



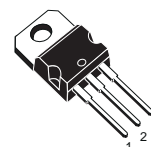
# STGP12NB60K

N-CHANNEL 18A - 600V TO-220

SHORT CIRCUIT PROOF PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max) @ 25°C	I <sub>C</sub> (#) @ 100°C
STGP12NB60K	600 V	< 2.8 V	18 A

- HIGH INPUT IMPEDANCE
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- TYPICAL SHORT CIRCUIT WITHSTAND TIME 10 MICROS



TO-220

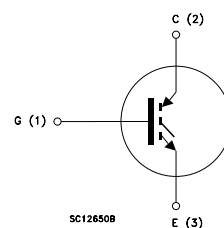
## DESCRIPTION

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 "K" identifies a family optimized for high frequency applications (up to 50kHz) and short circuit proof in order to achieve very high switching performances (reduced t<sub>fall</sub>) maintaining a low voltage drop.

## APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS
- UPS

## INTERNAL SCHEMATIC DIAGRAM



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP12NB60K	GP12NB60K	TO-220	TUBE

## STGP12NB60K

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	600	V
$V_{ECR}$	Emitter-Collector Voltage	20	V
$V_{GE}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current (continuous) at $T_C = 25^\circ\text{C}$ (#)	30	A
$I_C$	Collector Current (continuous) at $T_C = 100^\circ\text{C}$ (#)	18	A
$I_{CM}(\bullet)$	Collector Current (pulsed)	60	A
$T_{sc}$	Short Circuit Withstand	10	$\mu\text{s}$
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	125	W
	Derating Factor	1.0	W/ $^\circ\text{C}$
$T_{stg}$	Storage Temperature	-65 to 150	$^\circ\text{C}$
$T_j$	Max. Operating Junction Temperature	150	$^\circ\text{C}$

( $\bullet$ ) Pulse width limited by safe operating area

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1.0	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	$^\circ\text{C}/\text{W}$

### ELECTRICAL CHARACTERISTICS ( $T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED) OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR}(CES)$	Collector-Emitter Breakdown Voltage	$I_C = 250\ \mu\text{A}$ , $V_{GE} = 0$	600			V
$I_{CES}$	Collector cut-off ( $V_{GE} = 0$ )	$V_{CE} = \text{Max Rating}$ , $T_C = 25^\circ\text{C}$ $V_{CE} = \text{Max Rating}$ , $T_C = 125^\circ\text{C}$			50 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 20\text{V}$ , $V_{CE} = 0$			$\pm 100$	nA

### ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 250\ \mu\text{A}$	5		7	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ , $I_C = 12\text{A}$ $V_{GE} = 15\text{V}$ , $I_C = 12\text{A}$ , $T_j = 125^\circ\text{C}$		2.2 1.7	2.8	V V

### DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25\text{V}$ , $I_C = 12\text{A}$		5		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25\text{V}$ , $f = 1\text{MHz}$ , $V_{GE} = 0$		890 110 22		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480\text{V}$ , $I_C = 12\text{A}$ , $V_{GE} = 15\text{V}$		54 8 31		nC nC nC
$I_{CL}$	Latching Current	$V_{clamp} = 480\text{V}$ , $V_{GE} = 15\text{V}$ , $T_j = 125^\circ\text{C}$ , $R_G = 10\ \Omega$		48		A
$T_{wsc}$	Short Circuit WITHSTAND Time	$V_{CE} = 0.5\text{BV}_{ces}$ , $V_{GE} = 15\text{V}$ $T_j = 125^\circ\text{C}$ , $R_G = 10\ \Omega$	10			$\mu\text{s}$

**ELECTRICAL CHARACTERISTICS (CONTINUED)****SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480\text{ V}$ , $I_C = 12\text{ A}$		25		ns
$t_r$	Rise Time	$R_G = 10\Omega$ , $V_{GE} = 15\text{ V}$		14.5		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480\text{ V}$ , $I_C = 12\text{ A}$ , $R_G = 10\Omega$		590		A/ $\mu$ s
$E_{on}$	Turn-on Switching Losses	$V_{GE} = 15\text{ V}$ , $T_j = 125^\circ\text{C}$		180		$\mu$ J

**SWITCHING OFF**

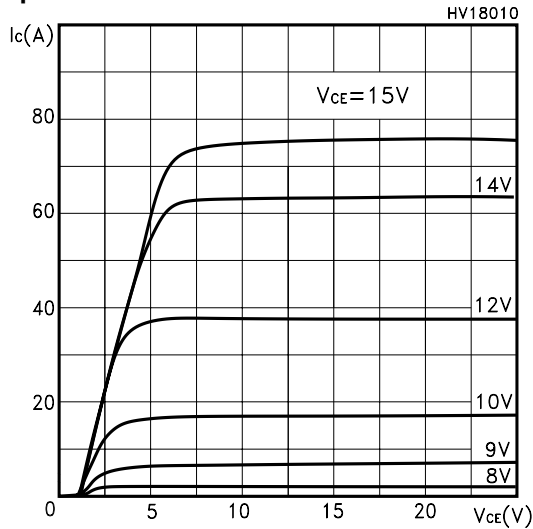
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}$ , $I_C = 12\text{ A}$ , $R_{GE} = 10\Omega$ , $V_{GE} = 15\text{ V}$		130		ns
$t_r(V_{off})$	Off Voltage Rise Time			25		ns
$t_{d(off)}$	Delay Time			96		ns
$t_f$	Fall Time			100		ns
$E_{off(**)}$	Turn-off Switching Loss			258		$\mu$ J
$E_{ts}$	Total Switching Loss			410		$\mu$ J
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}$ , $I_C = 12\text{ A}$ , $R_{GE} = 10\Omega$ , $V_{GE} = 15\text{ V}$ , $T_j = 125^\circ\text{C}$		310		ns
$t_r(V_{off})$	Off Voltage Rise Time			80		ns
$t_{d(off)}$	Delay Time			150		ns
$t_f$	Fall Time			220		ns
$E_{off(**)}$	Turn-off Switching Loss			650		$\mu$ J
$E_{ts}$	Total Switching Loss			830		$\mu$ J

Note: 1. Pulsed: Pulse duration = 300  $\mu$ s, duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*) Losses include Also the Tail (Jedec Standardization)

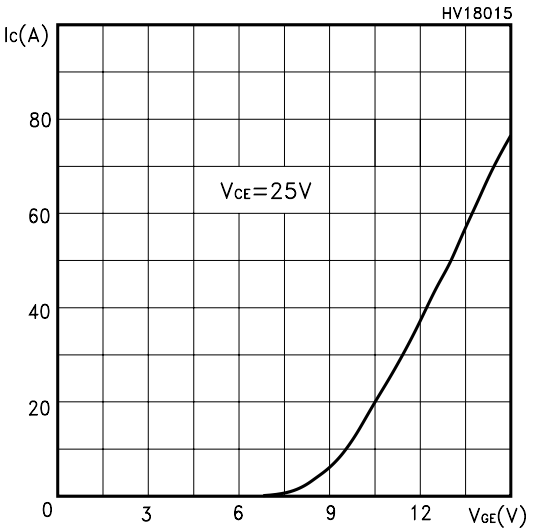
(#) Calculated according to the iterative formula:

$$I_C(T_C) = \frac{T_{JMAX} - T_C}{R_{THJ-C} \times V_{CESAT(MAX)}(T_C, I_C)}$$

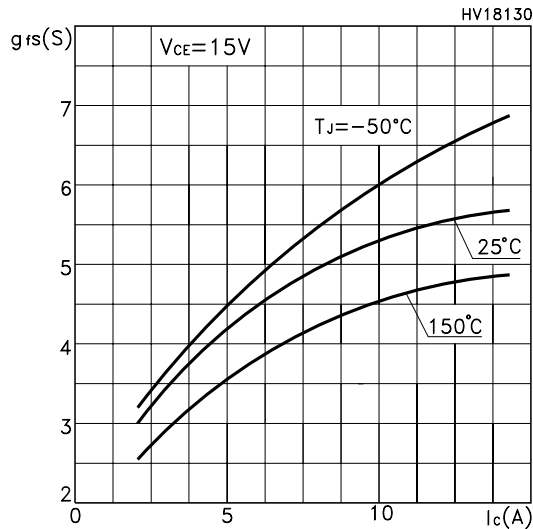
Output Characteristics



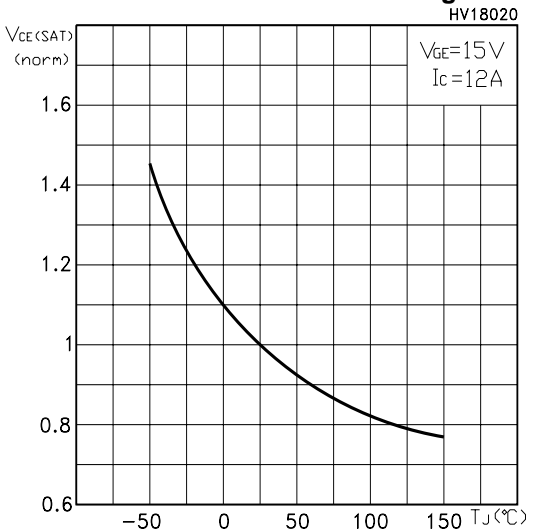
Transfer Characteristics



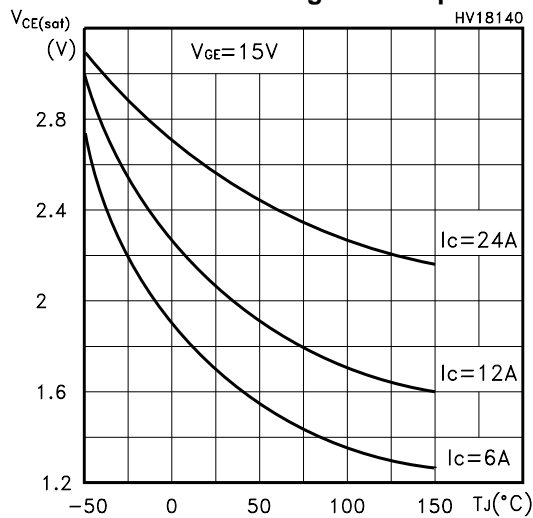
Transconductance



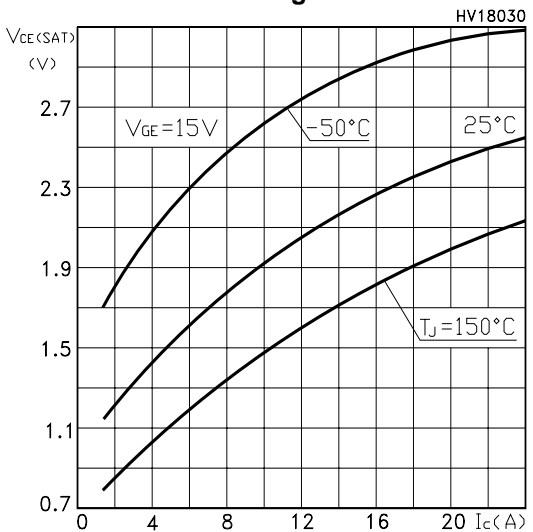
Normalized Collector-Emitter On Voltage vs Temp.



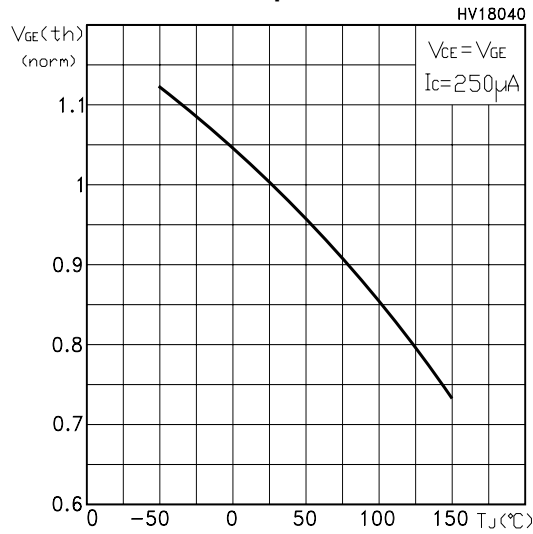
Collector-Emitter On Voltage vs Temperature



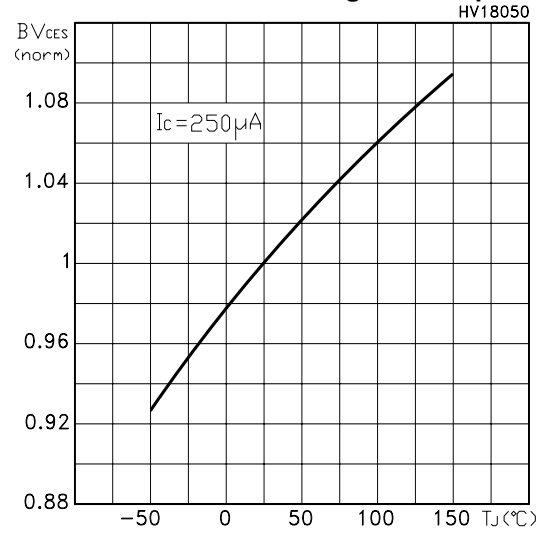
Collector-Emitter On Voltage vs Collector Current



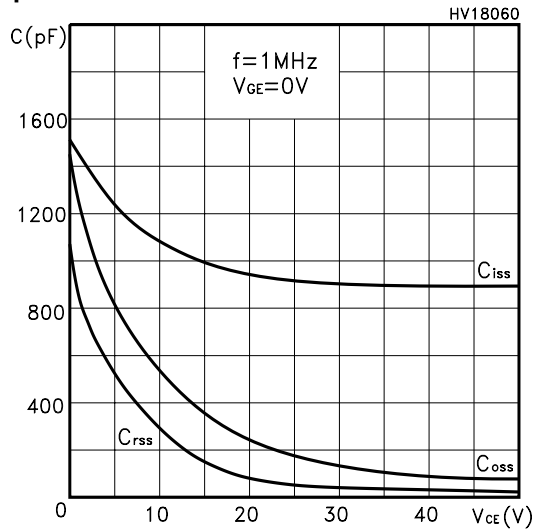
Gate Threshold vs Temperature



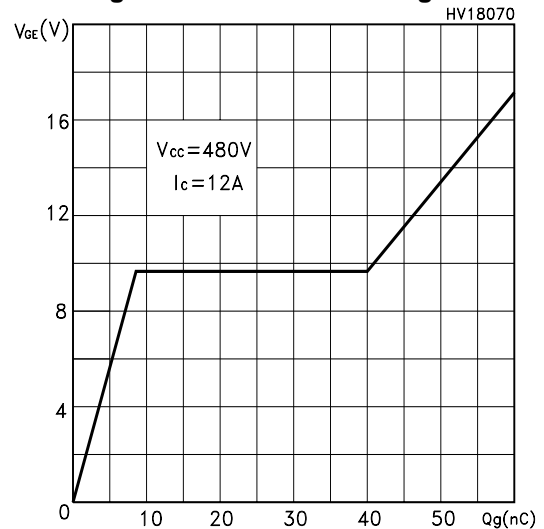
Normalized Breakdown Voltage vs Temperature



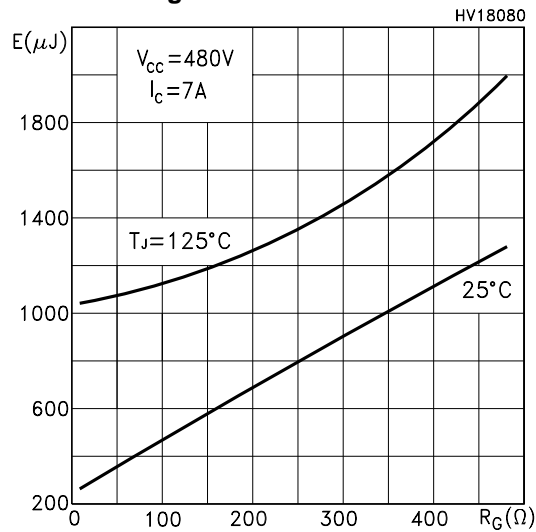
Capacitance Variations



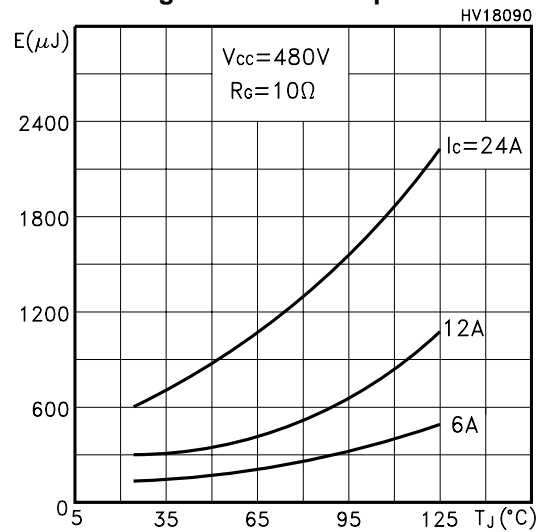
Gate Charge vs Gate-Emmitter Voltage



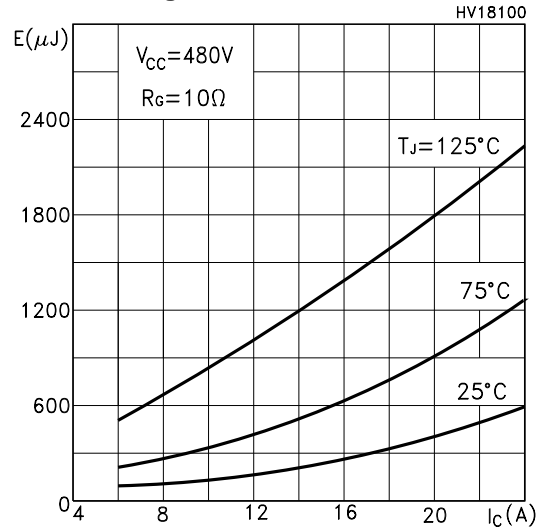
Total Switching Losses vs Gate Resistance



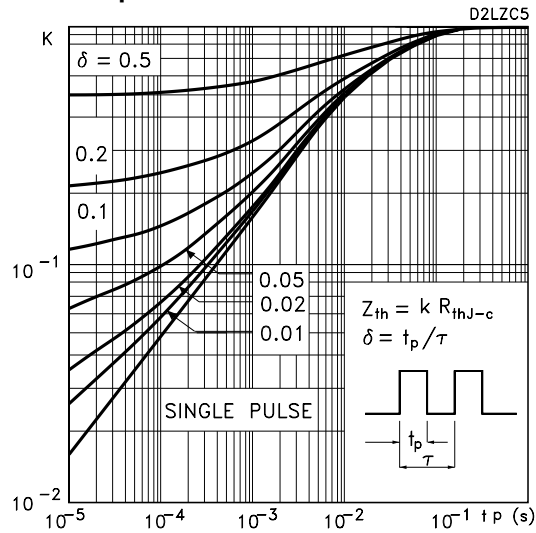
Total Switching Losses vs Temperature



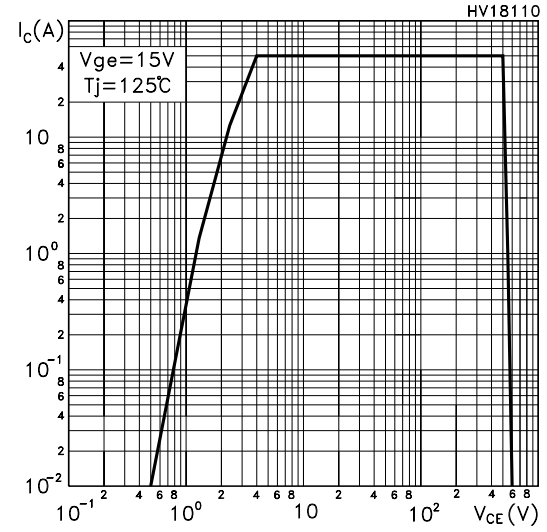
Total Switching Losses vs Collector Current



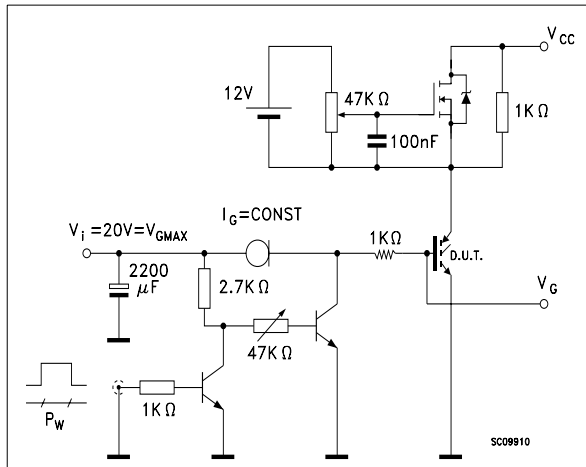
Thermal Impedance



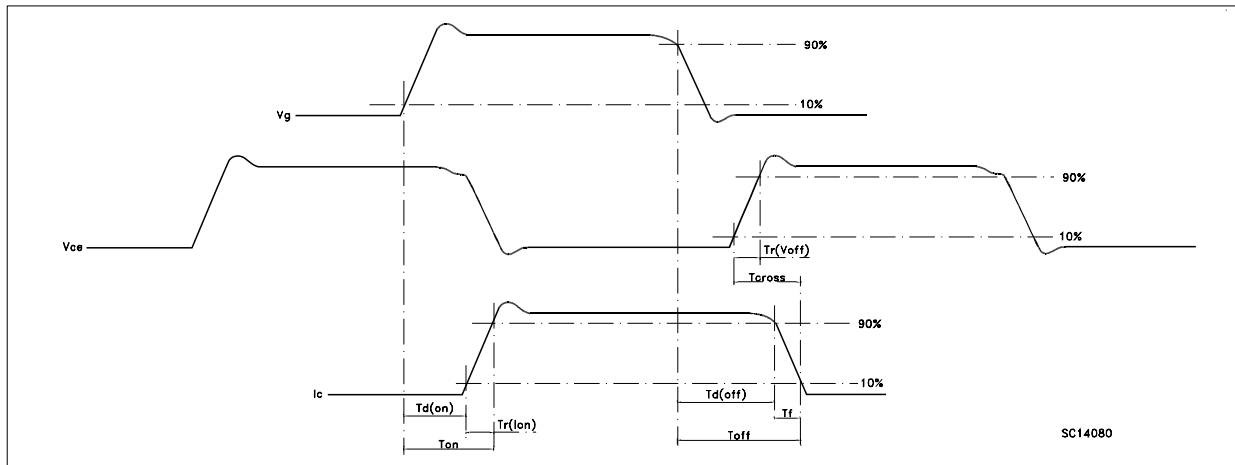
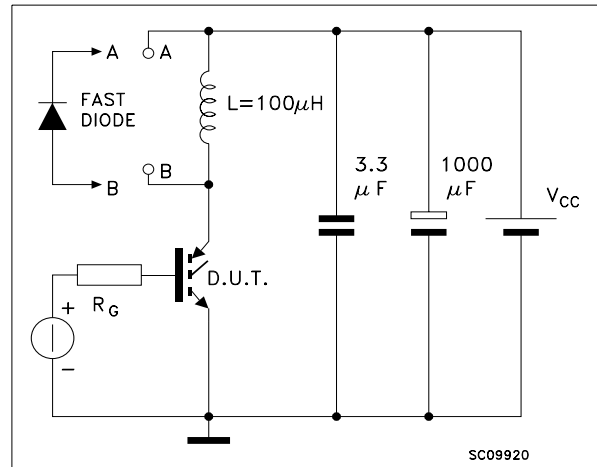
Turn-Off SOA



**Fig. 1: Gate Charge test Circuit**

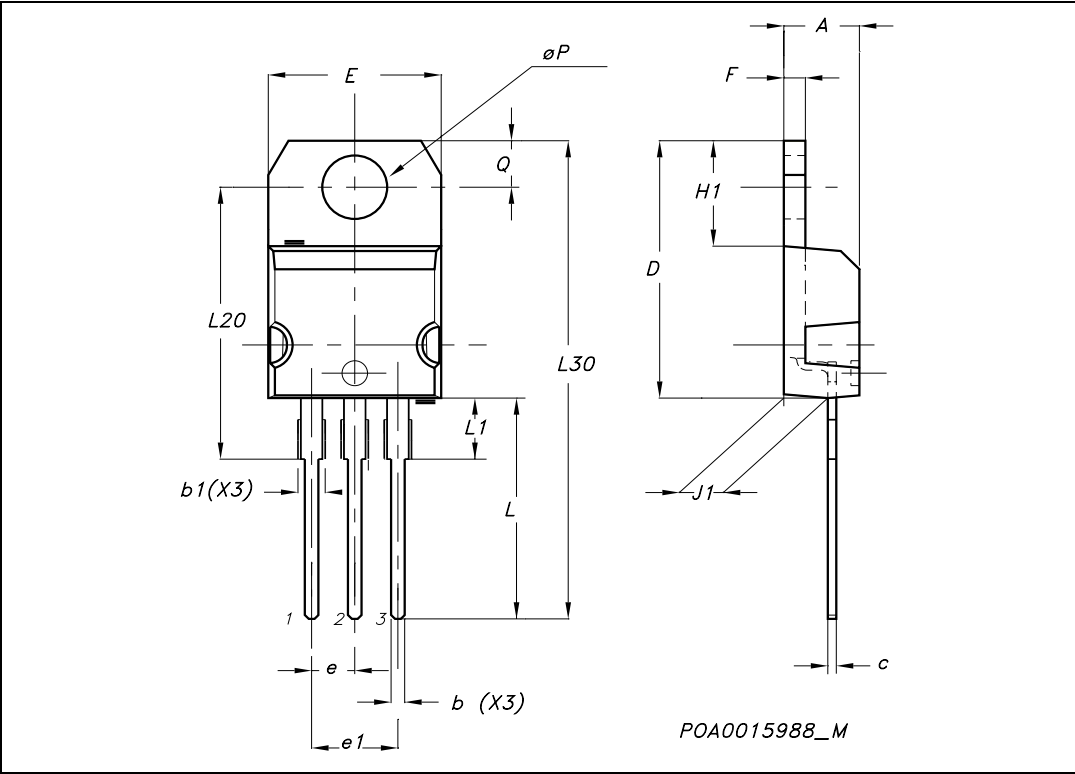


**Fig. 2: Test Circuit For Inductive Load Switching**



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





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