STGB14NC60KD
STGF14NC60KD - STGP14NC60KD

N-channel 14A - 600V - TO-220 - TO-220FP - D^{2}PAK
Short circuit rated PowerMESH™ IGBT

General features

Type	V_{CES}	$V_{CE(sat)}$ (Max)@ 25°C	I_C @100°C
STGB14NC60KD	600V	<2.5V	14A
STGF14NC60KD	600V	<2.5V	7A
STGP14NC60KD	600V	<2.5V	14A

- Low on-voltage drop (Vcesat)
- Low C_{res} / C_{ies} ratio (no cross conduction susceptibility)
- Switching losses include diode recovery energy
- Very soft ultra fast recovery antiparallel diode
- Short circuit withstand time 10µs

TO-263

TO-220

TO-220FP

Description

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the Power MESH™ IGBTs, with outstanding performances. The suffix "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

Applications

- High frequency inverters
- SMPS and PFC in both hard switch and resonant topologies
- Motor drivers

Internal schematic diagram

SC12850

Order codes

Part number	Marking	Package	Packaging
STGB14NC60KD	GB14NC60KD	D²PAK	Tape & reel
STGF14NC60KD	GF14NC60KD	TO-220FP	Tube
STGP14NC60KD	GP14NC60KD	TO-220	Tube
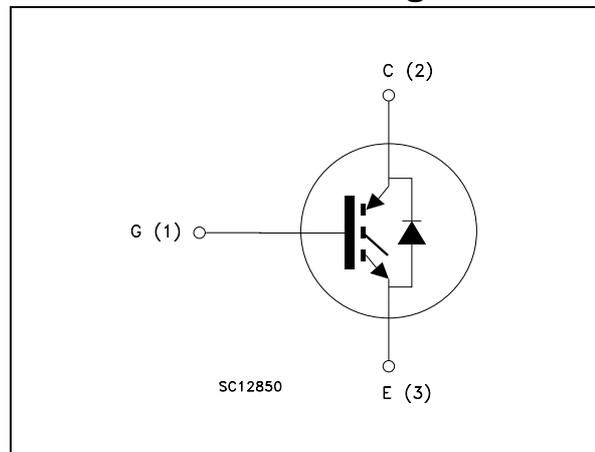
Contents

1 Electrical ratings

Table 1. Absolute maximum ratings

Symbol	Parameter	Value		Unit
		TO-220/D²PAK	**TO-220FP**	
V_{CES}	Collector-emitter voltage ($V_{GS} = 0$)	600		V
I_C[1]	Collector current (continuous) at $T_C = 25°C$	25	11	A
I_C[1]	Collector current (continuous) at $T_C = 100°C$	14	7	A
I_{CM}[2]	Collector current (pulsed)	50		A
V_{GE}	Gate-emitter voltage	±20		V
I_F	Diode RMS forward current at $T_C = 25°C$	20		A
V_{ISO}	Insulation withstand voltage A.C.(t = 1sec; Tc = 25°C)	--	2500	V
t_{scw}	Short circuit withstand time, $V_{CE} = 0.5V_{BR(CES)}$, Tj = 125°C, $R_G = 10Ω$, $V_{GE} = 12V$	10		µs
T_{stg}	Storage temperature	– 55 to 150		°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. Pulse width limited by max junction temperature.

Table 2. Thermal resistance

Symbol	Parameter	Value		Unit
		TO-220/D²PAK	**TO-220FP**	
$R_{thj-case}$	Thermal resistance junction-case Max	1.56	5.6	°C/W
$R_{thj-amb}$	Thermal resistance junction-ambient Max	62.5		°C/W
T_L	Maximum lead temperature for soldering purpose (1.6mm from case, for 10sec.)	300		°C

2   Electrical characteristics

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

Table 3.   Static

Symbol	Parameter	Test condictions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-emitter breakdown voltage	I_C= 1mA, V_{GE}= 0	600			V
I_{GES}	Collector-emitter saturation voltage	V_{CE}= Max rating, T_C= 25°C V_{CE}= Max rating, T_C= 125°C			150 1	µA mA
I_{CES}	Gate threshold voltage	V_{GE}= ±20V , V_{CE}= 0			±100	nA
$V_{GE(th)}$	Collector-emitter leakage current (V_{CE} = 0)	V_{CE}= V_{GE}, I_C= 250µA	4.5		6.5	V
$V_{CE(SAT)}$	Gate-emitter leakage current (V_{CE} = 0)	V_{GE}= 15V, I_C= 7A V_{GE}= 15V, I_C= 7A, Tc= 125°C		2.0 1.8	2.5	V V
g_{fs} [1]	Forward transconductance	V_{CE} = 15V , I_C = 7A		3		S

