THE DATASHEET OF

STW90NF20

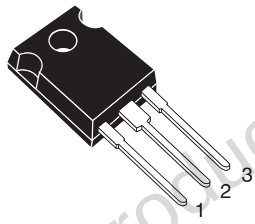
STW90NF20

N-channel 200 V, 0.019 Ω, 83 A, TO-247 low gate charge STripFET™ Power MOSFET

Features

Type	V_{DSS}	$R_{DS(on)}$ max	I_D
STW90NF20	200 V	< 0.023 Ω	83 A

- Exceptional dv/dt capability
- Low gate charge
- 100% Avalanche tested



Application

- Switching applications

Description

This Power MOSFET series realized with STMicroelectronics unique STripFET™ process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters

Figure 1. Internal schematic diagram

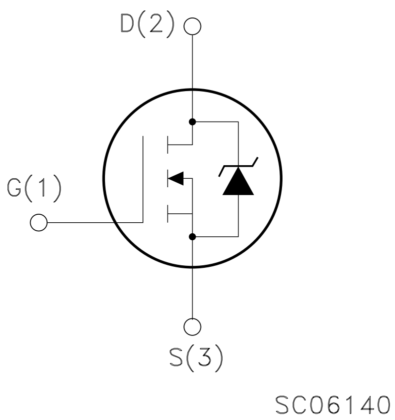


Table 1. Device summary

Order code	Marking	Package	Packaging
STW90NF20	90NF20	TO-247	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	200	V
V_{GS}	Gate-source voltage	± 20	V
I_D	Drain current (continuous) at T_C = 25 °C	83	A
I_D	Drain current (continuous) at T_C = 100 °C	52	A
I_{DM}(1)	Drain current (pulsed)	332	A
	Derating factor	2.4	W/°C
P_{TOT}	Total dissipation at T_C = 25 °C	300	W
dv/dt (2)	Peak diode recovery voltage slope	15	V/ns
T_J Tstg	Operating junction temperature Storage temperature	-50 to 150	°C

1. Pulse width limited by safe operating area
2. $I_{SD} \leq$ 83 A, di/dt $\leq$ 400 A/µs, $V_{DD} \leq$ 80% $V_{(BR)DSS}$

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case max	0.42	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient max	50	°C/W
T_l	Maximum lead temperature for soldering purpose	300	°C

Table 3. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	83	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	400	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	200			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating, V_{DS} = Max rating @125 °C			1 10	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{DS} = ± 20 V			±100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	2	3	4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS}= 10 V, I_D= 45 A		0.018	0.023	Ω

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 15 V, I_D = 45 A		40		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse Transfer Capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		5736 1126 196		pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{DS} = 0 to 160 V, V_{GS} = 0		687		pF
R_G	Intrinsic gate resistance	f = 1 MHz open drain		1.7		Ω
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 160 V, I_D = 83 A, V_{GS} = 10 V *(see Figure 15)*		164 46 72		nC nC nC

1. Pulsed: pulse duration = 300µs, 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 times

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $t_{d(off)}$ t_f	Turn-on delay time Rise time Turn-off delay time Fall time	V_{DD} = 100 V, I_D = 41.5 A R_G = 4.7 Ω, V_{GS} = 10 V, *(see Figure 14)*		24 138 148 142		ns ns ns ns

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM}(1)	Source-drain current Source-drain current (pulsed)				83 332	A A
V_{SD}(2)	Forward on voltage	I_{SD} = 83 A, V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 83 A,V_{DD} = 100 V di/dt = 100 A/µs *(see Figure 19)*		200 1.6 16		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} =83 A, V_{DD} = 100 V di/dt = 100 A/µs T_j = 150°C *(see Figure 19)*		235 2.2 18		ns µC A

