



STGB10NC60HD STGP10NC60HD

N-channel 600V - 10A - TO-220 - D²PAK
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

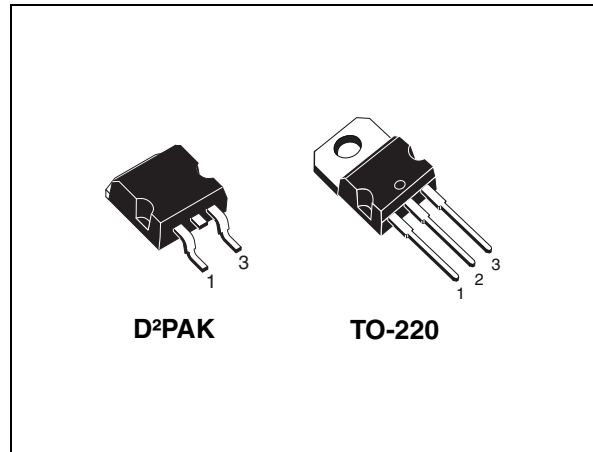
- Low on-voltage drop (V_{cesat})
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode

Description

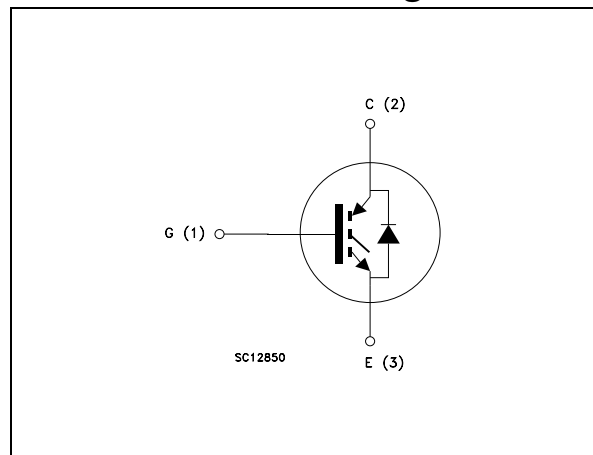
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "H" identifies a family optimized for high frequency applications in order to achieve very high switching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

Applications

- High frequency motor controls
- Sm_{ps} and p_{fc} in both hard switch and resonant topologies
- Motor drivers



Internal schematic diagram



Order codes

Part Number	Marking	Package	Packaging
STGB10NC60HD	GB10NC60HD	D ² PAK	Tape & reel
STGP10NC60HD	GP10NC60HD	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 $T_C = 25^\circ\text{C}$	20	A
$I_C^{(1)}$	Collector current (continuous) at $T_C = 100^\circ\text{C}$	10	A
$I_{CL}^{(2)}$	Collector current (pulsed)	40	A
I_F	Diode RMS forward current at $T_C = 25^\circ\text{C}$	10	A
V_{GE}	Gate-emitter voltage	± 20	V
P_{TOT}	Total dissipation at $T_C = 25^\circ\text{C}$	60	W
T_{stg}	Storage temperature	– 55 to 150	$^\circ\text{C}$
T_j	Operating junction temperature		

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. $V_{clamp}=480\text{V}$, $T_j=150^\circ\text{C}$, $R_G=10\Omega$, $V_{GE}=15\text{V}$

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
$R_{thj-case}$	Thermal resistance junction-case max	2.08	$^\circ\text{C/W}$
$R_{thj-amb}$	Thermal resistance junction-ambient max	62.5	$^\circ\text{C/W}$

2 Electrical characteristics

($T_{CASE}=25^{\circ}\text{C}$ unless otherwise specified)

