



# STB180N55F3 STP180N55F3

N-channel 55V - 3.2mΩ - 120A - D<sup>2</sup>PAK/TO-220  
STripFET™ Power MOSFET

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>	P <sub>w</sub>
STB180N55F3	55V	3.5mΩ	120A <sup>(1)</sup>	330W
STP180N55F3	55V	3.8mΩ	120A <sup>(1)</sup>	330W

1. Value limited by wire bonding

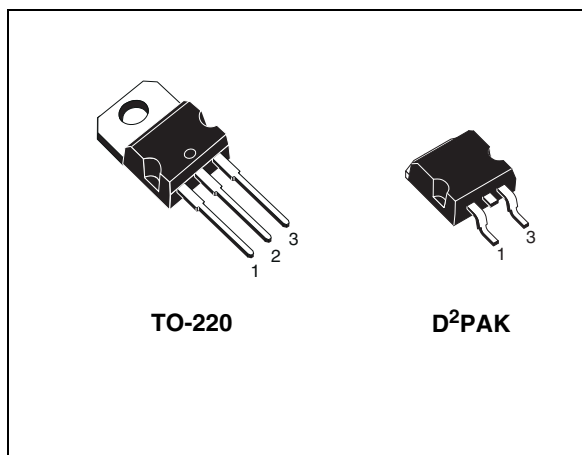
- Ultra low on-resistance
- 100% avalanche tested

## Description

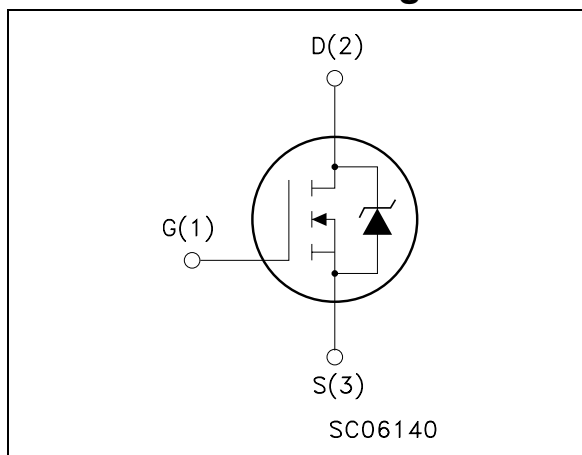
This n-channel enhancement mode Power MOSFET is the latest refinement of STMicroelectronics unique “single feature size™” strip-based process with less critical alignment steps and therefore a remarkable manufacturing reproducibility. The resulting transistor shows extremely high packing density for low on resistance, rugged avalanche characteristics and low gate charge.

## Application

- Switching applications



## Internal schematic diagram



## Order codes

Part number	Marking	Package	Packaging
STB180N55F3	180N55F3	D <sup>2</sup> PAK	Tape & reel
STP180N55F3	180N55F3	TO-220	Tube

# Contents

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# 1 Electrical ratings

**Table 1. Absolute maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source voltage ( $V_{GS}=0$ )	55	V
$V_{GS}$	Gate-source voltage	$\pm 20$	V
$I_D^{(1)}$	Drain current (continuous) at $T_C = 25^\circ\text{C}$	120	A
$I_D^{(1)}$	Drain current (continuous) at $T_C=100^\circ\text{C}$	120	A
$I_{DM}^{(2)}$	Drain current (pulsed)	480	A
$P_{TOT}$	Total dissipation at $T_C = 25^\circ\text{C}$	330	W
	Derating factor	2.2	W/ $^\circ\text{C}$
$dv/dt^{(3)}$	Peak diode recovery voltage slope	11	V/ns
$E_{AS}^{(4)}$	Single pulse avalanche energy	1000	mJ
$T_j$ $T_{stg}$	Operating junction temperature storage temperature	-55 To 175	$^\circ\text{C}$

1. Current limited by package.
2. Pulse width limited by safe operating area.
3.  $I_{SD} \leq 120\text{A}$ ,  $di/dt \leq 900\text{A}/\mu\text{s}$ ,  $V_{DD} \leq V_{(BR)DSS}$ ,  $T_J \leq T_{JMAX}$
4. Starting  $T_j=25^\circ\text{C}$ ,  $I_d=60\text{A}$ ,  $V_{dd}=40\text{V}$  (see [Figure 15](#) and [Figure 16](#))

