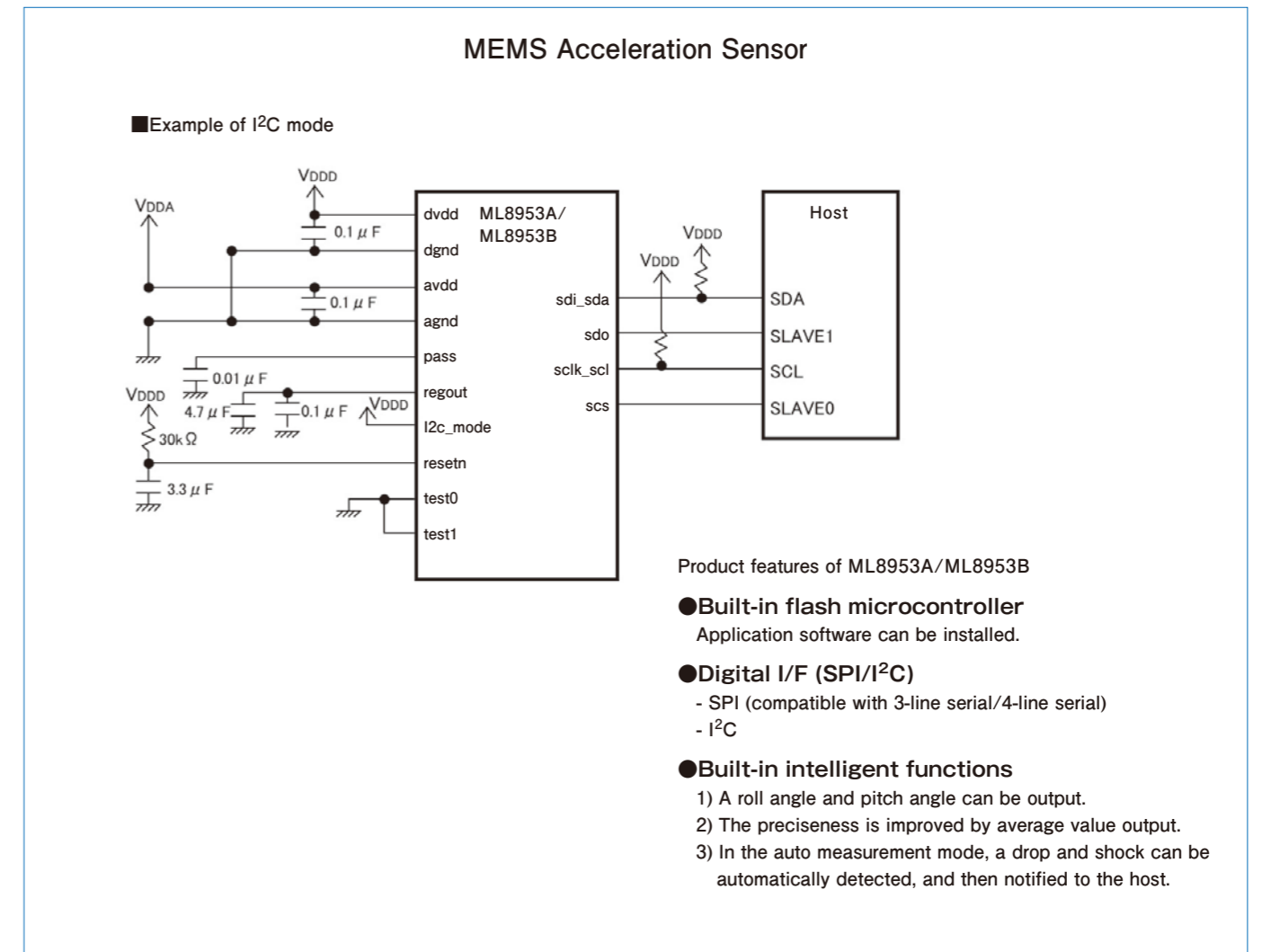
MEMS Acceleration Sensor's versatile functions bring you opportunities for introducing your products in various markets.



### Product Line-up

Description	Part Number
3-Axis Accelerometer Equipped with Flash Microcontroller	ML8953A
Low Power Version 3-Axis Accelerometer Equipped with Flash Microcontroller	ML8953B

### Applied Circuit



### MEMS Acceleration Sensor

Part Number	Feature	Package	Rated Acceleration	Supply Voltage (V)	Typical Current (*1) Consumption(Typ.)	Output Type	Temperature Sensor	Impact Resistance	Operating Temperature(°C)
ML8953A	3-Axis Accelerometer Equipped with Flash Microcontroller	C-TQFN18	±3g	Analogue : 2.5~3.6 Digital : 1.74~3.6	250μA	SPI, I <sup>2</sup> C	Built-in	5000g	-20~+70
ML8953B	Low Power Version 3-Axis Accelerometer Equipped with Flash Microcontroller	C-TQFN18	±3g	Analogue : 2.5~3.6 Digital : 1.65~3.6	120μA	SPI, I <sup>2</sup> C	Built-in	5000g	-20~+70

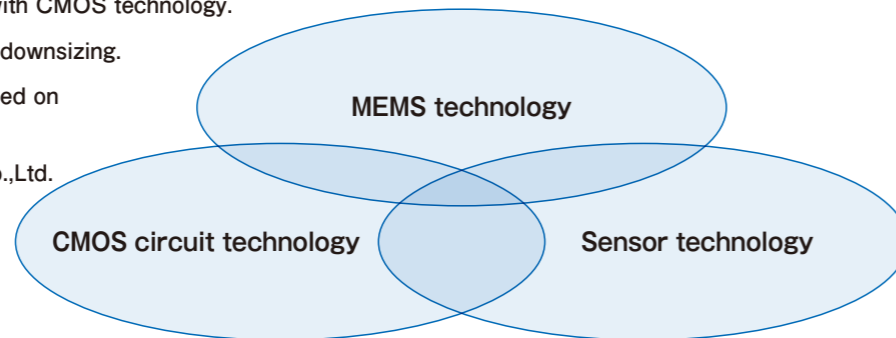
\*1: When the current consumption is measured in the interval of 30 msec.

# MEMS/Sensor

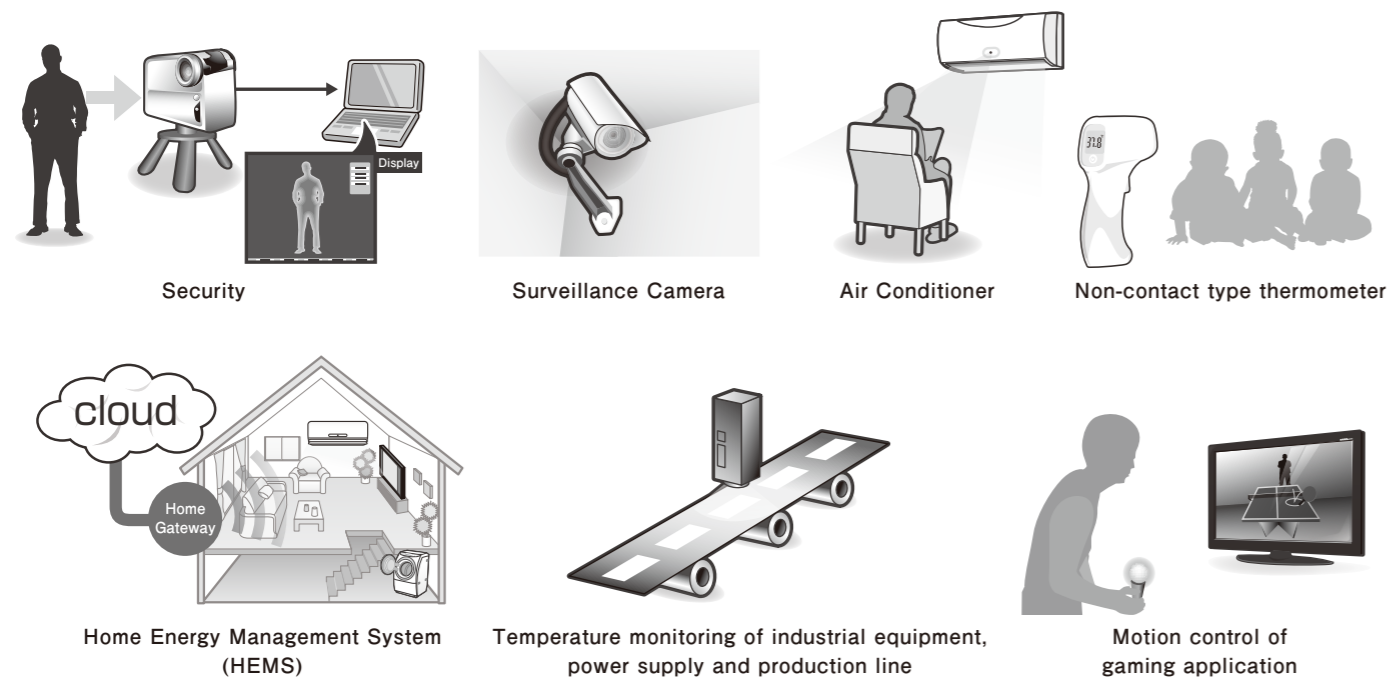
## Infrared (IR) Sensor Overview

### Product Overview

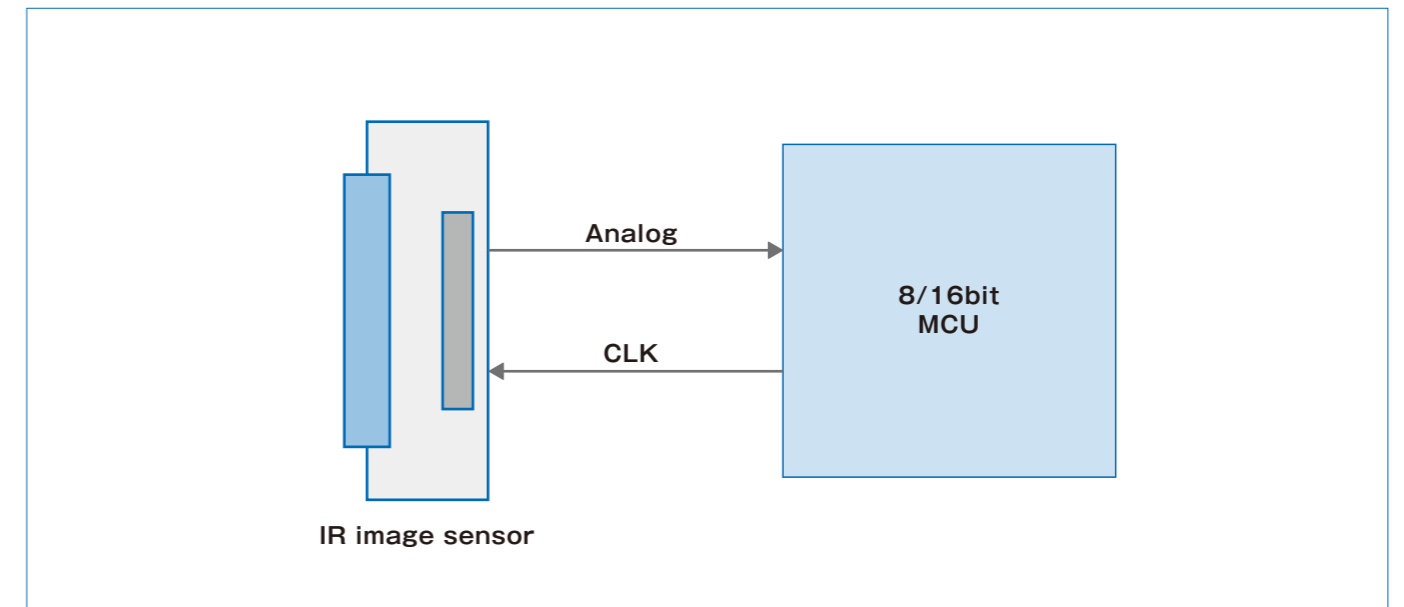
- 2K pixels medium-resolution, thermopile type infrared image sensor.
- Integrated sensor and peripheral circuit with CMOS technology.
- No cooling system for saving energy and downsizing.
- High sensitivity and low cost product based on LAPIS' s original technology.
- Jointly developed with NISSAN Motor Co.,Ltd.



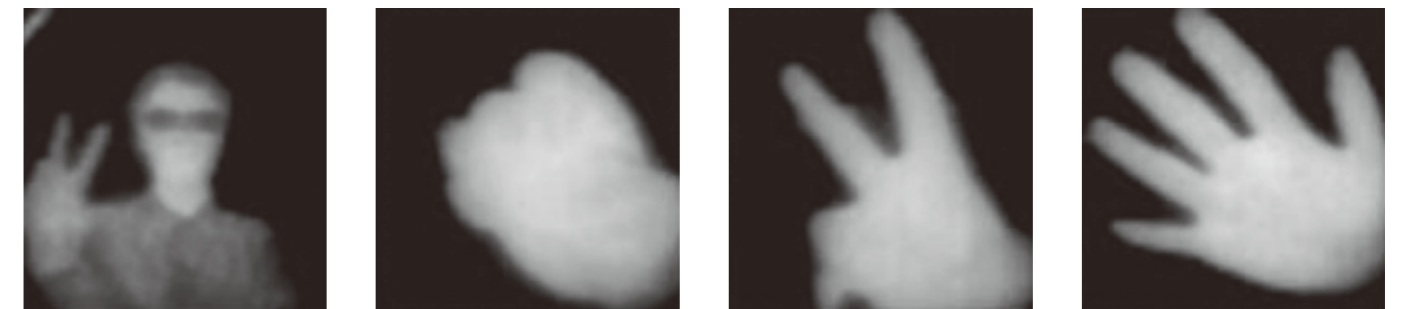
### Application Examples



### Applied Circuit



IR image screen example



### Product Line-up

Description	Part Number
Infrared Sensor	ML8540WD
Infrared Sensor	ML8540 (Under development)

### Infrared (IR) sensor

Part Number	Feature	Package	Pixel	Measurement Range (°C)	Temperature precision (°C)	Output Type	Read Speed	Supply Voltage(V)	Operating Temperature (°C)
ML8540WD	2K pixels thermopile type IR image sensor	Wafer	48row* 47column 2256 pixels	-30~300 (Variable)	0.5	Analog	6PFS	4.5~5.5V	-30~+85
ML8540 (Under development)	2K pixels thermopile type IR image sensor PKG	C-QFN24	48row* 47column 2256 pixels	-30~300 (Variable)	0.5	Analog	6PFS	4.5~5.5V	-30~+85