Table 3. Static

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	$I_C = 1\text{mA}$, $V_{GE} = 0$	600			V
$V_{CE(sat)}$	Collector-emitter saturation voltage	$V_{GE} = 15\text{V}$, $I_C = 5\text{A}$ $V_{GE} = 15\text{V}$, $I_C = 5\text{A}$, $T_C = 125^{\circ}\text{C}$		1.9 1.7	2.5	V V
$V_{GE(th)}$	Gate threshold voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	3.75		5.75	V
I_{CES}	Collector cut-off current ($V_{GE} = 0$)	$V_{CE} = \text{Max rating}$, $T_C = 25^{\circ}\text{C}$ $V_{CE} = \text{Max rating}$, $T_C = 125^{\circ}\text{C}$			150 1	μA mA
I_{GES}	Gate-emitter leakage current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{V}$, $V_{CE} = 0$			± 100	nA
g_{fs}	Forward transconductance	$V_{CE} = 15\text{V}$, $I_C = 5\text{A}$		3.5		S

Table 4. Dynamic

Symbol	Parameter	Test conditions	Min.	Typ.	Max.	Unit
C_{ies}	Input capacitance	$V_{CE} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GE} = 0$		365		pF
C_{oes}	Output capacitance			43		pF
C_{res}	Reverse transfer capacitance			8.3		pF
Q_g	Total gate charge	$V_{CE} = 390\text{V}$, $I_C = 5\text{A}$, $V_{GE} = 15\text{V}$, (see Figure 17)		19.2		nC
Q_{ge}	Gate-emitter charge			4.5		nC
Q_{gc}	Gate-collector charge			7		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	$V_{CC} = 390V$, $I_C = 5A$ $R_G = 10\Omega$, $V_{GE} = 15V$, $T_J = 25^\circ C$ (see Figure 16)		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	$V_{CC} = 390V$, $I_C = 5A$ $R_G = 10\Omega$, $V_{GE} = 15V$, $T_J = 125^\circ C$ (see Figure 16)		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	$V_{CC} = 390V$, $I_C = 5A$, $R_{GE} = 10\Omega$, $V_{GE} = 15V$, $T_J = 25^\circ C$ (see Figure 16)		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	$V_{CC} = 390V$, $I_C = 5A$, $R_{GE} = 10\Omega$, $V_{GE} = 15V$, $T_J = 125^\circ C$ (see Figure 16)		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	$V_{CC} = 390V$, $I_C = 5A$ $R_G = 10\Omega$, $V_{GE} = 15V$, $T_J = 25^\circ C$ (see Figure 16)		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	$V_{CC} = 390V$, $I_C = 5A$ $R_G = 10\Omega$, $V_{GE} = 15V$, $T_J = 125^\circ C$ (see Figure 16)		61.8 173 234.8		μJ μJ μJ

1. E_{on} is the turn-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-pack diode, the co-pack diode is used as external diode. IGBTs & Diode are at the same temperature ($25^\circ C$ and $125^\circ C$)
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	$I_f = 2.5\text{A}$ $I_f = 2.5\text{A}, T_j = 125^\circ\text{C}$		1.75 1.3	2.1	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_f = 5\text{A}, V_R = 40\text{V}$, $T_j = 25^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19)		21.5 14.2 1.32		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	$I_f = 5\text{A}, V_R = 40\text{V}$, $T_j = 125^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$ (see Figure 19)		33 30.5 1.85		ns nC A

