STx30NM60ND

N-channel 600 V, 0.11 Ω, 25 A FDmesh™ II Power MOSFET (with fast diode) TO-220, TO-220FP, D²PAK, I²PAK, TO-247

Features

Type	V_{DSS} @T_J max	$R_{DS(on)}$ max	I_D
STB30NM60ND	650 V	0.13 Ω	25 A
STI30NM60ND			25 A
STF30NM60ND			25 A(1)
STP30NM60ND			25 A
STW30NM60ND			25 A

1. Limited only by maximum temperature allowed

- The world's best $R_{DS(on)}$ in TO-220 amongst the fast recovery diode devices
- 100% avalanche tested
- Low input capacitance and gate charge
- Low gate input resistance
- Extremely high dv/dt and avalanche capabilities

Application

- Switching applications

Description

The FDmesh™ II series belongs to the second generation of MDmesh™ technology. This revolutionary Power MOSFET associates a new vertical structure to the company's strip layout and associates all advantages of reduced on-resistance and fast switching with an intrinsic fast-recovery body diode.

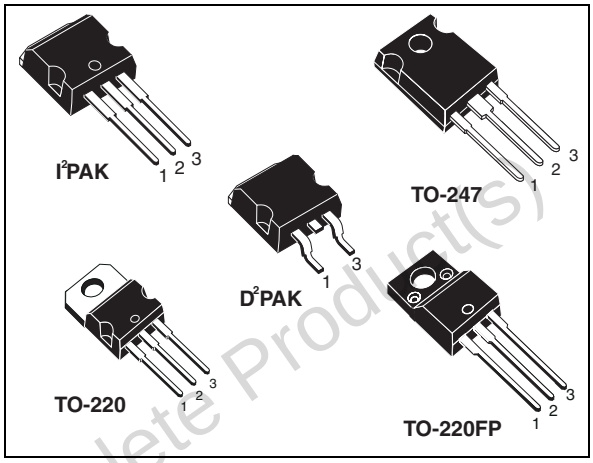
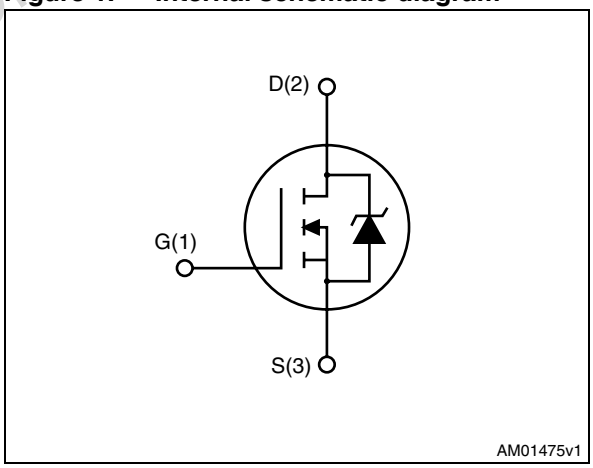


Figure 1. Internal schematic diagram



It is therefore strongly recommended for bridge topologies, in particular ZVS phase-shift converters.

Table 1. Device summary

Order codes	Marking	Package	Packaging
STB30NM60ND	30NM60ND	D²PAK	Tape and reel
STI30NM60ND	30NM60ND	I²PAK	Tube
STF30NM60ND	30NM60ND	TO-220FP	Tube
STP30NM60ND	30NM60ND	TO-220	Tube
STW30NM60ND	30NM60ND	TO-247	Tube

Obsolete Product(s) - Obsolete Product(s)

Contents

1 Electrical ratings 3

2 Electrical characteristics 4

2.1 Electrical characteristics (curves) 6

3 Test circuits 9

4 Package mechanical data 10

5 Packing mechanical data 16

6 Revision history 17

Obsolete Product(s) - Obsolete Product(s)

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D²PAK I²PAK / TO-247	TO-220FP	
V_{DS}	Drain-source voltage (V_{GS} = 0)	600		V
V_{GS}	Gate- source voltage	± 25		V
I_D	Drain current (continuous) at T_C = 25 °C	25	25(1)	A
I_D	Drain current (continuous) at T_C = 100 °C	15.8	15.8(1)	A
I_{DM} (2)	Drain current (pulsed)	100	100(1)	A
P_{TOT}	Total dissipation at T_C = 25 °C	190	40	W
dv/dt(3)	Peak diode recovery voltage slope	40		V/ns
V_{ISO}	Insulation withstand voltage (RMS) from all three leads to external heat sink (t = 1 s; T_C = 25 °C)	--	2500	V
T_{stg}	Storage temperature	– 55 to 150		°C
T_J	Max. operating junction temperature	150		

1. Limited only by maximum temperature allowed
2. Pulse width limited by safe operating area
3. $I_{SD} \leq 25$ A, di/dt $\leq$ 600 A/µs, V_{DD} = 80% $V_{(BR)DSS}$

Table 3. Thermal data

Symbol	Parameter	TO-220	I²PAK	TO-247	D²PAK	TO-220FP	Unit
Rthj-case	Thermal resistance junction-case max	0.66				3.1	°C/W
Rthj-amb	Thermal resistance junction-ambient max	62.5		50	--	62.5	°C/W
Rthj-pcb	Thermal resistance junction-pcb max	--	--	--	30	--	°C/W
T_l	Maximum lead temperature for soldering purpose	300					°C

Table 4. Avalanche characteristics

Symbol	Parameter	Max value	Unit
I_{AR}	Avalanche current, repetitive or not-repetitive (pulse width limited by T_J max)	12	A
E_{AS}	Single pulse avalanche energy (starting T_J = 25 °C, I_D = I_{AR}, V_{DD} = 50 V)	900	mJ

Obsolete Product(s) Obsolete Product(s)

2 Electrical characteristics

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

Table 5. On/off states

Symbol	Parameter	Test conditions	Value			Unit
			Min.	Typ.	Max.	
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0	600			V
dv/dt(1)	Drain source voltage slope	V_{DD}= 480 V, I_D= 25 A, V_{GS}= 10 V		48		V/ns
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = Max rating V_{DS} = Max rating @125 °C			1 100	µA µA
I_{GSS}	Gate-body leakage current (V_{DS} = 0)	V_{GS} = ± 20 V			100	nA
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS}, I_D = 250 µA	3	4	5	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V, I_D = 12.5 A		0.11	0.13	Ω

