



# STB3N62K3, STD3N62K3, STF3N62K3 STP3N62K3, STU3N62K3

N-channel 620 V, 2.2  $\Omega$  , 2.7 A SuperMESH3™ Power MOSFET  
D<sup>2</sup>PAK, DPAK, TO-220FP, TO-220, IPAK

## Features

Type	V <sub>DSS</sub>	R <sub>DS(on) max</sub>	I <sub>D</sub>	P <sub>w</sub>
STB3N62K3	620 V	< 2.5 $\Omega$	2.7 A	45 W
STD3N62K3	620 V	< 2.5 $\Omega$	2.7 A	45 W
STF3N62K3	620 V	< 2.5 $\Omega$	2.7 A <sup>(1)</sup>	20 W
STP3N62K3	620 V	< 2.5 $\Omega$	2.7 A	45 W
STU3N62K3	620 V	< 2.5 $\Omega$	2.7 A	45 W

1. Limited by package

- 100% avalanche tested
- Extremely high dv/dt capability
- Very low intrinsic capacitances
- Improved diode reverse recovery characteristics
- Zener-protected

## Application

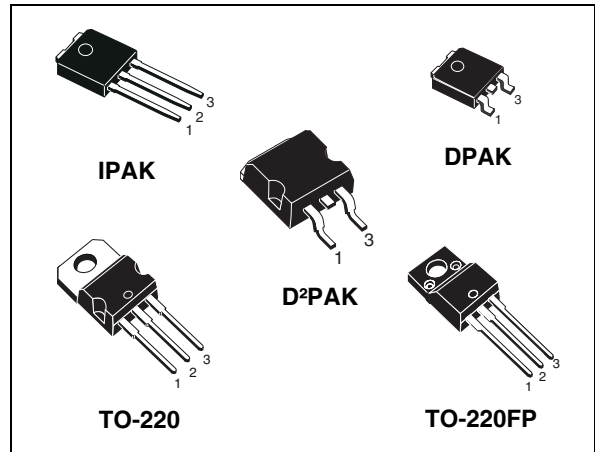
- Switching applications

## Description

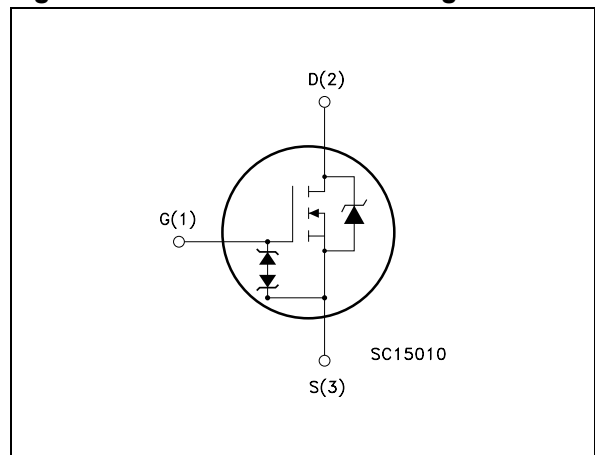
The new SuperMESH3™ series is obtained through the combination of a further fine tuning of ST's well established strip-based PowerMESH™ layout with a new optimization of the vertical structure. In addition to reducing on-resistance significantly versus previous generation, special attention has been taken to ensure a very good dv/dt capability and higher margin in breakdown voltage for the most demanding application.

**Table 1. Device summary**

Order codes	Marking	Package	Packaging
STB3N62K3	6N62K3	D <sup>2</sup> PAK	Tape and reel
STD3N62K3	6N62K3	DPAK	Tape and reel
STF3N62K3	6N62K3	TO-220FP	Tube
STP3N62K3	6N62K3	TO-220	Tube
STU3N62K3	6N62K3	IPAK	Tube



**Figure 1. Internal schematic diagram**



## Contents

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# 1 Electrical ratings

**Table 2. Absolute maximum ratings**

Symbol	Parameter	Value			Unit
		TO-220 D <sup>2</sup> PAK	DPAK IPAK	TO-220FP	
V <sub>DS</sub>	Drain-source voltage (V <sub>GS</sub> = 0)	620			V
V <sub>GS</sub>	Gate- source voltage	± 30			V
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 25 °C	2.7		2.7 <sup>(1)</sup>	A
I <sub>D</sub>	Drain current (continuous) at T <sub>C</sub> = 100 °C	1.7		1.7 <sup>(1)</sup>	A
I <sub>DM</sub> <sup>(2)</sup>	Drain current (pulsed)	10.8		10.8 <sup>(1)</sup>	A
P <sub>TOT</sub>	Total dissipation at T <sub>C</sub> = 25 °C	45		20	W
	Derating factor	0.36		0.16	W/°C
V <sub>ESD(G-S)</sub>	Gate source ESD (HBM-C = 100 pF, R = 1.5 kΩ)	2500			V
dv/dt <sup>(3)</sup>	Peak diode recovery voltage slope	9			V/ns
V <sub>ISO</sub>	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T <sub>C</sub> = 25 °C)	--		2500	V
T <sub>stg</sub>	Storage temperature	-55 to 150			°C
T <sub>j</sub>	Max. operating junction temperature	150			°C

1. Limited by package
2. Pulse width limited by safe operating area
3. I<sub>SD</sub> ≤ 2.7 A, di/dt ≤ 200 A/μs, V<sub>DD</sub> = 80% V<sub>(BR)DSS</sub>

**Table 3. Thermal data**

Symbol	Parameter	TO-220	D <sup>2</sup> PAK	DPAK	IPAK	TO-220FP	Unit
R <sub>thj-case</sub>	Thermal resistance junction-case max	2.78				6.25	°C/W
R <sub>thj-pcb</sub>	Thermal resistance junction-pcb max	--	50		--	--	°C/W
R <sub>thj-amb</sub>	Thermal resistance junction-amb max	62.5		100		62.5	°C/W
T <sub>l</sub>	Maximum lead temperature for soldering purpose	300					°C

