



# STP130NS04ZB STB130NS04ZB - STW130NS04ZB

N-CHANNEL CLAMPED - 7 mΩ - 80A TO-220/D<sup>2</sup>PAK/TO-247  
FULLY PROTECTED MESH OVERLAY™ MOSFET

**Table 1: General Features**

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STP130NS04ZB	CLAMPED	< 9 mΩ	80 A
STB130NS04ZB	CLAMPED	< 9 mΩ	80 A
STW130NS04ZB	CLAMPED	< 9 mΩ	80 A

- TYPICAL R<sub>DS(on)</sub> = 7 mΩ
- 100% AVALANCHE TESTED
- LOW CAPACITANCE AND GATE CHARGE
- 175°C MAXIMUM JUNCTION TEMPERATURE

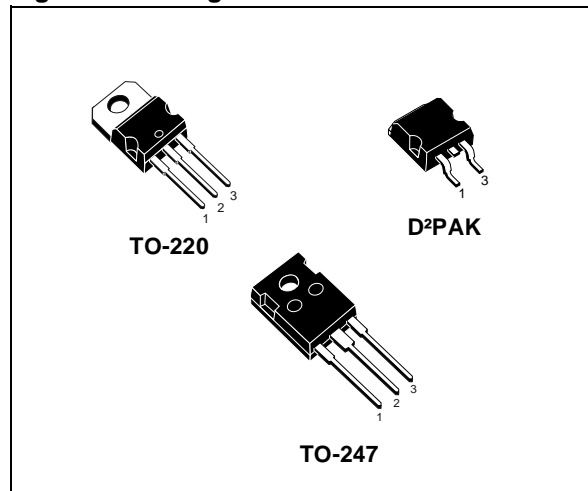
## DESCRIPTION

This fully clamped MOSFET is produced by using the latest advanced Company's Mesh Overlay process which is based on a novel strip layout. The inherent benefits of the new technology coupled with the extra clamping capabilities make this product particularly suitable for the harshest operation conditions such as those encountered in the automotive environment. Any other application requiring extra ruggedness is also recommended.

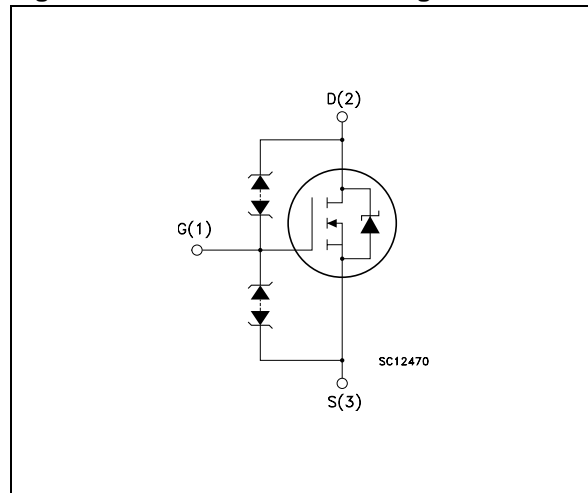
## APPLICATIONS

- HIGH SWITCHING CURRENT
- LINEAR APPLICATIONS

**Figure 1: Package**



**Figure 2: Internal Schematic Diagram**



**Table 2: Order Codes**

Sales Type	Marking	Package	Packaging
STP130NS04ZB	P130NS04ZB	TO-220	TUBE
STB130NS04ZBT4	B130NS04ZB	D <sup>2</sup> PAK	TAPE & REEL
STW130NS04ZB	W130NS04ZB	TO-247	TUBE

