



# STFV4N150 - STFW4N150 STP4N150 - STW4N150

N-channel 1500 V - 5  $\Omega$  - 4 A - PowerMESH™ Power MOSFET  
TO-220 - TO-220FH - TO-247 - TO-3PF

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub> max	I <sub>D</sub>
STFV4N150	1500 V	< 7 $\Omega$	4 A
STFW4N150 <sup>(1)</sup>	1500 V	< 7 $\Omega$	4 A
STP4N150	1500 V	< 7 $\Omega$	4 A
STW4N150	1500 V	< 7 $\Omega$	4 A

1. All data which refers solely to the TO-3PF package is preliminary

- 100% avalanche tested
- Intrinsic capacitances and Q<sub>g</sub> minimized
- High speed switching
- Fully isolated TO-3PF and TO-220FH plastic packages
- Creepage distance path is 5.4 mm (typ.) for TO-3PF
- Creepage distance path is > 4 mm for TO-220FH

## Application

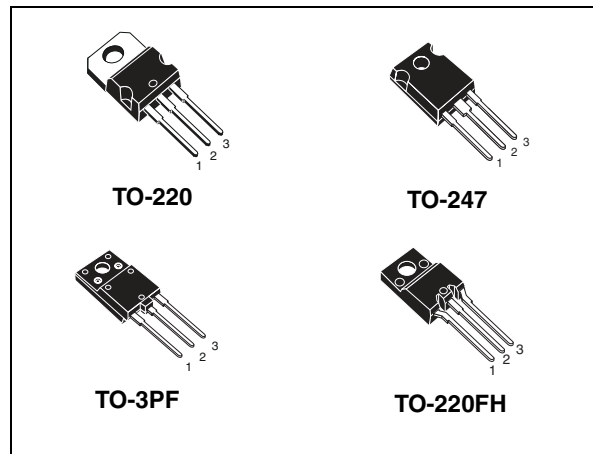
- Switching applications

## Description

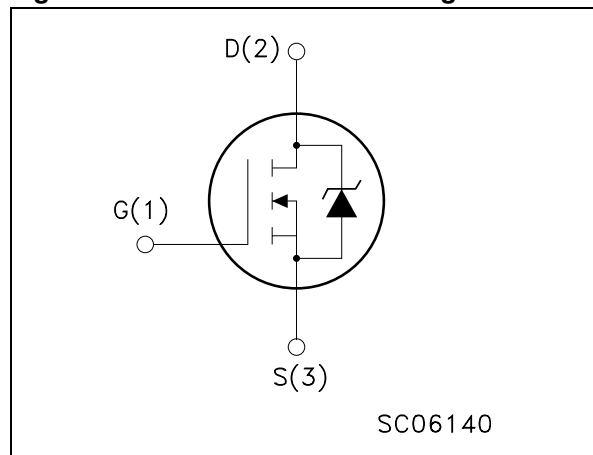
Using the well consolidated high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of very high voltage Power MOSFETs with outstanding performances. The strengthened layout coupled with the company's proprietary edge termination structure, gives the lowest R<sub>DS(on)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

**Table 1. Device summary**

Order codes	Marking	Package	Packaging
STFV4N150	4N150	TO-220FH	Tube
STFW4N150	4N150	TO-3PF	Tube
STP4N150	P4N150	TO-220	Tube
STW4N150	W4N150	TO-247	Tube



**Figure 1. Internal schematic diagram.**



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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value				Unit
		TO-220	TO-247	TO-220FH	TO-3PF	
$V_{DS}$	Drain-source voltage ( $V_{GS} = 0$ )	1500				V
$V_{GS}$	Gate- source voltage	$\pm 30$				V
$I_D$	Drain current (continuous) at $T_C = 25\text{ }^\circ\text{C}$	4	4	4 <sup>(1)</sup>	4 <sup>(1)</sup>	A
$I_D$	Drain current (continuous) at $T_C = 100\text{ }^\circ\text{C}$	2.5	2.5	2.5 <sup>(1)</sup>	2.5 <sup>(1)</sup>	A
$I_{DM}^{(1)}$	Drain current (pulsed)	12	12	12 <sup>(1)</sup>	12 <sup>(1)</sup>	A
$P_{TOT}$	Total dissipation at $T_C = 25\text{ }^\circ\text{C}$	160		40	Tbd	W
$T_{stg}$	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

**Table 3. Thermal data**

Symbol	Parameter	Value				Unit
		TO-220	TO-247	TO-220FH	TO-3PF	
$R_{thj-case}$	Thermal resistance junction-case max	0.78		3.12	Tbd	$^\circ\text{C}/\text{W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	50	62.5		$^\circ\text{C}/\text{W}$

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
$I_{AR}$	Avalanche current, repetitive or not-repetitive (pulse width limited by $T_j$ max)	4	A
$E_{AS}$	Single pulse avalanche energy (starting $T_j = 25\text{ }^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 50\text{ V}$ )	350	mJ

