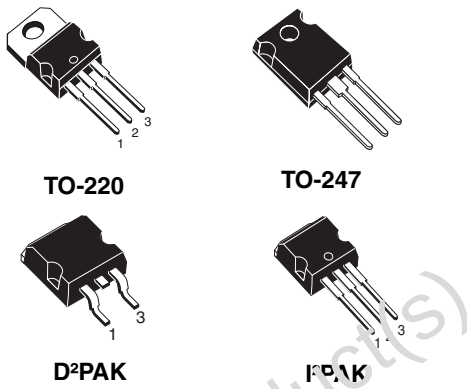
STP130NS04ZB - STB130NS04ZB-1
STB130NS04ZB - STW130NS04ZB

N-channel clamped - 7 mΩ - 80A TO-220/I²/D²PAK/TO-247
Fully protected mesh overlay™ MOSFET

General features

Type	V_{DSS}	$R_{DS(on)}$	I_D
STP130NS04ZB	clamped	<9 mΩ	80A
STB130NS04ZB	clamped	<9 mΩ	80A
STW130NS04ZB	clamped	<9 mΩ	80A
STB130NS04ZB	clamped	<9 mΩ	80A

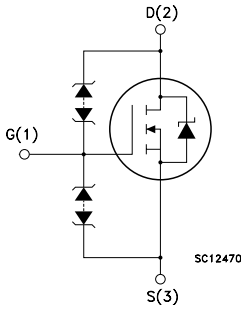
- 100% avalanche tested
- Low capacitance and gate charge
- 175°C maximum junction temperature



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.

Internal schematic diagram



Applications

- High switching current
- Linear applications

Order codes

Part number	Marking	Package	Packaging
STP130NS04ZB	P130NS04ZB	TO-220	Tube
STB130NS04ZBT4	B130NS04ZB	D²PAK	Tape & reel
STW130NS04ZB	W130NS04ZB	TO-247	Tube
STB130NS04ZB-1	B130NS04ZB	I²PAK	Tube

Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source voltage (V_{GS} = 0)	clamped	V
V_{GS}	Gate-source voltage	clamped	V
I_D	Drain current (continuous) at T_C = 25°C	80	A
I_D	Drain current (continuous) at T_C = 100°C	60	A
I_{DG}	Drain gate current (continuous)	± 50	mA
I_{GS}	Gate source current (continuous)	± 50	mA
I_{DM}(1)	Drain current (pulsed)	320	A
P_{TOT}	Total dissipation at T_C = 25°C	300	W
	Derating factor	2.0	W/°C
$V_{ESD(G-S)}$	Gate-source ESD(HBM-C=100 pF, R=1.5 KΩ)	4	KV
T_J T_{stg}	Operating junction temperature Storage temperature	-55 to 175	°C

1. Pulse width limited by safe operating area

Table 2. Thermal data

		TO-220	D²PAK/I²PAK	TO-247	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case Max	0.50			°C/W
Rthj-pcb(1)	Thermal resistance junction-pcb Max		35		°C/W
$R_{thj\text{-}a}$	Thermal resistance junction-ambient Max	62.5		50	
T_l(2)	Maximum lead temperature for soldering purpose	300			°C

1. When mounted on 1 inch² FR4 2oZ Cu
2. (1.6 mm from case, for 10 sec)

Table 3. Avalanche characteristics

Symbol	Parameter	Value	Unit
I_{AS}	Avalanche current, repetitive or not-repetitive (pulse width limited by Tj Max)	80	A
E_{AS}	Single pulse avalanche energy (starting Tj=25°C, Id=Iar, Vdd=30V)	500	mJ

2 Electrical characteristics

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

Table 4. On/off states

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source breakdown voltage	I_D = 1 mA, V_{GS} = 0 -40 < Tj < 175 °C	33			V
I_{DSS}	Zero gate voltage drain current (V_{GS} = 0)	V_{DS} = 16 V,T_j = 25 °C V_{DS} = 16 V,T_j = 125 °C			10 100	µA µA
I_{GSS}	Gate body leakage current (V_{DS} = 0)	V_{GS} = ±10 V, T_j = 25 °C			10	nA
V_{GSS}	Gate-source breakdown voltage	I_{GS}= ± 100µA	18			V
$V_{GS(th)}$	Gate threshold voltage	V_{DS} = V_{GS} = I_D = 1 mA	2		4	V
$R_{DS(on)}$	Static drain-source on resistance	V_{GS} = 10 V ,I_D = 40 A		7	9	mΩ

