STP25NM60N

N-CHANNEL 600V 0.140Ω-20A TO-220/FP/D²/I²PAK/TO-247 SECOND GENERATION MDmesh™ MOSFET

PRODUCT PREVIEW

Table 1: General Features

TYPE	V_{DSS} (@Tjmax)	$R_{DS(on)}$	I_D
STB25NM60N-1	650 V	< 0.170 Ω	20 A
STF25NM60N	650 V	< 0.170 Ω	20(*) A
STP25NM60N	650 V	< 0.170 Ω	20 A
STW25NM60N	650 V	< 0.170 Ω	20 A
STB25NM60N	650 V	< 0.170 Ω	20 A

- WORLD'S LOWEST ON RESISTANCE
- TYPICAL $R_{DS}(on)$ = 0.140 Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE

Figure 1: Package

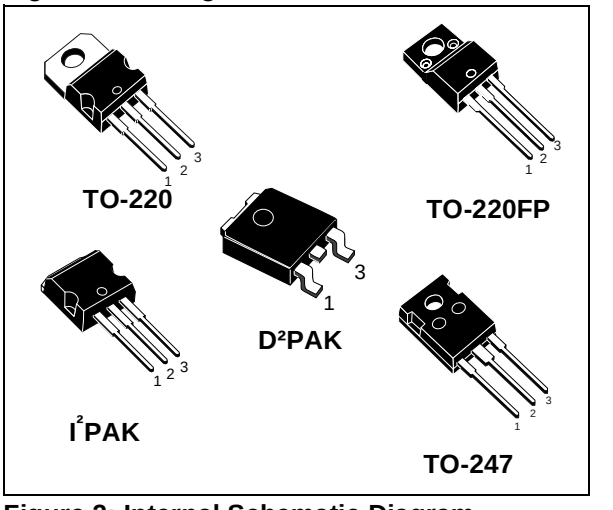
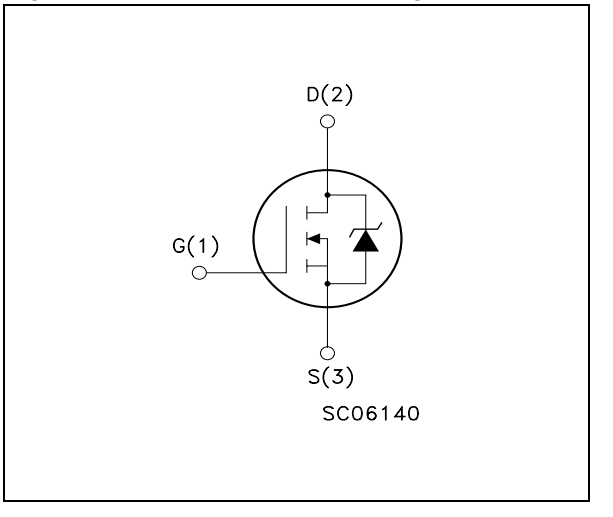


Figure 2: Internal Schematic Diagram



DESCRIPTION

The **STP25NM60N** is realized with the second generation of MDmesh Technology. This revolutionary MOSFET associates a new vertical structure to the Company's strip layout to yield the world's lowest on-resistance and gate charge. It is therefore suitable for the most demanding high efficiency converters

APPLICATIONS

The MDmesh™ II family is very suitable for increase the power density of high voltage converters allowing system miniaturization and higher efficiencies.

Table 2: Order Code

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB25NM60N-1	B25NM60N	I²PAK	TUBE
STF25NM60N	F25NM60N	TO-220FP	TUBE
STP25NM60N	P25NM60N	TO-220	TUBE
STW25NM60N	W25NM60N	TO-247	TUBE
STB25NM60N	B25NM60N	D²PAK	TAPE & REEL

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/I²PAK TO-247/D²PAK	TO-220FP	
V_{DS}	Drain-source Voltage (V_{GS} = 0)	600		V
V_{DGR}	Drain-gate Voltage (R_{GS} = 20 kΩ)	600		V
V_{GS}	Gate- source Voltage	± 25		V
I_D	Drain Current (continuous) at T_C = 25°C	20	20 (*)	A
I_D	Drain Current (continuous) at T_C = 100°C	12.8	12.8 (*)	A
I_{DM} (1)	Drain Current (pulsed)	80	80 (*)	A
P_{TOT}	Total Dissipation at T_C = 25°C	160	40	W
	Derating Factor	1.28	0.32	W/°C
dv/dt (2)	Peak Diode Recovery voltage slope	TBD		V/ns
T_{stg}	Storage Temperature	– 55 to 150		°C
T_j	Max. Operating Junction Temperature	150		°C

(*) Limited only by maximum temperature allowed
(1) Pulse width limited by safe operating area
(2) $I_{SD} \leq 20$ A, di/dt ≤ 400 A/µs, V_{DD} =80%$V_{(BR)DSS}$.