## 2 Electrical characteristics

( $T_{CASE}=25^{\circ}C$  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 ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}, T_C = 125^{\circ}C$			10 500	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30 \text{ V}$			$\pm 100$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}, I_D = 2 \text{ A}$		5	7	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 30 \text{ V}, I_D = 2 \text{ A}$		3.5		S
$C_{iss}$	Input capacitance	$V_{DS} = 25 \text{ V}, f = 1 \text{ MHz},$ $V_{GS} = 0$		1300		pF
$C_{oss}$	Output capacitance			120		pF
$C_{rss}$	Reverse transfer capacitance			12		pF
$t_{d(on)}$	Turn-on delay time	$V_{DD} = 750 \text{ V}, I_D = 2 \text{ A},$ $R_G = 4.7 \Omega, V_{GS} = 10 \text{ V}$ <i>(see Figure 21)</i>		35		ns
$T_r$	Rise time			30		ns
$t_{d(off)}$	Turn-off delay time			45		ns
$t_f$	Fall time			45		ns
$Q_g$	Total gate charge	$V_{DD} = 600 \text{ V}, I_D = 4 \text{ A},$ $V_{GS} = 10 \text{ V}$ <i>(see Figure 22)</i>		30	50	nC
$Q_{gs}$	Gate-source charge			10		nC
$Q_{gd}$	Gate-drain charge			9		nC

1. Pulsed: pulse duration=300  $\mu s$ , duty cycle 1.5%

Table 7. Source drain diode

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				4	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				12	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 4 \text{ A}$ , $V_{GS} = 0$			2	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 4 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 45 \text{ V}$ <i>(see Figure 21)</i>		510		ns
$Q_{rr}$	Reverse recovery charge			3		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			12		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 4 \text{ A}$ , $di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 45 \text{ V}$ , $T_j = 150^\circ\text{C}$ <i>(see Figure 21)</i>		615		ns
$Q_{rr}$	Reverse recovery charge			4		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			12.6		A

