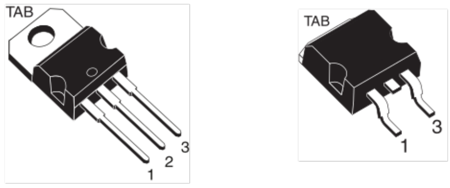
STGB10NB37LZ
STGP10NB37LZ

10 A - 410 V internally clamped IGBT

Features

- Low threshold voltage
- Low on-voltage drop
- Low gate charge
- High current capability
- High voltage clamping feature



TO-220 **D²PAK**

Applications

- Automotive ignition

Description

This IGBT utilizes the advanced PowerMESH™ process resulting in an excellent trade-off between switching performance and low on-state behavior. The built in collector-gate Zener exhibits a very precise active clamping while the gate-emitter Zener supplies an ESD protection.

Figure 1. Internal schematic diagram

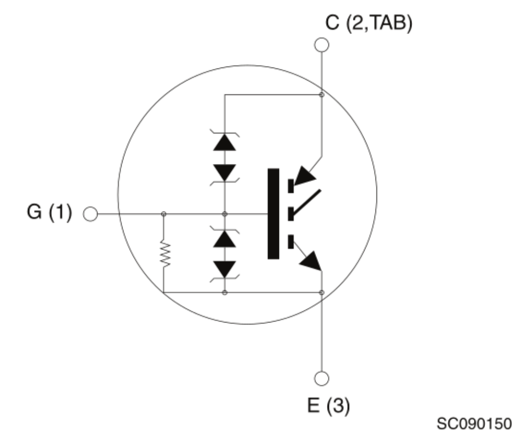


Table 1. Device summary

Order codes	Marking	Package	Packaging
STGB10NB37LZ	GB10NB37LZ	D²PAK	Tube
STGB10NB37LZT4	GB10NB37LZ	D²PAK	Tape and reel
STGP10NB37LZ	GP10NB37LZ	TO-220	Tube

Contents

1 Electrical ratings

Table 2. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-emitter voltage (V_{GE} = 0)	V_{CES} (clamped)	V
V_{ECS}	Emitter collector voltage (V_{GE} = 0)	18	V
I_C (1)	Collector current (continuous) at T_C = 25 °C	20	A
I_C (1)	Collector current (continuous) at T_C = 100 °C	10	A
I_{CP} (2)	Pulsed collector current	40	A
I_{CL} (3)	Turn-off latching current	40	A
V_{GE}	Gate-emitter voltage	V_{GE} (clamped)	V
P_{TOT}	Total dissipation at T_C = 25 °C	125	W
ESD(HBM)	Electrostatic sensitive discharge, human body model applied to all three pins (C=100 pF, R=1.5 kΩ)	4	kV
E_{AS}	Single pulse energy at T_C = 25 °C	300	mJ
T_{stg}	Storage temperature	– 65 to 175	°C
T_j	Operating junction temperature		

1. Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{j(max)} - T_C}{R_{thj-c} \times V_{CE(sat)(max)}(T_{j(max)}, I_C(T_C))}$$

2. Pulse width limited by maximum junction temperature and turn-off within RBSOA
3. V_{clamp} = 328 V, T_C = 125 °C, R_G=1 kΩ, V_{GE}= 5 V

Table 3. Thermal data

Symbol	Parameter	Value	Unit
$R_{thj\text{-}case}$	Thermal resistance junction-case	1.2	°C/W
$R_{thj\text{-}amb}$	Thermal resistance junction-ambient	62.5	°C/W

2 Electrical characteristics

(T_J = 25 °C unless otherwise specified)