Table 4: Thermal Data

		TO-220/I²PAK TO-247/D²PAK	TO-220FP	
Rthj-case	Thermal Resistance Junction-case Max	0.78	3.1	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		°C/W
T_l	Maximum Lead Temperature For Soldering Purpose	300		°C

Table 5: Avalanche Characteristics

Symbol	Parameter	Max Value	Unit
I_{AS}	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T_j max)	TBD	A
E_{AS}	Single Pulse Avalanche Energy (starting T_j = 25 °C, $I_D = I_{AS}$, V_{DD} = 50 V)	TBD	mJ

ELECTRICAL CHARACTERISTICS (T_{CASE} =25°C UNLESS OTHERWISE SPECIFIED)

Table 6: On /Off

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(2)	Drain Source Voltage Slope	Vdd=TBD, Id=TBD, Vgs=TBD		TBD		V/ns
I_{DSS}	Zero Gate Voltage Drain Current (V_{GS} = 0)	V_{DS} = Max Rating V_{DS} = Max Rating, T_C = 125°C			1 10	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	2	3	4	V
$R_{DS(on}$	Static Drain-source On Resistance	V_{GS} = 10 V, I_D = 10 A		0.140	0.170	Ω

(2) Characteristic value at turn off on inductive load

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 7: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{DS} = 15V , I_D= 10A		17		S
C_{iss} C_{oss} C_{rss}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{DS} = 25 V, f = 1 MHz, V_{GS} = 0		2565 511 77		pF pF pF
$C_{OSS\ eq}$ (3).	Equivalent Output Capacitance	V_{GS} = 0 V, V_{DS} = 0 to 480 V		TBD		pF
R_G	Gate Input Resistance	f=1 MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		2		Ω
$t_{d(on)}$ 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 = 10 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 4)		TBD TBD TBD TBD		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 = 20 A, V_{GS} = 10 V (see Figure 7)		93 TBD TBD		nC nC nC

Table 8: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD} I_{SDM} (2)	Source-drain Current Source-drain Current (pulsed)				20 80	A A
V_{SD} (1)	Forward On Voltage	I_{SD} = 20 A, V_{GS} = 0			1.3	V
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 25 A, di/dt = 100 A/µs V_{DD} = 100V (see Figure 5)		TBD TBD TBD		ns µC A
t_{rr} Q_{rr} I_{RRM}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_{SD} = 25 A, di/dt = 100 A/µs V_{DD} = 100V, T_j = 150°C (see Figure 5)		TBD TBD TBD		ns µC A

(1) Pulsed: Pulse duration = 300 µs, duty cycle 1.5 %.
(2) Pulse width limited by safe operating area.
(3) $C_{oss\ eq.}$ 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}.

