



# STP25NM50N - STF25NM50N STB25NM50N/-1 - STW25NM50N

N-CHANNEL 550V @TjMAX - 0.12 Ω - 21.5 A TO-220/FP/D<sup>2</sup>/I<sup>2</sup>PAK/TO-247  
SECOND GENERATION MDmesh™ MOSFET

PRODUCT PREVIEW

**Table 1: General Features**

TYPE	V <sub>DSS</sub> (@T <sub>jMAX</sub> )	I <sub>D</sub>	R <sub>DS(on)</sub>
STB25NM50N-1	550V	21.5 A	0.150 Ω
STF25NM50N	550V	21.5 A	0.150 Ω
STP25NM50N	550V	21.5 A	0.150 Ω
STW25NM50N	550V	21.5 A	0.150 Ω
STB25NM50NT4	550V	21.5 A	0.150 Ω

- WORLD'S LOWEST ON RESISTANCE
- TYPICAL R<sub>DS(on)</sub> = 0.12Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE

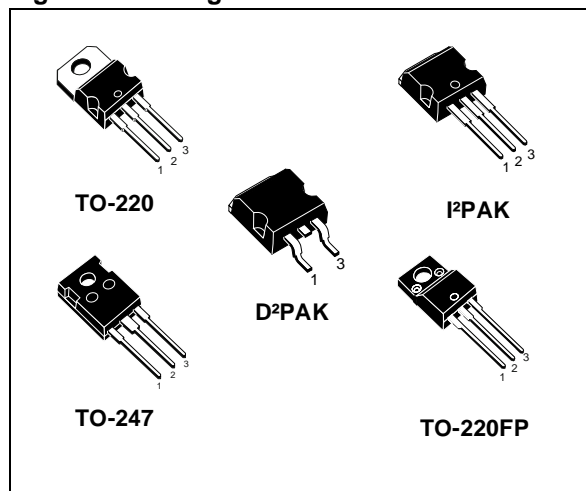
## DESCRIPTION

The STP25NM50N 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

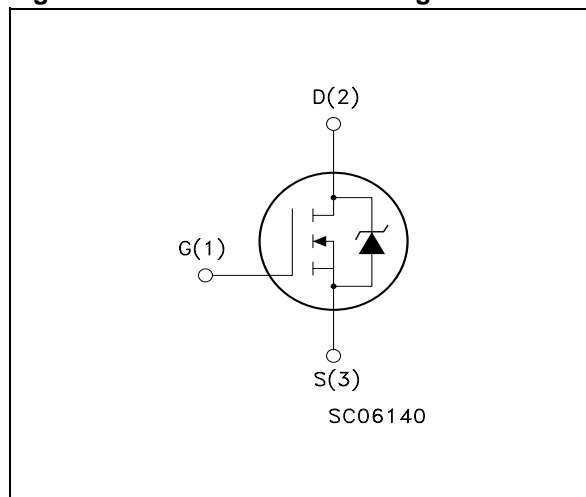
## APPLICATIONS

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

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

SALES TYPE	MARKING	PACKAGE	PACKAGING
STP25NM50N	P25NM50N	TO-220	TUBE
STF25NM50N	F25NM50N	TO-220FP	TUBE
STB25NM50N-1	B25NM50N	I <sup>2</sup> PAK	TUBE
STW25NM50N	W25NM50N	TO-247	TUBE
STB25NM50NT4	B25NM50N	D <sup>2</sup> PAK	TAPE & REEL

Rev. 1

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value		Unit
		TO-220/D <sup>2</sup> PAK/I <sup>2</sup> PAK/ TO-247	TO-220FP	
V <sub>GS</sub>	Gate- source Voltage	±30		V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	21.5	21.5 (*)	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	13.6	13.6 (*)	A
I <sub>DM</sub> (●)	Drain Current (pulsed)	86	86 (*)	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	160	40	W
	Derating Factor	1.28	0.32	W/°C
dv/dt(1)	Peak Diode Recovery voltage slope	TBD		V/ns
T <sub>stg</sub>	Storage Temperature	-55 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(●) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 21.5 A, di/dt ≤ 400 A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