1. Characteristic value at turn off on inductive load

Table 6. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} = 15 V, I_D = 12.5 A		25		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} = 50 V, f = 1 MHz, V_{GS} = 0		2800 200 24		pF pF pF
$C_{oss\ eq.}$ (2)	Equivalent output capacitance	V_{GS} = 0, V_{DS} = 0 to 480 V		125		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} =300 V, I_D = 12.5 A R_G = 4.7 Ω, V_{GS} = 10 V *(see Figure 23),* *(see Figure 18)*		20 50 110 75		ns ns ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD} = 480 V, I_D = 25 A, V_{GS} = 10 V, *(see Figure 19)*		100 16 54		nC nC nC
R_g	Gate input resistance	f=1MHz Gate DC Bias=0 Test signal level=20 mV Open drain		3.0		Ω

1. Pulsed: pulse duration=300 µs, 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}

Obsolete Product(s) - Obsolete Product(s)

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)				25 100	A A
V_{SD} (2)	Forward on voltage	I_{SD} = 25 A, V_{GS} = 0			1.6	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 25 A, V_{DD} = 60 V di/dt=100 A/µs *(see Figure 20)*		170 1.2 15		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD} = 25 A,V_{DD} = 60 V di/dt=100 A/µs, T_J = 150 °C *(see Figure 20)*		250 2.5 20		ns µC A

1. Pulse width limited by safe operating area
2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%.

Obsolete Product(s) - Obsolete Product(s)