Figure 3: Unclamped Inductive Load Test Circuit

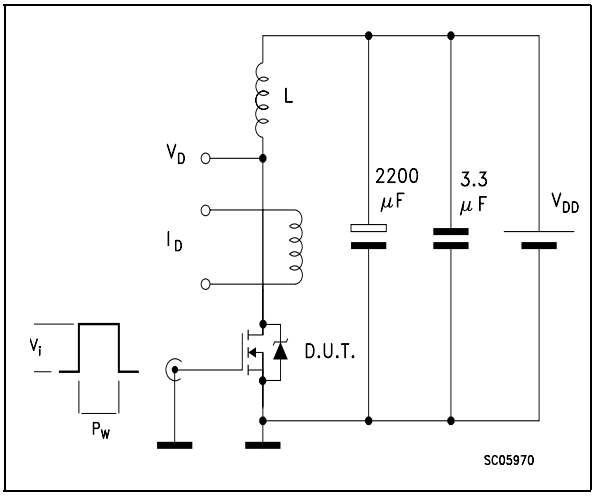


Figure 4: Switching Times Test Circuit For Resistive Load

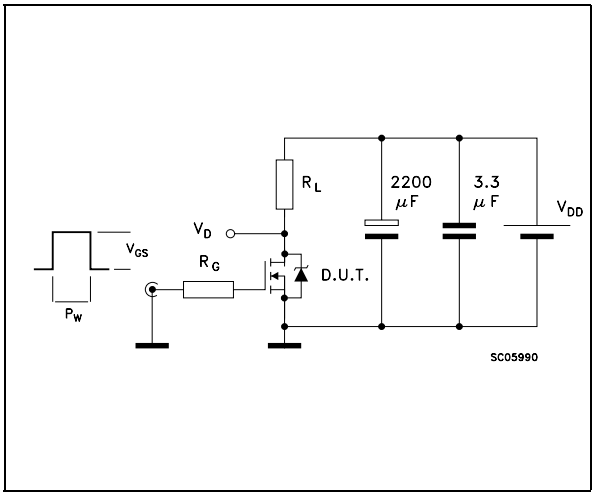


Figure 5: Test Circuit For Inductive Load Switching and Diode Recovery Times

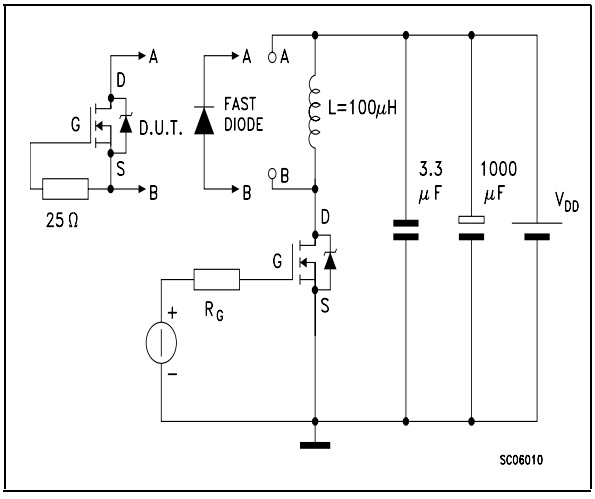


Figure 6: Unclamped Inductive Wafeform

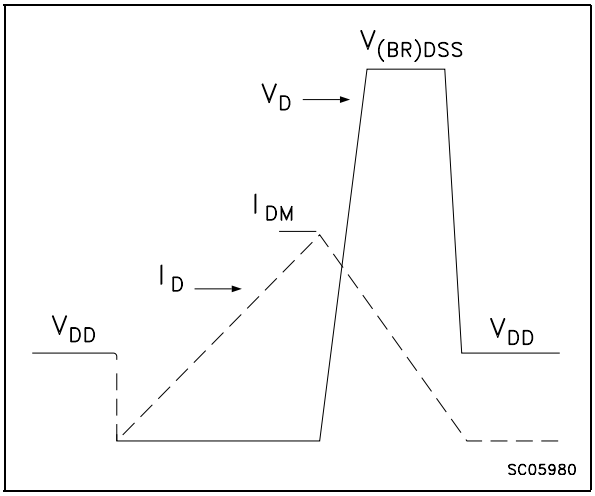
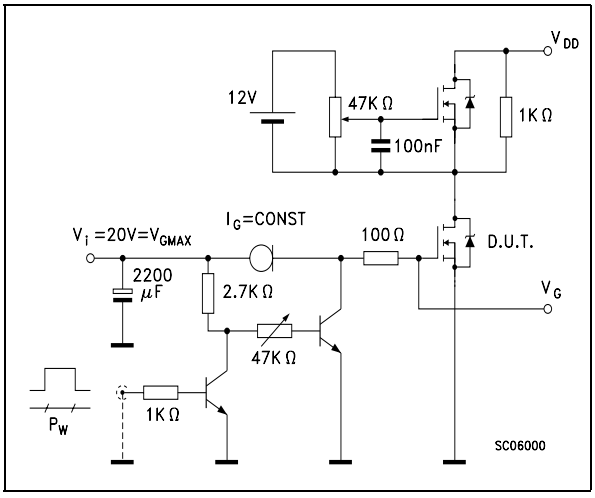
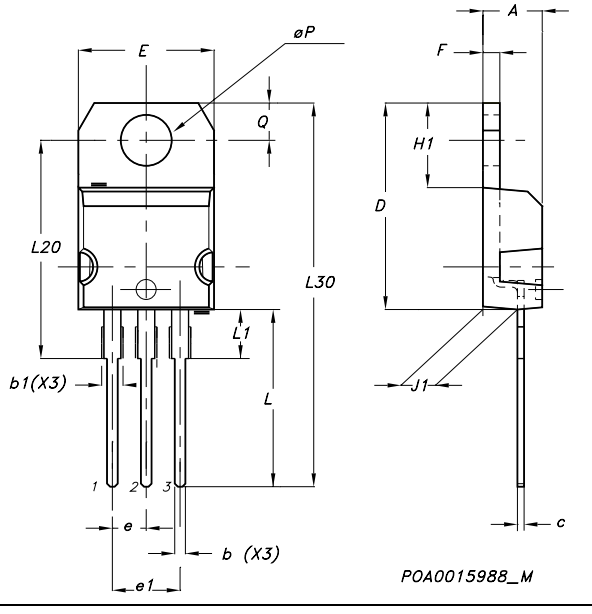


