STGF19NC60WD

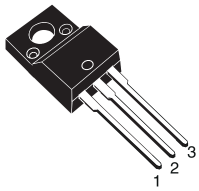
N-channel 600V - 7A - TO-220
Ultra fast PowerMESH™ IGBT

PRELIMINARY DATA

Features

Type	V_{CES}	$V_{CE(sat)}$ (max)@25°C	I_C @100°C
STGF19NC60WD	600V	< 2.5V	7A

- High frequency operation
- Low C_{RES} / C_{IES} ratio (no cross-conduction susceptibility)
- Very soft ultra fast recovery antiparallel diode



TO-220FP

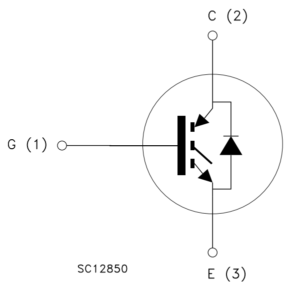
Description

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 “W” identifies a family optimized for very high frequency application.

Applications

- High frequency motor controls, inverters, UPS
- HF, SMPS and PFC in both hard switch and resonant topologies

Internal schematic diagram



Order code

Part number	Marking	Package	Packaging
STGF19NC60WD	GF19NC60WD	TO-220	Tube

This is preliminary information on a new product now in development or undergoing evaluation. Details are subject to change without notice.

Contents

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	14	A
I_C (1)	Collector current (continuous) at T_C = 100°C	7	A
I_{CL} (2)	Collector current (pulsed)	35	A
I_F	Diode RMS forward current at T_C = 25°C	12	A
V_{GE}	Gate-emitter voltage	±20	V
P_{TOT}	Total dissipation at T_C = 25°C	32	W
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. Vclamp=480V, Tj=150°C, R_G=10Ω, V_{GE}=15V

Table 2. Thermal resistance

Symbol	Parameter	Value	Unit
Rthj-case	Thermal resistance junction-case max	4	°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= 12A V_{GE}= 15V, I_C=12A,Tc=125°C		2.1 1.8	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}	Forward transconductance	V_{CE} = 15V, I_C= 12A		10		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		1180 130 26		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, *Figure 16*		53 10 21		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 = 12A R_G= 10Ω, V_{GE}= 15V, *Figure 17*		25 7 1600		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 = 12A R_G= 10Ω, V_{GE}= 15V, Tj = 125°C *Figure 17*		25 8 1400		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 = 12A R_G= 10Ω, V_{GE}= 15V, *Figure 17*		22 90 43		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 = 12A R_G= 10Ω, V_{GE}= 15V, Tj = 125°C *Figure 17*		47 127 77		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 = 12A R_G= 10Ω, V_{GE}= 15V, *Figure 17*		81 125 206		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 = 12A R_G= 10Ω, V_{GE}= 15V, Tj = 125°C *Figure 17*		161 255 416		µJ µJ µJ

1. Eon is the turn-on losses when a typical diode is used in the test circuit in *Figure 15* 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 = 12A I_f = 12A, Tj = 125°C		1.9 1.5	2.5	V V
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_f = 12A,V_R = 50V, Tj = 25°C, di/dt = 100 A/µs *Figure 18*		31 30 2		ns nC A
t_{rr} Q_{rr} I_{rrm}	Reverse recovery time Reverse recovery charge Reverse recovery current	I_f = 12A,V_R = 50V, Tj =125°C, di/dt = 100A/µs *Figure 18*		59 102 4		ns nC A