2.1 Electrical characteristics (curves)

Figure 2. Safe operating area for TO-220 / D²PAK / I²PAK

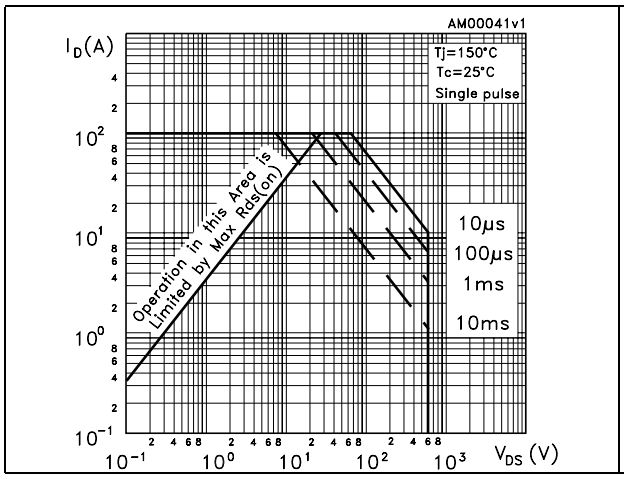


Figure 3. Thermal impedance for TO-220 / D²PAK / I²PAK

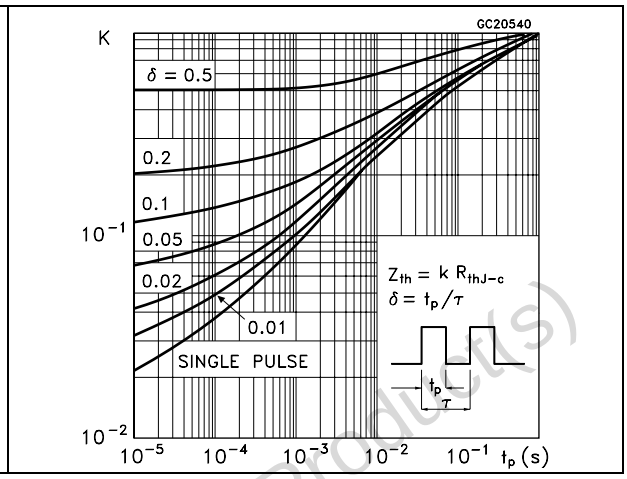


Figure 4. Safe operating area for TO-220FP

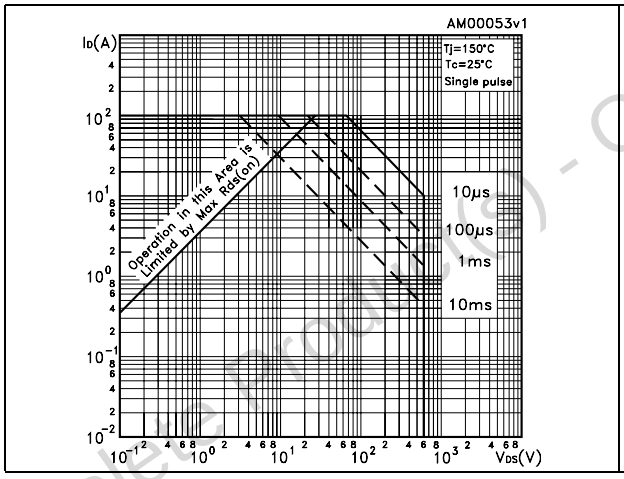


Figure 5. Thermal impedance for TO-220FP

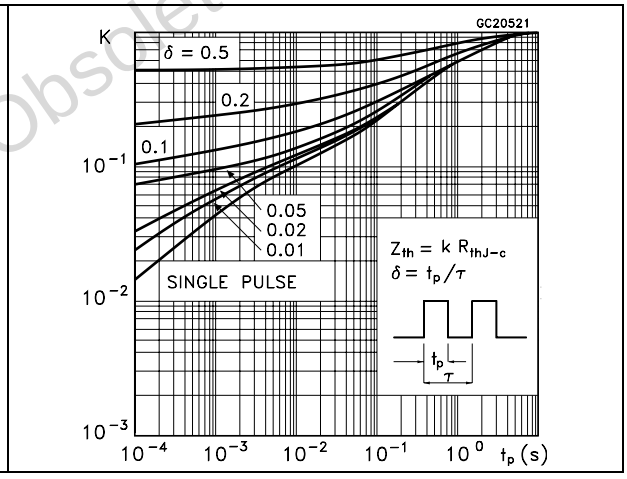


Figure 6. Safe operating area for TO-247

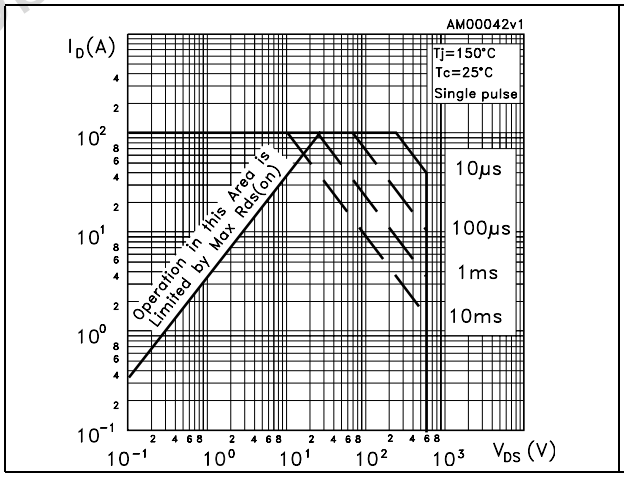
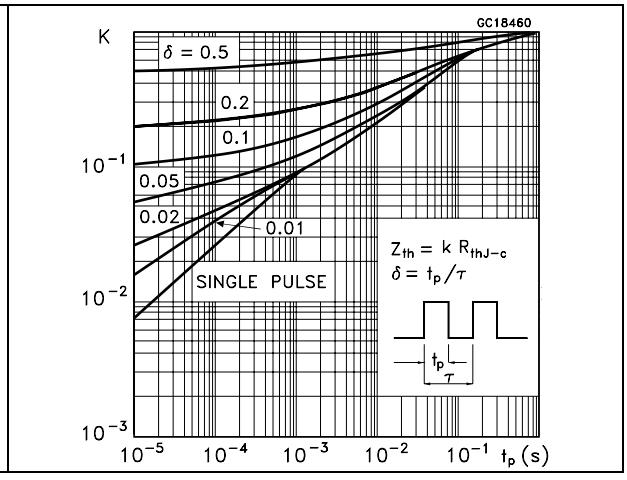


Figure 7. Thermal impedance for TO-247



Obsolete Product(s) - Obsolete Product(s)