Figure 7: Gate Charge Test Circuit



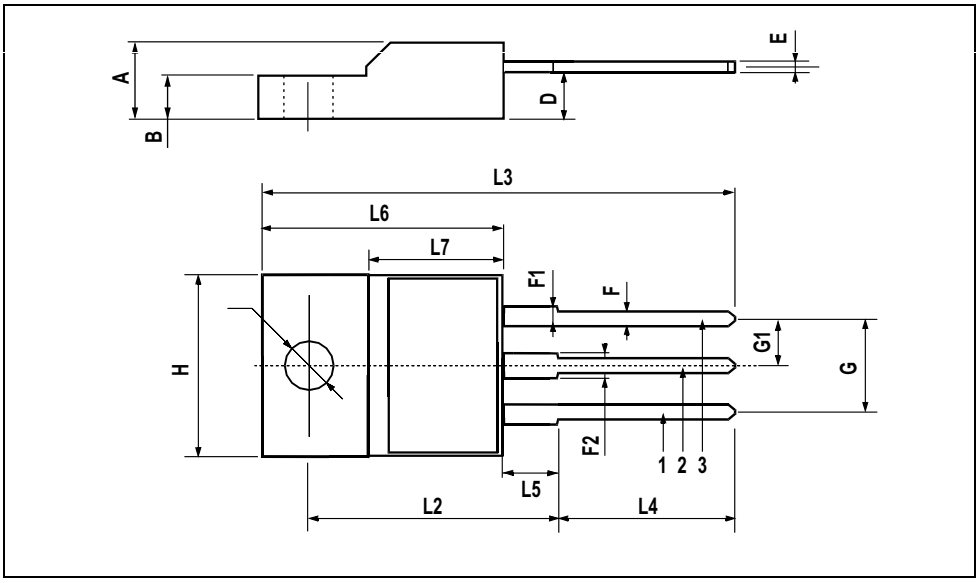
TO-220 MECHANICAL DATA

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



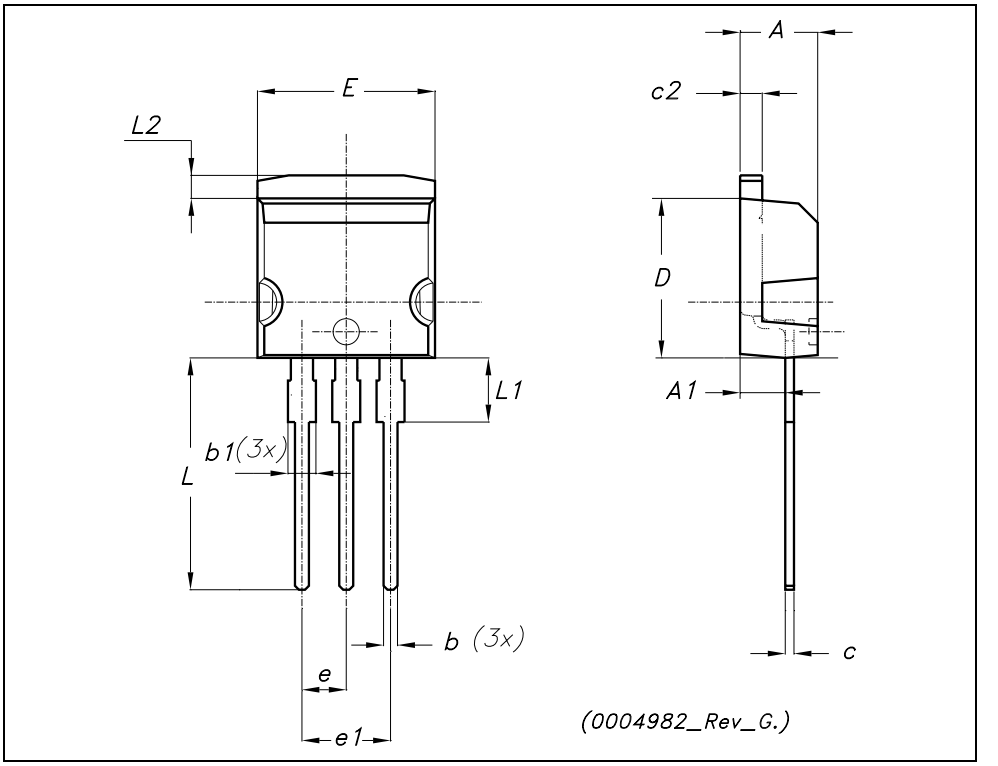
TO-220FP MECHANICAL DATA

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