**Table 3: Absolute Maximum ratings**

Symbol	Parameter	Value	Unit
$V_{DS}$	Drain-source Voltage ( $V_{GS} = 0$ )	CLAMPED	V
$V_{DG}$	Drain-gate Voltage	CLAMPED	V
$V_{GS}$	Gate- source Voltage	CLAMPED	V
$I_D$	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	80	A
$I_D$	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	60	A
$I_{DG}$	Drain Gate Current (continuous)	$\pm 50$	mA
$I_{GS}$	Gate Source Current (continuous)	$\pm 50$	mA
$I_{DM}(\bullet)$	Drain Current (pulsed)	320	A
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	300	W
	Derating Factor	2.0	W/ $^\circ\text{C}$
$V_{ESD(G-S)}$	Gate-Source ESD(HBM-C=100 pF, R=1.5 K $\Omega$ )	4	KV
$T_j$ $T_{stg}$	Max Operating Junction Temperature Storage Temperature	-55 to 175	$^\circ\text{C}$

( $\bullet$ ) Pulse width limited by safe operating area

**Table 4: Thermal Data**

		TO-220	D <sup>2</sup> PAK	TO-247	Unit
$R_{thj-case}$	Thermal Resistance Junction-case Max	0.50			$^\circ\text{C}/\text{W}$
$R_{thj-pcb} (*)$	Thermal Resistance Junction-pcb Max	--	35	--	$^\circ\text{C}/\text{W}$
$R_{thj-a}$	Thermal Resistance Junction-ambient Max	62.5	--	50	
$T_l$	Maximum Lead Temperature For Soldering Purpose (1.6 mm from case, for 10 sec)	300			$^\circ\text{C}$

(\*)When mounted on 1 inch<sup>2</sup> FR4 2oZ Cu

**Table 5: Avalanche Characteristics**

Symbol	Parameter	Max Value	Unit
$I_{AR}$	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by $T_j$ max)	80	A
$E_{AS}$	Single Pulse Avalanche Energy (starting $T_j = 25^\circ\text{C}$ , $I_D = I_{AR}$ , $V_{DD} = 30\text{V}$ )	500	mJ

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

**Table 6: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Clamped Voltage	$I_D = 1\text{ mA}$ , $V_{GS} = 0$ $-40 < T_j < 175\text{ }^{\circ}C$	33			V
$I_{DSS}$	Zero Gate Voltage Drain Current ( $V_{GS} = 0$ )	$V_{DS} = 16\text{ V}$ , $T_j = 25\text{ }^{\circ}C$ $V_{DS} = 16\text{ V}$ , $T_j = 125\text{ }^{\circ}C$			10 100	$\mu A$ $\mu A$
$I_{GSS}$	Gate-body Leakage Current ( $V_{DS} = 0$ )	$V_{GS} = \pm 10\text{ V}$ , $T_j = 25\text{ }^{\circ}C$			10	$\mu A$
$V_{GSS}$	Gate-Source Breakdown Voltage	$I_{GS} = \pm 100\text{ }\mu A$	18			V
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS} = I_D = 1\text{ mA}$	2		4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{ V}$ , $I_D = 40\text{ A}$		7	9	$m\Omega$

**Table 7: Dynamic**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{DS} = 15\text{ V}$ , $I_D = 40\text{ A}$		50		S
$C_{iss}$ $C_{oss}$ $C_{rss}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{DS} = 25\text{ V}$ , $f = 1\text{ MHz}$ , $V_{GS} = 0$		2700 1275 285		pF pF pF
$t_{d(on)}$ $t_f$ $t_{d(off)}$ $t_f$	Turn-on Delay Time Fall Time Turn-off Delay Time Fall Time	$V_{DD} = 17.5\text{ V}$ , $I_D = 40\text{ A}$ , $R_G = 4.7\text{ }\Omega$ , $V_{GS} = 10\text{ V}$ (see Figure 15)		40 220 170 100		ns ns ns ns
$Q_g$ $Q_{gs}$ $Q_{gd}$	Total Gate Charge Gate-Source Charge Gate-Drain Charge	$V_{DD} = 20\text{ V}$ , $I_D = 80\text{ A}$ , $V_{GS} = 10\text{ V}$ (see Figure 17)		80 20 27	105	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)				80 320	A A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 80\text{ A}$ , $V_{GS} = 0$			1.5	V
$t_{rr}$ $Q_{rr}$ $I_{RRM}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_{SD} = 80\text{ A}$ , $di/dt = 100\text{ A}/\mu s$ $V_{DD} = 25\text{ V}$ , $T_j = 150^{\circ}C$ (see Figure 16)		90 0.18 4		ns $\mu C$ A