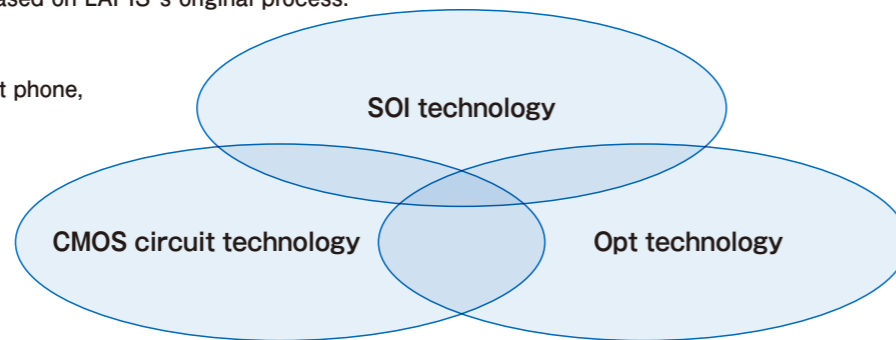


# MEMS/Sensor

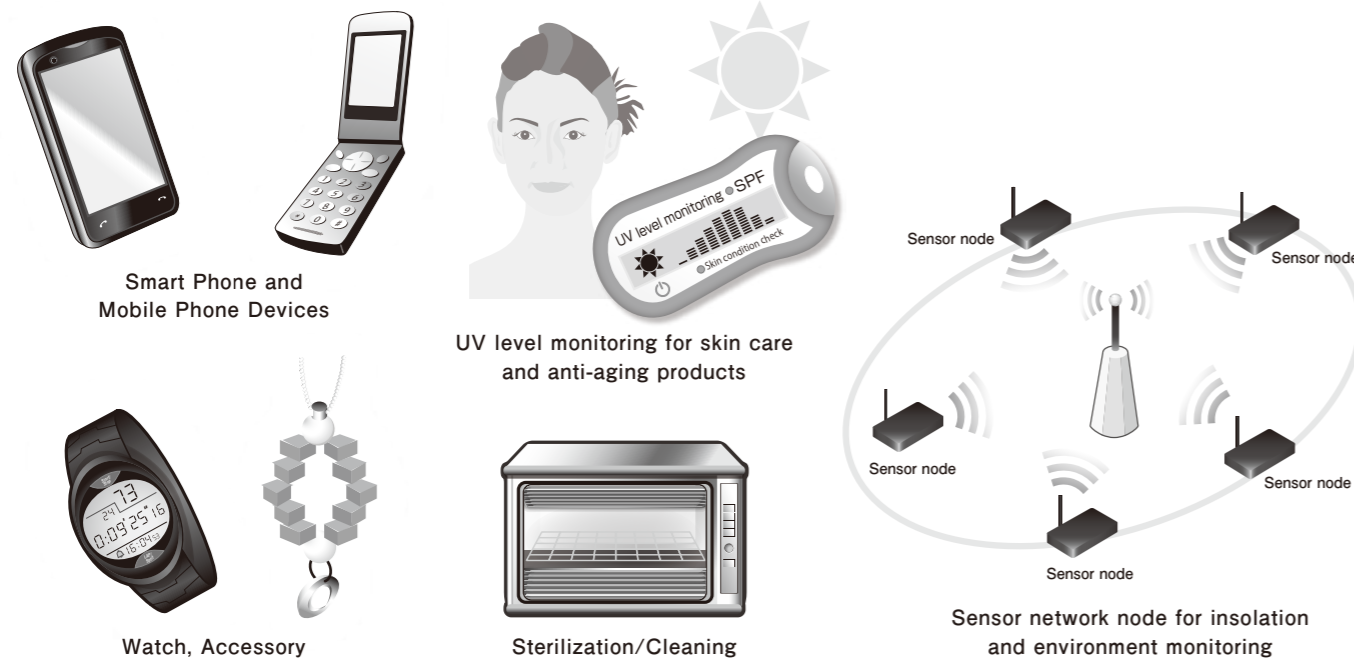
## Ultraviolet (UV) Sensor Overview

### Product Overview

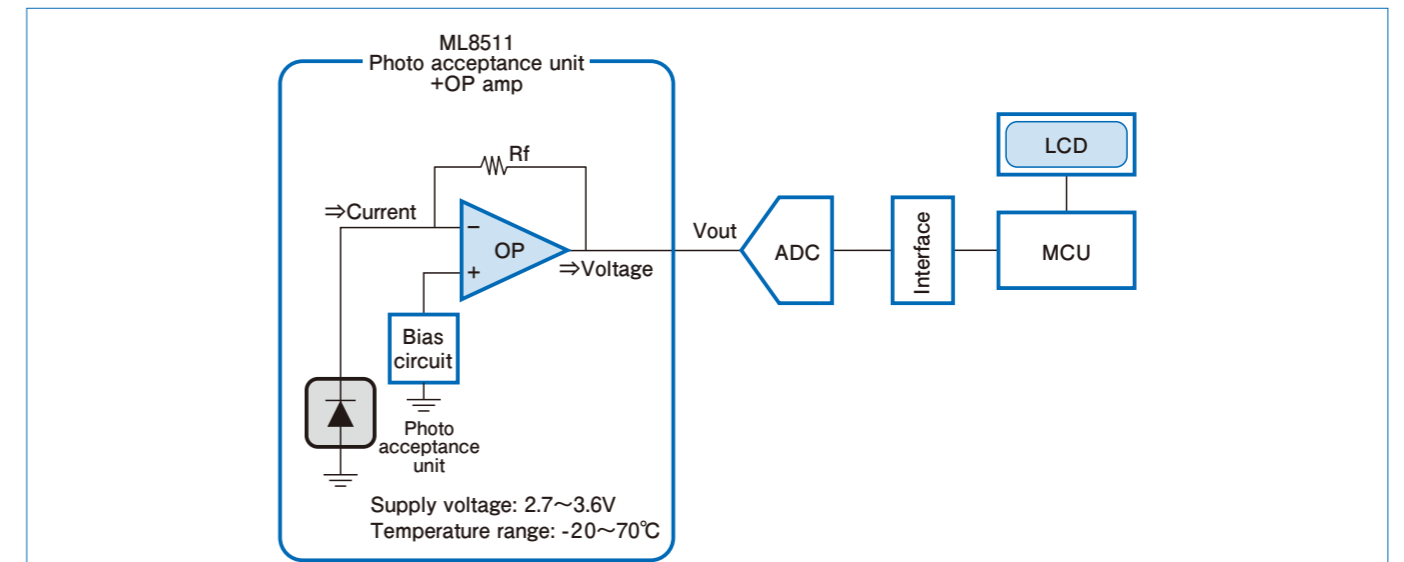
- UV sensor with built-in amplifier.
- Small unit and low power consumption based on LAPIS' s original process.
- Detect UV-A and UV-B.
- Suitable for mobile devices such as smart phone, mobile phone and watch.
- Easy implementation of UV monitoring.



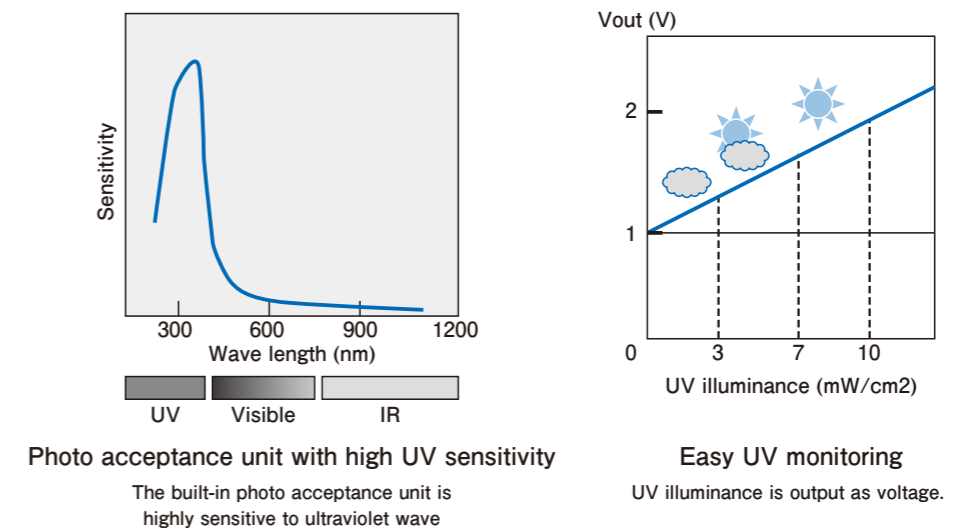
### Application Examples



### 応用回路図



### Features of ML8511



### Product Line-up

Description	Part Number
Ultraviolet Sensor	ML8511-00FC
Ultraviolet Sensor	ML8511-00NA (Under development)

### Ultraviolet (UV) sensor

Part Number	Feature	Package	Maximum Sensitive Wave	Length Sensitive Range	Supply Voltage (V)	Output Type	Current Consumption (Operation)	Current Consumption (Stand-by)	Operating Temperature (°C)
ML8511-00FC	UV sensor with built-in amplifier	C-TQFN12	365nm	UV-A and B	2.7~3.6V	Analog	300uA	0.1uA	-20~+70
ML8511-00NA (Under development)	UV sensor with built-in amplifier CSP small package	S-WFBGA6	365nm	UV-A and B	2.7~3.6V	Analog	300uA	0.1uA	-20~+70

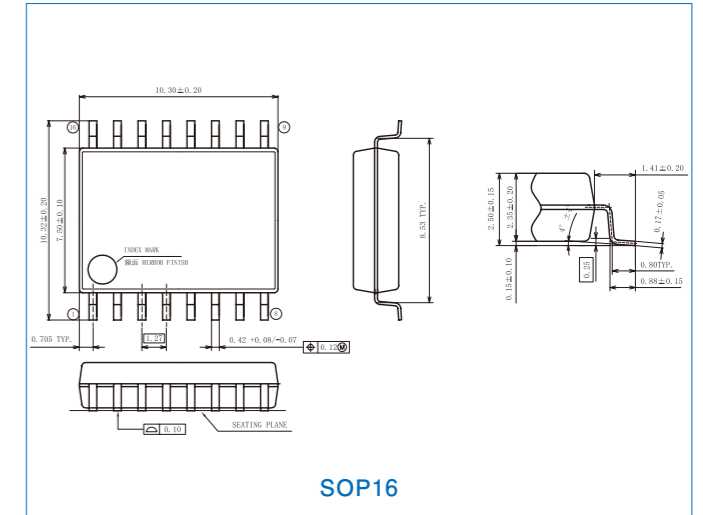
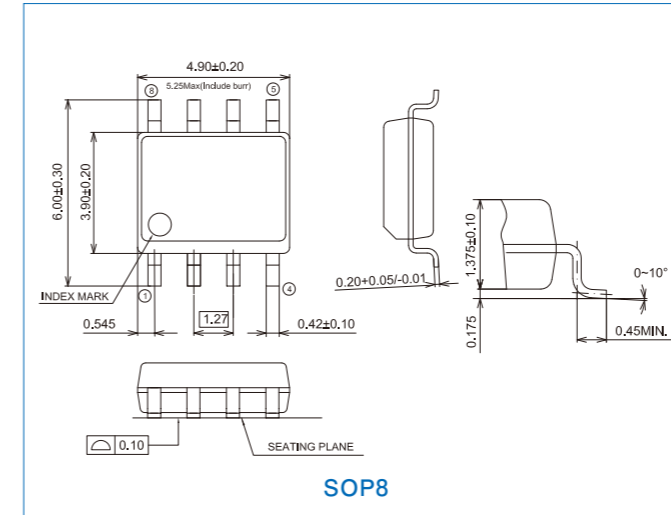
# LSI Packages

## Package type

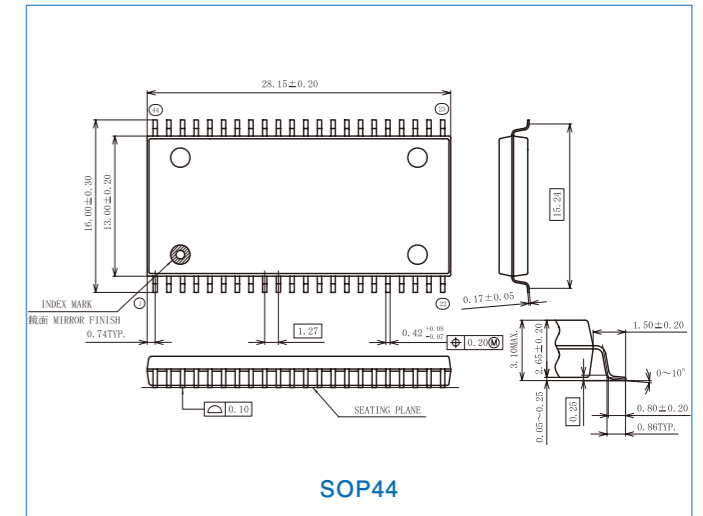
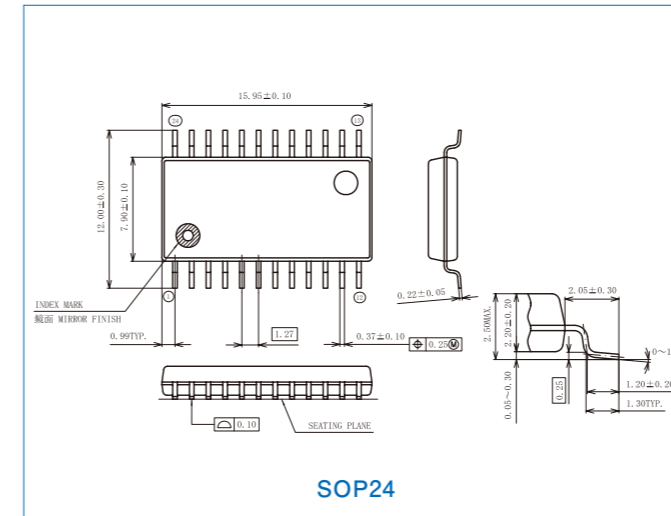
Type	Package Type	Package Symbol	Pin Count	
Surface Mount Type	SOP	MA	GS, MS	8, 16, 24, 44
	SSOP	MB	GS, MS	16, 20, 30, 32, 60, 70
	TSOP (Type I)	TA	TS	28, 32, 48, 56
	TSOP (Type II)			26/20, 26/24, 28, 44/40, 44, 50/44, 50, 54, 70, 86
	QFP	GA	GS	44, 56, 64, 80, 100, 128, 208
	LQFP	TC	GS	144, 176
	TQFP	TB	TS	44, 48, 64, 80, 100, 120, 128
	VQFN			32, 48
	WQFN			12, 16, 20, 24, 28, 32, 36, 40, 48, 52, 56, 64, 80
	LFBGA	LA	LS	48, 84, 144, 324
TFBGA	60, 64, 84, 90, 144, 176, 208			
	WL-CSP (Wafer-level CSP)	Custom Design		
Special Package (Examples)	COF (Chip On Film)	Package for LCD Drivers		
	C-TQFN (Ceramic TQFN)			12, 18

