



## STW30NM60D

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

### General features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STW30NM60D	600V	< 0.145Ω	30A

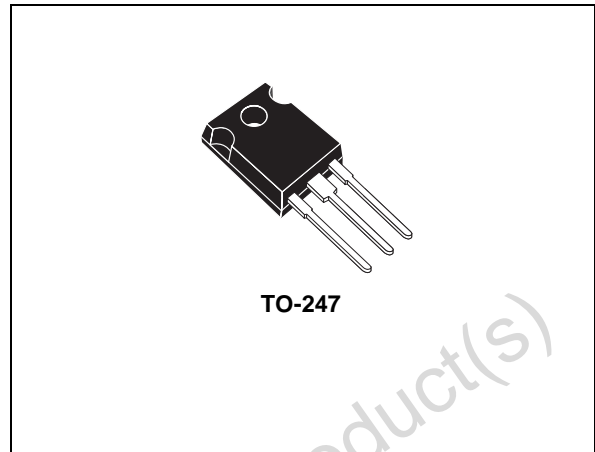
- High dv/dt and avalanche capabilities
- 100% avalanche rated
- Low input capacitance and gate charge
- Low gate input resistance
- Fast internal recovery diode

### Description

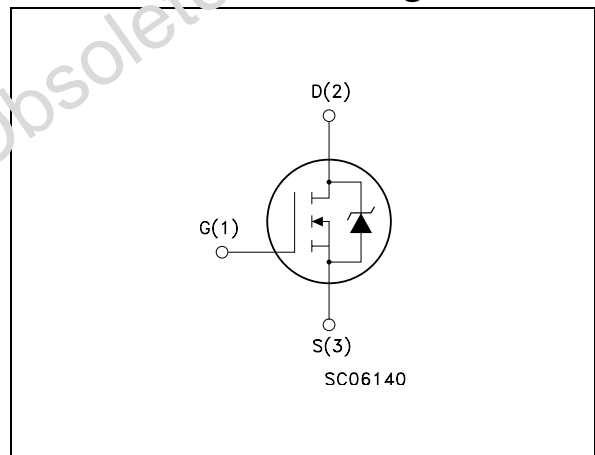
The FDmesh™ associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode. It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

### Applications

- Switching application



### Internal schematic diagram



### Order codes

Part number	Marking	Package	Packaging
STW30NM60D	W30NM60D	TO-247	Tube

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Obsolete Product(s) - Obsolete Product(s)

# 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	$\pm 30$	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/ $^\circ\text{C}$
$dv/dt^{(2)}$	Peak diode recovery voltage slope	20	V/ns
$T_j$ $T_{stg}$	Operating junction temperature Storage temperature	-55 to 150	$^\circ\text{C}$

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	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300	$^\circ\text{C}$