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

(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area

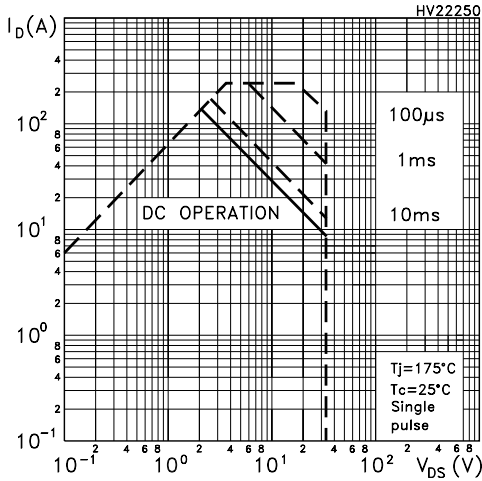


Figure 4: Output Characteristics

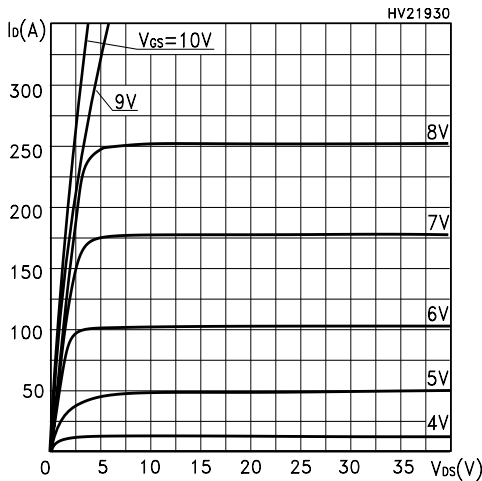


Figure 5: Transconductance

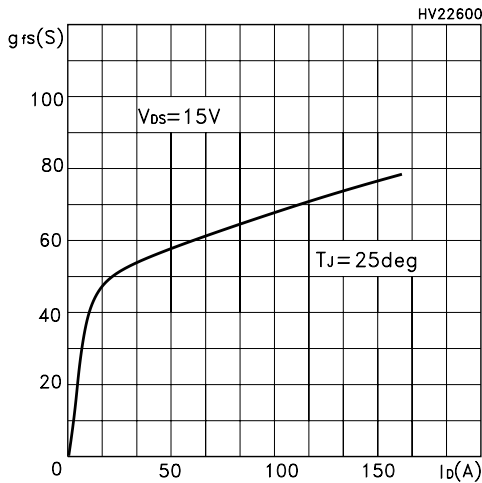


Figure 6: Thermal Impedance

