



STW30NM60D

N-channel 600V - 0.125Ω - 30A - TO-247
Fast diode MDmesh™ Power MOSFET

General features

Type	V _{DSS}	R _{DS(on)}	I _D
STW30NM60D	600V	< 0.145Ω	30A

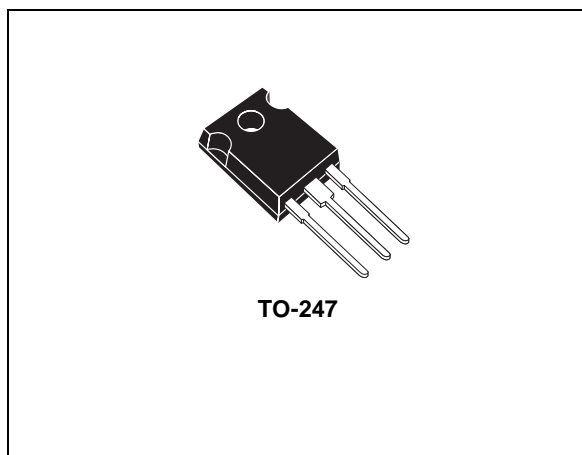
- High dv/dt and avalanche capabilities
- 100% avalanche rated
- Low input capacitance and gate charge
- Low gate input resistance
- Fast internal recovery diode

Description

The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

Applications

- Switching application



Internal schematic diagram



Order codes

Part number	Marking	Package	Packaging
STW30NM60D	W30NM60D	TO-247	Tube

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1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage ($V_{GS} = 0$)	600	V
V_{DGR}	Drain-gate voltage ($R_{GS} = 20k\Omega$)	600	V
V_{GS}	Gate- source voltage	± 30	V
I_D	Drain current (continuous) at $T_C = 25^\circ\text{C}$	30	A
I_D	Drain current (continuous) at $T_C = 100^\circ\text{C}$	18.9	A
$I_{DM}^{(1)}$	Drain current (pulsed)	120	A
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	312	W
	Derating factor	2.5	W/°C
$dv/dt^{(2)}$	Peak diode recovery voltage slope	20	V/ns
T_j T_{stg}	Operating junction temperature Storage temperature	-55 to 150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq 30\text{A}$, $di/dt \leq 400\text{A}/\mu\text{s}$, $V_{DD} = 80\%V_{(BR)DSS}$

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	0.4	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_j max)	15	A
E_{AS}	Single pulse avalanche energy (starting $T_j = 25^\circ\text{C}$, $I_D = I_{AR}$, $V_{DD} = 50\text{V}$)	740	mJ

2 Electrical characteristics

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

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1mA, V_{GS} = 0$	600			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating, @ } 125^{\circ}C$			10 100	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20V$			± 10	μA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 15A$		0.125	0.145	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 15A$		16		S
C_{iss}	Input capacitance	$V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$		2520		pF
C_{oss}	Output capacitance			800		pF
C_{rss}	Reverse transfer capacitance			75		pF
$C_{oss\ eq.}^{(2)}$	Equivalent output capacitance	$V_{GS} = 0V, V_{DS} = 0 \text{ to } 480V$		390		pF
Q_g	Total gate charge	$V_{DD} = 480V, I_D = 30A,$ $V_{GS} = 10V$ <i>Figure 15</i>		82	115	nC
Q_{gs}	Gate-source charge			24		nC
Q_{gd}	Gate-drain charge			42		nC

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

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

Table 6. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 300V, I_D = 15A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ <i>Figure 14</i>		32		ns
t_r	Rise time			33		ns
$t_{d(off)}$	Turn-off-delay time			75		ns
t_f	Fall time			35		ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain current				30	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				120	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 30A, V_{GS} = 0$			1.5	V
t_{rr}	Reverse recovery time	$I_{SD} = 30A, di/dt=100A/\mu s$ $V_{DD} = 50V, T_j=25^\circ C$ <i>Figure 17</i>		165		ns
Q_{rr}	Reverse recovery charge			1.1		nC
I_{RRM}	Reverse recovery current			14		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 1. Safe operating area