**Table 4. Avalanche characteristics**

Symbol	Parameter	Max value	Unit
I <sub>AR</sub>	Avalanche current, repetitive or not-repetitive (pulse width limited by T <sub>j</sub> max)	2.7	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)	100	mJ



## 2 Electrical characteristics

( $T_C = 25\text{ °C}$  unless otherwise specified)

**Table 5. On /off states**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$	620			V
$I_{DSS}$	Zero gate voltage drain current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max rating}$ $V_{DS} = \text{Max rating}$ , $T_C = 125\text{ °C}$			1 50	$\mu\text{A}$ $\mu\text{A}$
$I_{GSS}$	Gate-body leakage current ( $V_{DS} = 0$ )	$V_{GS} = \pm 20\text{ V}$			$\pm 10$	$\mu\text{A}$
$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ , $I_D = 50\text{ }\mu\text{A}$	3	3.75	4.5	V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10\text{ V}$ , $I_D = 1.4\text{ A}$		2.2	2.5	$\Omega$

**Table 6. Dynamic**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$g_{fs(1)}$	Forward transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 1.4\text{ A}$		2.1		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input capacitance Output capacitance Reverse transfer capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		385 55 6		pF pF pF
$C_{OSS\ eq(1)}$	Equivalent output capacitance	$V_{GS} = 0$ , $V_{DS} = 0\text{ to }496\text{ V}$		32.3		pF
$R_G$	Intrinsic gate resistance	$f = 1\text{ MHz}$ open drain		10		$\Omega$
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total gate charge Gate-source charge Gate-drain charge	$V_{DD} = 496\text{ V}$ , $I_D = 2.7\text{ A}$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 17</a> )		13 2.5 7.5		nC nC nC

1.  $C_{OSS\ eq}$  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 7. 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	$V_{DD} = 310\text{ V}$ , $I_D = 1.7\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see <a href="#">Figure 16</a> )		9 6.8 22 15.6		ns ns ns ns

**Table 8. Source drain diode**

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain current				2.7	A
$I_{SDM}^{(1)}$	Source-drain current (pulsed)				10.8	A
$V_{SD}^{(2)}$	Forward on voltage	$I_{SD} = 2.7 \text{ A}, V_{GS} = 0$			1.6	V
$t_{rr}$	Reverse recovery time	$I_{SD} = 2.7 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}$ (see <a href="#">Figure 21</a> )		190		ns
$Q_{rr}$	Reverse recovery charge			825		nC
$I_{RRM}$	Reverse recovery current			9		A
$t_{rr}$	Reverse recovery time	$I_{SD} = 2.7 \text{ A}, di/dt = 100 \text{ A}/\mu\text{s}$ $V_{DD} = 60 \text{ V}, T_j = 150 \text{ }^\circ\text{C}$ (see <a href="#">Figure 21</a> )		255		ns
$Q_{rr}$	Reverse recovery charge			1100		nC
$I_{RRM}$	Reverse recovery current			10		A

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

**Table 9. Gate-source Zener diode**

Symbol	Parameter	Test conditions	Min	Typ	Max	Unit
$BV_{GSO}^{(1)}$	Gate-source breakdown voltage	$I_{GS} = \pm 1 \text{ mA}$ (open drain)	30			V