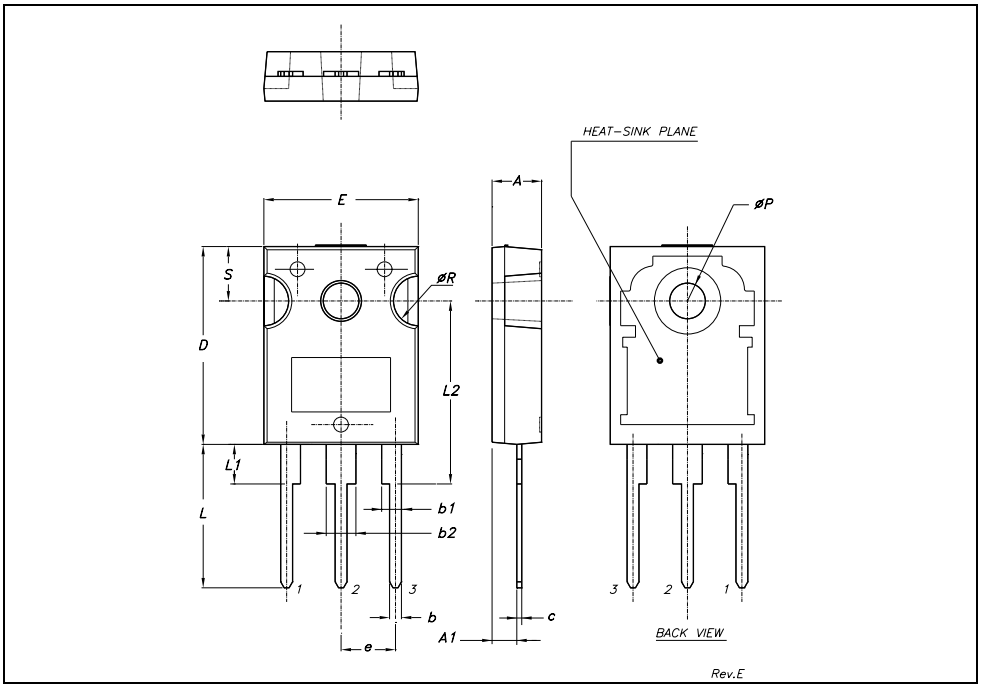
TO-262 (I^2PAK) MECHANICAL DATA

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



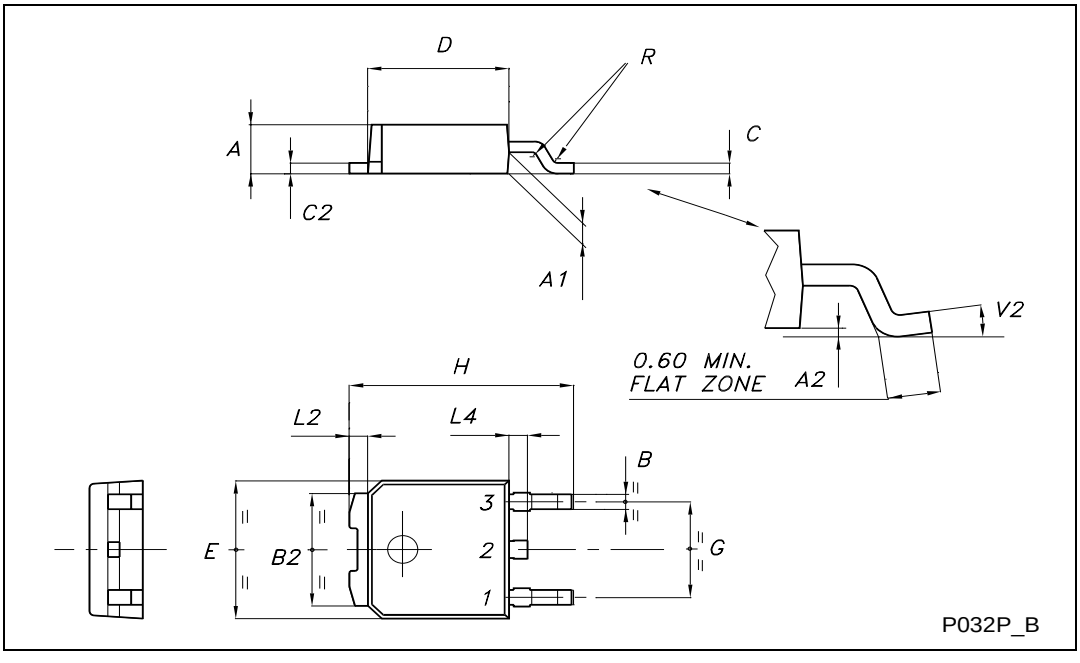
TO-247 MECHANICAL DATA

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	

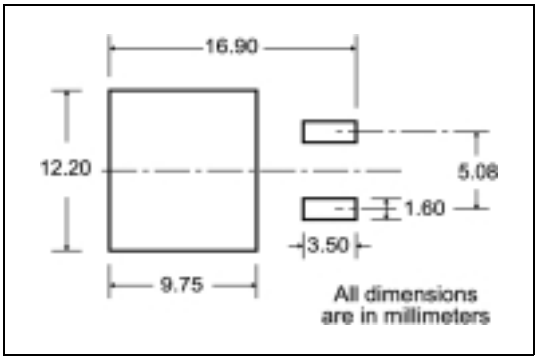


TO-252 (DPAK) MECHANICAL DATA