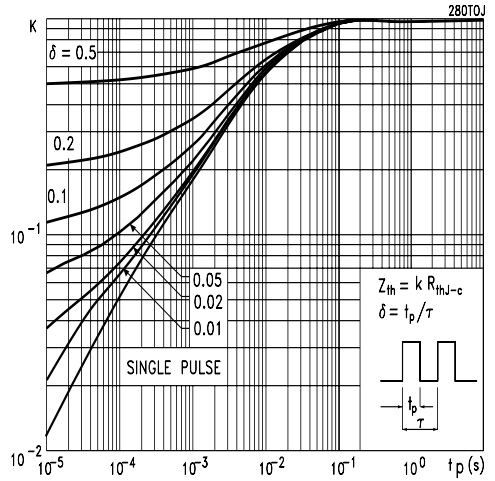


Figure 7: Transfer Characteristics

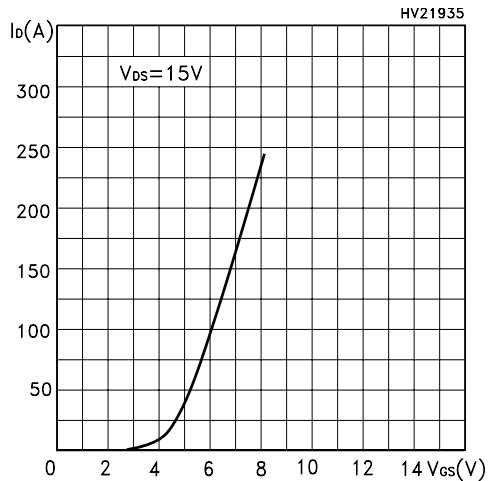


Figure 8: Static Drain-source On Resistance

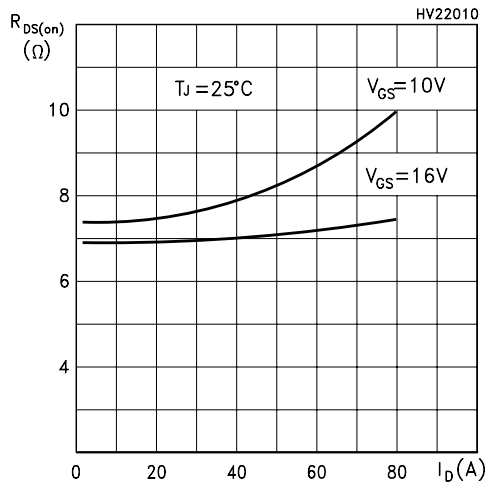


Figure 9: Gate Charge vs Gate-source Voltage

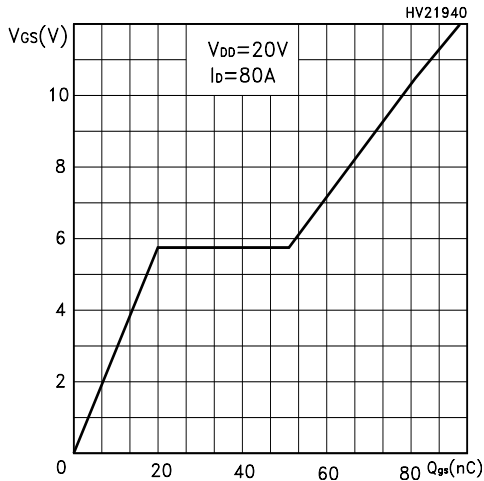


Figure 10: Normalized Gate Threshold Voltage vs Temperature