1. Pulse width limited by safe operating area
2. Pulsed: pulse duration=300 $\mu\text{s}$ , duty cycle 1.5%

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220

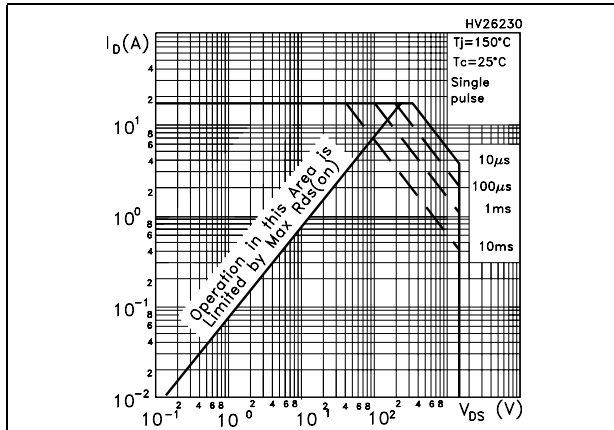


Figure 3. Thermal impedance for TO-220

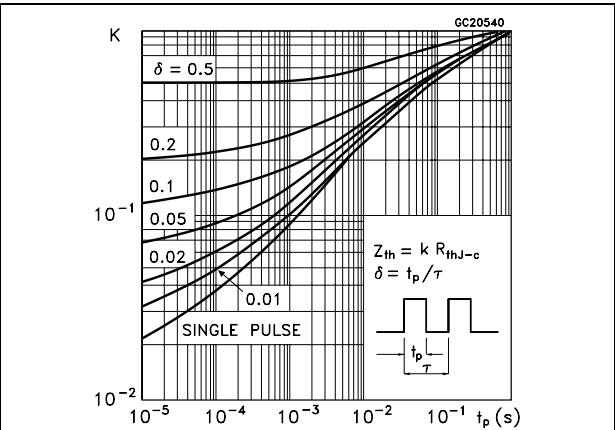


Figure 4. Safe operating area for TO-220FH

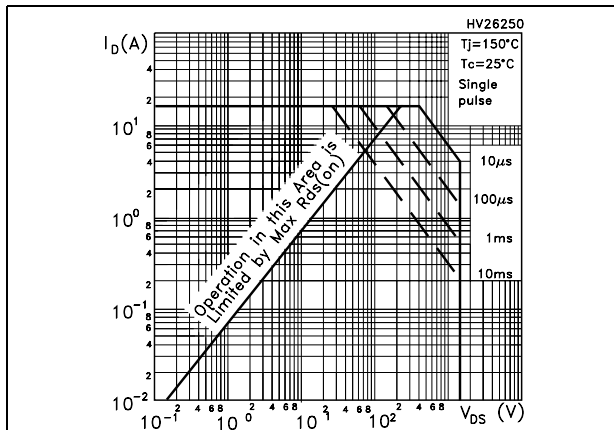


Figure 5. Thermal impedance for TO-220FH

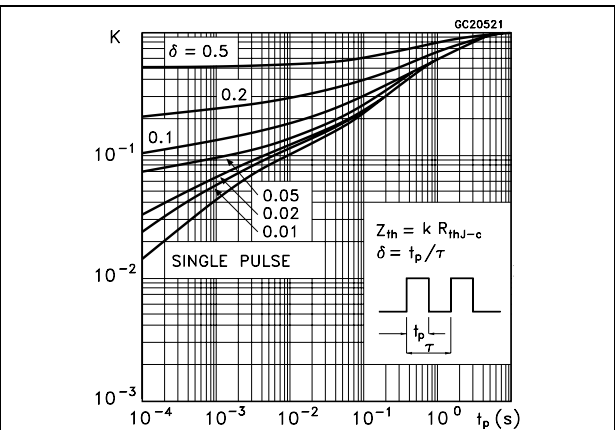


Figure 6. Safe operating area for TO-247

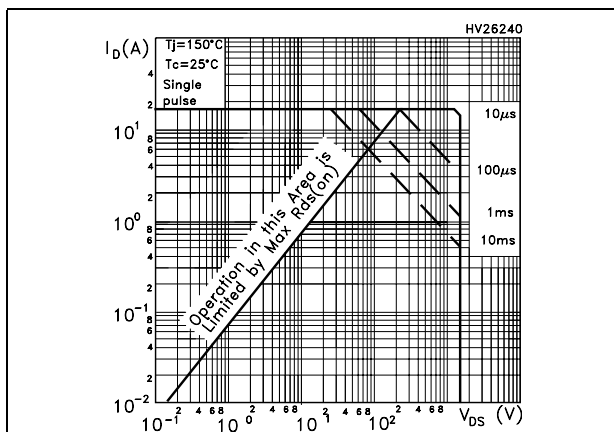