1. The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components

## 2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220, IPAK, DPAK, D<sup>2</sup>PAK

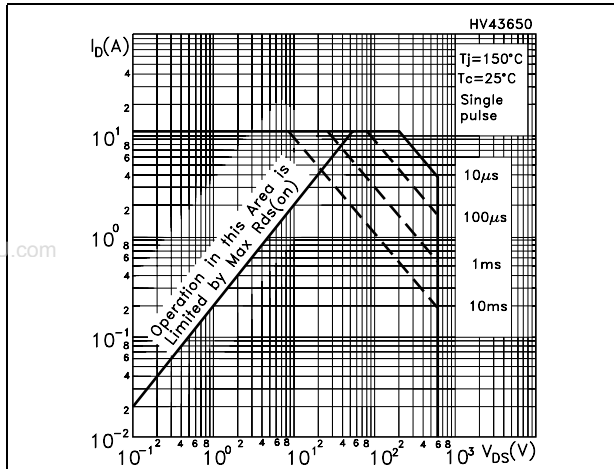


Figure 3. Thermal impedance for TO-220, IPAK, DPAK, D<sup>2</sup>PAK

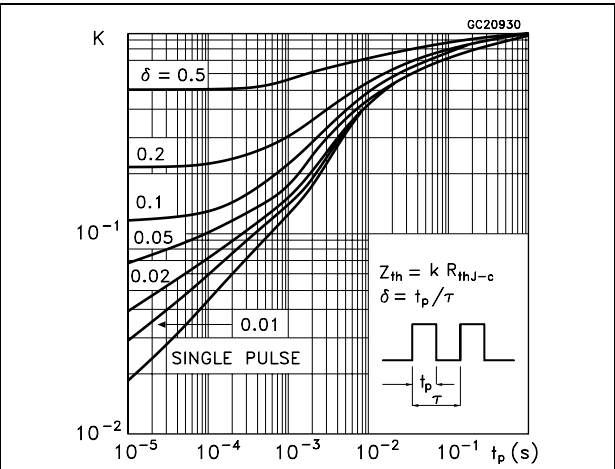


Figure 4. Safe operating area for TO-220FP

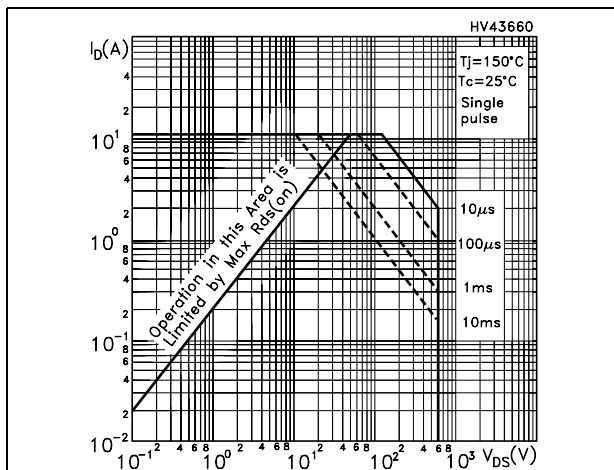


Figure 5. Thermal impedance for TO-220FP

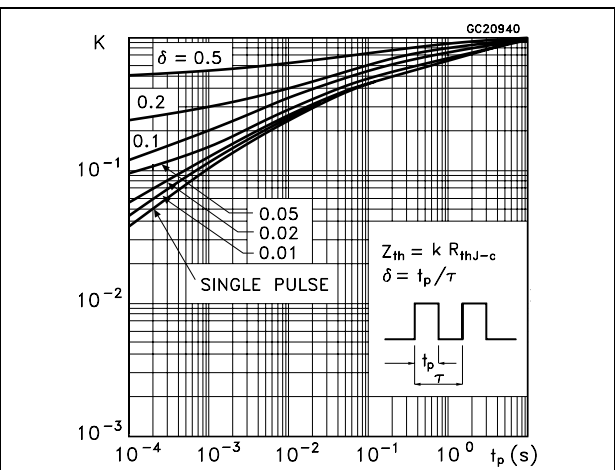


Figure 6. Output characteristics

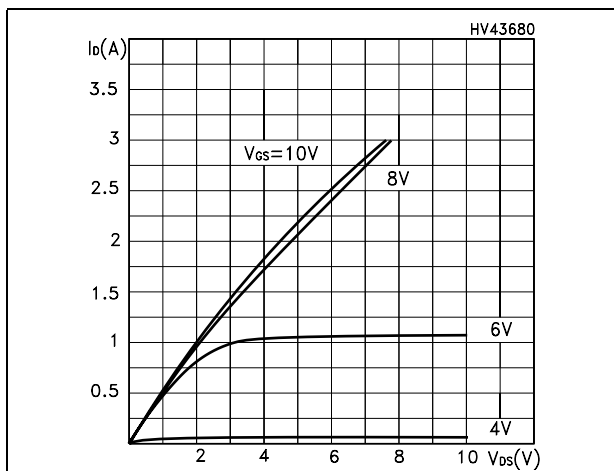


Figure 7. Transfer characteristics

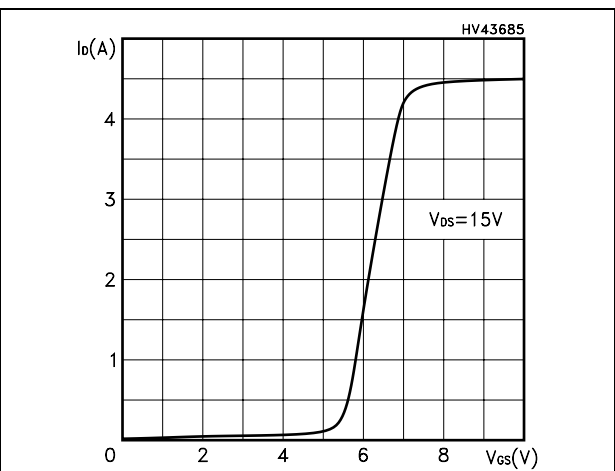


Figure 8. Normalized  $BV_{DSS}$  vs temperature      Figure 9. Static drain-source on resistance

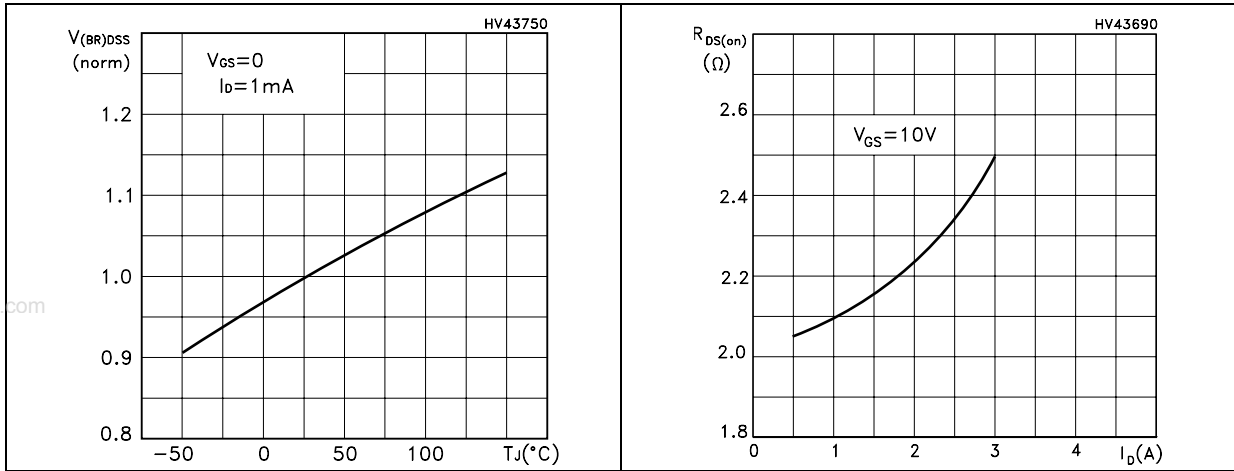


Figure 10. Gate charge vs gate-source voltage      Figure 11. Capacitance variations