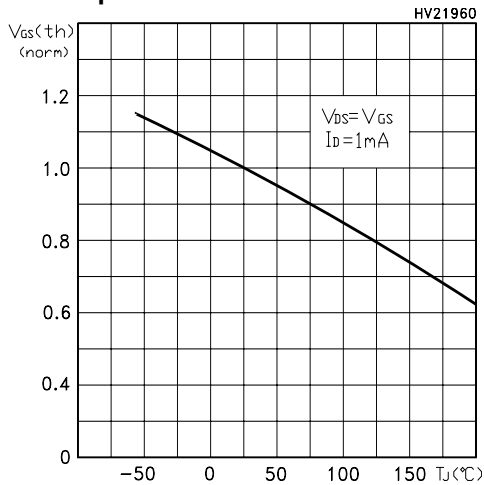


Figure 11: Capacitance Variations

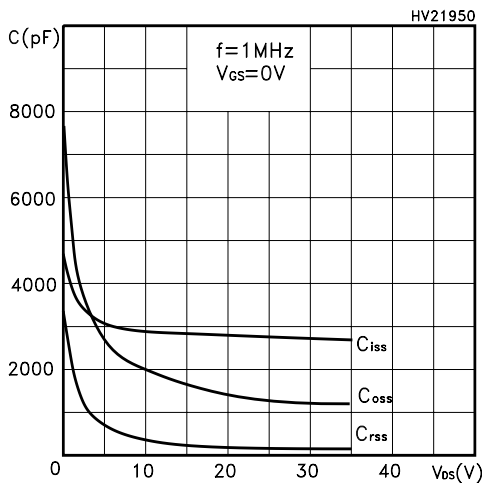


Figure 12: Normalized On Resistance vs Temperature

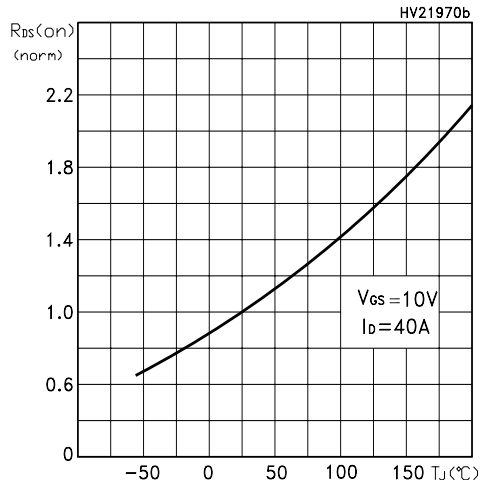


Figure 13: Source-drain Diode Forward Characteristics

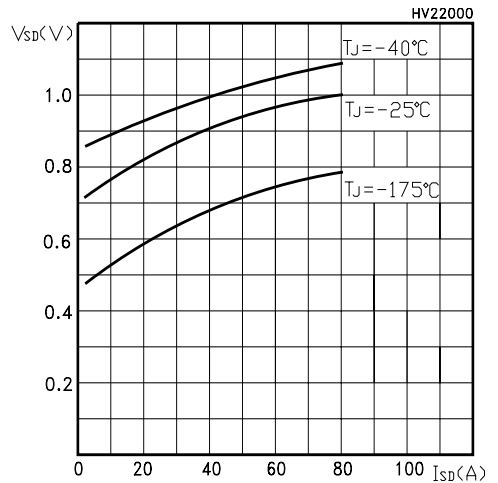


Figure 14: Normalized BVDS vs Temperature