Table 4. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
V_{CES}(clamped)	Collector emitter clamped voltage (V_{GE} = 0)	I_C = 2 mA, T_J = -40 °C to 150 °C	380	410	440	V
$V_{(BR)ECS}$	Emitter collector break-down voltage (V_{GE} = 0)	I_{EC} = 75 mA	18			V
V_{GE}(clamped)	Gate emitter clamped voltage	I_G = ± 2 mA	12		16	V
$V_{CE(sat)}$	Collector-emitter saturation voltage	V_{GE} = 4.5 V, I_C= 10 A V_{GE} = 4.5 V, I_C= 20 A		1.2 1.3	1.8	V V
$V_{GE(th)}$	Gate threshold voltage	V_{CE} = V_{GE}, I_C= 250 µA T_J = -40 °C to 150 °C	0.6		2.2	V
I_{CES}	Collector cut-off current (V_{GE} = 0)	V_{CE} = 15 V, T_J= 150 °C V_{CE} = 200 V, T_J=150 °C			10 100	µA µA
I_{GES}	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= ±10 V			±700	µA
R_{GE}	Gate emitter resistance			20		kΩ
g_{fs}	Forward transconductance	V_{CE} = 25 V, I_C = 20 A		18		S

Table 5. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0		1300 105 12		pF pF pF
Q_g	Total gate charge	V_{CE} = 328 V, I_C = 10 A, V_{GE} = 5 V, (see *Figure 18*)		28		nC

Table 6. Functional characteristics

Symbol	Parameter	Test condition	Min.	Typ.	Max.	Unit
U.I.S.	Unclamped inductive switching current	R_{GOFF} = 1 kΩ, L = 1 mH, T_J = 125 °C	13			A

Table 7. Switching on/off (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on delay time Current rise time Turn-on current slope	V_{CC} = 328 V, I_C = 10 A R_G= 1 kΩ, V_{GE} = 5 V (see *Figure 19*)		1300 270 60		ns ns A/µs
t_c $t_r(V_{off})$ $t_d(_{off})$ t_f	Cross-over time Off voltage rise time Delay time Fall time	V_{CC} = 328 V, I_C = 10 A R_G= 1 KΩ, V_{GE} = 5 V (see *Figure 19*)		3.6 2 8 1.4		µs µs µs µs
t_c $t_r(V_{off})$ $t_d(_{off})$ t_f	Cross-over time Off voltage rise time Delay time Fall time	V_{CC} = 328 V, I_C = 10 A R_G= 1 kΩ, V_{GE} = 5 V, T_J = 125 °C (see *Figure 19*)		5.7 2.7 9.2 2.8		µs µs µs µs

Table 8. Switching energy (inductive load)

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
E_{on}(1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 328 V, I_C = 10 A R_G= 1 kΩ, V_{GE} = 5 V (see *Figure 19*)		2.4 5 7.4		mJ mJ mJ
E_{on}(1) E_{off}(2) E_{ts}	Turn-on switching losses Turn-off switching losses Total switching losses	V_{CC} = 328 V, I_C = 10 A R_G= 1 kΩ, V_{GE} = 5 V, T_J = 125 °C (see *Figure 19*)		2.6 8.7 11.3		mJ mJ mJ

1. Eon is the tun-on losses when a typical diode is used in the test circuit in figure 2. If the IGBT is offered in a package with a co-pak diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature (25 °C and 125 °C)
2. Turn-off losses include also the tail of the collector current