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward transconductance	V_{DS} =15V, I_D = 40A		50		S
C_{iss} C_{oss} C_{rss}	Input capacitance Output capacitance Reverse transfer capacitance	V_{DS} =25V, f=1 MHz, V_{GS}=0		2700 1275 285		pF pF pF
$t_{d(on)}$ t_r	Turn-on delay time Rise time	V_{DD} = 17.5 V, I_D = 40 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13)		40 10		ns ns
$t_{d(off)}$ t_f	Turn-off delay time Fall time	V_{DD} = 17.5 V, I_D = 40 A, R_G = 4.7 Ω, V_{GS} = 10 V (see Figure 13)		220 100		ns ns
Q_g Q_{gs} Q_{gd}	Total gate charge Gate-source charge Gate-drain charge	V_{DD}=20V, I_D = 80A V_{GS} =10V (see Figure 14)		80 20 27	105	nC nC nC

1. Pulsed: pulse duration=300µs, duty cycle 1.5%

Table 6. Source drain diode

Symbol	Parameter	Test conditions	Min	Typ.	Max	Unit
I_{SD}	Source-drain current				80	A
I_{SDM}(1)	Source-drain current (pulsed)				320	A
V_{SD}(2)	Forward on voltage	I_{SD}=80A, V_{GS}=0			1.5	V
t_{rr} Q_{rr} I_{RRM}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_{SD}=80A, di/dt = 100A/µs, V_{DD}=25V, Tj=150°C (see Figure 15)		90 0.18 4		ns µC A