1. Pulse with limited by maximum temperature
2. Pulsed: pulse duration = 300µs, duty cycle 1.5%

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area

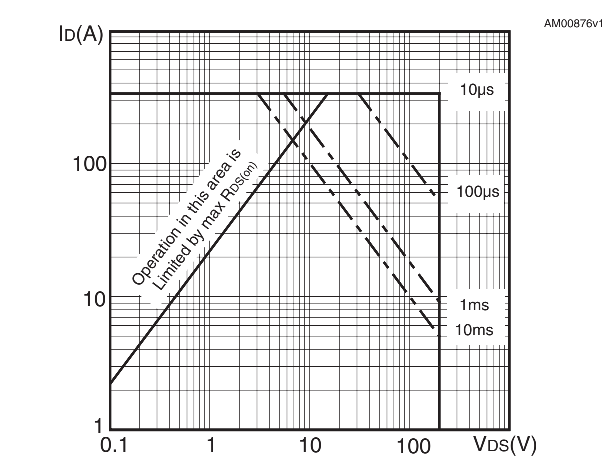


Figure 3. Thermal impedance

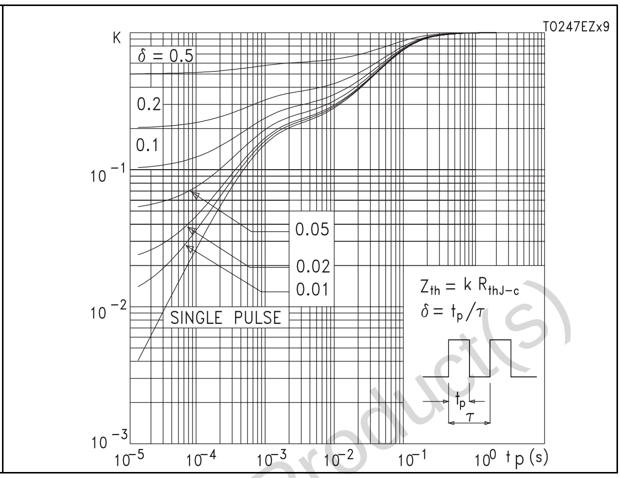


Figure 4. Output characteristics

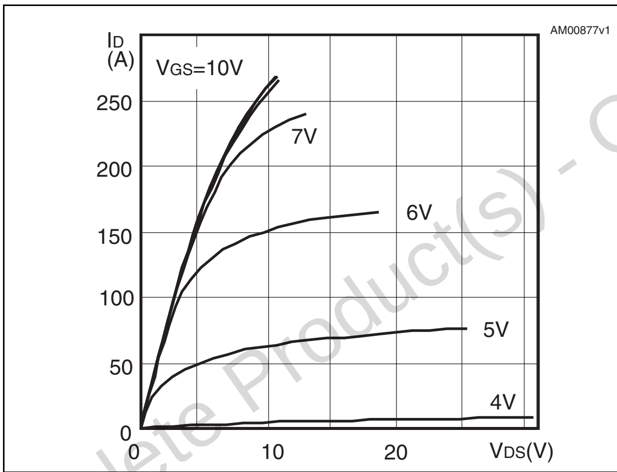


Figure 5. Transfer characteristics