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

Table 4.   Dynamic

Symbol	Parameter	Test condictions	Min.	Typ.	Max.	Unit
C_{ies} C_{oes} C_{res}	Input capacitance Output capacitance Reverse transfer capacitance	V_{CE} = 25V, f = 1 MHz, V_{GE}= 0		760 86 15.5		pF pF pF
Q_g Q_{ge} Q_{gc}	Total gate charge Gate-emitter charge Gate-collector charge	V_{CE} = 390V, I_C = 7A, V_{GE} = 15V (see Figure 18)		34.4 8.1 16.4		nC nC nC

Table 5.   Switching on/off (inductive load)

Symbol	Parameter	Test condictions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390V, I_C = 7A		22.5		ns
t_r	Current rise time	R_G= 10Ω, V_{GE}= 15V,		8.5		ns
$(di/dt)_{on}$	Turn-on current slope	Tj= 25°C(see Figure 17)		700		A/µs
$t_{d(on)}$	Turn-on delay time	V_{CC} = 390V, I_C = 7A		22		ns
t_r	Current rise time	R_G= 10Ω, V_{GE}= 15V,		9.5		ns
$(di/dt)_{on}$	Turn-on current slope	Tj= 125°C (see Figure 17)		680		A/µs
$t_r(V_{off})$	Off voltage rise time	V_{cc} = 390V, I_C = 7A,		60		ns
$t_d(_{off})$	Turn-off delay time	R_{GE} = 10Ω , V_{GE} = 15V		116		ns
t_f	Current fall time	T_J = 25°C (see Figure 17)		75		ns
$t_r(V_{off})$	Off voltage rise time	V_{cc} = 390V, I_C = 7A,		24		ns
$t_d(_{off})$	Turn-off delay time	R_{GE} = 10Ω , V_{GE} = 15V		196		ns
t_f	Current fall time	Tj = 125°C (see Figure 17)		144		ns

Table 6.   Switching energy (inductive load)

Symbol	Parameter	Test condictions	Min	Typ.	Max	Unit
Eon [1]	Turn-on switching losses	V_{CC} = 390V, I_C = 7A		82		µJ
E_{off} [2]	Turn-off switching losses	R_G= 10Ω, V_{GE}= 15V,		155		µJ
E_{ts}	Total switching losses	Tj= 25°C (see Figure 17)		237		µJ
Eon [1]	Turn-on switching losses	V_{CC} = 390V, I_C = 7A		131		µJ
E_{off} [2]	Turn-off switching losses	R_G= 10Ω, V_{GE}= 15V,		370		µJ
E_{ts}	Total switching losses	Tj= 125°C (see Figure 17)		501		µJ

1. Eon 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°C and 125°C)

2. Turn-off losses include also the tail of the collector current.

Table 7.   Collector-emitter diode

Symbol	Parameter	Test condictions	Min	Typ.	Max	Unit
V_f	Forward on-voltage	If = 3.5A If = 3.5A, Tj = 125°C		1.3 1.1	1.9	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	If = 7A, V_R = 40V, T_j = 25°C, di/dt = 100A/µs (see Figure 20)		37 40 2.1		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	If = 7A, V_R = 40V, T_j = 125°C, di/dt = 100A/µs (see Figure 20)		61 98 3.2		ns nC A