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

2.1 Electrical characteristics (curves)

Figure 1. Safe operating area

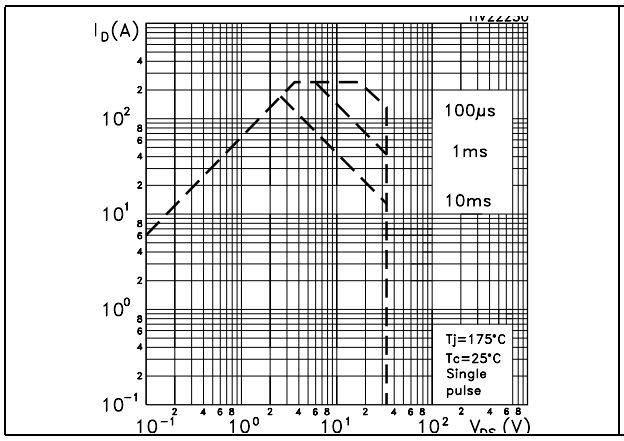


Figure 2. Thermal impedance

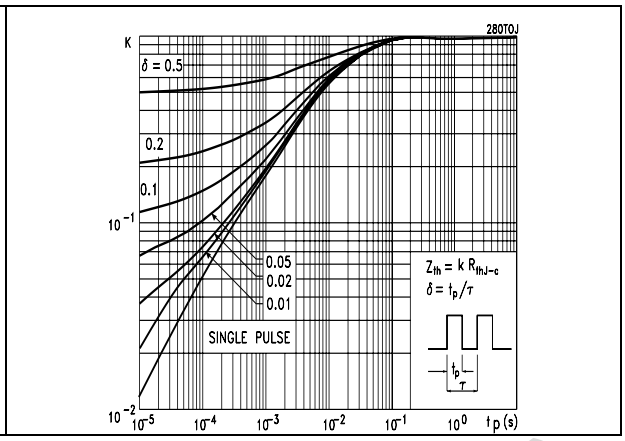


Figure 3. Output characterisics

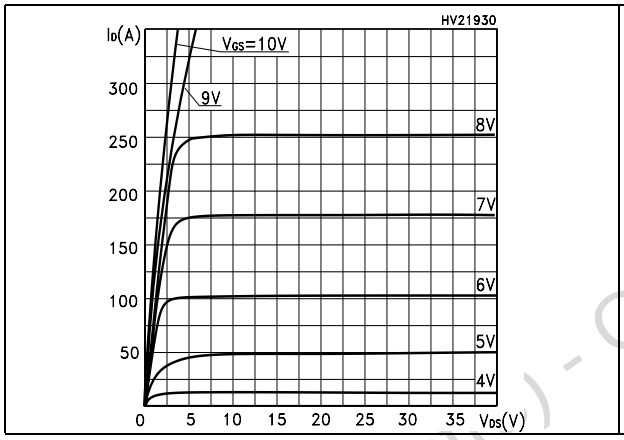


Figure 4. Transfer characteristics

