



# 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

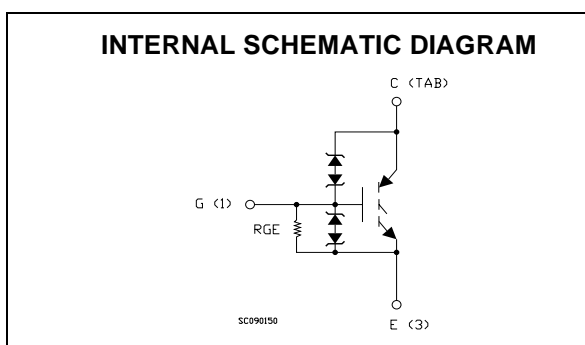
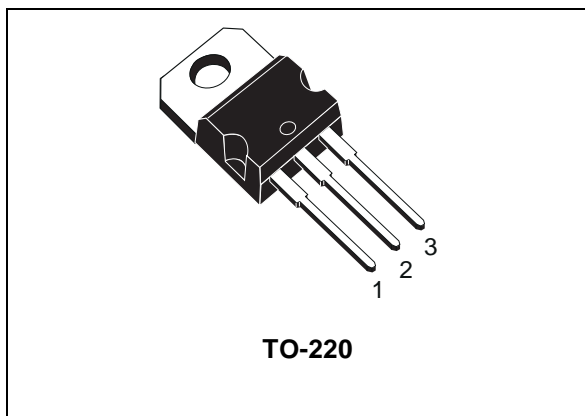
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

### 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
E <sub>SD</sub>	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

**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
$I_L$	Latching Current	$V_{Clamp} = 320\text{ V}$ , $T_C = 125\text{ }^\circ\text{C}$ $R_{G\text{OFF}} = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$ $L = 300\mu\text{H}$	20			A
U.I.S.	Unclamped Inductive Switching Current	$R_{G\text{OFF}} = 1\text{ K}\Omega$ , $L = 1.6\text{ mH}$ , $T_C = 125\text{ }^\circ\text{C}$ , $V_{CC} = 30\text{ V}$	15			A

## SWITCHING ON

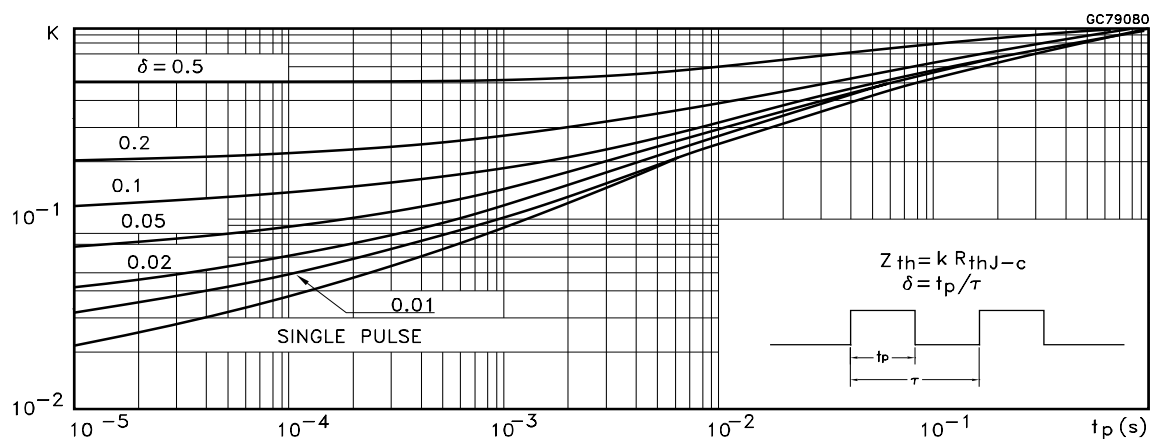
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(\text{on})}$	Turn-on Delay Time	$V_{CC} = 320\text{ V}$ , $I_C = 10\text{ A}$		520		ns
$t_r$	Rise Time	$R_G = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		340		ns
$(di/dt)_{\text{on}}$	Turn-on Current Slope	$V_{CC} = 320\text{ V}$ , $I_C = 10\text{ A}$		17		A/ $\mu\text{s}$
$E_{\text{on}}$	Turn-on Switching Losses	$R_G = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		180		$\mu\text{J}$

## SWITCHING OFF

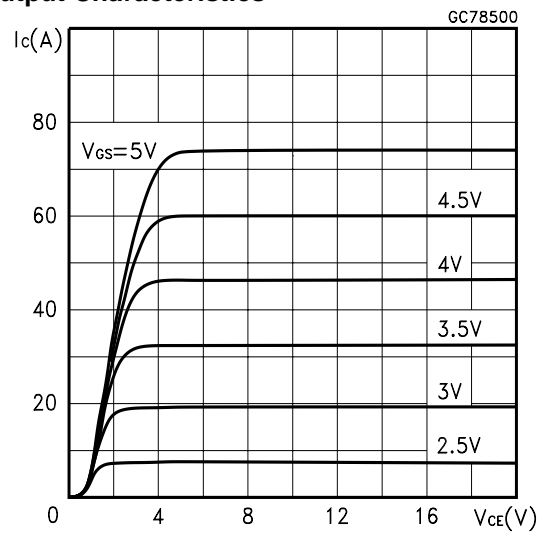
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{\text{clamp}} = 320\text{ V}$ , $I_C = 10\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$		4		$\mu\text{s}$
$t_r(V_{\text{off}})$	Off Voltage Rise Time			2.2		$\mu\text{s}$
$t_{d(\text{off})}$	Delay Time			14.8		$\mu\text{s}$
$t_f$	Fall Time			1.5		$\mu\text{s}$
$E_{\text{off}}(**)$	Turn-off Switching Loss			4.0		mJ
$t_c$	Cross-over Time	$V_{\text{clamp}} = 320\text{ V}$ , $I_C = 10\text{ A}$ , $R_{GE} = 1\text{ K}\Omega$ , $V_{GE} = 5\text{ V}$ $T_J = 125\text{ }^\circ\text{C}$		5.2		$\mu\text{s}$
$t_r(V_{\text{off}})$	Off Voltage Rise Time			2.8		$\mu\text{s}$
$t_{d(\text{off})}$	Delay Time			15.8		$\mu\text{s}$
$t_f$	Fall Time			2		$\mu\text{s}$
$E_{\text{off}}(**)$	Turn-off Switching Loss			6.5		mJ

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

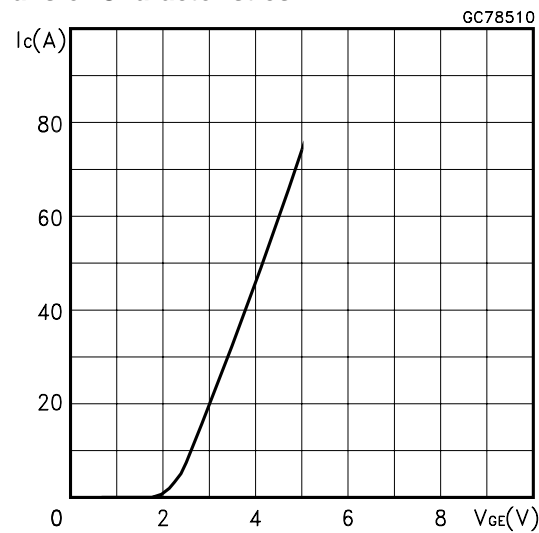
## Normalized Transient Thermal Impedance



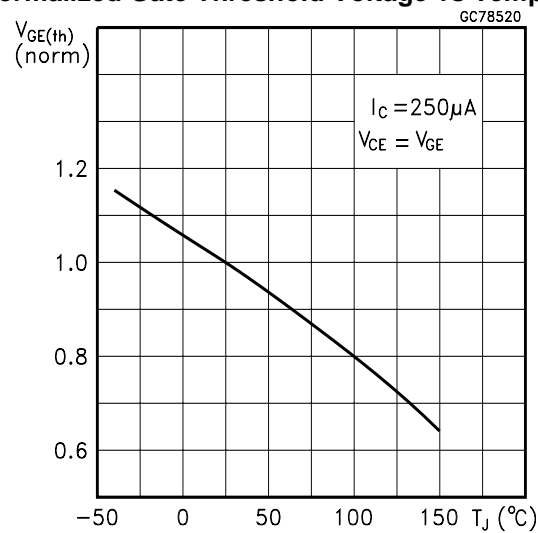
Output Characteristics



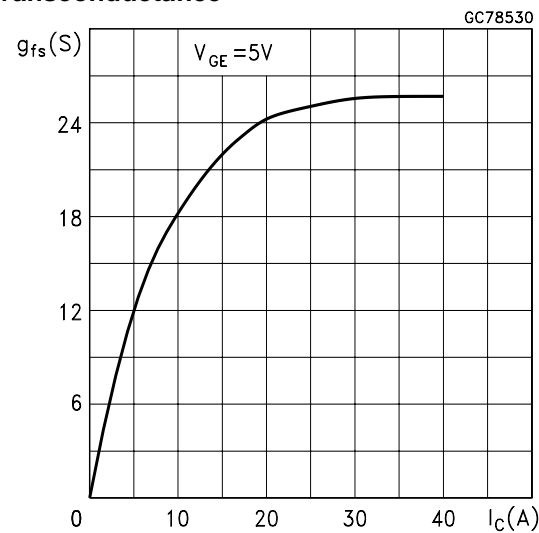
Transfer Characteristics



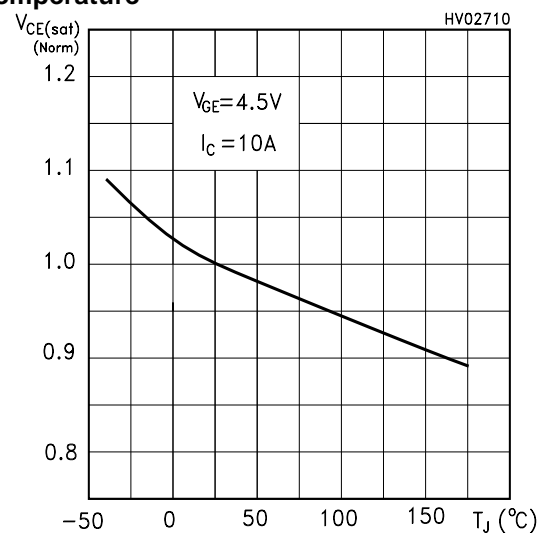
Normalized Gate Threshold Voltage vs Temp.



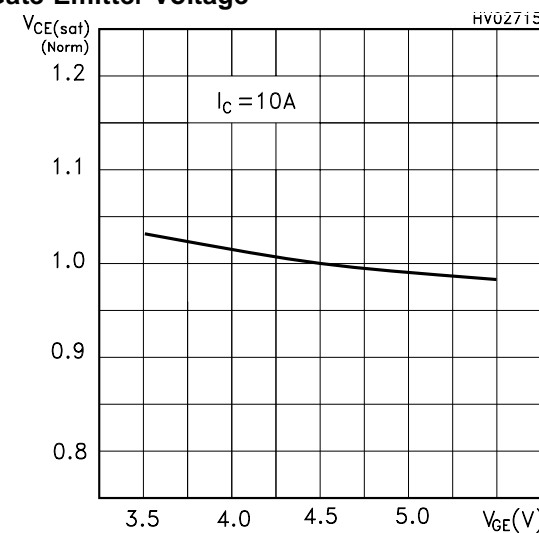
Transconductance



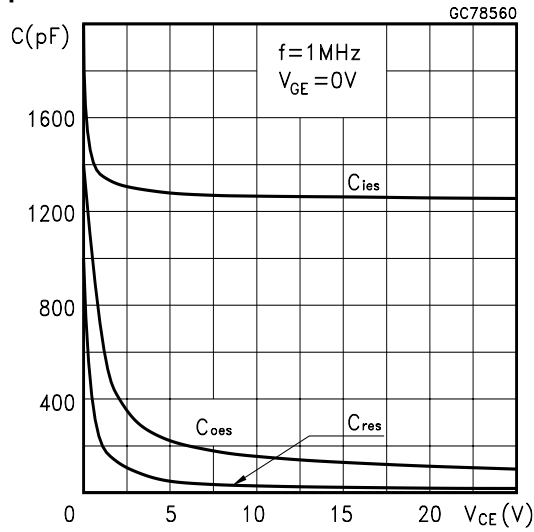
Normalized Collector-Emitter On Voltage vs Temperature



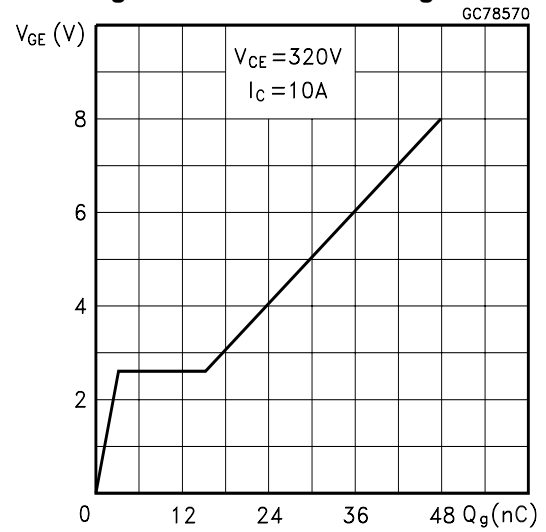
Normalized Collector-Emitter On Voltage vs Gate-Emitter Voltage



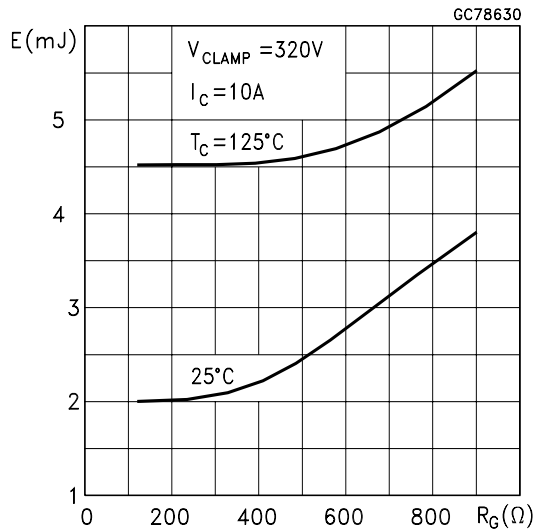
### Capacitance Variations



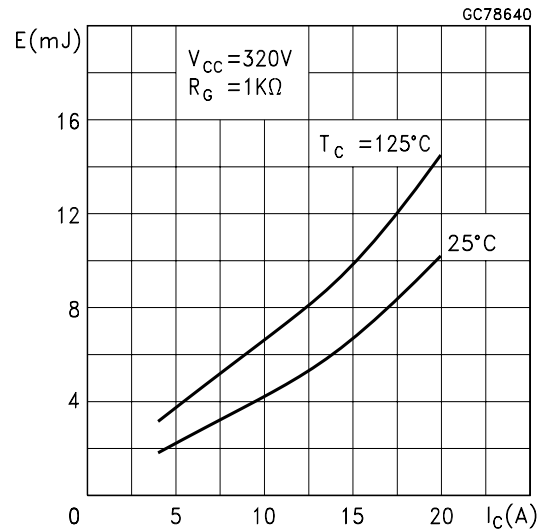
### Gate Charge vs Gate-Emitter Voltage



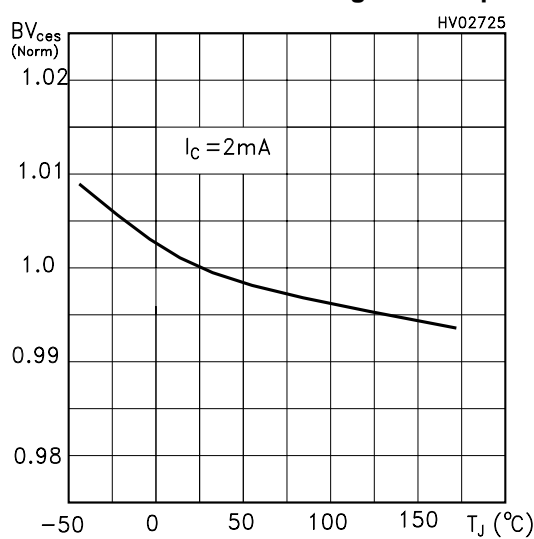
### Off Losses vs Gate Resistance



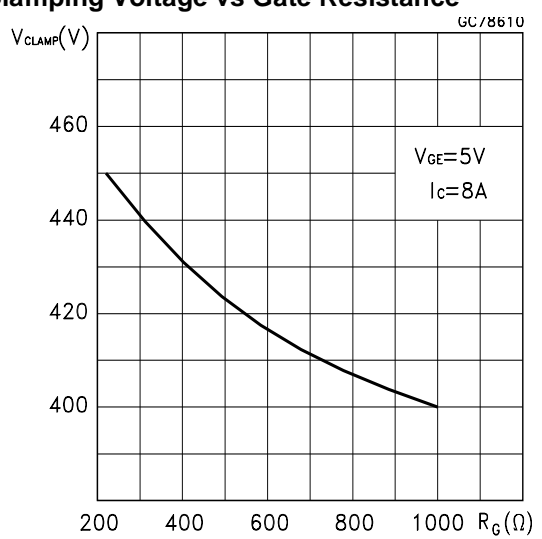
### Off Losses vs Collector Current



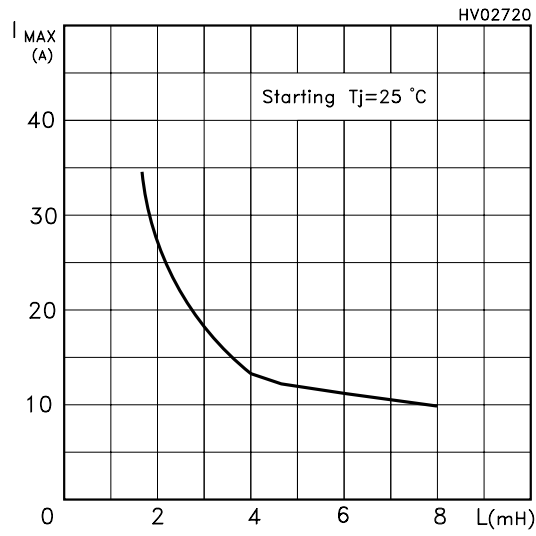
### Normalized Break-down Voltage vs Temp.



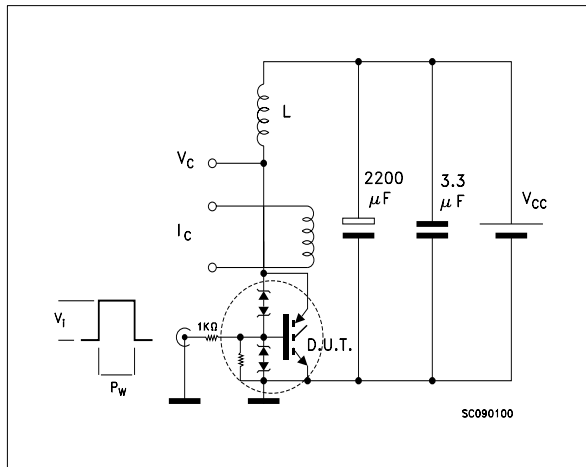
### Clamping Voltage vs Gate Resistance



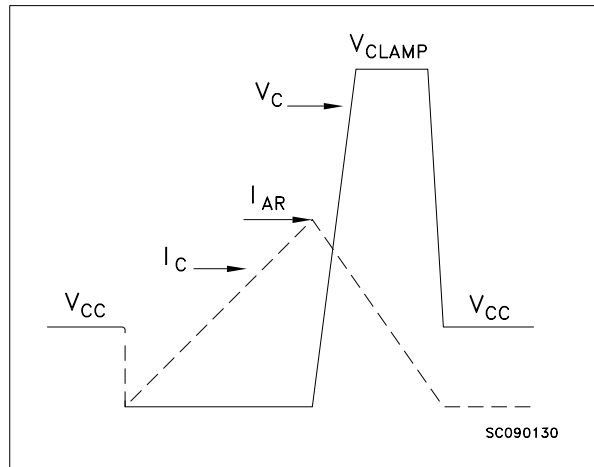
Self Clamped Inductive Switching I<sub>MAX</sub> vs  
Open Secondary Coil



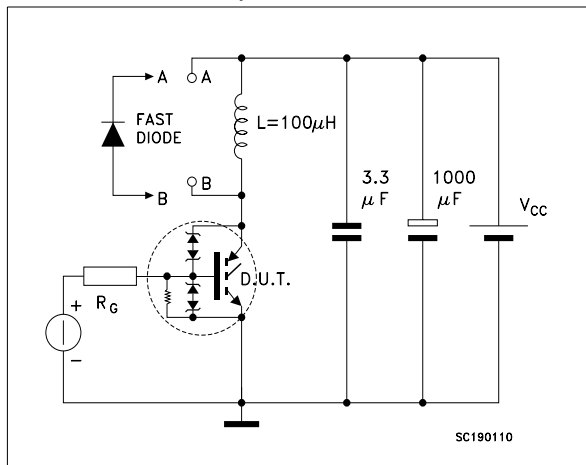
**Fig. 1: Unclamped Inductive Load Test Circuit**



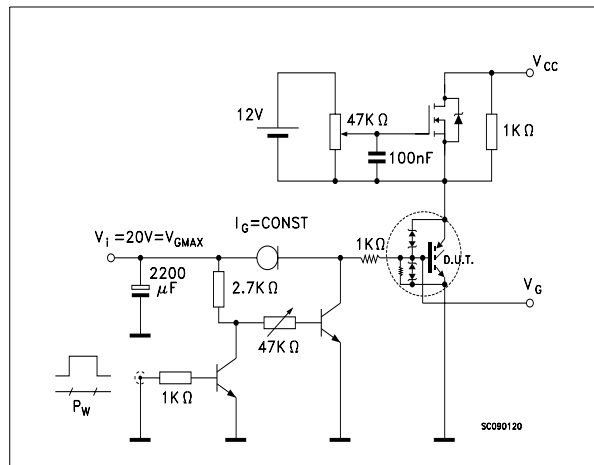
**Fig. 2: Unclamped Inductive Waveform**



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

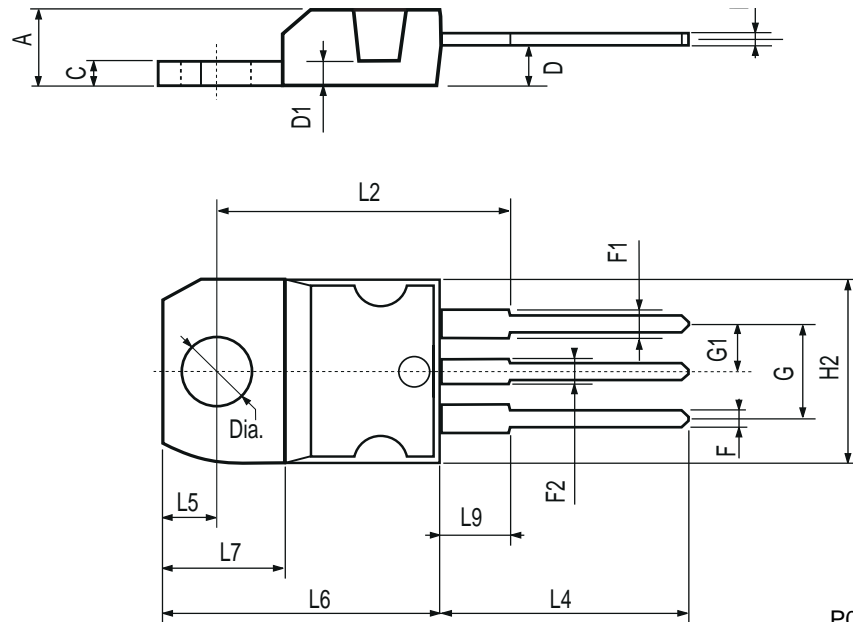


**Fig. 4: Gate Charge test Circuit**



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





Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specification mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

The ST logo is a trademark of STMicroelectronics

© 2000 STMicroelectronics – Printed in Italy – All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - China - Finland - France - Germany - Hong Kong - India - Italy - Japan - Malaysia - Malta - Morocco -  
Singapore - Spain - Sweden - Switzerland - United Kingdom - U.S.A.

<http://www.st.com>