2.1 Electrical characteristics (curves)

Figure 2. Output characteristics

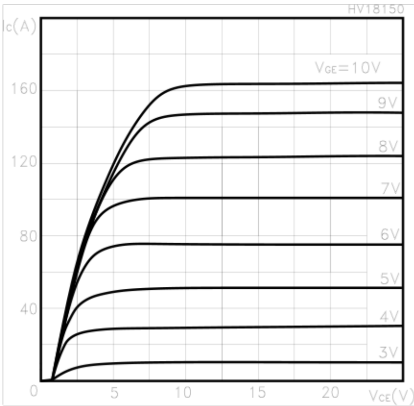


Figure 3. Transfer characteristics

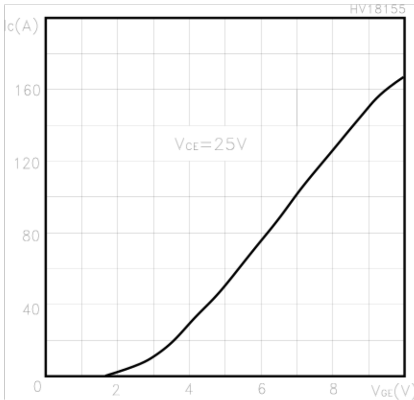


Figure 4. Transconductance

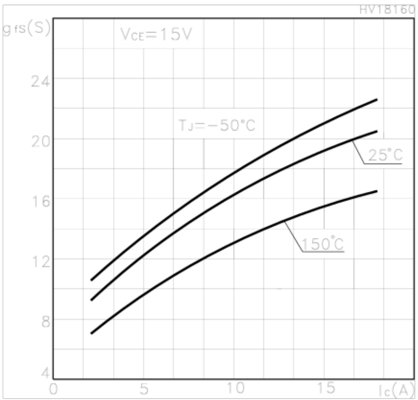


Figure 5. Collector-emitter on voltage vs temperature

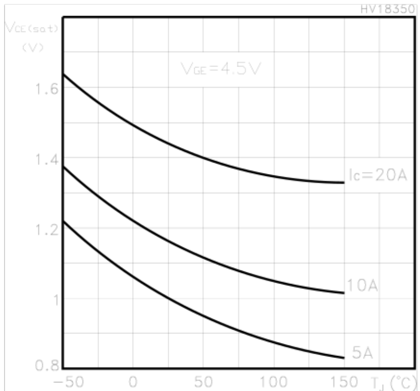


Figure 6. Gate charge vs gate-source voltage

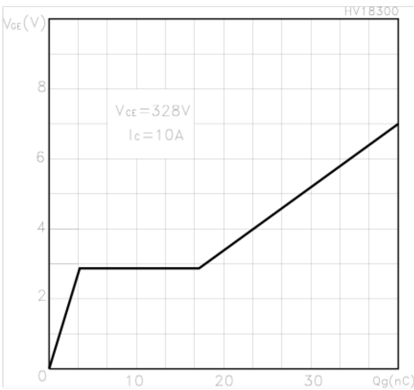


Figure 7. Capacitance variations

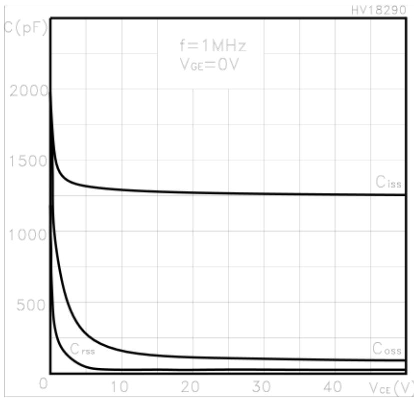