Figure 8. Output characteristics

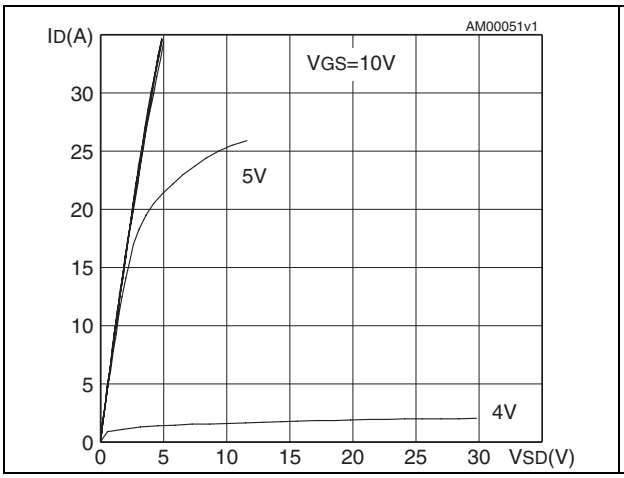


Figure 9. Transfer characteristics

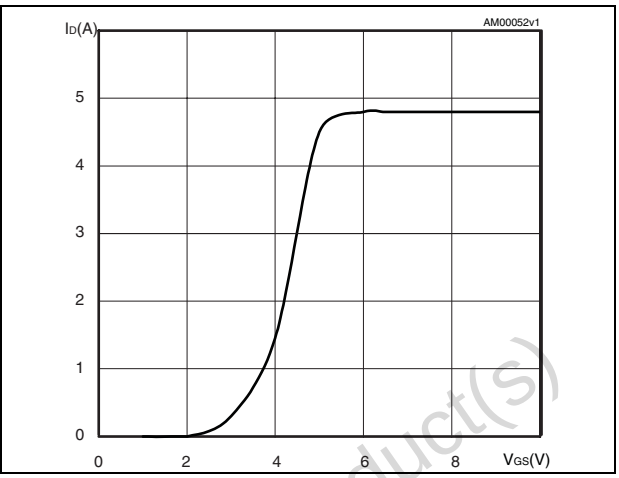


Figure 10. Transconductance

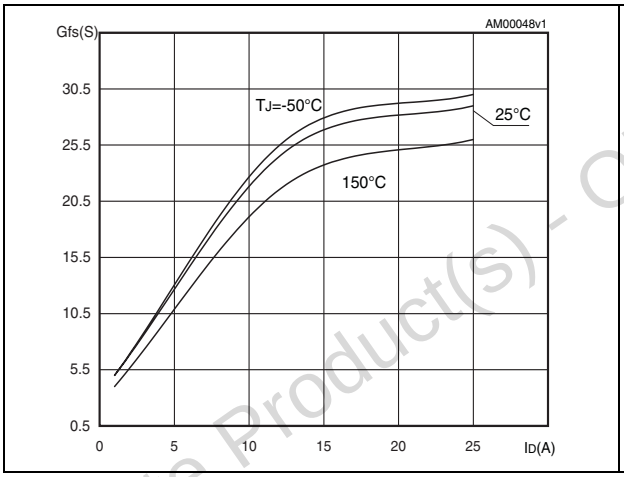


Figure 11. Static drain-source on resistance

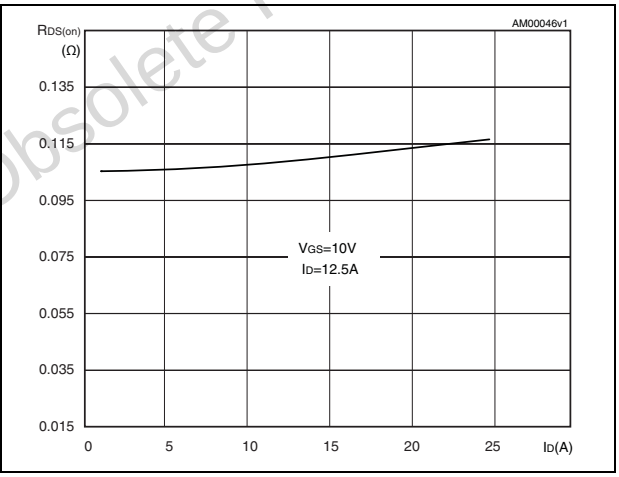


Figure 12. Gate charge vs gate-source voltage

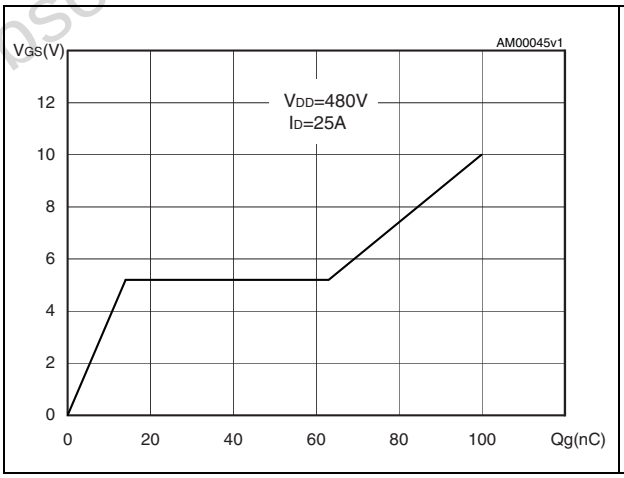
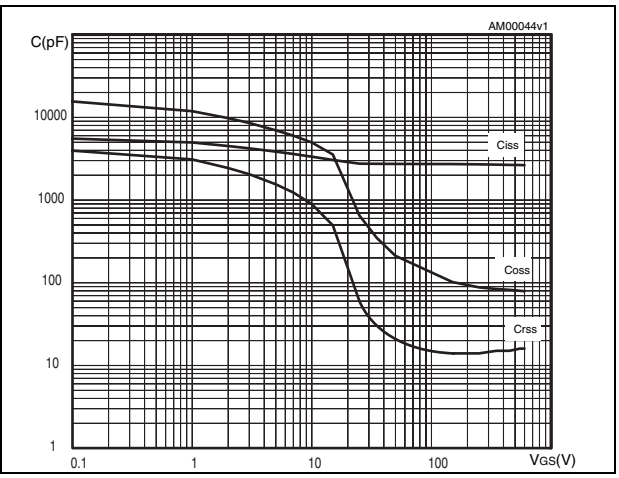


Figure 13. Capacitance variations



Obsolete Product(s) - Obsolete Product(s)

Figure 14. Normalized gate threshold voltage vs temperature

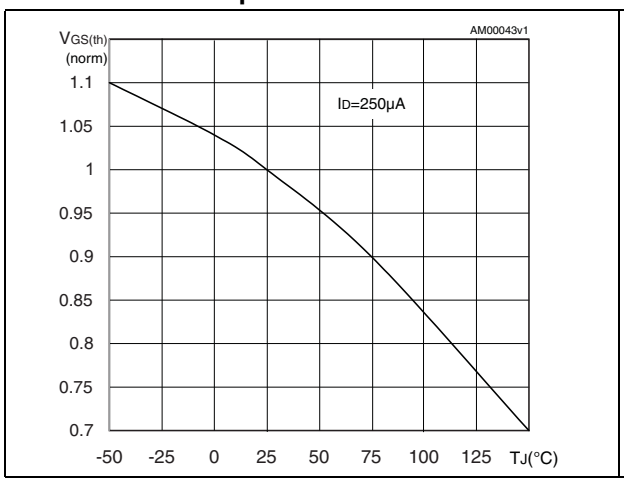


Figure 15. Normalized on resistance vs temperature

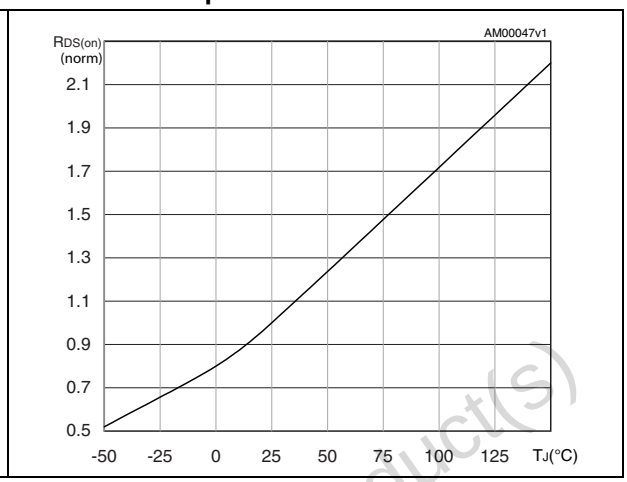


Figure 16. Source-drain diode forward characteristics

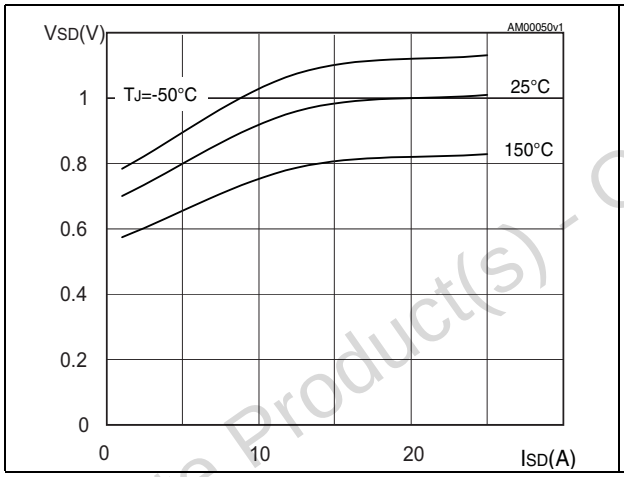
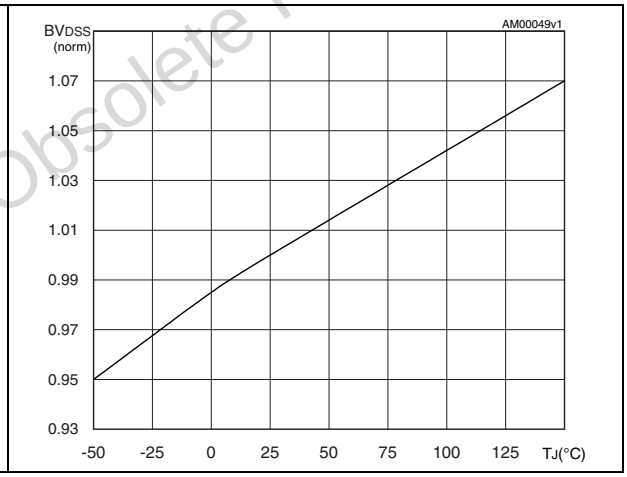