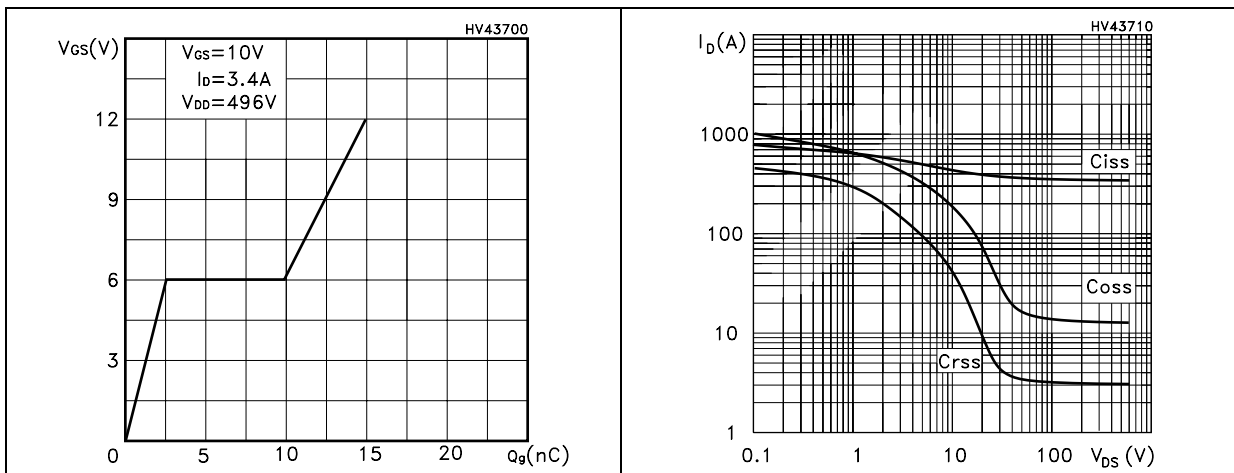


Figure 12. Normalized gate threshold voltage vs temperature      Figure 13. Normalized on resistance vs temperature

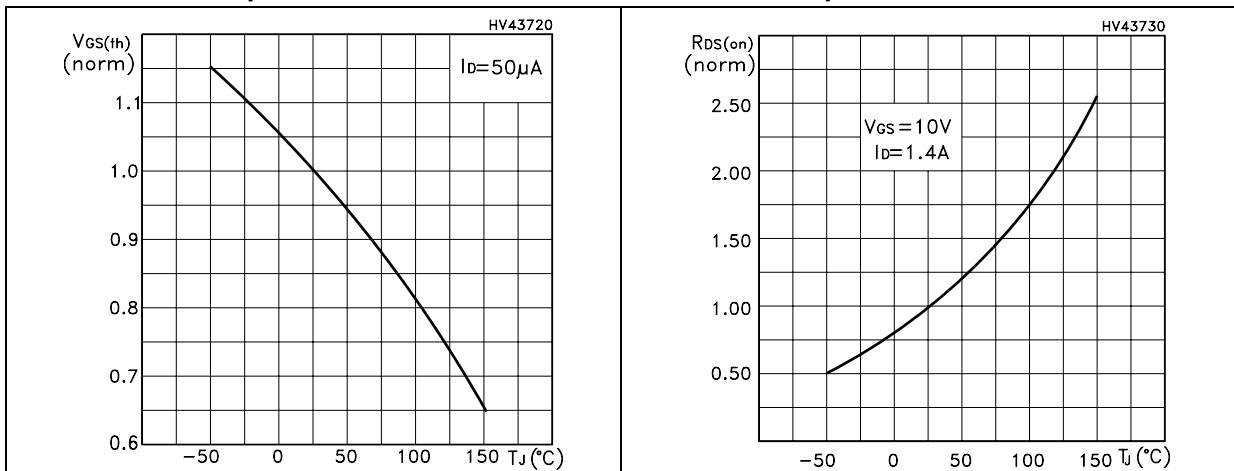


Figure 14. Source-drain diode forward characteristics

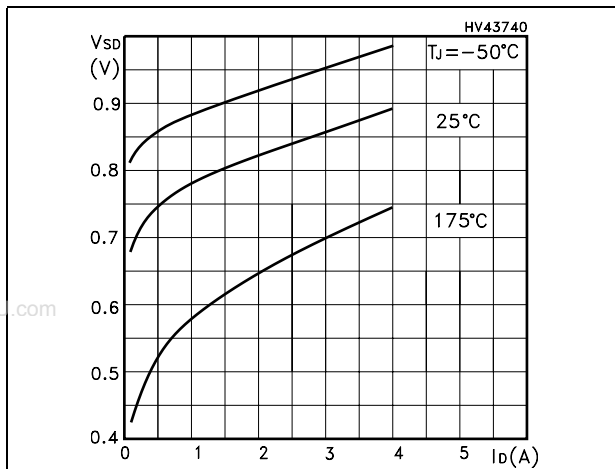
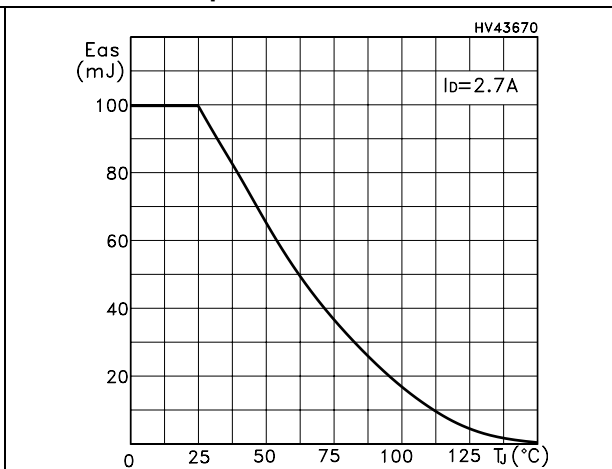