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

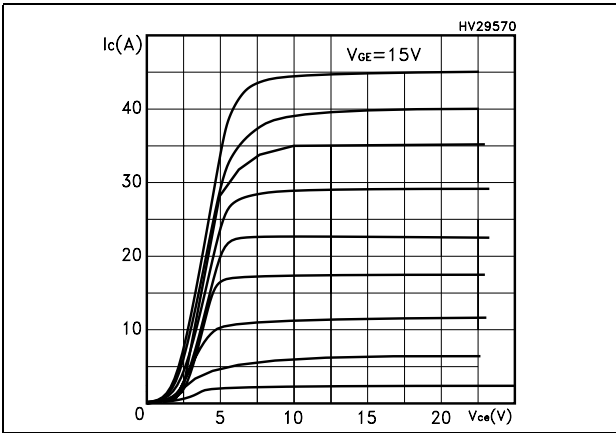


Figure 2. Transfer characteristics

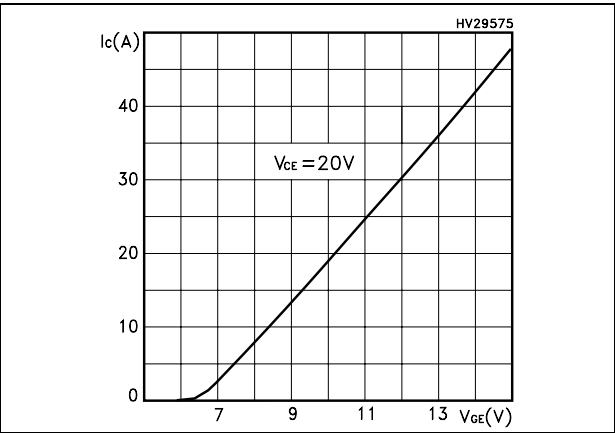


Figure 3. Transconductance

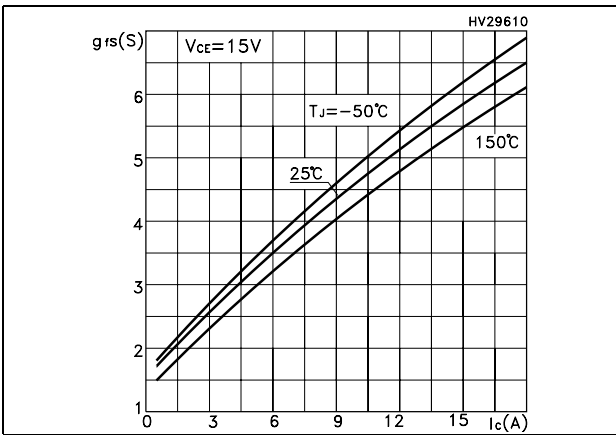


Figure 4. Collector-emitter on voltage vs temperature

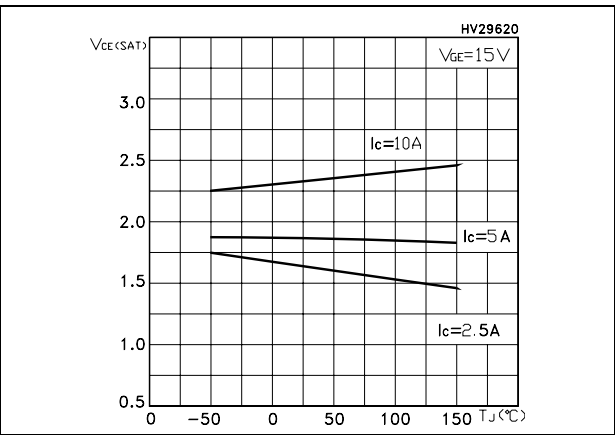


Figure 5. Gate charge vs gate-source voltage

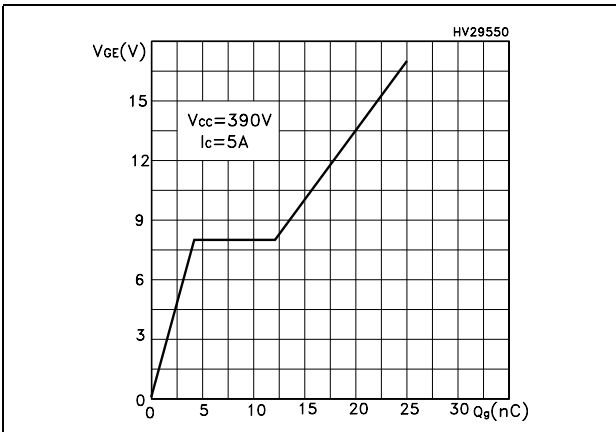