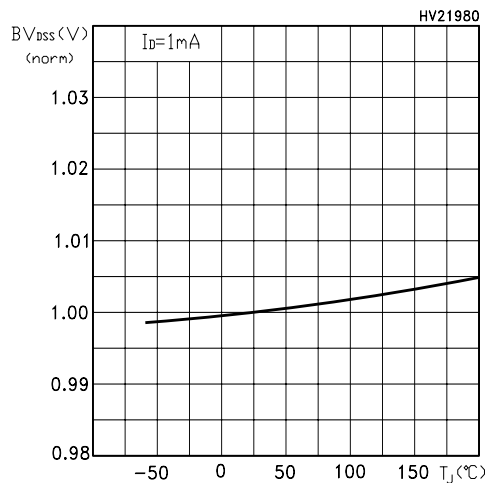


Figure 15: Switching Times Test Circuit For Resistive Load

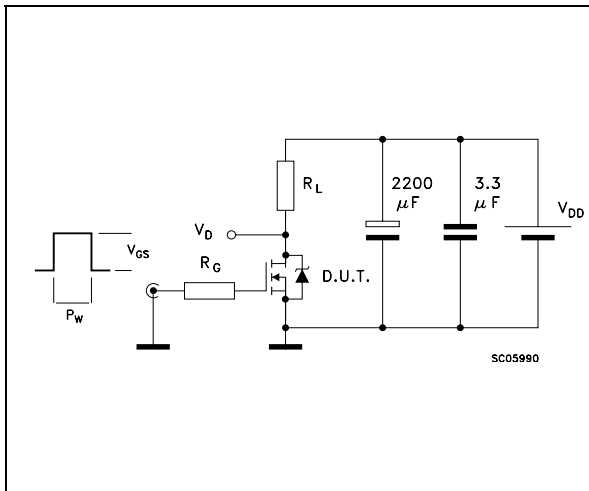


Figure 16: Test Circuit For Diode Recovery Behaviour

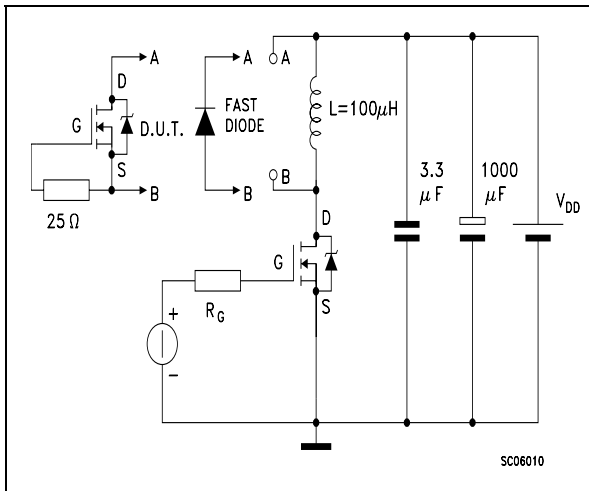
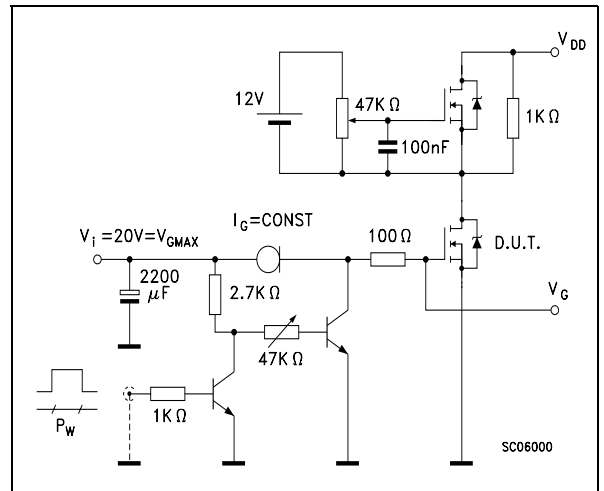
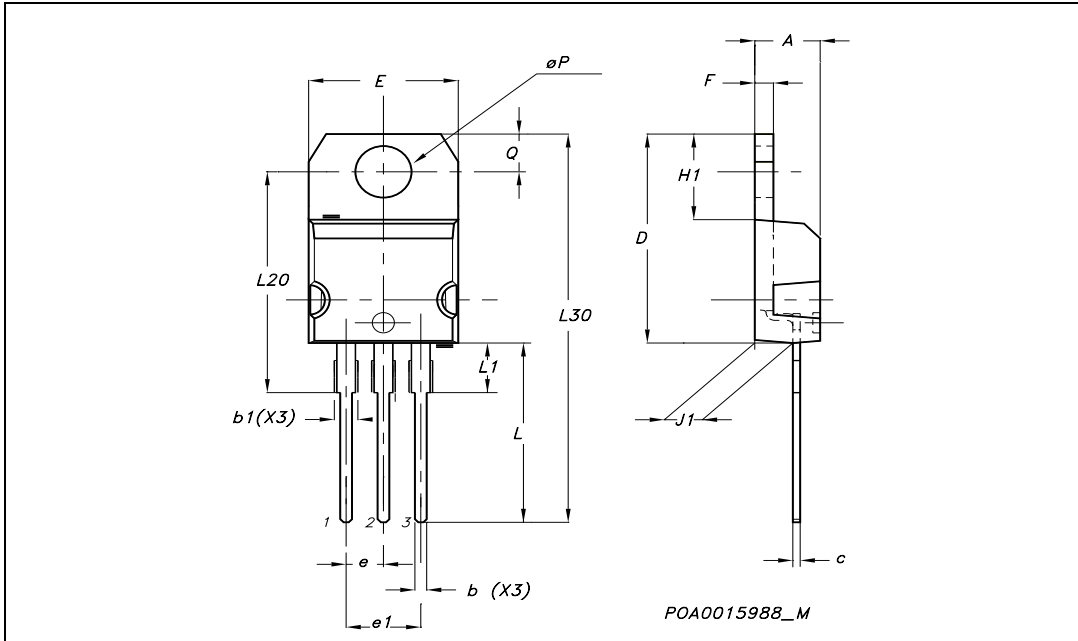


