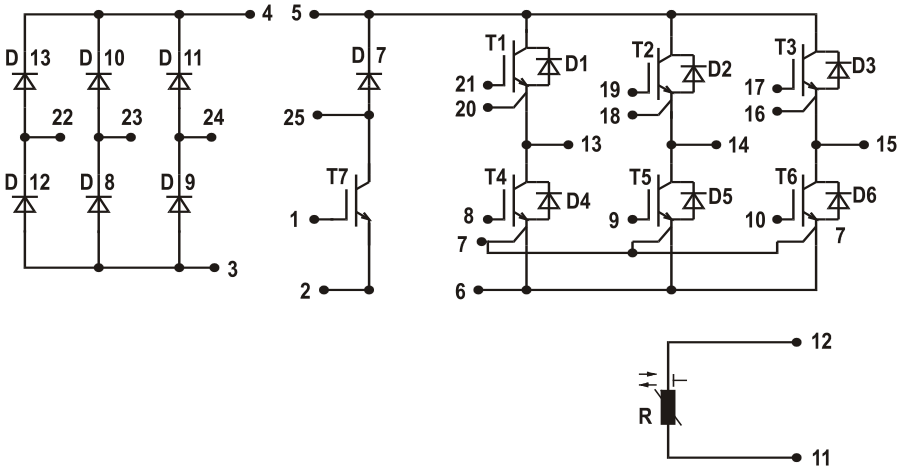
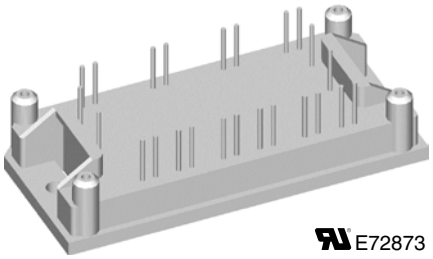
Converter - Brake - Inverter Module (CBI 1)
NPT IGBT

Three Phase Rectifier	Brake Chopper	Three Phase Inverter
V_{RRM} = 1600 V	V_{CES} = 1200 V	V_{CES} = 1200 V
I_{DAVM25} = 130 A	I_{C25} = 19 A	I_{C25} = 19 A
I_{FSM} = 300 A	$V_{CE(sat)}$ = 2.9 V	$V_{CE(sat)}$ = 2.9 V

Part name (Marking on product)

MUBW15-12A6K





Pin configuration see outlines.

Features:

- High level of integration - only one power semiconductor module required for the whole drive
- Inverter with NPT IGBTs
- low saturation voltage
- positive temperature coefficient
- fast switching
- short tail current
- Epitaxial free wheeling diodes with hiperfast and soft reverse recovery
- Industry standard package with insu lated copper base plate and soldering pins for PCB mounting
- Temperature sense included

Application:

AC motor drives with

- Input from single or three phase grid
- Three phase synchronous or asynchronous motor
- Electric braking operation

Package:

- UL registered
- Industry standard E1-pack

Ouput Inverter T1 - T6

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{CES}	*collector emitter voltage*	T_{VJ} = 25°C to 150°C				1200	V
V_{GES}	*max. DC gate voltage*	continuous				±20	V
V_{GEM}	*max. transient collector gate voltage*	transient				±30	V
I_{C25}	*collector current*		T_C = 25°C			19	A
I_{C80}			T_C = 80°C			13	A
P_{tot}	*total power dissipation*		T_C = 25°C			90	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 15 A; V_{GE} = 15 V	T_{VJ} = 25°C		3.0	3.4	V
			T_{VJ} = 125°C		3.5		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.35 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	4.5		6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.6	mA
			T_{VJ} = 125°C		1.3		mA
I_{GES}	*gate emitter leakage current*	V_{CE} = 0 V; V_{GE} = ±20 V				100	nA
C_{ies}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz			600		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A			45		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 10 A V_{GE} = ±15 V; R_G = 82 Ω	T_{VJ} = 125°C		50		ns
t_r	*current rise time*				40		ns
$t_{d(off)}$	*turn-off delay time*				290		ns
t_f	*current fall time*				60		ns
E_{on}	*turn-on energy per pulse*				1.2		mJ
E_{off}	*turn-off energy per pulse*				1.1		mJ
I_{CM}	*reverse bias safe operating area*	RBSOA; V_{GE} = ±15 V; R_G = 82 Ω L = 100 µH; clamped induct. load V_{CEmax} = V_{CES} - L_S·di/dt	T_{VJ} = 125°C		26		A
t_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; non-repetitive	T_{VJ} = 125°C		10		µs
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.35	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per IGBT)			0.5		K/W

Output Inverter D1 - D6

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{RRM}	*max. repetitve reverse voltage*		T_{VJ} = 150°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			26	A
I_{F80}			T_C = 80°C			17	A
V_F	*forward voltage*	I_F = 30 A; V_{GE} = 0 V	T_{VJ} = 25°C			3.4	V
			T_{VJ} = 125°C		2.3		V
I_{RM}	*max. reverse recovery current*	V_R = 600 V di_F/dt = -400 A/µs I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 100°C		16		A
t_{rr}	*reverse recovery time*				130		ns
$E_{rec(off)}$	*reverse recovery energy*				tbd		µJ
R_{thJC}	*thermal resistance junction to case*	(per diode)				1.6	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.55		K/W

