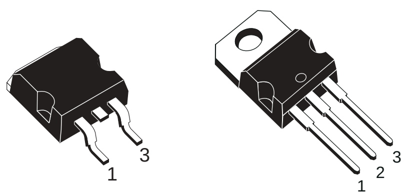
STGB10NC60HD
STGP10NC60HD

N-CHANNEL 600V - 10A - TO-220 - D^2PAK
VERY FAST PowerMESH™ IGBT

General features

Type	V_{CES}	$V_{CE(sat)}$ (Max)@ 25°C	I_C @100°C
STGB10NC60HD	600V	< 2.5V	10A
STGP10NC60HD	600V	< 2.5V	10A

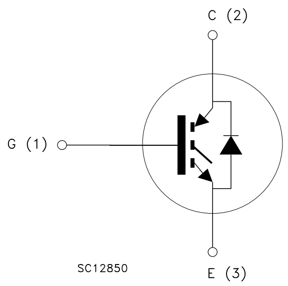
- Lower on-voltage drop (V_{cesat})
- Lower C_{RES} / C_{IES} ratio (no cross-conduction susceptbility)
- Very soft ultra fast recovery antiparallel diode



Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized for high frequency applications in order to achieve very high switching performances (reduced tfall) mantaining a low voltage drop.

Internal schematic diagram



Applications

- High frequency motor controls
- Smps and pfc in both hard switch and resonant topologies
- Motor drivers

Order codes

Sales Type	Marking	Package	Packaging
STGB10NC60HD	B10NC60HD	D²PAK	TAPE & REEL
STGP10NC60HD	P10NC60HD	TO-220	TUBE

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage (V_{GS} = 0)	600	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_{CM} (2)	Collector Current (pulsed)	40	A
I_F	Diode RMS Forward Current at T_C = 25°C	10	A
V_{GE}	Gate-Emitter Voltage	±20	V
P_{TOT}	Total Dissipation at T_C = 25°C	60	W
T_{stg}	Storage Temperature	– 55 to 150	°C
T_j	Operating Junction Temperature		
T_l	Maximum Lead Temperature For Soldering Purpose (for 10sec. 1.6 mm from case)	300	°C

1. Calculated according to the iterative formula::

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

2. Pulsed: Pulse duration = 300 µs, duty cycle 1.5%

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
Rthj-case	Thermal Resistance Junction-case Max	2.08	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W

2 Electrical characteristics

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

Table 3. Static

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	I_C= 1mA, V_{GE}= 0	600			V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE}= 15V, I_C= 5A V_{GE}= 15V, I_C= 5A, Tc= 125°C		1.9 1.7	2.5	V V
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE}= V_{GE}, I_C= 250 µA	3.75		5.75	V
I_{CES}	Collector cut-off Current (V_{GE} = 0)	V_{CE}= Max Rating,T_C= 25°C V_{CE}=Max Rating,T_C= 125°C			150 1	µA mA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE}= ±20V , V_{CE}= 0			±100	nA
g_{fs} 2	Forward Transconductance	V_{CE} = 15V, I_C= 5A		3.5		S

Table 4. Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{CE} = 25V, f = 1MHz, V_{GE} = 0		365 43 8.3		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CE} = 390V, I_C = 5A, V_{GE} = 15V, (see Figure 2)		19.2 4.5 7		nC nC nC

Table 5. 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} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, Tj= 25°C (see Figure 18)		14.2 5 1000		ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Turn-on Delay Time Current Rise Time Turn-on Current Slope	V_{CC} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, Tj=125°C (see Figure 18)		14 5 920		ns ns A/µs
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	V_{cc} = 390V, I_C = 5A, R_{GE} = 10Ω , V_{GE} = 15V,T_J=25°C (see Figure 18)		27 72 85		ns ns ns
$t_r(V_{off})$ $t_d(_{off})$ t_f	Off Voltage Rise Time Turn-off Delay Time Current Fall Time	V_{cc} = 390V, I_C = 5A, R_{GE}=10Ω , V_{GE} =15V, Tj=125°C (see Figure 18)		50 108 139		ns ns ns

Table 6. 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} = 390V, I_C = 5A R_G= 10Ω, V_{GE}=15V, Tj=25°C (see Figure 18)		31.8 95 126.8		µJ µJ µJ
E_{on}(1) E_{off}(2) E_{ts}	Turn-on Switching Losses Turn-off Switching Losses Total Switching Losses	V_{CC} = 390V, I_C = 5A R_G= 10Ω, V_{GE}= 15V, Tj= 125°C (see Figure 18)		61.8 173 234.8		µJ µJ µJ