**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

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

**Table 4. Static**

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

**Table 5. Dynamic**

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

1. Pulsed: Pulse duration =  $300\mu\text{s}$ , 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%  $V_{DSS}$

**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 $\mu s$ , duty cycle 1.5 %

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

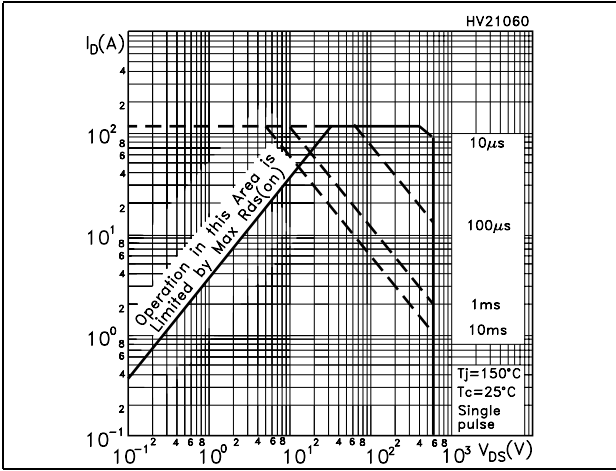


Figure 2. Thermal impedance

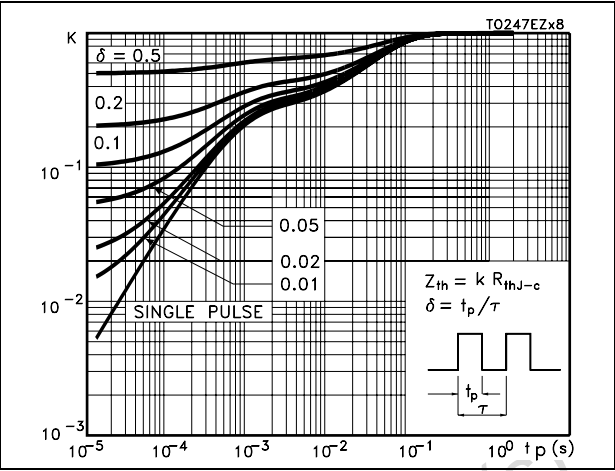


