



# STB11NM80 - STF11NM80 STP11NM80 - STW11NM80

N-channel 800 V - 0.35  $\Omega$  - 11 A - TO-220/FP- D<sup>2</sup>PAK - TO-247  
MDmesh™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	R <sub>DS(on)</sub> *Q <sub>g</sub>	I <sub>D</sub>
STB11NM80	800 V	< 0.40 $\Omega$	14 $\Omega$ *nC	11 A
STF11NM80	800 V	< 0.40 $\Omega$	14 $\Omega$ *nC	11 A
STP11NM80	800 V	< 0.40 $\Omega$	14 $\Omega$ *nC	11 A
STW11NM80	800 V	< 0.40 $\Omega$	14 $\Omega$ *nC	11 A

- Low input capacitance and gate charge
- Low gate input resistance
- Best R<sub>DS(on)</sub>\*Q<sub>g</sub> in the industry

## Application

- Switching applications

## Description

The MDmesh™ associates the multiple drain process with the Company's PowerMesh™ horizontal layout assuring an outstanding low on-resistance. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

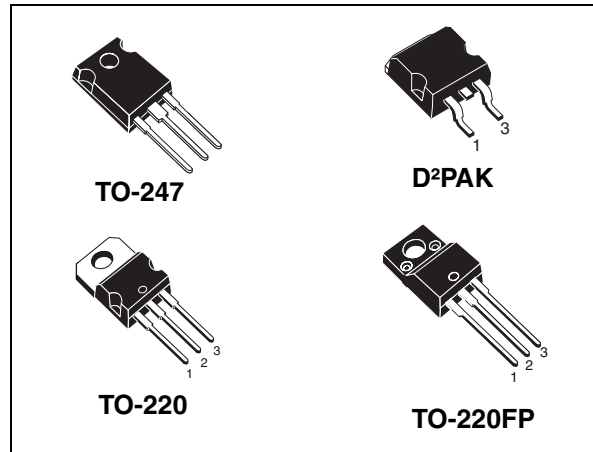


Figure 1. Internal schematic diagram

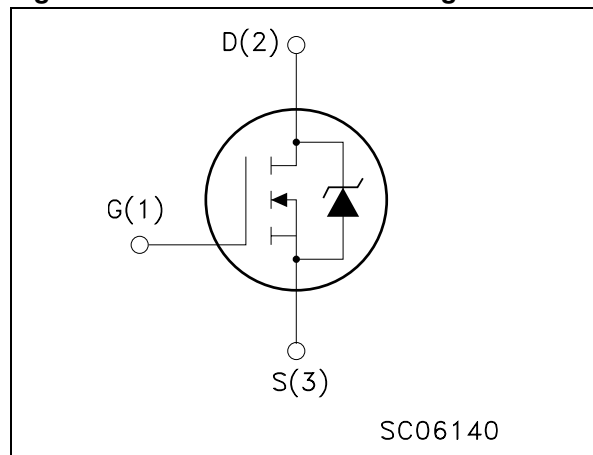


Table 1. Device summary

Order codes	Marking	Package	Packaging
STB11NM80	B11NM80	D <sup>2</sup> PAK	Tape & reel
STF11NM80	F11NM80	TO-220FP	Tube
STP11NM80	P11NM80	TO-220	Tube
STW11NM80	W11NM80	TO-247	Tube

# Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK/ TO-247	TO-220FP	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	800		V
V <sub>GS</sub>	Gate-source voltage	±30		V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25°C	11	11 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> =100°C	8	8 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	44	44 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25°C	150	35	W
	Derating factor	1.2	0.28	W/°C
V <sub>ISO</sub>	Insulation withstand voltage (DC)	--	2500	V
T <sub>J</sub> T <sub>stg</sub>	Operating junction temperature Storage temperature	-65 to 150		°C