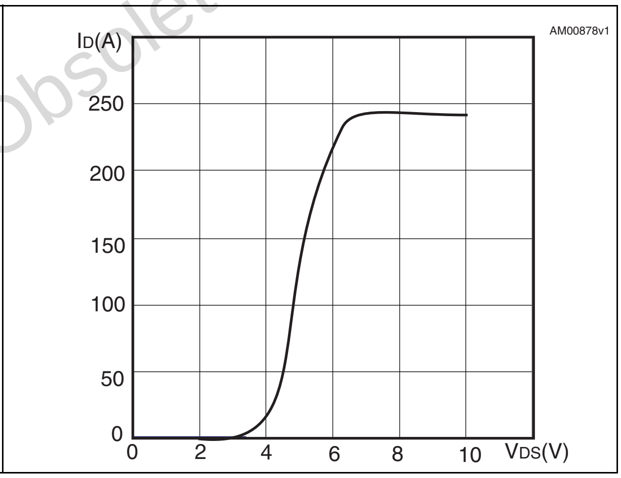


Figure 6. Normalized BV_{DSS} vs temperature

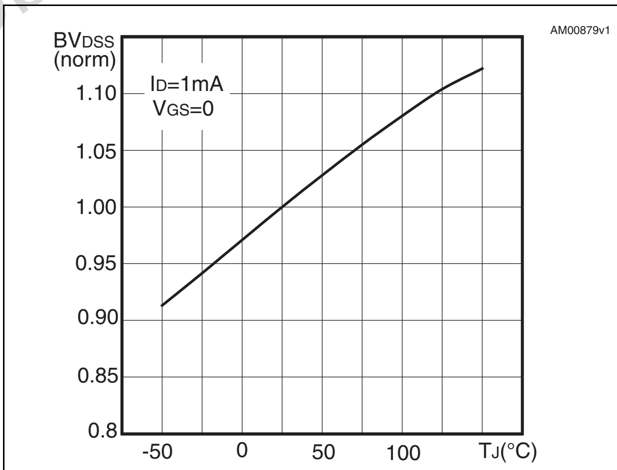


Figure 7. Static drain-source on resistance

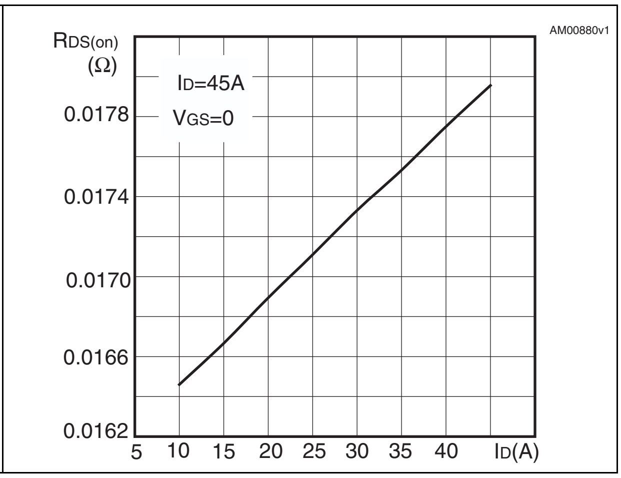


Figure 8. Gate charge vs gate-source voltage

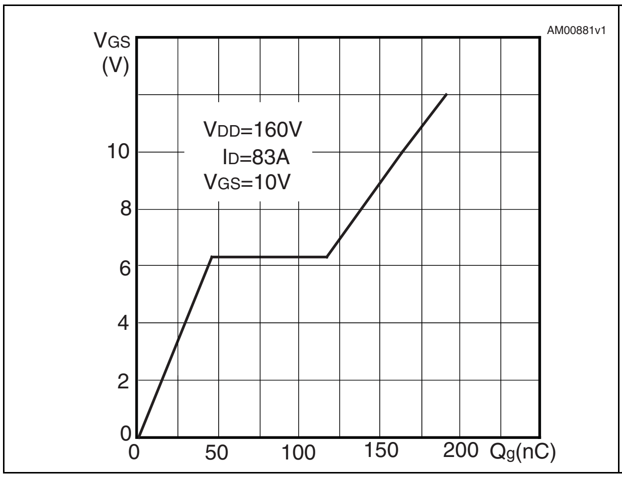


Figure 9. Capacitance variations