Figure 6. Capacitance variations

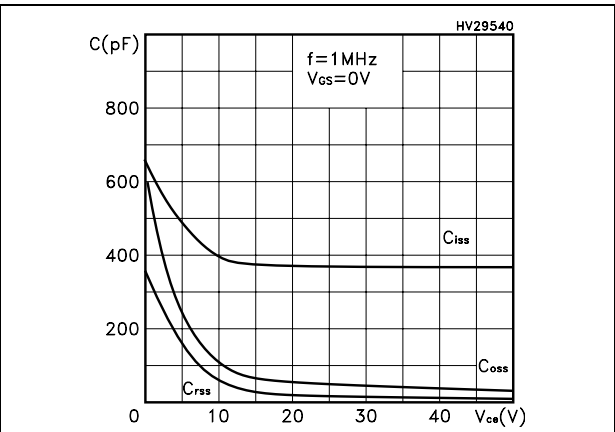


Figure 7. Normalized gate threshold voltage vs temperature

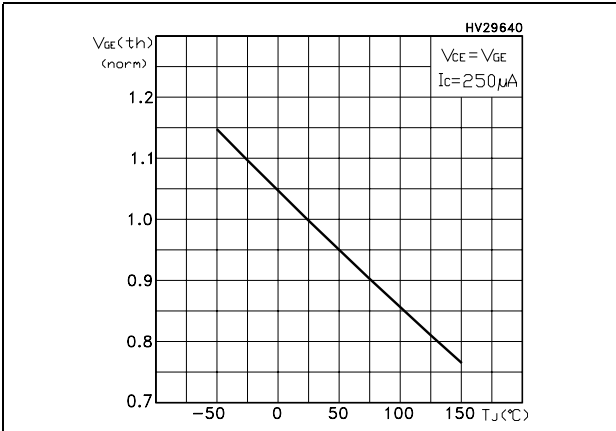


Figure 8. Collector-emitter on voltage vs collector current

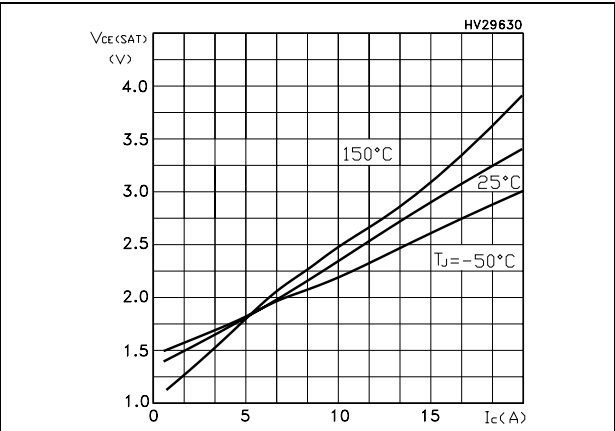


Figure 9. Normalized breakdown voltage vs temperature

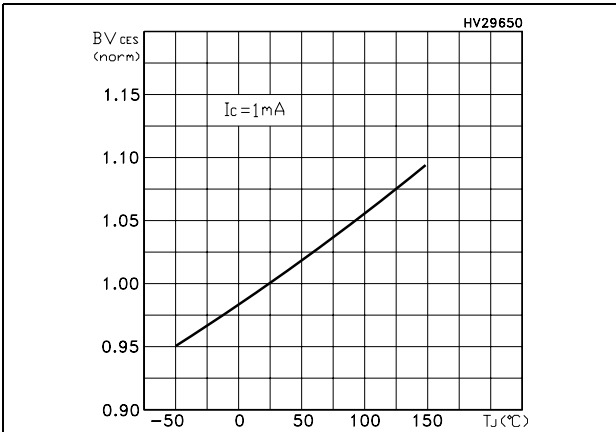


Figure 10. Switching losses vs temperature