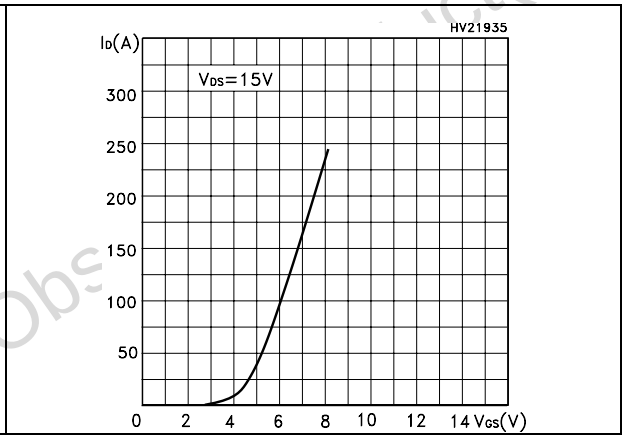


Figure 5. Transconductance

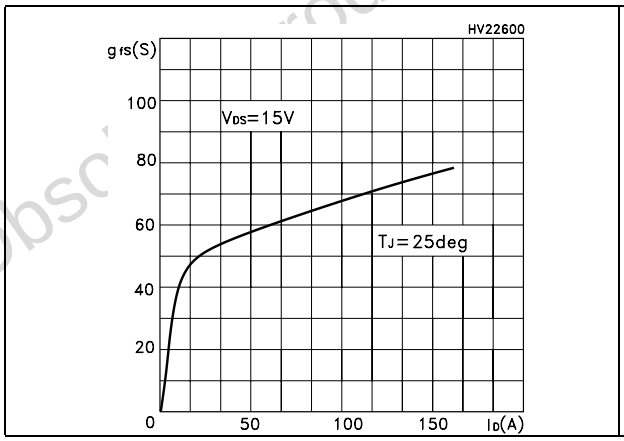


Figure 6. Static drain-source on resistance

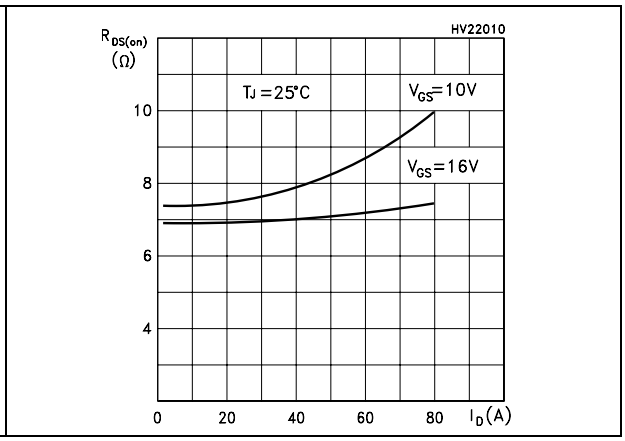


Figure 7. Gate charge vs gate-source voltage

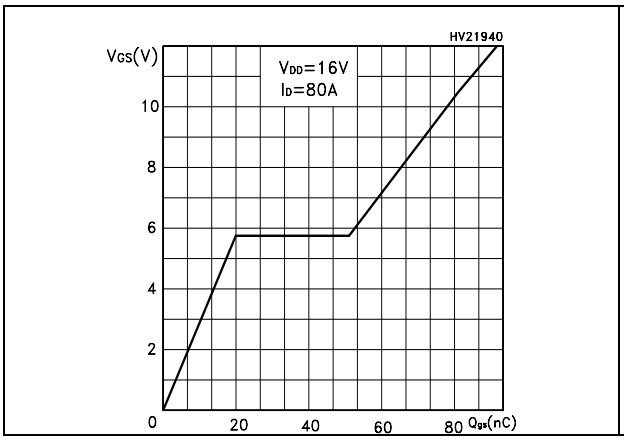


Figure 8. Normalized on resistance vs temperature