1. Limited only by the maximum temperature allowed
2. Pulse width limited by safe operating area

**Table 3. Thermal data**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK/ TO-247	TO-220FP	
R <sub>thj-case</sub>	Thermal resistance junction-case max	0.83	3.6	°C/W
R <sub>thj-a</sub>	Thermal resistance junction-ambient max	62.5		°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purpose	300		°C

**Table 4. Avalanche characteristics**

Symbol	Parameter	Value	Unit
I <sub>AS</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>J</sub> Max)	2.5	A
E <sub>AS</sub>	Single pulse avalanche energy (starting T <sub>J</sub> =25°C, I <sub>d</sub> =I <sub>ar</sub> , V <sub>dd</sub> =50 V)	400	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	$I_D = 250 \mu A, V_{GS} = 0$	800			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	$\mu A$ $\mu A$
$I_{GSS}$	Gate body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30 V$			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	$V_{GS} = 10 V, I_D = 5.5 A$		0.35	0.40	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} > I_{D(on)} \times R_{DS(on)max},$ $I_D = 7.5 A$		8		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25 V, f = 1 \text{ MHz},$ $V_{GS} = 0$		1630 750 30		pF pF pF
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 640 V, I_D = 11 A$ $V_{GS} = 10 V$ (see Figure 10)		43.6 11.6 21		nC nC nC
$R_g$	Gate input resistance	$f = 1 \text{ MHz}$ Gate DC Bias = 0 Test signal level = 20 mV Open drain		2.7		$\Omega$
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 400 V, I_D = 5.5 A,$ $R_G = 4.7 \Omega, V_{GS} = 10 V$ (see Figure 17)		22 17 46 15		ns ns ns ns

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				11	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				44	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=11\text{ A}$ , $V_{GS}=0$			0.86	V
$t_{rr}$	Reverse recovery time	$I_{SD}=11\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}=50\text{ V}$ , $T_j=25\text{ }^\circ\text{C}$		612		ns
$Q_{rr}$	Reverse recovery charge			7.22		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			23.6		A
$t_{rr}$	Reverse recovery time	$I_{SD}=11\text{ A}$ , $di/dt = 100\text{ A}/\mu\text{s}$ , $V_{DD}=50\text{ V}$ , $T_j=150\text{ }^\circ\text{C}$		970		ns
$Q_{rr}$	Reverse recovery charge			11.25		$\mu\text{C}$
$I_{RRM}$	Reverse recovery current			23.2		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 / D<sup>2</sup>PAK / TO-247