Figure 17: Gate Charge Test Circuit



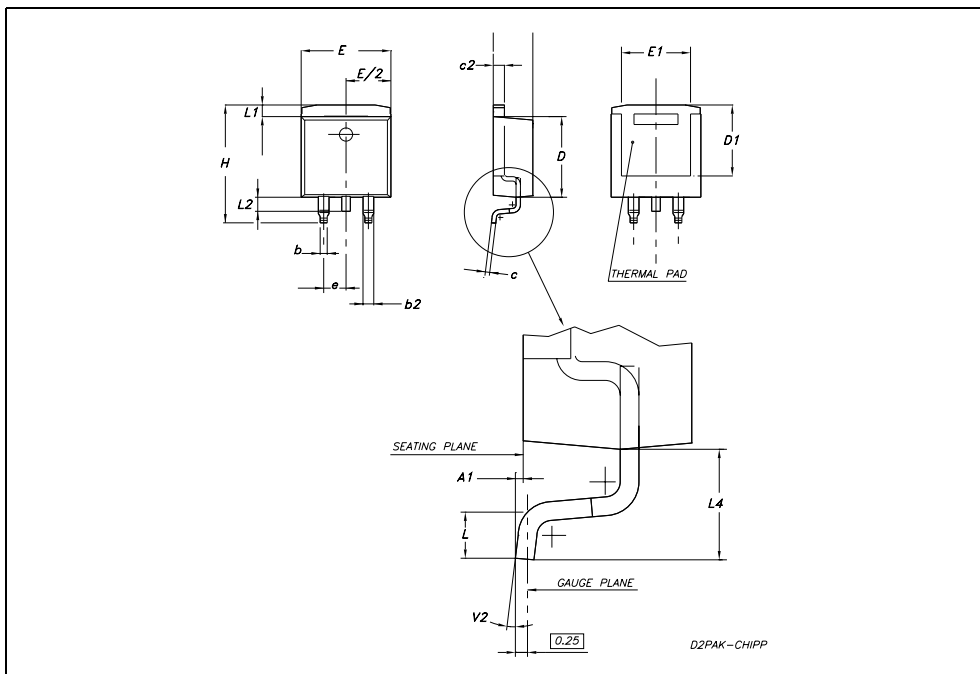
**TO-220 MECHANICAL DATA**

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-263 (D<sup>2</sup>PAK) MECHANICAL DATA

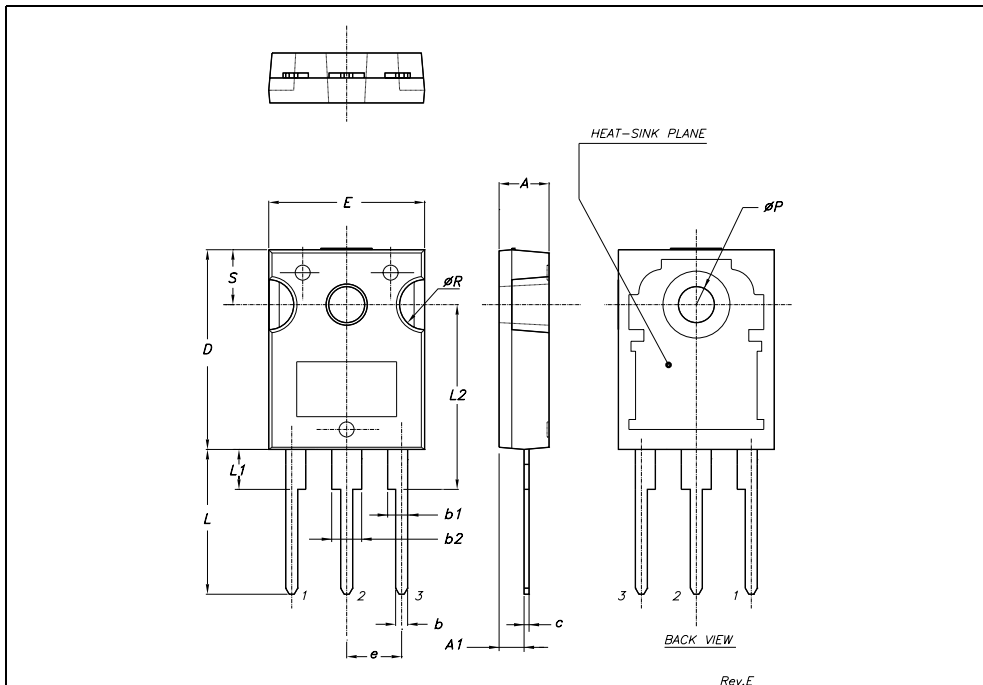
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.32		4.57	0.178		0.180
A1	0.00		0.25	0.00		0.009
b	0.71		0.91	0.028		0.350
b2	1.15		1.40	0.045		0.055
c	0.46		0.61	0.018		0.024
c2	1.22		1.40	0.048		0.055
D	8.89	9.02	9.40	0.350	0.355	0.370
D1	8.01			0.315		
E	10.04		10.28	0.395		0.404
e		2.54			0.010	
H	13.10		13.70	0.515		0.540
L	1.30		1.70	0.051		0.067
L1	1.15		1.39	0.045		0.054
L2	1.27		1.77	0.050		0.069
L4	2.70		3.10	0.106		0.122
V2	0°		8°	0°		8°