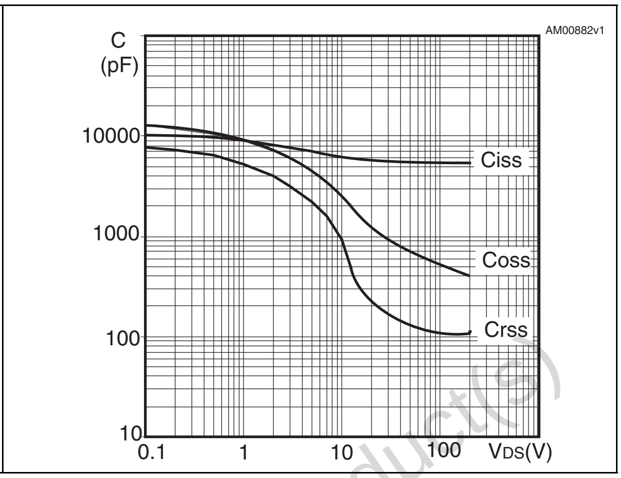


Figure 10. Normalized gate threshold voltage vs temperature

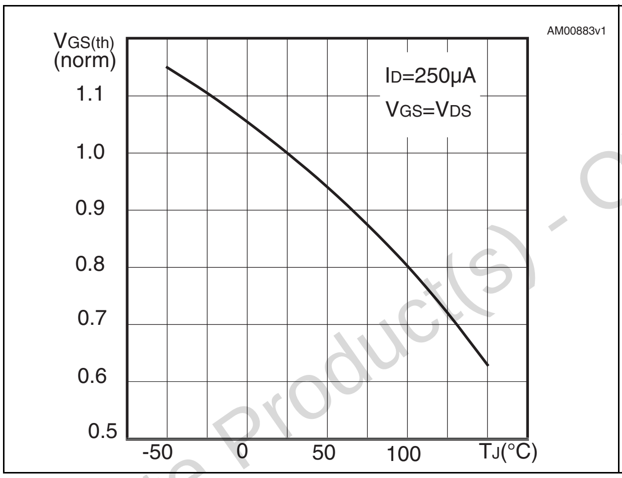


Figure 11. Normalized on resistance vs temperature

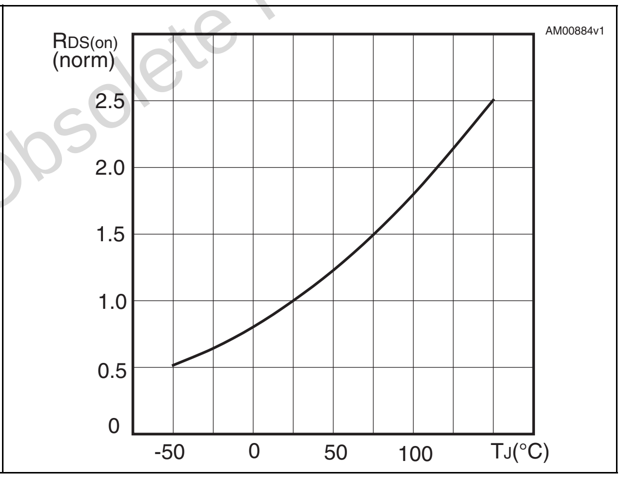


Figure 12. Source-drain diode forward characteristics

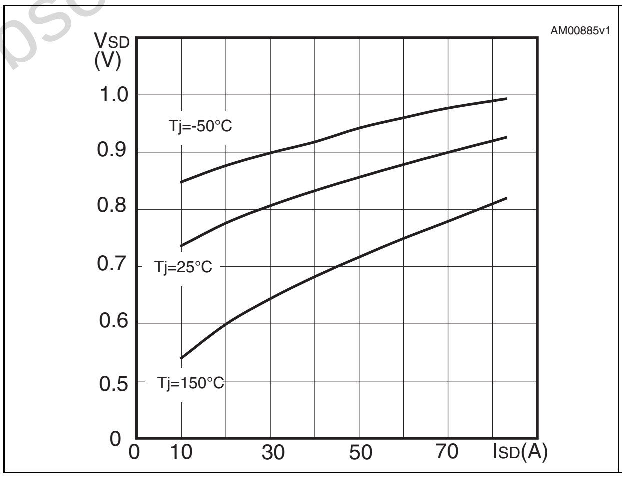
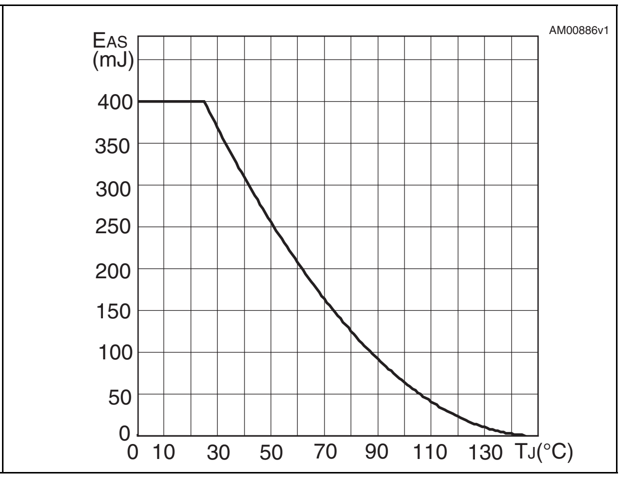