(\*) Limited only by maximum temperature allowed

**Table 4: Thermal Data**

		TO-220/D <sup>2</sup> PAK/ I <sup>2</sup> PAK/TO-247	TO-220FP	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	0.78	3.1	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5		°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose	300		°C

**Table 5: 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)	TBD	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)	TBD	mJ

**ELECTRICAL CHARACTERISTICS** ( $T_{CASE} = 25^{\circ}C$  UNLESS OTHERWISE SPECIFIED)

**Table 6: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 1mA, V_{GS} = 0$	500			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}, T_C = 125^{\circ}C$			1 10	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 30V$			$\pm 100$	$\mu A$
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250 \mu A$	2	3	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10V, I_D = 12.5A$		0.12	0.150	$\Omega$

**Table 7: Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs} (1)$	Forward Transconductance	$V_{DS} 15V, I_D = 10.75A$		19		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25V, f = 1MHz, V_{GS} = 0$		2280 450 50		pF pF pF
$C_{oss eq. (*)}$	Equivalent Output Capacitance	$V_{GS} = 0V, V_{DS} = 0V \text{ to } 400V$		TBD		pF
$t_{d(on)}$ $t_r$ $t_{d(off)}$ $t_f$	Turn-on Delay Time Rise Time Off-voltage Rise Time Fall Time	$V_{DD} = 250V, I_D = 10.75A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see Figure 3)		TBD TBD TBD TBD		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 400V, I_D = 21.5A,$ $V_{GS} = 10V,$ (see Figure 7)		TBD TBD TBD		nC nC nC
$R_g$	Gate Input Resistance	$f = 1MHz$ Gate DC Bias=0 Test Signal Level=20mV Open Drain		1.9		$\Omega$

(\*)  $C_{oss eq.}$  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 8: Source Drain Diode**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$ $I_{SDM}$	Source-drain Current Source-drain Current (pulsed)				21.5 86	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 21.5A, V_{GS} = 0$			1.3	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 21.5A, di/dt = 100A/\mu s$ $V_{DD} = 100V, T_j = 25^{\circ}C$ (see Figure 5)		TBD TBD TBD		ns $\mu C$ A
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 21.5A, di/dt = 100A/\mu s$ $V_{DD} = 100V, T_j = 150^{\circ}C$ (see Figure 5)		TBD TBD TBD		ns $\mu C$ A

