



STY80NM60N

N-channel 600 V, 0.030 Ω , 74 A, MDmesh™ II Power MOSFET
Max247

Features

Type	V _{DSS} @ T _{Jmax}	R _{DS(on)} max	I _D
STY80NM60N	650 V	< 0.035 Ω	74 A

- The worldwide best R_{DS(on)} in Max247
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance

Applications

- Switching applications

Description

This device is an N-channel Power MOSFET developed using the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a vertical structure to the company's strip layout to yield one of the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters.

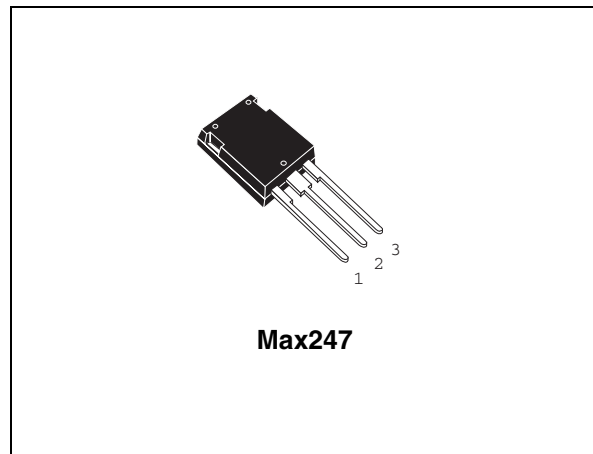


Figure 1. Internal schematic diagram

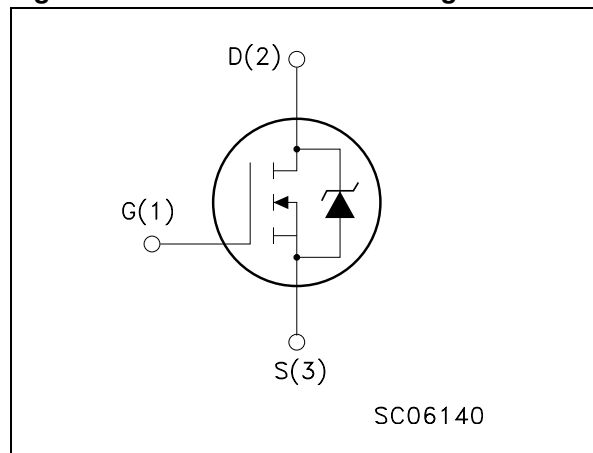


Table 1. Device summary

Order code	Marking	Package	Packaging
STY80NM60N	80NM60N	Max247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	600	V
V_{GS}	Gate- source voltage	± 25	V
I_D	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	74	A
I_D	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	46	A
$I_{DM}^{(1)}$	Drain current (pulsed)	296	A
P_{TOT}	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	447	W
$dv/dt^{(2)}$	Peak diode recovery voltage slope	15	V/ns
T_{stg}	Storage temperature	-55 to 150	$^\circ\text{C}$
T_j	Max. operating junction temperature	150	$^\circ\text{C}$

1. Pulse width limited by safe operating area

2. $I_{SD} \leq 74\text{ A}$, $di/dt \leq 400\text{ A}/\mu\text{s}$, $V_{DSpeak} \leq V_{(BR)DSS}$, $V_{DD} = 80\% V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.28	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	30	$^\circ\text{C}/\text{W}$
T_l	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

Table 4. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j Max)	25	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$, $I_D = I_{AS}$, $V_{DD} = 50\text{ V}$)	2	J

2 Electrical characteristics

($T_{CASE}=25\text{ }^{\circ}\text{C}$ unless otherwise specified)

Table 5. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage ($V_{GS} = 0$)	$I_D = 1\text{ mA}$	600			V
$dv/dt^{(1)}$	Drain source voltage slope	$V_{DD} = 480\text{ V}$, $I_D = 74\text{ A}$, $V_{GS} = 10\text{ V}$		48		V/ns
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{max rating}$ $V_{DS} = \text{max rating}$, $T_C = 125\text{ }^{\circ}\text{C}$			10 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{ V}$			100	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250\text{ }\mu\text{A}$	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$, $I_D = 37\text{ A}$		0.030	0.035	Ω