**Table 2. Thermal data**

Symbol	Parameter	TO-220	D <sup>2</sup> PAK	Unit
$R_{thj-case}$	Thermal resistance junction-case	0.45		$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal resistance junction-ambient max	62.5	--	$^\circ\text{C}/\text{W}$
$R_{thj-pcb}^{(1)}$	Thermal resistance junction-ambient max	--	50	$^\circ\text{C}/\text{W}$
$T_l$	Maximum lead temperature for soldering purpose	300		$^\circ\text{C}$

1. When mounted on FR-4 board, on 1inch<sup>2</sup>, 2oz Cu.

## 2 Electrical characteristics

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

**Table 3. On/off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 250\mu A, V_{GS} = 0$	55			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 ( $V_{DS} = 0$ )	$V_{GS} = \pm 20V$			$\pm 200$	nA
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}, I_D = 250\mu A$	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10V, I_D = 60A$ <b>D<sup>2</sup>PAK</b> <b>TO-220</b>		2.9 3.2	3.5 3.8	$m\Omega$ $m\Omega$

**Table 4. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs}^{(1)}$	Forward transconductance	$V_{DS} = 15V, I_D = 60A$		150		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25V, f = 1MHz,$ $V_{GS} = 0$		6800 1450 15		pF pF pF
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on delay time Rise time Turn-off delay time Fall time	$V_{DD} = 27.5V, I_D = 60A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see <a href="#">Figure 12</a> , <a href="#">Figure 17</a> )		25 150 110 50		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 44V, I_D = 120A,$ $V_{GS} = 10V,$ (see <a href="#">Figure 13</a> )		100 30 26		nC nC nC

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

**Table 5. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}^{(1)}$	Source-drain current Source-drain current (pulsed)				120 480	A A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD}=120A, V_{GS}=0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_{SD}=120A,$ $di/dt = 100A/\mu s,$ $V_{DD}=35V, T_j=150^\circ C$ (see <a href="#">Figure 14</a> )		60 0.11 3.5		ns $\mu C$ 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