## Package size

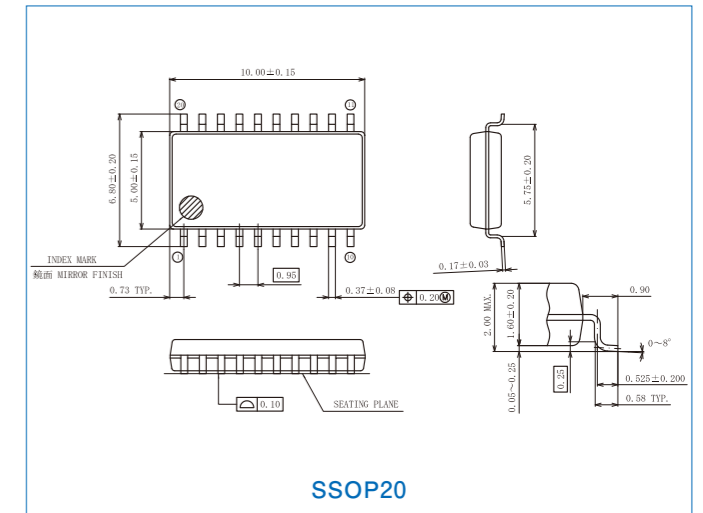
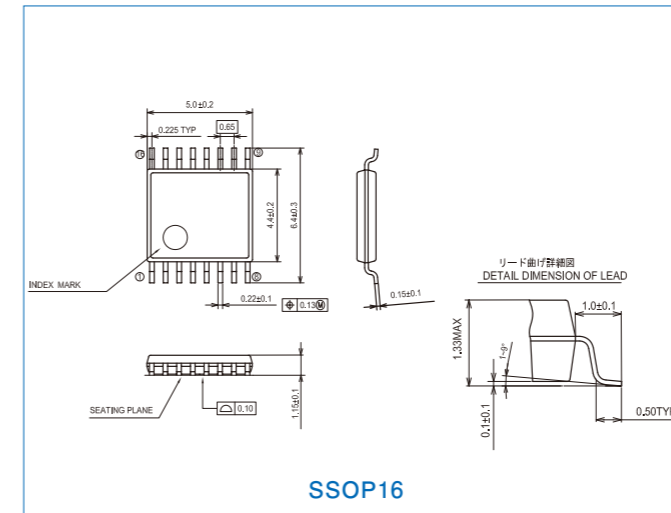
### SOP



### SOP



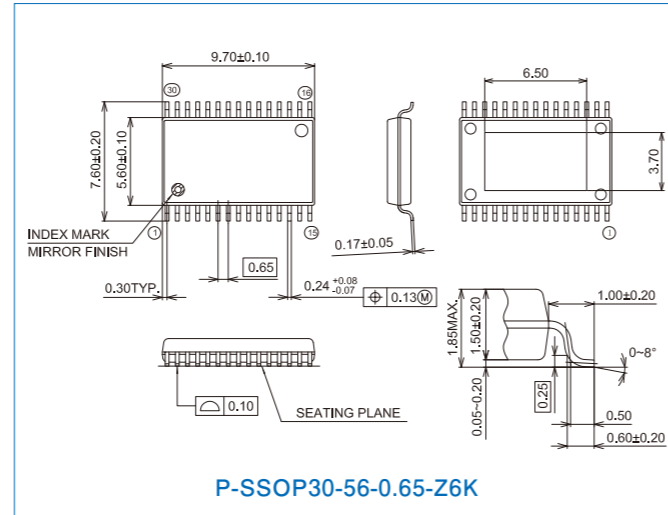
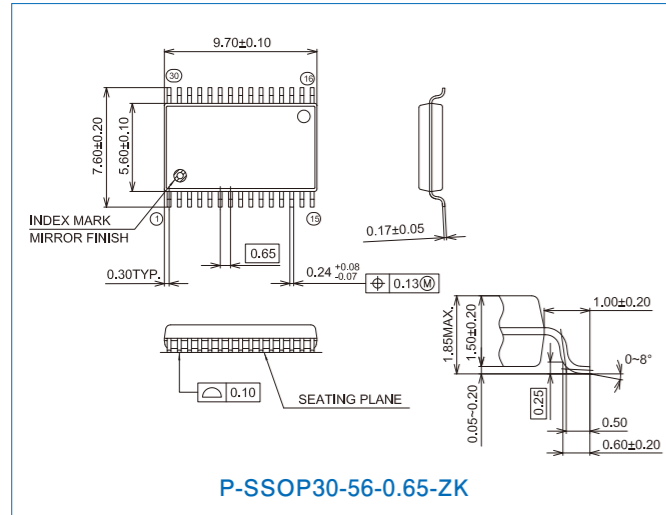
### SSOP



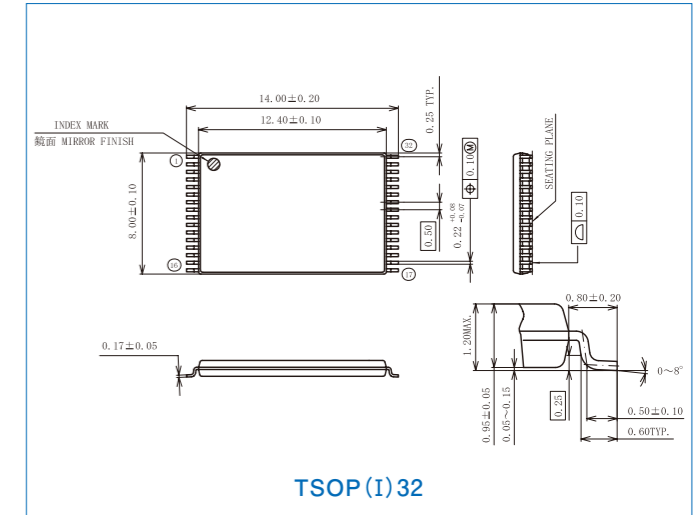
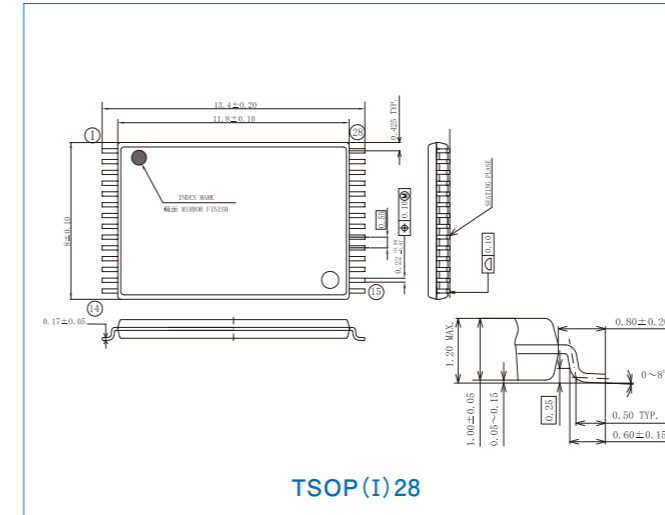
# LSI Packages

## Package size

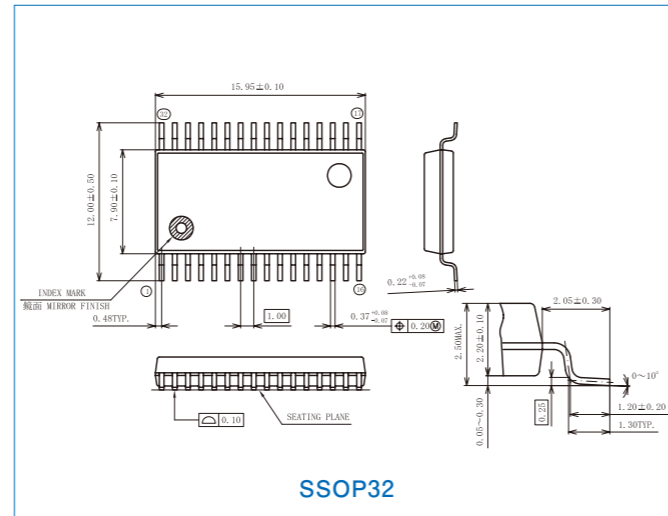
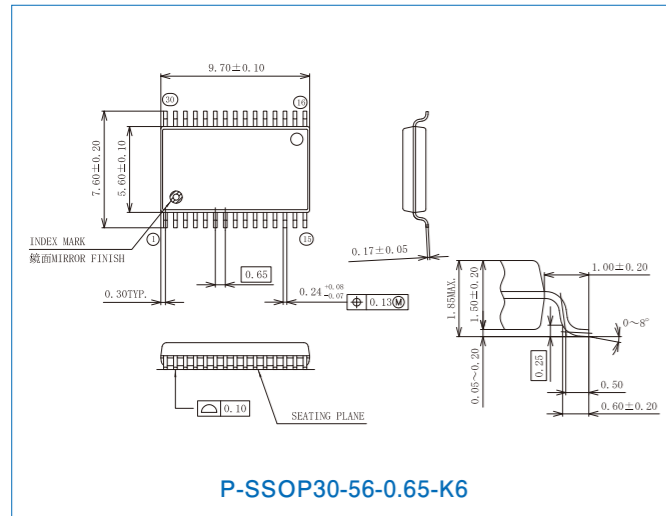
### SSOP



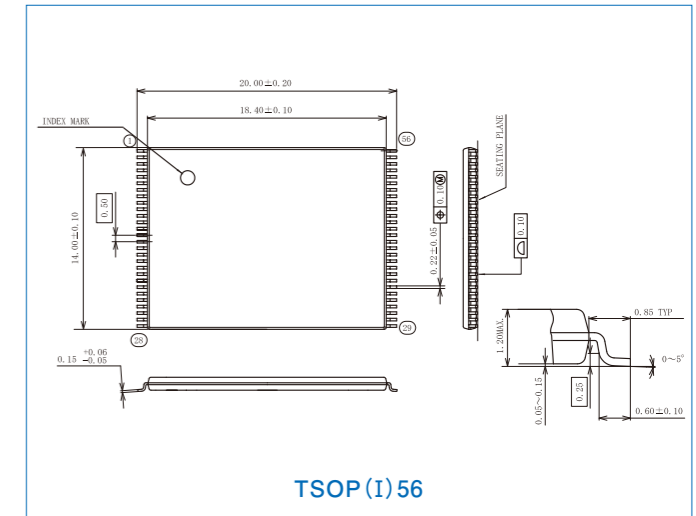
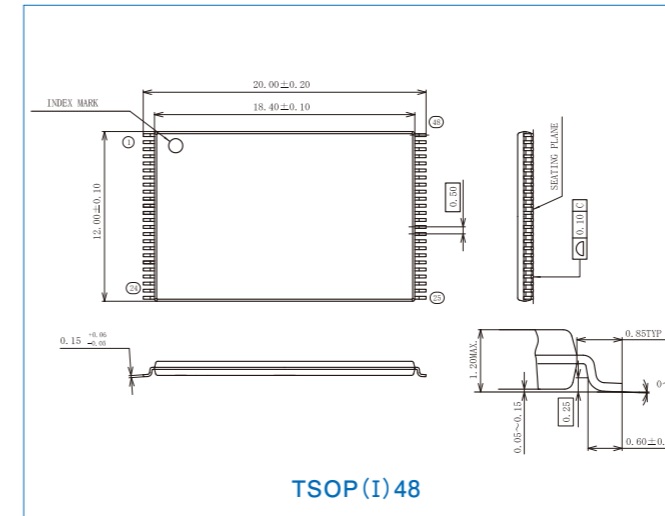
### TSOP (Type I)



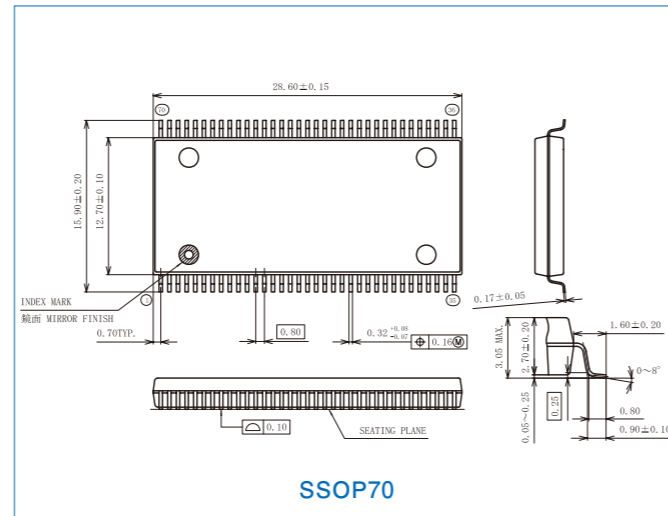
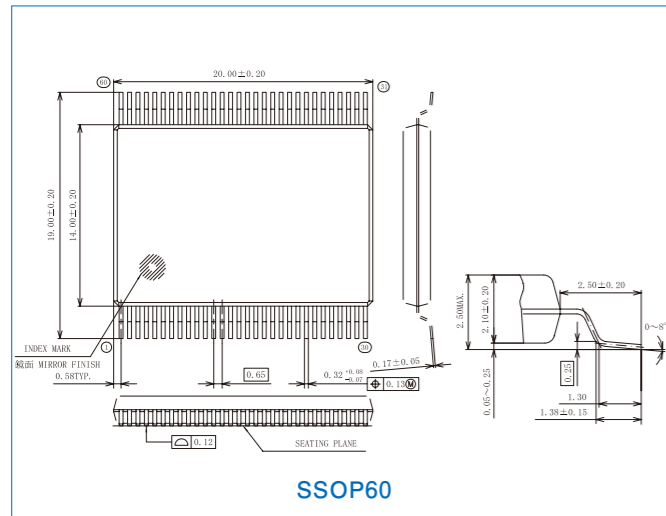
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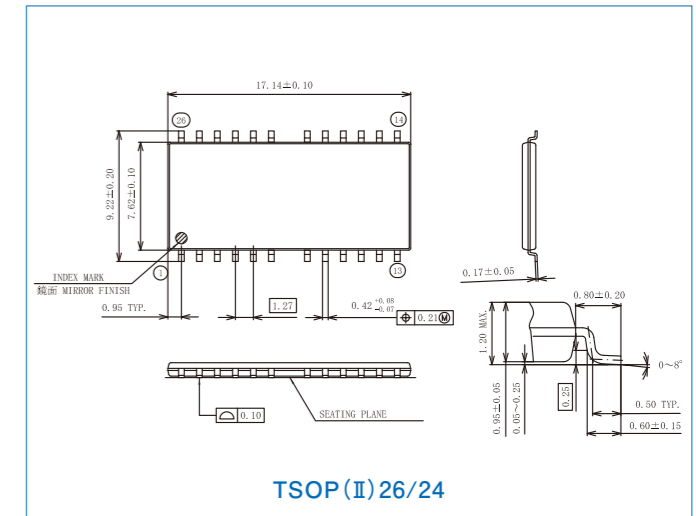
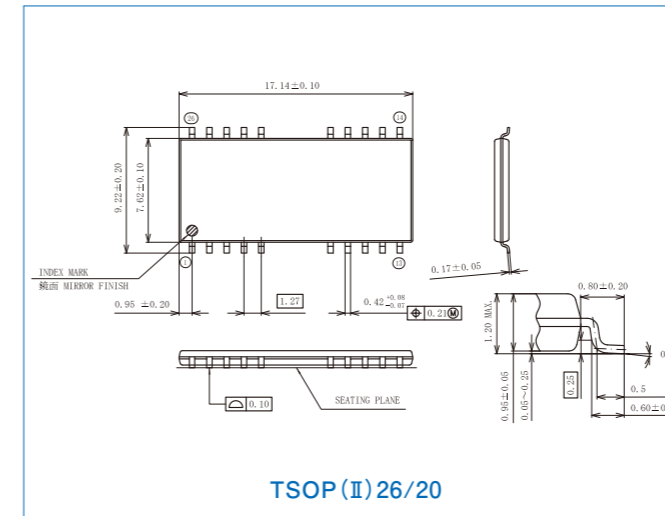
### TSOP (Type I)