2.1 Electrical characteristics (curves)

Figure 1. Output characteristics

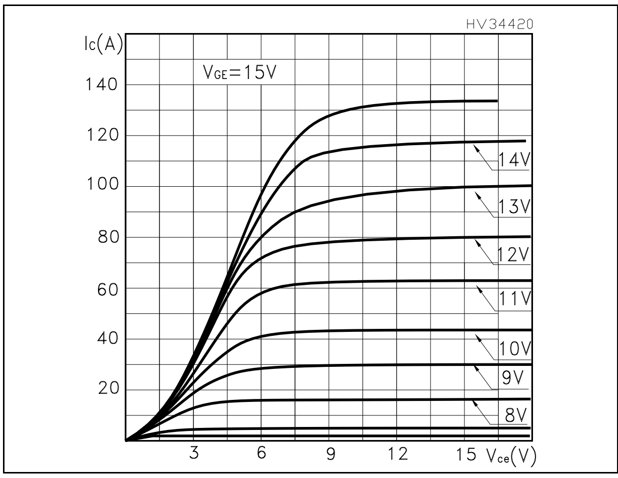


Figure 2. Transfer characteristics

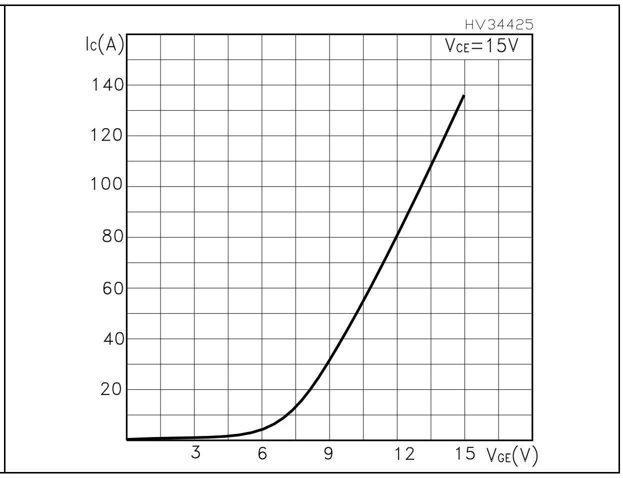


Figure 3. Transconductance

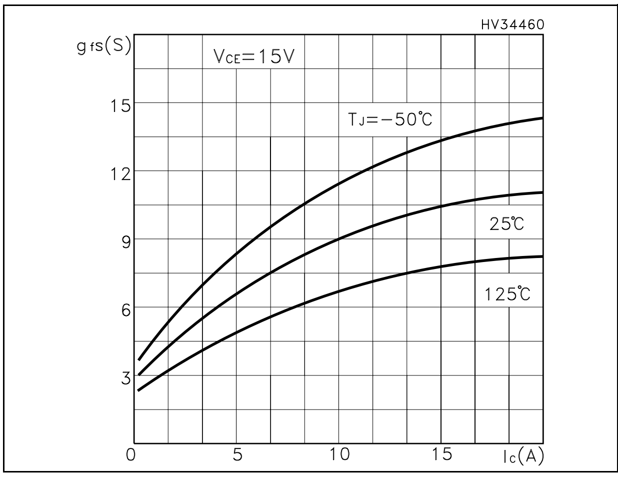


Figure 4. Collector-emitter on voltage vs temperature