Figure 8. Normalized gate threshold voltage vs temperature

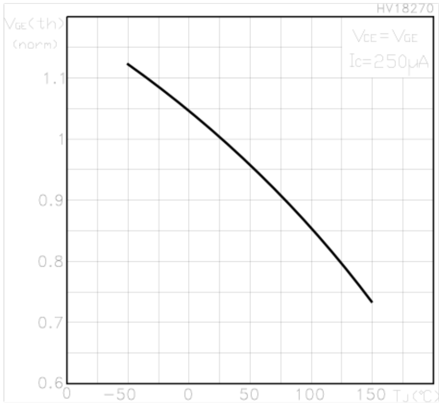


Figure 9. Collector-emitter on voltage vs collector current

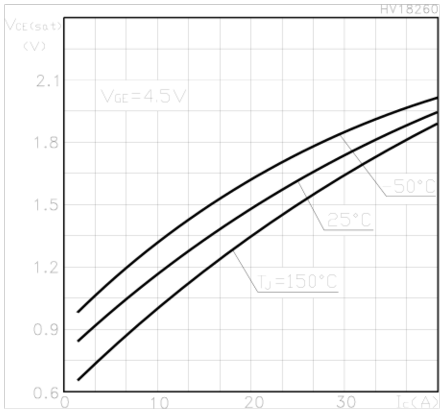


Figure 10. Normalized clamping voltage vs temperature

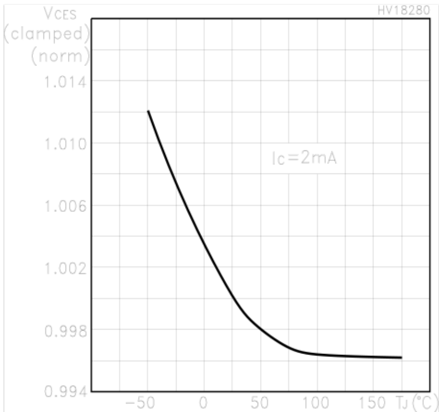


Figure 11. Switching losses vs temperature

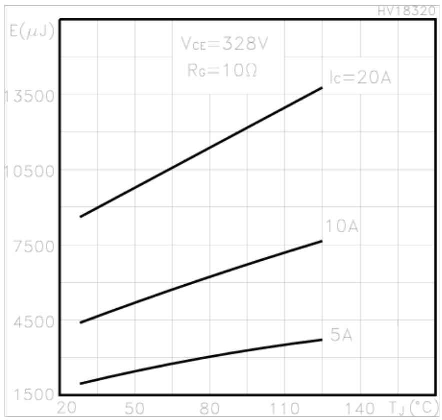


Figure 12. Switching losses vs gate resistance

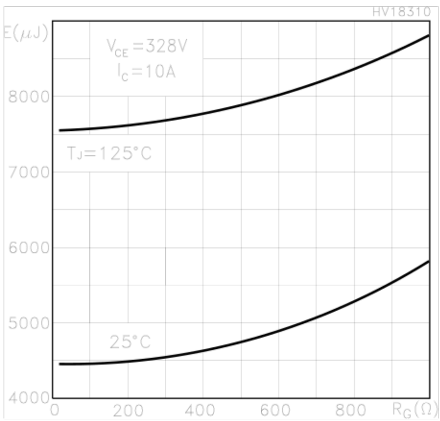


Figure 13. Switching losses vs collector current