2.1   Electrical characteristics (curves)

Figure 1.   Output characterisics
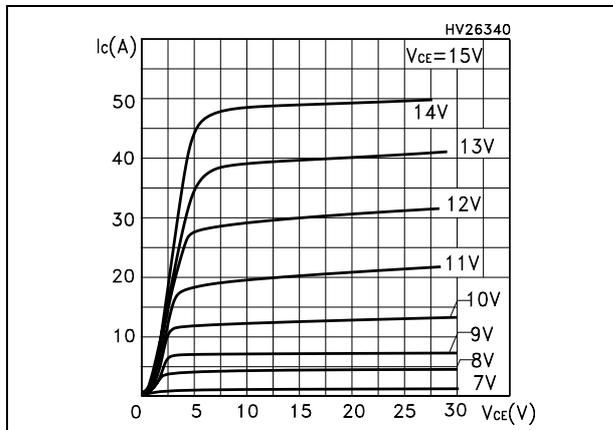
Figure 2.   Transfer characteristics
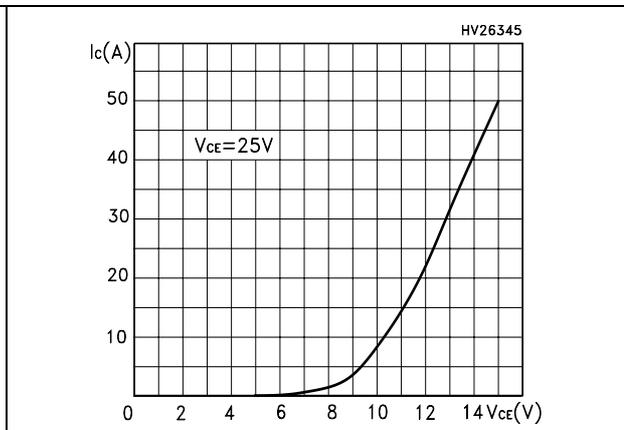
Figure 3.   Transconductance
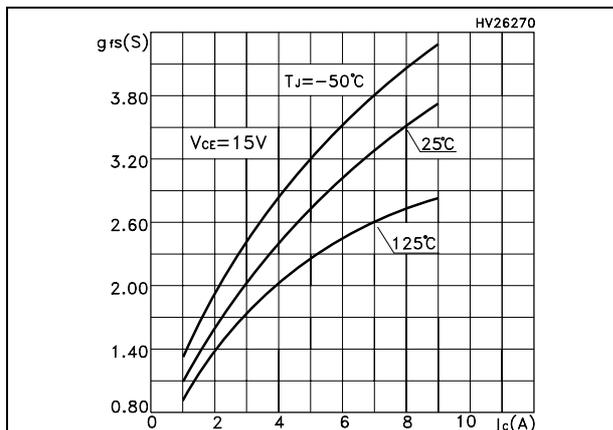
Figure 4.   Collector-emitter on voltage vs temperature
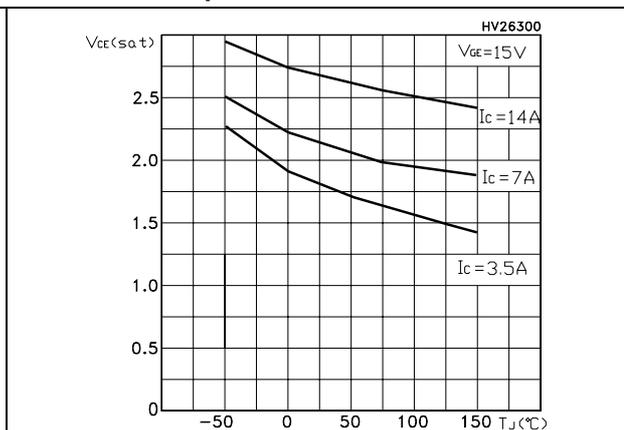
Figure 5.   Collector-emitter on voltage vs collector current
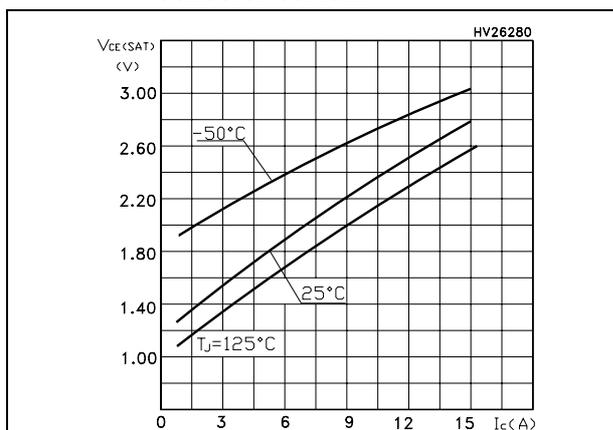
Figure 6.   Normalized gate threshold vs temperature
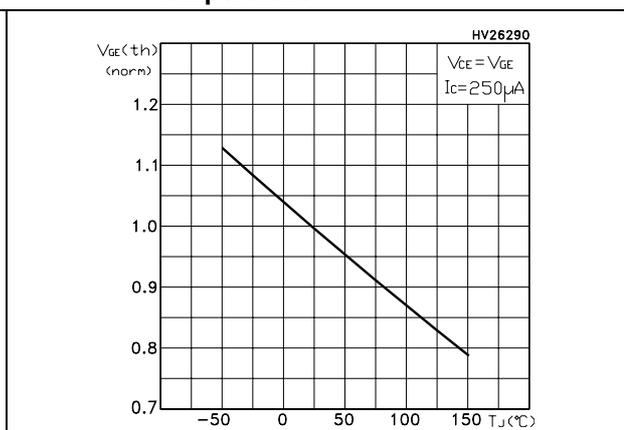