Figure 3. Output characteristics

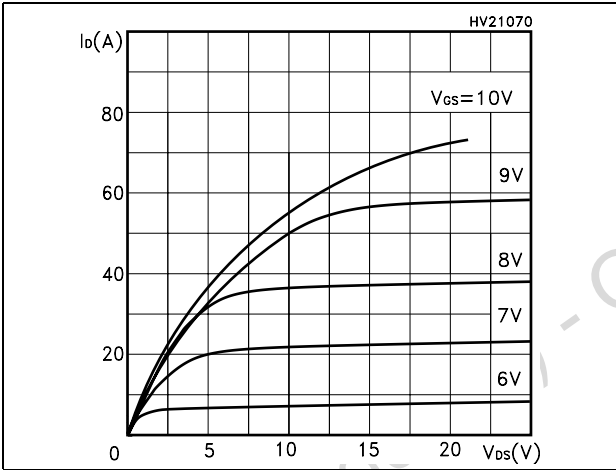


Figure 4. Transfer characteristics

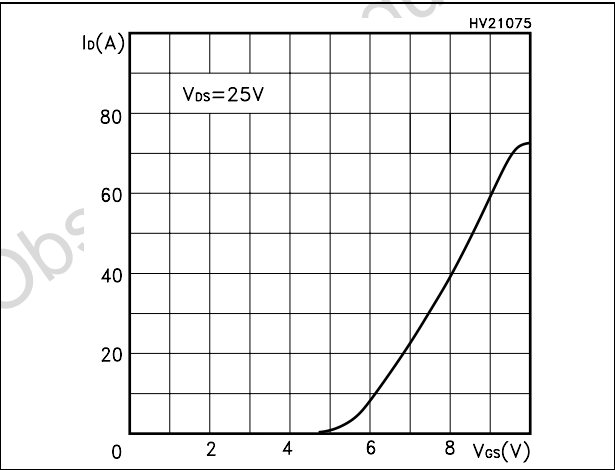


Figure 5. Transconductance

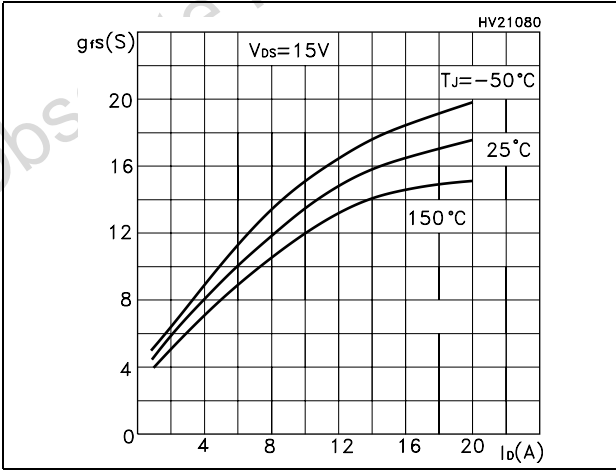


Figure 6. Static drain-source on resistance

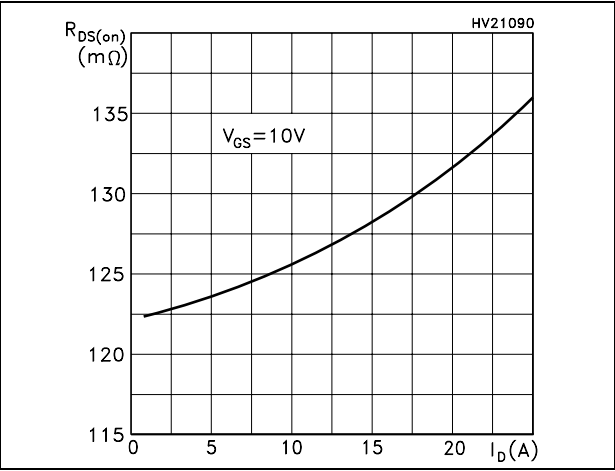


Figure 7. Gate charge vs gate-source voltage    Figure 8. Capacitance variations

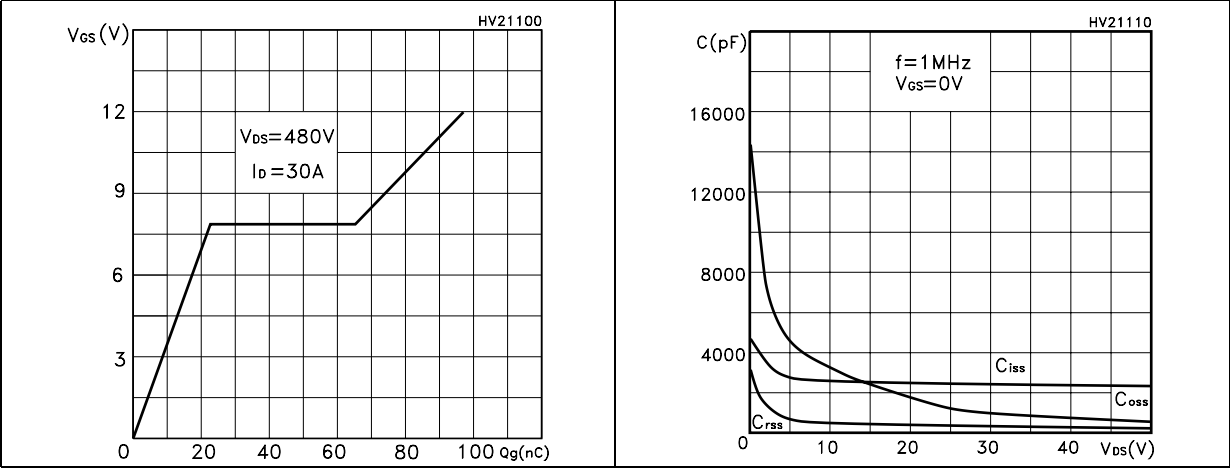


Figure 9. Normalized gate threshold voltage vs temperature    Figure 10. Normalized on resistance vs temperature

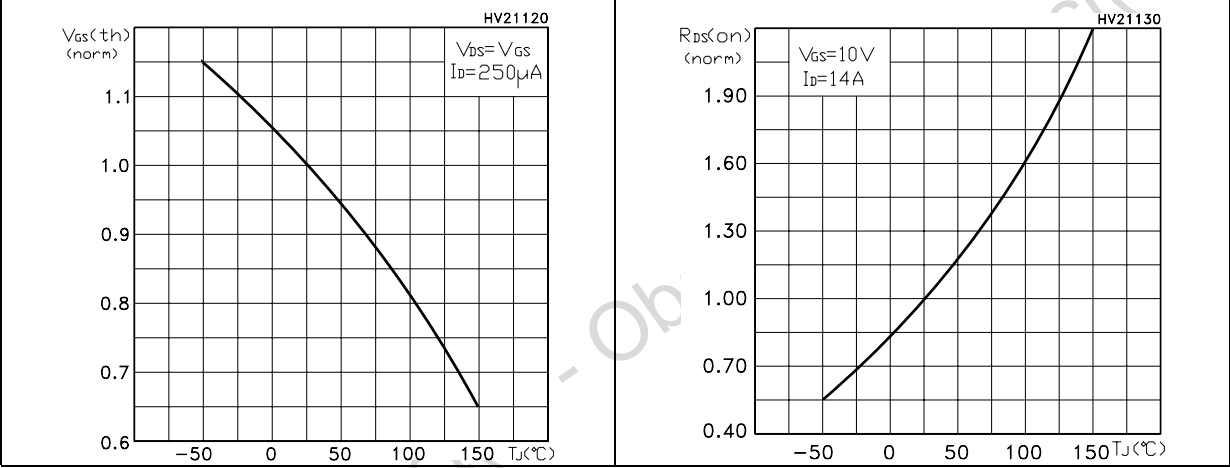
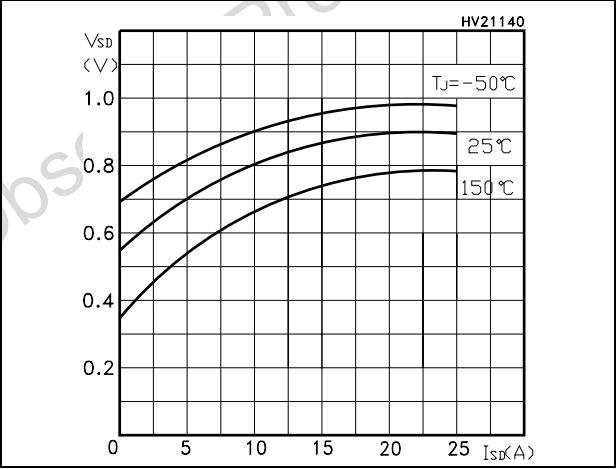