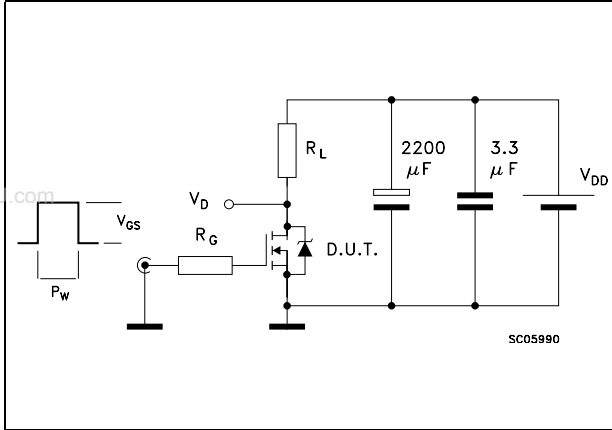
Figure 15. Maximum avalanche energy vs temperature



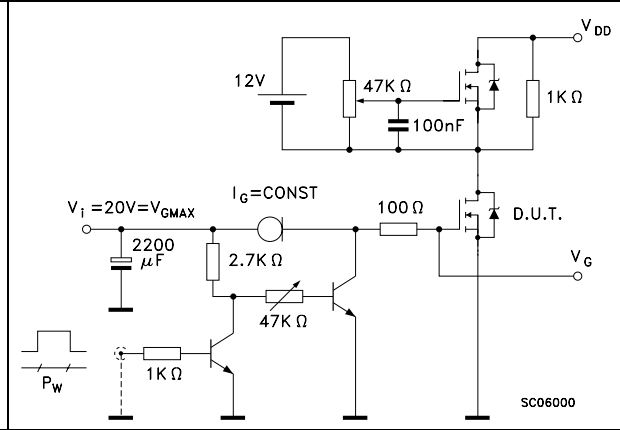


### 3 Test circuits

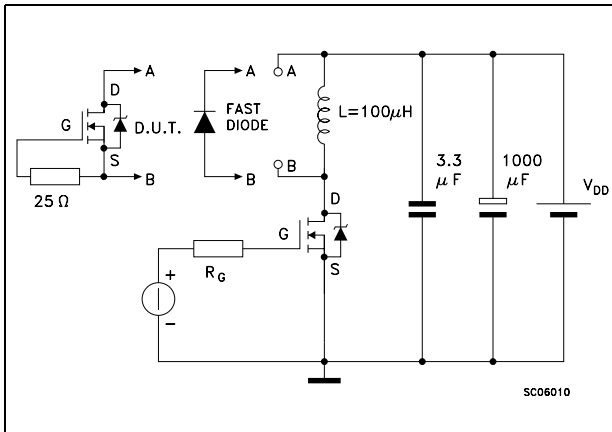
**Figure 16. Switching times test circuit for resistive load**



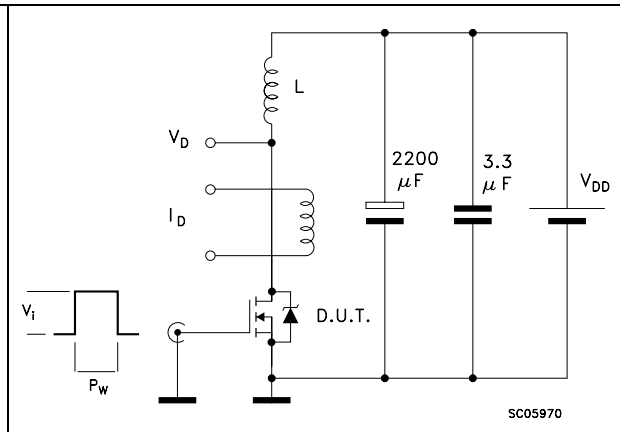
**Figure 17. Gate charge test circuit**



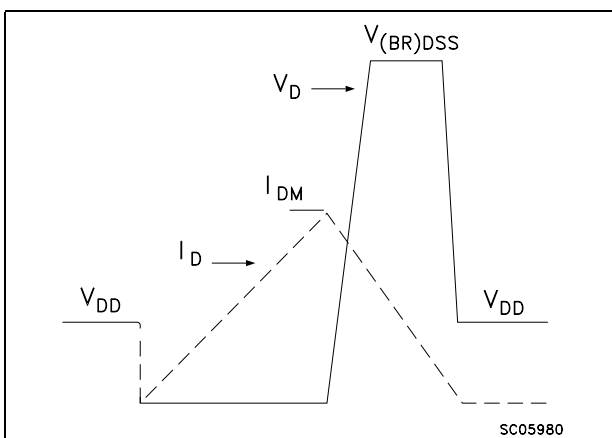
**Figure 18. Test circuit for inductive load switching and diode recovery times**



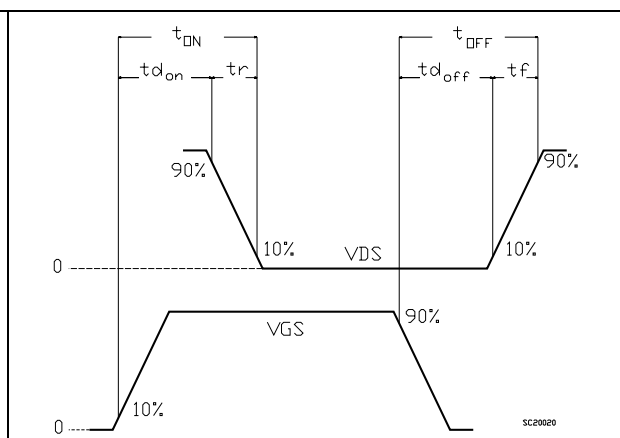
**Figure 19. Unclamped Inductive load test circuit**