T_C = 25°C unless otherwise stated

Brake Chopper T7

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{CES}	*collector emitter voltage*		T_{VJ} = 25°C to 150°C			1200	V
V_{GES}	*max. DC gate voltage*	continuous				±20	V
V_{GEM}	*max. transient collector gate voltage*	transient				±30	V
I_{C25}	*collector current*		T_C = 25°C			19	A
I_{C80}			T_C = 80°C			13	A
P_{tot}	*total power dissipation*		T_C = 25°C			90	W
$V_{CE(sat)}$	*collector emitter saturation voltage*	I_C = 15 A; V_{GE} = 15 V	T_{VJ} = 25°C		2.9	3.4	V
			T_{VJ} = 125°C		3.5		V
$V_{GE(th)}$	*gate emitter threshold voltage*	I_C = 0.4 mA; V_{GE} = V_{CE}	T_{VJ} = 25°C	4.5		6.5	V
I_{CES}	*collector emitter leakage current*	V_{CE} = V_{CES}; V_{GE} = 0 V	T_{VJ} = 25°C			0.5	mA
			T_{VJ} = 125°C		0.8		mA
I_{GES}	*gate emitter leakage current*	V_{CE} = 0 V; V_{GE} = ±20 V				100	nA
C_{ies}	*input capacitance*	V_{CE} = 25 V; V_{GE} = 0 V; f = 1 MHz			600		pF
$Q_{G(on)}$	*total gate charge*	V_{CE} = 600 V; V_{GE} = 15 V; I_C = 10 A			45		nC
$t_{d(on)}$	*turn-on delay time*	inductive load V_{CE} = 600 V; I_C = 10 A V_{GE} = ±15 V; R_G = 82 Ω	T_{VJ} = 125°C		45		ns
t_r	*current rise time*				40		ns
$t_{d(off)}$	*turn-off delay time*				290		ns
t_f	*current fall time*				60		ns
E_{on}	*turn-on energy per pulse*				1.2		mJ
E_{off}	*turn-off energy per pulse*				1.1		mJ
I_{CM}	*reverse bias safe operating area*	RBSOA; V_{GE} = ±15 V; R_G = 82 Ω L = 100 µH; clamped induct. load V_{CEmax} = V_{CES} - L_S·di/dt	T_{VJ} = 125°C		20		A
t_{SC} (SCSOA)	*short circuit safe operating area*	V_{CE} = 720 V; V_{GE} = ±15 V; R_G = 82 Ω; non-repetitive	T_{VJ} = 125°C		10		µs
R_{thJC}	*thermal resistance junction to case*	(per IGBT)				1.35	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per IGBT)			0.45		K/W

Brake Chopper D7

Symbol	Definitions	Conditions		Ratings min.	typ.	max.	Unit
V_{RRM}	*max. repetitive reverse voltage*		T_{VJ} = 150°C			1200	V
I_{F25}	*forward current*		T_C = 25°C			15	A
I_{F80}			T_C = 80°C			10	A
V_F	*forward voltage*	I_F = 15 A; V_{GE} = 0 V	T_{VJ} = 25°C			3.5	V
			T_{VJ} = 125°C		2.0		V
I_R	*reverse current*	V_R = V_{RRM}	T_{VJ} = 25°C			0.06	mA
			T_{VJ} = 125°C		0.2		mA
I_{RM}	*max. reverse recovery current*	V_R = 600 V; I_F = 10 A di_F/dt = -400 A/µs			13		A
t_{rr}	*reverse recovery time*		T_{VJ} = 100°C		110		ns
R_{thJC}	*thermal resistance junction to case*	(per diode)				2.5	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.85		K/W

T_C = 25°C unless otherwise stated

Input Rectifier Bridge D8 - D13

Symbol	Definitions	Conditions		Maximum Ratings	
V_{RRM}	*max. repetitive reverse voltage*			1600	V
I_{FAV}	*average forward current*	sine 180°	T_C = 80°C	31	A
I_{DAVM}	*max. average DC output current*	rectangular; d = $^1/_3$; bridge	T_C = 80°C	89	A
I_{FSM}	*max. surge forward current*	t = 10 ms; sine 50 Hz	T_C = 25°C	320	A
P_{tot}	*total power dissipation*		T_C = 25°C	80	W

Symbol	Conditions			Characteristic Values		
				min.	typ.	max.	
V_F	*forward voltage*	I_F = 30 A	T_{VJ} = 25°C		1.0	1.35	V
			T_{VJ} = 125°C		1.1		V
I_R	*reverse current*	$V_R = V_{RRM}$	T_{VJ} = 25°C			0.02	mA
			T_{VJ} = 125°C		0.4		mA
R_{thJC}	*thermal resistance junction to case*	(per diode)	T_{VJ} = 25°C			1.4	K/W
R_{thCH}	*thermal resistance case to heatsink*	(per diode)			0.45		K/W