1. Characteristic value at turn off on inductive load.

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS}=15\text{ V}$, $I_D = 37\text{ A}$		12		S
C_{iss}	Input capacitance	$V_{DS} = 50\text{ V}$, $f = 1\text{ MHz}$, $V_{GS} = 0$		10100		pF
C_{oss}	Output capacitance			455		pF
C_{rss}	Reverse transfer capacitance			26		pF
$C_{oss\text{ eq.}}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0$, $V_{DS} = 0\text{ to }480\text{ V}$		1300		pF
Q_g	Total gate charge	$V_{DD} = 480\text{ V}$, $I_D = 74\text{ A}$, $V_{GS} = 10\text{ V}$, <i>(see Figure 15)</i>		360		nC
Q_{gs}	Gate-source charge			85		nC
Q_{gd}	Gate-drain charge			160		nC
R_g	Gate input resistance	$f=1\text{ MHz}$ Gate DC Bias=0 Test signal level = 20 mV open drain		2.0		Ω

1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5%

2. $C_{oss\text{ eq.}}$ is defined as a constant equivalent capacitance giving the same charging time as C_{oss} when V_{DS} increases from 0 to 80% V_{DS}

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300\text{ V}$, $I_D = 37\text{ A}$ $R_G = 4.7\ \Omega$, $V_{GS} = 10\text{ V}$ (see Figure 14)		50		ns
t_r	Rise time			65		ns
$t_{d(off)}$	Turn-off delay time			440		ns
t_f	Fall time			200		ns

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				74	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				296	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 74\text{ A}$, $V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 74\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 25\text{ }^\circ\text{C}$ (see Figure 16)		700		ns
Q_{rr}	Reverse recovery charge			25		μC
I_{RRM}	Reverse recovery current			65		A
t_{rr}	Reverse recovery time	$I_{SD} = 74\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 100\text{ V}$, $T_j = 150\text{ }^\circ\text{C}$ (see Figure 16)		840		ns
Q_{rr}	Reverse recovery charge			30		μC
I_{RRM}	Reverse recovery current			69		A

