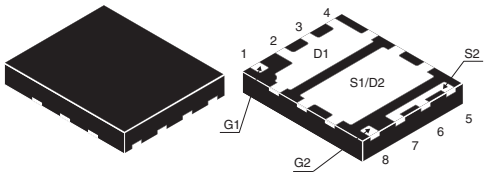
STL60N32N3LL

Dual N-channel 30 V, 0.005 Ω, 15 A PowerFLAT™ 5x6 asymmetrical double island, STripFET™ Power MOSFET

Features

Order code		V_{DSS}	$R_{DS(on)}$	I_D
STL60N32N3LL	Q_1	30 V	< 0.0092 Ω	13.6 A
	Q_2	30 V	< 0.0055 Ω	15 A

- $R_{DS(on)}$ * Q_g industry benchmark
- Extremely low on-resistance $R_{DS(on)}$
- Very low switching gate charge
- High avalanche ruggedness
- Low gate drive power losses



PowerFLAT™5x6 asymmetrical double island

Application

- Switching applications

Description

This device is a dual N-channel Power MOSFET which utilizes the latest generation of design rules for ST's proprietary STripFET™ V and STripFET™ VI DeepGATE™ technology. The lowest available RDS(on)* Qg in this chip scale package renders the device suitable for the most demanding DC-DC converter applications, where high power density is required.

Figure 1. Internal schematic diagram

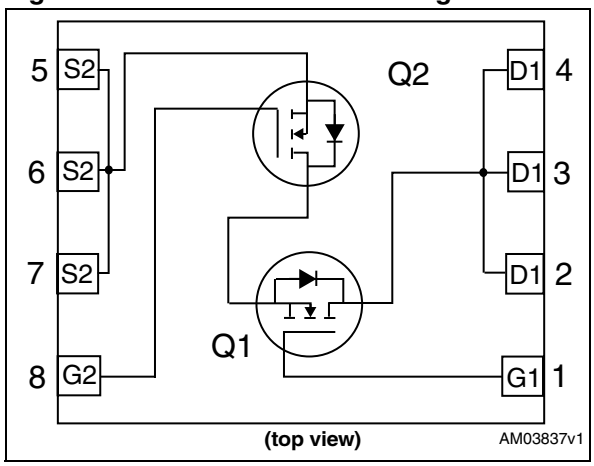


Table 1. Device summary

Order code	Marking	Package	Packaging
STL60N32N3LL	60N32N3LL	PowerFLAT™5x6 asymmetrical double island	Tape and reel

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Type	Value	Unit
V_{DS}	Drain-source voltage	Q_1 Q_2	30 30	V V
V_{GS}	Gate- source voltage	Q_1 Q_2	± 20 ± 20	V V
I_D(1)	Drain current (continuous) at T_C = 25 °C	Q_1 Q_2	32 60	A A
I_D(1)	Drain current (continuous) at T_C = 100 °C	Q_1 Q_2	23 37	A A
I_D(2)	Drain current (continuous) at T_{pcb} = 25 °C	Q_1 Q_2	13.6 15	A A
I_D(2)	Drain current (continuous) at T_{pcb} = 100 °C	Q_1 Q_2	8.5 9.3	A A
I_{DM} (2),(3)	Drain current (pulsed)	Q_1 Q_2	54.4 60	A A
P_{TOT}(1)	Total dissipation at T_C = 25 °C	Q_1 Q_2	23 50	W W
P_{TOT}(2)	Total dissipation at T_{pcb} = 25 °C	Q_1 Q_2	3.12 3.12	W W
T_j	Operating junction temperature		-55 to 150	°C
T_{stg}	Storage temperature			

1. This value is according to$R_{thj\text{-}c}$
2. This value is according to$R_{thj\text{-}pcb}$
3. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Type	Value	Unit
$R_{thj\text{-}pcb}$(1)	Thermal resistance junction-pcb max		40	°C/W
$R_{thj\text{-}c}$	Thermal resistance junction-case	Q_1 Q_2	5.5 2.5	°C/W

1. When mounted on FR-4 board of 1inch², 2oz Cu, t < 10 sec

2 Electrical characteristics

(T_{CASE}=25°C unless otherwise specified)

Table 4. On/off states

Symbol	Parameter	Test conditions	Type	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown voltage	I_D = 250 µA, V_{GS} = 0	Q_1 Q_2	30 30			V V
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} = 30 V	Q_1 Q_2			1 1	µA µA
I_{DSS}	Zero gate voltage Drain current (V_{GS} = 0)	V_{DS} =30 V, T_C =125°C	Q_1 Q_2			10 10	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V	Q_1 Q_2			±100 ±100	nA nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	Q_1 Q_2	1 1			V V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 6.8 A V_{GS} = 10 V, I_D = 7.5 A	Q_1 Q_2		0.0085 0.005	0.0092 0.0055	Ω Ω
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 4.5 V, I_D = 6.8 A V_{GS} = 4.5 V, I_D = 7.5 A	Q_1 Q_2		0.0109 0.0065	0.012 0.0073	Ω Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Type	Min.	Typ.	Max.	Unit
C_{iss}	Input capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0	Q_1 Q_2	-	950 1690	-	pF pF
C_{oss}	Output capacitance		Q_1 Q_2	-	193 291	-	pF pF
C_{rss}	Reverse transfer capacitance		Q_1 Q_2	-	27.6 176	-	pF pF
Q_g	Total gate charge	V_{DD} = 15 V, I_D = 15 A, V_{GS} = 4.5 V *(see Figure 25)*	Q_1 Q_2	-	6.6 17	-	nC nC
Q_{gs}	Gate-source charge		Q_1 Q_2	-	3.3 8	-	nC nC
Q_{gd}	Gate-drain charge		Q_1 Q_2	-	2.4 6	-	nC nC