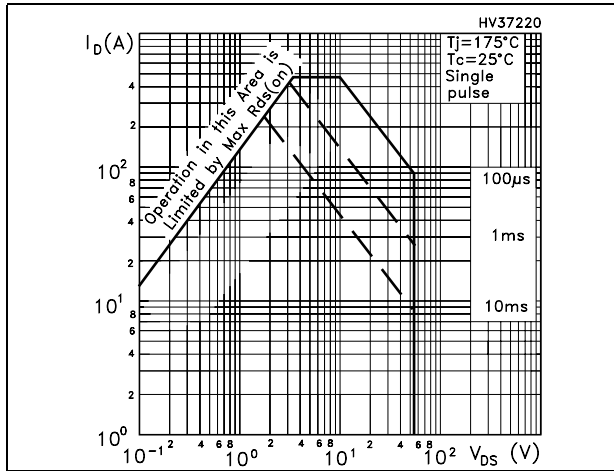


Figure 2. Thermal impedance

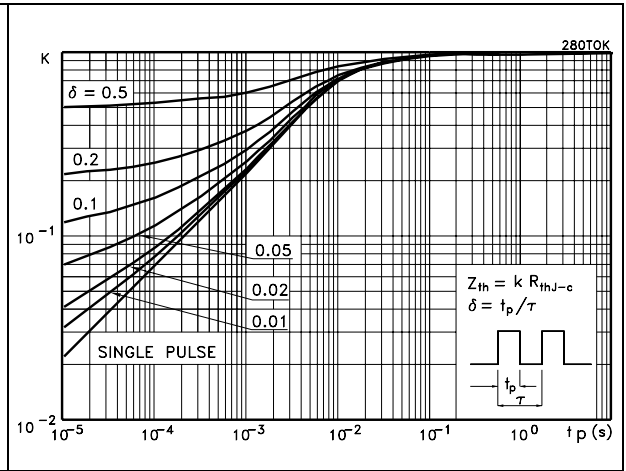


Figure 3. Output characteristics

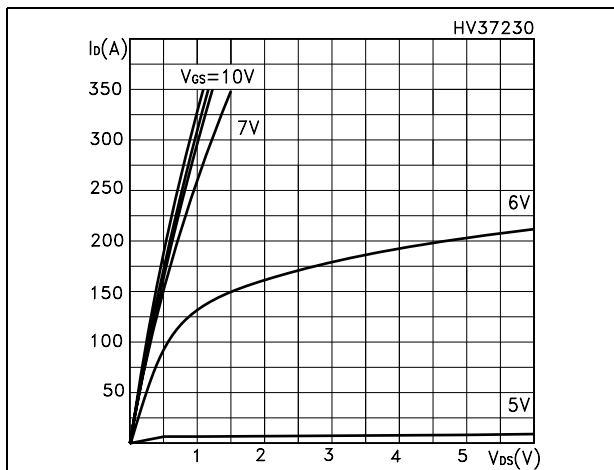


Figure 4. Transfer characteristics

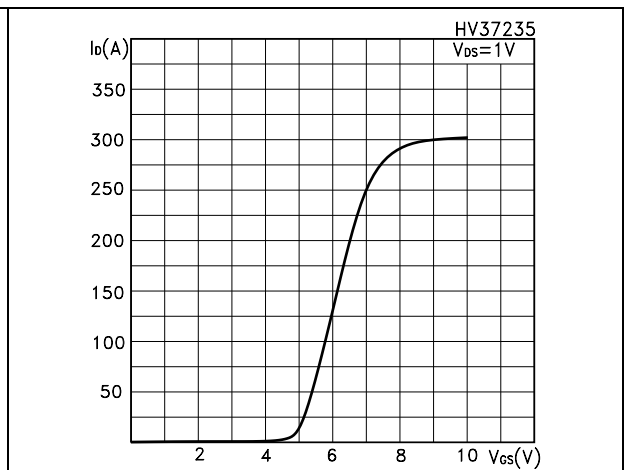


Figure 5. Normalized  $B_{V_{DS}}$  vs temperature

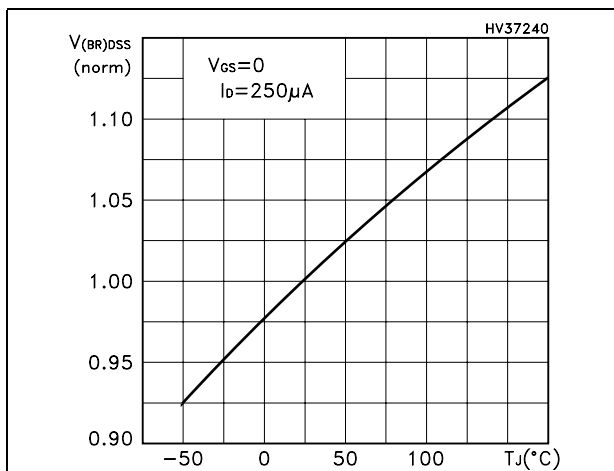