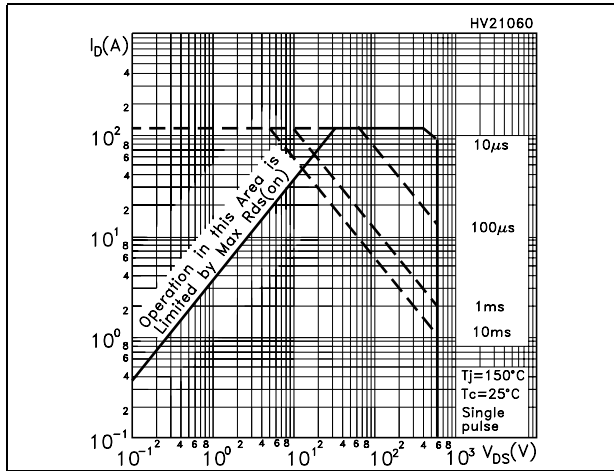


Figure 2. Thermal impedance

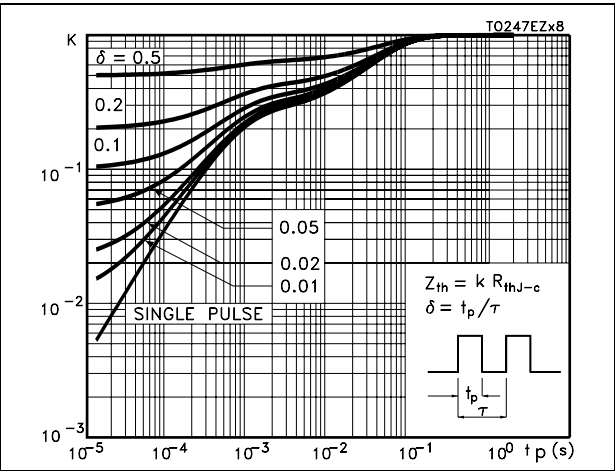


Figure 3. Output characteristics

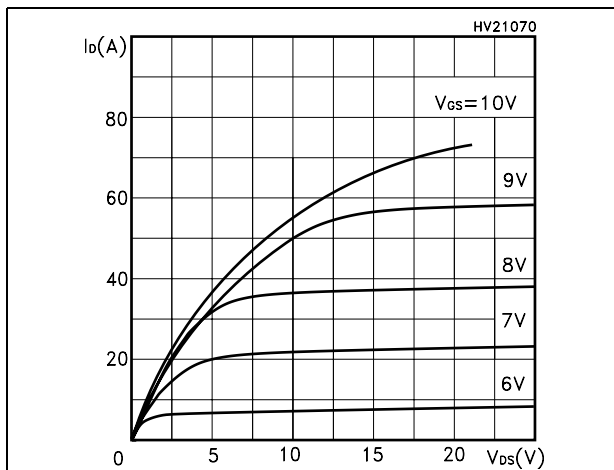


Figure 4. Transfer characteristics