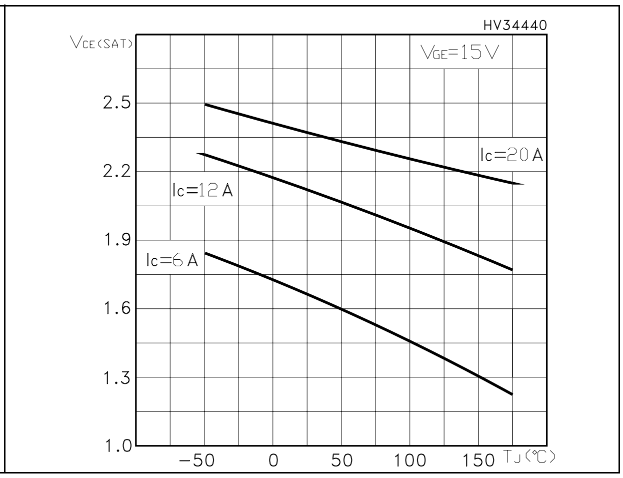


Figure 5. Gate charge vs gate-source voltage

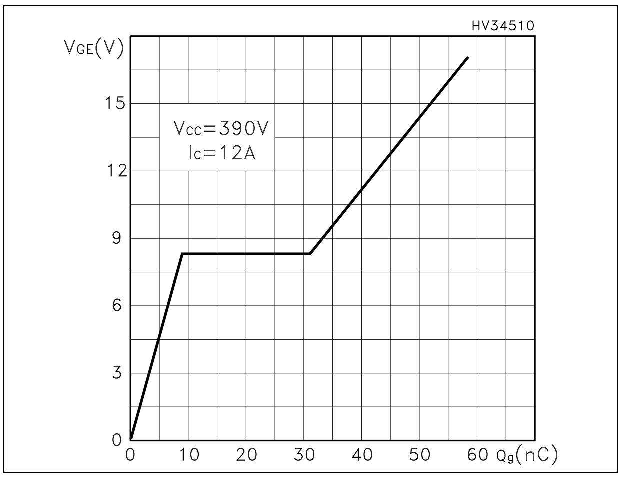


Figure 6. Capacitance variations

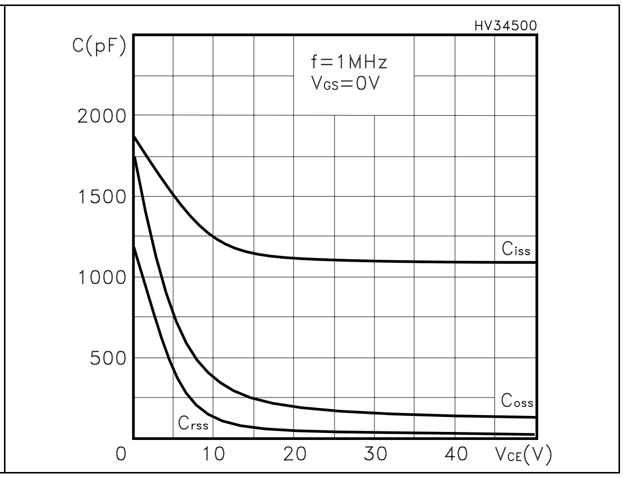


Figure 7. Normalized gate threshold voltage vs temperature