### SSOP



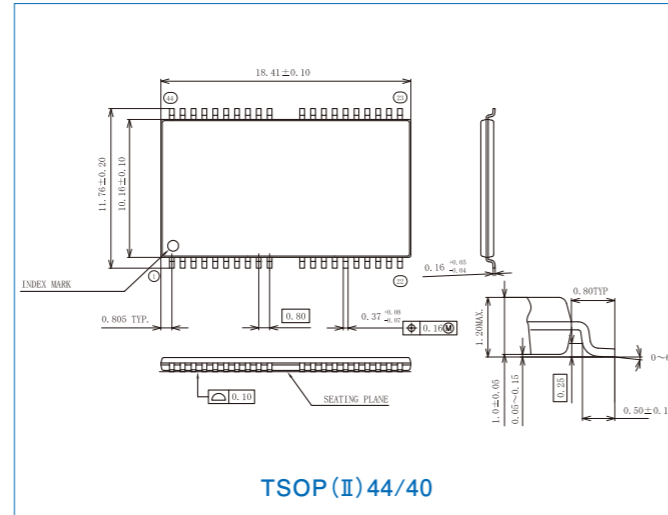
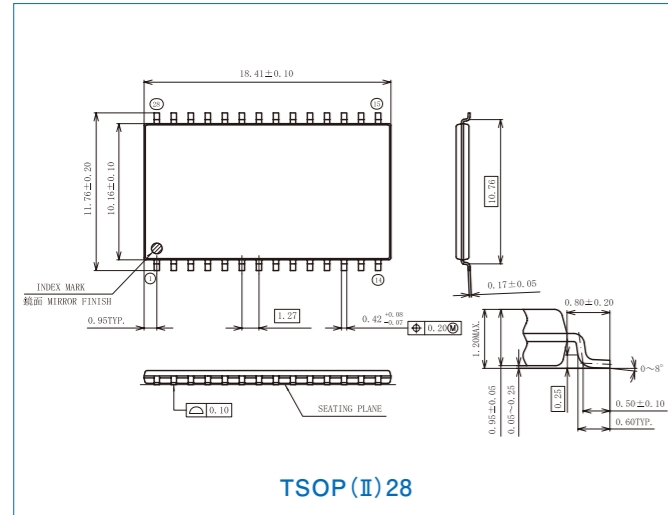
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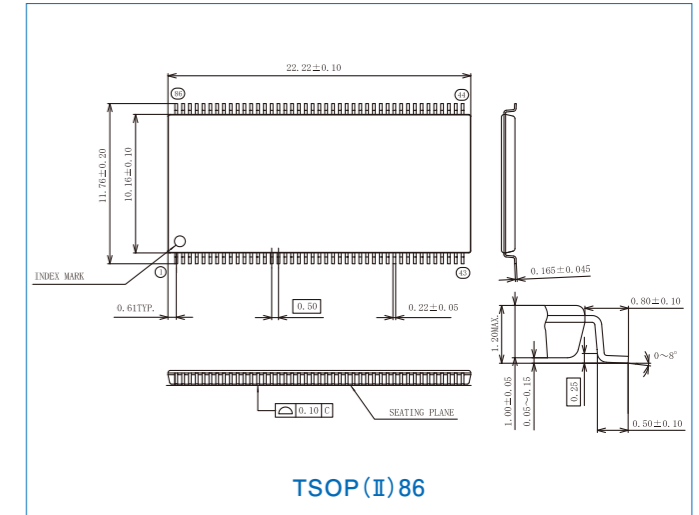
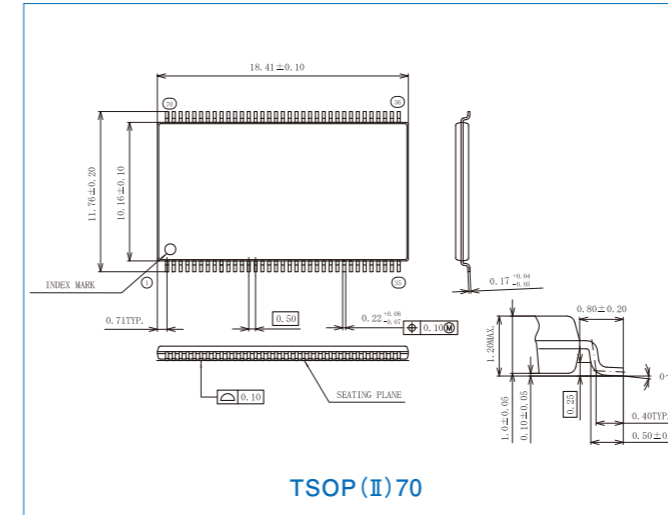
# LSI Packages

## Package size

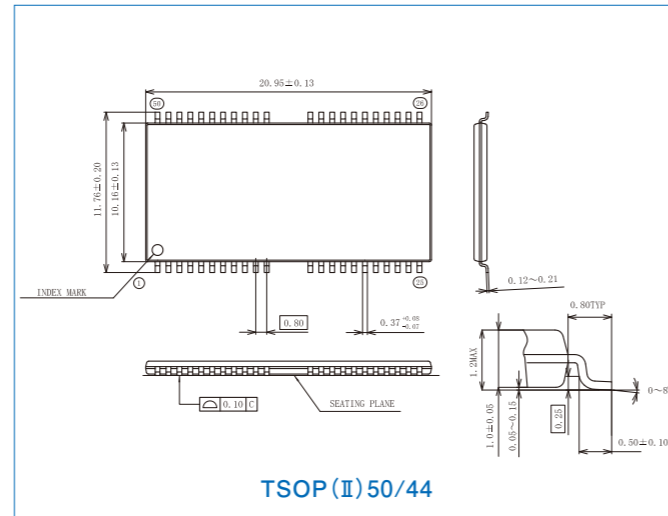
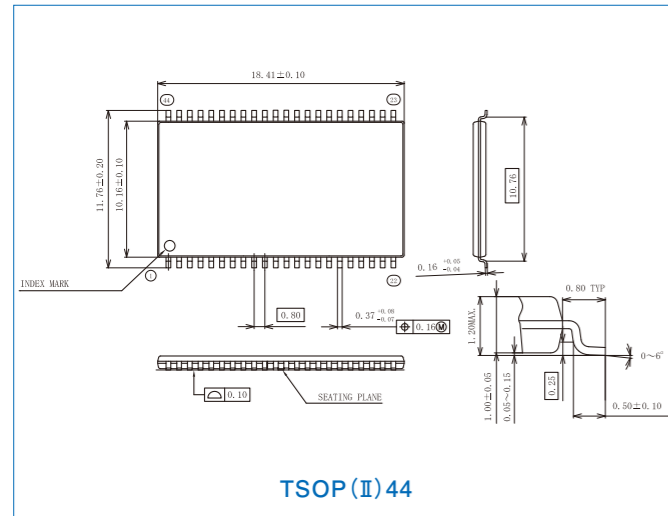
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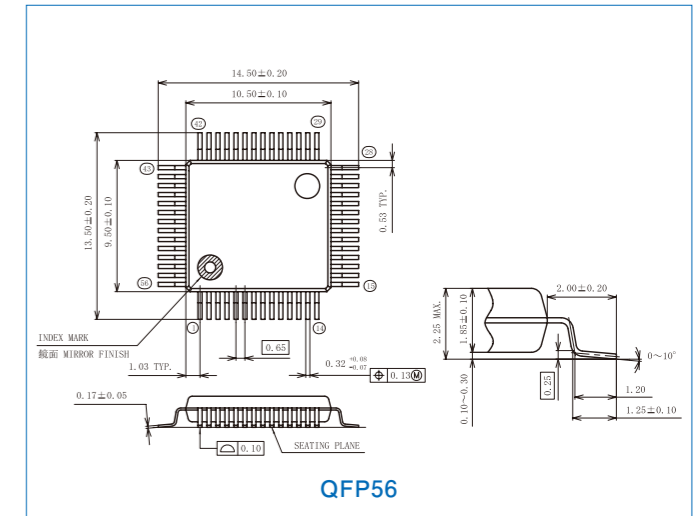
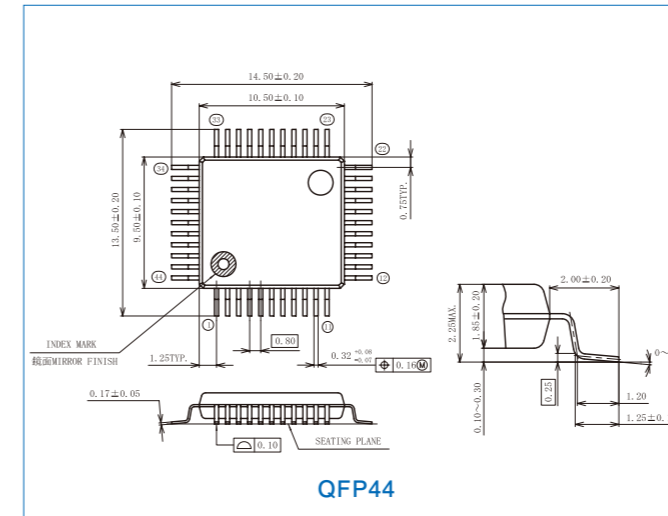
### TSOP (Type II)



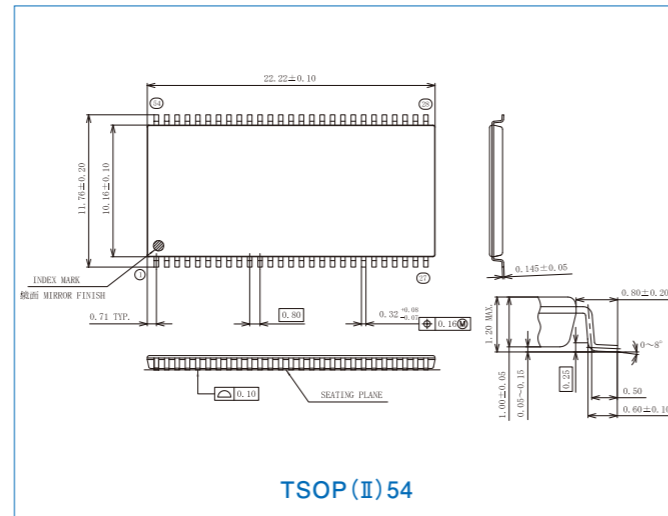
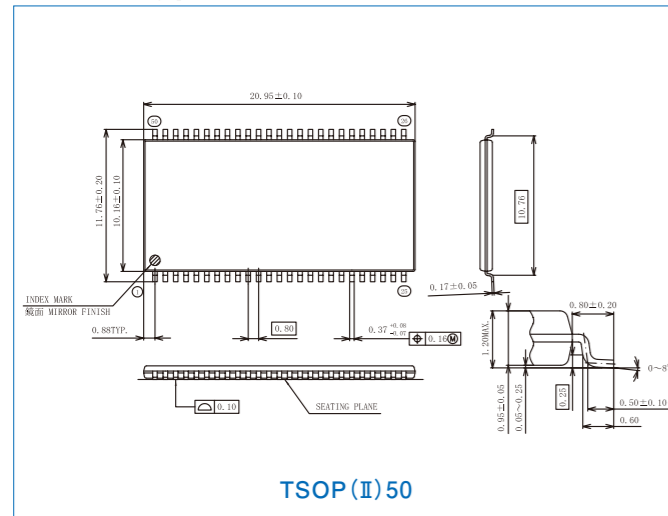
### TSOP (Type II)



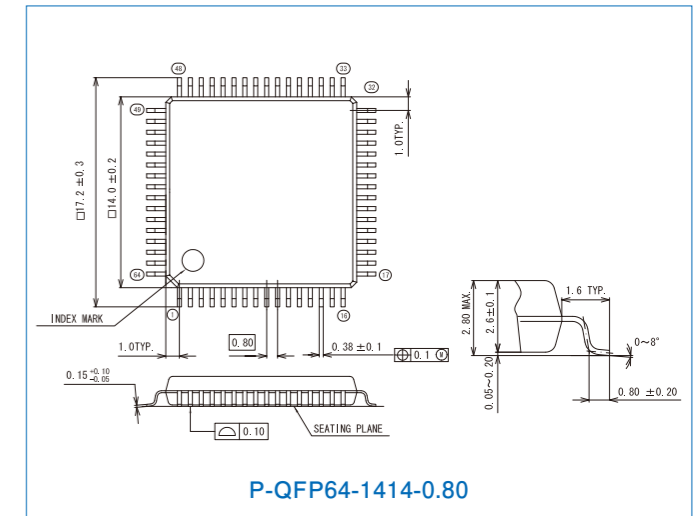
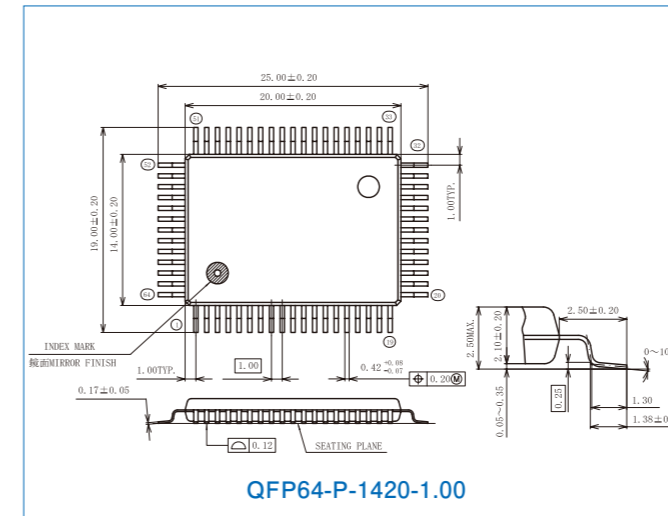
### QFP