Table 6. Switching times

Symbol	Parameter	Test conditions	Type	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{DD}=15 V, I_D=7.5 A, R_G=4.7 Ω, V_{GS}= 4.5 V *(see Figure 29)*	Q_1	-	10.8	-	ns
			Q_2		9.5		ns
t_r	Rise time		Q_1		15.6		ns
			Q_2		30		ns
$t_{d(off)}$	Turn-off delay time	V_{DD}=15 V, I_D=7.5 A, R_G=4.7 Ω, V_{GS}= 4.5V *(see Figure 29)*	Q_1	-	14.2	-	ns
			Q_2		37		ns
t_f	Fall time		Q_1		6		ns
			Q_2		12		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Type	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current	V_{DD}=15 V, I_D=7.5 A R_G=4.7 Ω, V_{GS}=4.5 V	Q_1	-		13.6	A
			Q_2			15	A
I_{SDM} (1)	Source-drain current (pulsed)	V_{DD}=15 V, I_D= 7.5 A R_G=4.7 Ω, V_{GS}=4.5 V	Q_1	-		54.4	A
			Q_2			60	A
V_{SD} (2)	Forward on voltage	I_{SD} = 15 A, V_{GS} = 0	Q_1	-		1.1	V
			Q_2			1.1	V
t_{rr}	Reverse recovery time	I_{SD} = 15 A, V_{DD} = 15 V di/dt = 100 A/µs, T_j = 150°C *(see Figure 29)*	Q_1	-	20		ns
			Q_2		24		ns
Q_{rr}	Reverse recovery charge		Q_1		10		nC
			Q_2		16.8		nC
I_{RRM}	Reverse recovery current		Q_1		1		A
			Q_2		1.4		A