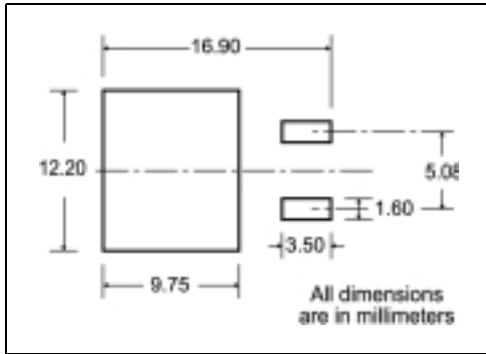


TO-247 MECHANICAL DATA

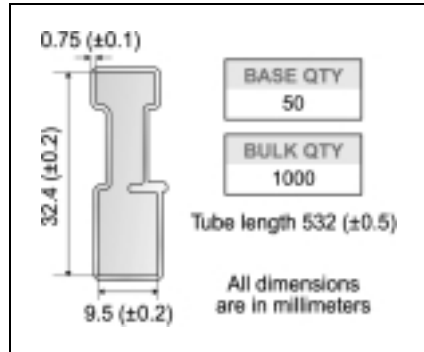
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.85		5.15	0.19		0.20
A1	2.20		2.60	0.086		0.102
b	1.0		1.40	0.039		0.055
b1	2.0		2.40	0.079		0.094
b2	3.0		3.40	0.118		0.134
c	0.40		0.80	0.015		0.03
D	19.85		20.15	0.781		0.793
E	15.45		15.75	0.608		0.620
e		5.45			0.214	
L	14.20		14.80	0.560		0.582
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	



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



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



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

Diagram showing the tape mechanical data. It includes a top view of the tape with dimensions A, B, C, D, and G. A note indicates "40 mm min. Access hole at slot location". Another note says "Tape slot in core for tape start 2.5mm min. width". A third note says "Full radius". A side view shows dimensions T, C, and N, with a note "G measured at hub".

**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

Diagram showing the reel mechanical data. It includes a top view of the reel with dimensions A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q, R, S, T, U, V, W, X, Y, Z. A note indicates "10 pitches cumulative tolerance on tape + / - 0.2 mm". A note says "TOP COVER TAPE". A note says "Center line of cavity". A note says "User Direction of Feed". A note says "FEED DIRECTION". A note says "Bending radius R min.".

\* on sales type

**Table 9: Revision History**

Date	Revision	Description of Changes
10-June-2004	1	First Release.
14-Jan-2005	2	Inserted D <sup>2</sup> PAK, Complete version.

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