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

Table 7. Collector-emitter diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_f	Forward On-Voltage	I_f = 2.5A I_f = 2.5A, Tj = 125°C		1.75 1.3	2.1	V V
t_{rr} Q_{rr} I_{rrm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_f = 5A ,V_R = 40V, Tj = 25°C, di/dt = 100 A/µs (see Figure 4)		21.5 14.2 1.32		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_f = 5A ,V_R = 40V, Tj =125°C, di/dt = 100A/µs (see Figure 4)		33 30.5 1.85		ns nC A

2.1 Electrical characteristics (curves)

Figure 1. Output characterisics

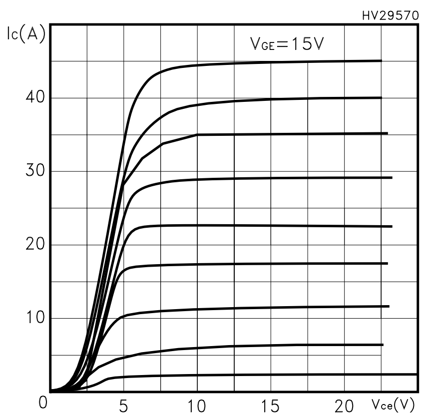


Figure 2. Transfer charactristics

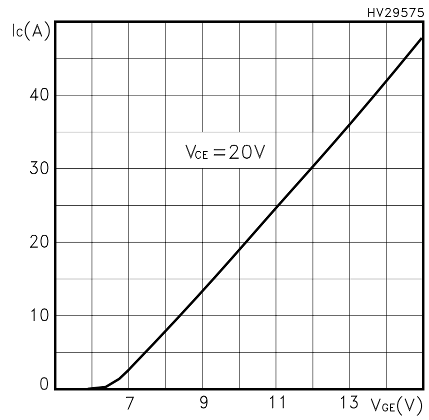


Figure 3. Transconductance

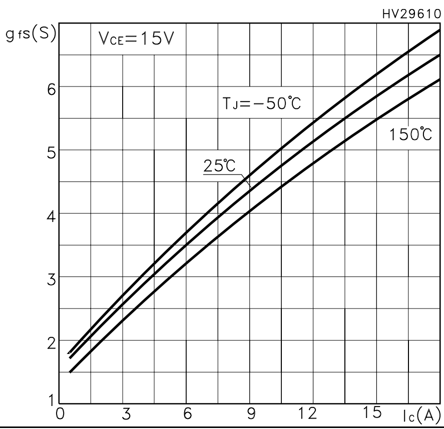


Figure 4. Collector-emitter on voltage vs temperature

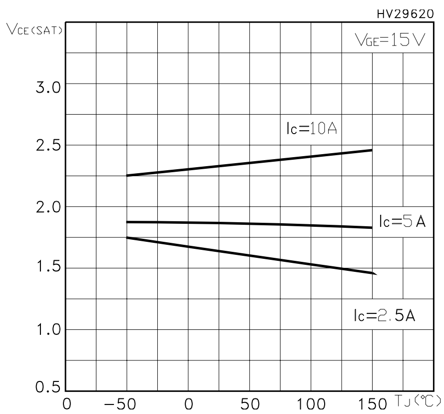


Figure 5. Gate charge vs gate-source voltage

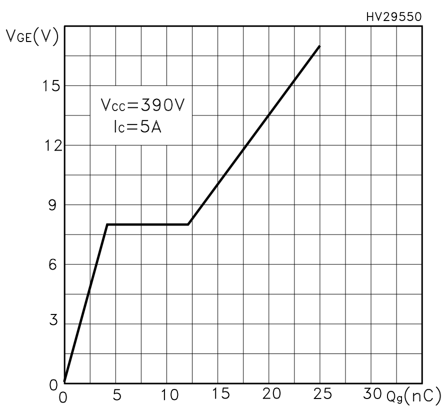


Figure 6. Capacitance variations

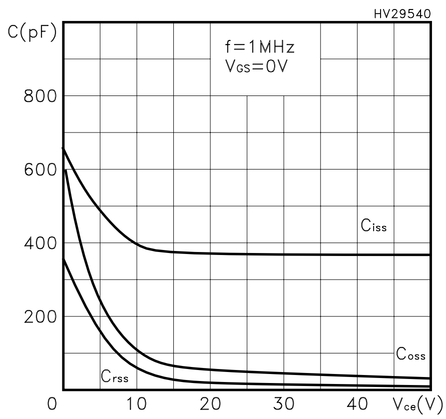


Figure 7. Normalized gate threshold voltage vs temperature

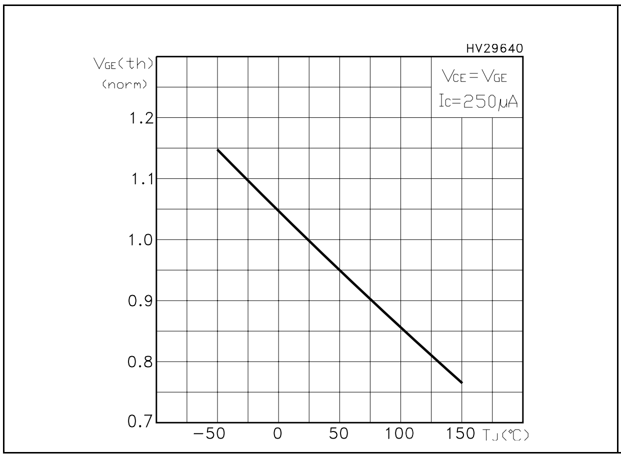


Figure 8. Collector-emitter on voltage vs collector current