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

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

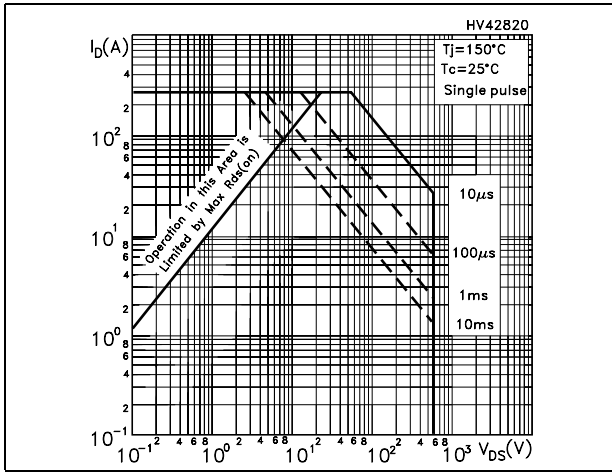


Figure 3. Thermal impedance

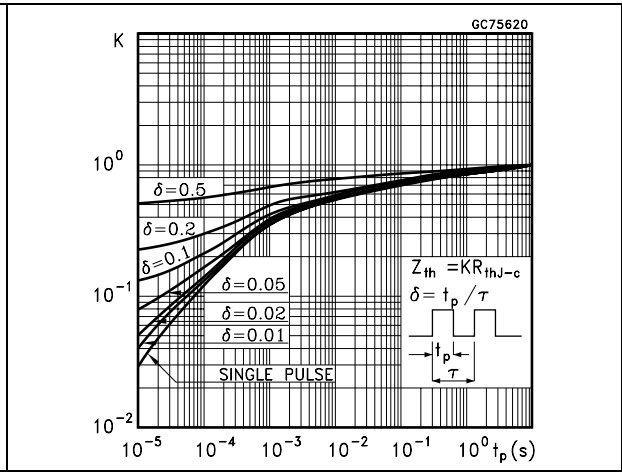


Figure 4. Output characteristics

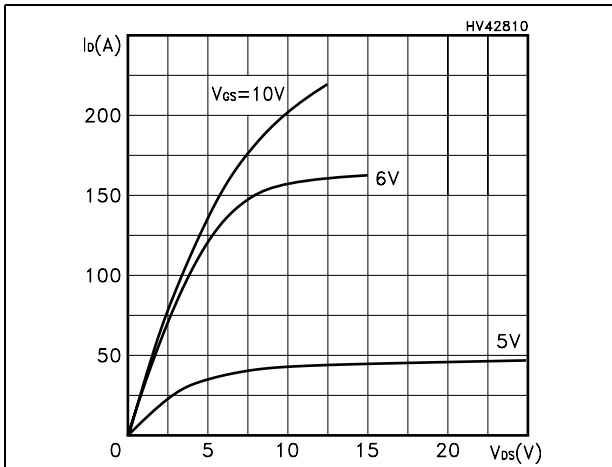


Figure 5. Transfer characteristics

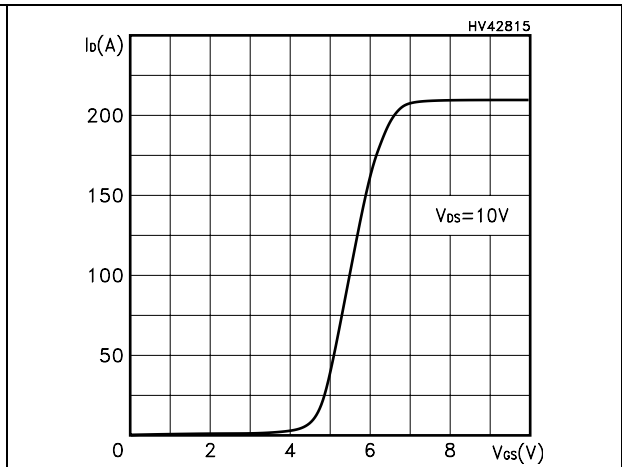