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Unclamped inductive load test circuit

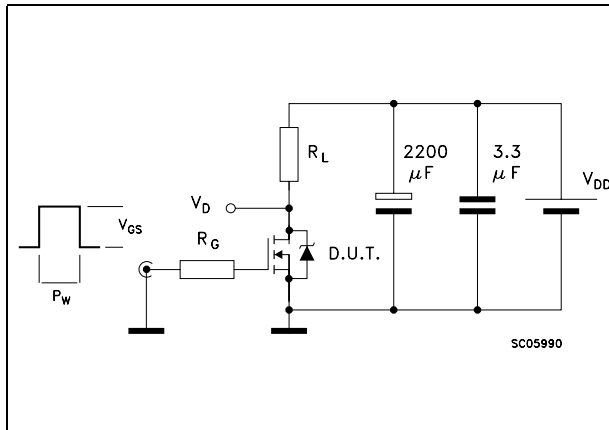


Figure 13. Unclamped inductive waveform

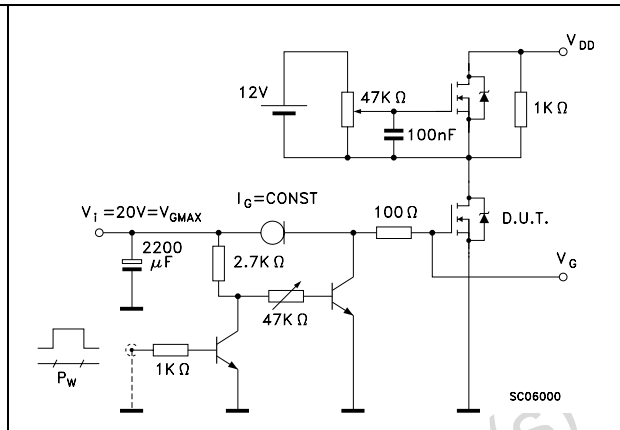


Figure 14. Switching times test circuit for resistive load

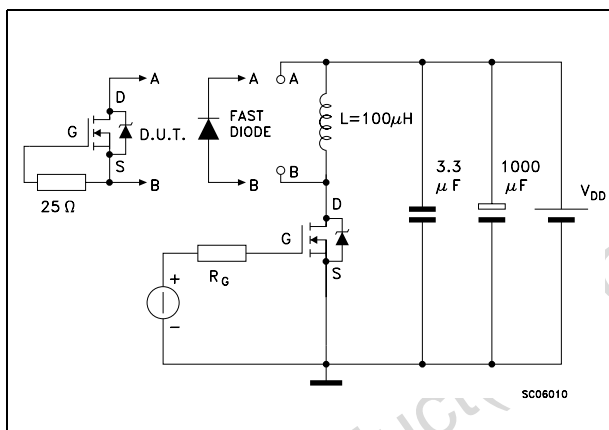


Figure 15. Gate charge test circuit

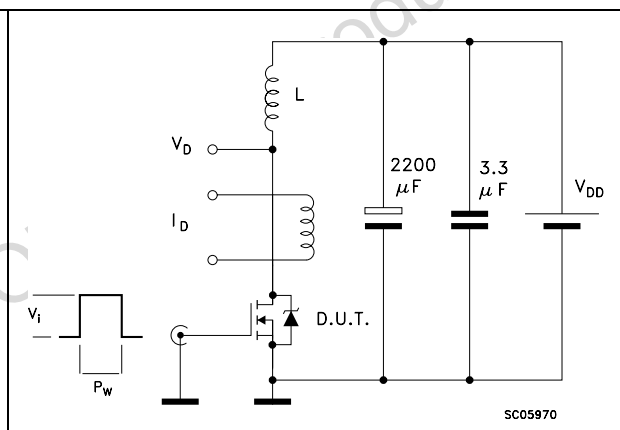


Figure 16. Test circuit for inductive load switching and diode recovery times

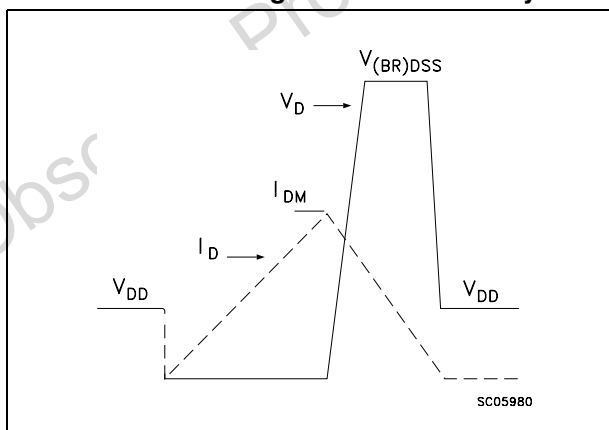
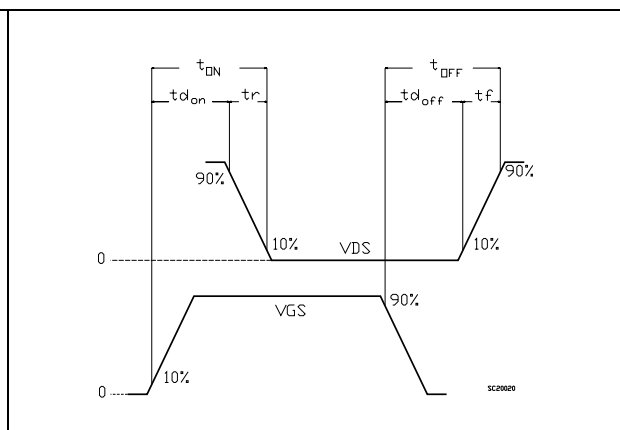


Figure 17. Switching time waveform