### TSOP (Type II)



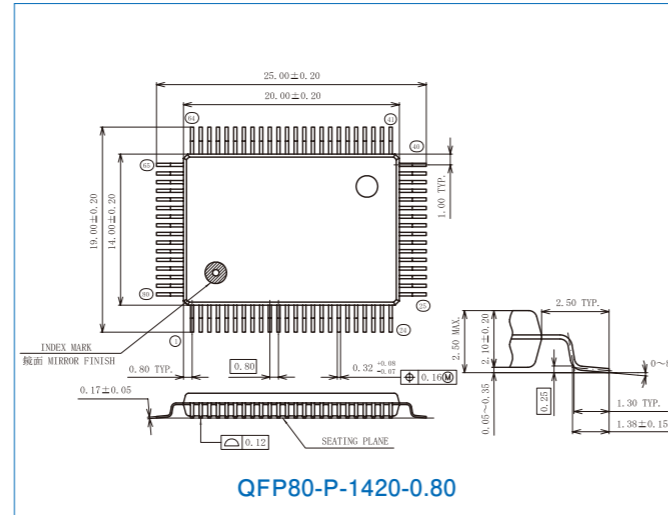
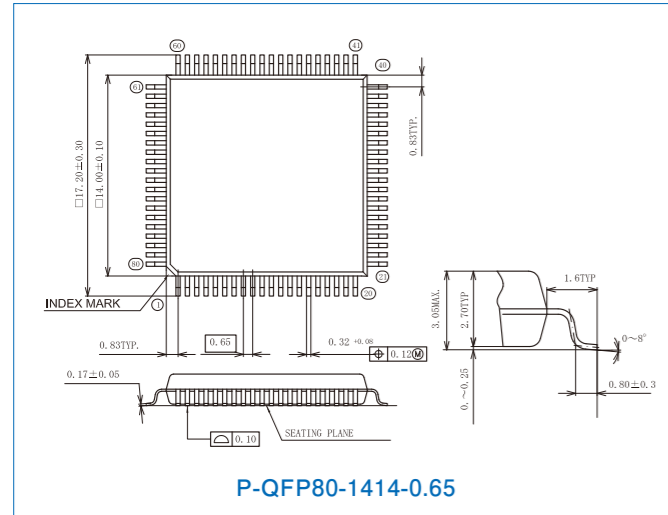
### QFP



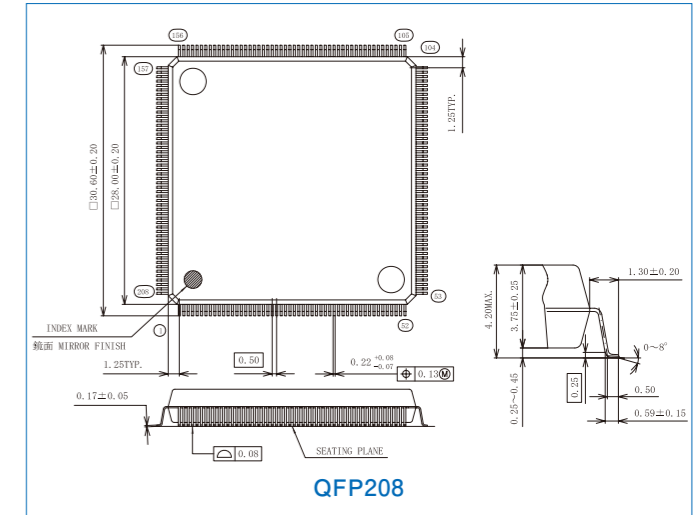
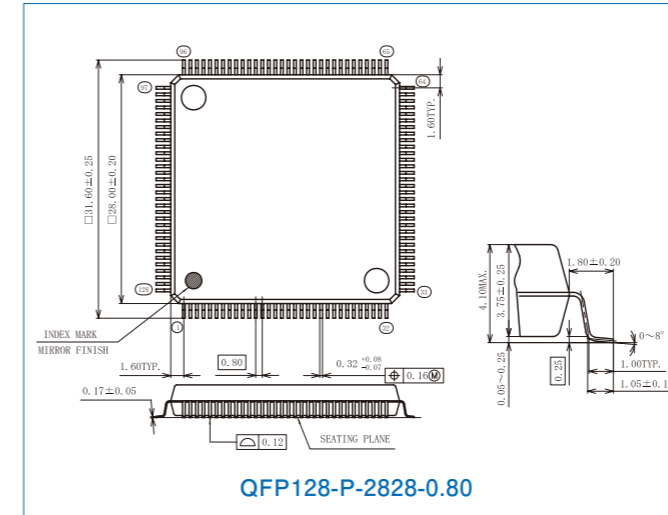
# LSI Packages

## Package size

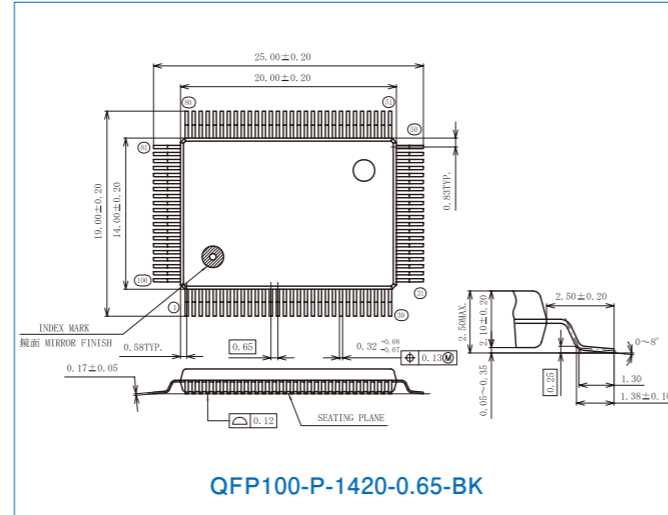
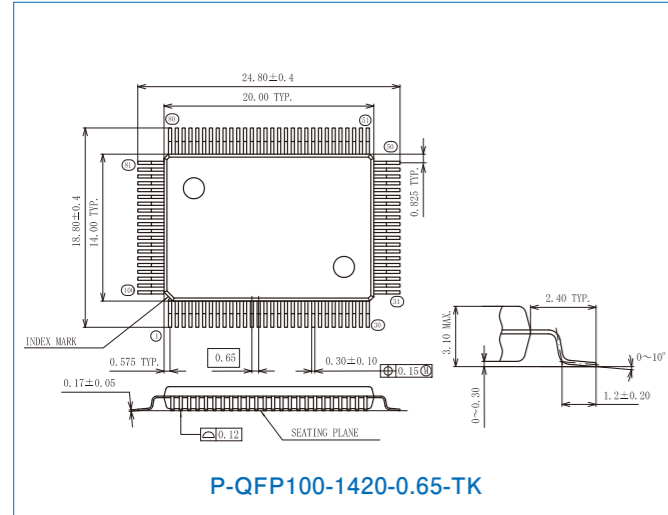
### QFP



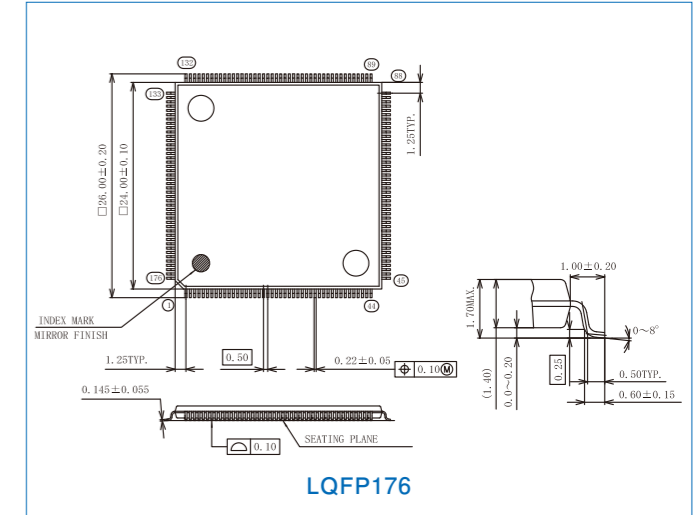
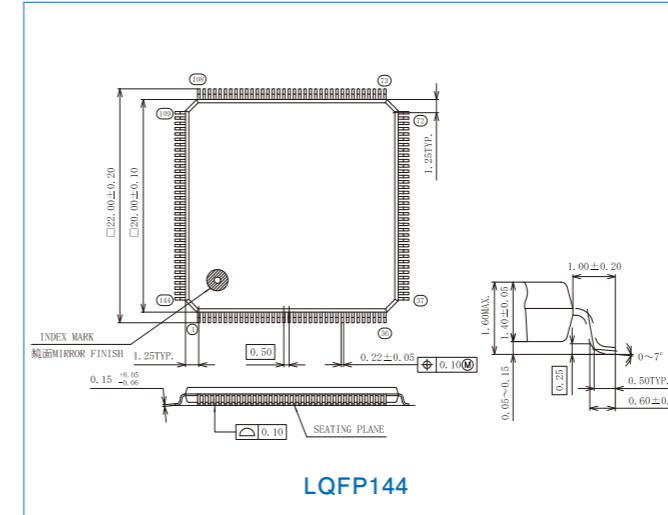
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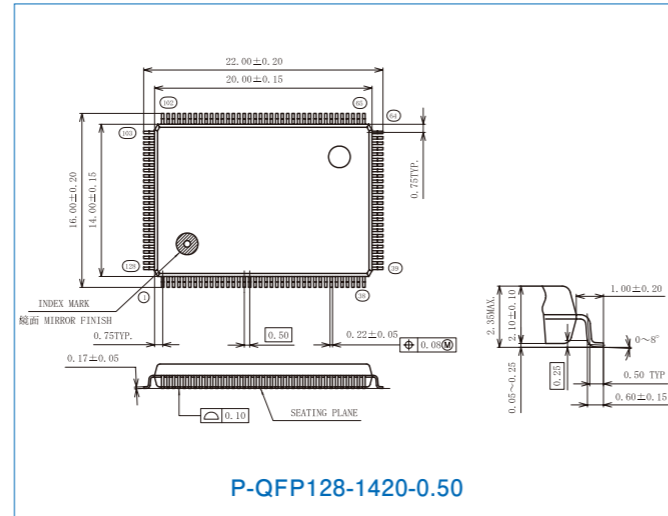
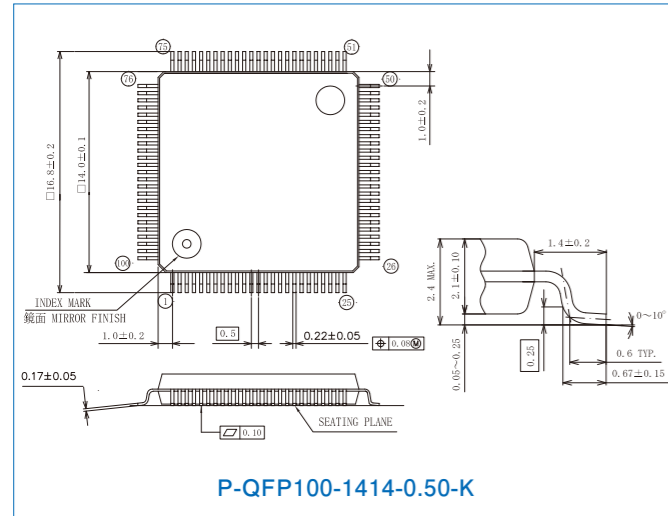
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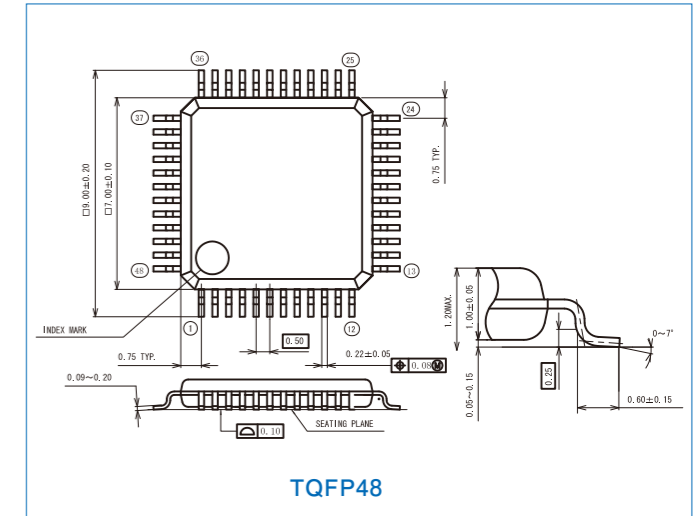
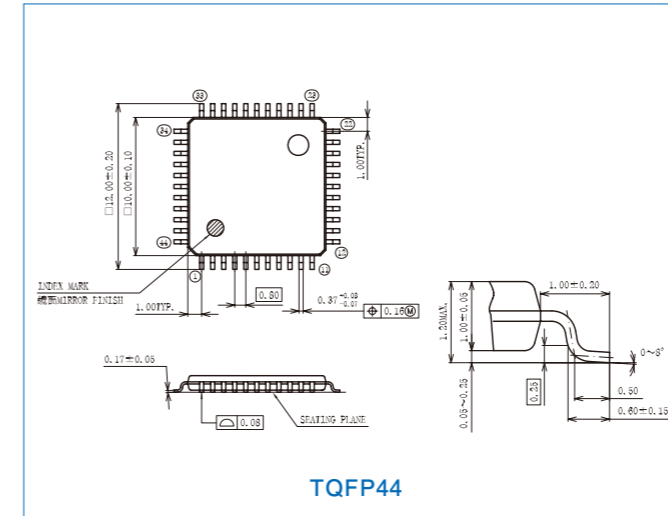
### LQFP



### QFP



### TQFP

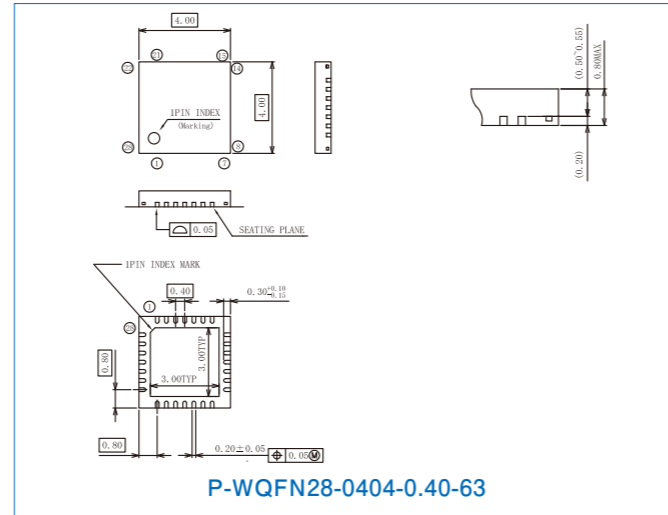
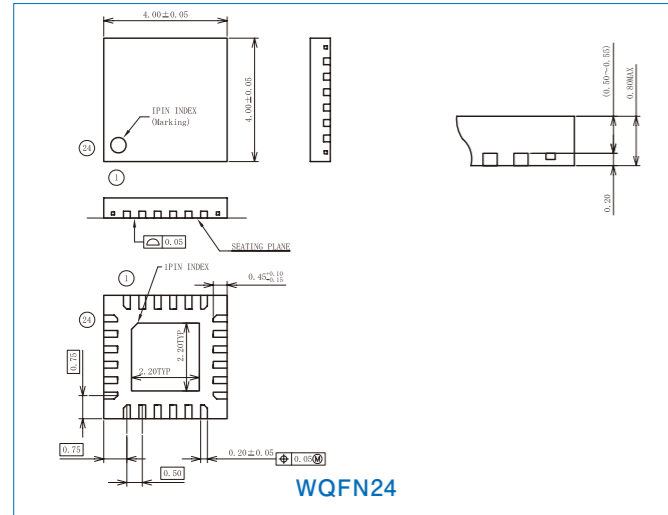