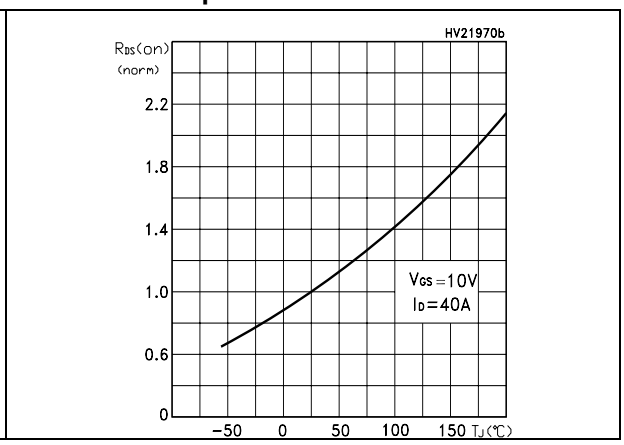


Figure 9. Normalized gate threshold voltage vs temperature

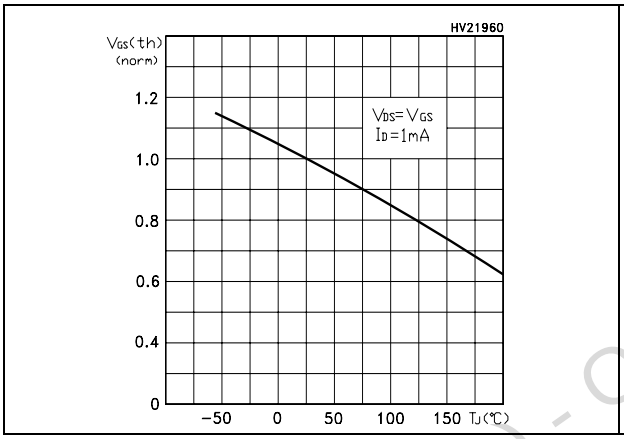


Figure 10. Source-drain diode forward characteristics

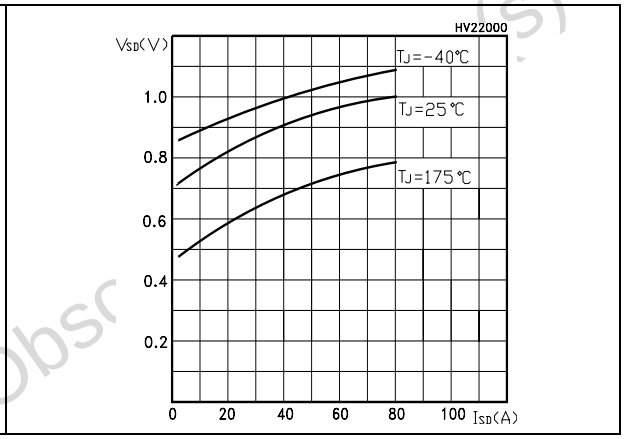


Figure 11. Capacitance variations

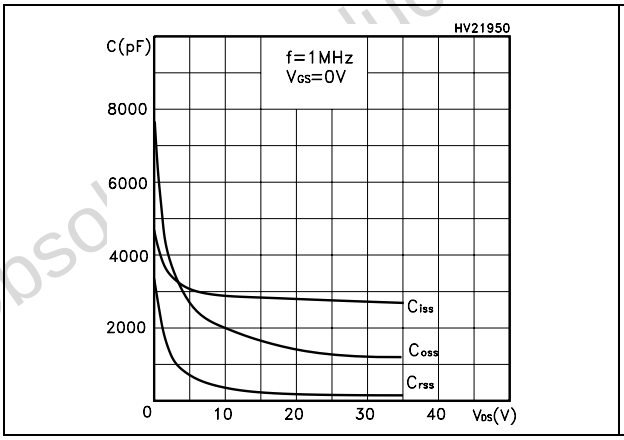
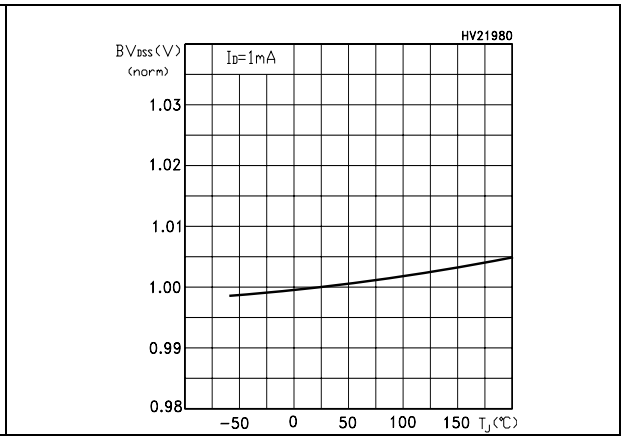