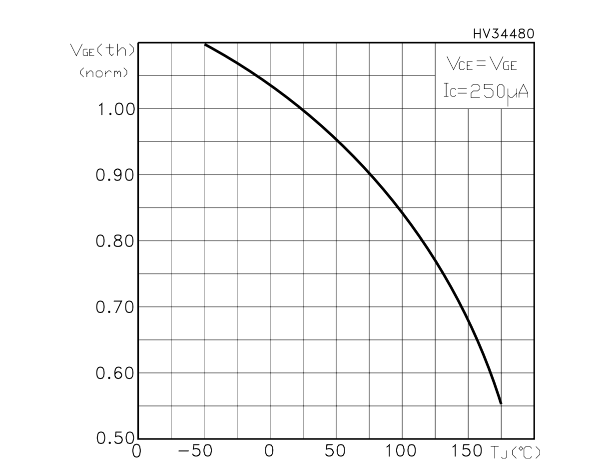


Figure 8. Collector-emitter on voltage vs collector current

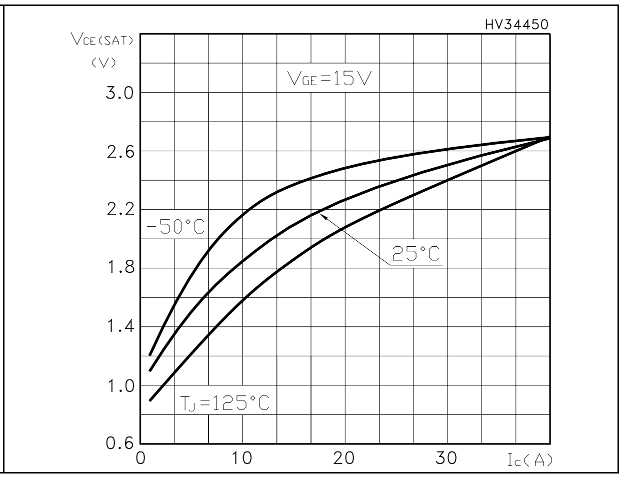


Figure 9. Normalized breakdown voltage vs temperature

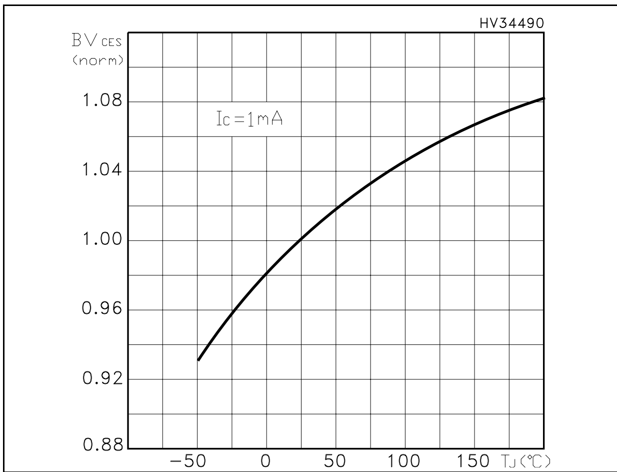


Figure 10. Switching losses vs temperature

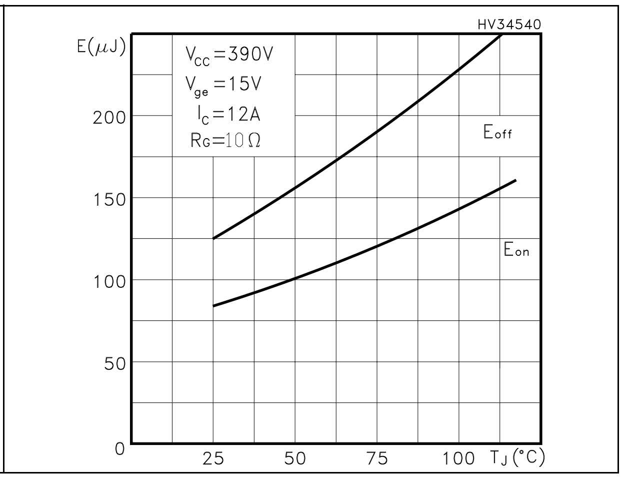