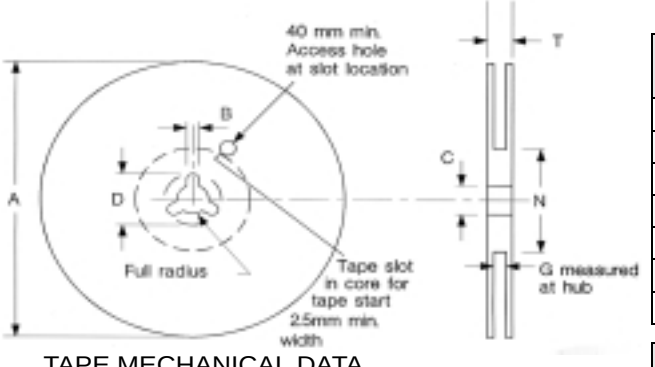
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0^o		8^o	0^o		0^o



D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



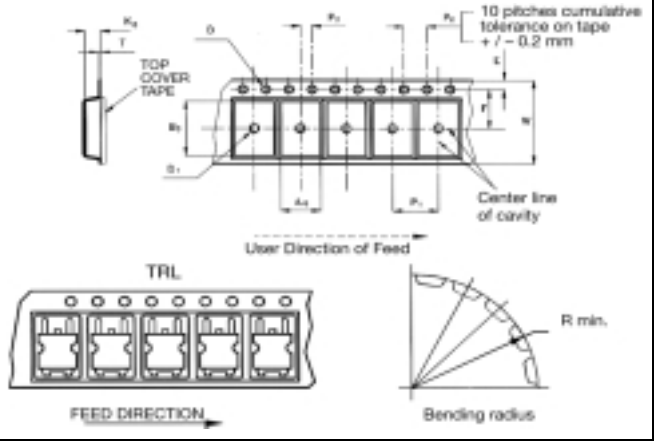
REEL MECHANICAL DATA

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