STGF3NC120HD

N-CHANNEL 3A - 1200V TO-220FP
FAST PowerMESH™ IGBT with Integral Damper Diode

Table 1: General Features

TYPE	V_{CES}	$V_{CE(sat)}$ (Max) @25°C	I_C @100°C
STGF3NC120HD	1200 V	< 2.8 V	3 A

- LOW ON-VOLTAGE DROP (V_{cesat})
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH SPEED

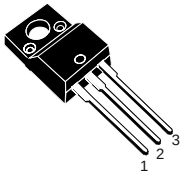
DESCRIPTION

This PowerMESH™ IGBT is designed using the latest high voltage technology based on a patented strip layout. A new lifetime control allows good switching performance and low voltage drop. This IGBT featuring a co-packaged diode is optimized for horizontal deflection applications in small and medium sets.

APPLICATIONS

- HORIZONTAL DEFLECTION
- HOME APPLIANCE
- LIGHTING

Figure 1: Package



TO-220FP

Figure 2: Internal Schematic Diagram

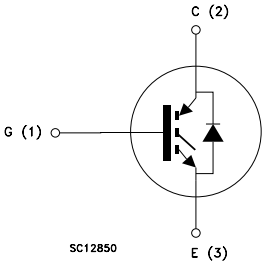


Table 2: Order Code

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGF3NC120HD	GF3NC120HD	TO-220FP	TUBE

Rev. 2

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage (V_{GS} = 0)	1200	V
V_{ECR}	Emitter-Collector Voltage	20	V
V_{GE}	Gate-Emitter Voltage	±20	V
I_C	Collector Current (continuous) at T_C = 25°C	6	A
I_C	Collector Current (continuous) at T_C = 100°C	3	A
I_{CM} (▪)	Collector Current (pulsed)	10	A
P_{TOT}	Total Dissipation at T_C = 25°C	25	W
	Derating Factor	0.20	W/°C
V_{ISO}	Insulation withstand voltage AC (t=1sec, Tc=25°C)	2500	V
T_{stg}	Storage Temperature	–55 to 150	°C
T_j	Operating Junction Temperature range		

(▪) Pulse width limited by safe operating area

Table 4: Thermal Data

		Min.	Typ.	Max.	
Rthj-case	Thermal Resistance Junction-case			5.0	°C/W
Rthj-amb	Thermal Resistance Junction-ambient			62.5	°C/W
T_L	Maximum Lead Temperature for Soldering Purpose (1.6 mm from case, for 10 sec.)		300		°C

ELECTRICAL CHARACTERISTICS (T_{CASE} =25°C UNLESS OTHERWISE SPECIFIED)

Table 5: On/Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	I_C = 1 mA, V_{GE} = 0	1200			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			50 1	µA mA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = ± 20V , V_{CE} = 0			±100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 250 µA	2		5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V, I_C = 3 A V_{GE} = 15V, I_C = 3 A, Tc= 125°C		2.3 2.2	2.8	V V

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 6: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	V_{CE} = 25 V , I_C = 3 A		4		S
C_{ies}	Input Capacitance	V_{CE} = 25 V, f= 1 MHz, V_{GE} = 0		470		pF
C_{oes}	Output Capacitance			45		pF
C_{res}	Reverse Transfer Capacitance			6		pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CC} = 960 V, I_C = 3 A, V_{GE} = 15 V (see Figure 22)		24 3 10	32	nC nC nC
I_{CL}	Turn-off SOA minimum current	V_{clamp} = 960 V , Tj = 150°C R_G = 10 Ω, V_{GE} = 15 V	10			A

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

Table 7: Switching On

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} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 25°C (see Figure 20)		15 3.5 880		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} = 480 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 125°C (see Figure 20)		14.5 4 770		ns ns A/µs

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_r(V_{off})$	Off Voltage Rise Time	V_{cc} = 800 V, I_C = 3 A, R_G = 10 Ω , V_{GE} = 15 V T_J = 25 °C (see Figure 20)		72		ns
$t_{d(off)}$	Turn-off Delay Time			118		ns
t_f	Current Fall Time			250		ns
$t_r(V_{off})$	Off Voltage Rise Time	V_{cc} = 800 V, I_C = 3 A, R_G = 10 Ω , V_{GE} = 15 V Tj = 125 °C (see Figure 20)		132		ns
$t_{d(off)}$	Turn-off Delay Time			210		ns
t_f	Current Fall Time			470		ns