Figure 12. Normalized B_{VDSS} vs temperature



3 Test circuit

Figure 13. Switching times test circuit for resistive load

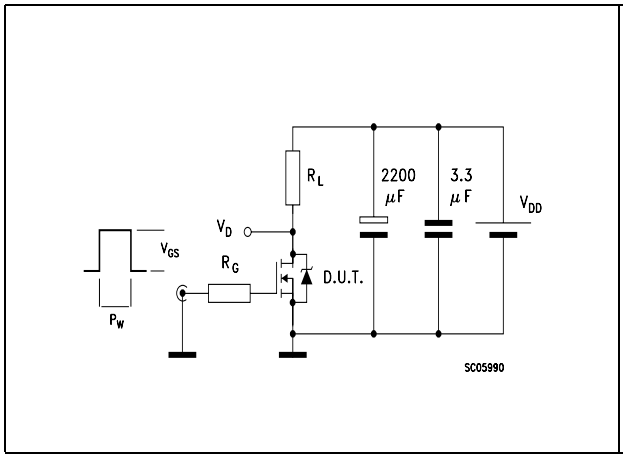


Figure 14. Gate charge test circuit

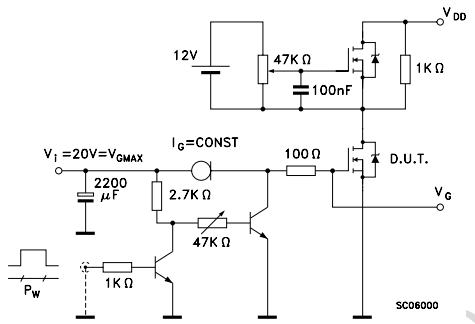


Figure 15. Test circuit for inductive load switching and diode recovery times

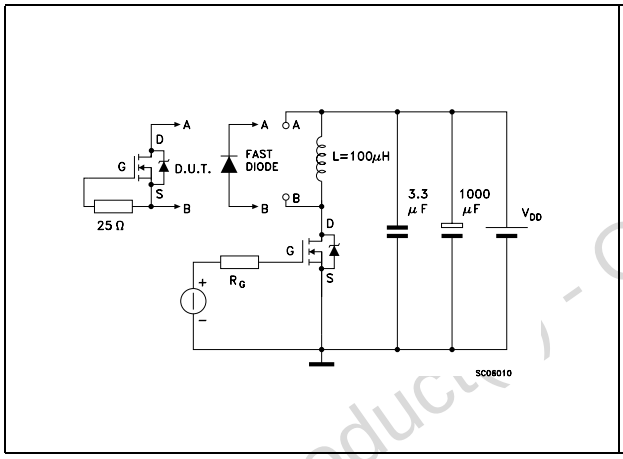


Figure 16. Unclamped Inductive load test circuit

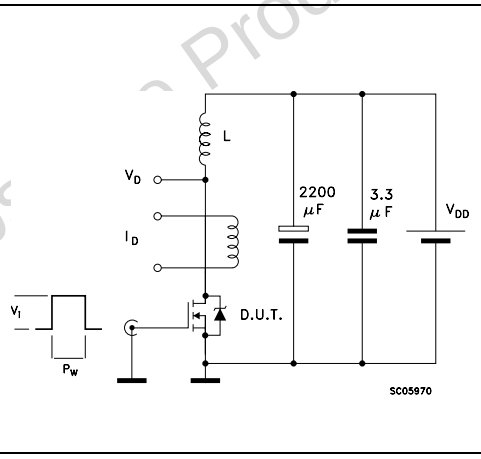


Figure 17. Unclamped inductive waveform

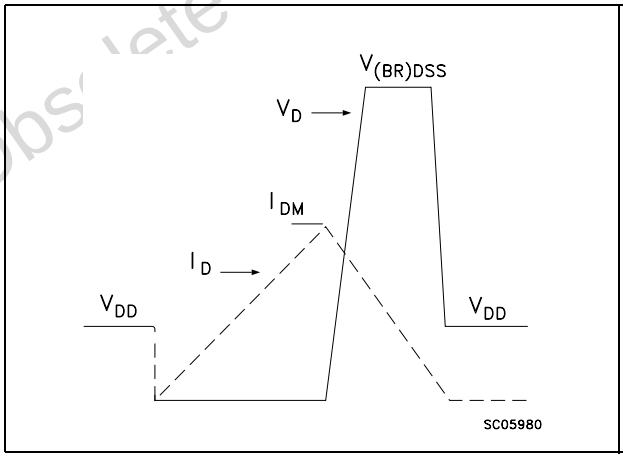
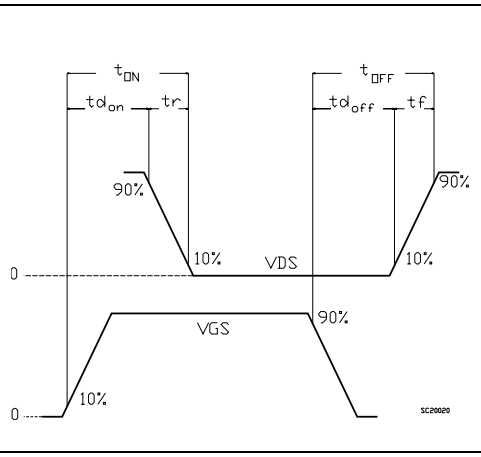