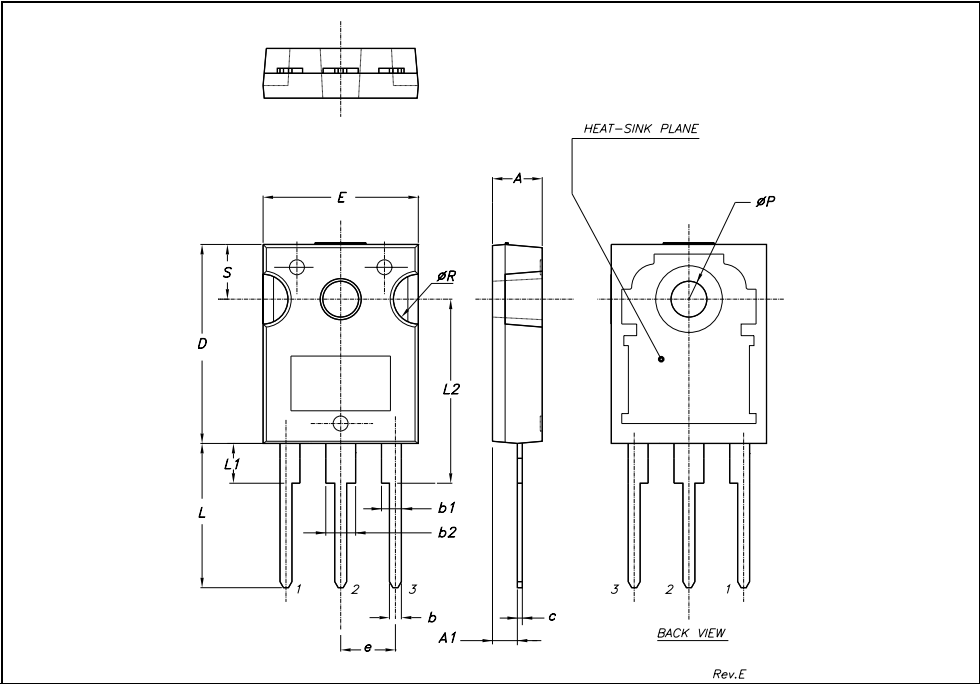
## 4 Package mechanical data

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](http://www.st.com)

Obsolete Product(s) - Obsolete Product(s)

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 <a href="#">Table 4</a> .
06-Dec-2005	2	Inserted ecopack indication
20-Dec-2005	3	Modified value on <a href="#">Source drain diode</a>
24-Jan-2006	4	Changed unit on <a href="#">Dynamic</a>
13-Jul-2006	5	New template, modified unit on <a href="#">Source drain diode</a>

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