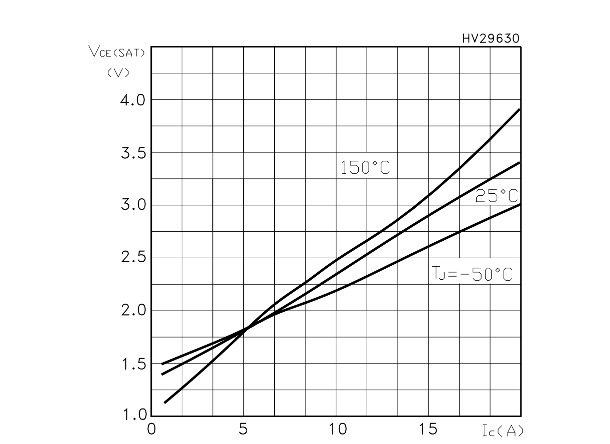


Figure 9. Normalized breakdown voltage vs temperature

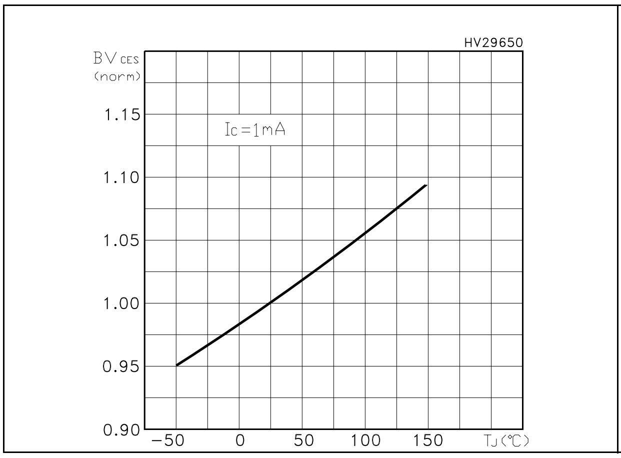


Figure 10. Switching losses vs temperature

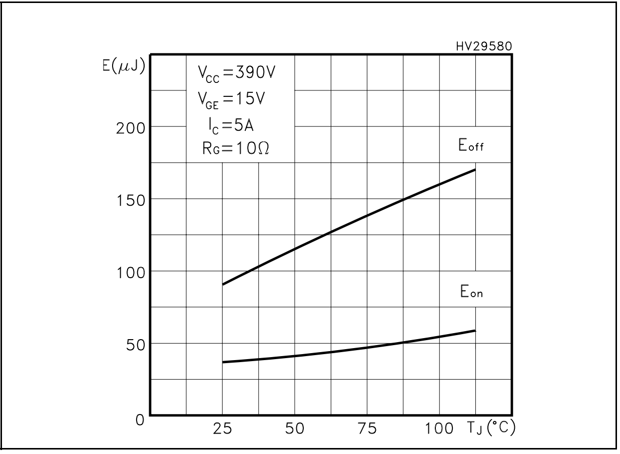


Figure 11. Switching losses vs gate resistance

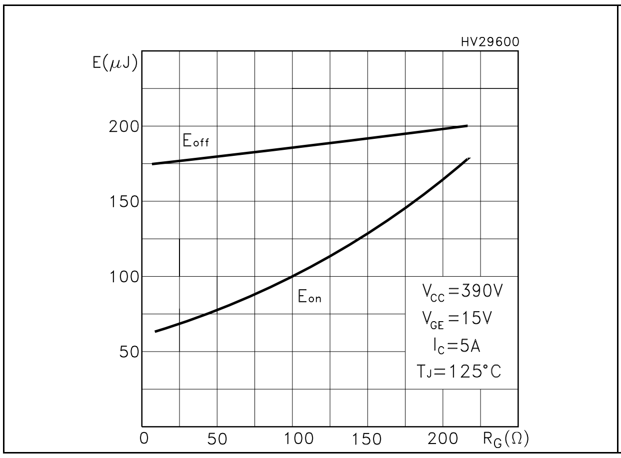


Figure 12. Switching losses vs collector current

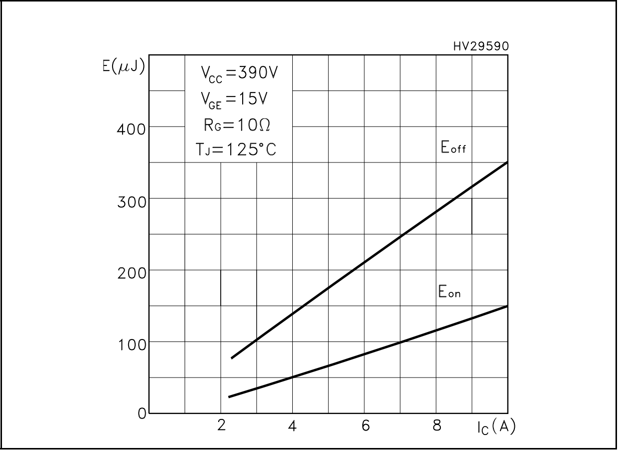


Figure 13. Thermal Impedance

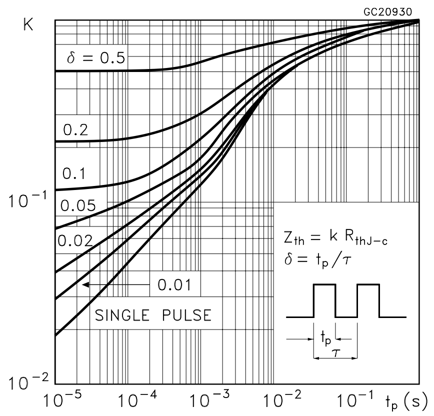


Figure 14. Turn-off SOA

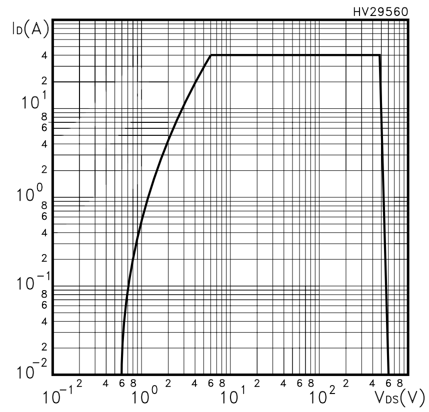
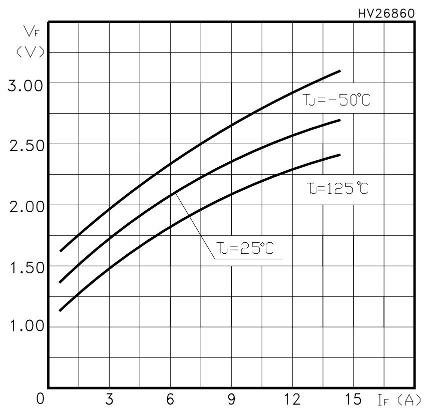