Figure 18. Switching time waveform

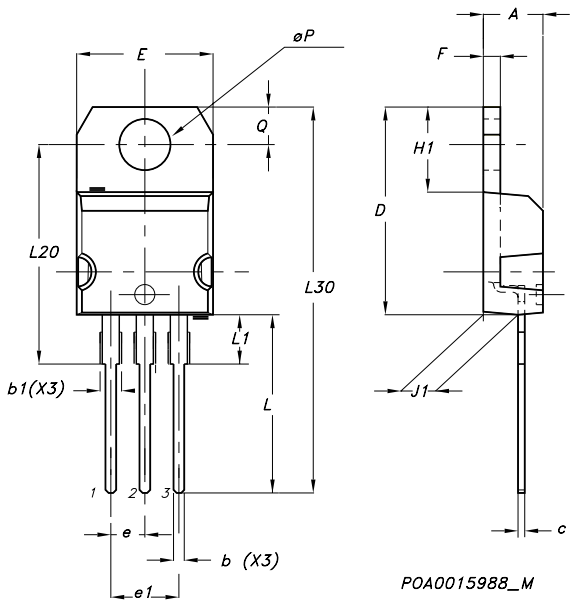


4 Package mechanical data

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

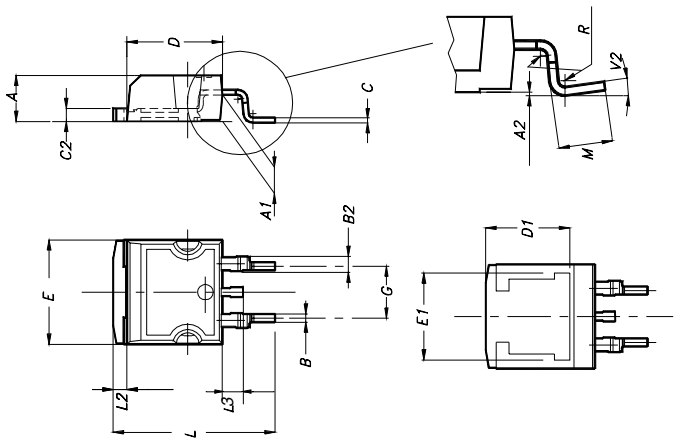
TO-220 MECHANICAL DATA

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



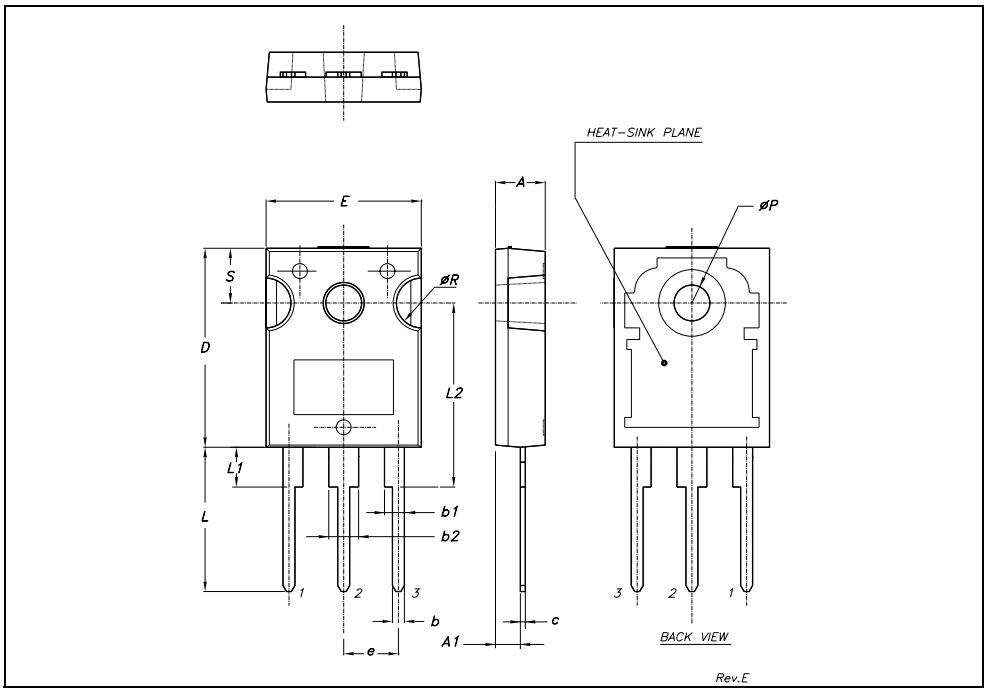
D²PAK MECHANICAL DATA

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	0º		4º			



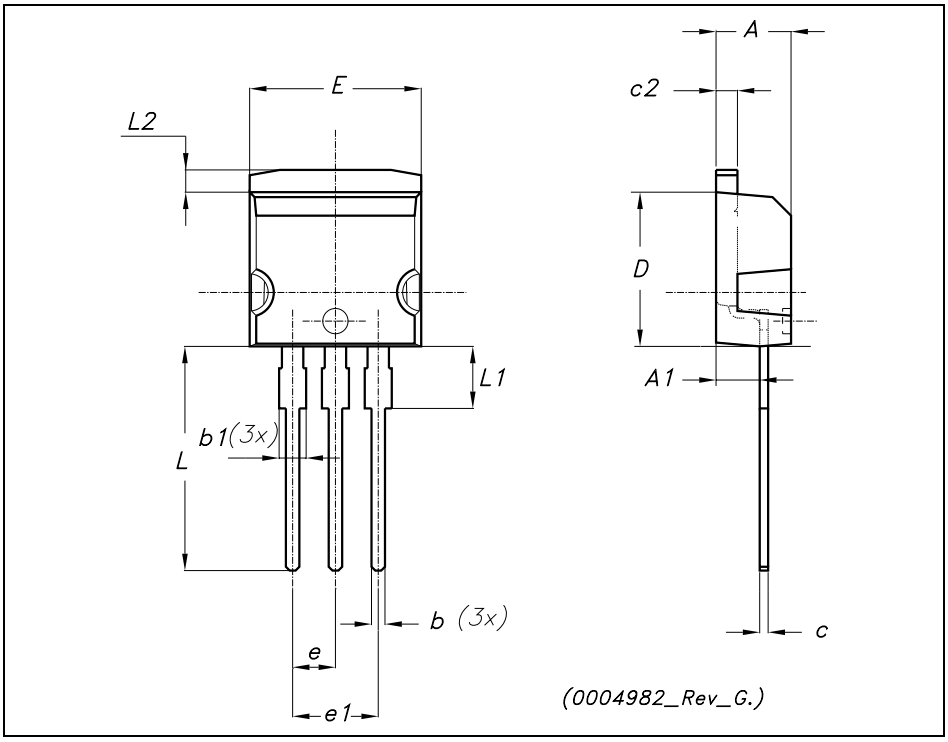
TO-247 MECHANICAL DATA

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	



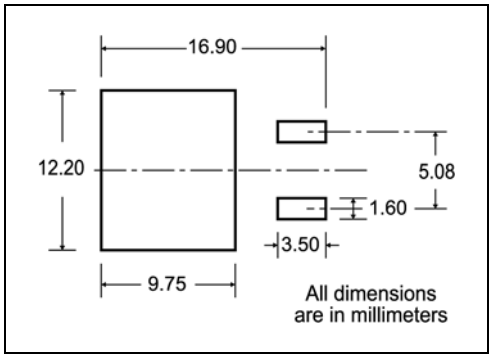
TO-262 (I^2PAK) MECHANICAL DATA