Table 9: Switching Energy

Symbol	Parameterr	Test Conditions	Min.	Typ.	Max	Unit
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 25°C (see Figure 21)		236 290 526		µJ µJ µJ
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 125°C (see Figure 21)		360 620 980		µJ µJ µJ

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

Table 10: Collector-Emitter Diode

Symbol	Parameterr	Test Conditions	Min.	Typ.	Max	Unit
I_f I_{fm}	Forward Current Forward Current pulsed				3 12	A A
V_f	Forward On-Voltage	If = 1.5 A If = 1.5A, Tj = 125°C		1.6 1.3	2.0	V V
t_{rr} Q_{rr} I_{rm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	If = 3 A, V_R = 40 V Tj = 25°C, di/dt = 100 A/µs (see Figure 23)		51 85 3.3		ns nC A
t_{rr} Q_{rr} I_{rm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	If = 3 A, V_R = 40 V Tj = 125°C, di/dt = 100 A/µs (see Figure 23)		64 133 4.2		ns nC A

Figure 3: Output Characteristics

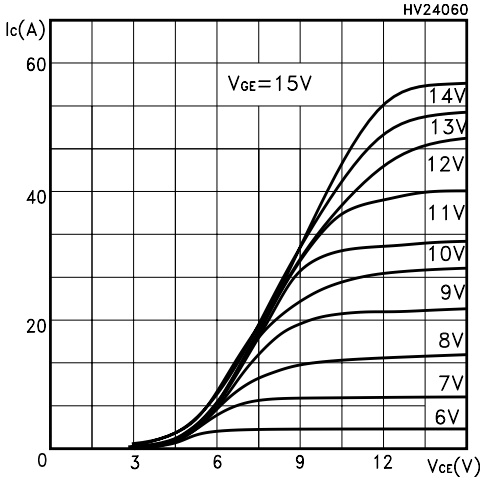


Figure 4: Transconductance

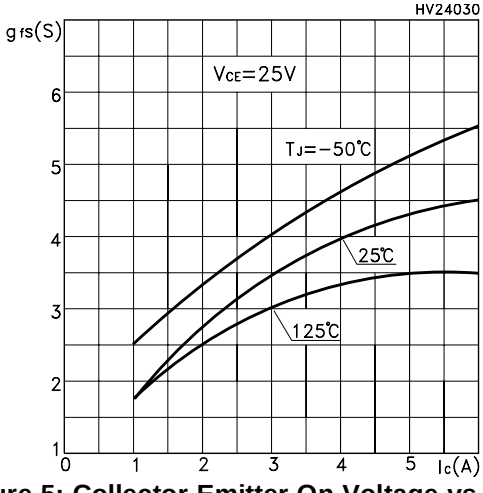


Figure 5: Collector-Emitter On Voltage vs Collector Current

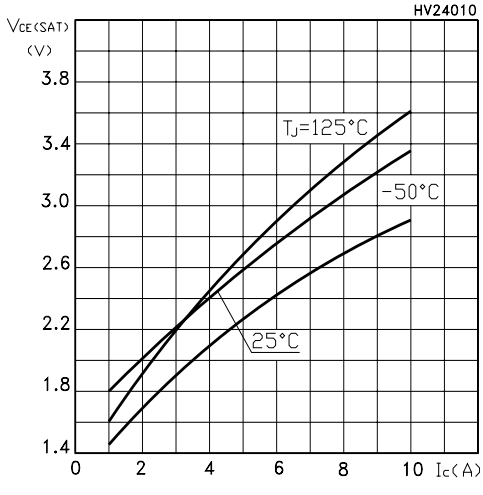


Figure 6: Transfer Characteristics

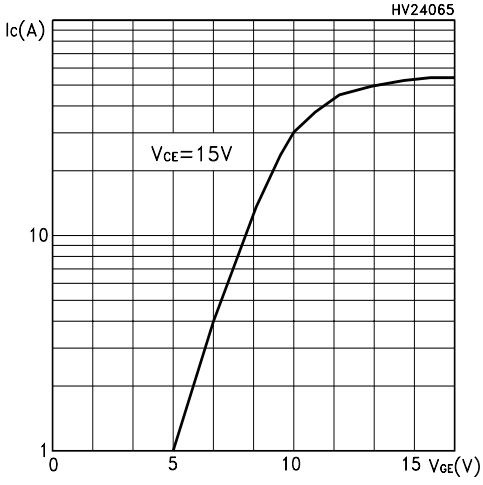


Figure 7: Collector-Emitter On Voltage vs Temperature

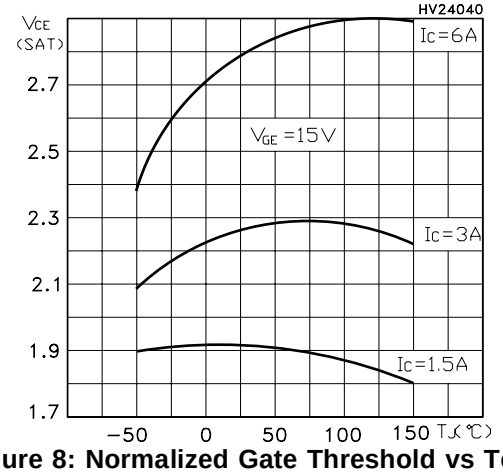


Figure 8: Normalized Gate Threshold vs Temperature

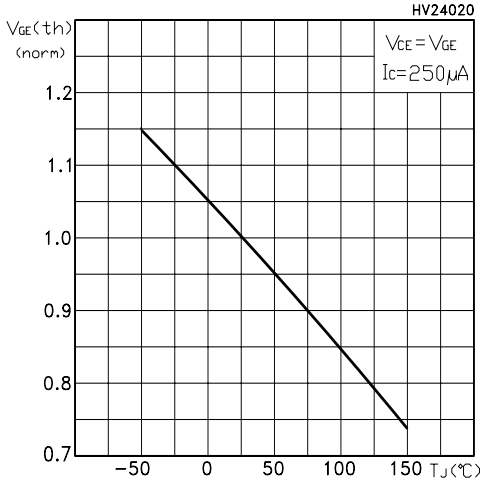


Figure 9: Normalized Breakdown Voltage vs Temperature

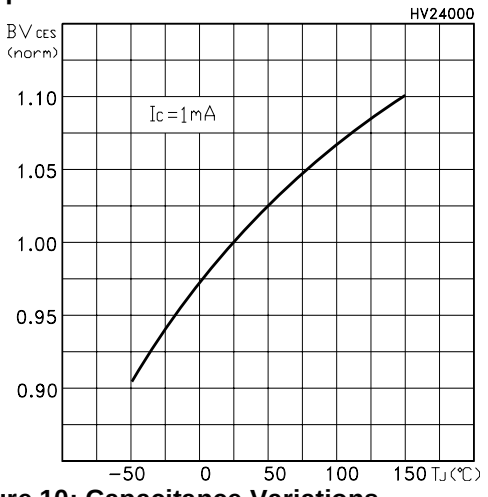


Figure 10: Capacitance Variations

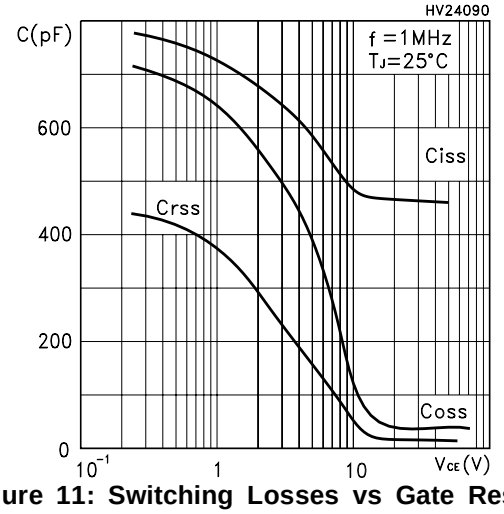


Figure 11: Switching Losses vs Gate Resistance

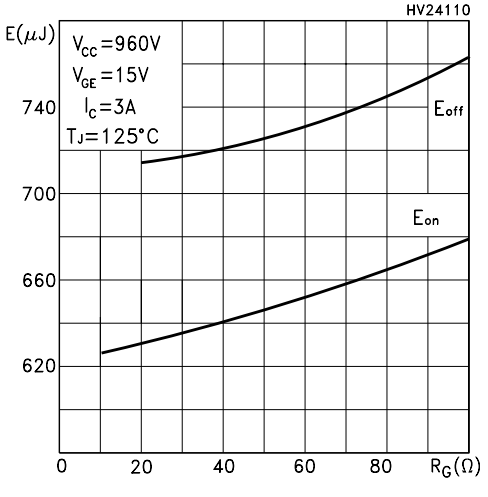


Figure 12: Gate Charge vs Gate-Emitter Voltage

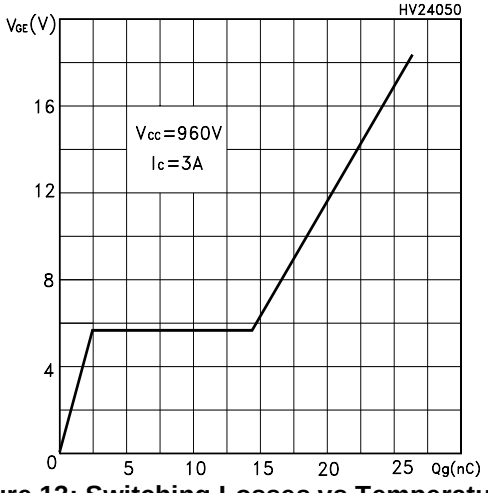


Figure 13: Switching Losses vs Temperature

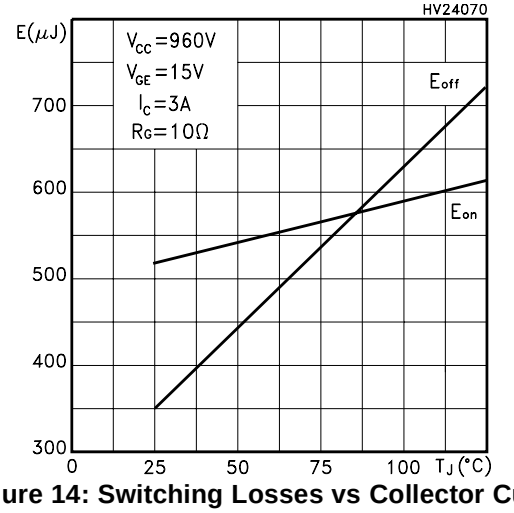


Figure 14: Switching Losses vs Collector Current

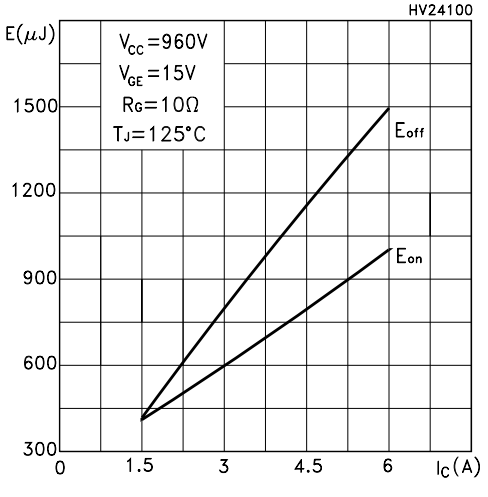


Figure 15: Thermal Impedance

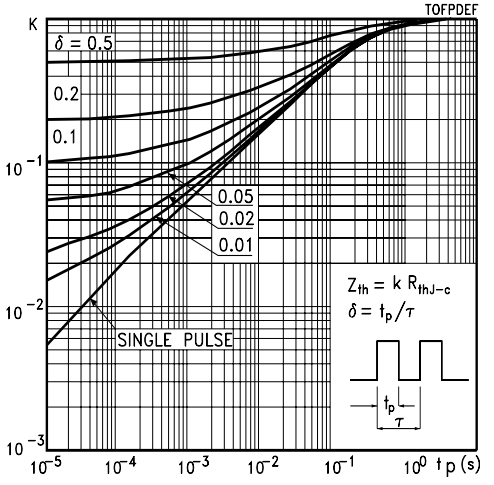


Figure 16: Collector-Emitter Diode Characteristics

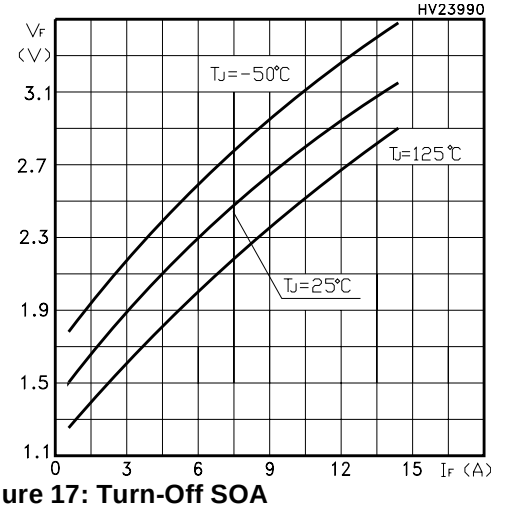


Figure 17: Turn-Off SOA

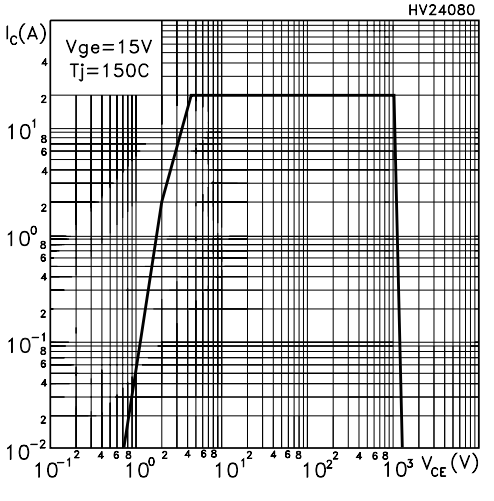


Figure 18: Power Losses

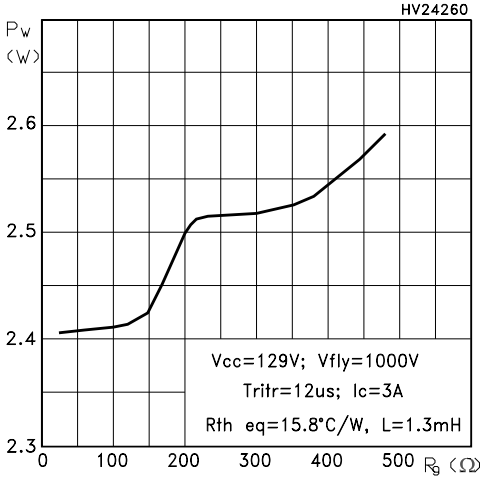


Figure 19: Power Losses

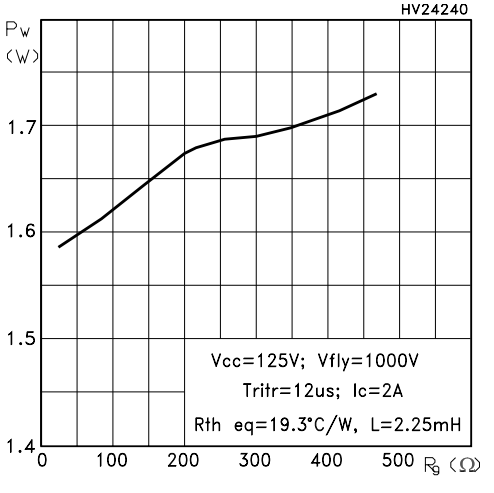


