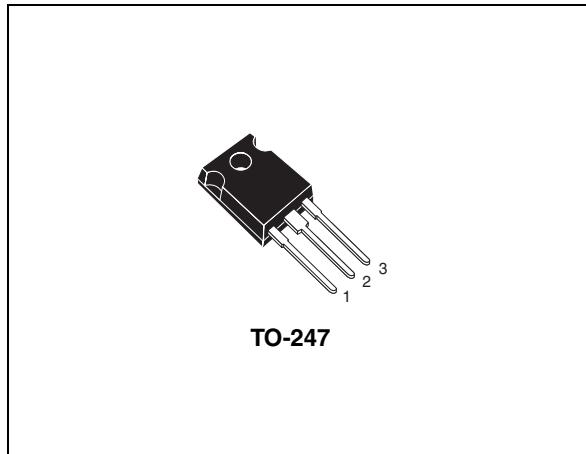


N-channel 1500 V - 1.8 Ω - 8 A - TO-247
very high voltage PowerMESH™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$	I_D	P_w
STW9N150	1500 V	< 2.5 Ω	8 A	320 W

- 100% avalanche tested
- Avalanche ruggedness
- Gate charge minimized
- Very low intrinsic capacitances
- High speed switching
- Very low on-resistance



Application

- Switching applications

Description

Using the well consolidated high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of Power MOSFETs with outstanding performances. The strengthened layout coupled with the company's proprietary edge termination structure, gives the lowest $R_{DS(on)}$ per area, unrivalled gate charge and switching characteristics.

Figure 1. Internal schematic diagram

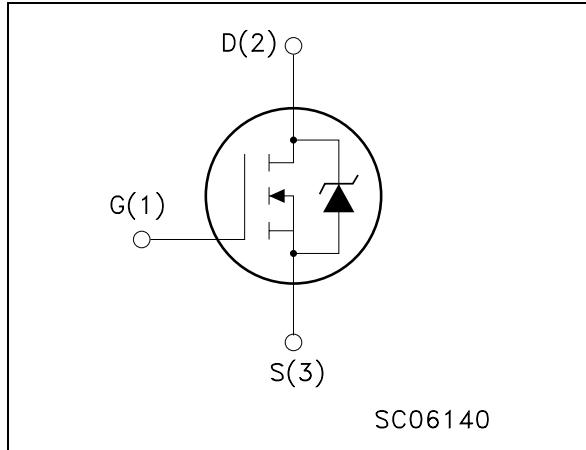


Table 1. Device summary

Order code	Marking	Package	Packaging
STW9N150	9N150	TO-247	Tube

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1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	1500	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25^\circ C$	8	A
I_D	Drain current (continuous) at $T_C = 100^\circ C$	5	A
$I_{DM}^{(1)}$	Drain current (pulsed)	32	A
P_{TOT}	Total dissipation at $T_C = 25^\circ C$	320	W
	Derating factor	2.56	W/ $^\circ C$
T_J	Operating junction temperature	-55 to 150	$^\circ C$
T_{stg}	Storage temperature		

1. Pulse width limited by safe operating area

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.39	$^\circ C/W$
$R_{thj-amb}$	Thermal resistance junction-ambient max	50	$^\circ C/W$
T_J	Maximum lead temperature for soldering purpose	300	$^\circ C/W$

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	8	A
E_{AS}	Single pulse avalanche energy (starting $T_J = 25^\circ C$, $I_D = I_{AR}$, $V_{DD} = 50$ V)	720	mJ

2 Electrical characteristics

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

Table 5. On /off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1 \text{ mA}$, $V_{GS} = 0$	1500			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$, $T_C = 125^\circ\text{C}$			10 500	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 30 \text{ V}$			± 100	nA
$V_{GS(\text{th})}$	Gate threshold voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	3	4	5	V
$R_{DS(\text{on})}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}$, $I_D = 4 \text{ A}$		1.8	2.5	Ω

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15 \text{ V}$, $I_D = 4 \text{ A}$		7.5		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25 \text{ V}$, $f = 1 \text{ MHz}$, $V_{GS} = 0$		3255 294 22.4		pF pF pF
$C_{oss \text{ eq.}}$	Equivalent Output capacitance	$V_{GS} = 0$, $V_{DS} = 0 \text{ to } 1200 \text{ V}$		118		pF
R_g	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20 mV open drain		2.4		Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 1200 \text{ V}$, $I_D = 8 \text{ A}$, $V_{GS} = 10 \text{ V}$ (see Figure 15)		89.3 15.8 50.4		nC nC nC