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

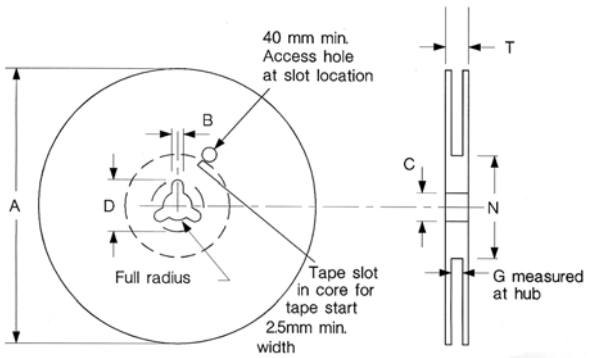


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



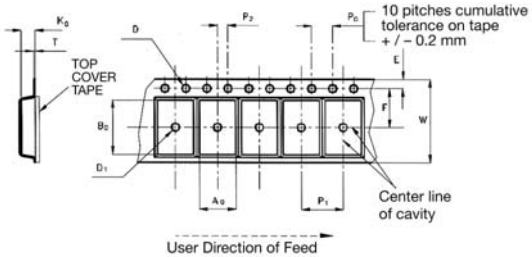
REEL MECHANICAL DATA

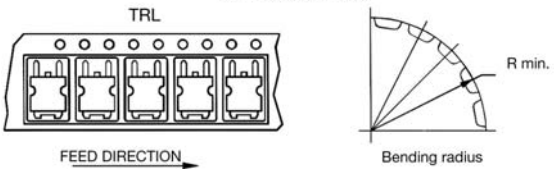
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

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

6 Revision history

Table 7. Revision history

Date	Revision	Changes
10-Feb-2005	1	First release.
14-Jan-2006	2	Inserted D²PAK, complete version.
03-Oct-2006	3	Inserted I²PAK.

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