Figure 17. Normalized B_{VDSS} vs temperature



Obsolete Product(s) - Obsolete Product(s)

3 Test circuits

Figure 18. Switching times test circuit for resistive load

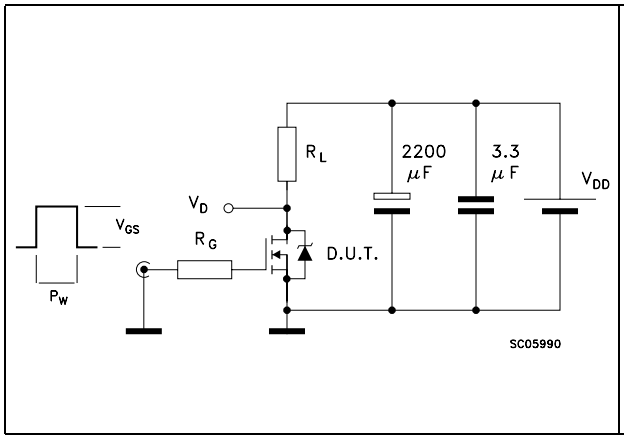


Figure 19. Gate charge test circuit

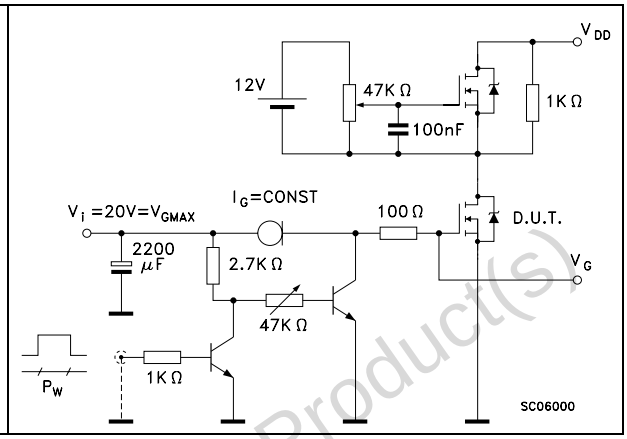


Figure 20. Test circuit for inductive load switching and diode recovery times

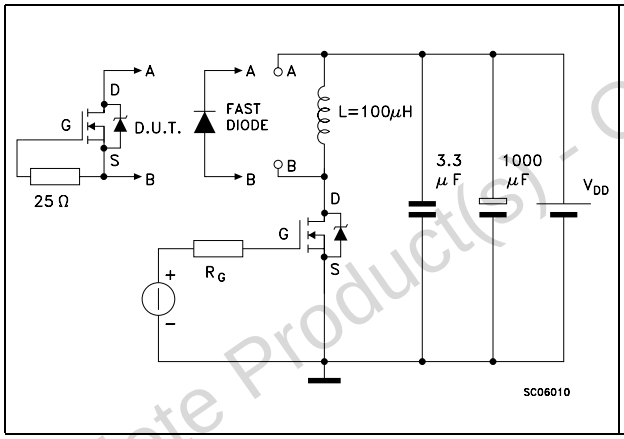


Figure 21. Unclamped Inductive load test circuit

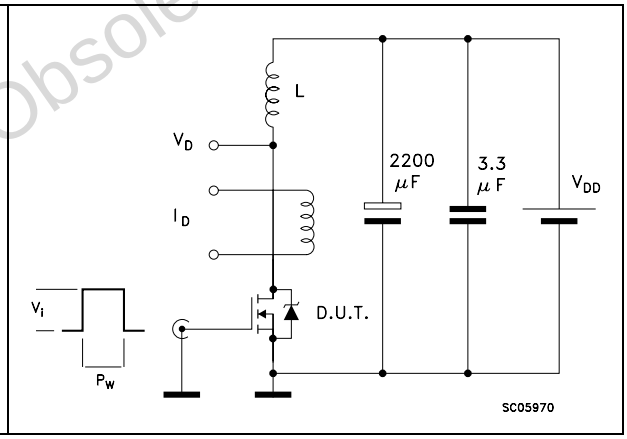


Figure 22. Unclamped inductive waveform

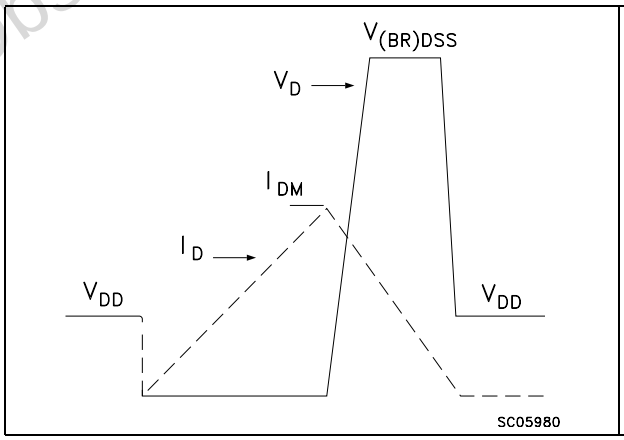
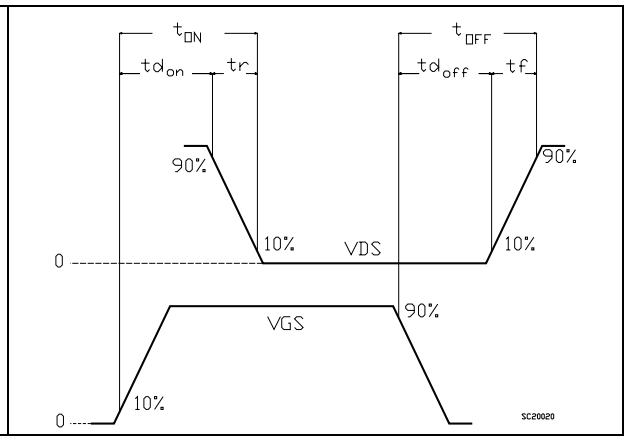