Figure 7.   Normalized breakdown voltage vs temperature
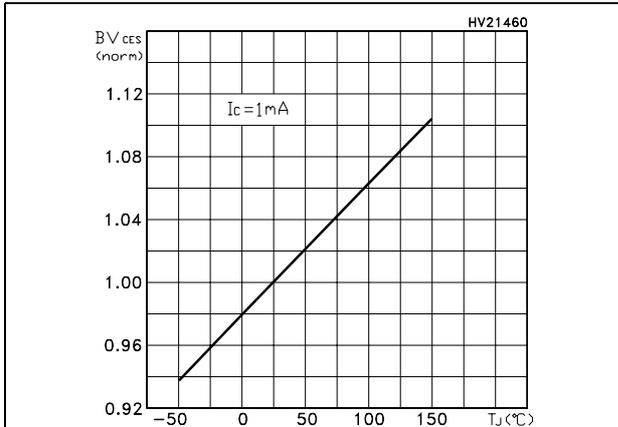
Figure 8.   Gate charge vs gate-emitter voltage
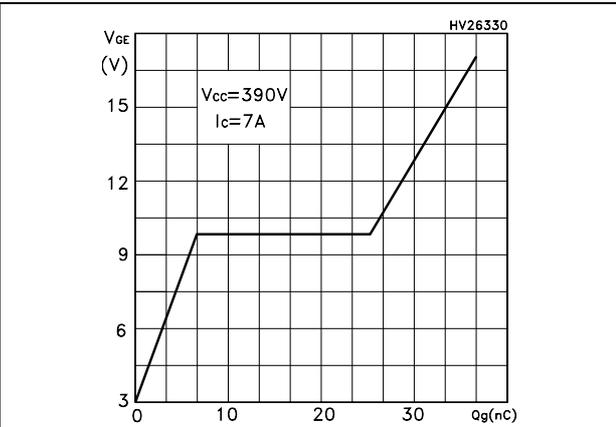
Figure 9.   Capacitance variations
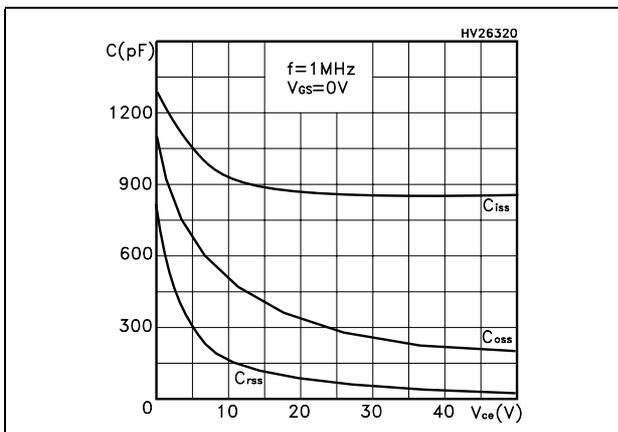
Figure 10. Switching losses vs temperature
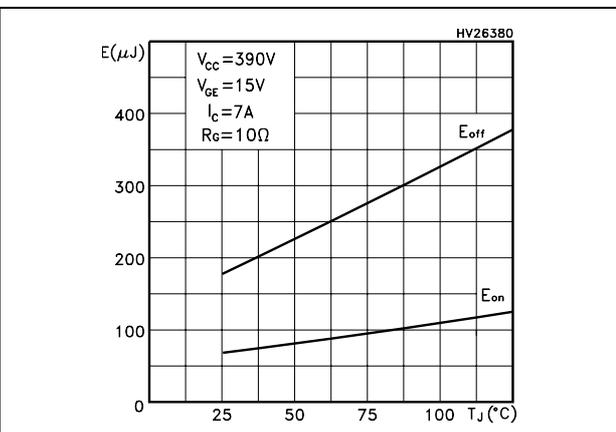
Figure 11. Switching losses vs gate resistance
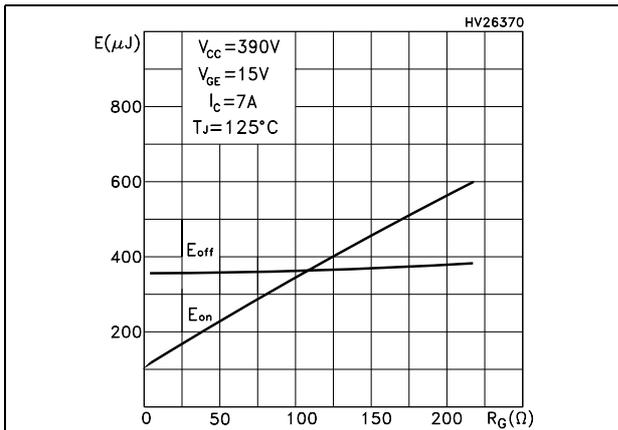
Figure 12. Switching losses vs collector current
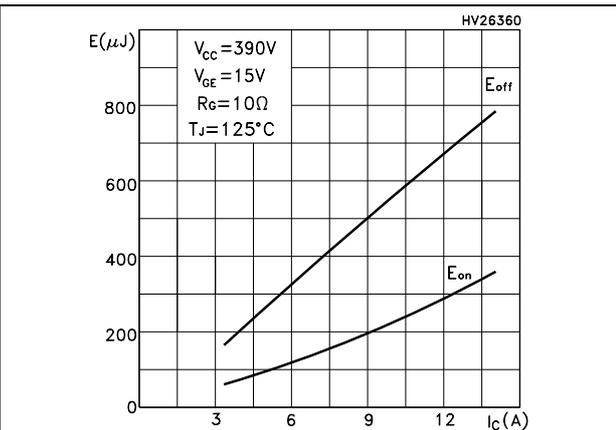
Figure 13. Thermal impedance