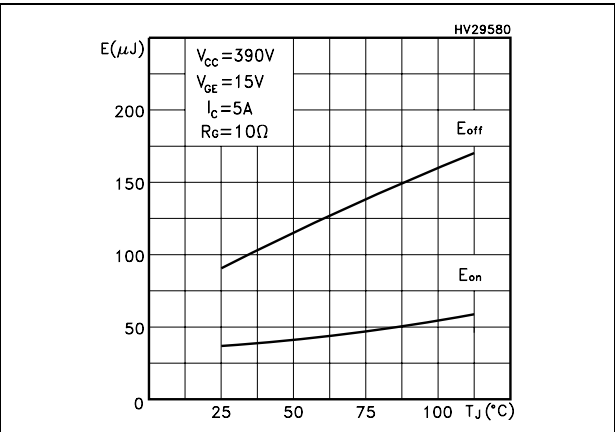


Figure 11. Switching losses vs gate resistance

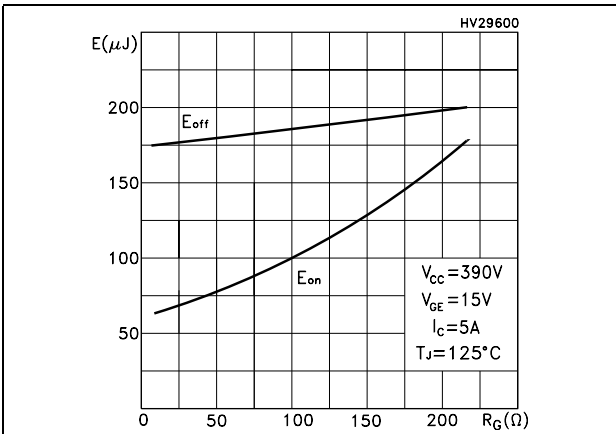


Figure 12. Switching losses vs collector current

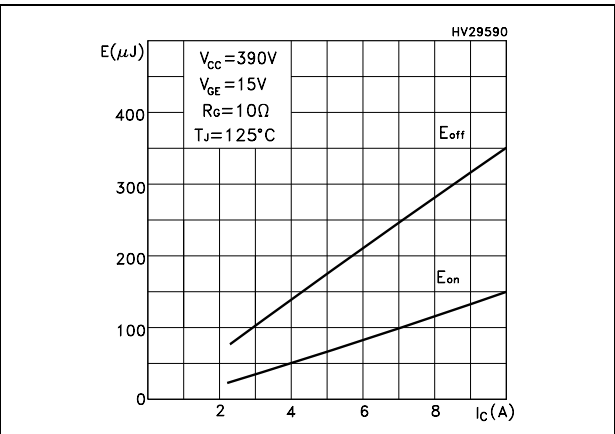


Figure 13. Thermal Impedance

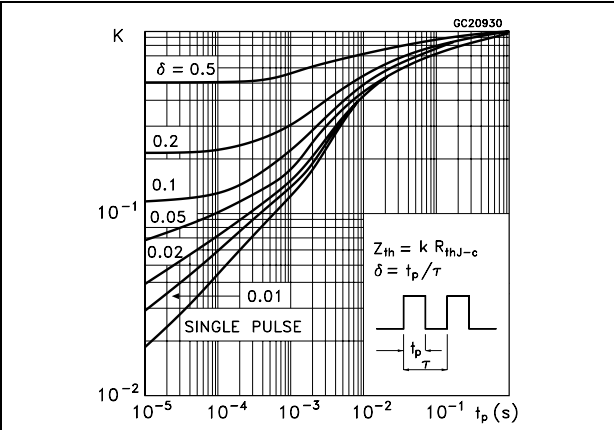


Figure 14. Turn-off SOA

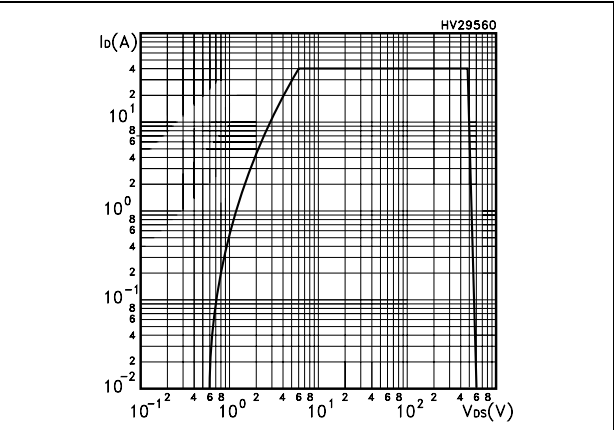
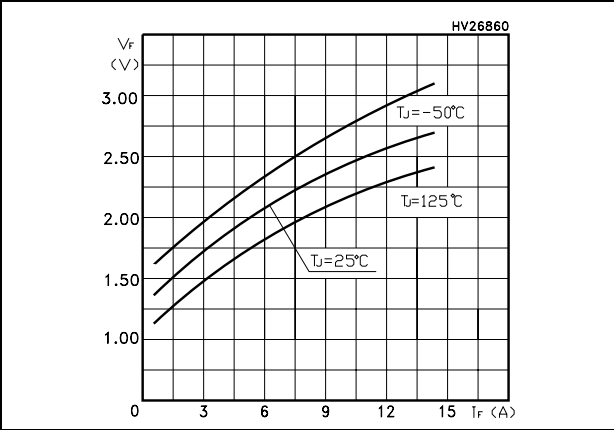


Figure 15. Emitter-collector diode characteristics



3 Test circuit

Figure 16. Test circuit for inductive load switching

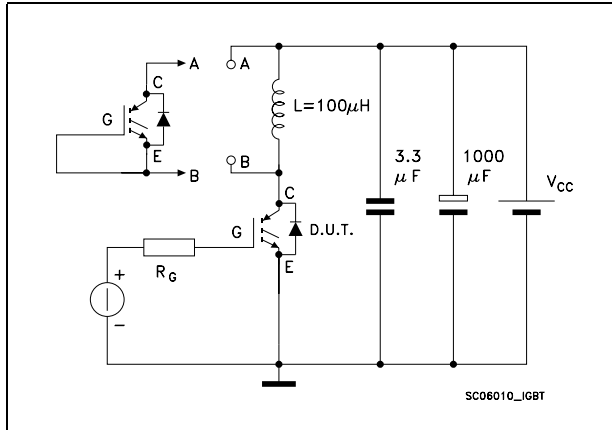


Figure 17. Gate charge test circuit

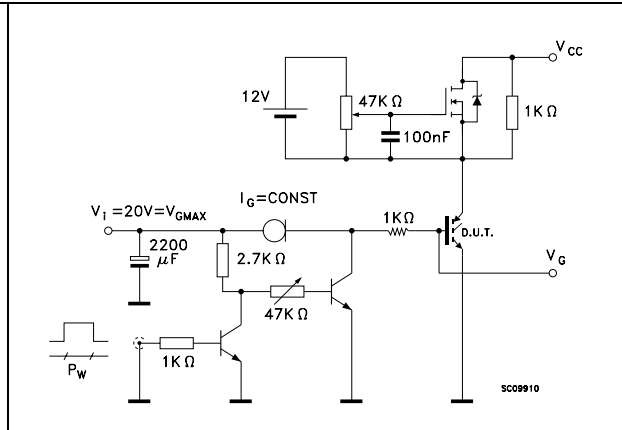


Figure 18. Switching waveform

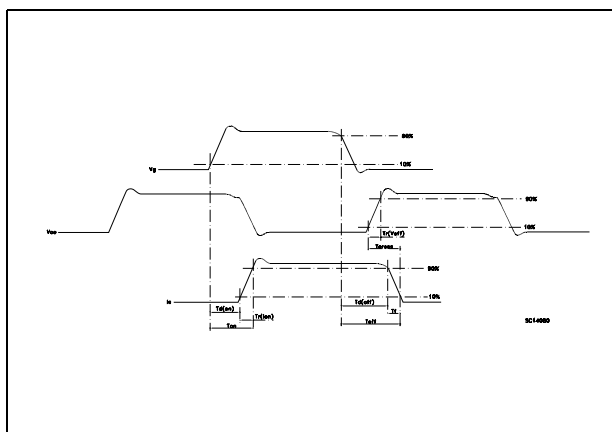
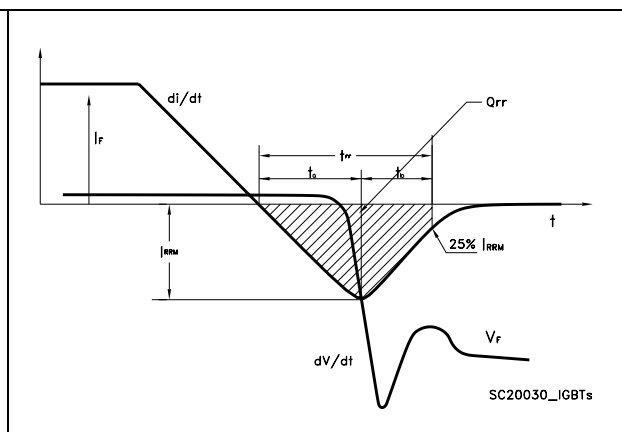


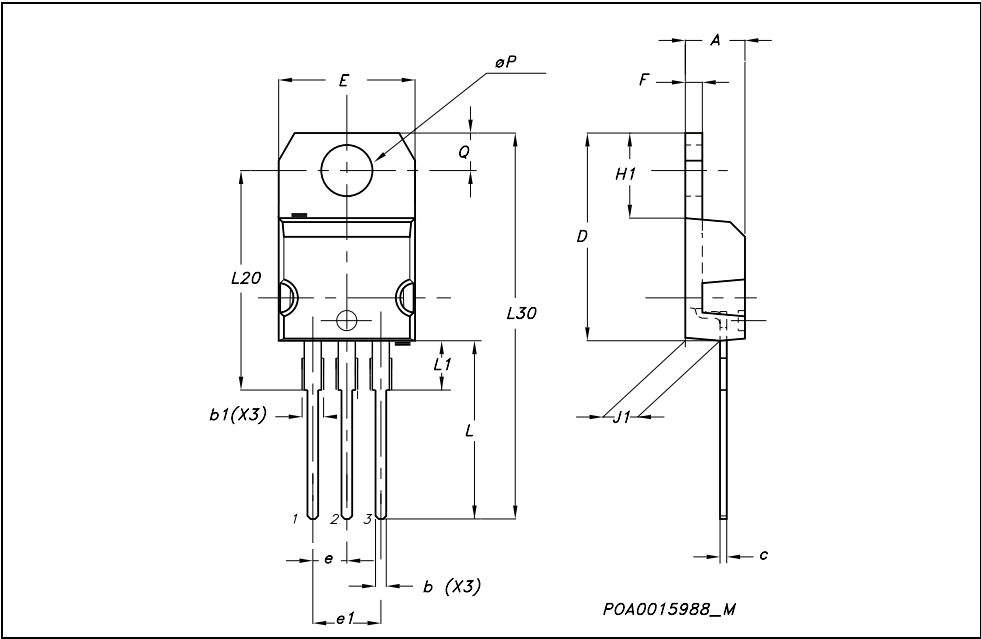
Figure 19. Diode recovery time waveform



4 Package mechanical data

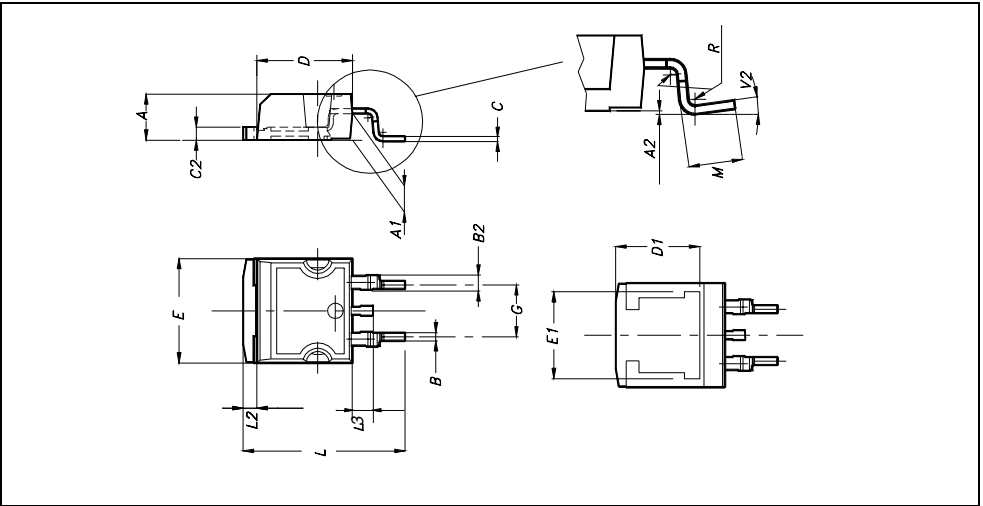
In order to meet environmental requirements, ST offers these devices in ECOPACK® packages. These packages have a Lead-free second level interconnect. The category of second level interconnect is marked on the package and on the inner box label, in compliance with JEDEC Standard JESD97. The maximum ratings 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



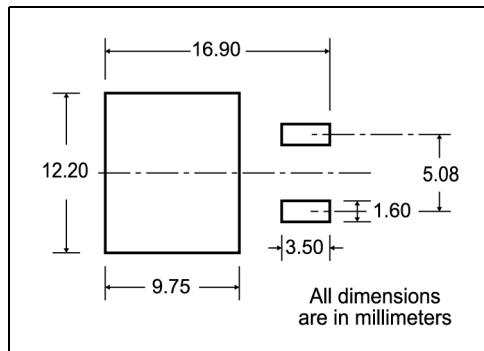
D²PAK MECHANICAL DATA

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	0°		4°			

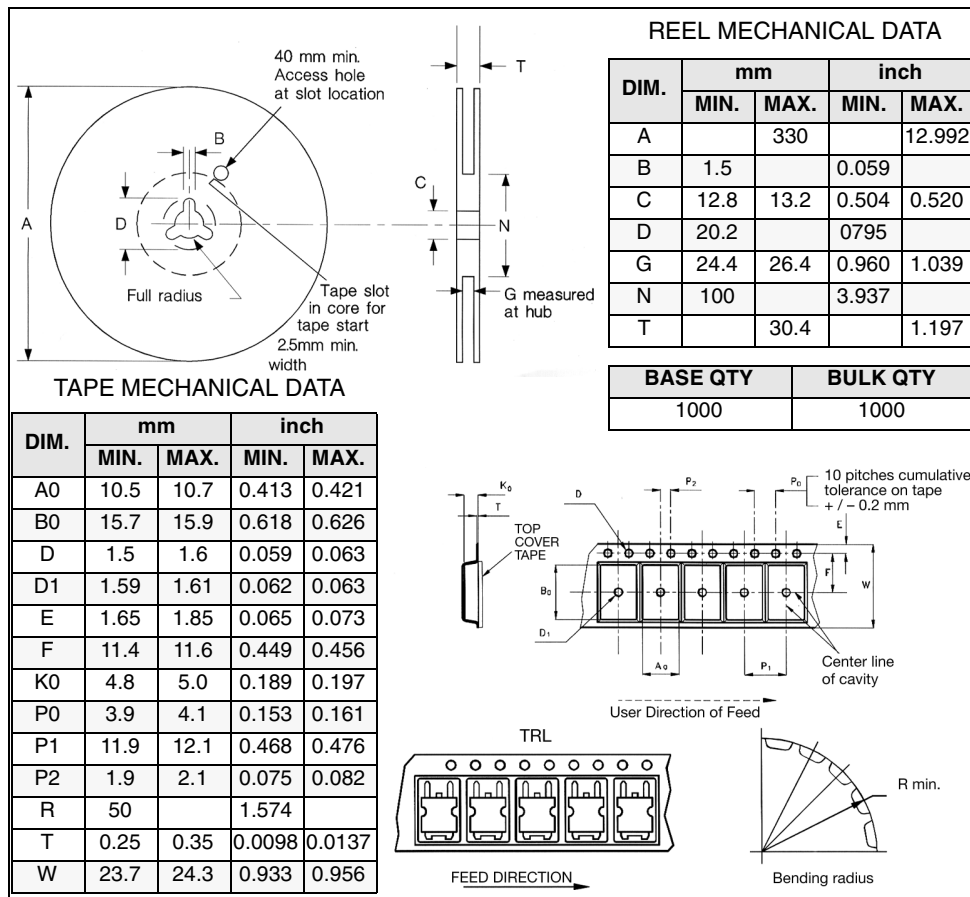


5 Packaging mechanical data

D²PAK FOOTPRINT



TAPE AND REEL SHIPMENT



* on sales type

6 Revision history

Table 8. Revision history

Date	Revision	Changes
30-Jan-2006	1	Initial release.
06-Nov-2006	2	Complete version
08-Feb-2007	3	The document has been reformatted

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