Figure 13. Maximum avalanche energy vs temperature



3 Test circuits

Figure 14. Switching times test circuit for resistive load

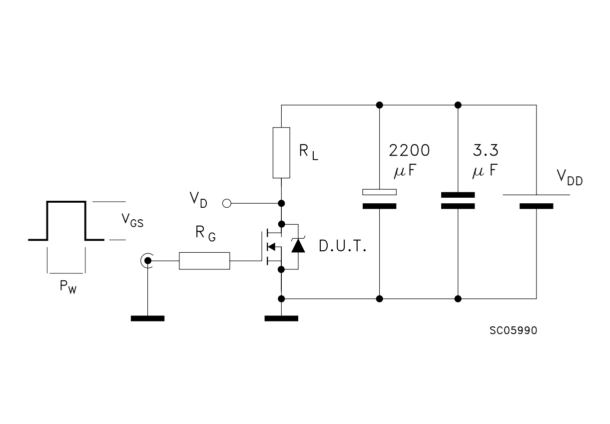


Figure 15. Gate charge test circuit

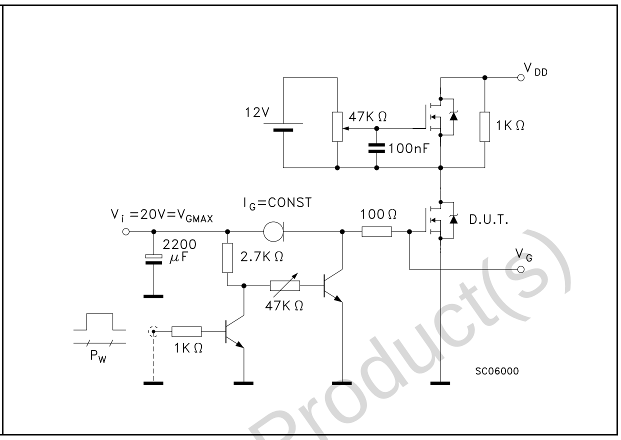


Figure 16. Test circuit for inductive load switching and diode recovery times

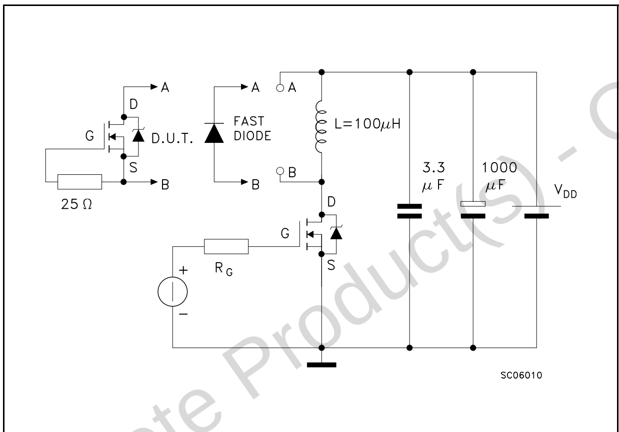


Figure 17. Unclamped inductive load test circuit

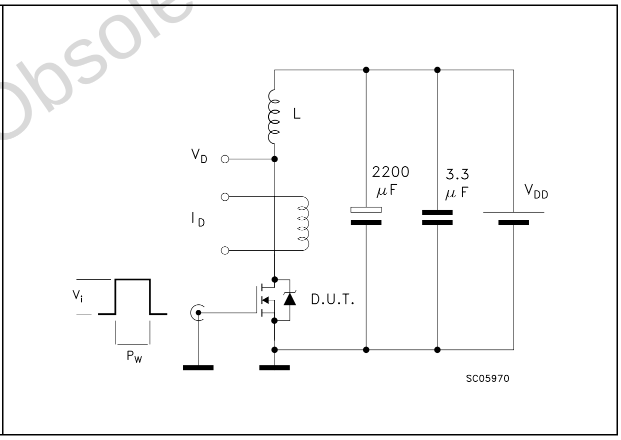


Figure 18. Unclamped inductive waveform

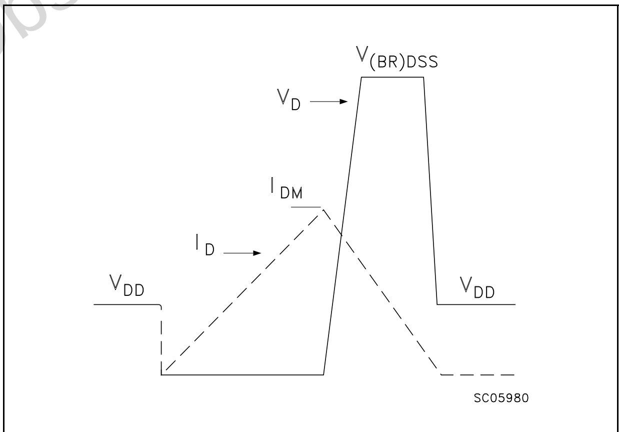