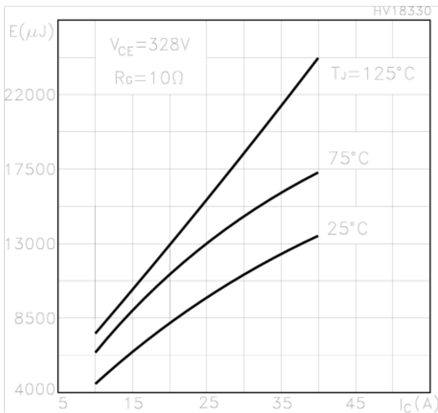


Figure 14. Thermal impedance

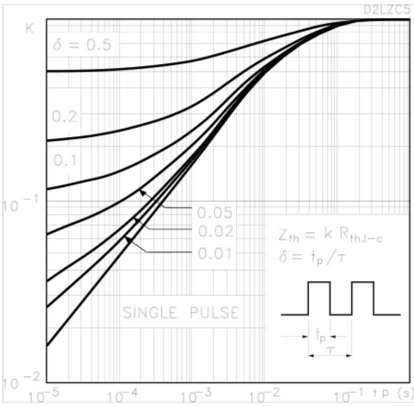


Figure 15. Turn-off SOA

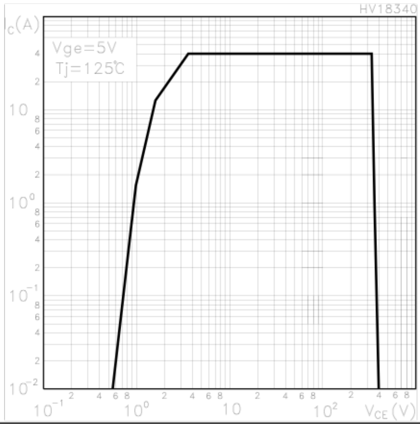
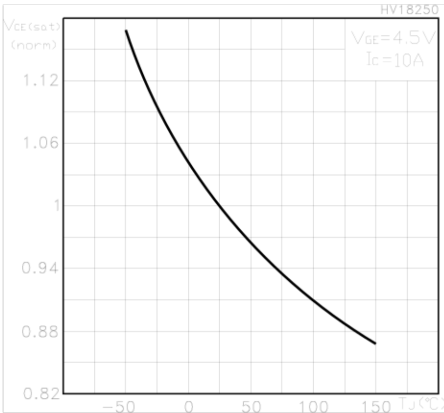


Figure 16. Normalized collector-emitter on voltage vs temperature



3 Test circuits

Figure 17. Test circuit for inductive load switching

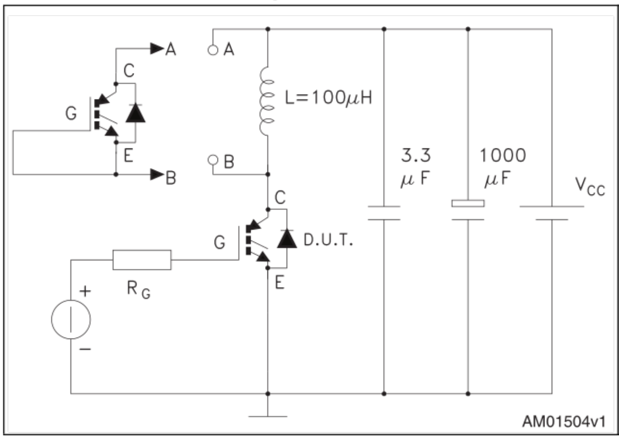


Figure 18. Gate charge test circuit

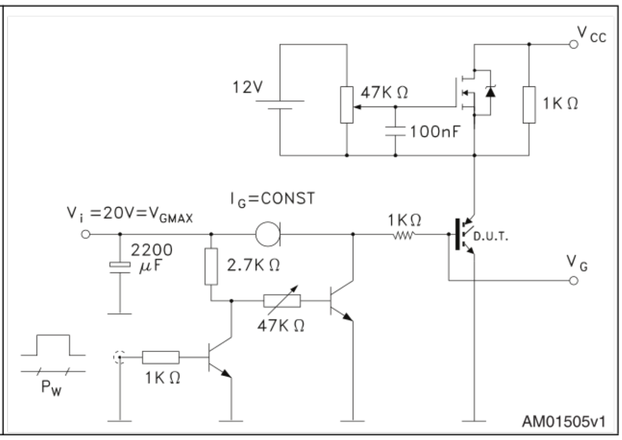
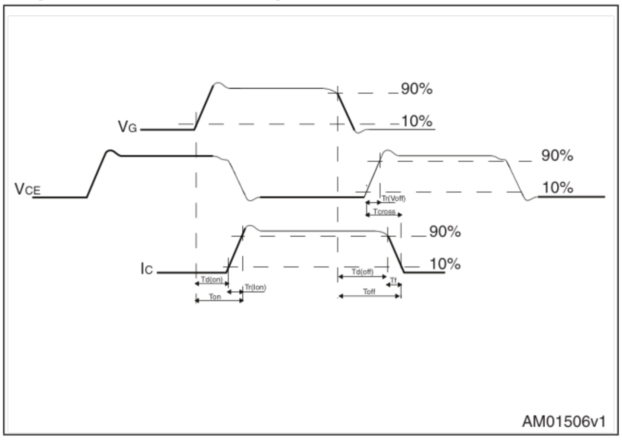