1. Pulse width limited by safe operating area.
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

2.1.1 Graphs for Q1

Figure 2. Safe operating area

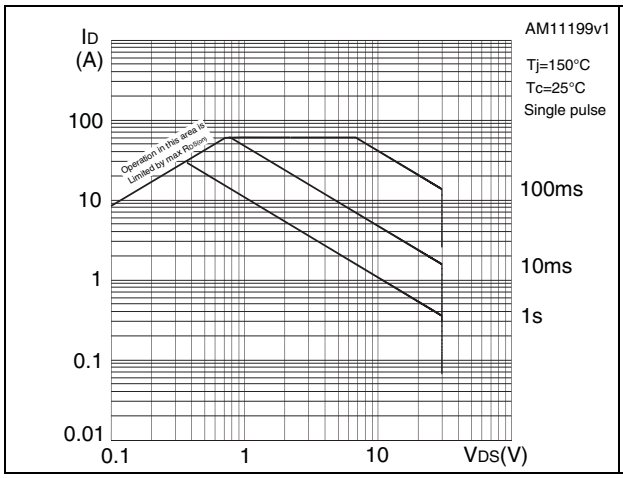


Figure 3. Thermal impedance

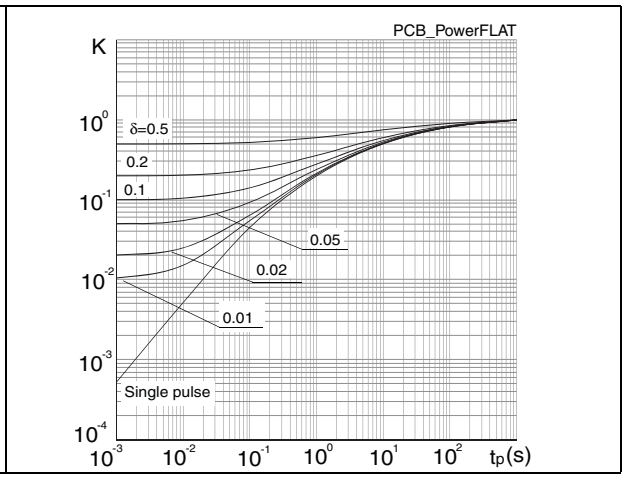


Figure 4. Output characteristics

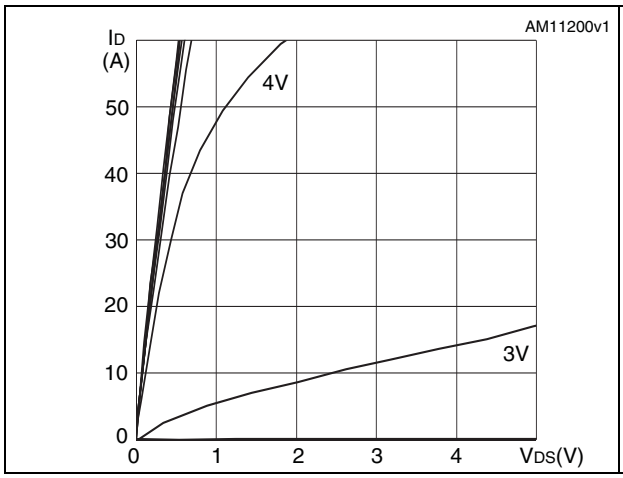


Figure 5. Transfer characteristics

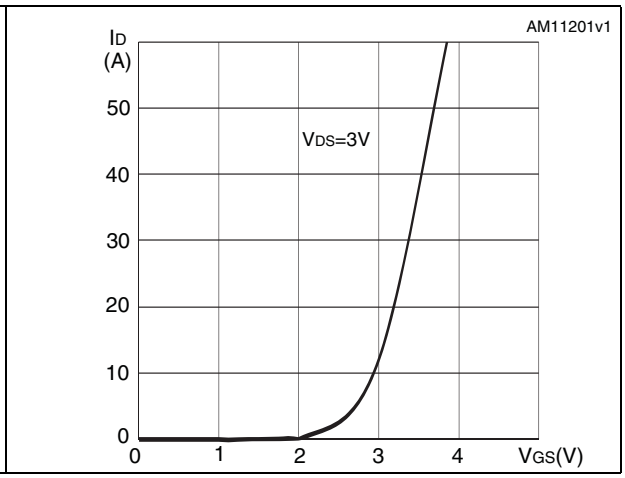


Figure 6. Normalized B_{VDSS} vs temperature

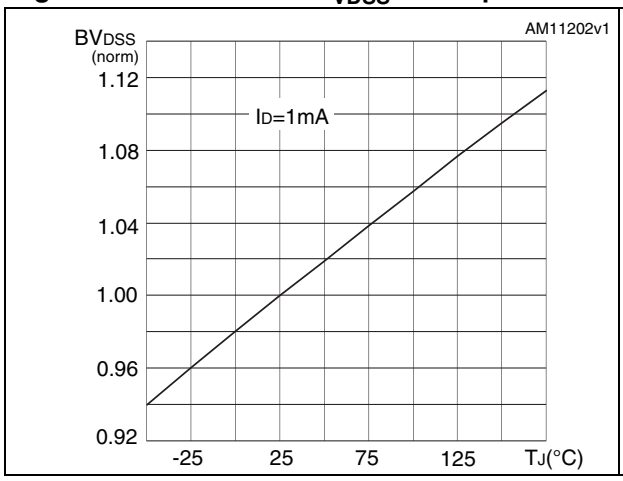