Figure 11. Switching losses vs gate resistance

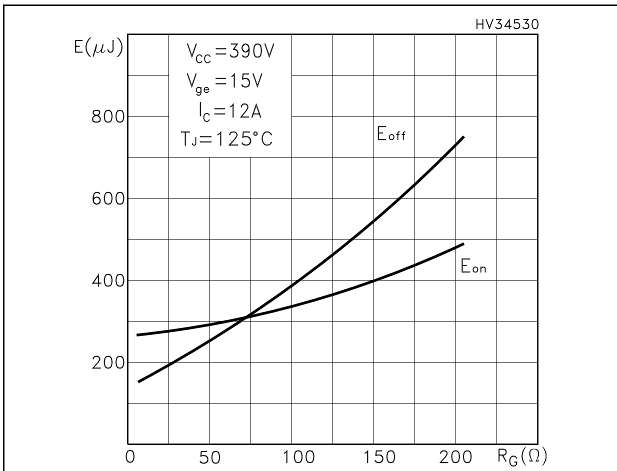


Figure 12. Switching losses vs collector current

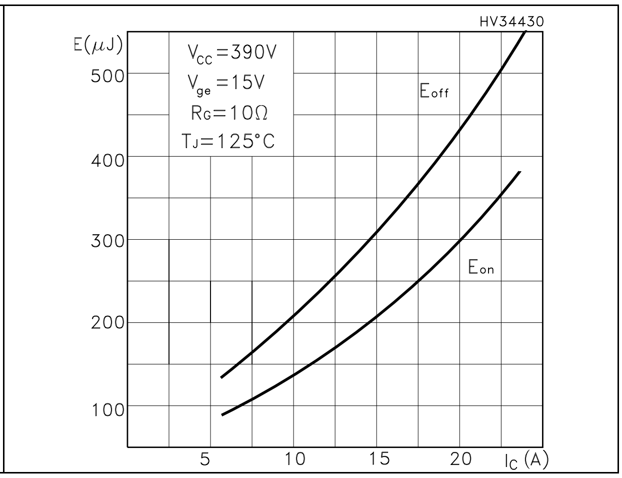


Figure 13. Turn-off SOA

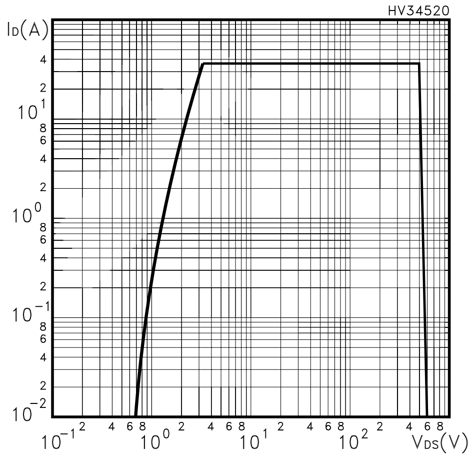
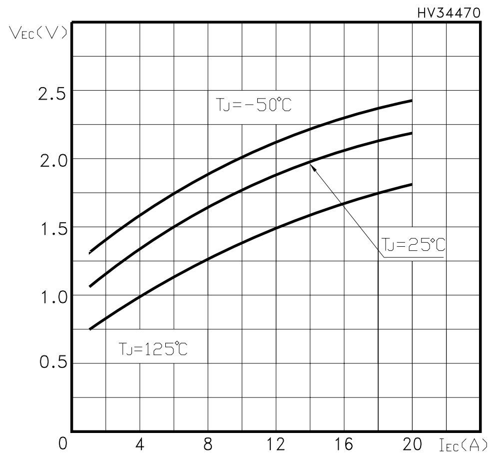