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

(\*)  $C_{oss eq.}$  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

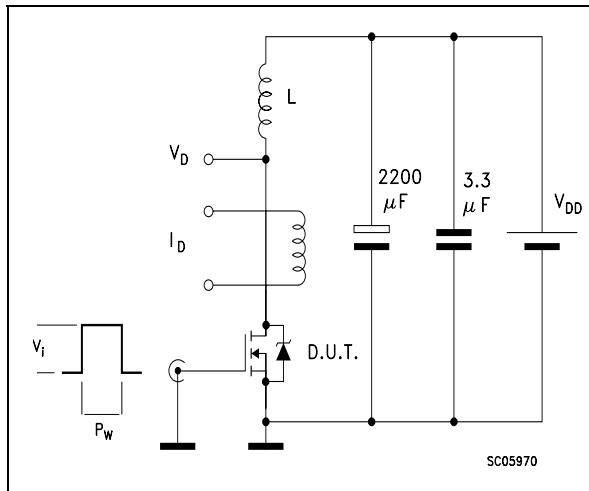


Figure 4: Switching Times Test Circuit For Resistive Load

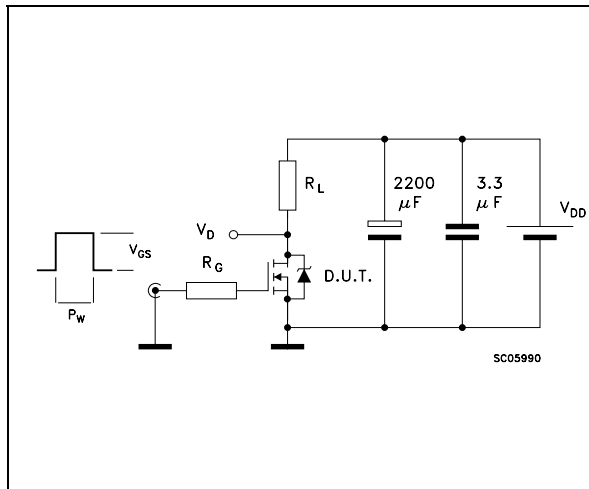