Figure 7. Static drain-source on resistance

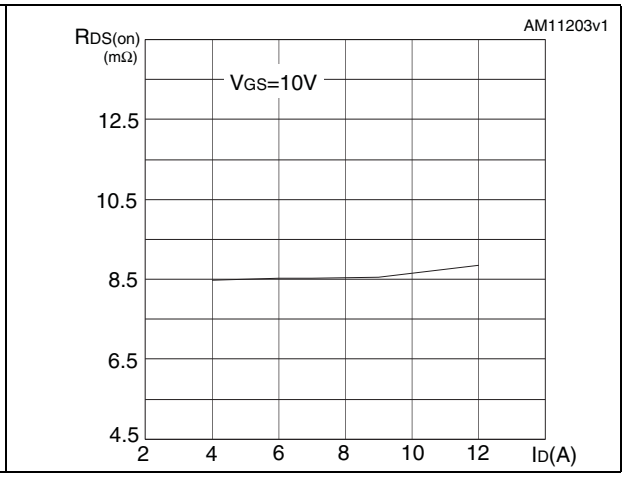


Figure 8. Gate charge vs gate-source voltage

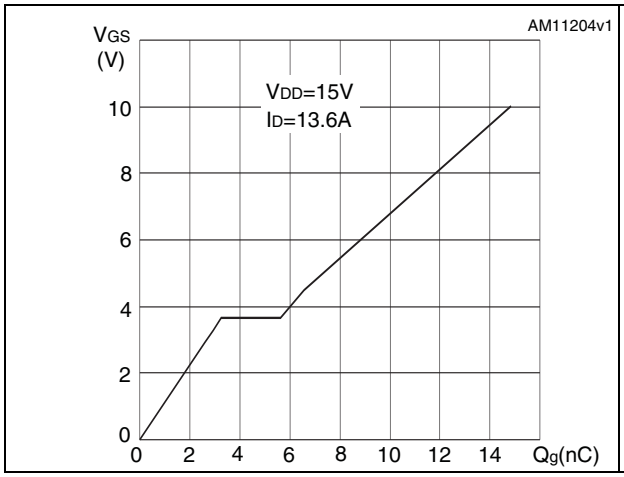


Figure 9. Capacitance variations

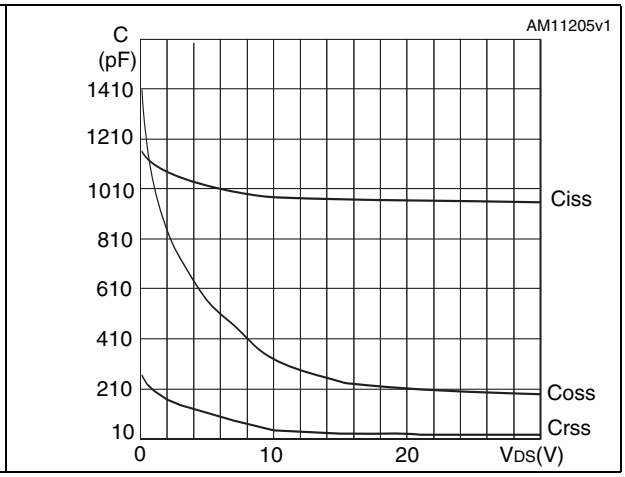


Figure 10. Normalized gate threshold voltage vs temperature

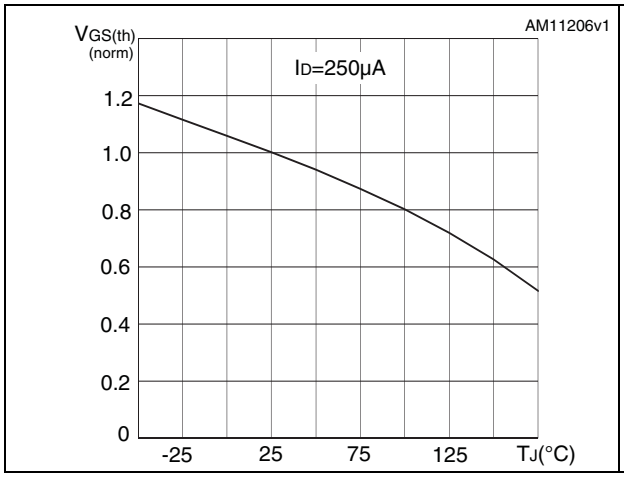


Figure 11. Normalized on resistance vs temperature

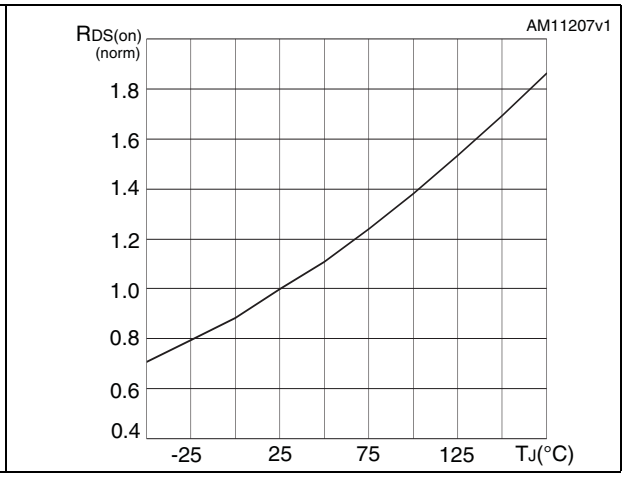
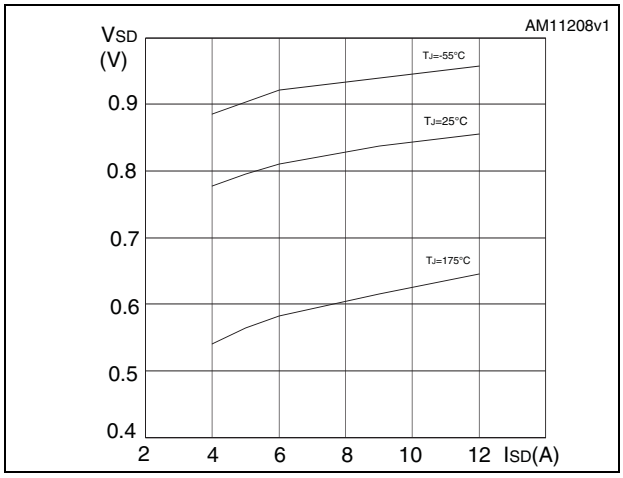