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

Table 7. Switching times

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 750 \text{ V}$, $I_D = 4 \text{ A}$, $R_G = 4.7 \Omega$, $V_{GS} = 10 \text{ V}$ (see Figure 14)	41 14.7 86 52	ns ns ns ns	ns ns ns ns	ns ns ns ns
t_r	Rise time					
$t_{d(off)}$	Turn-off-delay time					
t_f	Fall time					

Table 8. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max	Unit
I_{SD} $I_{SDM}^{(1)}$	Source-drain current			8 32	A A	A
	Source-drain current (pulsed)					
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 8 \text{ A}$, $V_{GS} = 0$			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time	$I_{SD} = 8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see Figure 16)	988 9.5 19.3	ns μC A	ns μC A	ns μC A
	Reverse recovery charge					
	Reverse recovery current					
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time	$I_{SD} = 8 \text{ A}$, $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$, $T_J = 150 \text{ }^\circ\text{C}$ (see Figure 16)	884 8.2 18.6	ns μC A	ns μC A	ns μC A
	Reverse recovery charge					
	Reverse recovery current					

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

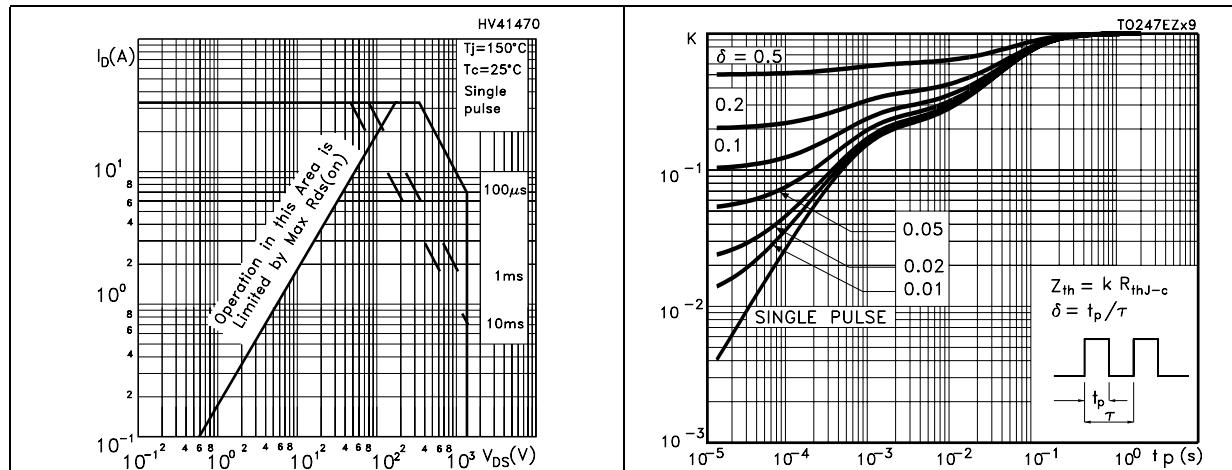


Figure 4. Output characteristics

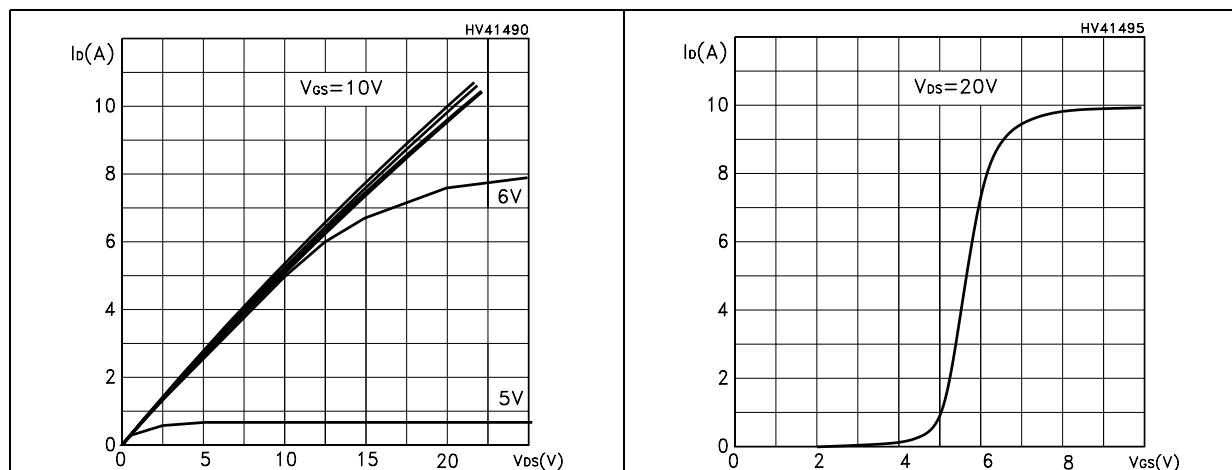
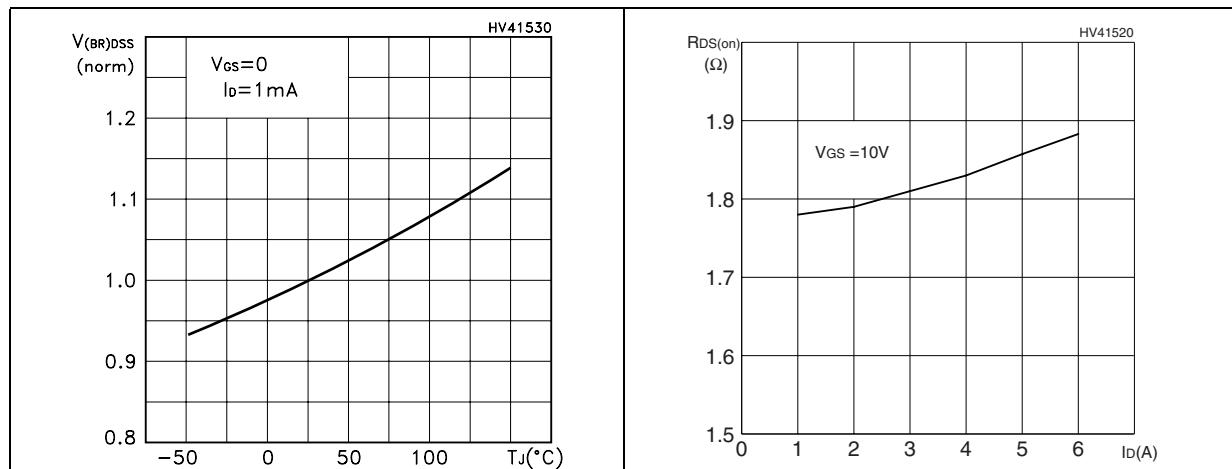
Figure 6. Normalized BV_{DSS} vs temperature