Figure 5: Test Circuit For Inductive Load Switching and Diode Recovery Times

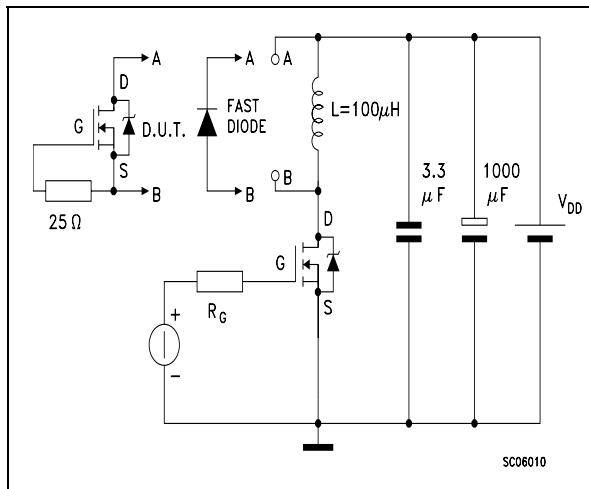


Figure 6: Unclamped Inductive Waform

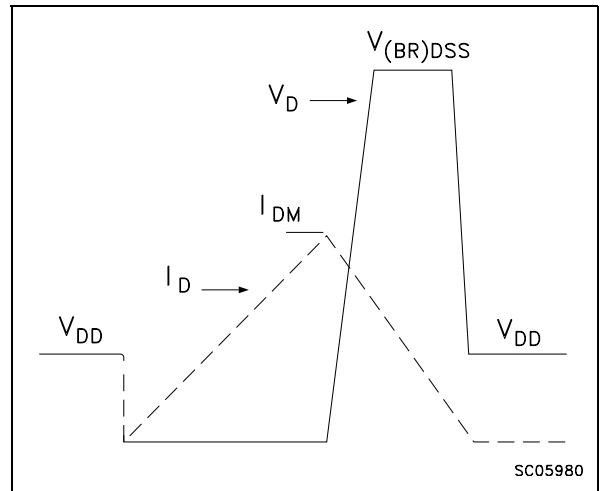
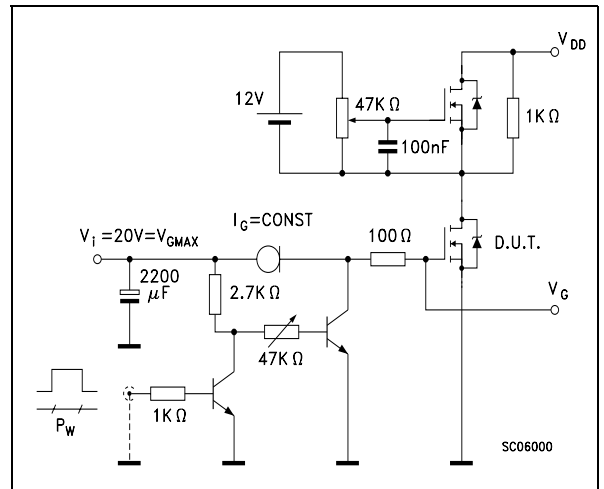
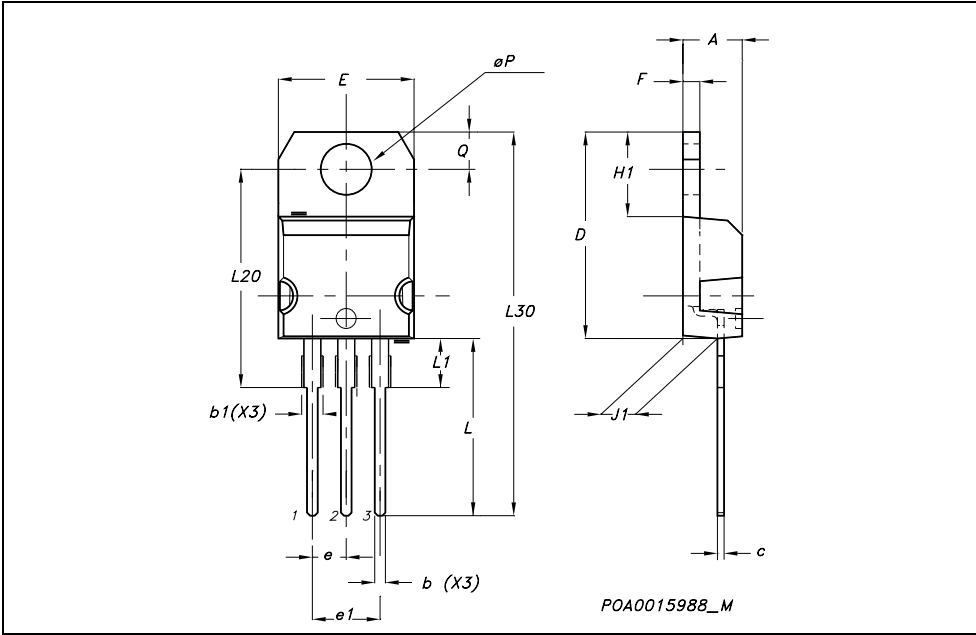