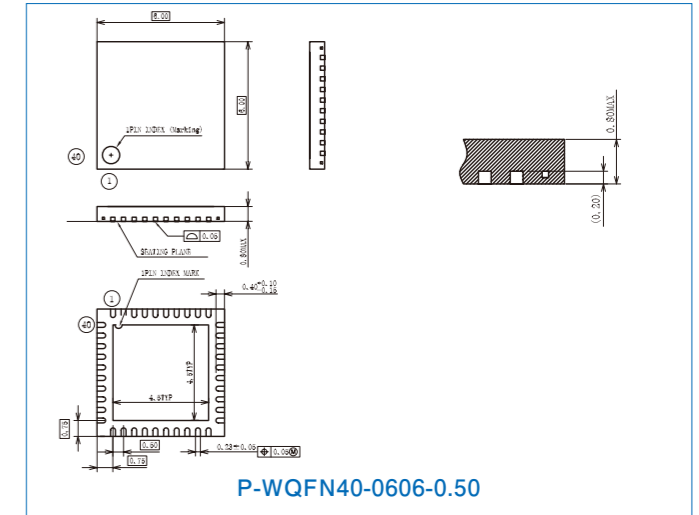
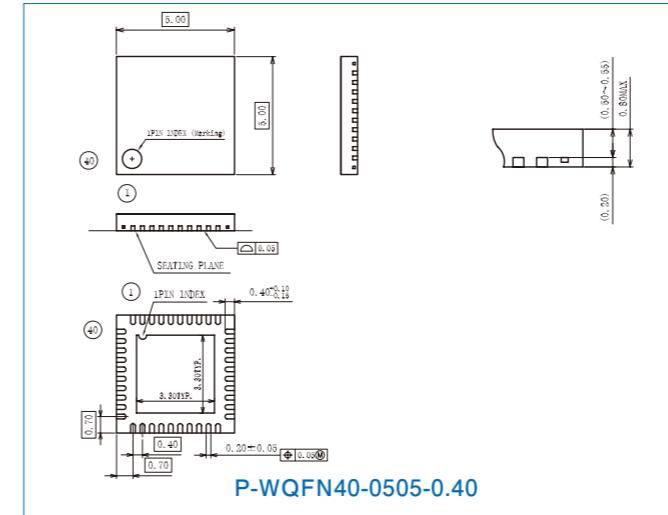
# LSI Packages

## Package size

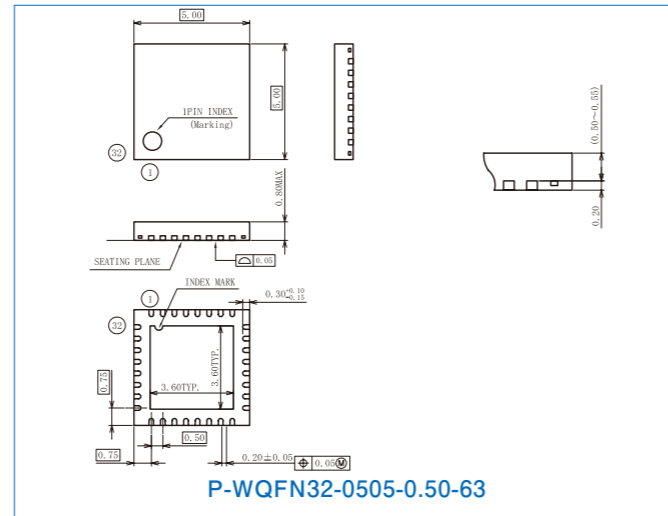
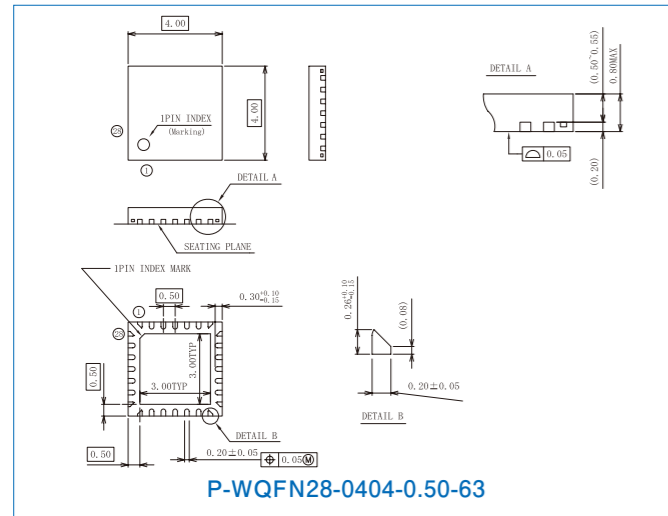
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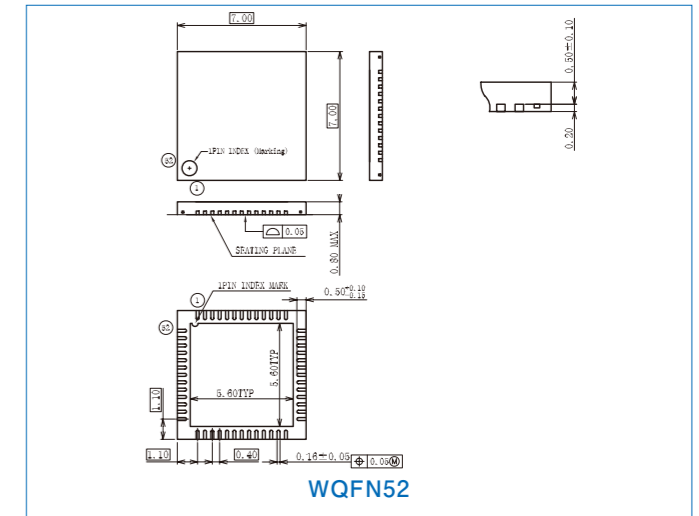
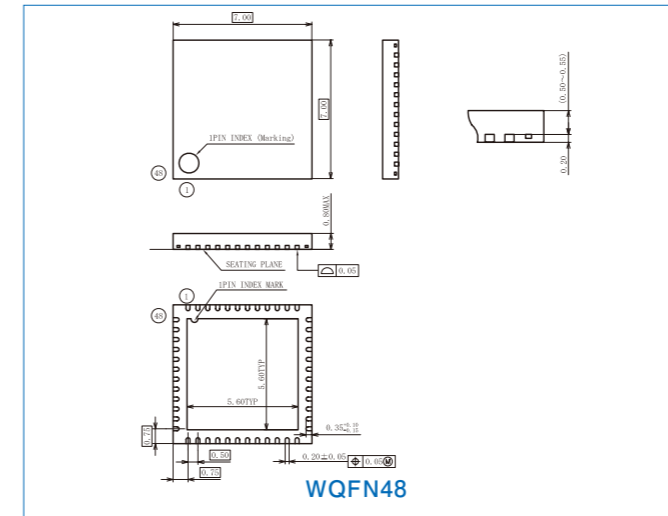
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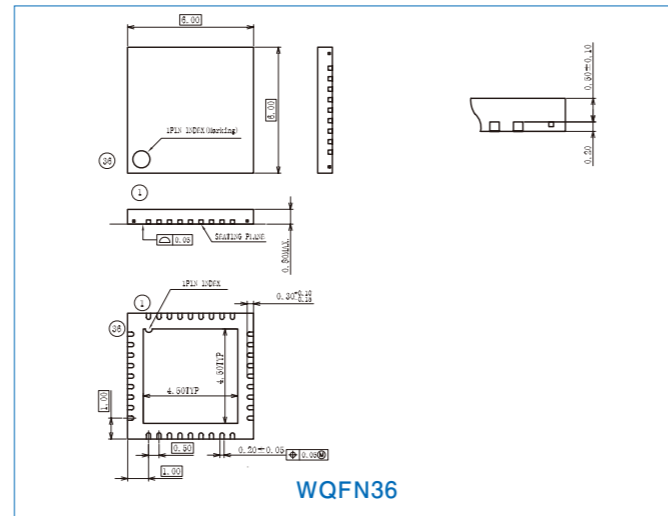
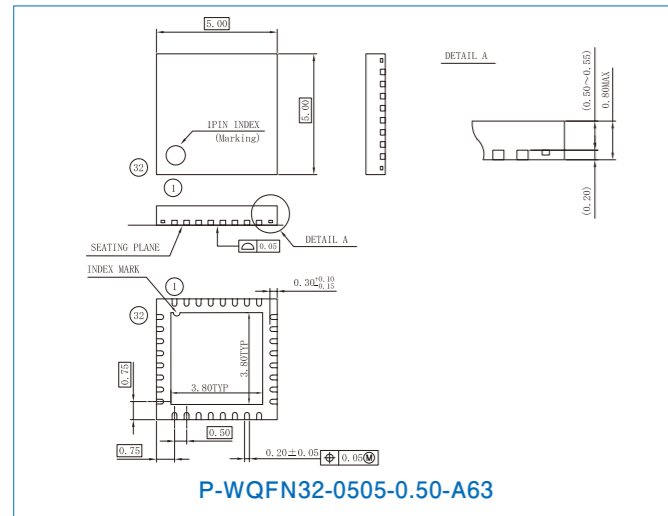
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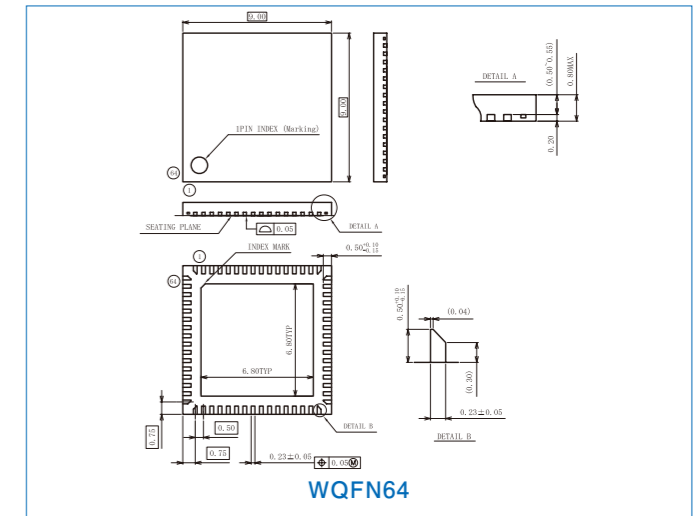
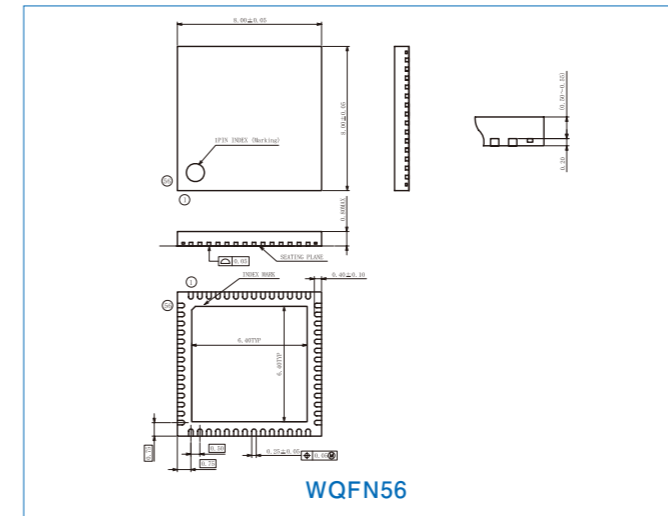
### WQFN



### WQFN



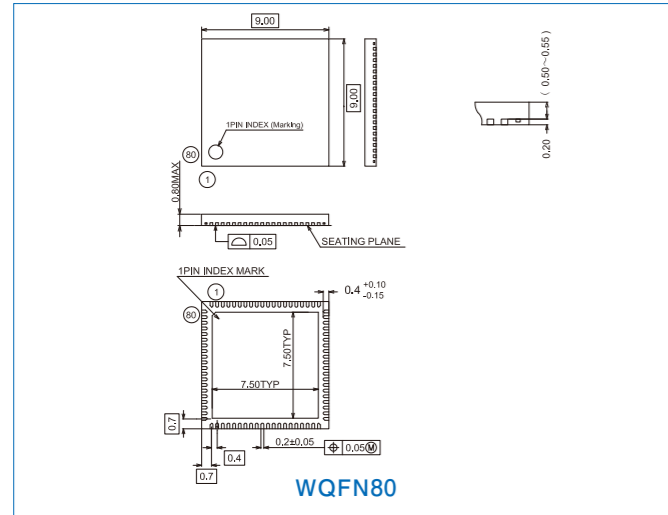
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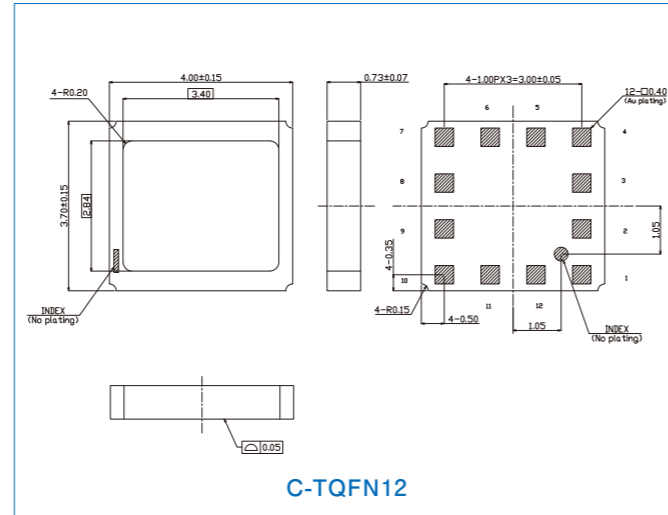
# LSI Packages