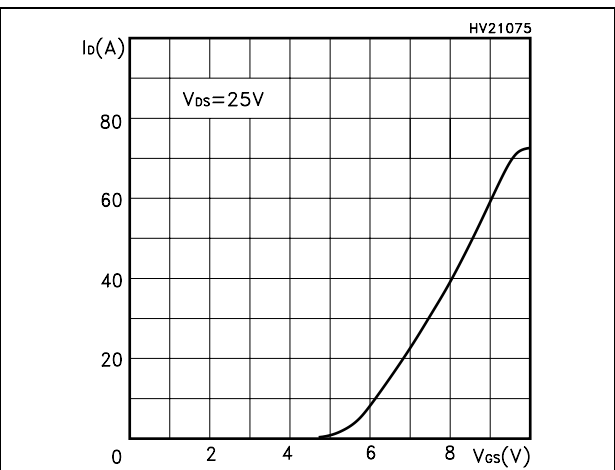


Figure 5. Transconductance

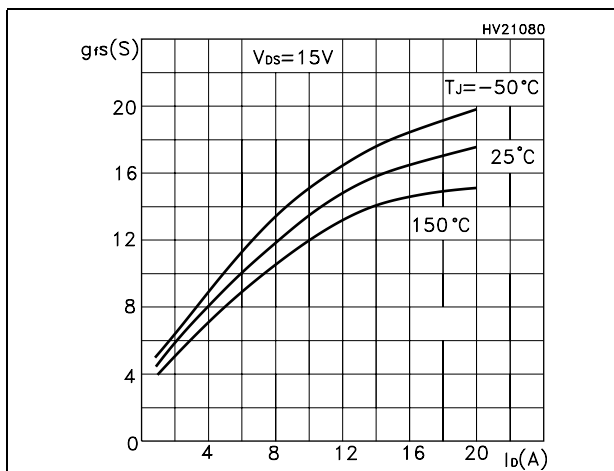


Figure 6. Static drain-source on resistance

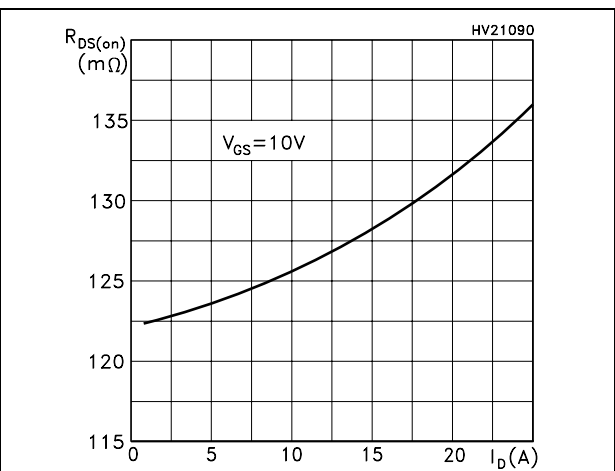