Figure 6. Static drain-source on resistance

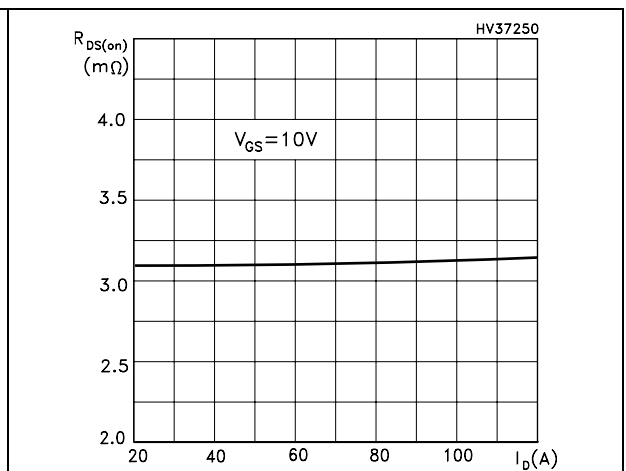


Figure 7. Gate charge vs gate-source voltage Figure 8. Capacitance variations

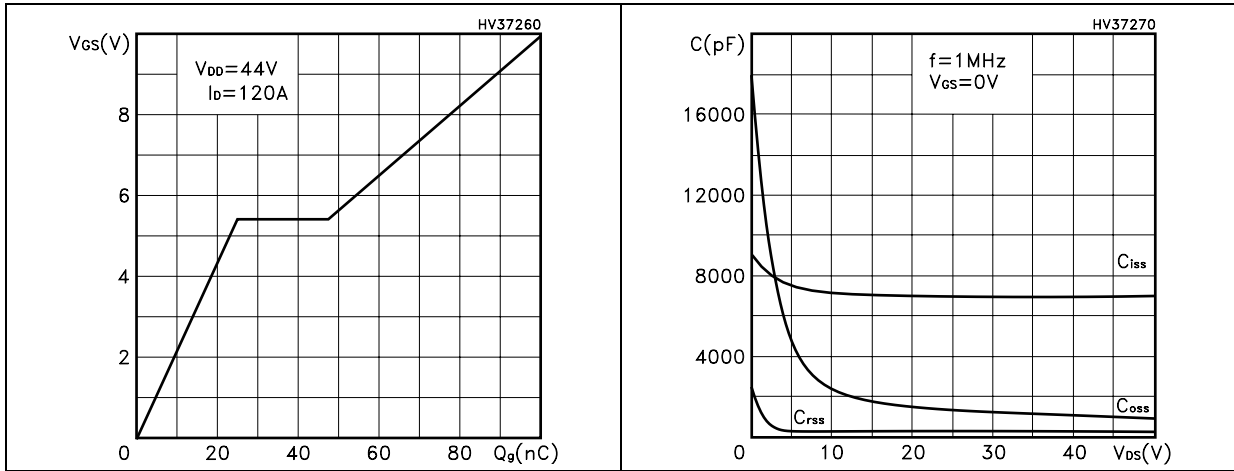


Figure 9. Normalized gate threshold voltage vs temperature Figure 10. Normalized on resistance vs temperature

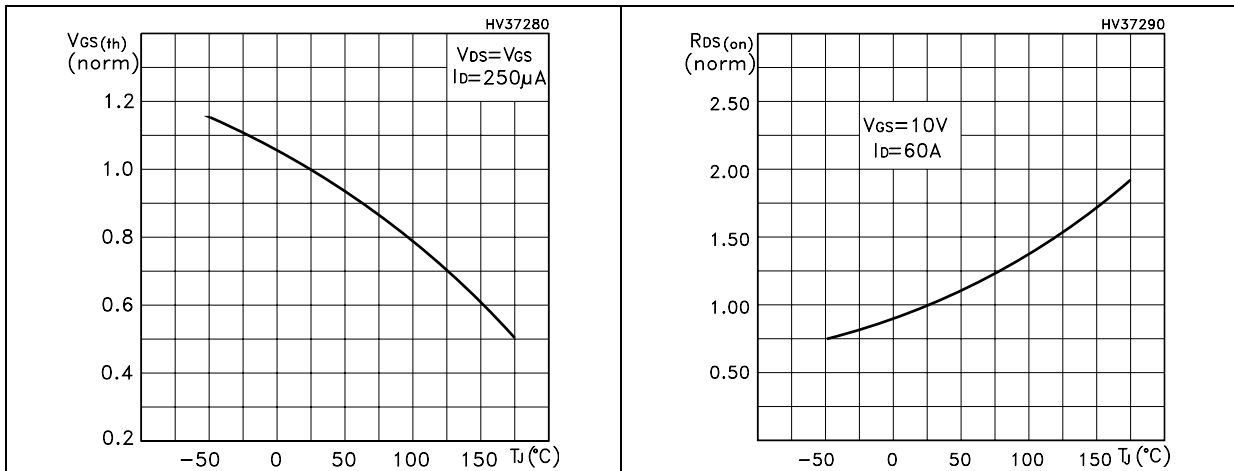
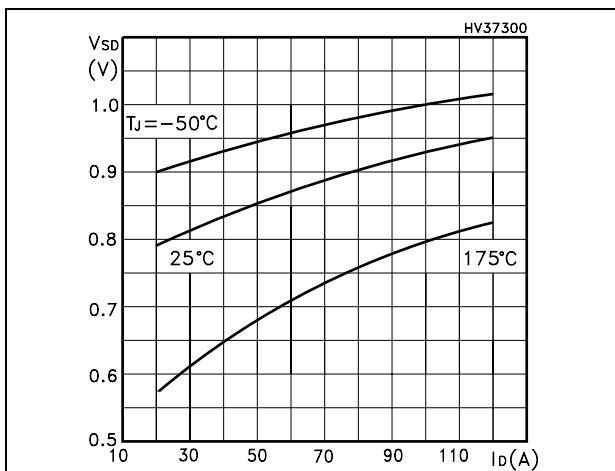