Figure 3. Thermal impedance

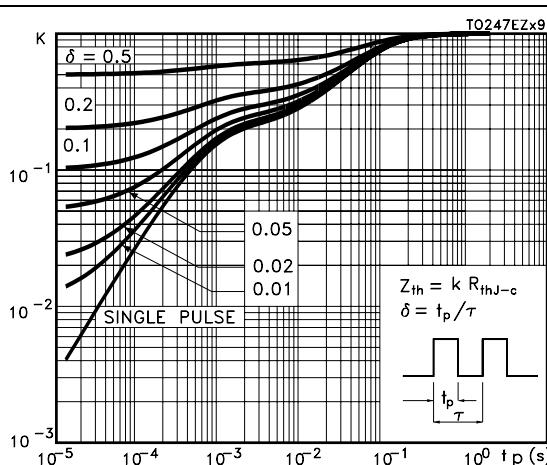


Figure 5. Transfer characteristics

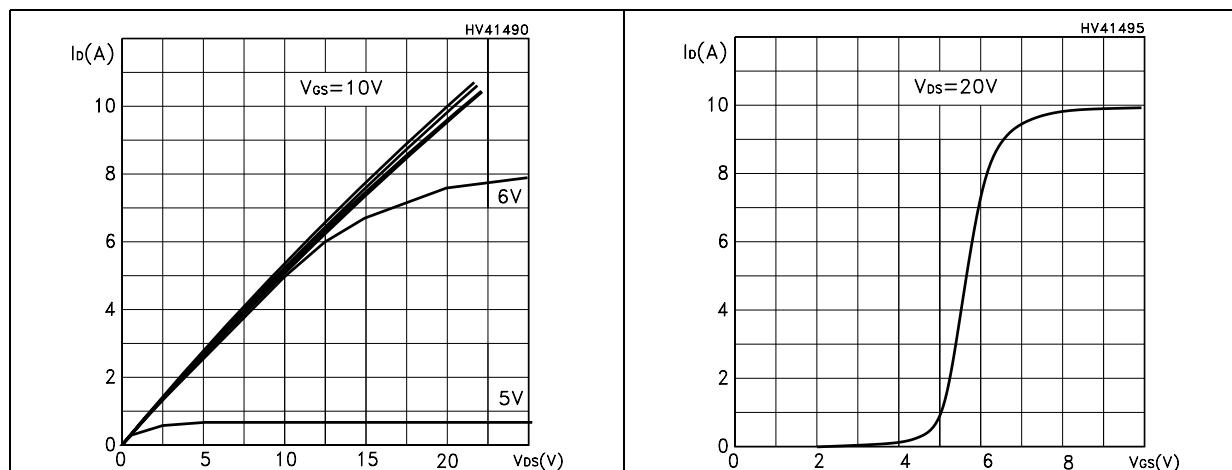


Figure 7. Static drain-source on resistance

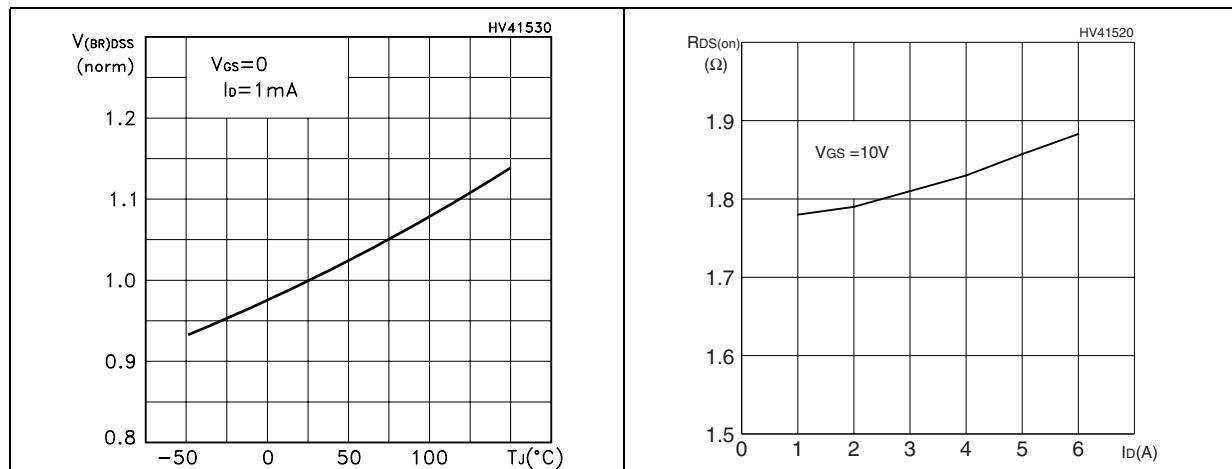


Figure 8. Gate charge vs gate-source voltage

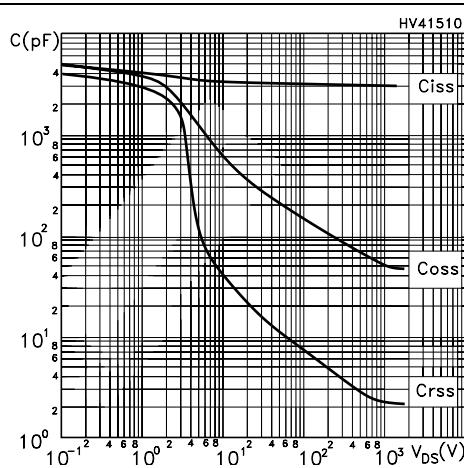
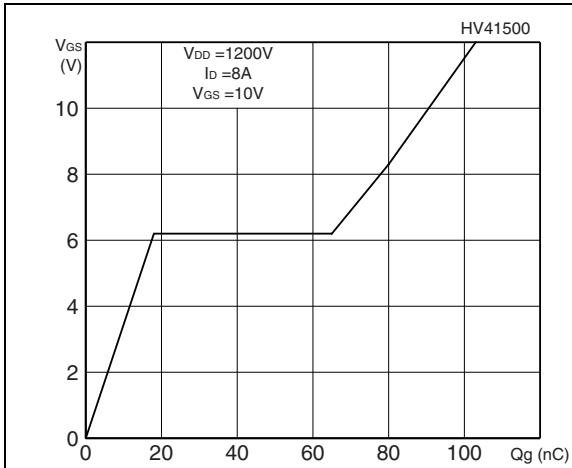