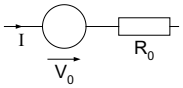
Temperature Sensor NTC

Symbol	Definitions	Conditions		Ratings			
				min.	typ.	max.	Unit
R_{25}	*resistance*		T_C = 25°C	4.45	4.7	5.0	kΩ
$B_{25/85}$					3510		K

Module

Symbol	Definitions	Conditions	Ratings			
			min.	typ.	max.	Unit
T_{VJ}	*operating temperature*		-40		125	°C
T_{VJM}	*max. virtual junction temperature*				150	°C
T_{stg}	*storage temperature*		-40		125	°C
V_{ISOL}	*isolation voltage*	$I_{ISOL} \leq$ 1 mA; 50/60 Hz			2500	V~
M_d	*mounting torque*	(M4)	2.0		2.2	Nm
d_S	*creep distance on surface*		12.7			mm
d_A	*strike distance through air*		12.7			mm
Weight				40		g

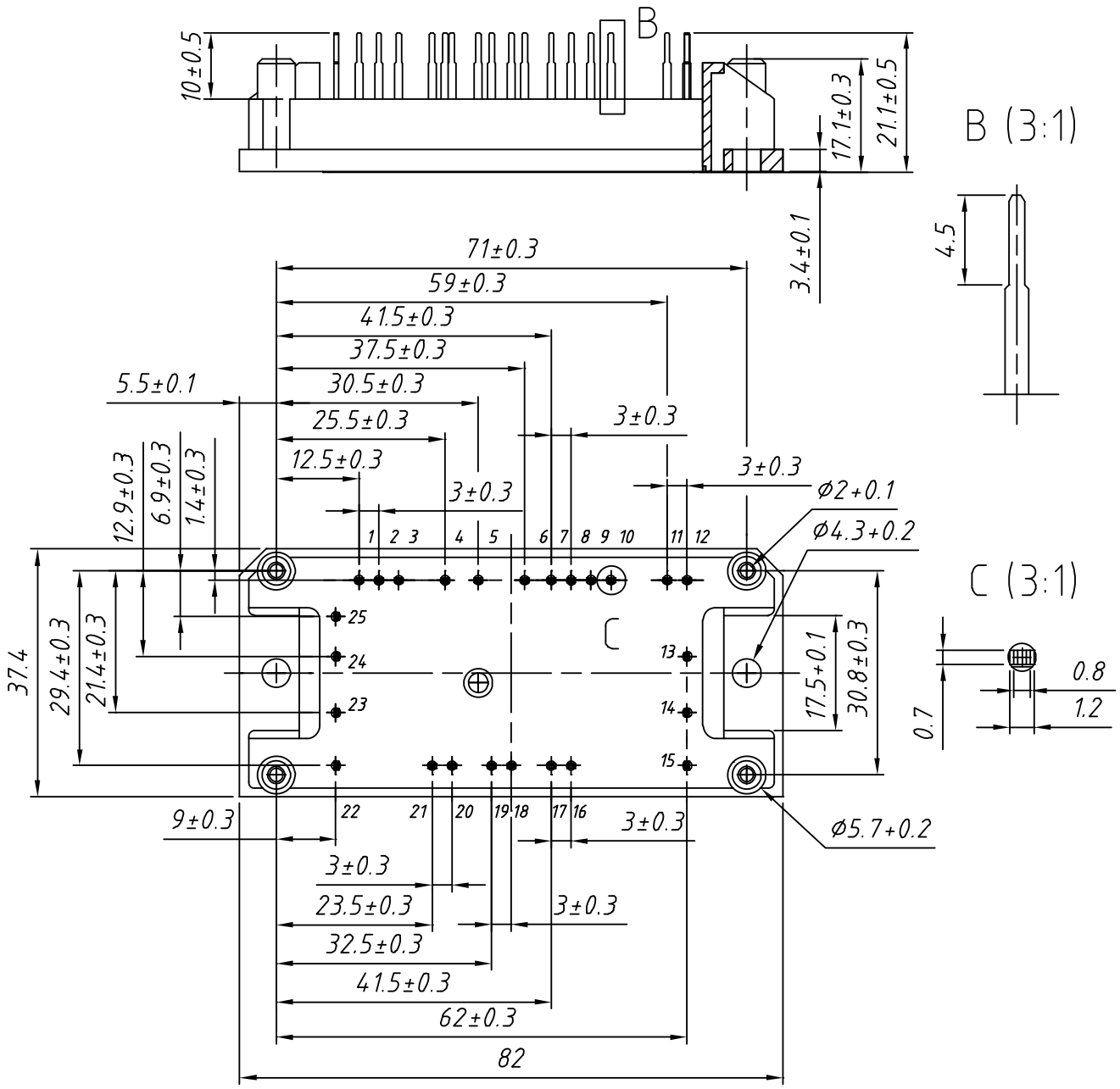
Equivalent Circuits for Simulation



Symbol	Definitions	Conditions		Ratings			
				min.	typ.	max.	Unit
V_0	*rectifier diode*	D8 - D13	T_{VJ} = 125°C		0.90		V
R_0					9		mΩ
V_0	*IGBT*	T1 - T6	T_{VJ} = 125°C		1.50		V
R_0					120		mΩ
V_0	*free wheeling diode*	D1 - D6	T_{VJ} = 125°C		1.46		V
R_0					31		mΩ
V_0	*IGBT*	T7	T_{VJ} = 125°C		1.50		V
R_0					120		mΩ
V_0	*free wheeling diode*	D7	T_{VJ} = 125°C		1.46		V
R_0					63		mΩ