Figure 12. Source-drain diode forward characteristics



2.1.2 Graphs for Q2

Figure 13. Safe operating area

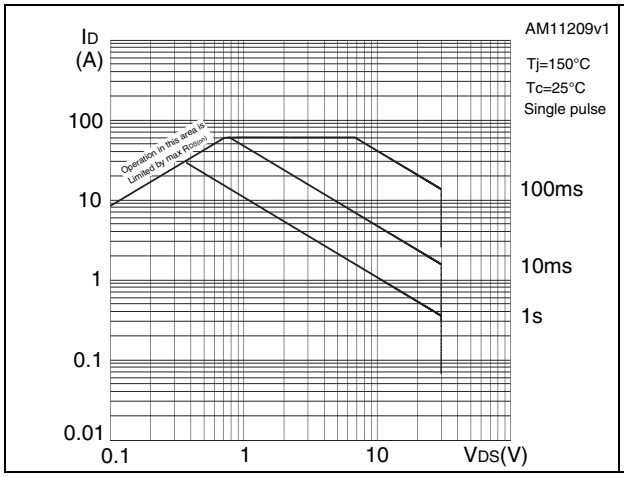


Figure 14. Thermal impedance

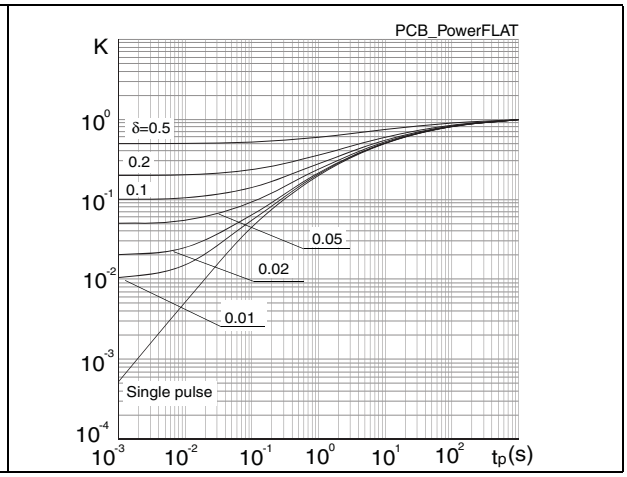


Figure 15. Output characteristics

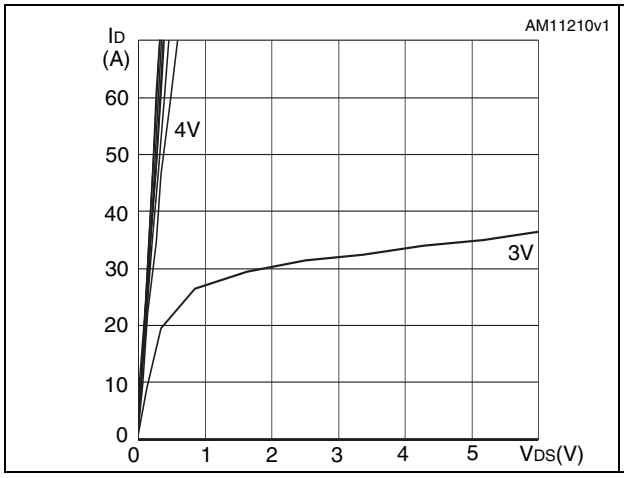


Figure 16. Transfer characteristics

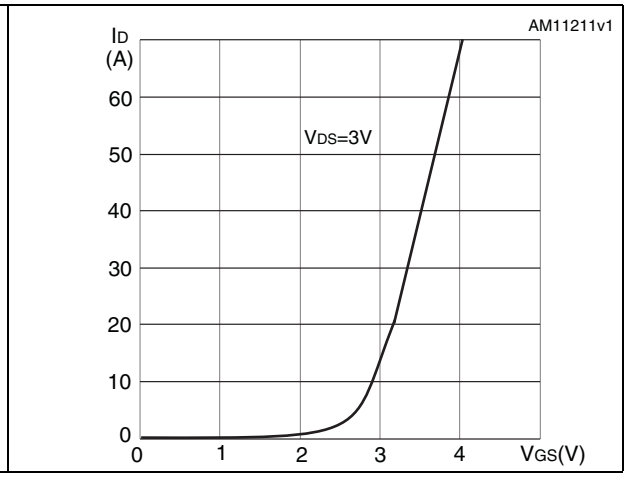


Figure 17. Normalized B_{VDSS} vs temperature

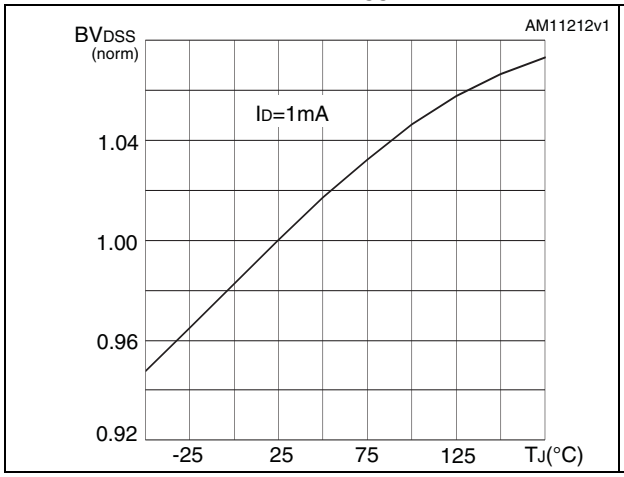