Figure 19. Switching waveform

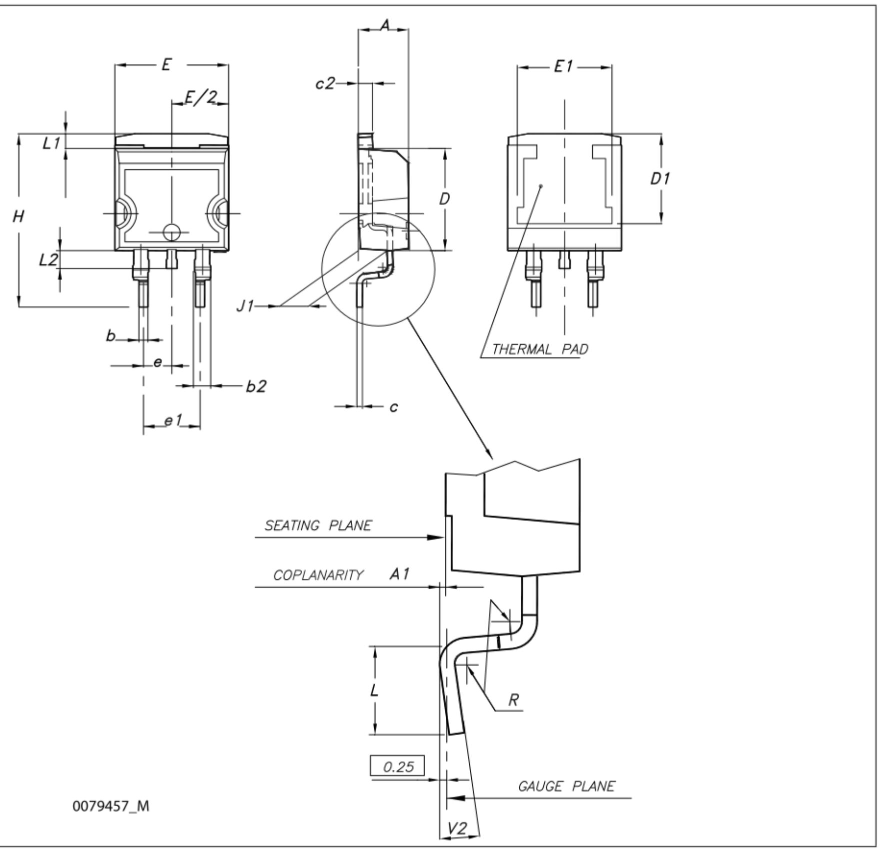


4 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK® packages, depending on their level of environmental compliance. ECOPACK® specifications, grade definitions and product status are available at: www.st.com. ECOPACK is an ST trademark.