Figure 23. Switching time waveform



Obsolete Product(s) - Obsolete Product(s)

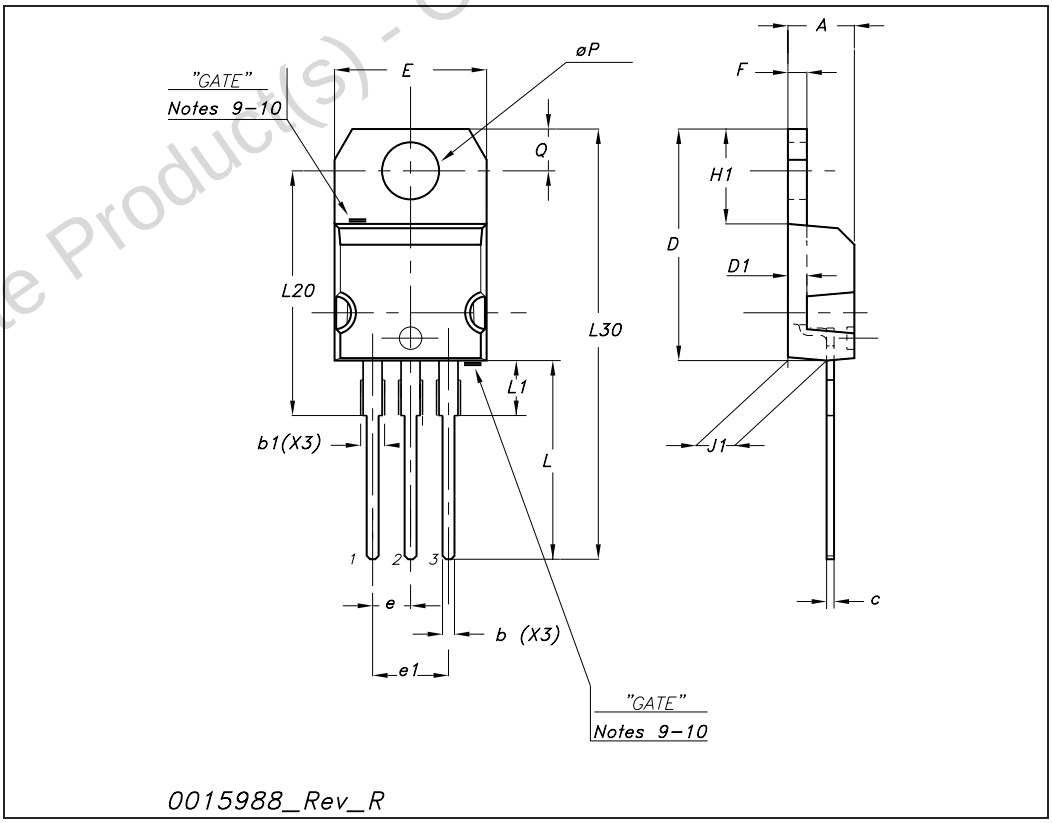
4 Package mechanical data

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*

Obsolete Product(s) - Obsolete Product(s)

TO-220 mechanical data

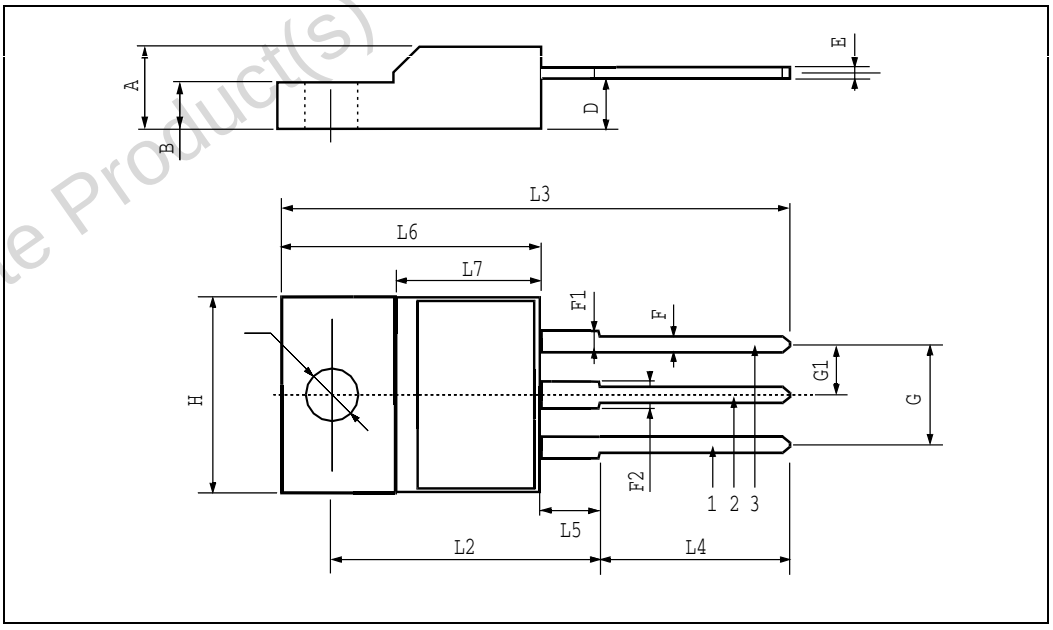
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	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.48		0.70	0.019		0.027
D	15.25		15.75	0.6		0.62
D1		1.27			0.050	
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
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