Figure 15. Emitter-collector diode characteristics



3 Test circuit

Figure 16. Test Circuit for Inductive Load Switching

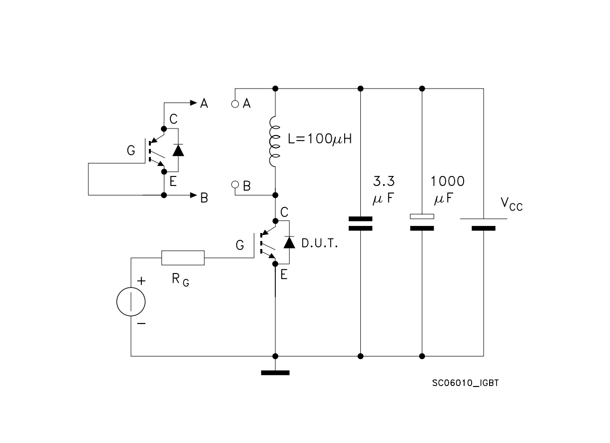


Figure 17. Gate charge test circuit

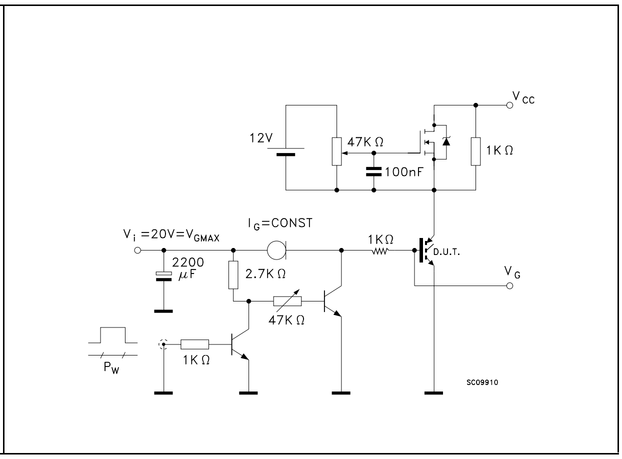


Figure 18. Switching Waveform

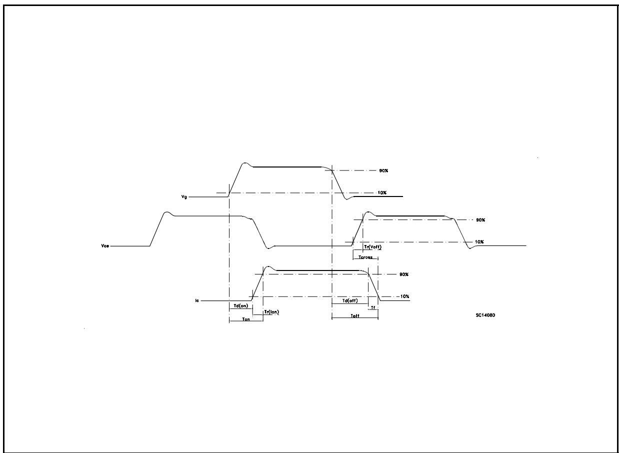
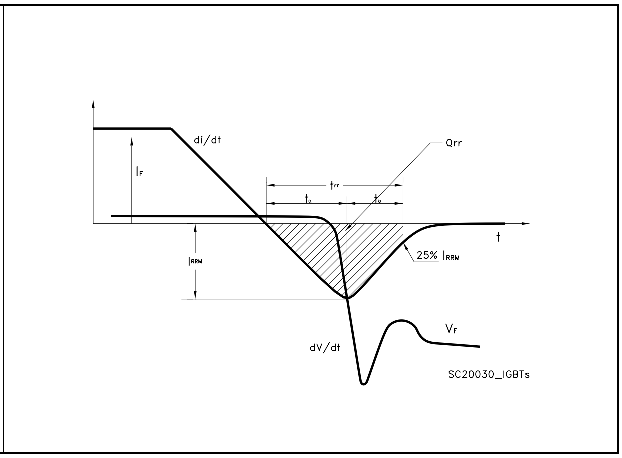