Figure 6. Transconductance

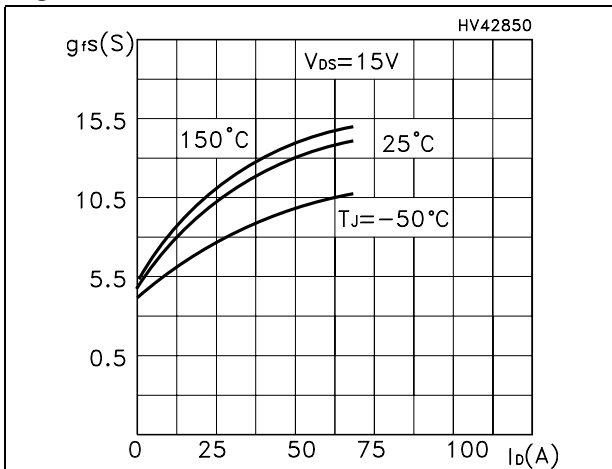


Figure 7. Static drain-source on resistance

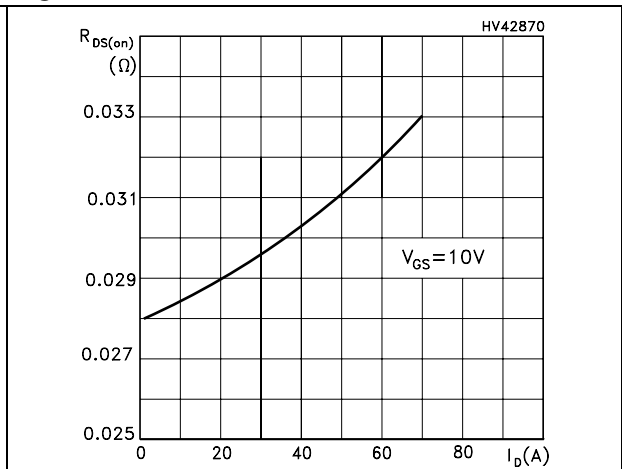


Figure 8. Gate charge vs gate-source voltage Figure 9. Capacitance variations

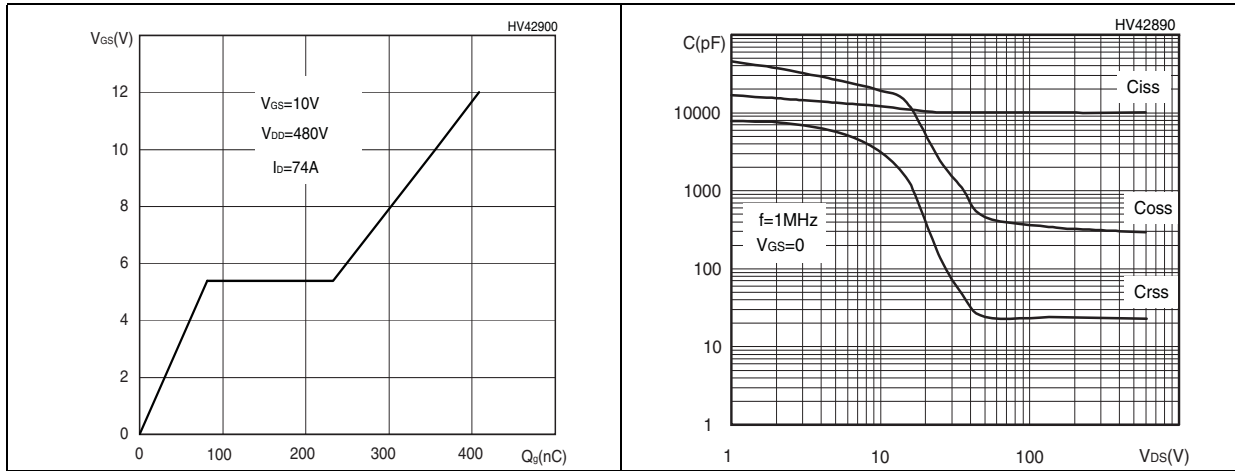


Figure 10. Normalized gate threshold voltage vs temperature Figure 11. Normalized on resistance vs temperature