Figure 14. Turn-off SOA
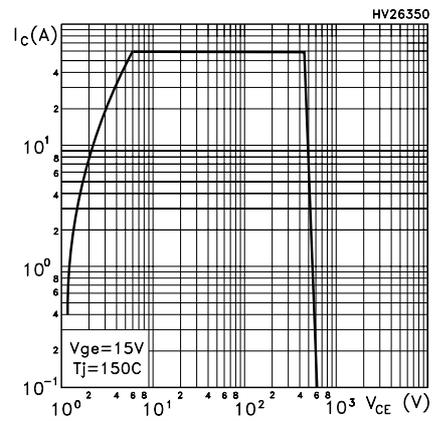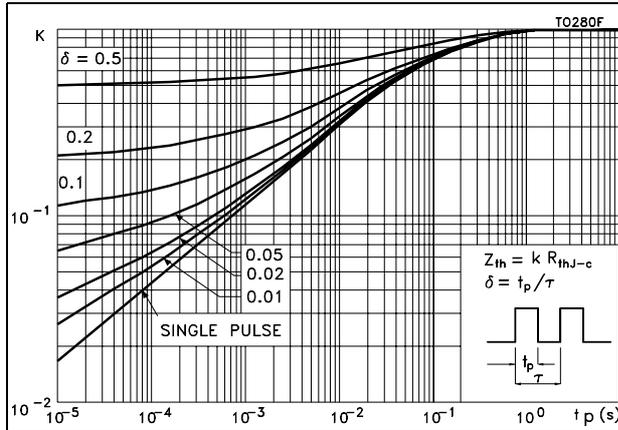
Figure 15. Thermal impedance for TO-220FP