Figure 20: Test Circuit for Inductive Load Switching

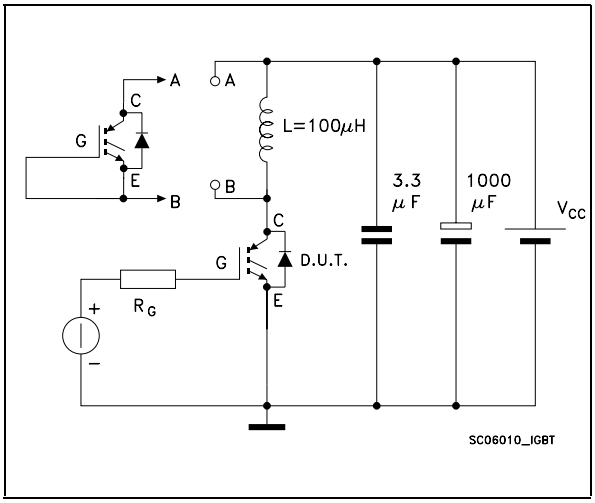


Figure 21: Switching Waveforms

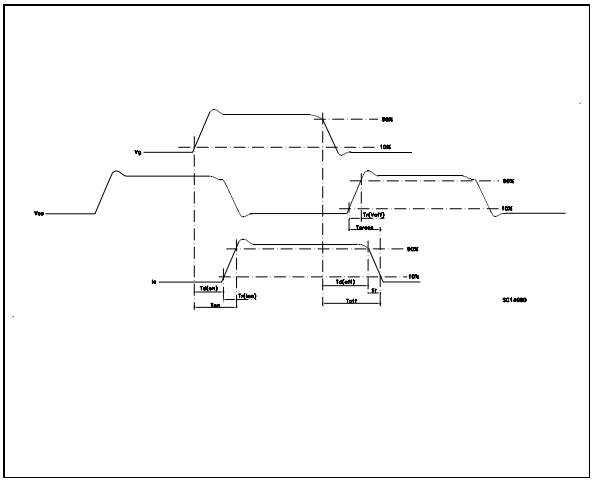


Figure 22: Gate Charge Test Circuit

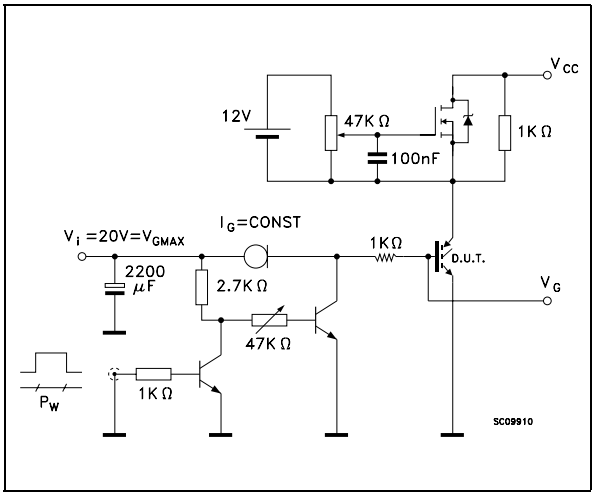
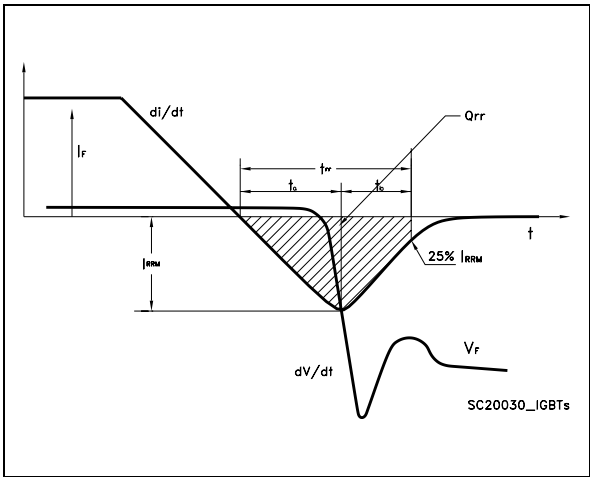


Figure 23: Diode Recovery Time Waveforms



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

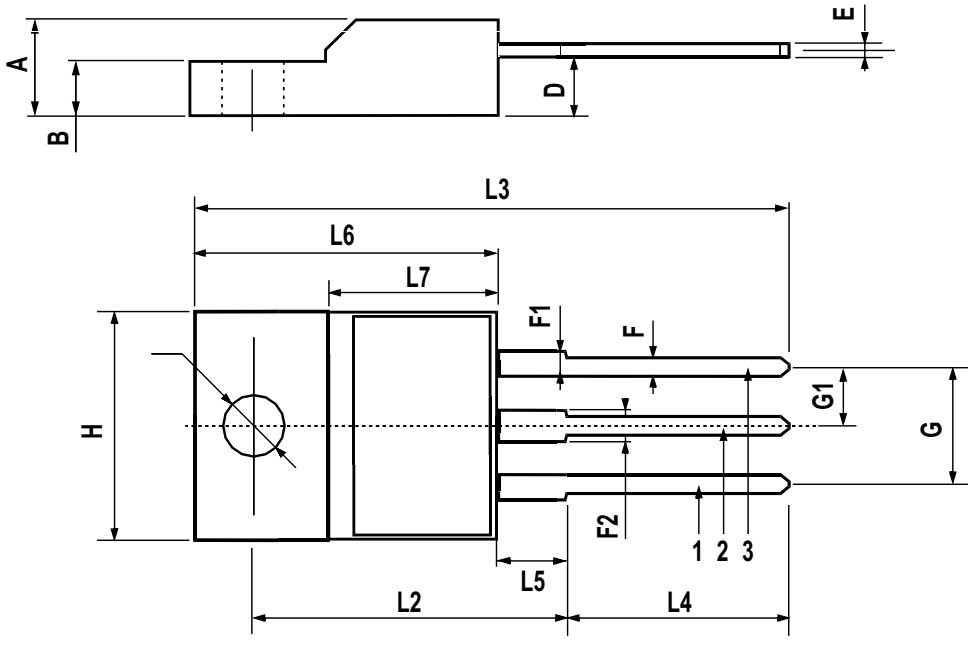


Table 11: Revision History

Date	Revision	Description of Changes
13-Dec-2004	1	First release
21-Jan-2005	2	Modified Curve 17