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

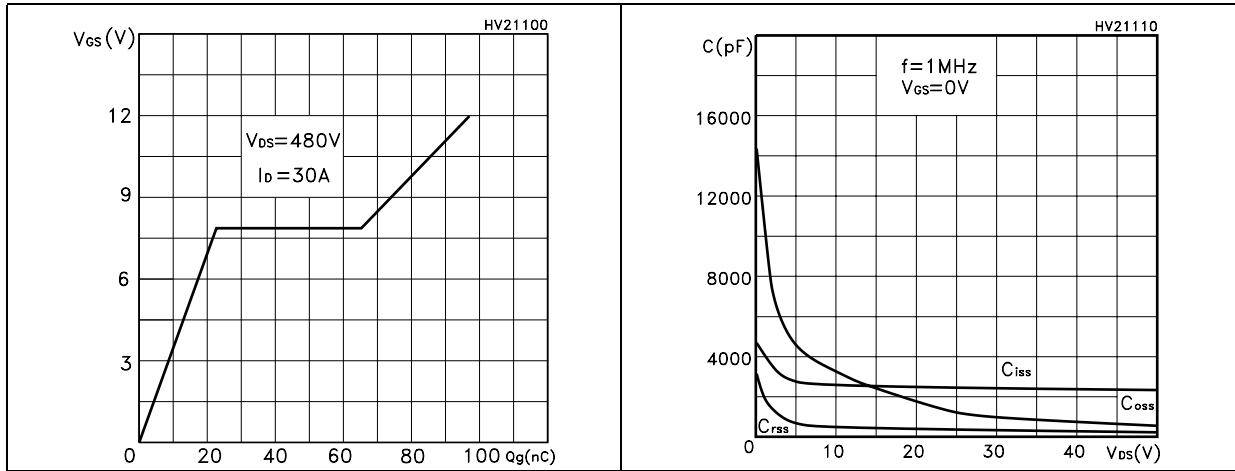


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

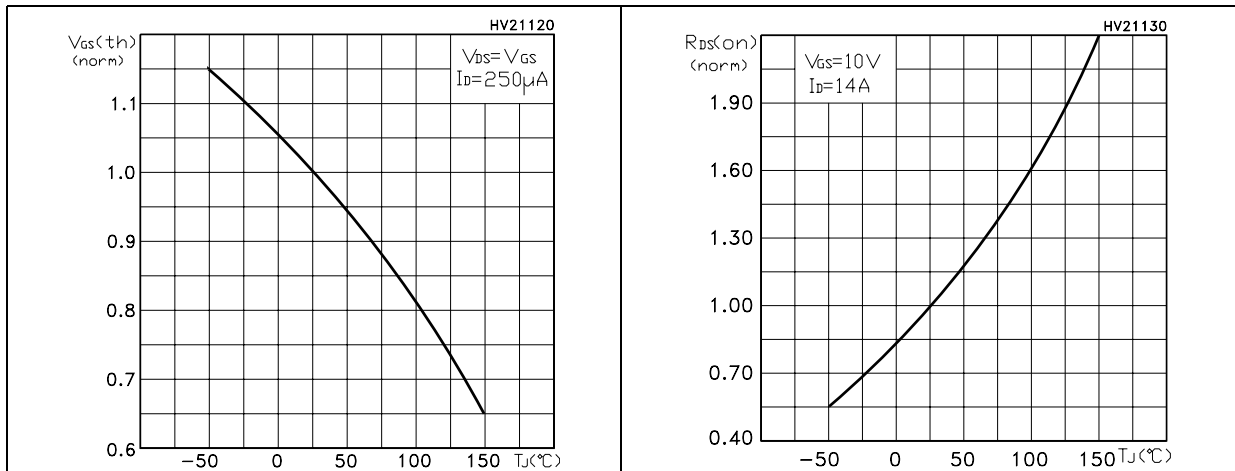
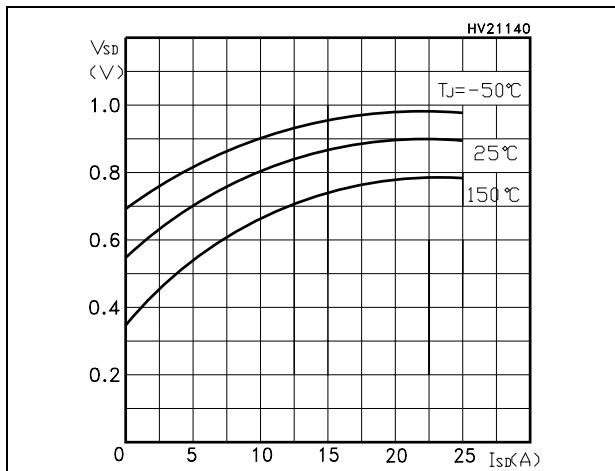