**Figure 20. Unclamped inductive waveform**



**Figure 21. Switching time waveform**



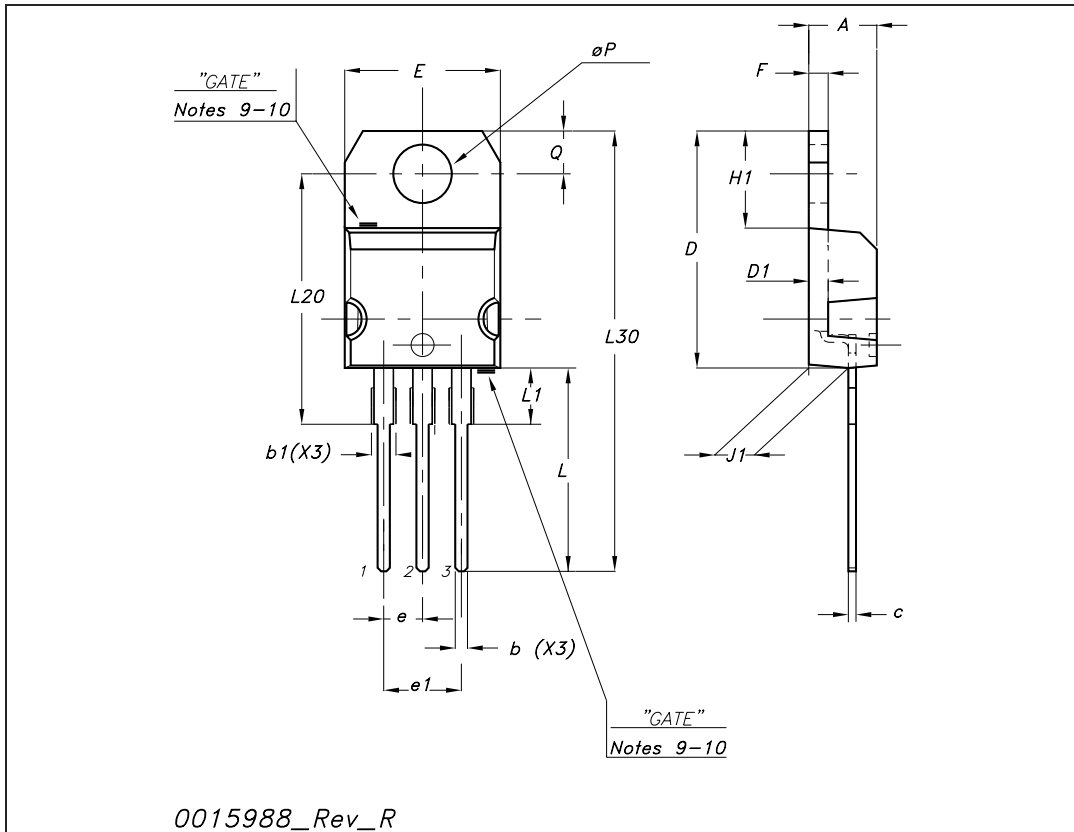
## 4 Package mechanical data

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

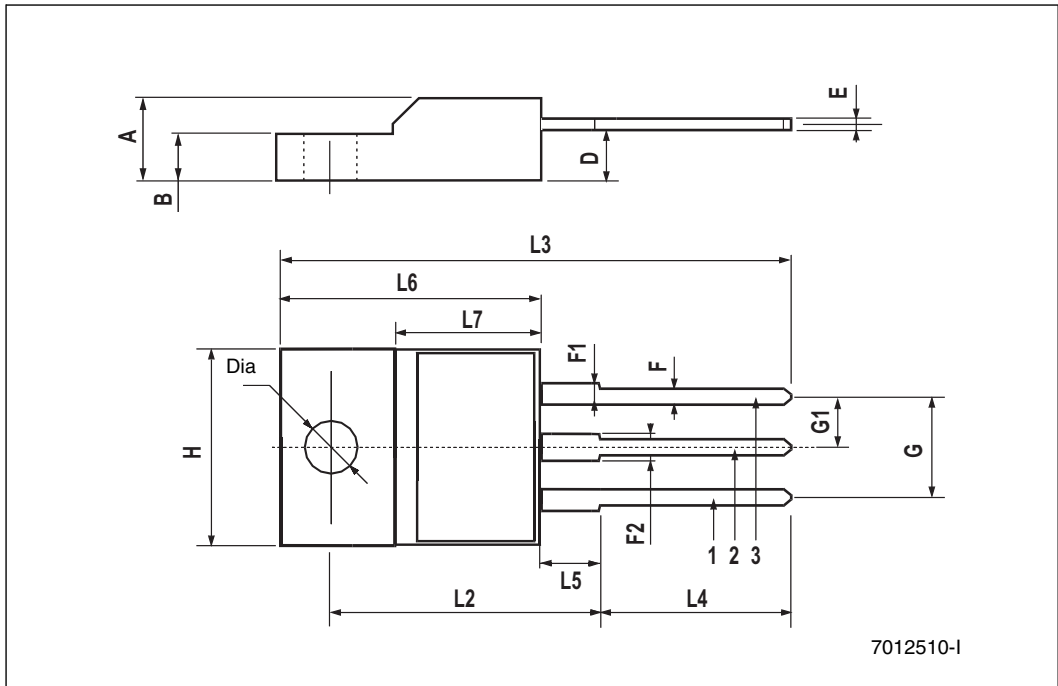
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**TO-220FP mechanical data**