Figure 18. Static drain-source on resistance

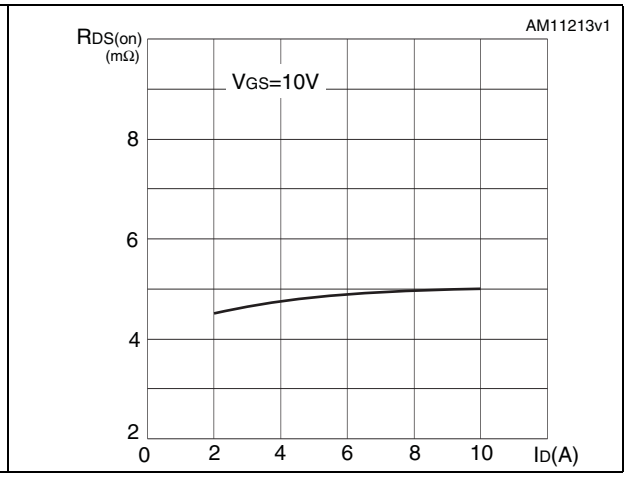


Figure 19. Gate charge vs gate-source voltage

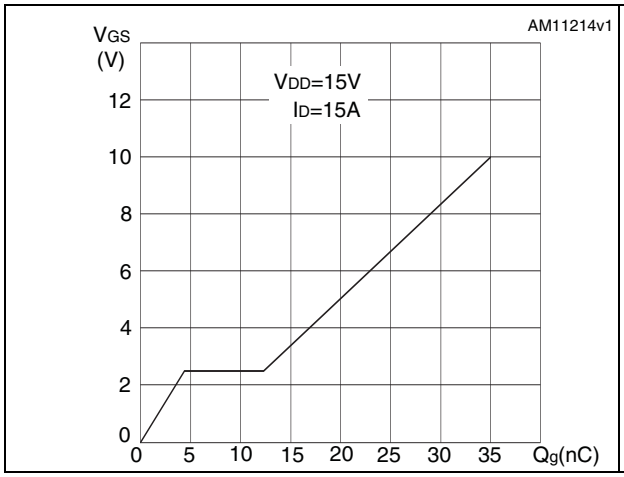


Figure 20. Capacitance variations

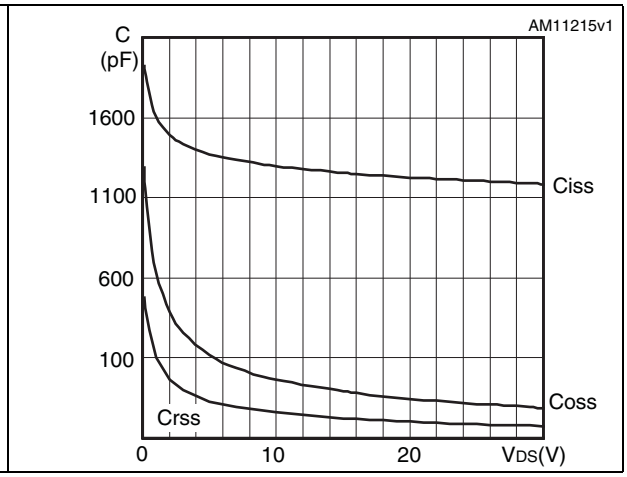


Figure 21. Normalized gate threshold voltage vs temperature

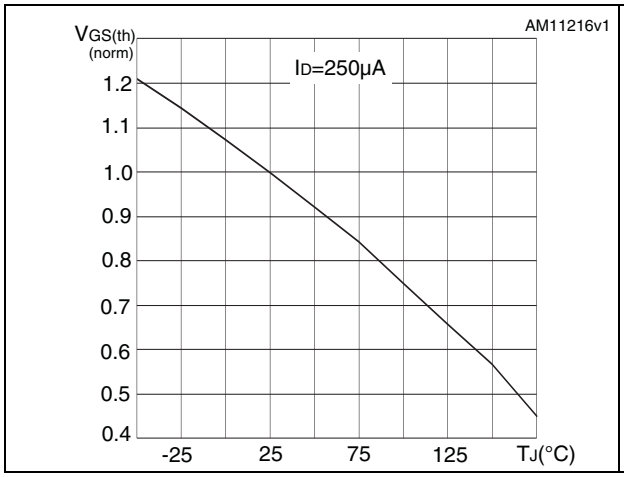


Figure 22. Normalized on resistance vs temperature

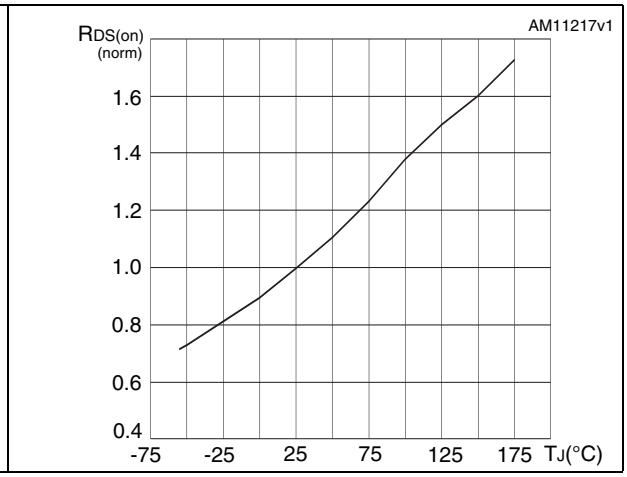
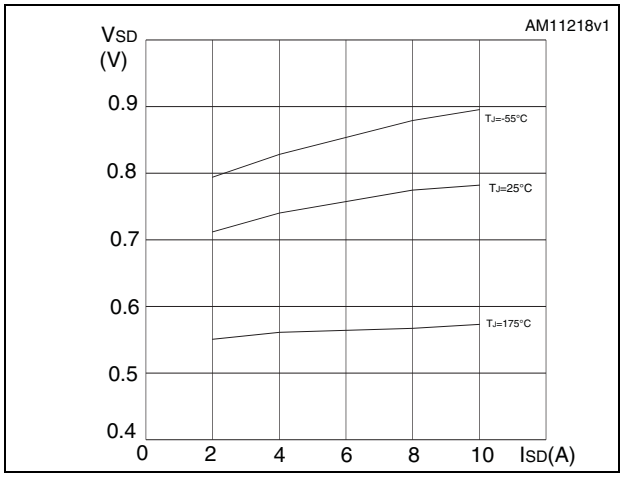