## Package size

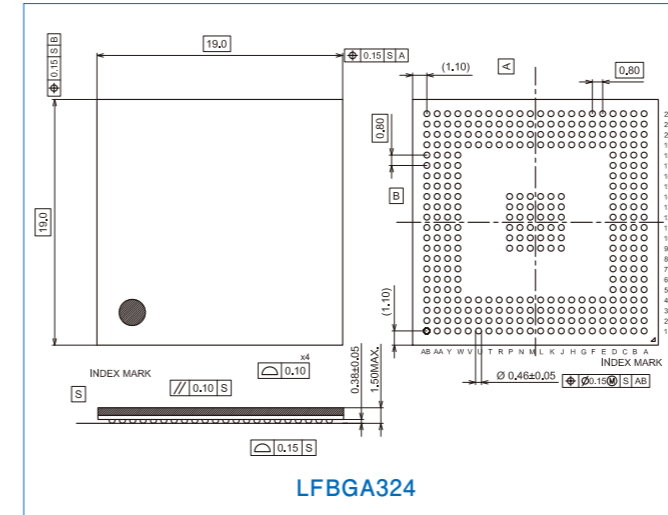
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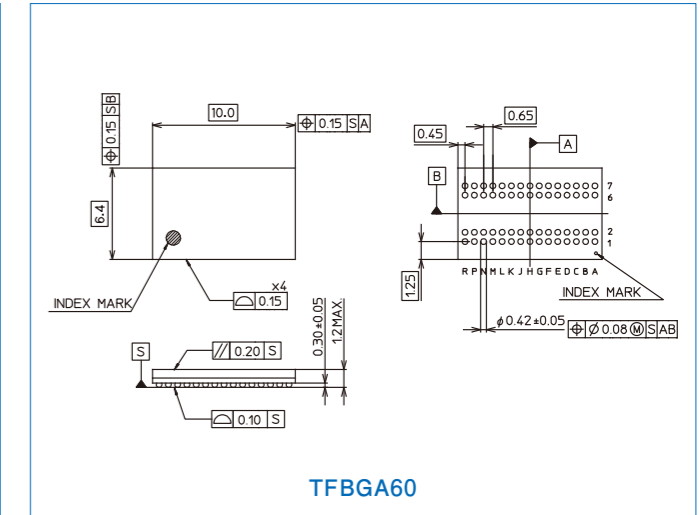
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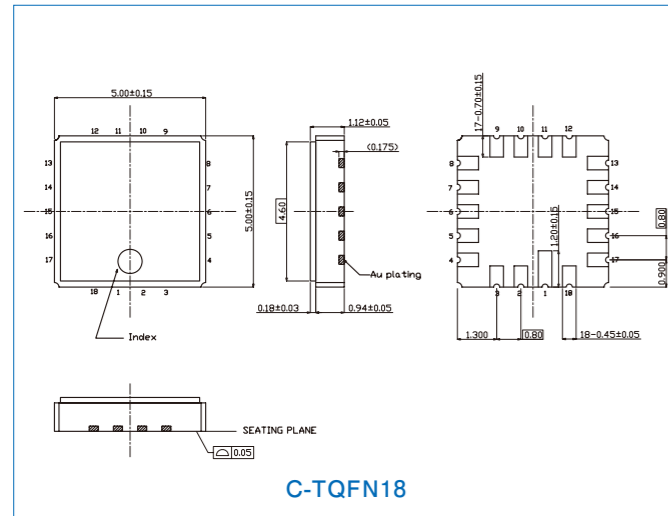
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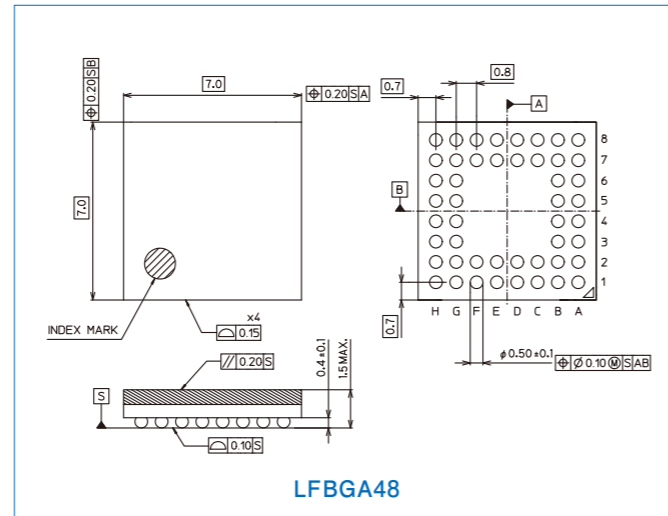
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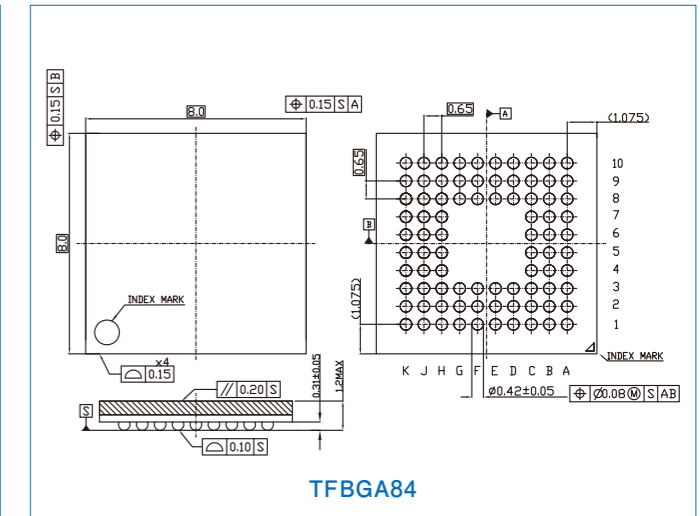
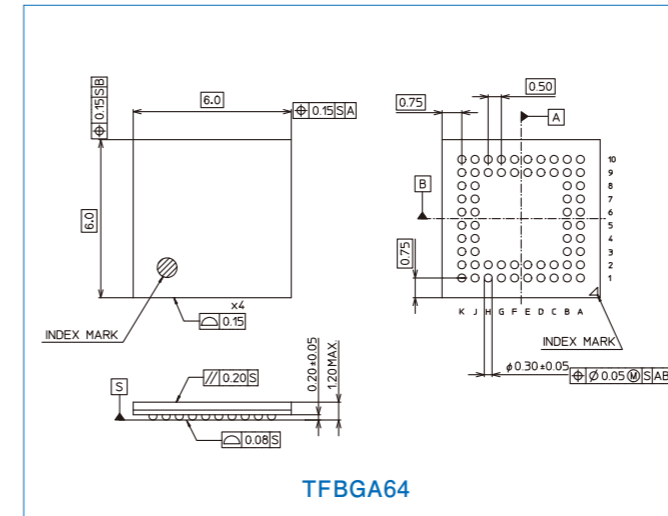
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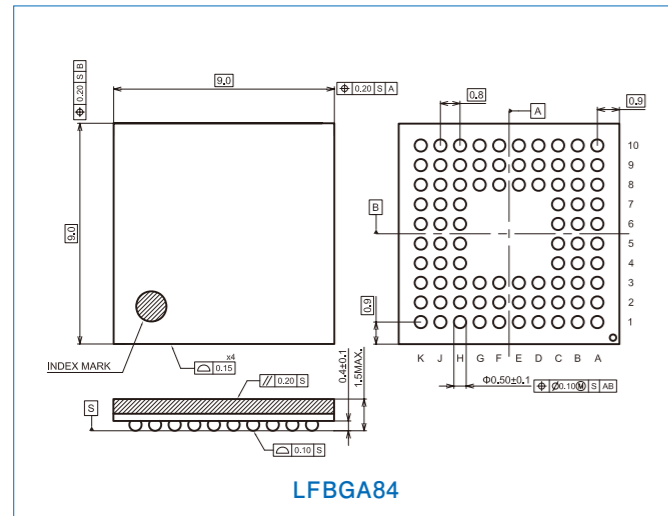
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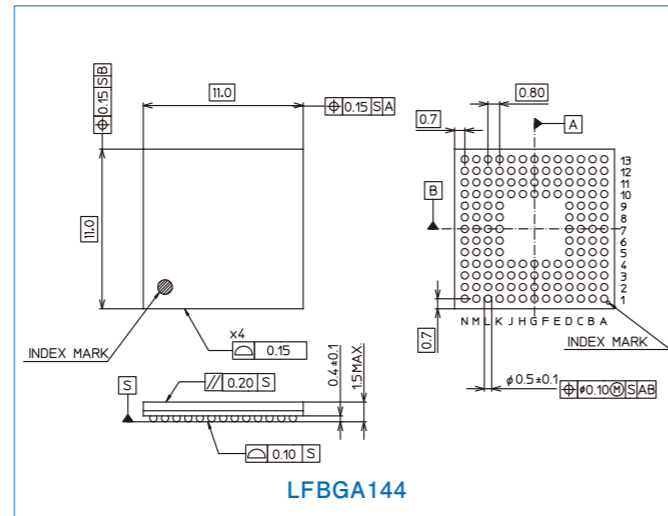
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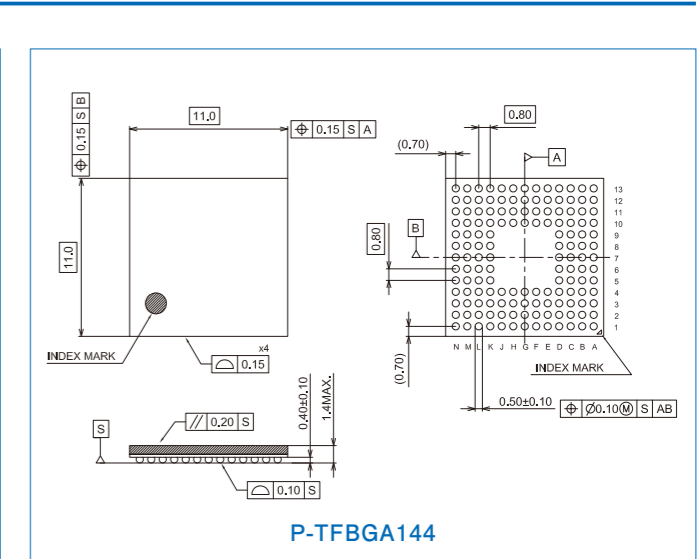
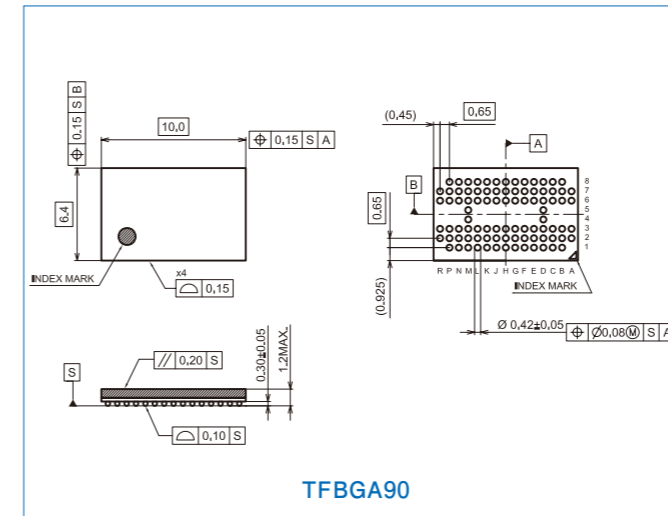
### LFBGA



### TFBGA



### TFBGA

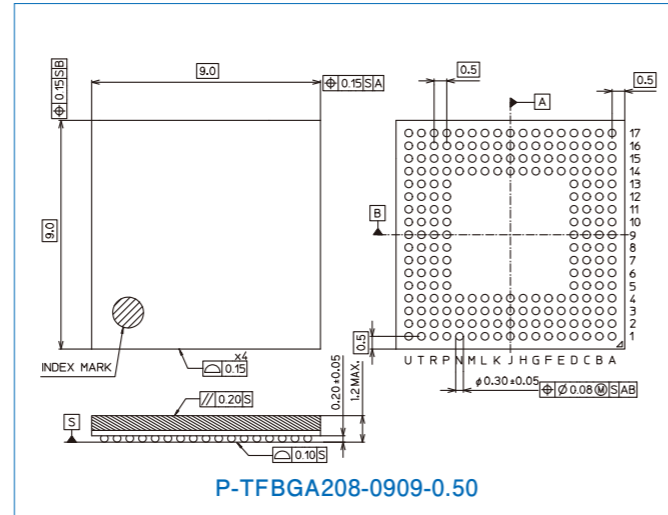
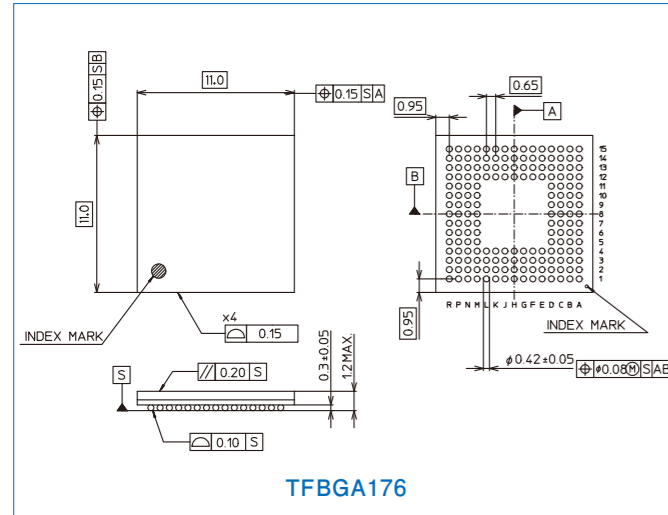