Figure 10. Normalized gate threshold voltage vs temperature

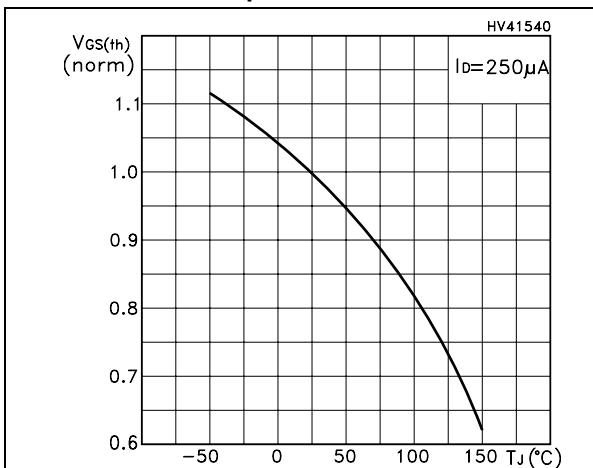


Figure 11. Normalized on resistance vs temperature

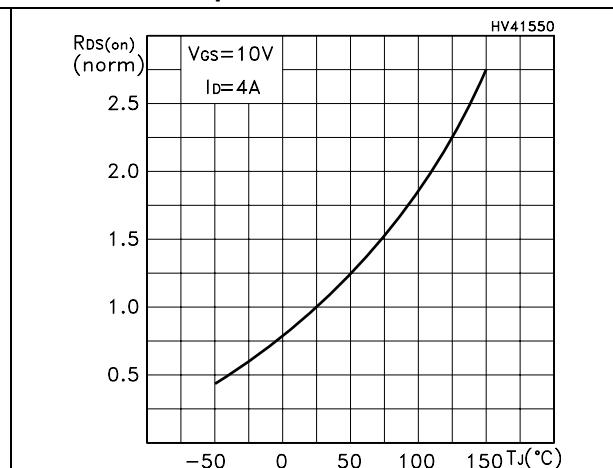


Figure 12. Source-drain diode forward characteristics

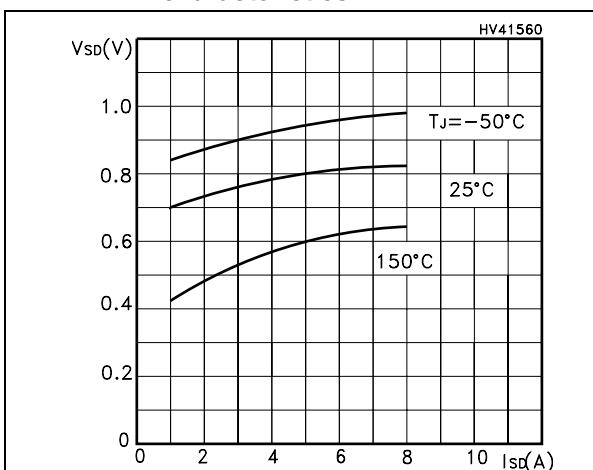
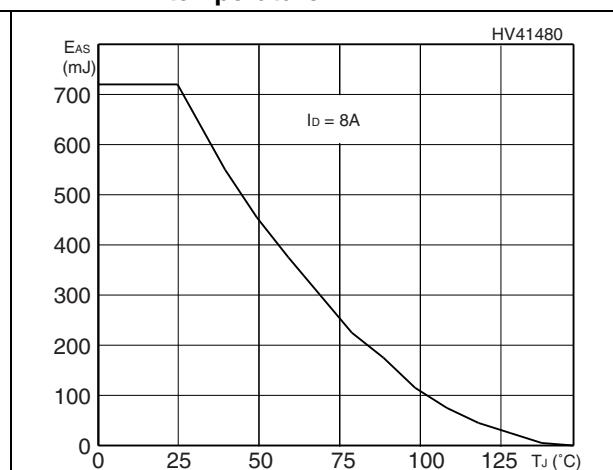