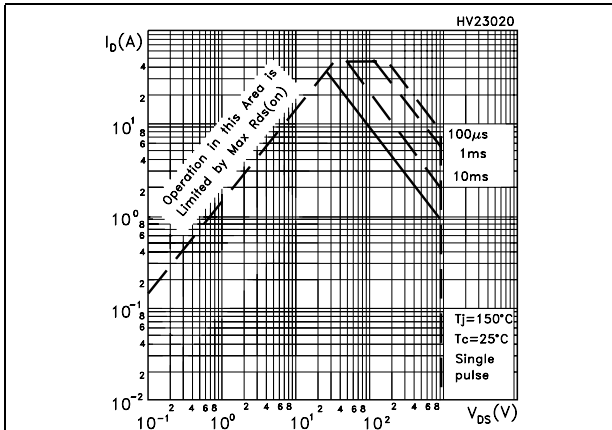


Figure 3. Thermal impedance for TO-220 / D<sup>2</sup>PAK / TO-247

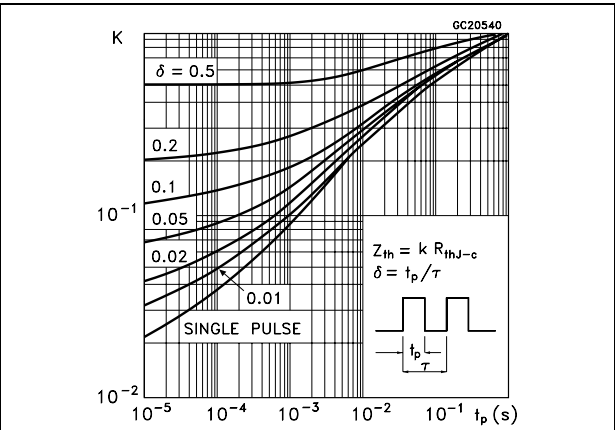


Figure 4. Safe operating area for TO-220FP

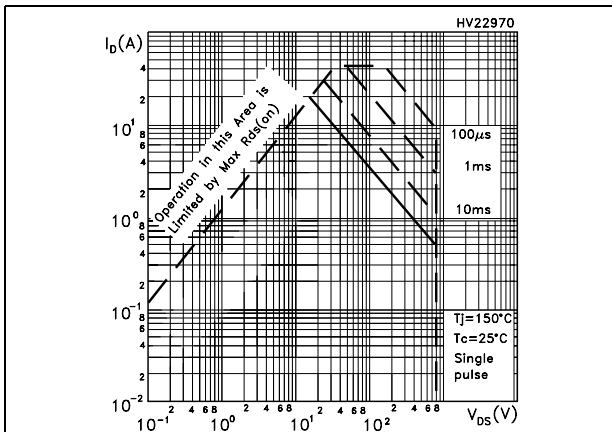


Figure 5. Thermal impedance for TO-220FP

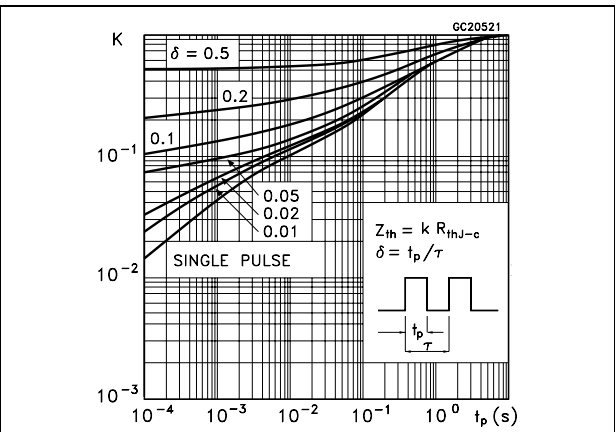


Figure 6. Output characteristics

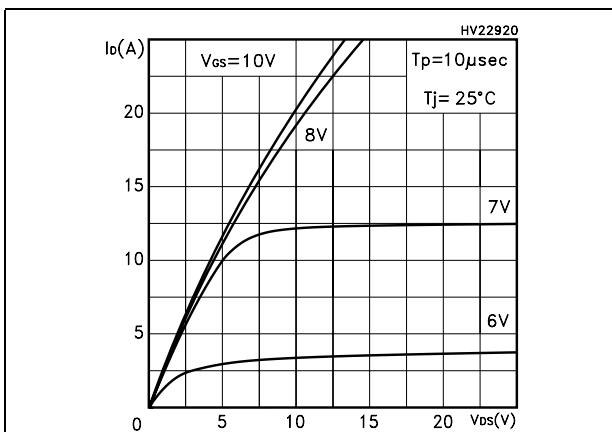