Figure 16. Turn-off SOA for TO-220FP
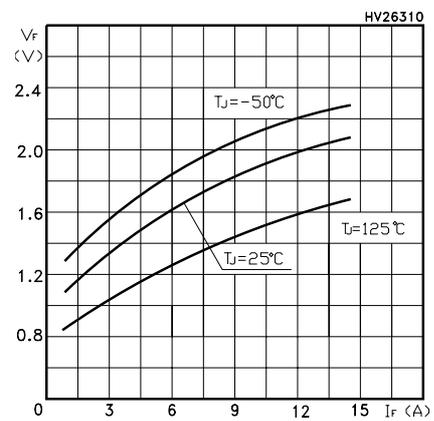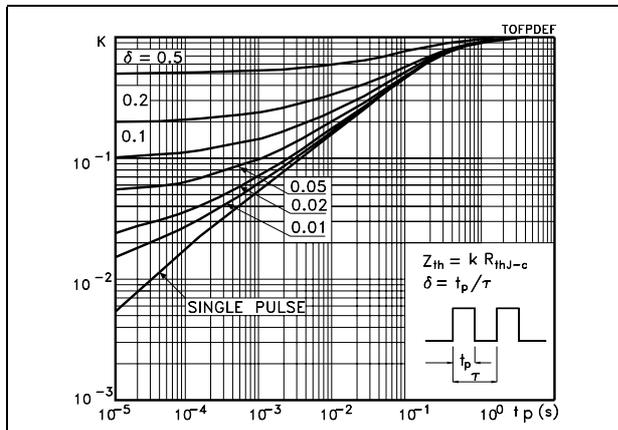
3   Test circuit

Figure 17. **Test circuit for inductive load switching**
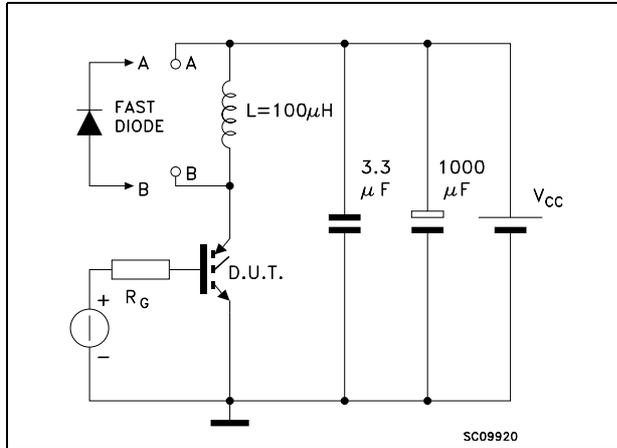

Figure 18. **Gate charge test circuit**
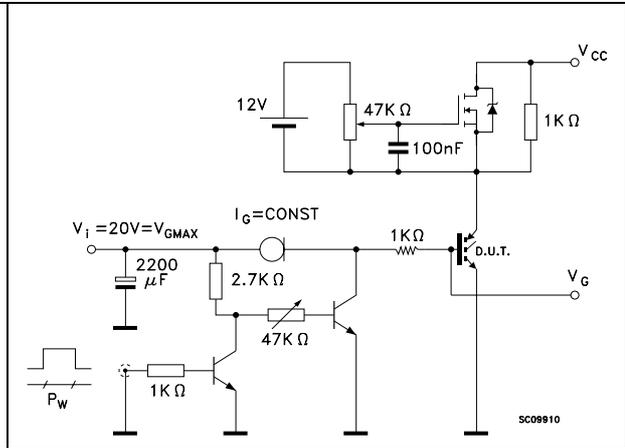
Figure 19. **Switching waveforms**
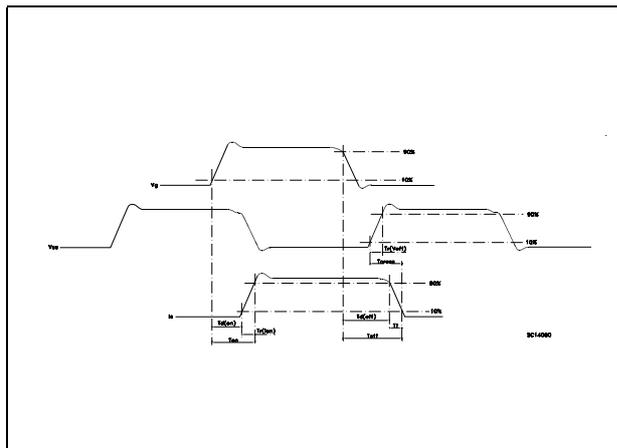
Figure 20. **Diode recovery times waveform**
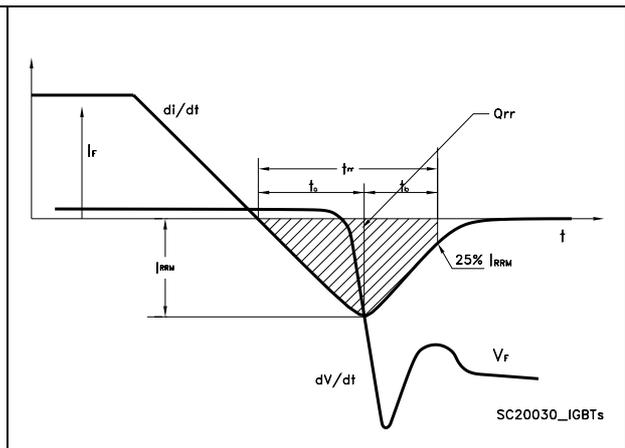
4   Package mechanical data