T_C = 25°C unless otherwise stated

Outline Drawing Dimensions in mm (1 mm = 0.0394“)



Product Marking

Ordering	Part Name	Marking on Product	Delivering Mode	Base Qty	Ordering Code
Standard	MUBW 15-12A6K	MUBW15-12A6K	Box	10	499 331

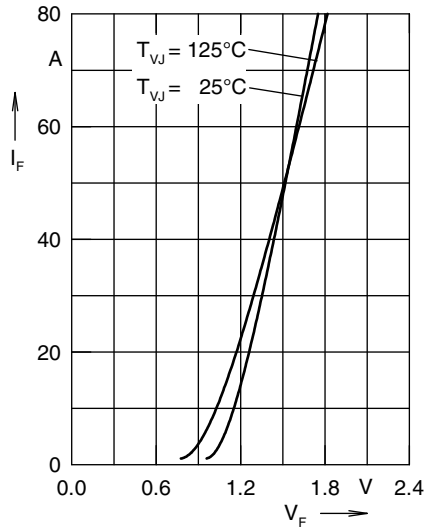


Fig. 1 Forward current versus voltage drop per diode

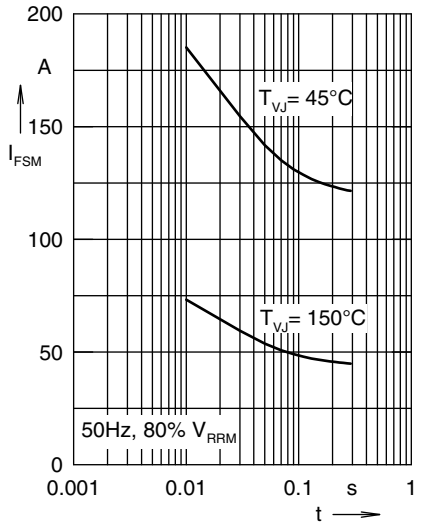


Fig. 2 Surge overload current

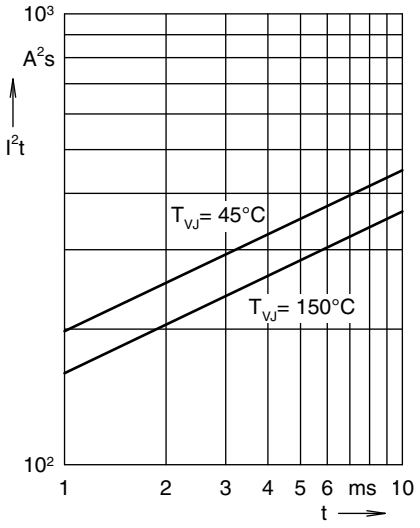


Fig. 3 I_2t versus time per diode

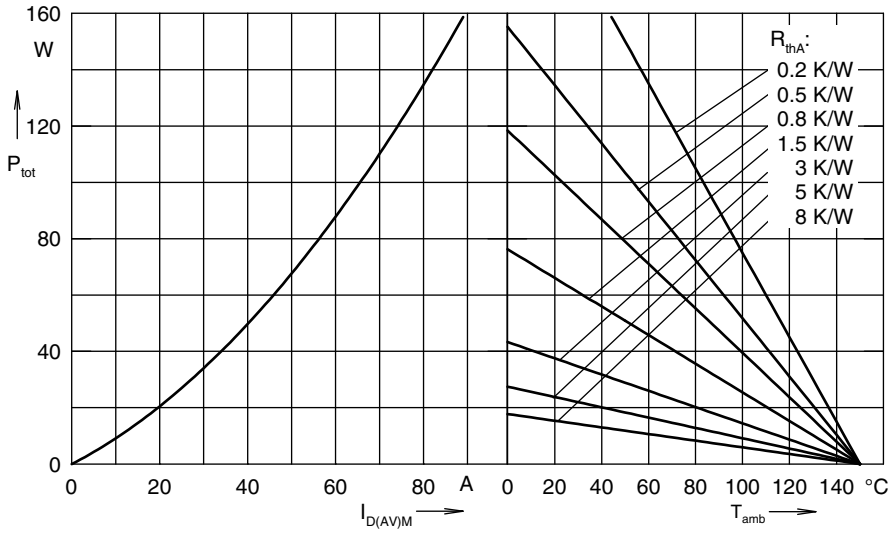


Fig. 4 Power dissipation versus direct output current and ambient temperature, sin 180°

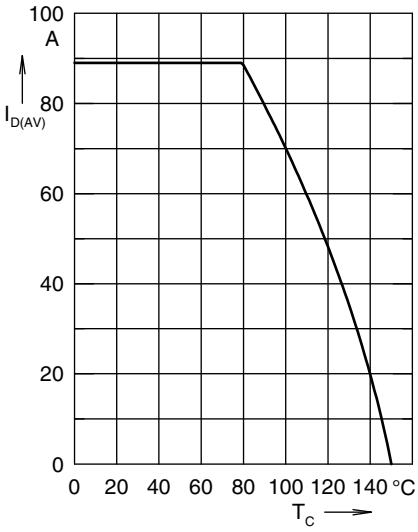


Fig. 5 Max. forward current vs. case temperature

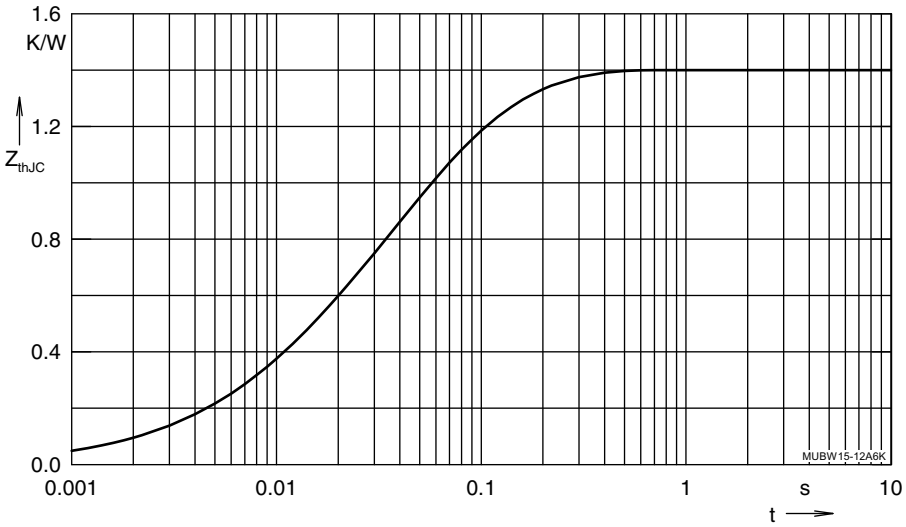


Fig. 6 Transient thermal impedance junction to case

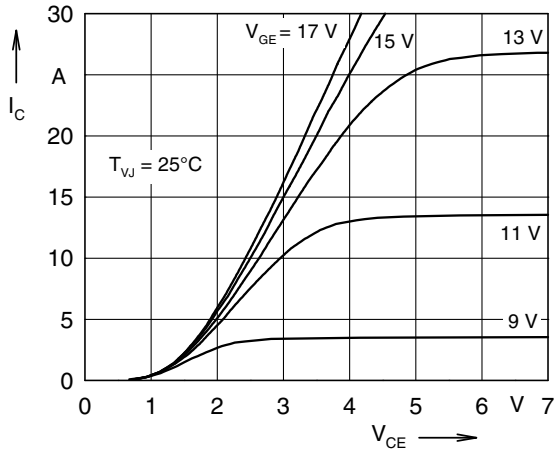


Fig. 7 Typ. output characteristics

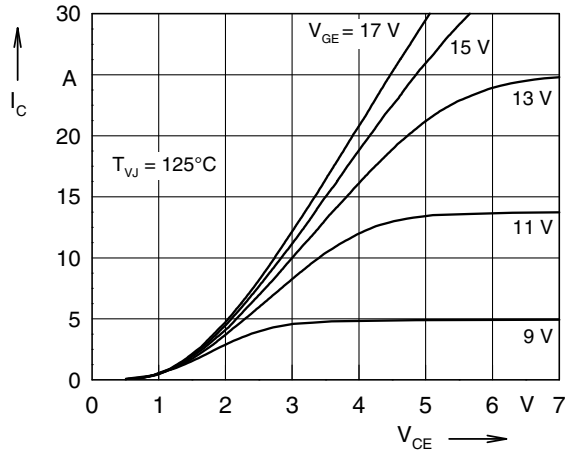


Fig. 8 Typ. output characteristics

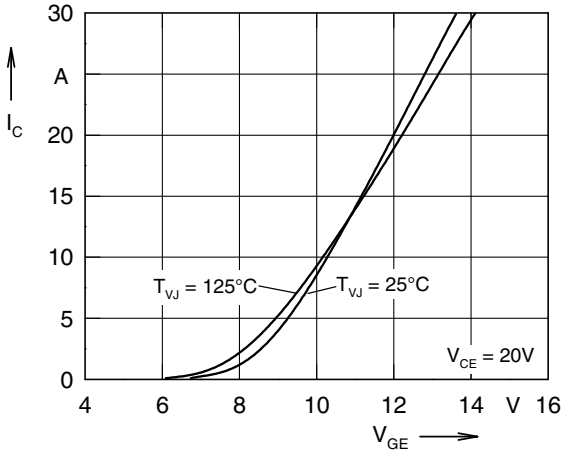


Fig. 9 Typ. transfer characteristics

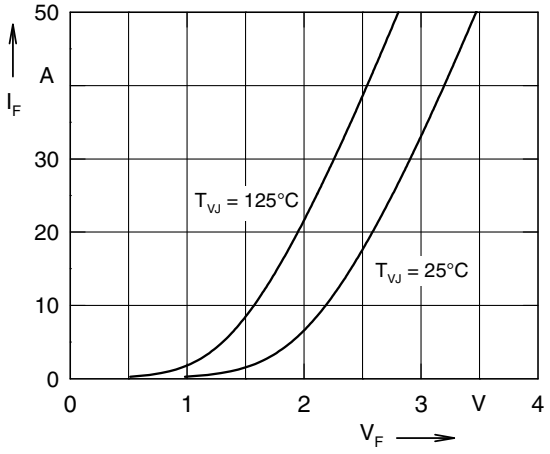


Fig. 10 Typ. forward characteristics of free wheeling diode

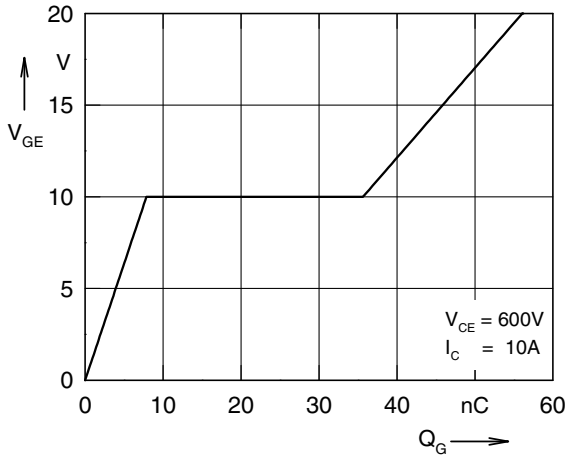


Fig. 11 Typ. turn on gate charge

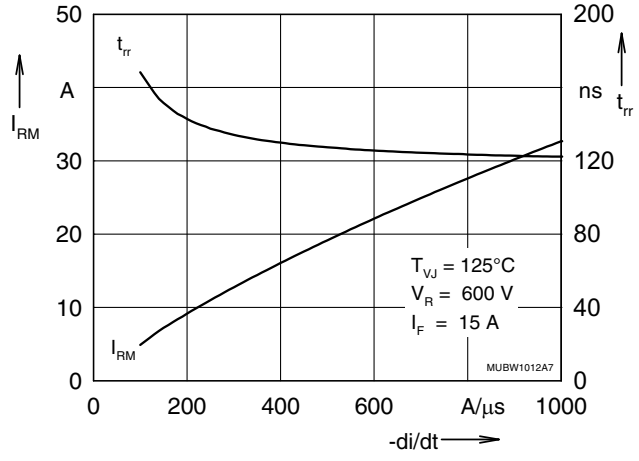


Fig. 12 Typ. turn off characteristics of free wheeling diode

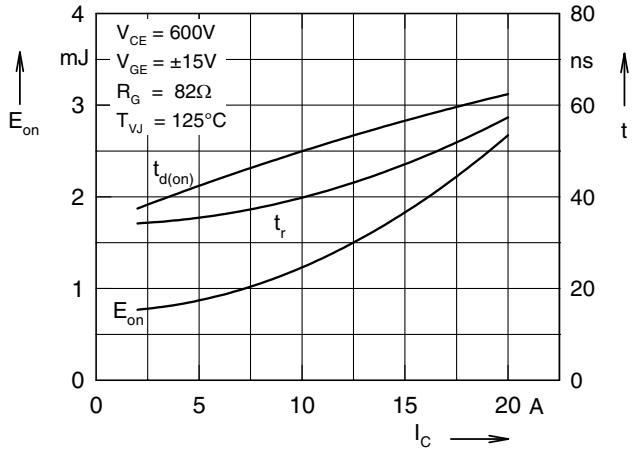


Fig. 13 Typ. turn on energy and switching times versus collector current

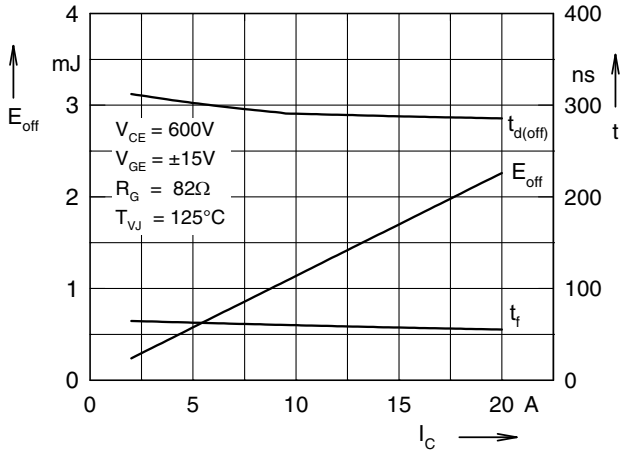


Fig. 14 Typ. turn off energy and switching times versus collector current

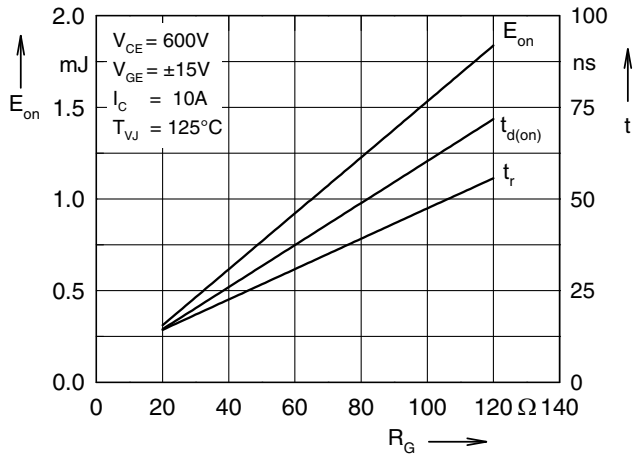


Fig. 15 Typ. turn on energy and switching times versus gate resistor

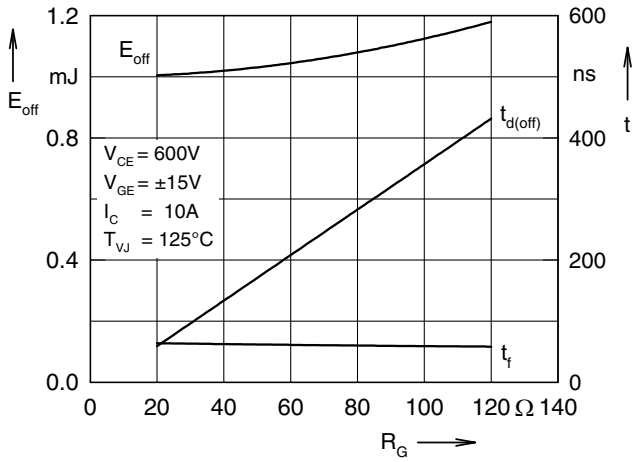


Fig.16 Typ. turn off energy and switching times versus gate resistor

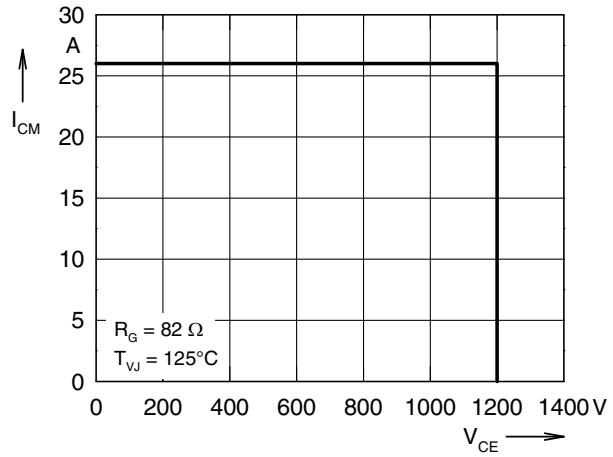


Fig. 17 Reverse biased safe operating area RBSOA

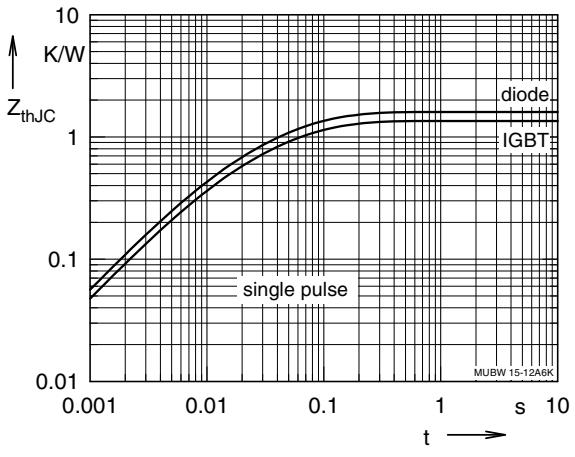


Fig. 18 Typ. transient thermal impedance

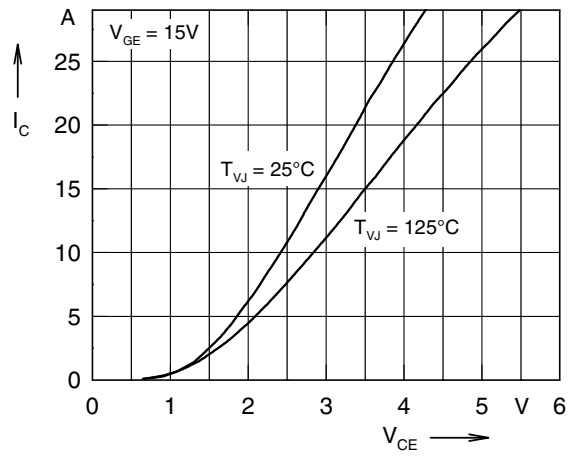


Fig. 19 Typ. output characteristics

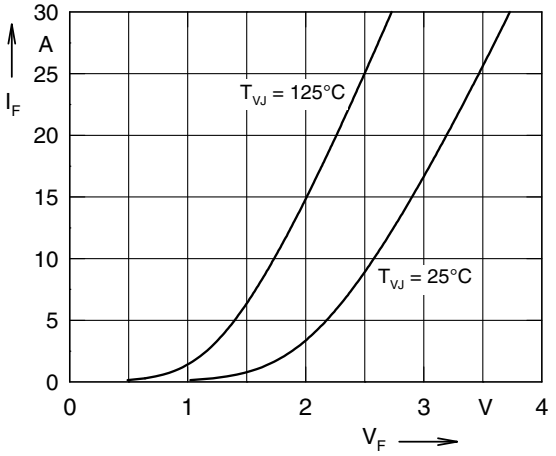


Fig. 20 Typ. forward characteristics of free wheeling diode

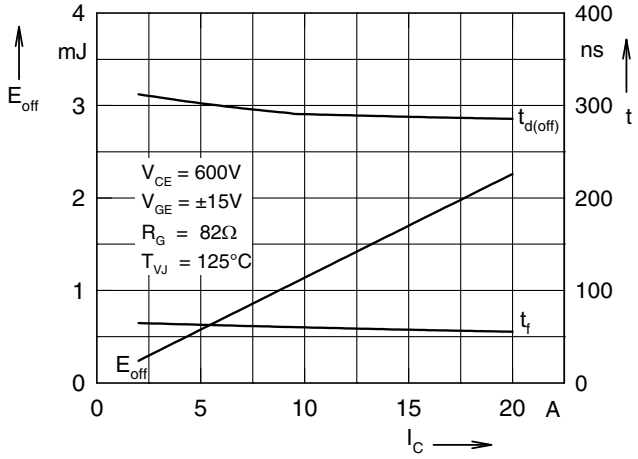


Fig. 21 Typ. turn off energy and switching times versus collector current

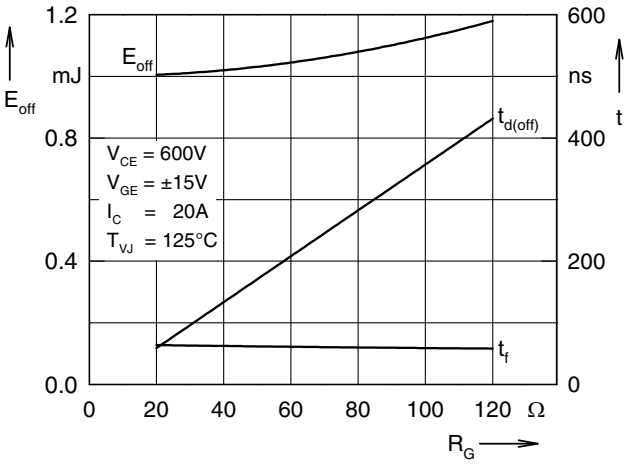


Fig. 22 Typ. turn off energy and switching times versus gate resistor

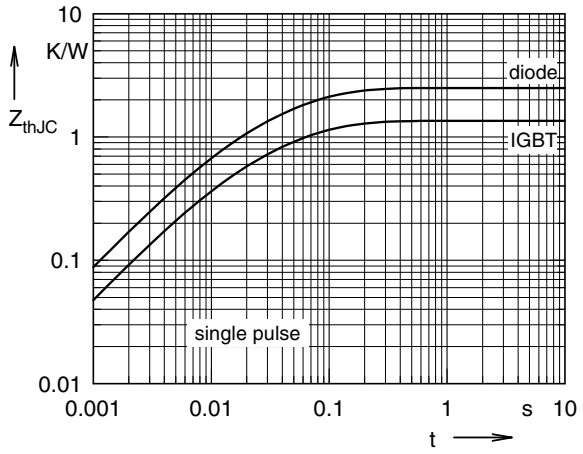


Fig. 23 Typ. transient thermal impedance

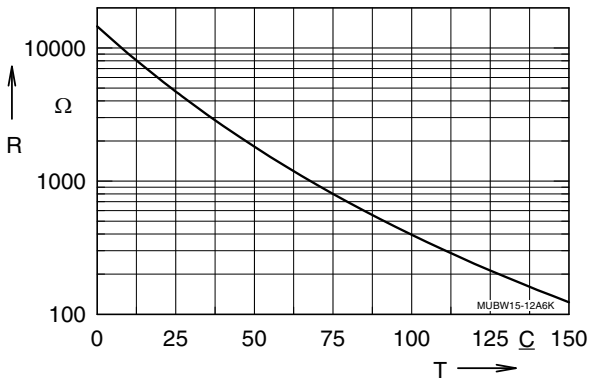


Fig. 24 Typ. thermistor resistance versus temperature