Figure 11. Source-drain diode forward characteristics



3 Test circuit

Figure 12. Unclamped inductive load test circuit

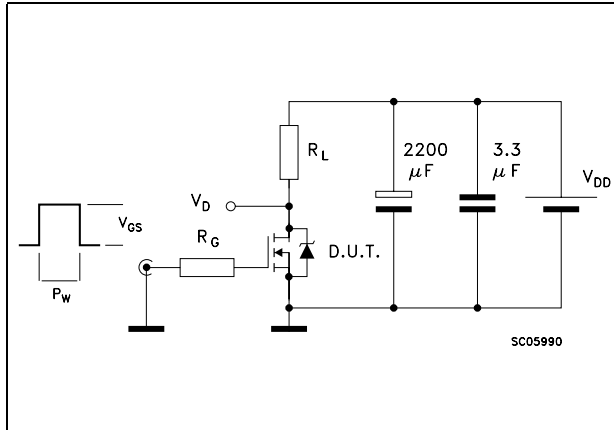


Figure 13. Unclamped inductive waveform

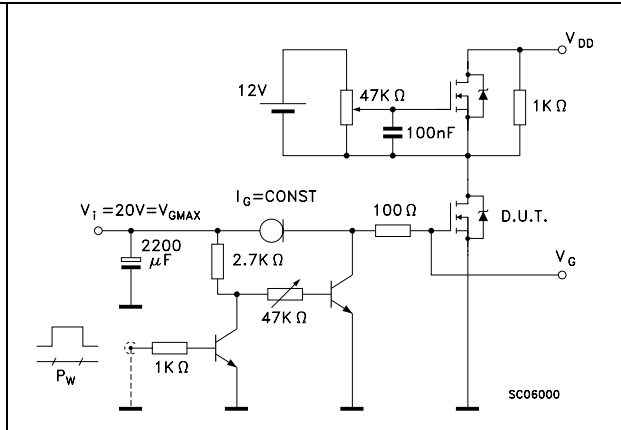


Figure 14. Switching times test circuit for resistive load

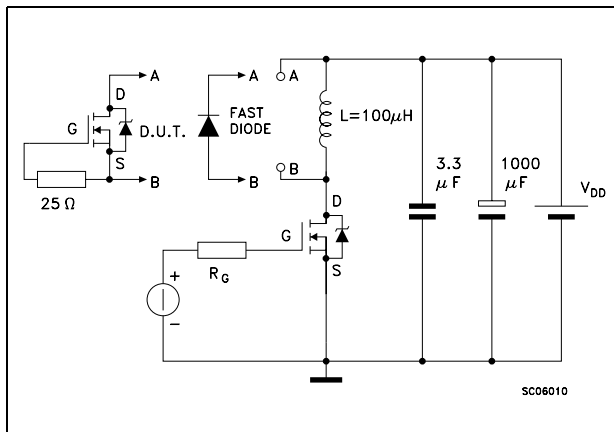


Figure 15. Gate charge test circuit

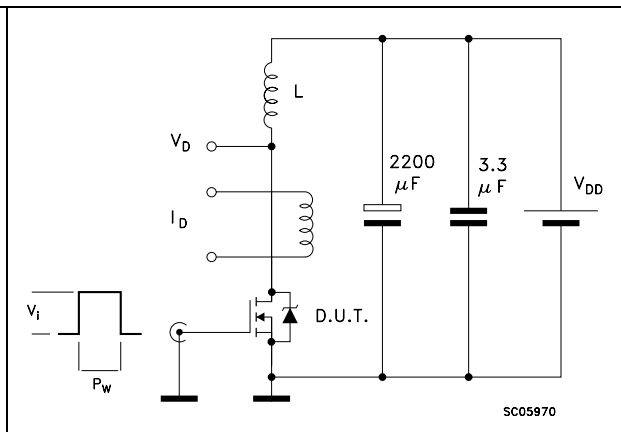
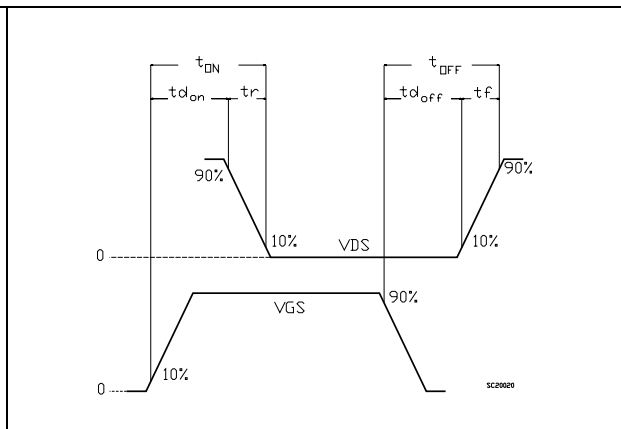
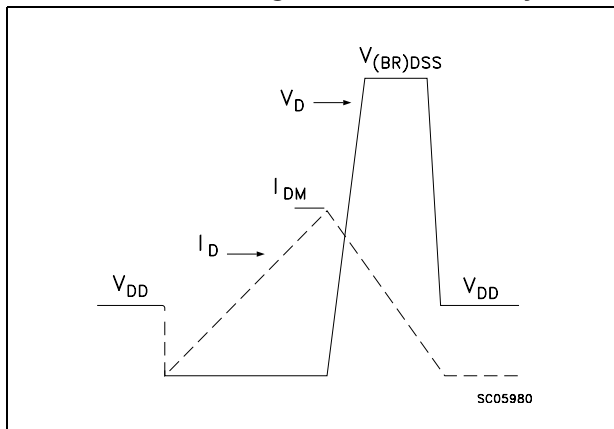