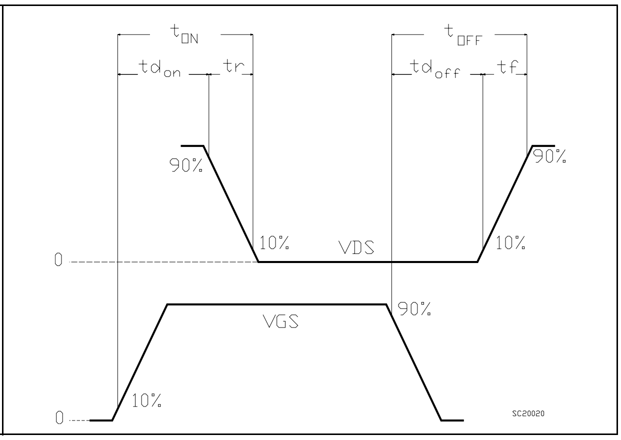


Figure 19. Switching time waveform

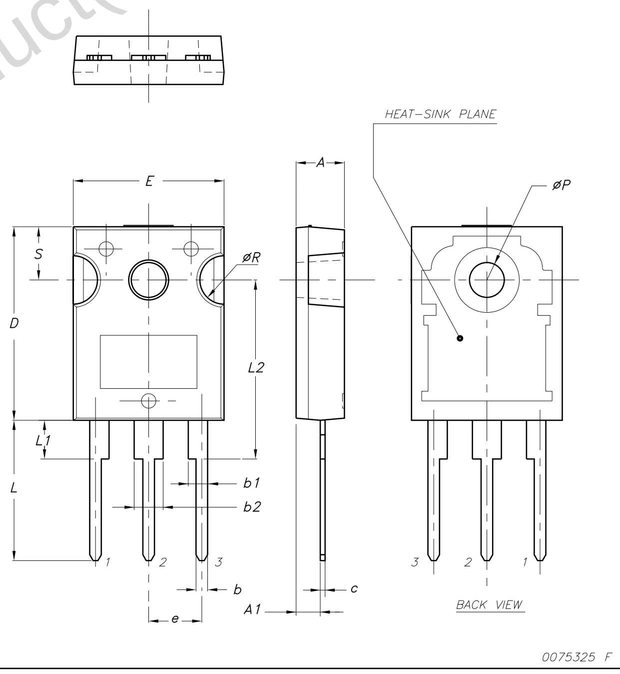


4 Package mechanical data

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.		
	Min.	Typ	Max.
A	4.85		5.15
A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



5 Revision history

Table 8. Document revision history

Date	Revision	Changes
28-Aug-2007	1	First release
04-Aug-2008	2	Document status promoted from preliminary data to datasheet.

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