Figure 23. Source-drain diode forward characteristics



3 Test circuits

Figure 24. Switching times test circuit for resistive load

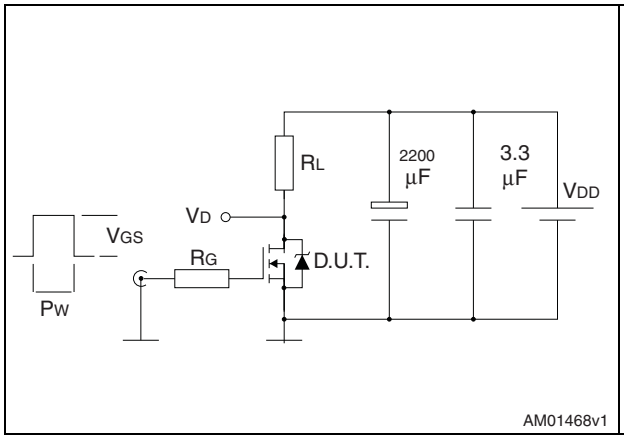


Figure 25. Gate charge test circuit

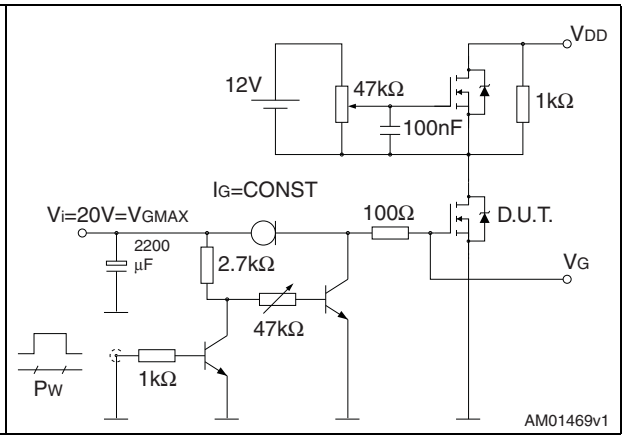


Figure 26. Test circuit for inductive load switching and diode recovery times

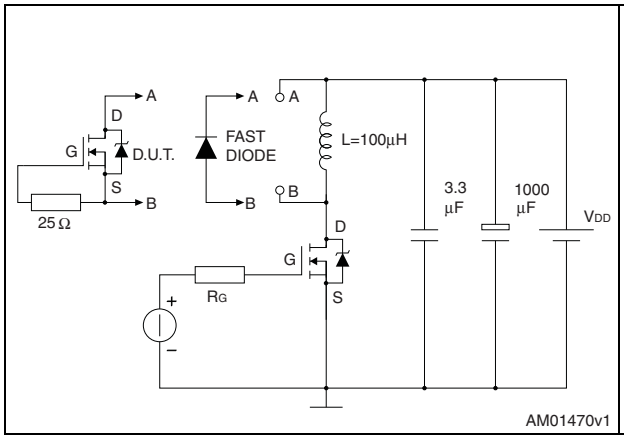


Figure 27. Unclamped inductive load test circuit

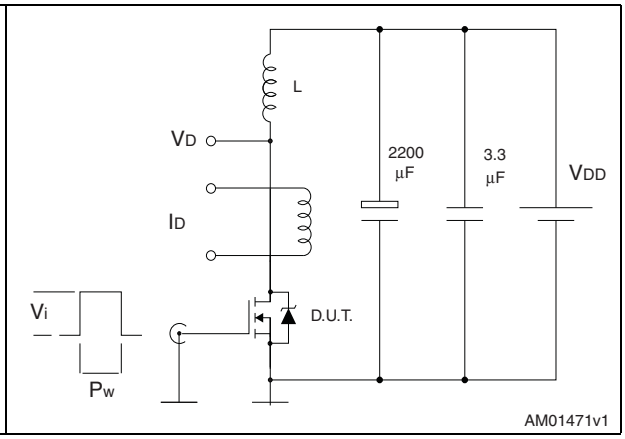


Figure 28. Unclamped inductive waveform

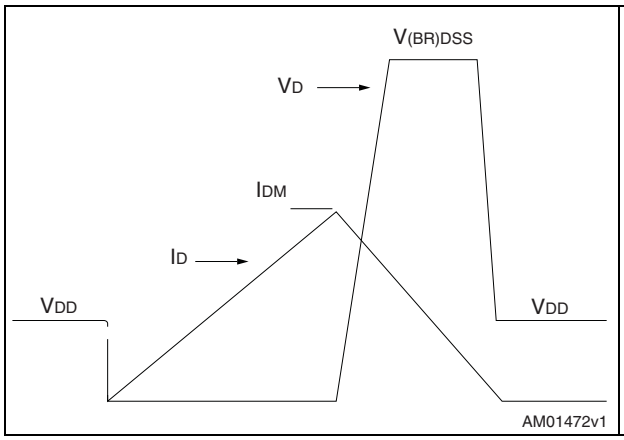
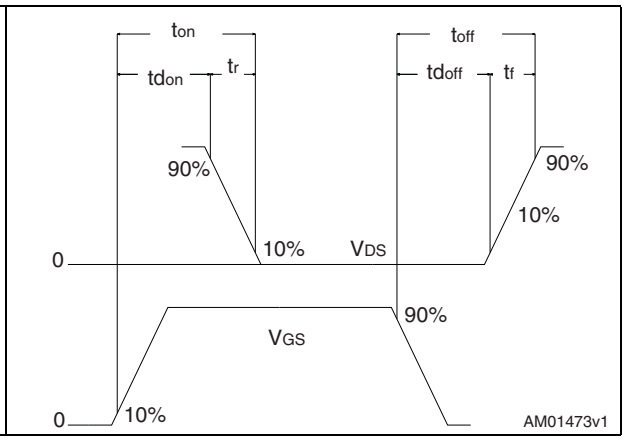


Figure 29. Switching time waveform



4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

Table 8. PowerFLAT™ 5x6 asymmetrical double island dimentions

Dim.	mm		
	Min.	Typ.	Max.
A	0.80		1.00
A1			0.05
b	0.45		0.55
D	4.90	5.00	5.10
E	5.90	6.00	6.10
e		1.27	
L	0.40		0.60
aaa		0.10	
bbb		0.10	
ccc		0.10	