Obsolete Product(s) - Obsolete Product(s)

TO-220FP mechanical data

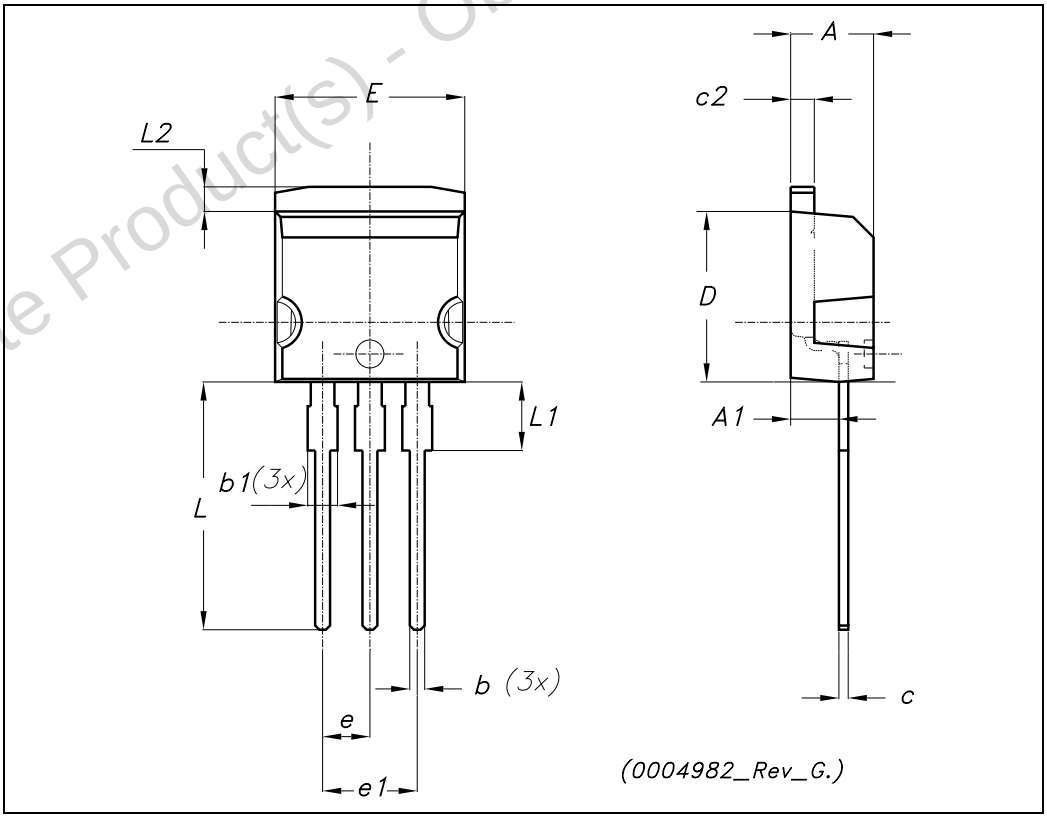
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	Min.	Typ.	Max.	Min.	Typ.	Max.
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B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		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



Obsolete Product(s) - Obsolete Product(s)

TO-262 (I^2PAK) mechanical data

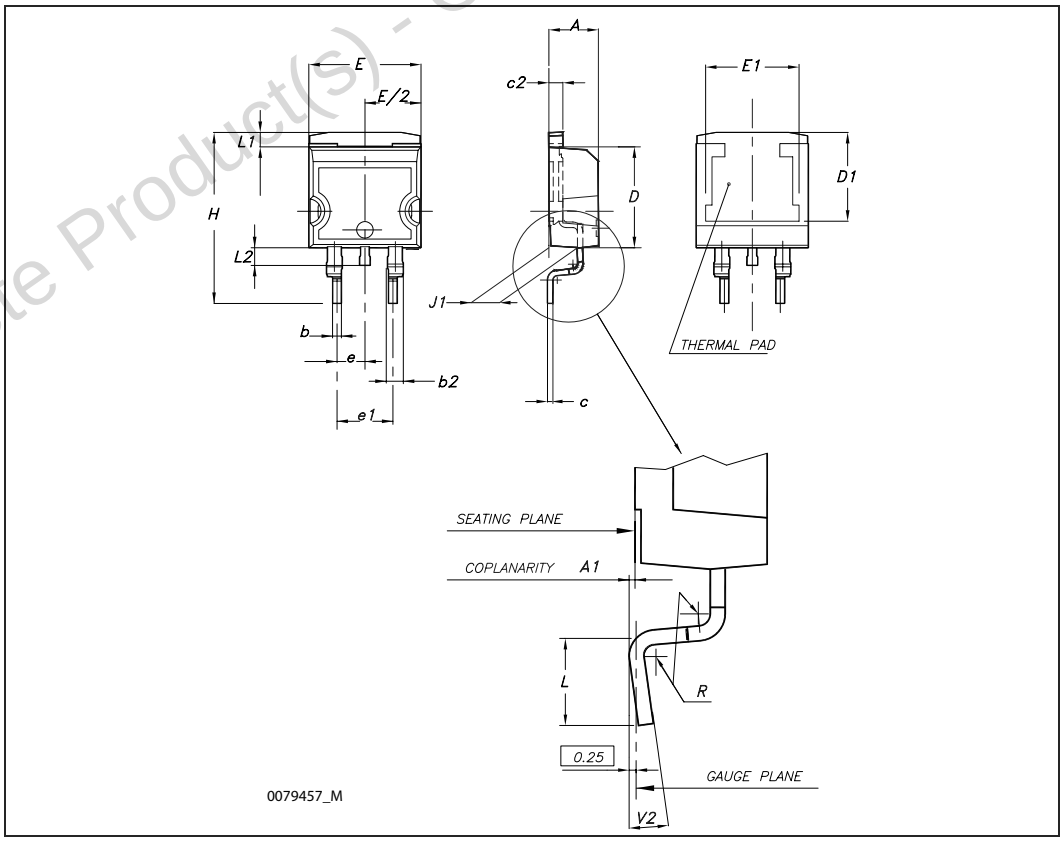
DIM.	mm.			inch		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A	4.40		4.60	0.173		0.181
A1	2.40		2.72	0.094		0.107
b	0.61		0.88	0.024		0.034
b1	1.14		1.70	0.044		0.066
c	0.49		0.70	0.019		0.027
c2	1.23		1.32	0.048		0.052
D	8.95		9.35	0.352		0.368
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
E	10		10.40	0.393		0.410
L	13		14	0.511		0.551
L1	3.50		3.93	0.137		0.154
L2	1.27		1.40	0.050		0.055