Figure 19. Diode Recovery Time Waveform

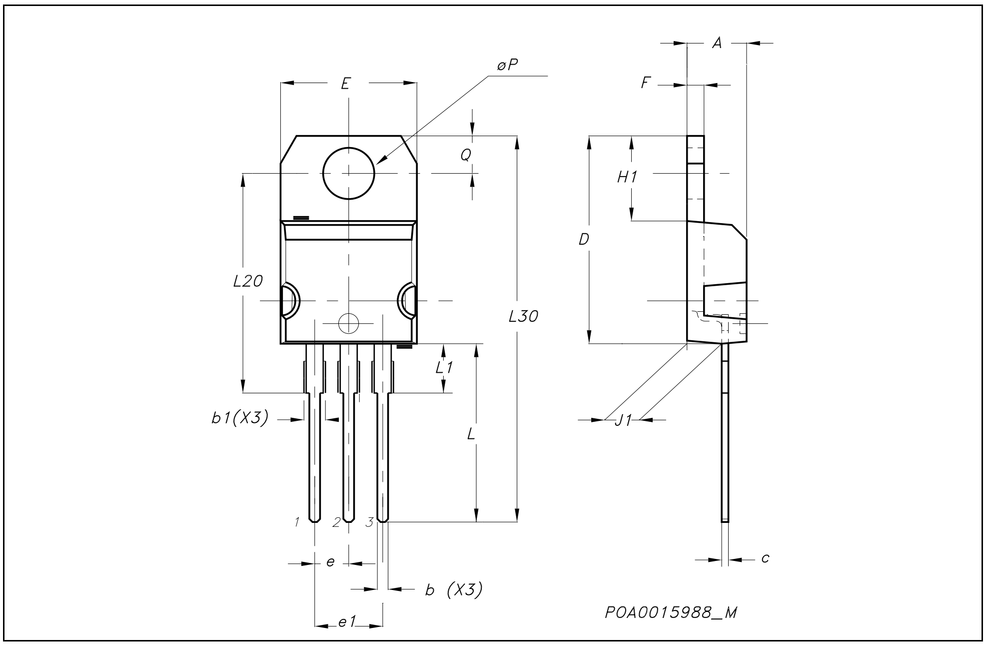


4 Package mechanical data

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

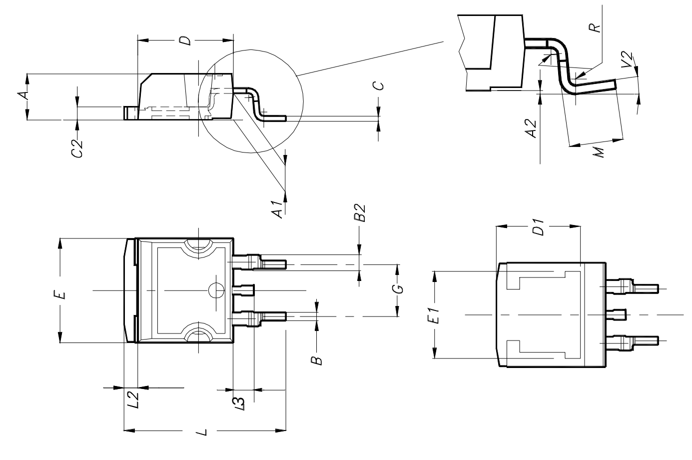
TO-220 MECHANICAL DATA

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



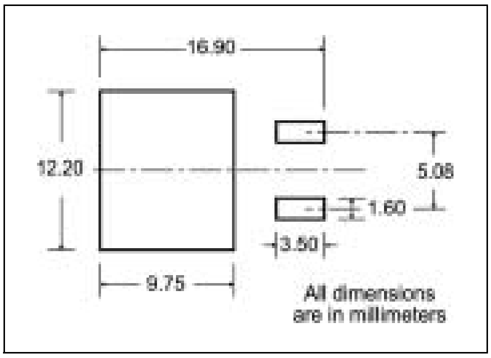
D^2PAK MECHANICAL DATA

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			

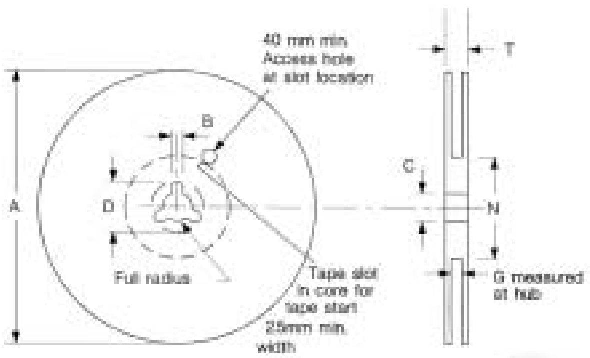


5 Packing mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



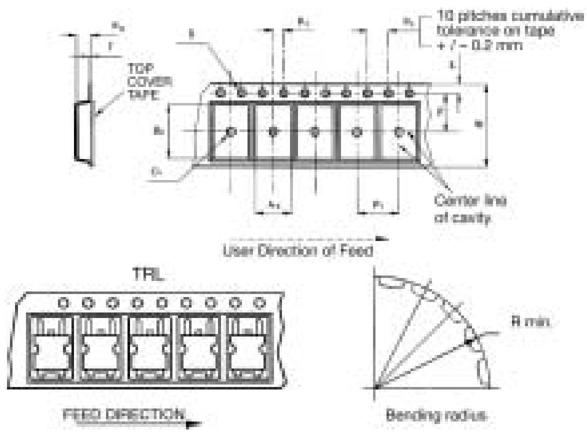
REEL MECHANICAL DATA

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 8. Document revision history

Date	Revision	Changes
24-Jan-2006	1	Initial release.