Figure 13. Maximum avalanche energy vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

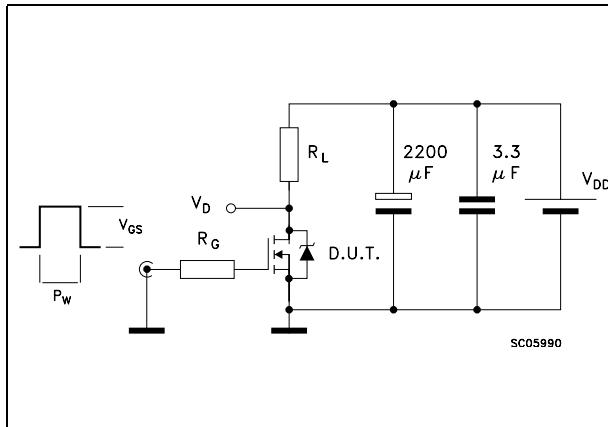


Figure 15. Gate charge test circuit

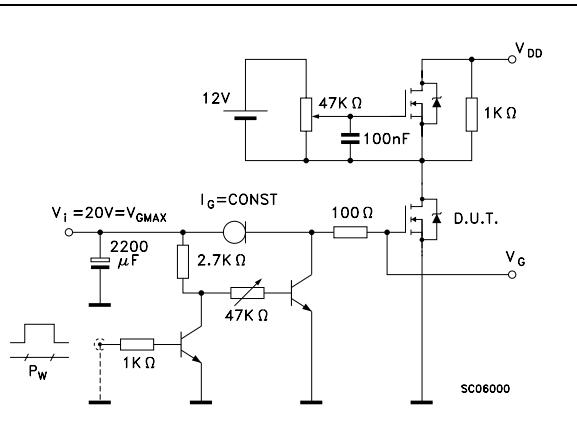


Figure 16. Test circuit for inductive load switching and diode recovery times

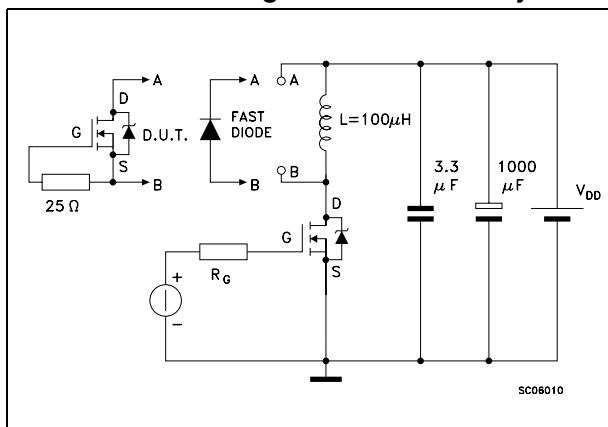


Figure 17. Unclamped Inductive load test circuit

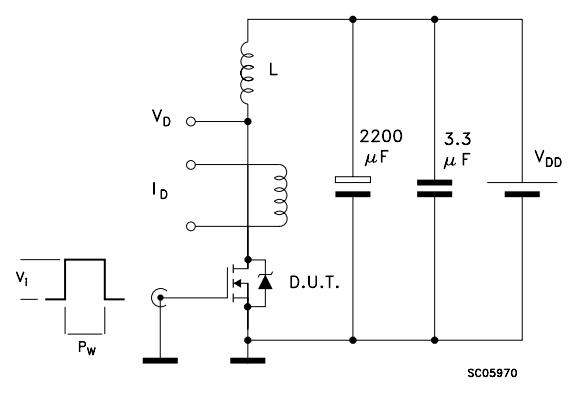


Figure 18. Unclamped inductive waveform

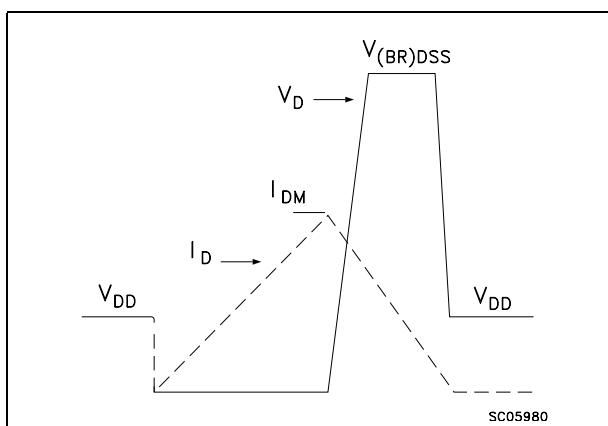
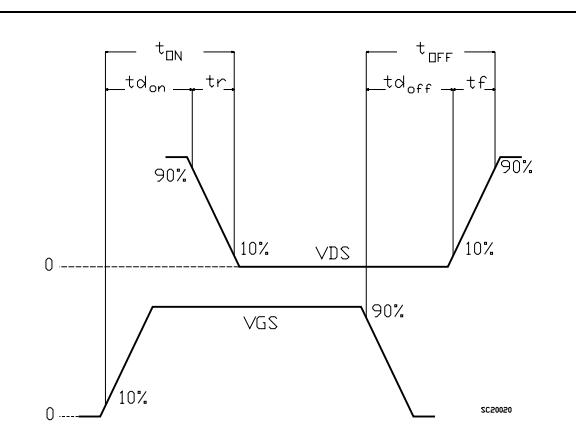


Figure 19. Switching time waveform

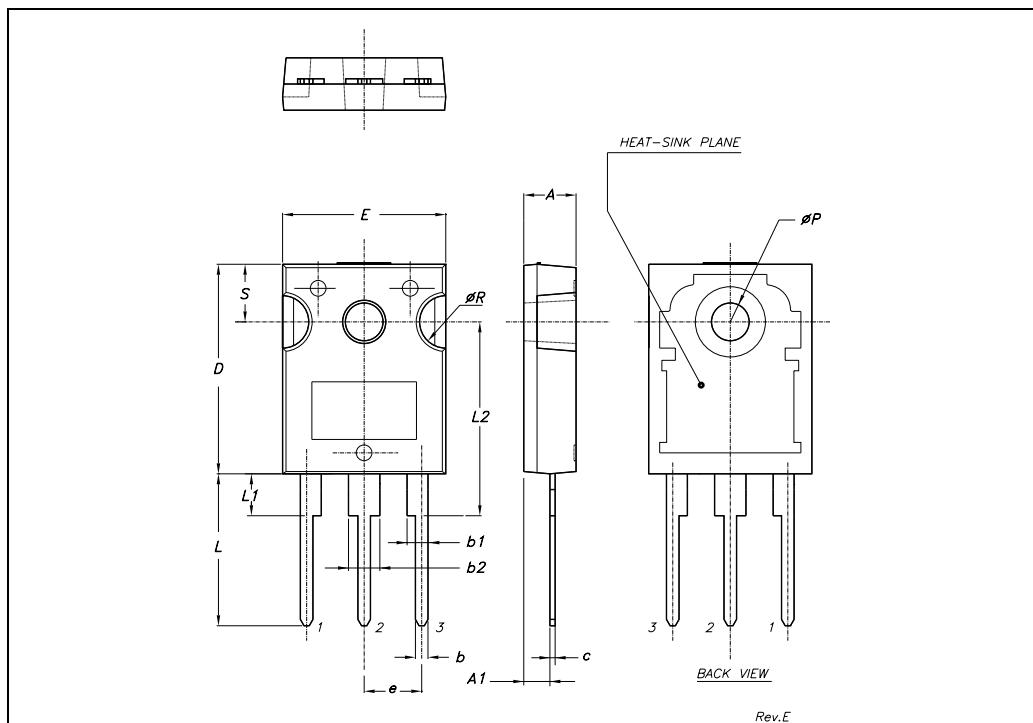


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings related to soldering conditions are also marked on the inner box label. ECOPACK is an ST trademark. ECOPACK specifications are available at: www.st.com

TO-247 MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
L1	3.70		4.30	0.14		0.17
L2		18.50			0.728	
ϕP	3.55		3.65	0.140		0.143
ϕR	4.50		5.50	0.177		0.216
S		5.50			0.216	



5 Revision history

Table 9. Document revision history

Date	Revision	Changes
24-May-2007	1	First release
04-Jan-2007	2	Document status promoted from preliminary data to datasheet

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