Figure 7. Output characteristics

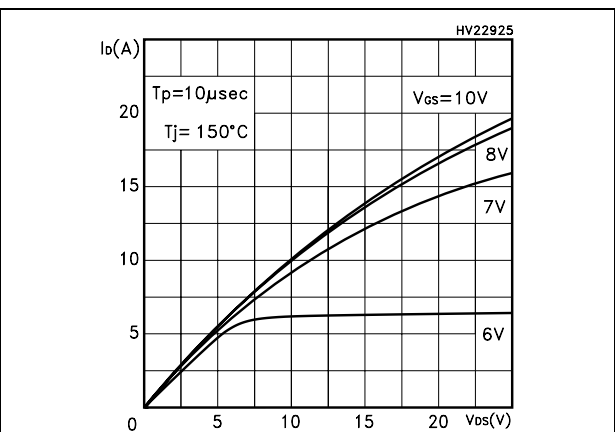


Figure 8. Transfer characteristics

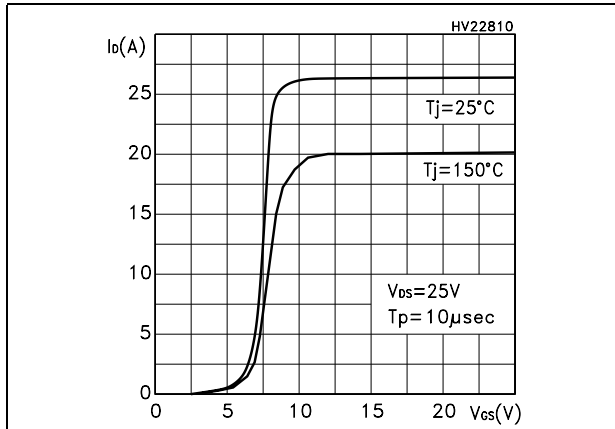


Figure 9. Transconductance

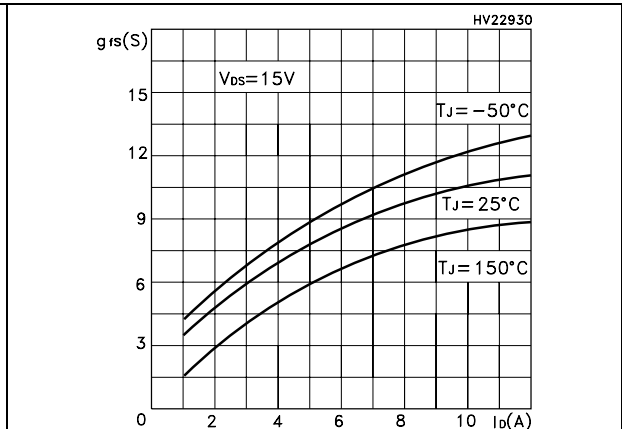


Figure 10. Gate charge vs gate-source voltage

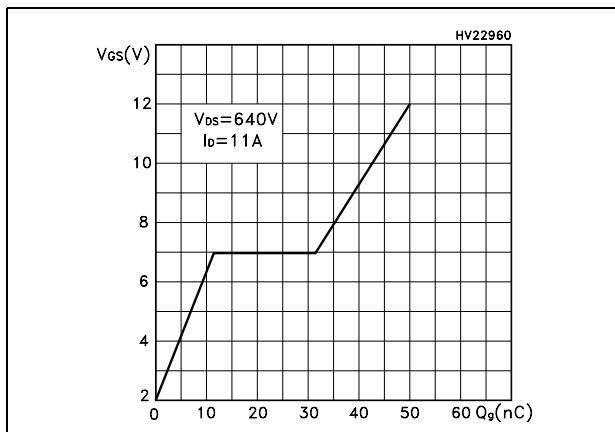


Figure 11. Capacitance variations

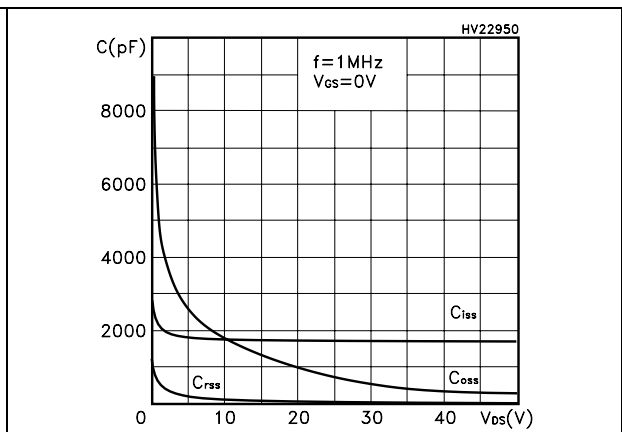


Figure 12. Normalized gate threshold voltage vs temperature

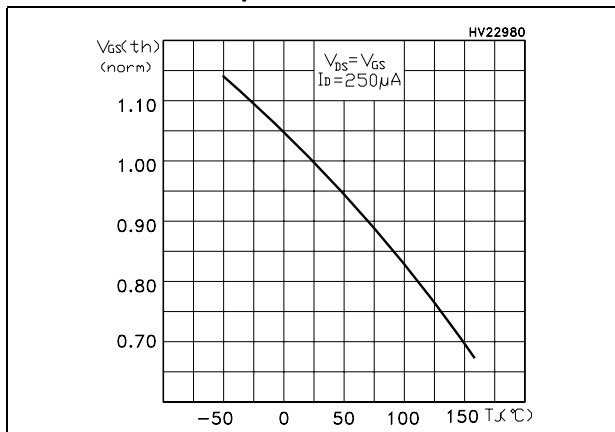


Figure 13. Static drain-source on resistance

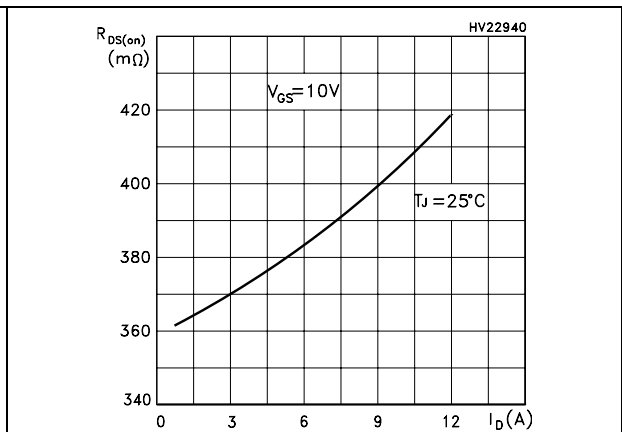


Figure 14. Source-drain diode forward characteristics

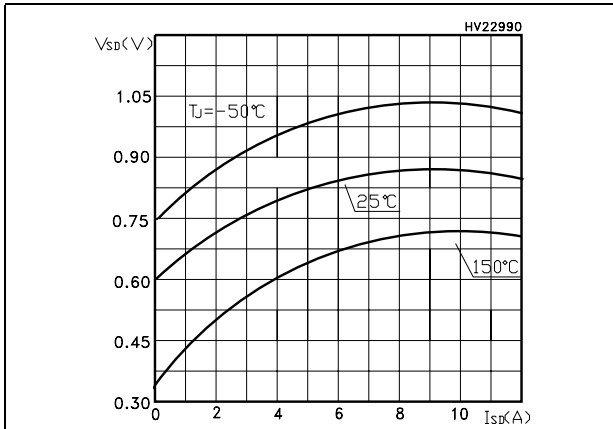


Figure 15. Normalized on resistance vs temperature

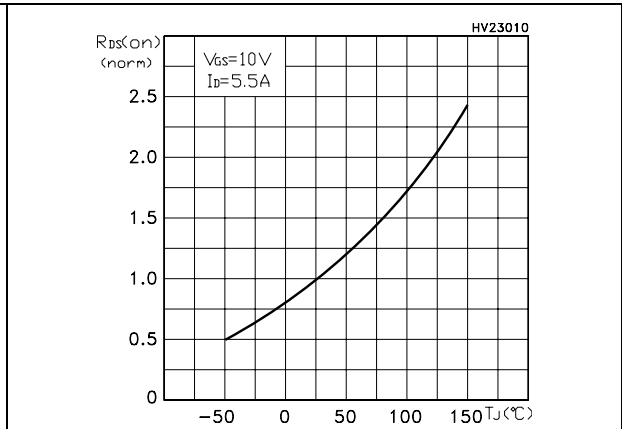
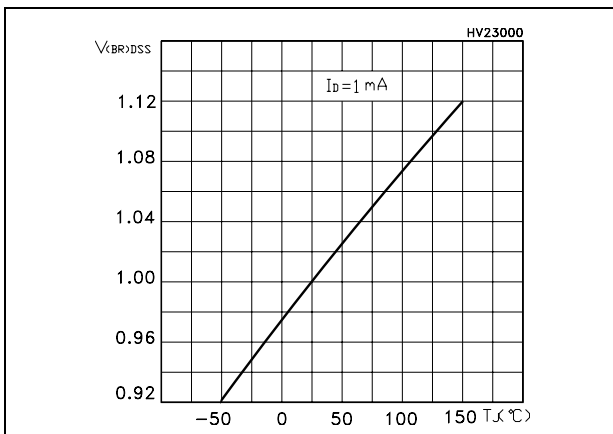


Figure 16. Normalized  $B_{VDSS}$  vs temperature





### 3 Test circuit

Figure 17. Switching times test circuit for resistive load



Figure 18. Gate charge test circuit



Figure 19. Test circuit for inductive load switching and diode recovery times



Figure 20. Unclamped inductive load test circuit



Figure 21. Unclamped inductive waveform



Figure 22. Switching time waveform

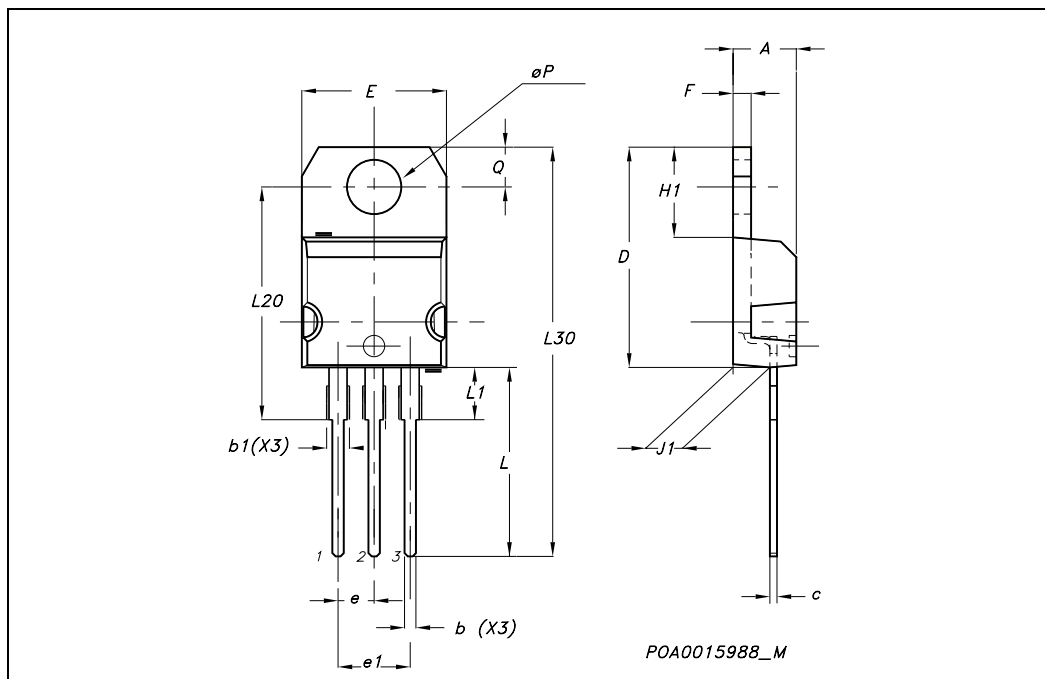


## 4 Package mechanical data

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)

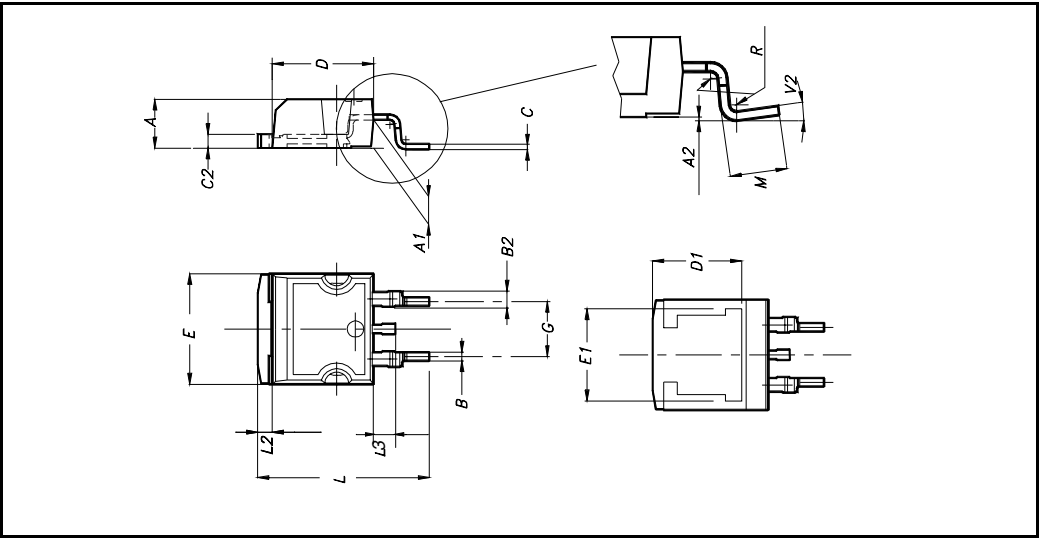
**TO-220 MECHANICAL DATA**

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	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
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		0.052
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	
øP	3.75		3.85	0.147		0.151
Q	2.65		2.95	0.104		0.116



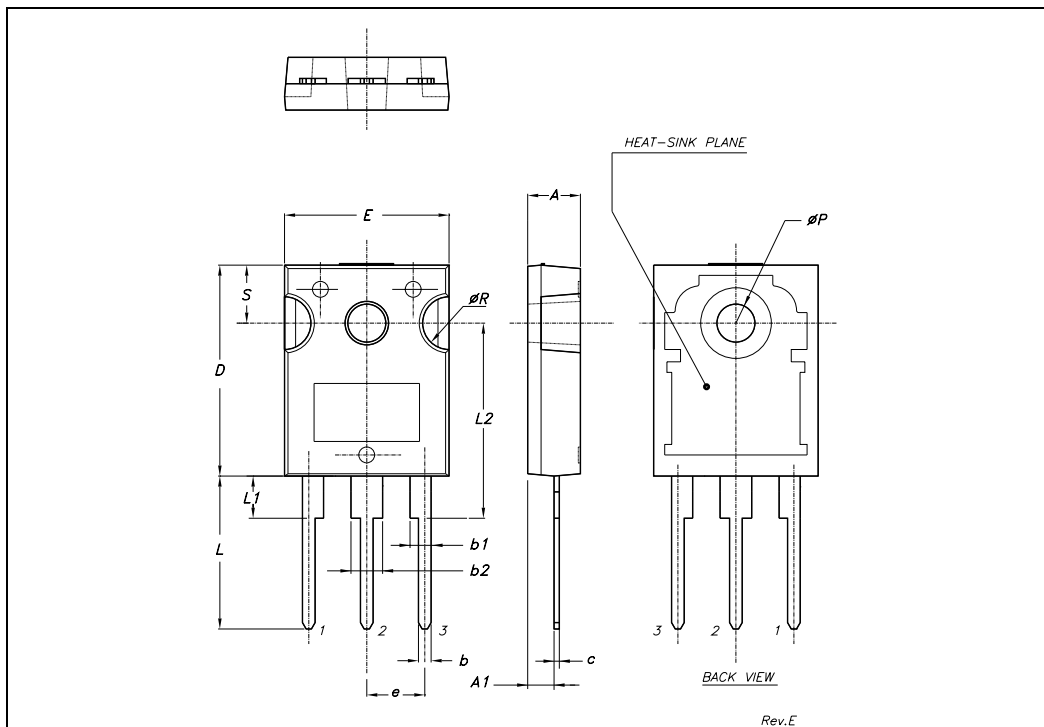
**D<sup>2</sup>PAK MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



**TO-247 MECHANICAL DATA**

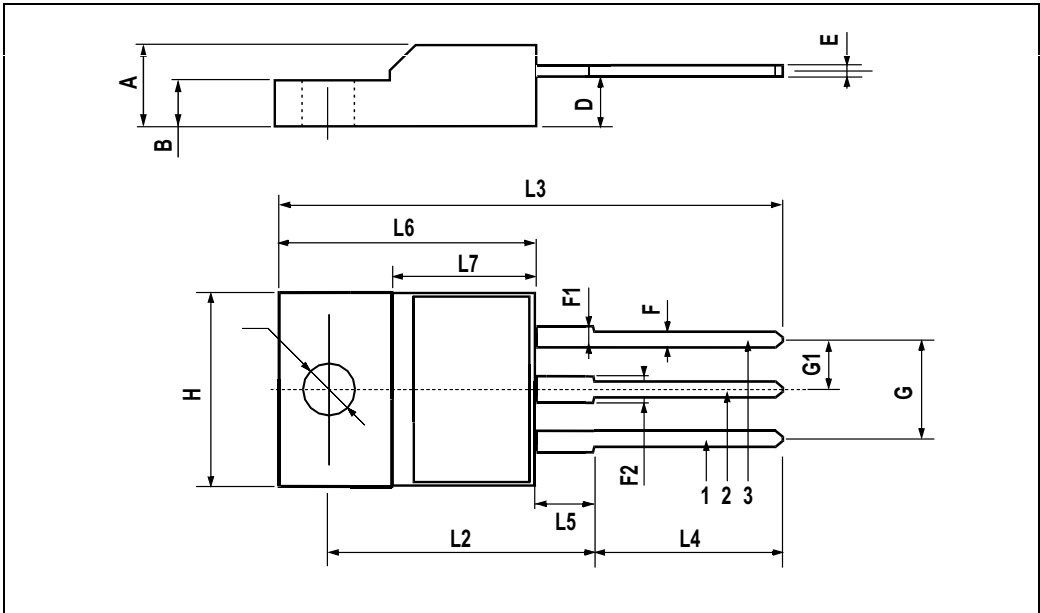
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
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	



Rev.E

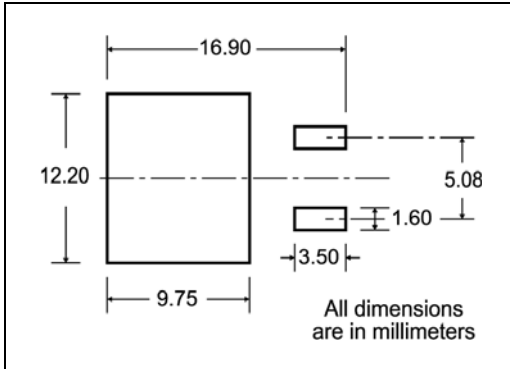
**TO-220FP MECHANICAL DATA**

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	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
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	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126



## 5 Packaging mechanical data

### D<sup>2</sup>PAK FOOTPRINT



### TAPE AND REEL SHIPMENT

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start

25mm min. width

#### REEL MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

#### TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

TRL

FEED DIRECTION

Bending radius R min.

\* on sales type

## 6 Revision history

**Table 8. Revision history**

Date	Revision	Changes
30-Sep-2004	4	Preliminary version
26-Nov-2005	5	Complete version
07-Apr-2006	6	Modified value on <a href="#">Figure 8</a>
15-May-2006	7	New dv/dt value on <a href="#">Table 5</a>
20-Jul-2006	8	The document has been reformatted
20-Dec-2007	9	Updated $I_D$ value on <a href="#">Table 2: Absolute maximum ratings</a>



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