Obsolete Product(s) - Obsolete Product(s)

D²PAK (TO-263) mechanical data

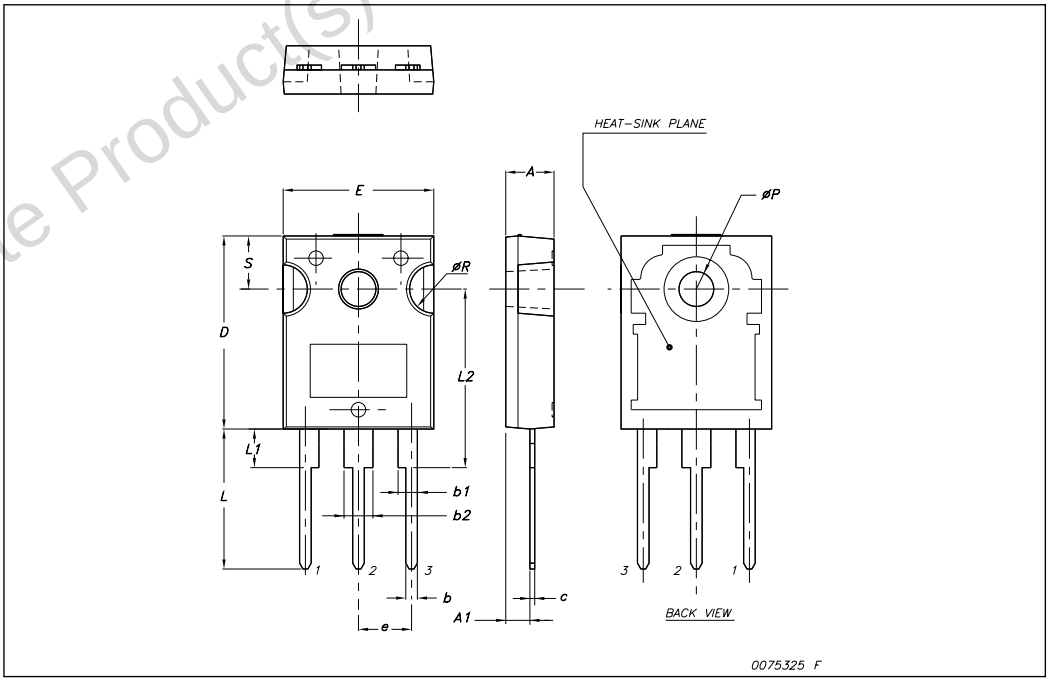
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	Min	Typ	Max	Min	Typ	Max
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A1	0.03		0.23	0.001		0.009
b	0.70		0.93	0.027		0.037
b2	1.14		1.70	0.045		0.067
c	0.45		0.60	0.017		0.024
c2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1	7.50			0.295		
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°



Obsolete Product(s) - Obsolete Product(s)

TO-247 Mechanical data

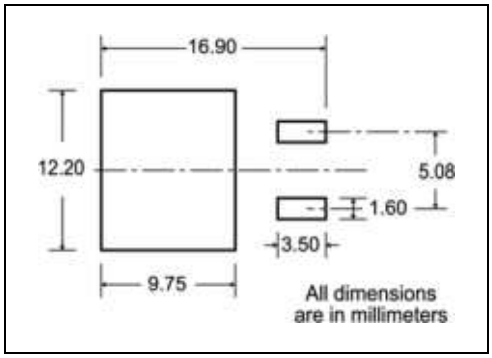
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	Min.	Typ	Max.
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A1	2.20		2.60
b	1.0		1.40
b1	2.0		2.40
b2	3.0		3.40
c	0.40		0.80
D	19.85		20.15
E	15.45		15.75
e		5.45	
L	14.20		14.80
L1	3.70		4.30
L2		18.50	
øP	3.55		3.65
øR	4.50		5.50
S		5.50	



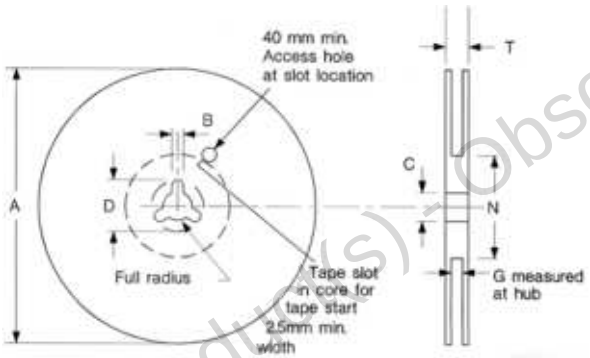
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5 Packing mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



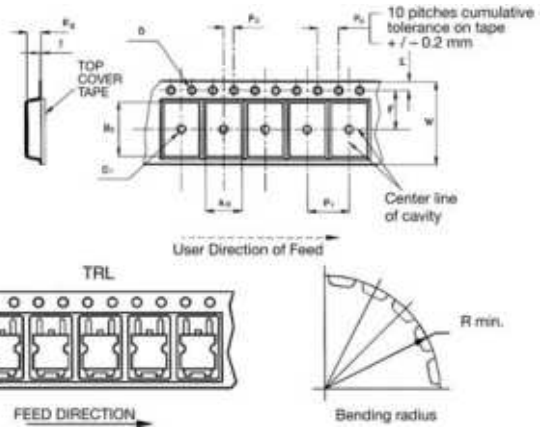
REEL MECHANICAL DATA

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		0795	
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



* on sales type

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6 Revision history

Table 8. Document revision history

Date	Revision	Changes
29-Nov-2007	1	initial release
11-Nov-2008	2	Document status promoted from preliminary data to datasheet.

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