Figure 7. Thermal impedance for TO-247

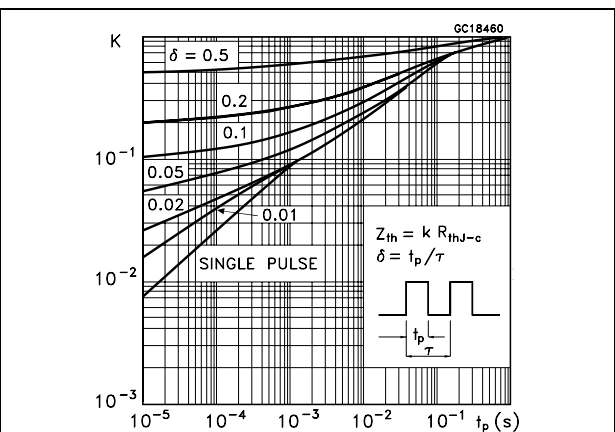


Figure 8. Output characteristics

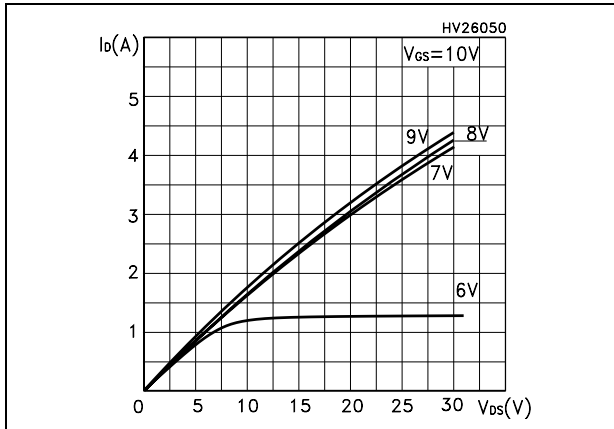


Figure 9. Transfer characteristics

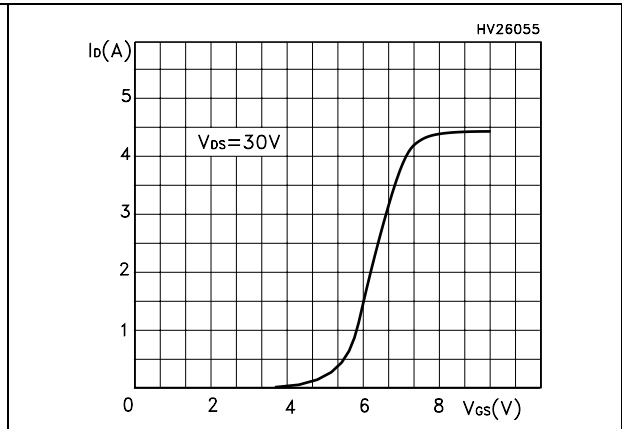


Figure 10. Transconductance

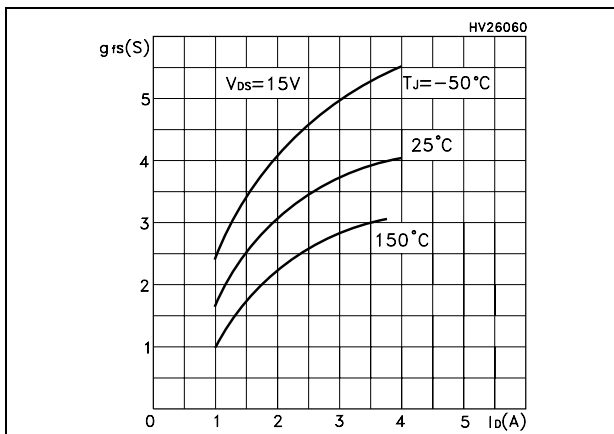


Figure 11. Static drain-source on resistance

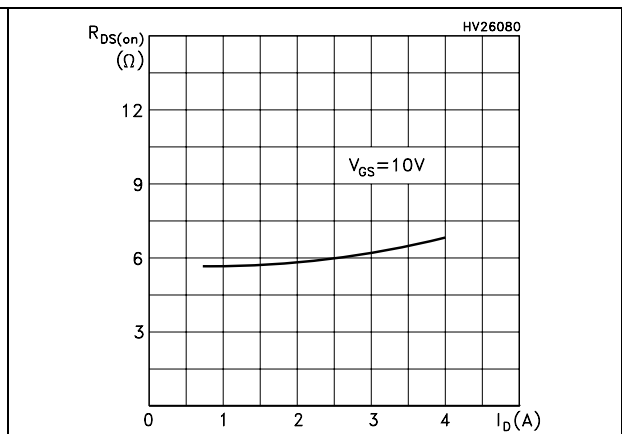


Figure 12. Gate charge vs gate-source voltage Figure 13. Capacitance variations

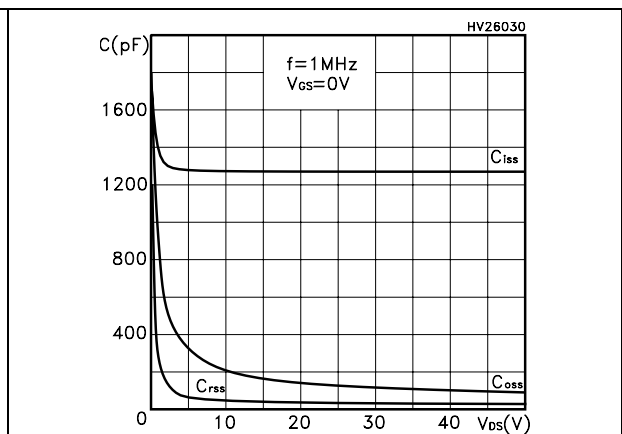
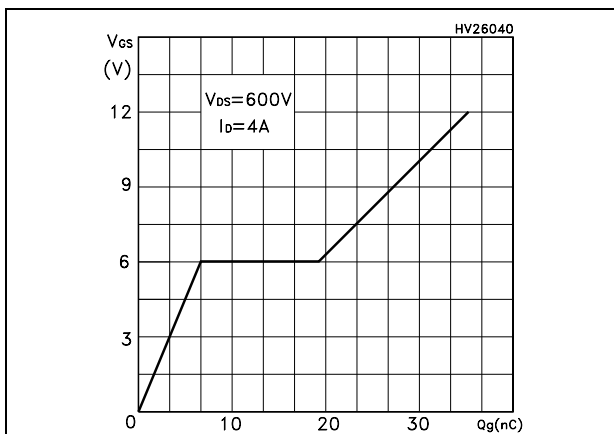


Figure 14. Normalized gate threshold voltage vs temperature

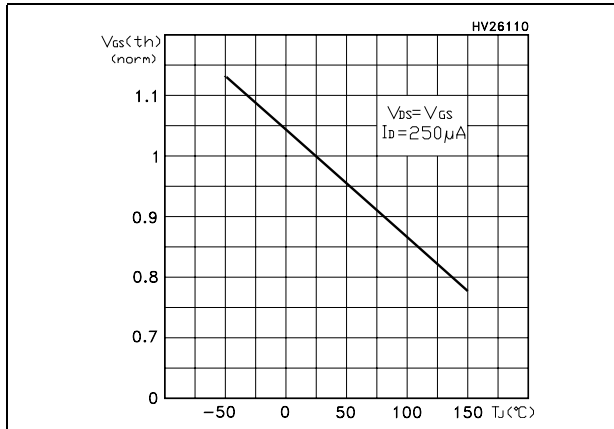


Figure 15. Normalized on resistance vs temperature

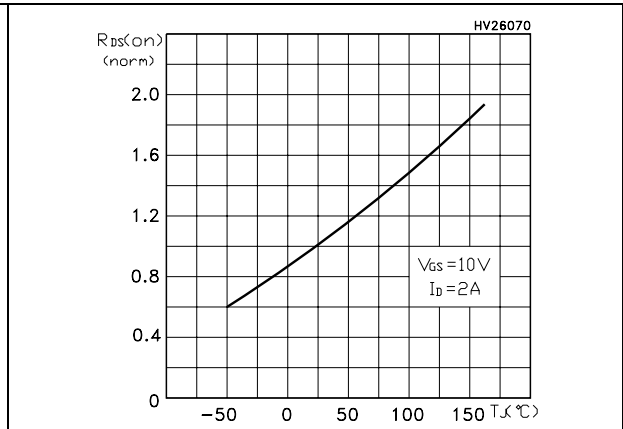


Figure 16. Source-drain diode forward characteristics

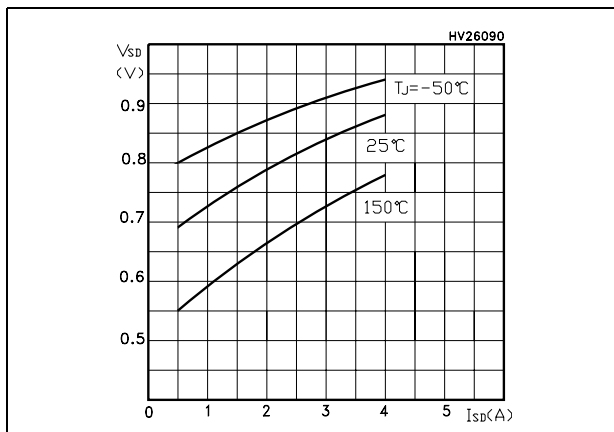


Figure 17. Normalized B<sub>VDSS</sub> vs temperature

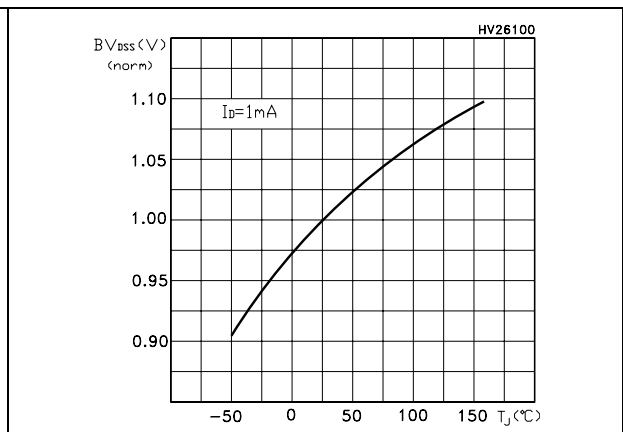
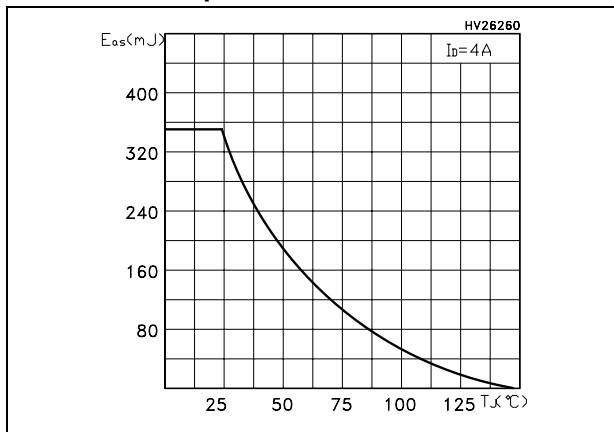


Figure 18. Maximum avalanche energy vs temperature





### 3 Test circuits

Figure 19. Unclamped inductive load test circuit

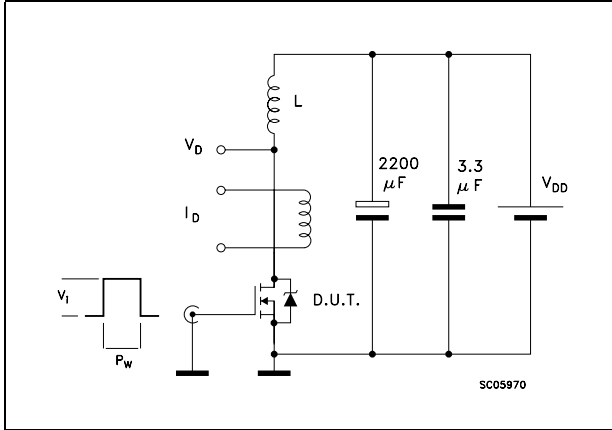


Figure 20. Unclamped inductive waveform

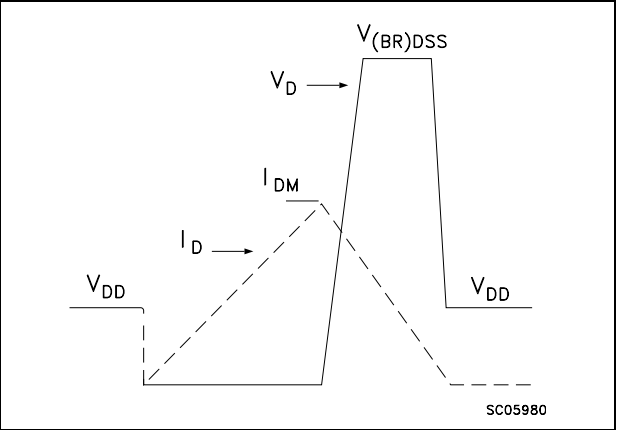


Figure 21. Switching times test circuit for resistive load

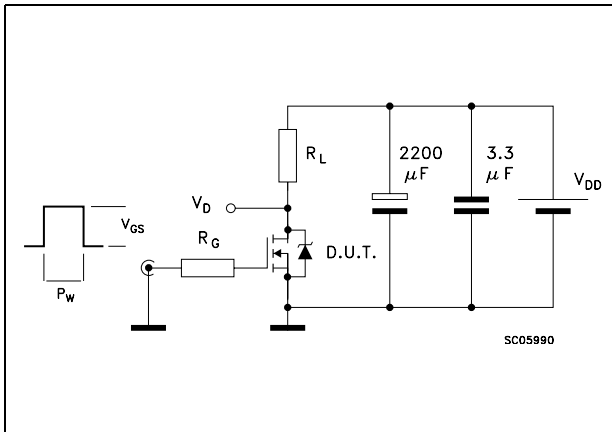


Figure 22. Gate charge test circuit

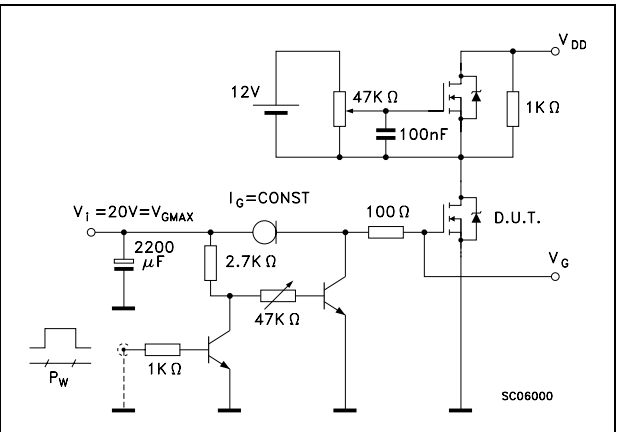


Figure 23. Test circuit for inductive load switching and diode recovery times

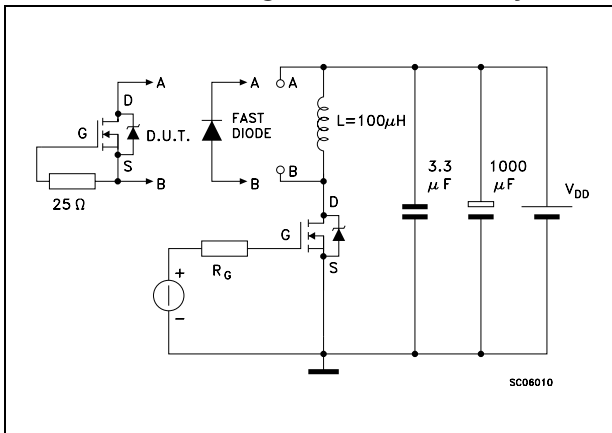
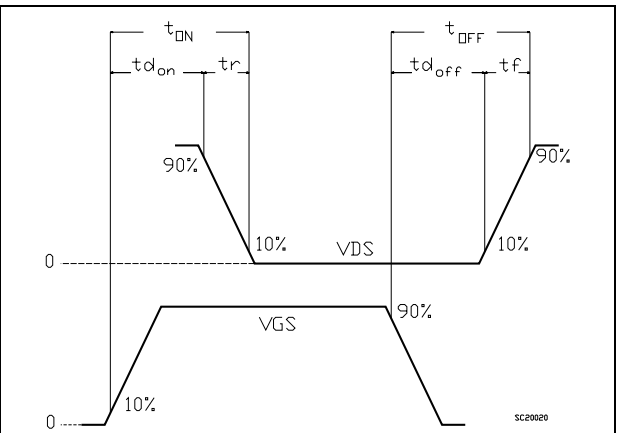


Figure 24. Switching time waveform

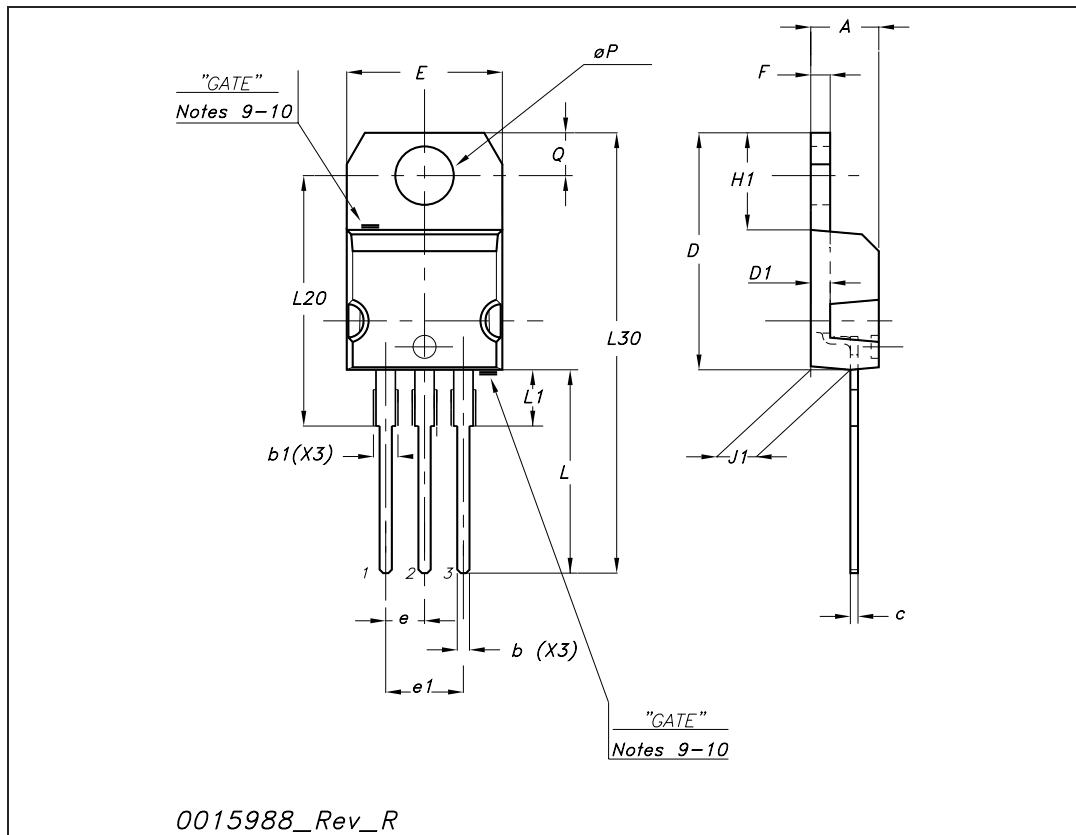


## 4 Package mechanical data

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)

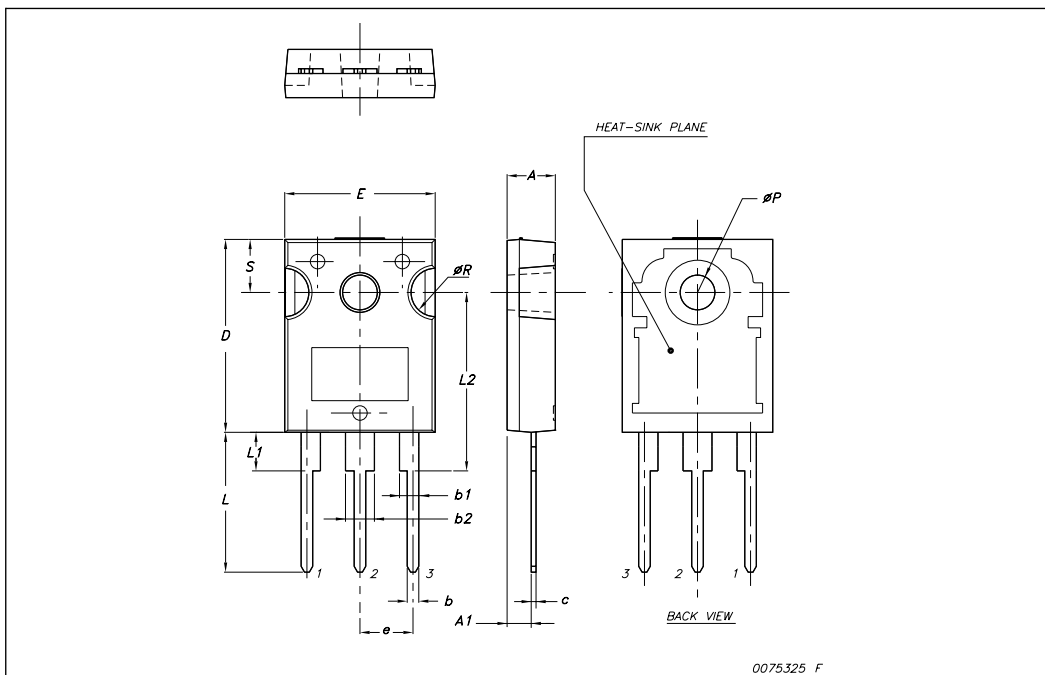
TO-220 mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.051
H1	6.20		6.60	0.244		0.256
J1	2.40		2.72	0.094		0.107
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L20		16.40			0.645	
L30		28.90			1.137	
∅P	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



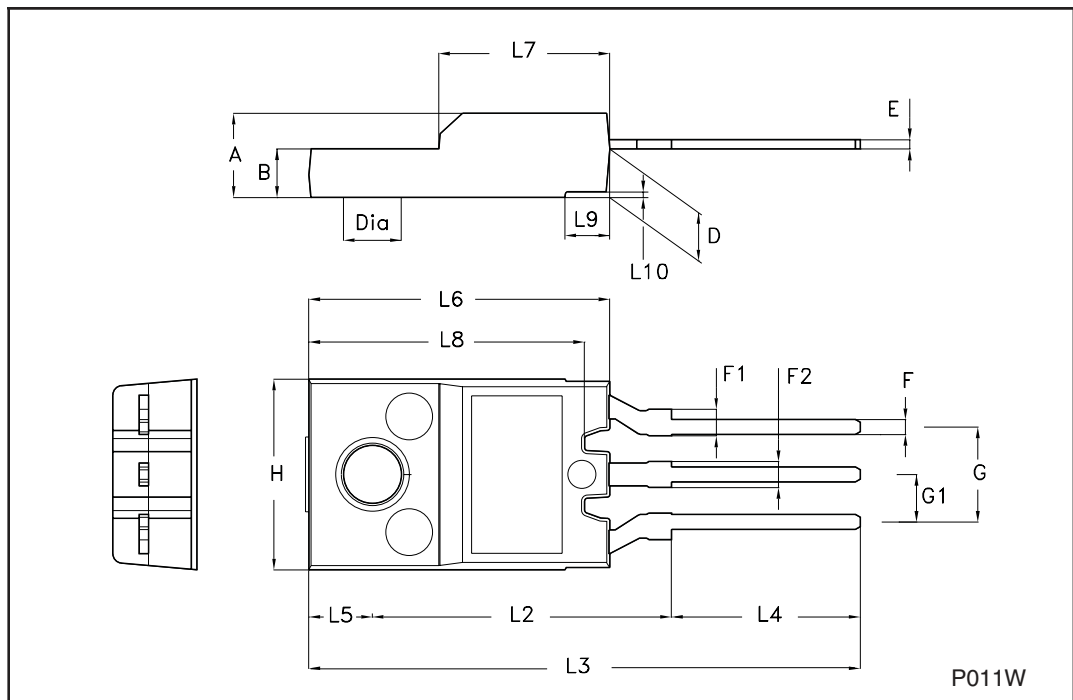
**TO-247 Mechanical data**

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	



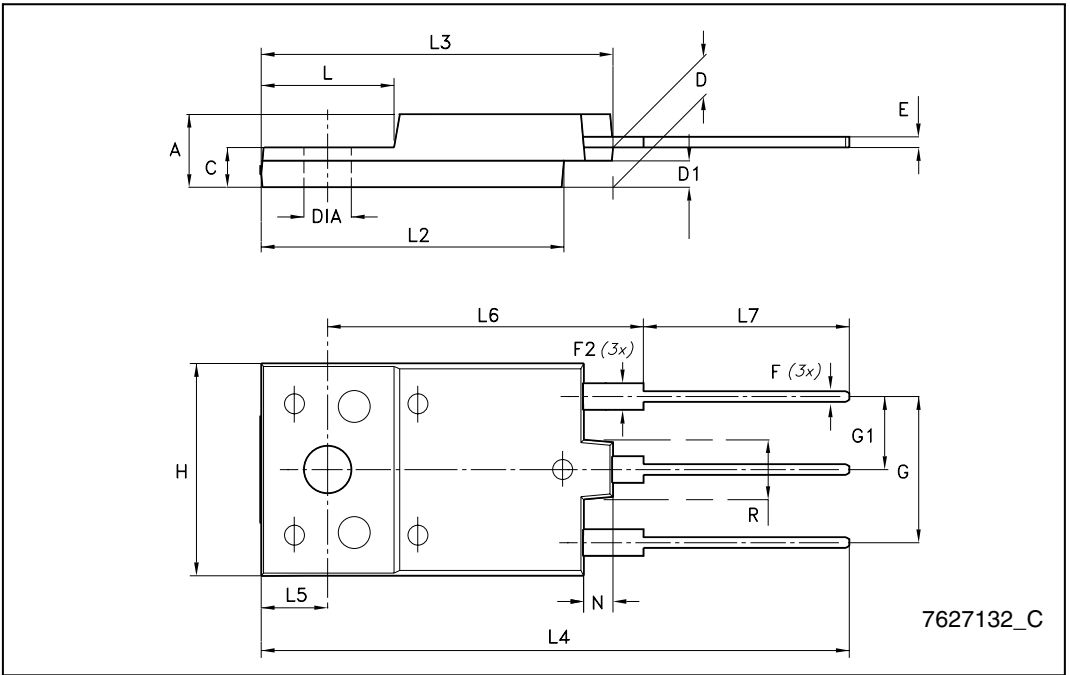
## TO-220FH (Fully plastic High voltage) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.3		1.8	0.051		0.070
F2	1.3		1.8	0.051		0.070
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	0.385		0.417
L5		3.4			0.134	
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
L8	14.5		15	0.570		0.590
L9		2.4			0.094	



**TO-3PF mechanical data**

DIM.	mm.		
	min.	typ	max.
A	5.30		5.70
C	2.80		3.20
D	3.10		3.50
D1	1.80		2.20
E	0.80		1.10
F	0.65		0.95
F2	1.80		2.20
G	10.30		11.50
G1		5.45	
H	15.30		15.70
L	9.80	10	10.20
L2	22.80		23.20
L3	26.30		26.70
L4	43.20		44.40
L5	4.30		4.70
L6	24.30		24.70
L7	14.60		15
N	1.80		2.20
R	3.80		4.20
Dia	3.40		3.80



## 5 Revision history

**Table 8. Document revision history**

Date	Revision	Changes
29-Mar-2005	1	Initial release
07-Jul-2005	2	Removed TO-220FP
07-Oct-2005	3	Document status promoted from preliminary data to datasheet
10-Aug-2006	4	Document reformatted, no content change
06-Nov-2007	5	Updated unit on <a href="#">Table 5: On/off states</a>
09-Apr-2008	6	Added new packages: TO-220FH, TO-3PF

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