Figure 16. Test circuit for inductive load switching and diode recovery times

Figure 17. Switching time waveform

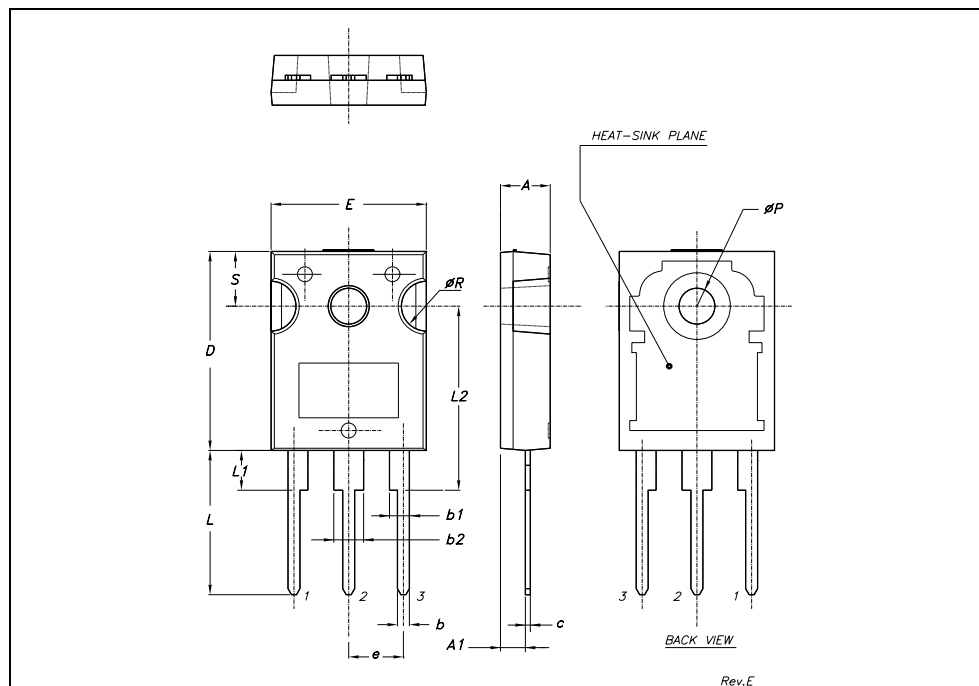


4 Package mechanical data

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	
øP	3.55		3.65	0.140		0.143
øR	4.50		5.50	0.177		0.216
S		5.50			0.216	



5 Revision history

Table 8. Revision history

Date	Revision	Changes
24-June-2004	1	The document change from "ADVANCED" to "COMPLETE". New stylesheet. Rds(on) Max@10V changed. See Table 4 .
06-Dec-2005	2	Inserted ecopack indication
20-Dec-2005	3	Modified value on Source drain diode
24-Jan-2006	4	Changed unit on Dynamic
13-Jul-2006	5	New template, modified unit on Source drain diode

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