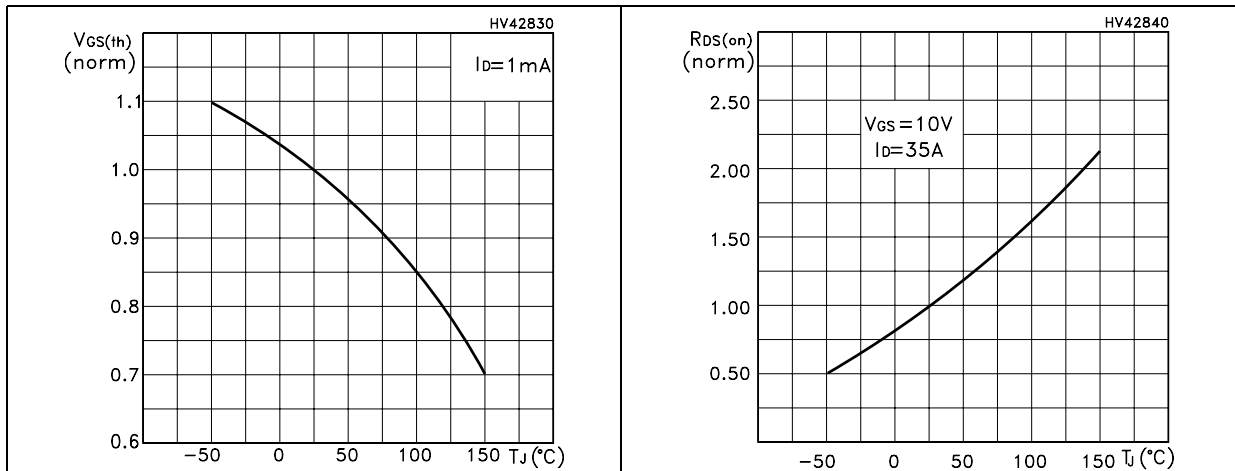
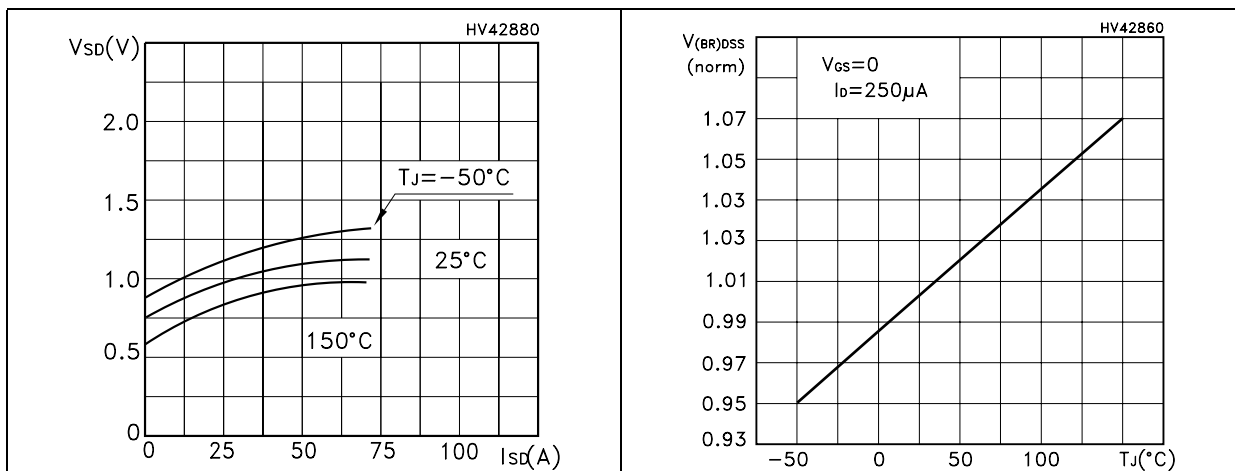


Figure 12. Source-drain diode forward characteristics Figure 13. Normalized BV_{DSS} vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