Figure 14. Emitter-collector diode characteristics



3 Test circuit

Figure 15. Test circuit for inductive load switching

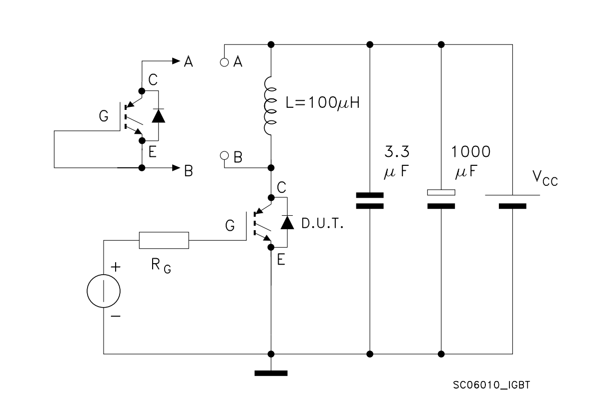


Figure 16. Gate charge test circuit

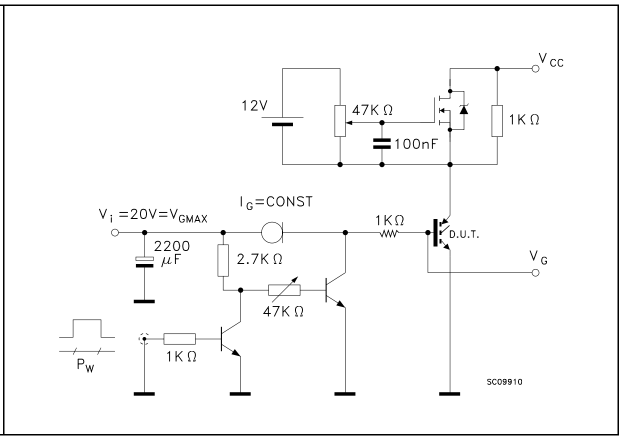


Figure 17. Switching waveform

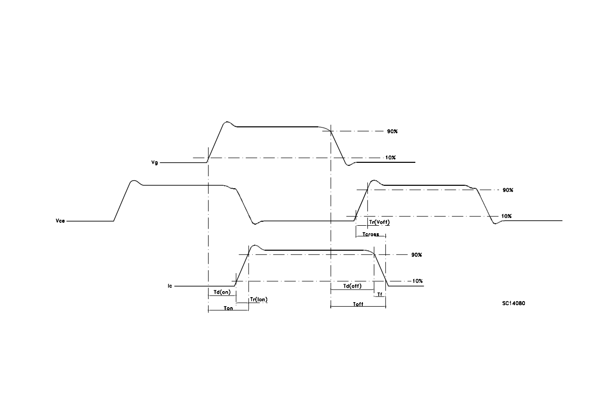
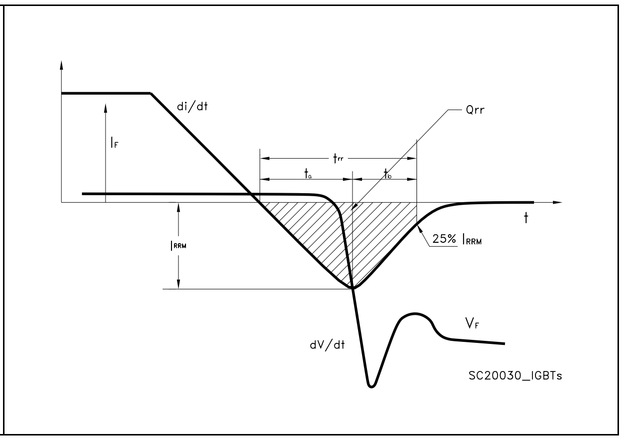


Figure 18. Diode recovery time waveform

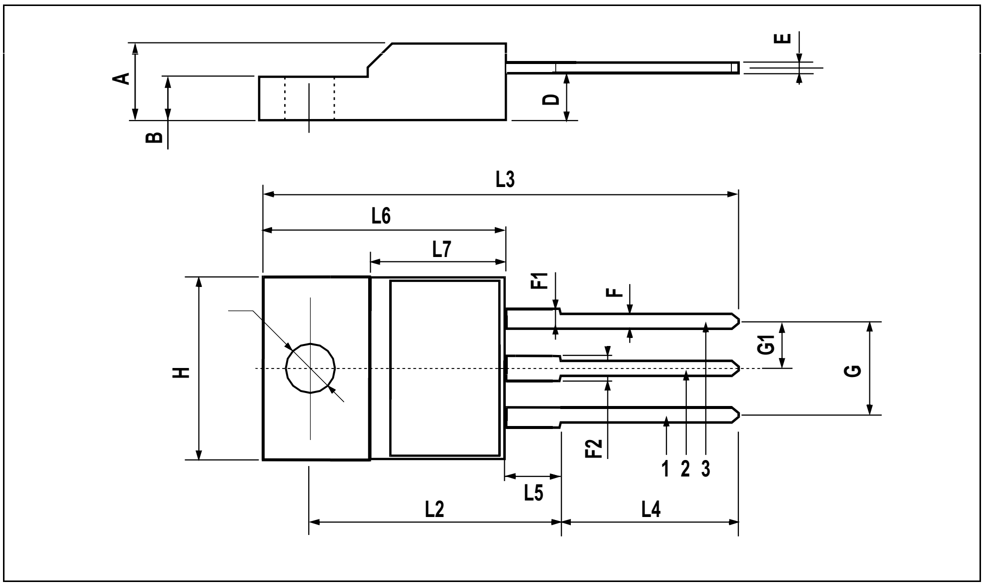


4 Package mechanical data

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-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



5 Revision history

Table 8. Revision history

Date	Revision	Changes
13-Oct-2006	1	Initial release.
08-May-2007	2	Corrected value on *Table 1*, *Table 2*