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

POA0015988_M
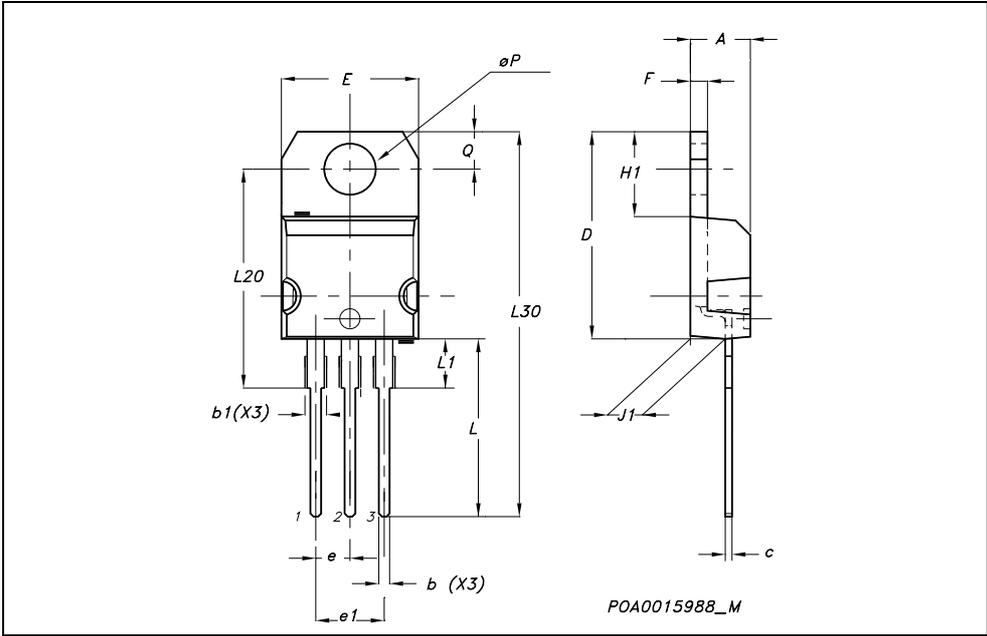
TO-220FP MECHANICAL DATA

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126
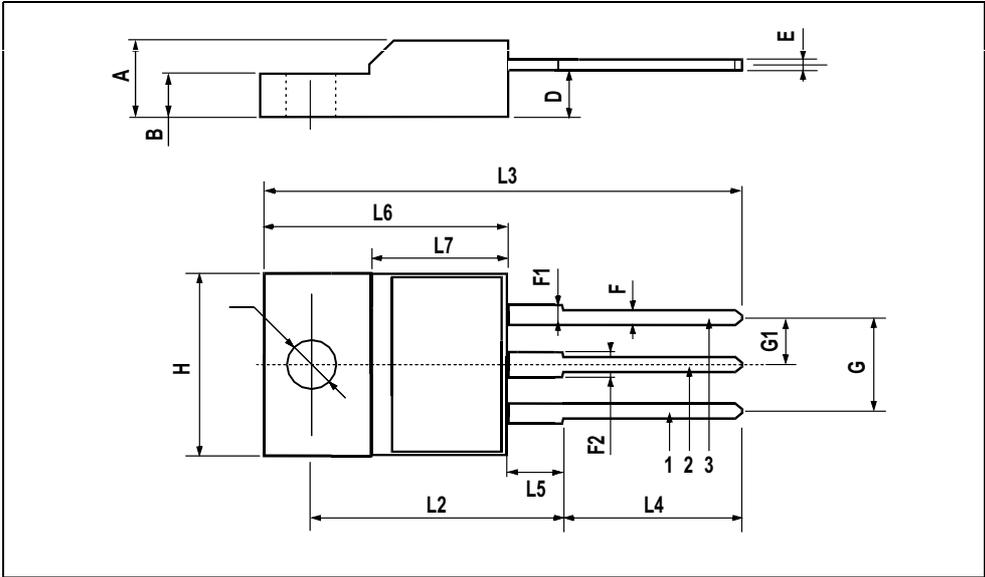
D²PAK MECHANICAL DATA

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			
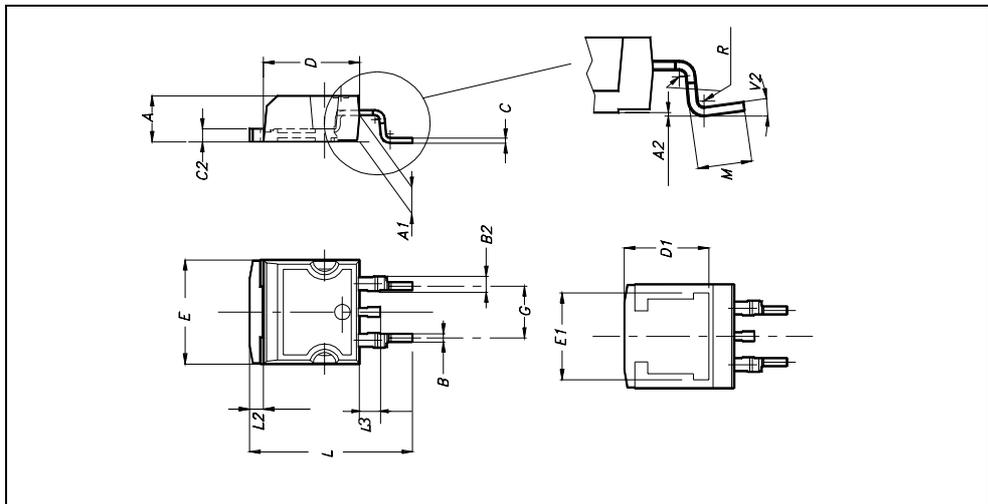
5   Packaging mechanical data

D^{2}PAK FOOTPRINT

16.90

12.20

5.08

1.60

3.50

9.75

All dimensions
are in millimeters

TAPE AND REEL SHIPMENT

40 mm min.
Access hole
at slot location

B

A

D

Full radius

Tape slot
in core for
tape start
2.5mm min.
width

T

C

N

G measured
at hub

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
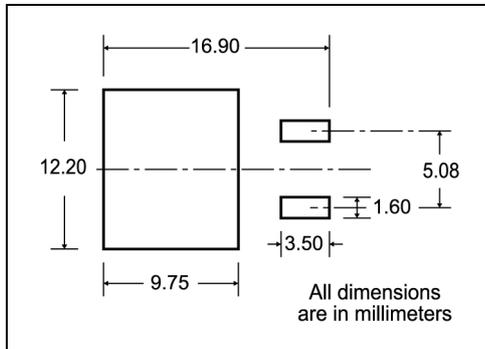
TAPE MECHANICAL DATA

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

10 pitches cumulative
tolerance on tape
+ / – 0.2 mm

TOP
COVER
TAPE

Center line
of cavity

User Direction of Feed

TRL

FEED DIRECTION

R min.

Bending radius

* on sales type

6 Revision history

Table 8.   Revision history

Date	Revision	Changes
14-Jun-2005	1	New release
05-Jul-2005	2	Complete version
22-Jul-2005	3	Value changed in table 6
27-Jan-2006	4	Inserted ecopack indication
28-Apr-2006	5	New template, modified curves 5 and 7

Please Read Carefully: