



# STGP10NB37LZ

## N-CHANNEL CLAMPED 20A - TO-220 INTERNALLY CLAMPED PowerMesh™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP10NB37LZ	CLAMPED	< 1.8 V	20 A

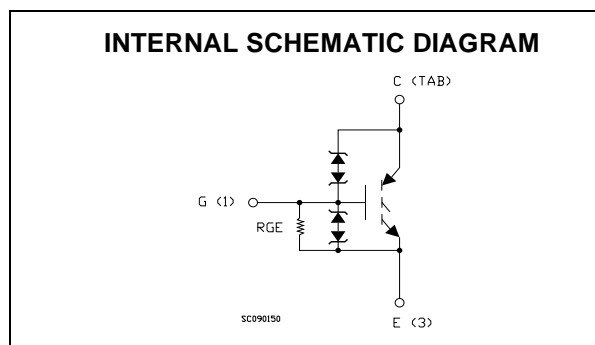
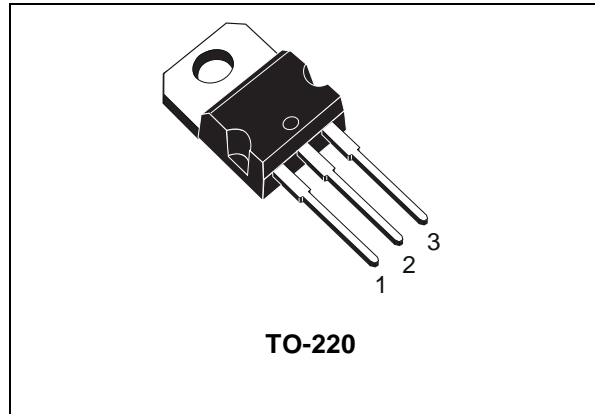
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

### 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 built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

### APPLICATIONS

- AUTOMOTIVE IGNITION



### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	CLAMPED	V
V <sub>ECR</sub>	Reverse Battery Protection	18	V
V <sub>GE</sub>	Gate-Emitter Voltage	CLAMPED	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	20	A
I <sub>CM</sub>	Collector Current (pulse width < 100μs)	60	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	125	W
	Derating Factor	0.83	W/°C
ESD	ESD (Human Body Model)	4	KV
T <sub>stg</sub>	Storage Temperature	-65 to 175	°C
T <sub>j</sub>	Max. Operating Junction Temperature	175	°C

## STGP10NB37LZ

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1.2	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W
Rthc-sink	Thermal Resistance Case-sink Typ	0.2	°C/W

### ELECTRICAL CHARACTERISTICS (TCASE = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
BV(CES)	Clamped Voltage	$I_C = 2 \text{ mA}$ , $V_{GE} = 0$ , $T_j = -40^\circ\text{C}$ to $150^\circ\text{C}$	375	400	425	V
BV(ECR)	Emitter Collector Break-down Voltage	$I_{EC} = 75 \text{ mA}$ , $V_{GE} = 0$ , $T_j = -40^\circ\text{C}$ to $150^\circ\text{C}$	18			V
BV <sub>GE</sub>	Gate Emitter Break-down Voltage	$I_G = \pm 2 \text{ mA}$ $T_j = -40^\circ\text{C}$ to $150^\circ\text{C}$	12		16	V
I <sub>CES</sub>	Collector cut-off Current ( $V_{GE} = 0$ )	$V_{CE} = 15 \text{ V}$ , $V_{GE} = 0$ , $T_j = 150^\circ\text{C}$ $V_{CE} = 200 \text{ V}$ , $V_{GE} = 0$ , $T_C = 150^\circ\text{C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
I <sub>GES</sub>	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 10 \text{ V}$ , $V_{CE} = 0$			$\pm 700$	$\mu\text{A}$
R <sub>GE</sub>	Gate Emitter Resistance			20		K $\Omega$