Figure 30. Package drawing

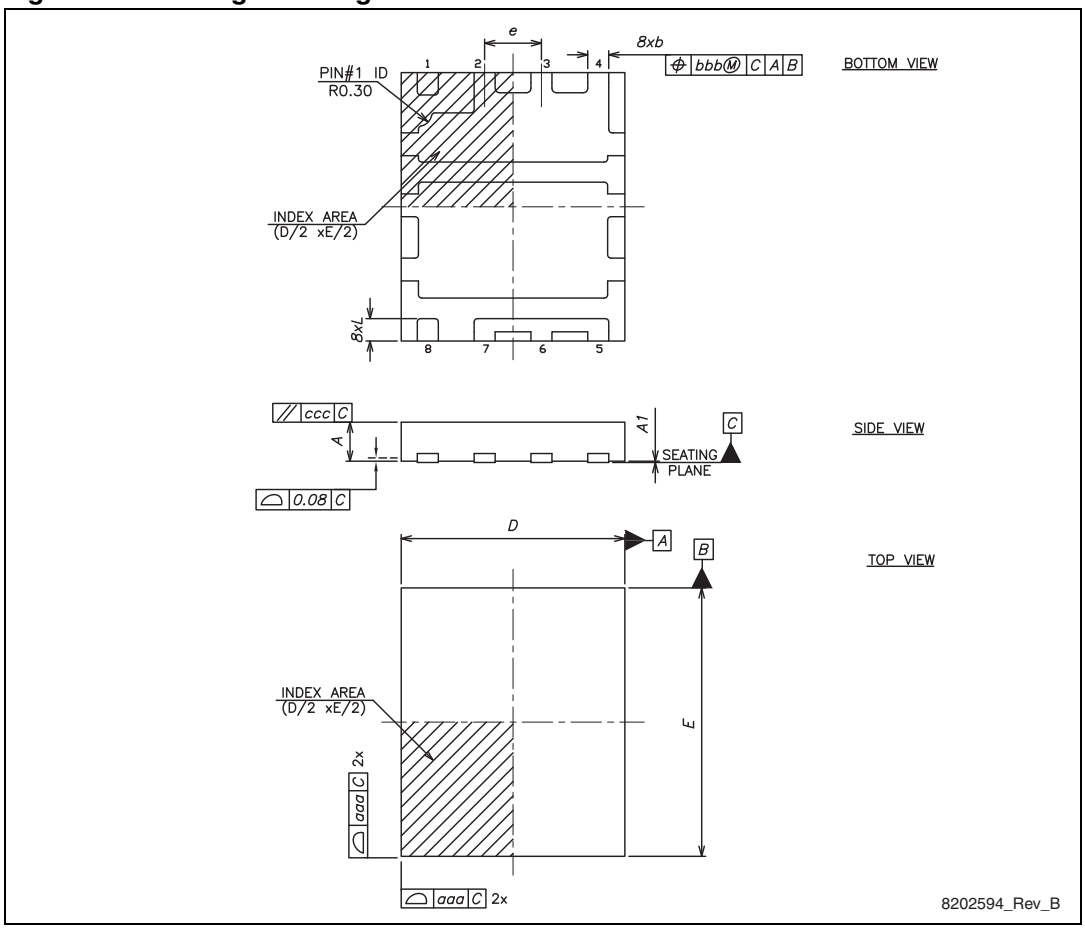
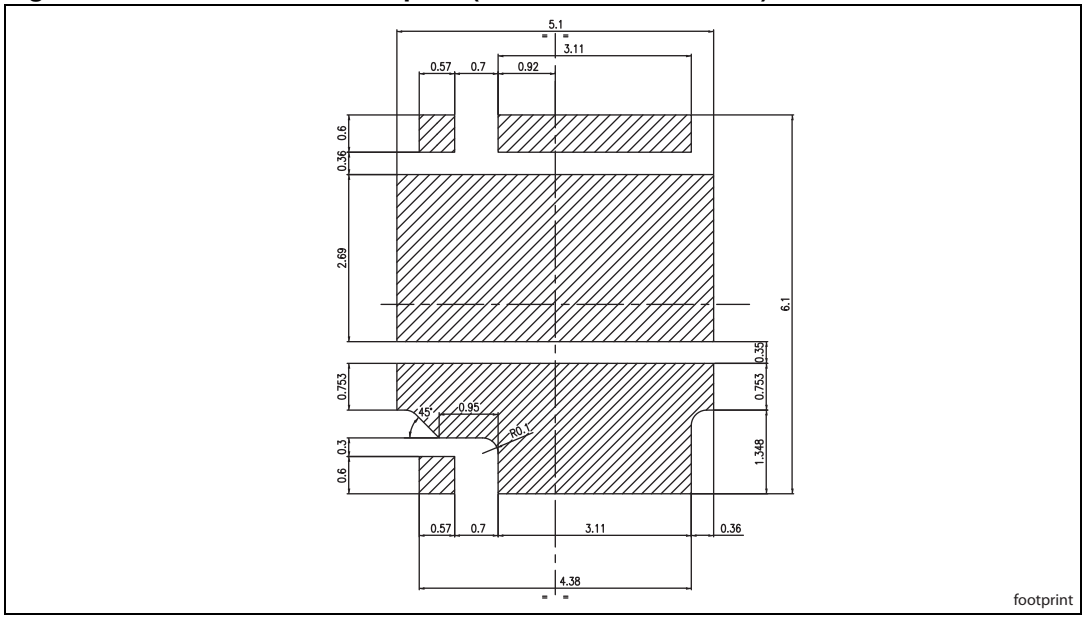


Figure 31. Recommended footprint (dimensions are in mm)



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
15-Mar-2010	1	First release
07-Feb-2011	2	Document status promoted from target specification to preliminary data.
21-Feb-2012	3	Document status promoted from preliminary data to datasheet. *Section 2.1: Electrical characteristics (curves)* has been added. *Section 4: Package mechanical data* has been updated. Minor text changes.

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