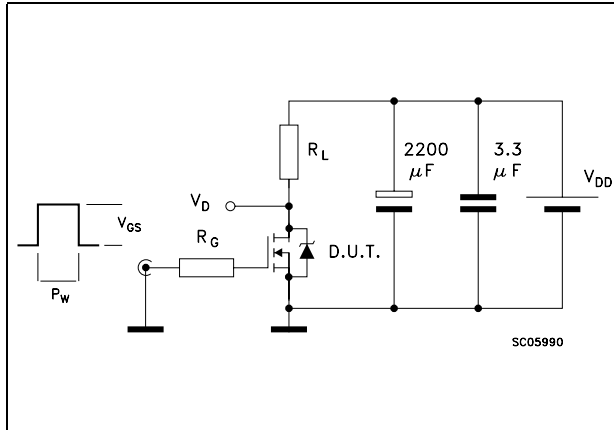


Figure 15. Gate charge test circuit

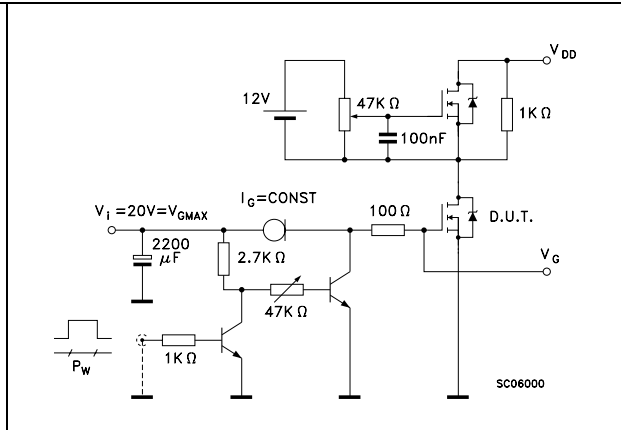


Figure 16. Test circuit for inductive load switching and diode recovery times

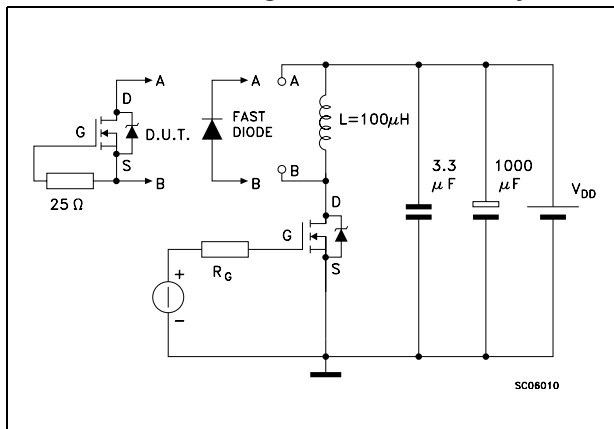


Figure 17. Unclamped inductive load test circuit

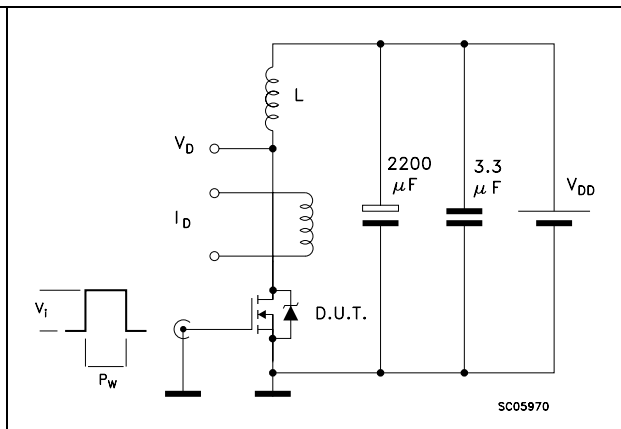


Figure 18. Unclamped inductive waveform

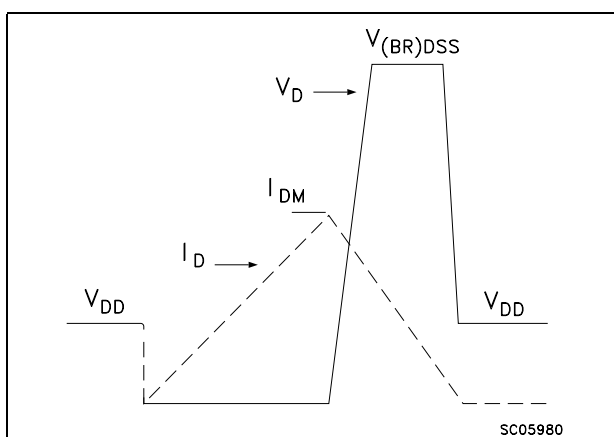
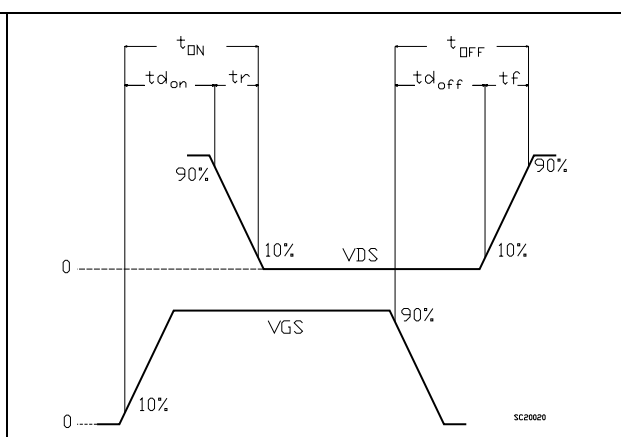