Figure 11. Source-drain diode forward characteristics



### 3 Test circuit

Figure 12. Switching times test circuit for resistive load

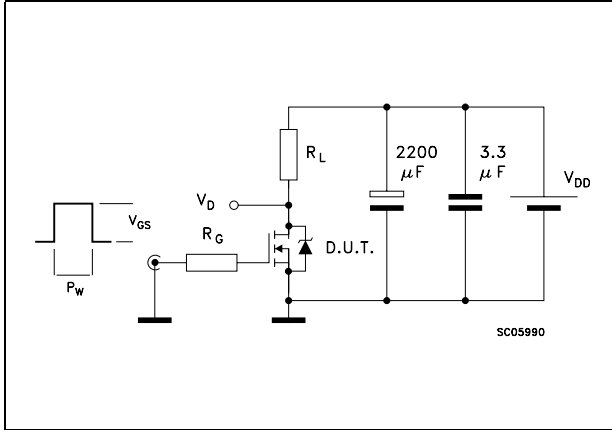


Figure 13. Gate charge test circuit



Figure 14. Test circuit for inductive load switching and diode recovery times

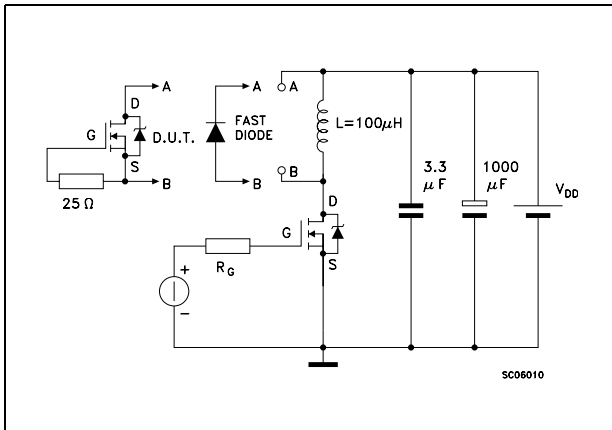


Figure 15. Unclamped Inductive load test circuit



Figure 16. Unclamped inductive waveform

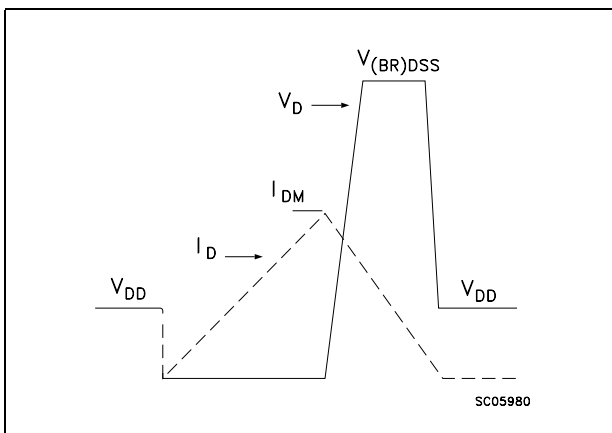


Figure 17. Switching time waveform



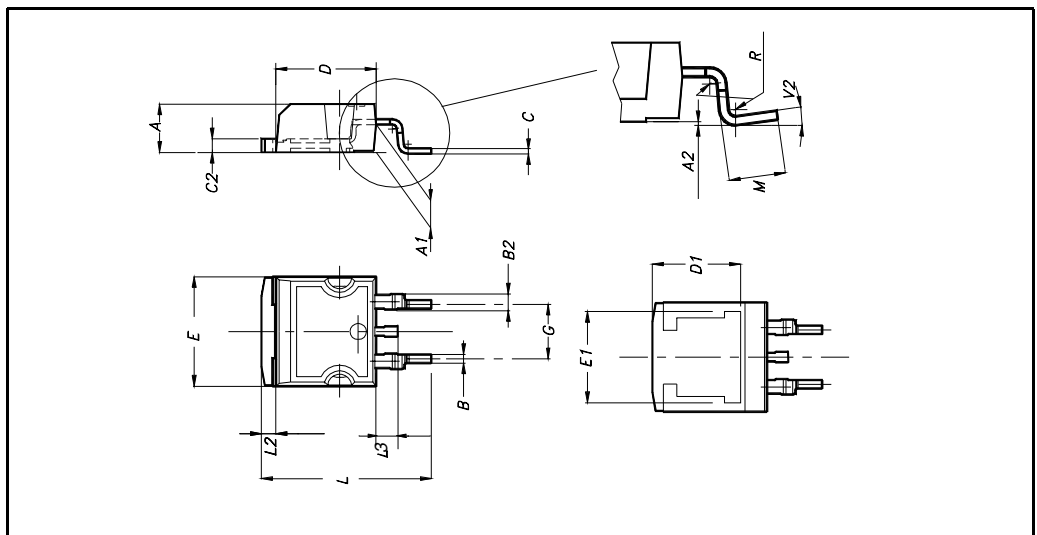


## 4 Package mechanical data

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)

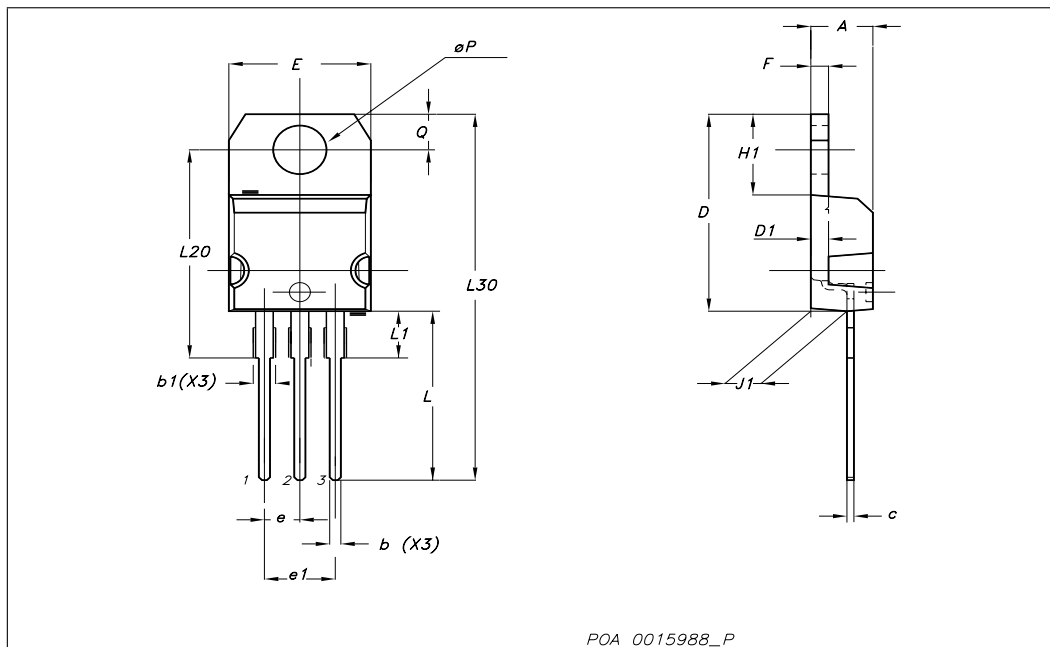
**D<sup>2</sup>PAK MECHANICAL DATA**

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-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	0.49		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



# 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 2.5mm min. width

G measured at hub

### 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

### 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

FEED DIRECTION

Bending radius R min.

\* on sales type

## 6 Revision history

**Table 6. Revision history**

<b>Date</b>	<b>Revision</b>	<b>Changes</b>
31-Jan-2007	1	First version
01-Jun-2007	2	Complete version

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