Dim.	mm.			inch		
	Min.	Typ	Max.	Min.	Typ.	Max.
A	4.40		4.60	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		0.70	0.017		0.027
F	0.75		1.00	0.030		0.039
F1	1.15		1.50	0.045		0.067
F2	1.15		1.50	0.045		0.067
G	4.95		5.20	0.195		0.204
G1	2.40		2.70	0.094		0.106
H	10		10.40	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.80		10.60	0.385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.90		16.40	0.626		0.645
L7	9		9.30	0.354		0.366
Dia	3		3.2	0.118		0.126

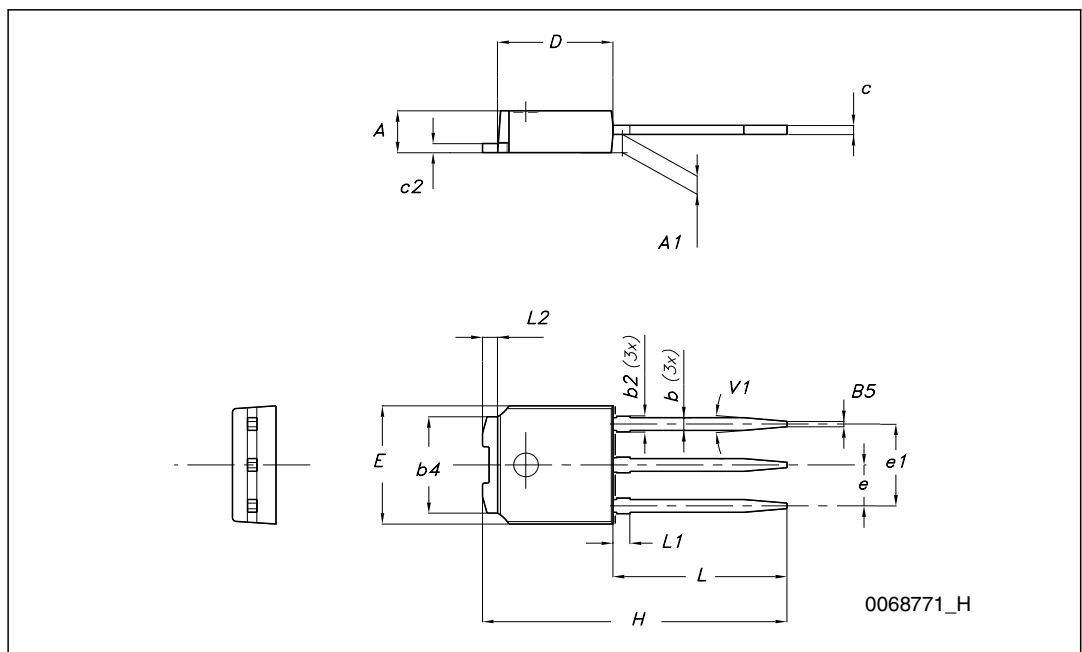
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TO-251 (IPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
b	0.64		0.90
b2			0.95
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
E	6.40		6.60
e		2.28	
e1	4.40		4.60
H		16.10	
L	9.00		9.40
(L1)	0.80		1.20
L2		0.80	
V1		10°	

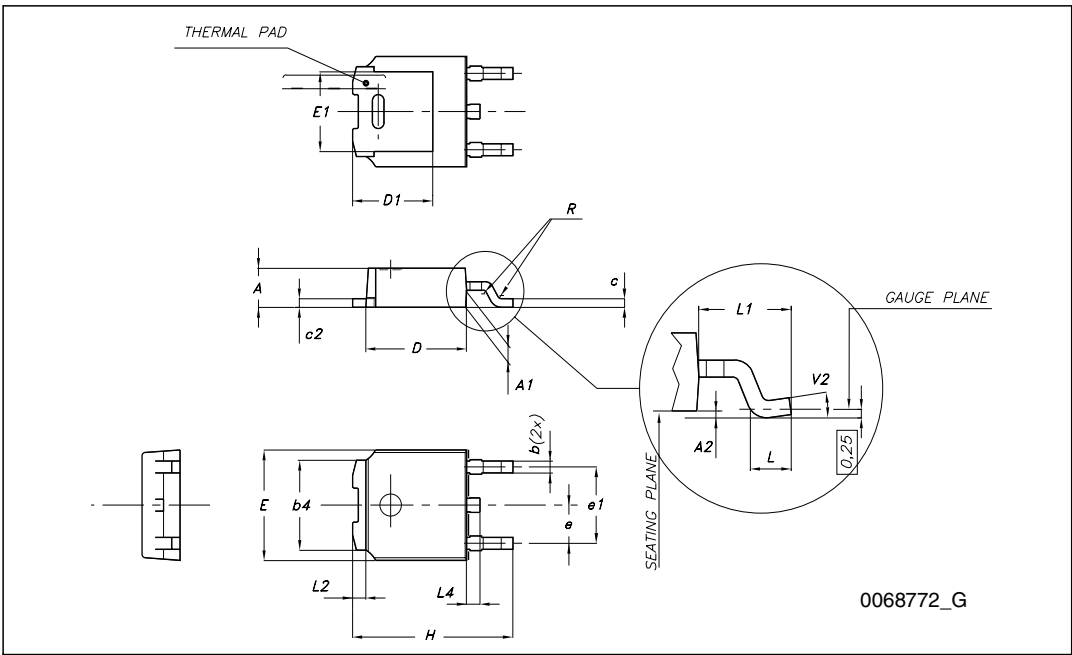
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TO-252 (DPAK) mechanical data