Figure 19. Switching time waveform



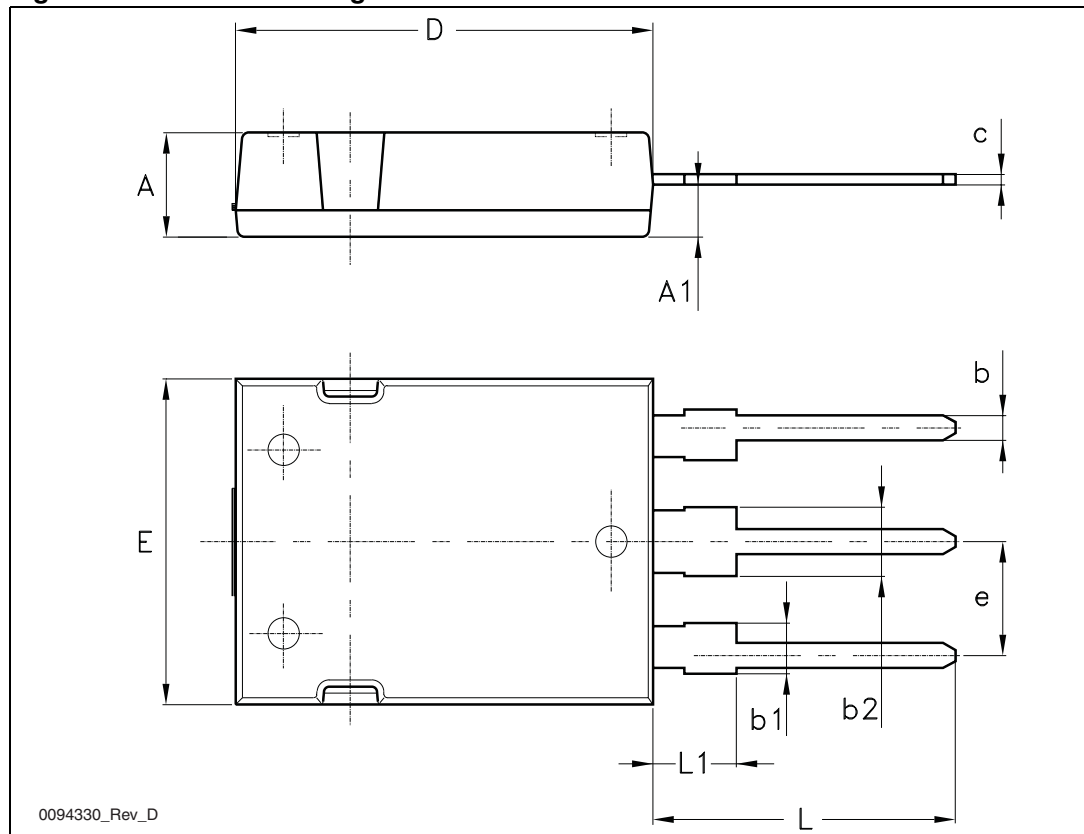
4 Package mechanical data

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 9. Max247 mechanical data

Dim.	mm		
	Min.	Typ.	Max.
A	4.70		5.30
A1	2.20		2.60
b	1.00		1.40
b1	2.00		2.40
b2	3.00		3.40
c	0.40		0.80
D	19.70		20.30
e	5.35		5.55
E	15.30		15.90
L	14.20		15.20
L1	3.70		4.30

Figure 20. Max247 drawing



5 Revision history

Table 10. Document revision history

Date	Revision	Changes
29-Nov-2007	1	First release.
04-Dec-2007	2	Header has been corrected.
04-Aug-2008	3	Document status promoted: from preliminary data to datasheet.
14-Nov-2008	4	<i>Figure 13: Normalized BV_{DSS} vs temperature</i> has been corrected.
04-Feb-2009	5	<i>Figure 7: Static drain-source on resistance</i> has been corrected.
06-Jul-2011	6	Modified I_{DSS} value in <i>Table 5: On/off states</i> .

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