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 250 \mu\text{A}$ , $T_j = -40^\circ\text{C}$ to $150^\circ\text{C}$	0.6		2.4	V
V <sub>CE(SAT)</sub>	Collector-Emitter Saturation Voltage	$V_{GE} = 4.5 \text{ V}$ , $I_C = 10 \text{ A}$ , $T_j = 25^\circ\text{C}$ $V_{GE} = 4.5 \text{ V}$ , $I_C = 10 \text{ A}$ , $T_C = -40^\circ\text{C}$		1.2 1.3	1.8	V V
I <sub>C</sub>	Collector Current	$V_{GE} = 4.5 \text{ V}$ , $V_{CE} = 9 \text{ V}$	20			A

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	$V_{CE} = 15 \text{ V}$ , $I_C = 20 \text{ A}$		18		S
C <sub>ies</sub>	Input Capacitance	$V_{CE} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		1250		pF
C <sub>oes</sub>	Output Capacitance			103		pF
C <sub>res</sub>	Reverse Transfer Capacitance			18		pF
Q <sub>g</sub>	Gate Charge	$V_{CE} = 320 \text{ V}$ , $I_C = 10 \text{ A}$ , $V_{GE} = 5 \text{ V}$		28		nC

FUNCTIONAL CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I <sub>L</sub>	Latching Current	V <sub>Clamp</sub> = 320 V, T <sub>C</sub> = 125 °C R <sub>G OFF</sub> = 1KΩ, V <sub>GE</sub> = 5 V L = 300μH	20			A
U.I.S.	Unclamped Inductive Switching Current	R <sub>G OFF</sub> = 1KΩ, L = 1.6 mH, T <sub>C</sub> = 125°C, V <sub>CC</sub> = 30V	15			A

SWITCHING ON

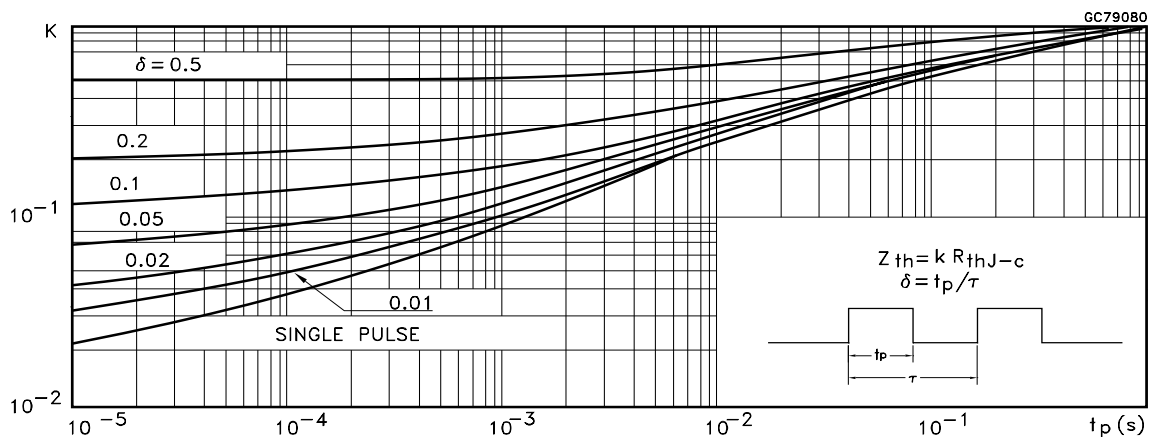
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>d(on)</sub>	Turn-on Delay Time	V <sub>CC</sub> = 320 V, I <sub>C</sub> = 10 A		520		ns
t <sub>r</sub>	Rise Time	R <sub>G</sub> = 1KΩ, V <sub>GE</sub> = 5 V		340		ns
(di/dt) <sub>on</sub> E <sub>on</sub>	Turn-on Current Slope Turn-on Switching Losses	V <sub>CC</sub> = 320 V, I <sub>C</sub> = 10 A R <sub>G</sub> = 1KΩ, V <sub>GE</sub> = 5 V		17 180		A/μs μJ

SWITCHING OFF

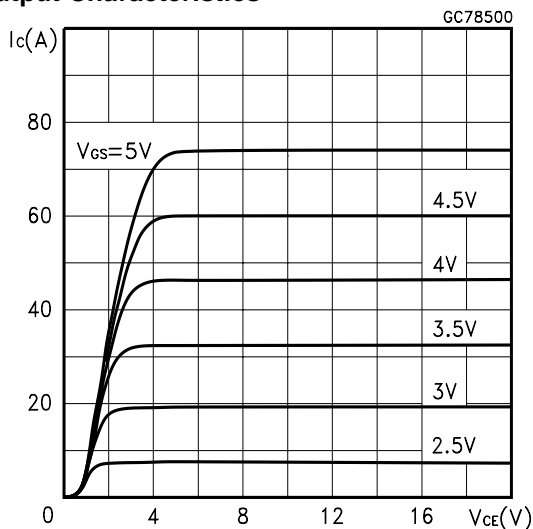
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t <sub>c</sub>	Cross-over Time	V <sub>clamp</sub> = 320 V, I <sub>C</sub> = 10 A, R <sub>GE</sub> = 1K Ω, V <sub>GE</sub> = 5 V		4		μs
t <sub>r(Voff)</sub>	Off Voltage Rise Time			2.2		μs
t <sub>d(off)</sub>	Delay Time			14.8		μs
t <sub>f</sub>	Fall Time			1.5		μs
E <sub>off(**)</sub>	Turn-off Switching Loss			4.0		mJ
t <sub>c</sub>	Cross-over Time	V <sub>clamp</sub> = 320 V, I <sub>C</sub> = 10 A, R <sub>GE</sub> = 1KΩ, V <sub>GE</sub> = 5 V T <sub>J</sub> = 125 °C		5.2		μs
t <sub>r(Voff)</sub>	Off Voltage Rise Time			2.8		μs
t <sub>d(off)</sub>	Delay Time			15.8		μs
t <sub>f</sub>	Fall Time			2		μs
E <sub>off(**)</sub>	Turn-off Switching Loss			6.5		mJ

(●) Pulsed: Pulse duration = 300 μs, duty cycle 1.5 %. (1) Pulse width limited by max. junction temperature. (\*\*) Losses Include Also the Tail

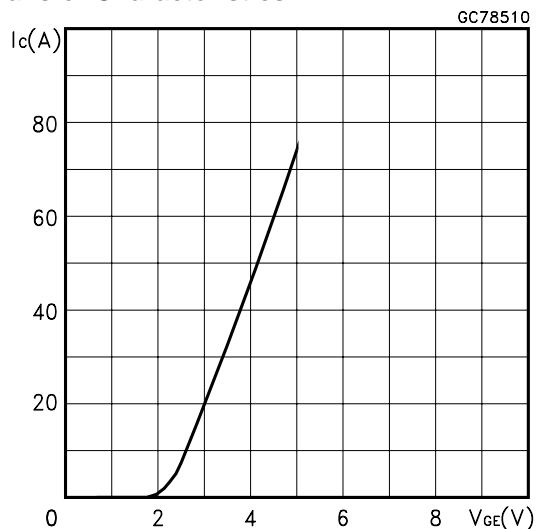
Normalized Transient Thermal Impedance



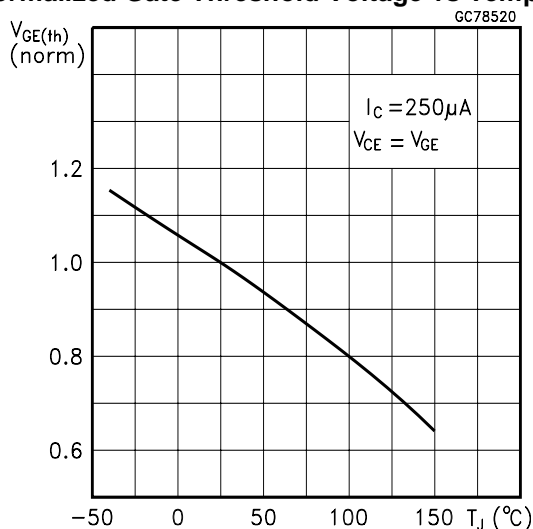
Output Characteristics



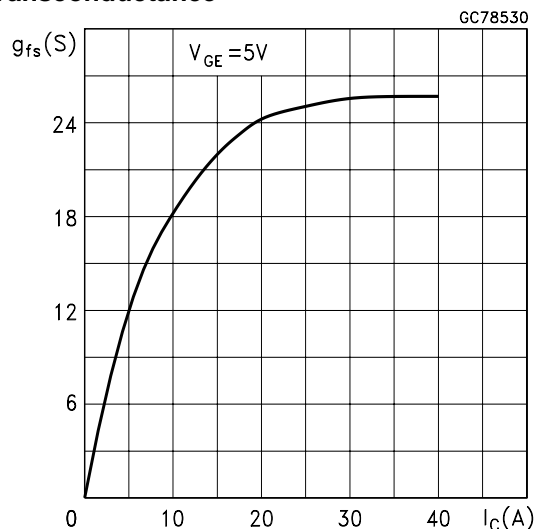
Transfer Characteristics



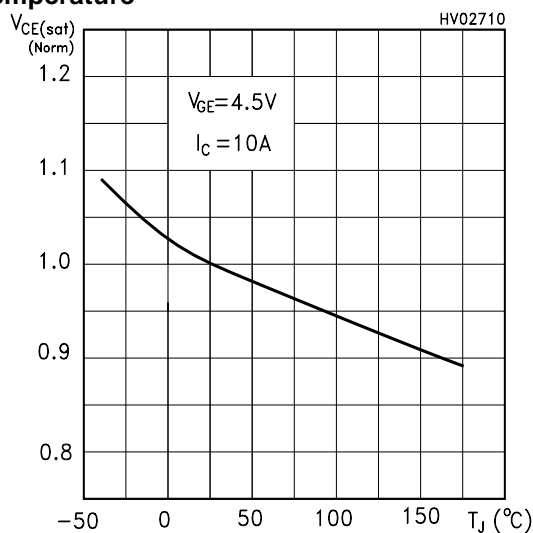
Normalized Gate Threshold Voltage vs Temp.



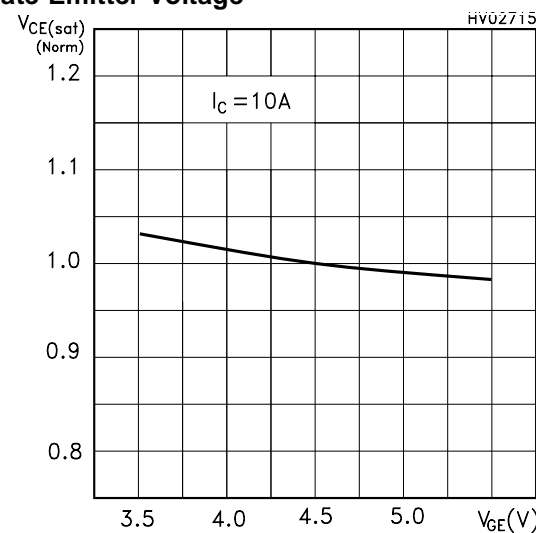
Transconductance



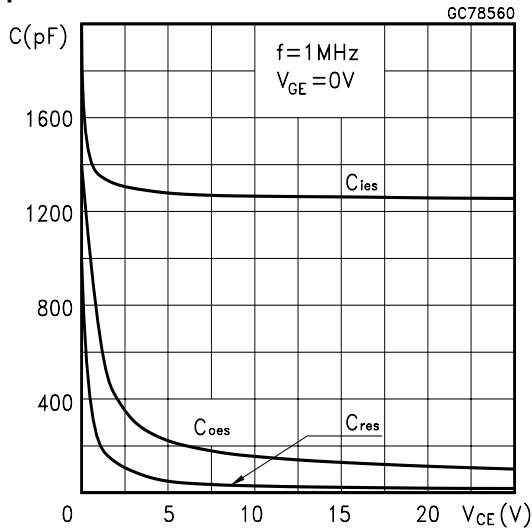
Normalized Collector-Emitter On Voltage vs Temperature



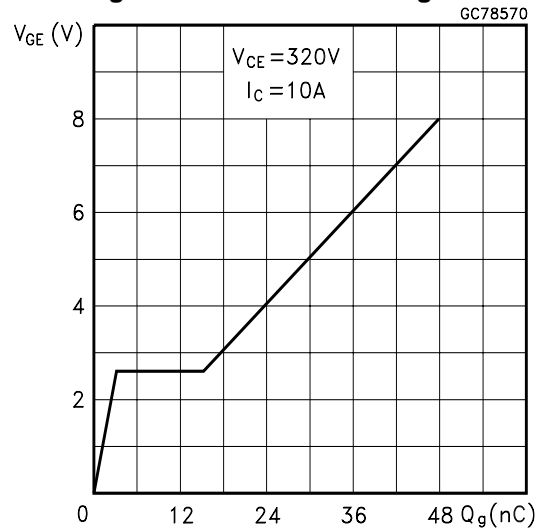
Normalized Collector-Emitter On Voltage vs Gate-Emitter Voltage



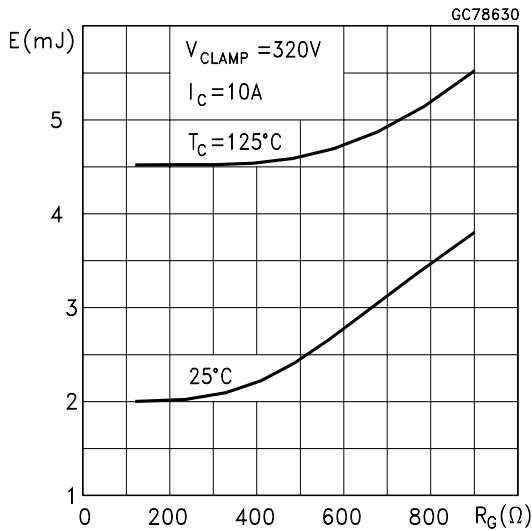
Capacitance Variations



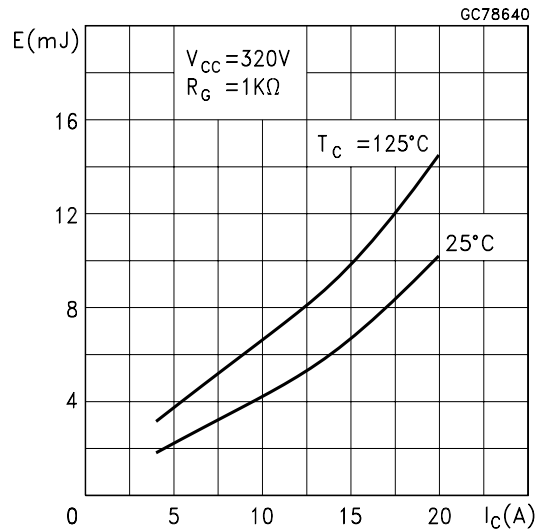
Gate Charge vs Gate-Emitter Voltage



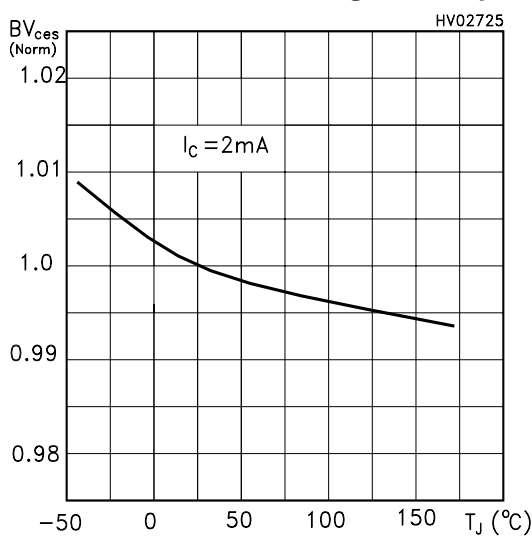
Off Losses vs Gate Resistance



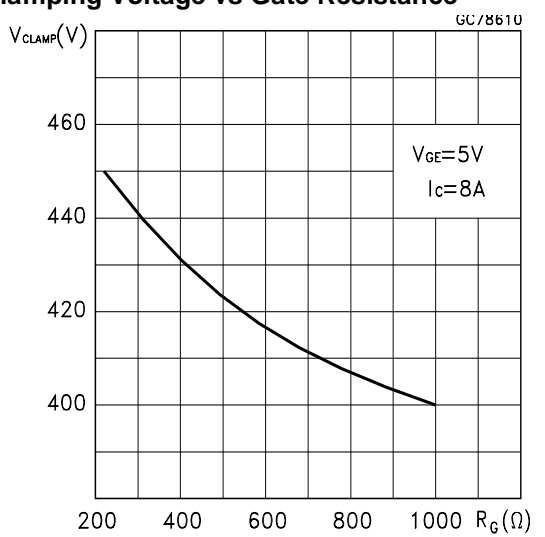
Off Losses vs Collector Current



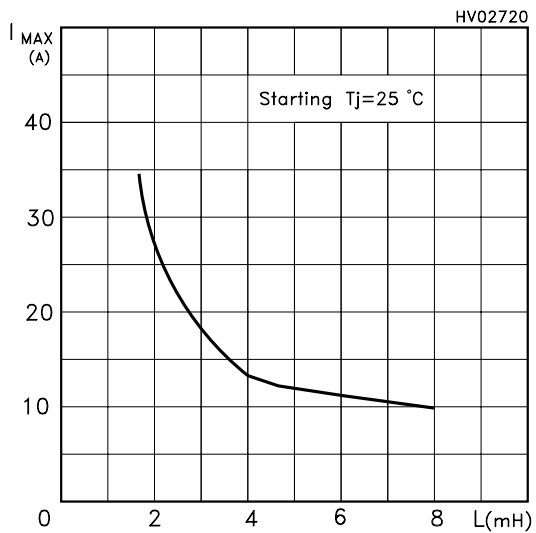
Normalized Break-down Voltage vs Temp.



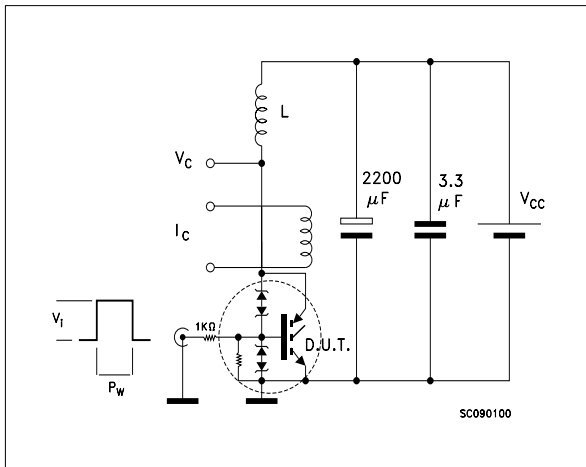
Clamping Voltage vs Gate Resistance



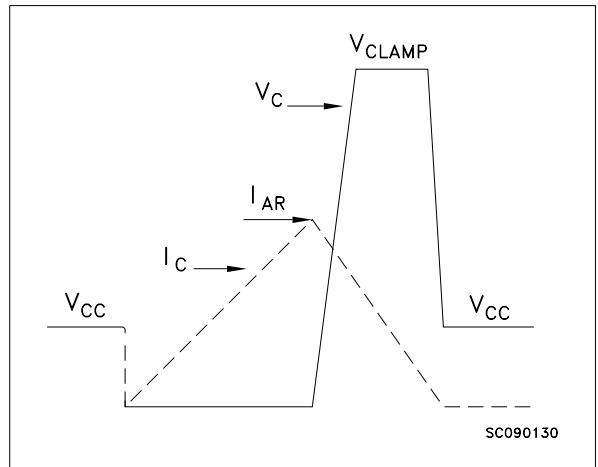
**Self Clamped Inductive Switching I<sub>MAX</sub> vs  
Open Secondary Coil**