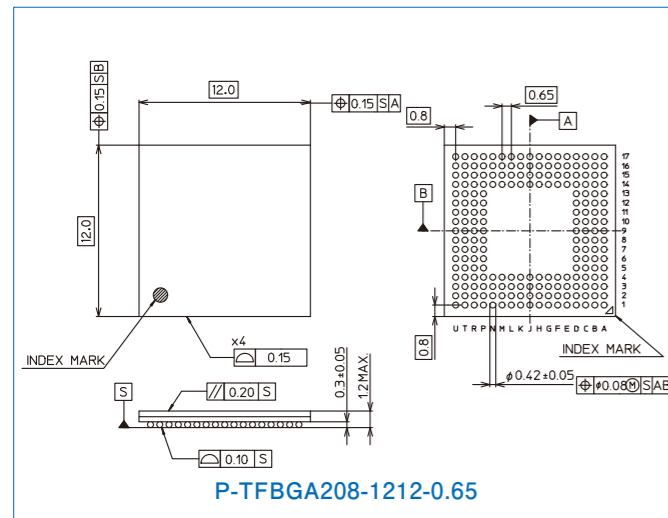
# LSI Packages

## Package size

### TFBGA



### TFBGA



# 2014 SHORT FORM CATALOG

## List of the products

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MD54V16258BSL	55	ML22Q563	27	ML610471	16
MD56V62160E	57	ML22Q573	29	ML610471P	16
MD56V62160E-xxTAP	57	ML2611GD	33	ML610472	16
MD56V62160M	57	ML2611HB	33	ML610472P	16
MD56V62160M-xxTAP	57	ML26121AHB	33	ML610473	16
MD56V62161M (NEW)	57	ML26124-00HB	33	ML610473P	16
MD56V62161M-xxTAP (NEW)	57	ML26124-02GD	33	ML610474 (NEW)	16
MD56V72160C (NEW)	57	ML26125HB	33	ML610475 (NEW)	16
MD56V72160C-xxTAP (NEW)	57	ML26127HB	33	ML610476 (NEW)	16
MD56V72161C (Under development)	57	ML26128HB	33	ML610477	16
MD56V72161C-xxTAP (Under development)	57	ML2612GD	33	ML610477P	16
MD56V82160A (NEW)	57	ML2614HB	33	ML610478	16
MD56V82160A-xxTAP (NEW)	57	ML2620GD	33	ML610478P	16
MD58W82160A (Under development)	57	ML2620HP	33	ML610479	16
MK71050-02 (Under development)	9	ML26211DHB	33	ML610479P	16
MK72220-01	9	ML26211EGD	33	ML610482	14
MK72660-01	9	ML5203 (NEW)	71	ML610482P	14
MK72750A-01	9	ML5208	71	ML610485 (Under development)	14
ML2011GD	33	ML5227	71	ML610485P (Under development)	14
ML2011HB	33	ML5235	71	ML610Q101 (NEW)	18
ML22321	27-29	ML5238 (NEW)	71	ML610Q102 (NEW)	18
ML22331	27-29	ML610340	18-29	ML610Q111 (NEW)	18
ML22341	27-29	ML610346	18-29	ML610Q112 (NEW)	18
ML22420	27	ML610347	18-29	ML610Q172 (NEW)	18
ML22460	27	ML610401	16	ML610Q173 (NEW)	18
ML22562	27	ML610401P	16	ML610Q174 (NEW)	18
ML22563	27	ML610402	16	ML610Q178	18
ML22572	29	ML610402P	16	ML610Q304 (NEW)	18-29
ML22573	29	ML610403	16	ML610Q340	18-29
ML22594 (NEW)	27-29	ML610403P	16	ML610Q346	18-29
ML22723	27	ML610404	16	ML610Q347	18-29
ML22724	27	ML610404P	16	ML610Q355	18-29
ML22725	27	ML610405	16	ML610Q356	18-29
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ML22765	27	ML610406P	16	ML610Q380	18-29
ML22802	27	ML610407	16	ML610Q383	18-29
ML22804	27	ML610407P	16	ML610Q384	18-29
ML22808	27	ML610408	16	ML610Q385	18-29
ML22823	27	ML610408P	16	ML610Q407	16
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ML22825	27	ML610409P	16	ML610Q408	16
ML22863	27	ML610421	14	ML610Q408P	16
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ML22P802	27	ML610422P	14	ML610Q411	16
ML22P804	27	ML610426 (NEW)	14	ML610Q411P	16
ML22P808	27	ML610426C (NEW)	14	ML610Q412	16
ML22Q321	27-29	ML610426P (NEW)	14	ML610Q412P	16
ML22Q331	27-29	ML610426PC (NEW)	14	ML610Q415	16
ML22Q341	27-29	ML610428	14	ML610Q419	16
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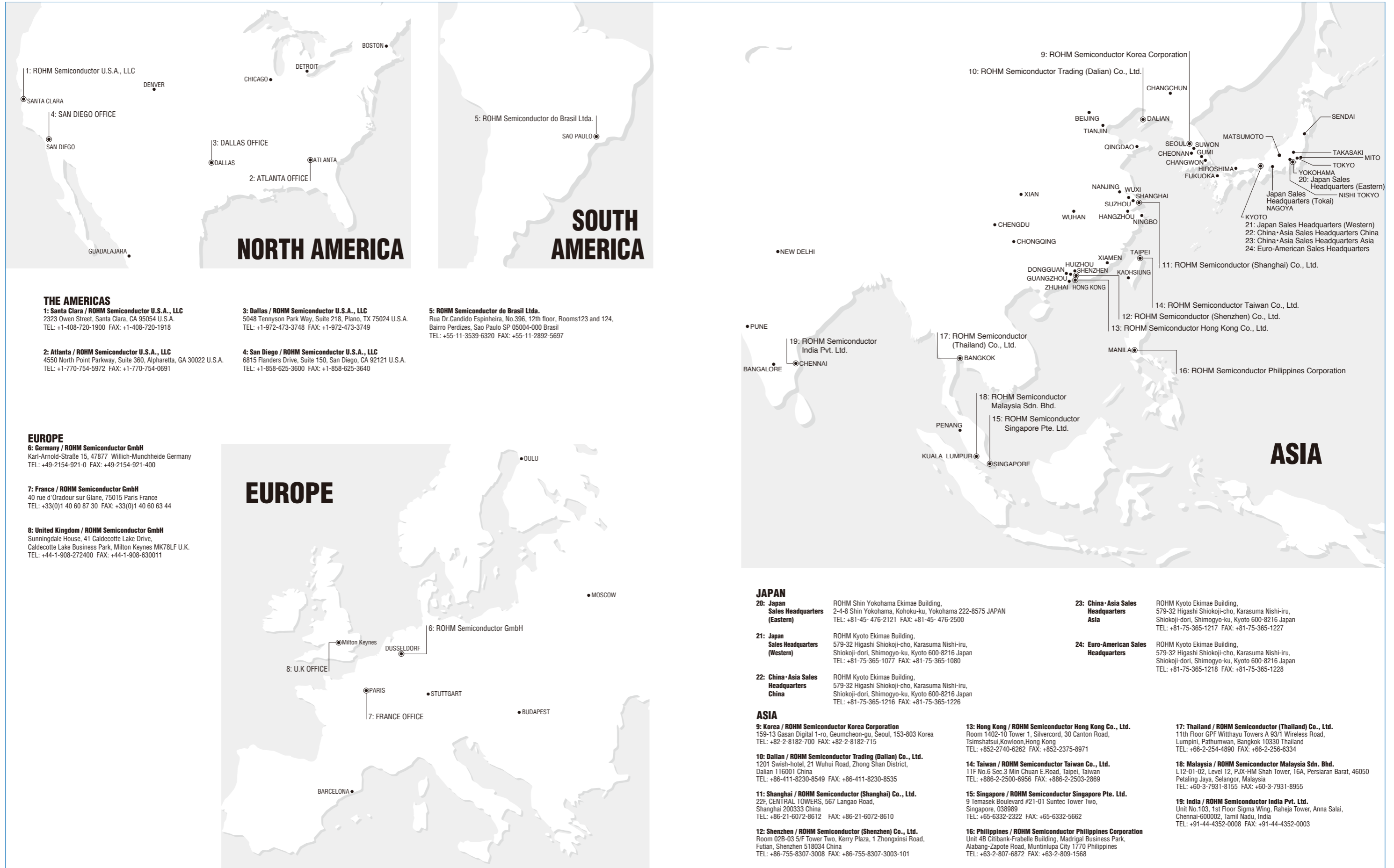
# 2014 SHORT FORM CATALOG

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ML610Q421	14	ML674001	20	ML8540 (Under development)	77	ML9270-xx	69	MR27V25653L	47	MSM5118160F	55
ML610Q421P	14	ML675001	20	ML8540WD	77	ML9271	69	MR27V3202L	45	MSM5118160FP	55
ML610Q422	14	ML675011	20	ML86101A	37	ML9272	69	MR27V3241L	49	MSM5118165F	55
ML610Q422P	14	ML675013	20	ML86101A Evaluation Board	40	ML9286-xx	69	MR27V3252J	47	MSM5118165FP	55
ML610Q426 (NEW)	14	ML67Q4050	20	ML86790	37	ML9289-xx	69	MR27V3252R (Under development)	47	MSM514260E	55
ML610Q426C (NEW)	14	ML67Q4051	20	ML86V7655	37	ML9298	69	MR27V6402L	45	MSM514260EP	55
ML610Q426P (NEW)	14	ML67Q4060	20	ML86V7655 Evaluation Board	40	ML9351A	69	MR27V6441L	49	MSM514265E	55
ML610Q426PC (NEW)	14	ML67Q4061	20	ML86V76580 Evaluation Board	37	ML9353A	69	MR27V6452L	47	MSM514400DP	55
ML610Q428	14	ML7005	11	ML86V76580 Evaluation Board	40	ML9362A	69	MR27V6452R	47	MSM514400E	55
ML610Q428P	14	ML7012-06	11	ML86V76652	37	ML9372A	69	MR27V802F	45	MSM514400EP	55
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ML610Q431	14	ML7033-01	11	ML86V76653 Evaluation Board	40	ML9460	67	MR29V12852A (Under development)	50	MSM51V16160F	55
ML610Q432	14	ML7037-003	9	ML86V76655	37	ML9461B	67	MR29V25652A (Under development)	50	MSM51V16165F	55
ML610Q435	14	ML7041	11	ML86V76655 Evaluation Board	40	ML9470-12	67	MR35V01G7xB	45	MSM51V16400F	55
ML610Q436	14	ML7066	7	ML86V7668A	37	ML9471	67	MR35V2567xB	45	MSM51V16405F	55
ML610Q438	14	ML7074-003	9	ML86V7668A Evaluation Board	40	ML9472	67	MR35V5127xB	45	MSM51V17400F	55
ML610Q438P	14	ML7074-004	9	ML86V7675	37	ML9473	67	MR36V01G52B	47	MSM51V17400FP	55
ML610Q439	14	ML7098C-01	11	ML86V7675 Evaluation Board	40	ML9475	67	MR36V02G54B	47	MSM51V17405F	55
ML610Q439P	14	ML7105-002 (NEW)	7	ML86V8101	39	ML9476	67	MR36V04G54B	47	MSM51V17800F	55
ML610Q461 (NEW)	16	ML7105C-001 (NEW)	7	ML86V8101 Evaluation Board	40	ML9477	67	MR36V04G54S	47	MSM51V17805F	55
ML610Q461P (NEW)	16	ML7109S	7	ML86V8102	39	ML9478C	67	MR36V08G57C	47	MSM51V18160F	55
ML610Q462 (NEW)	16	ML7114B (Under development)	11	ML86V8102 Evaluation Board	40	ML9479E	67	MR36V08G87C	47	MSM51V18165F	55
ML610Q462P (NEW)	16	ML7138 (NEW)	7	ML86V8201	39	ML9480	67	MR36V16G56C	47	MSM51V18165FP	55
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ML610Q463P (NEW)	16	ML7174 (Under development)	11	ML86V8202C	39	ML9489 (NEW)	67	MR37T12843B (NEW)	49	MSM51V4265EP	55
ML610Q471	16	ML7202-001	9	ML86V8202C Evaluation Board	40	ML9574	11	MR37T6441B (Under development)	49	MSM51V4400E	55
ML610Q471P	16	ML7204-003	9	ML86V8207	39	ML9860B	67	MR37T6443B (Under development)	49	MSM51V4400EP	55
ML610Q472	16	ML7207-01	11	ML86V8207 Evaluation Board	40	ML9863A	67	MR37V12841A	49	MSM51V4800E	55
ML610Q472P	16	ML7213	72	ML86V8209	39	ML9870	67	MR37V12852B	47	MSM5412222B	61
ML610Q473	16	ML7214A-001	9	ML86V8209 Evaluation Board	40	MR25T1287xL	45	MR37V25652T	47	MSM5416258B	55
ML610Q473P	16	ML7223	72	ML86V8401	39	MR25T1671L	45	MR37V25653T	47	MSM54V12222B	61
ML610Q474 (NEW)	16	ML7223V	72	ML86V8401 Evaluation Board	40	MR25T167xL	45	MR37V6452B	47	MSM54V16258B	55
ML610Q475 (NEW)	16	ML7224A-001	9	ML8953A	75	MR25T647xL	45	MR44V064A	63	MSM54V16258BP	55
ML610Q476 (NEW)	16	ML7234-021	9	ML8953B	75	MR26T51203L	45	MR45V032A	63	MSM56V16160F	57
ML610Q477	16	ML7246	7	ML9042-0x	67	MR26V01G53L	47	MR45V200A (Under development)	63	MSM56V16160FP	57
ML610Q477P	16	ML7247-001 (NEW)	9	ML9042-1x	67	MR26V02G54R	47	MR45V256A	63	MSM56V16160K	57
ML610Q478	16	ML7257-01	11	ML9042-2x	67	MR26V51252R	47	MR48V256C (Under development)	63	MSM56V16160KP	57
ML610Q478P	16	ML7265	7	ML9058E	67	MR26V51253L	47	MS8104160A	61	MSM56V16161K (NEW)	57
ML610Q479	16	ML7266	7	ML9059E	67	MR26V6455J	47	MS81V03120	61	MSM56V16161KP (NEW)	57
ML610Q479P	16	ML7275	7	ML9077	20	MR27T12800L	45	MS81V04160A	61	MSM56V16800F	57
ML610Q482	14	ML7304-0x2	9	ML9078-001	20	MR27T12802L	45	MS81V04160AP	61	MSM7533V	11
ML610Q482P	14	ML7344C (Under development)	7	ML9078-002	20	MR27T1602L	45	MS81V04166A	61	MSM7578V	11
ML610Q484	14	ML7344E (Under development)	7	ML9078-003	20	MR27T25603L	45	MS81V05200	61	MSM7581	11
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ML610Q486 (NEW)	14	ML7396A	7	ML9092-04	67	MR27V12800L	45	MS81V26000-25TPZP3	61	MSM7732A	11
ML610Q486P (NEW)	14-71	ML7396B	7	ML9098B	69	MR27V12850L	47	MSM5116160F	55	MSM9563	11
ML610Q488 (NEW)	14	ML7396E	7	ML9208A-xx	69	MR27V12852L	47	MSM5116400F	55	MSM9565	11
ML610Q488P (NEW)	14	ML7406 (NEW)	7	ML9208-xx	69	MR27V12852R (Under development)	47	MSM5117400F	55		
ML610Q793 (NEW)	18	ML7831	72	ML9209-xx	69	MR27V1602L	45	MSM5117405F	55		
ML610Q794G (NEW)	18	ML8511-00FC	79	ML9212GA	69	MR27V1641L	49	MSM5117800F	55		

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## New Products and Topics

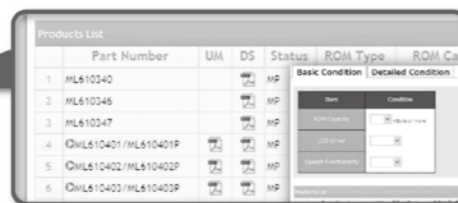
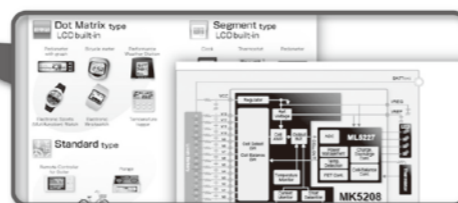
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**PDF** You can easily understand LAPIS Semiconductor's LSIs, modules, and development kits. You can download datasheet PDF files from the product list.

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