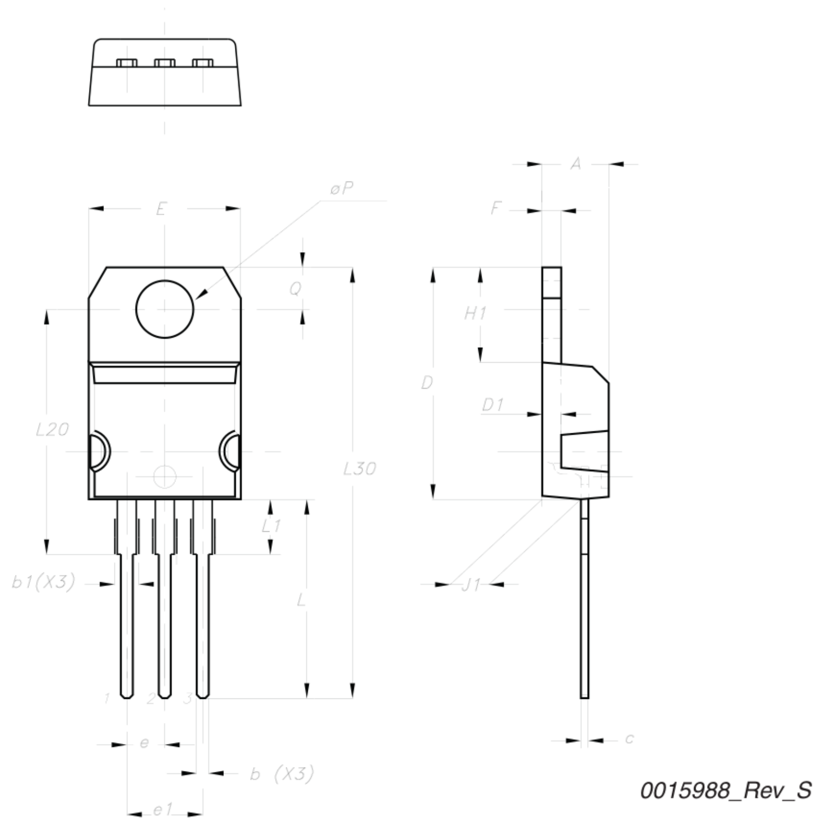
D^2PAK (TO-263) mechanical data

Dim	mm			inch		
	Min	Typ	Max	Min	Typ	Max
A	4.40		4.60	0.173		0.181
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°



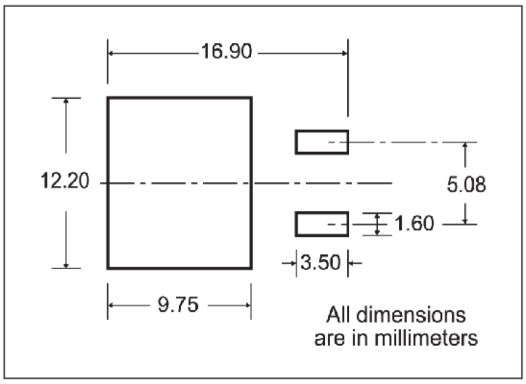
TO-220 type A mechanical data

Dim	mm		
	Min	Typ	Max
A	4.40		4.60
b	0.61		0.88
b1	1.14		1.70
c	0.48		0.70
D	15.25		15.75
D1		1.27	
E	10		10.40
e	2.40		2.70
e1	4.95		5.15
F	1.23		1.32
H1	6.20		6.60
J1	2.40		2.72
L	13		14
L1	3.50		3.93
L20		16.40	
L30		28.90	
∅P	3.75		3.85
Q	2.65		2.95

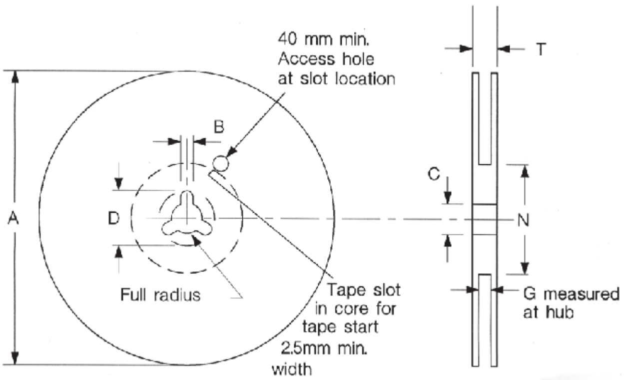


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



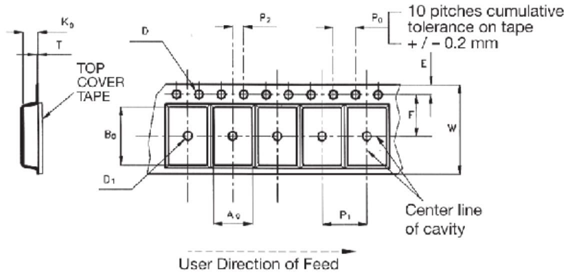
REEL MECHANICAL DATA

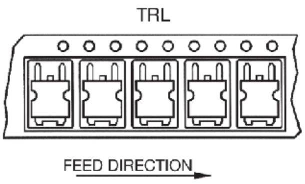
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

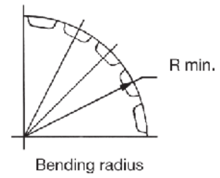
BASE QTY	BULK QTY
1000	1000

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







6 Revision history

Table 9. Document revision history

Date	Revision	Changes
23-Jan-2006	2	
11-Feb-2009	3	Added new package, mechanical data TO-220
06-Nov-2009	4	TO-220 mechanical data has been updated.