Figure 7: Gate Charge Test Circuit



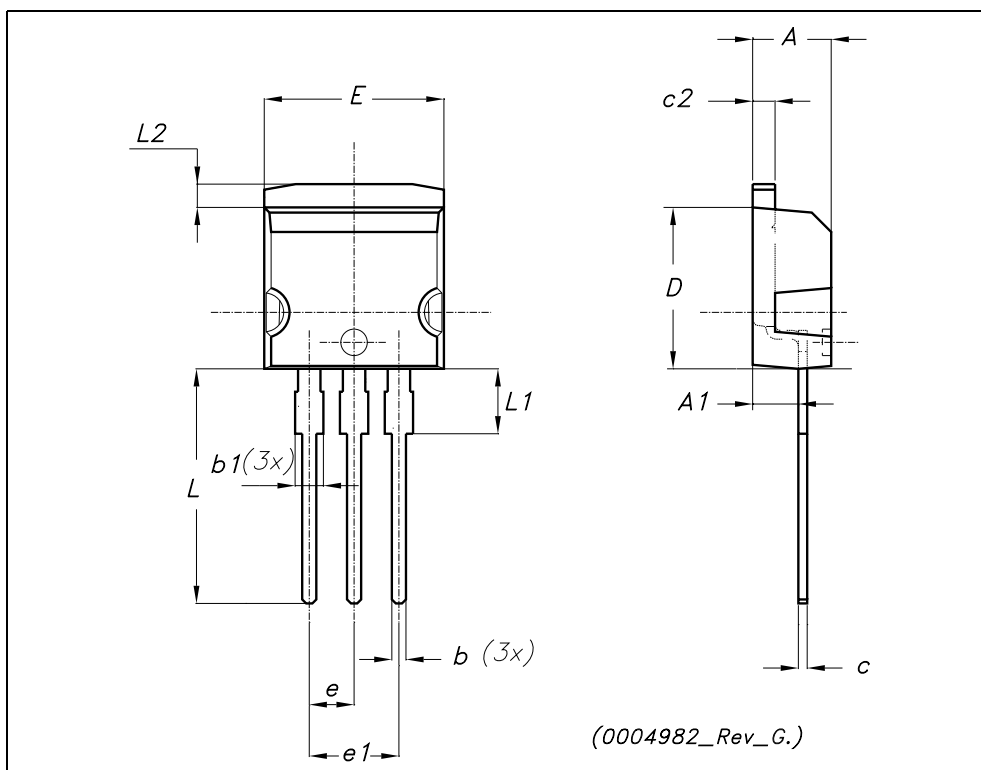
**TO-220 MECHANICAL DATA**

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



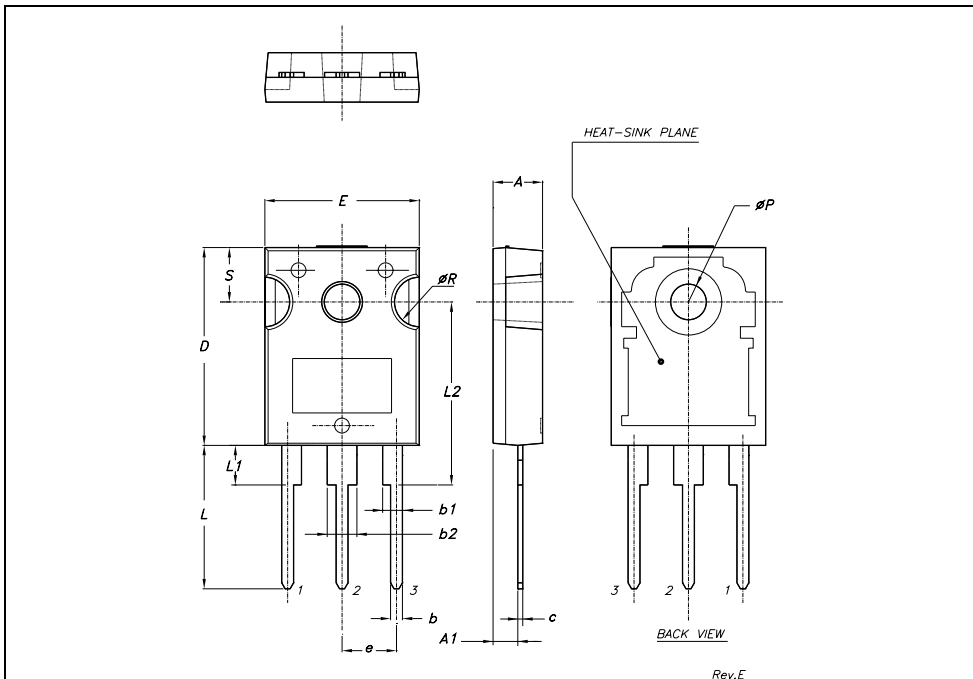
**TO-262 (I<sup>2</sup>PAK) MECHANICAL DATA**