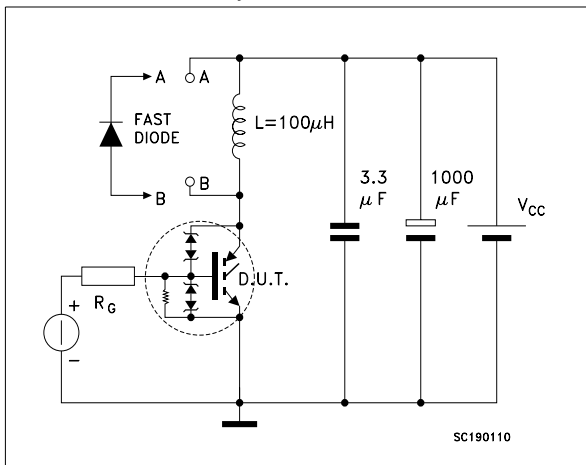
**Fig. 1: Unclamped Inductive Load Test Circuit**



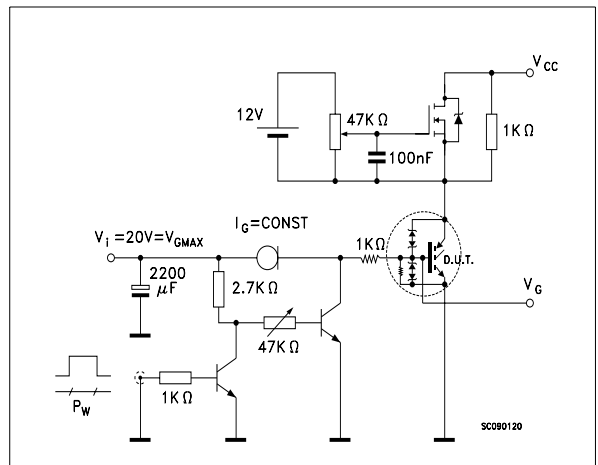
**Fig. 2: Unclamped Inductive Waveform**



**Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times**

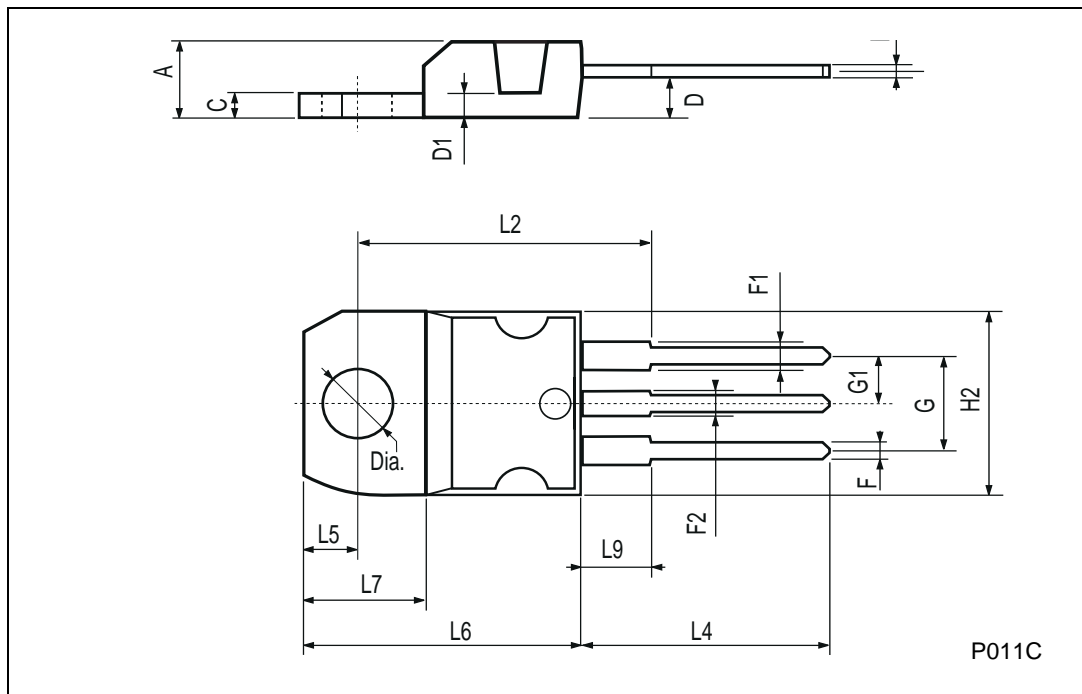


**Fig. 4: Gate Charge test Circuit**



TO-220 MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151





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