DIM.	mm.		
	min.	typ	max.
A	2.20		2.40
A1	0.90		1.10
A2	0.03		0.23
b	0.64		0.90
b4	5.20		5.40
c	0.45		0.60
c2	0.48		0.60
D	6.00		6.20
D1		5.10	
E	6.40		6.60
E1		4.70	
e		2.28	
e1	4.40		4.60
H	9.35		10.10
L	1		
L1		2.80	
L2		0.80	
L4	0.60		1
R		0.20	
V2	0°		8°

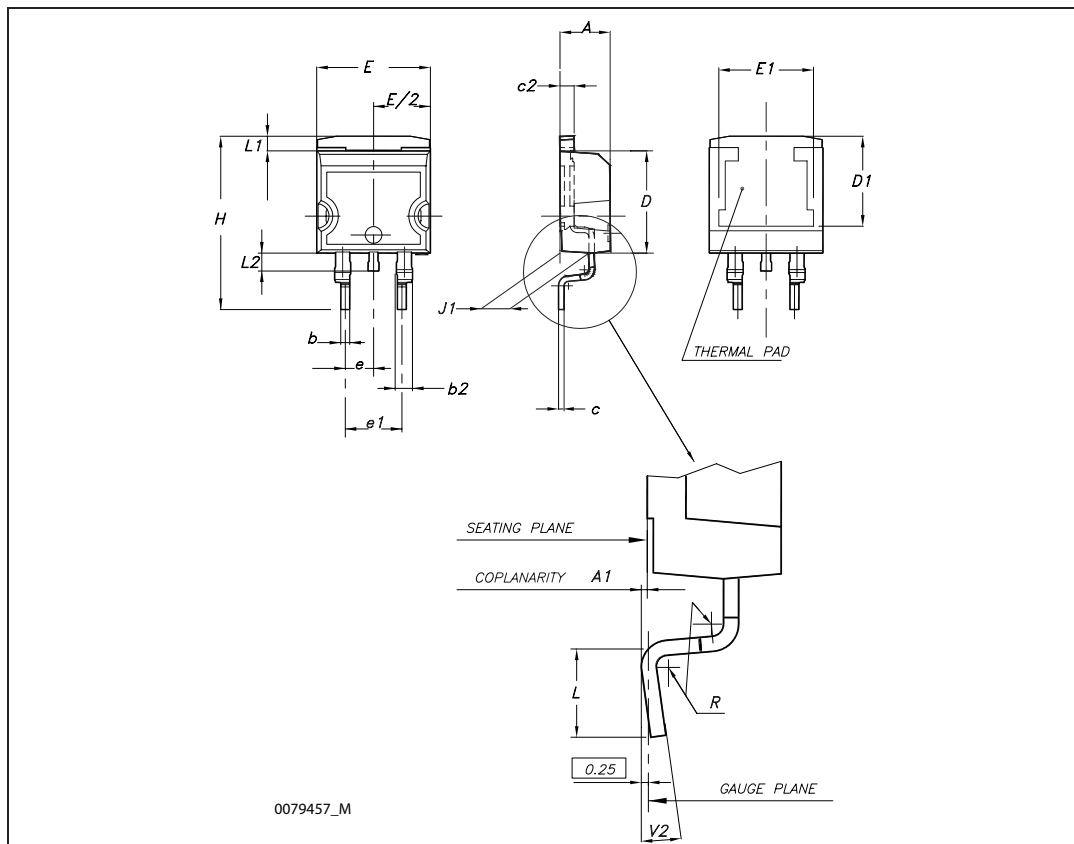
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D<sup>2</sup>PAK (TO-263) mechanical data

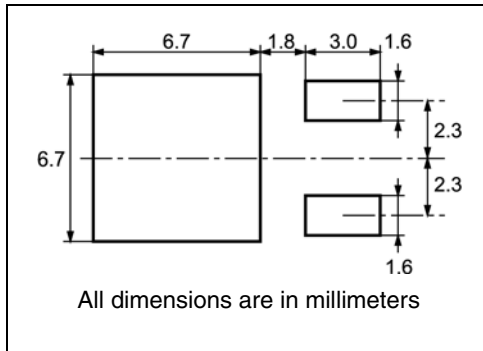
Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
E	10		10.40	0.394		0.409
E1	8.50			0.334		
e		2.54			0.1	
e1	4.88		5.28	0.192		0.208
H	15		15.85	0.590		0.624
J1	2.49		2.69	0.099		0.106
L	2.29		2.79	0.090		0.110
L1	1.27		1.40	0.05		0.055
L2	1.30		1.75	0.051		0.069
R		0.4			0.016	
V2	0°		8°	0°		8°

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# 5 Package mechanical data

## DPAK 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

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	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

BASE QTY	BULK QTY
2500	2500

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

TOP COVER TAPE

Center line of cavity

User Direction of Feed

Bending radius R min.

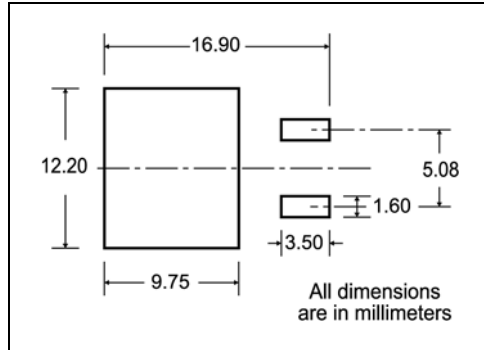
FEED DIRECTION

For machine ref. only including draft and radii concentric around B0

10 pitches cumulative tolerance on tape +/- 0.2 mm



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



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### TAPE AND REEL SHIPMENT

**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

**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

\* on sales type

## 6 Revision history

Table 10. Document revision history

Date	Revision	Changes
10-Jul-2008	1	First release

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