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



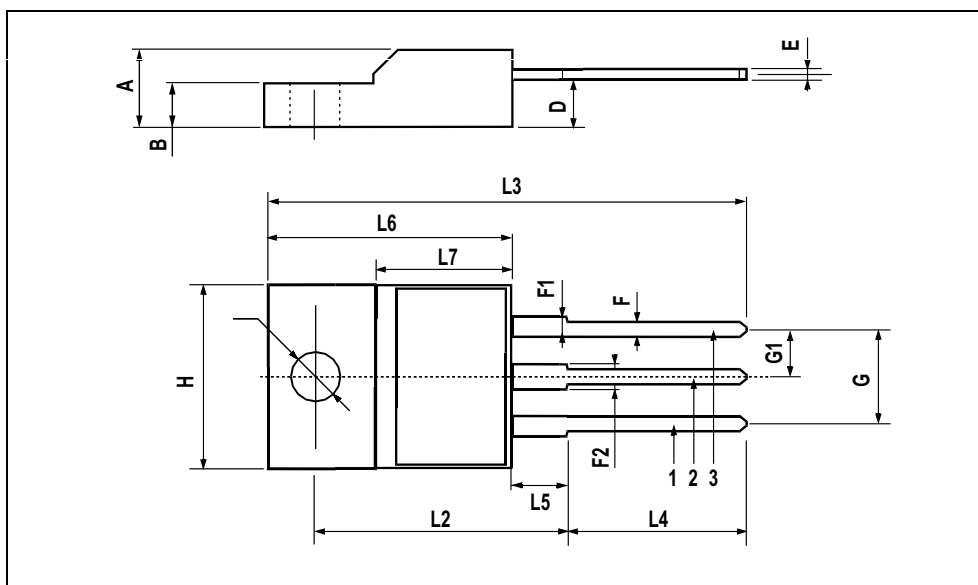
TO-247 MECHANICAL DATA

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-220FP MECHANICAL DATA**

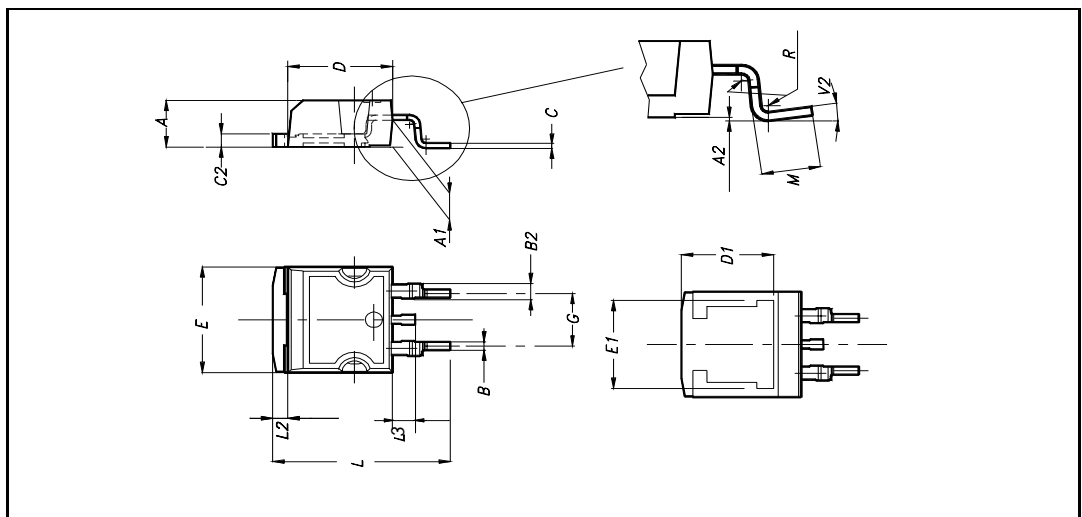
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			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



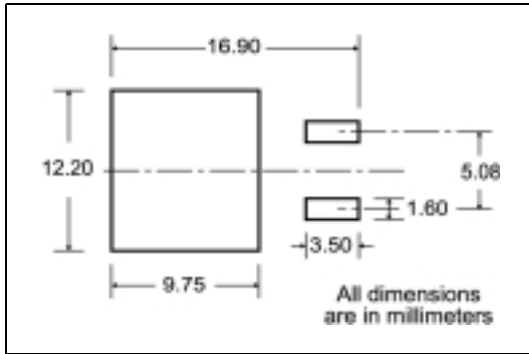


**D<sup>2</sup>PAK MECHANICAL DATA**

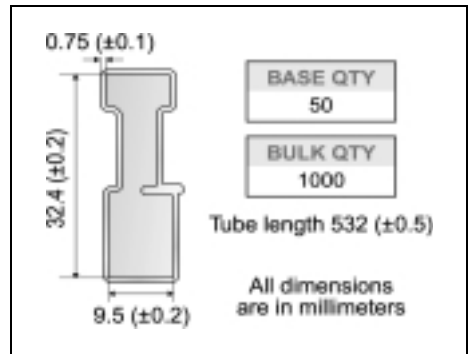
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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°			



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



**TUBE SHIPMENT (no suffix)\***



**TAPE AND REEL SHIPMENT (suffix "T4")\***

**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

**Table 9: Revision History**

Date	Revision	Description of Changes
30-Nov-2004	1	First Release.

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