



THE DATASHEET OF STGP12NB60K



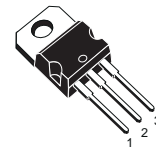


STGP12NB60K

N-CHANNEL 18A - 600V TO-220 SHORT CIRCUIT PROOF PowerMESH™ IGBT

TYPE	V _{CES}	V _{CE(sat)} (Max) @25°C	I _C (#) @ 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

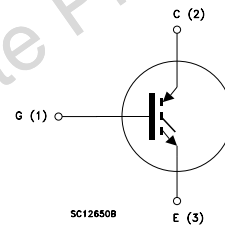
DESCRIPTION

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_{fall}) 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	± 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	μs
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	125	W
	Derating Factor	1.0	$\text{W}/^\circ\text{C}$
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	μA μA
I_{GES}	Gate-Emitter Leakage Current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{V}$, $V_{CE} = 0$			± 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}	Input Capacitance	$V_{CE} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GE} = 0$		890		pF
C_{oes}	Output Capacitance			110		pF
C_{res}	Reverse Transfer Capacitance			22		pF
Q_g	Total Gate Charge	$V_{CE} = 480\text{V}$, $I_C = 12\text{A}$, $V_{GE} = 15\text{V}$		54		nC
Q_{ge}	Gate-Emitter Charge			8		nC
Q_{gc}	Gate-Collector Charge			31		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			μs

ELECTRICAL CHARACTERISTICS (CONTINUED)**SWITCHING ON**

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

SWITCHING OFF

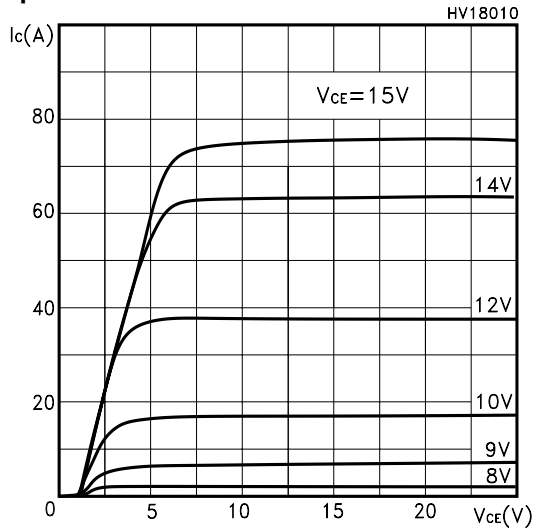
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c	Cross-over Time	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A},$ $R_{GE} = 10 \Omega, V_{GE} = 15 \text{ V}$		130		ns
$t_r(V_{off})$	Off Voltage Rise Time			25		ns
$t_{d(off)}$	Delay Time			96		ns
t_f	Fall Time			100		ns
$E_{off(**)}$	Turn-off Switching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

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

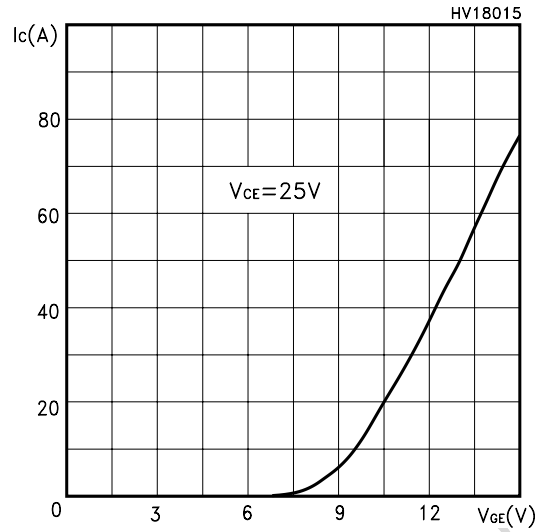
(#) Calculated according to the iterative formula:

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

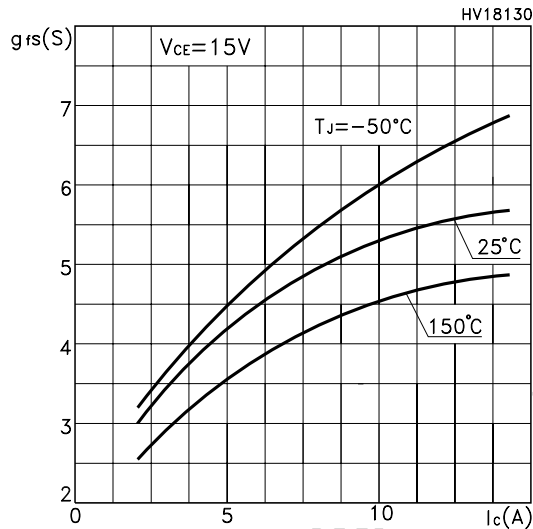
Output Characteristics



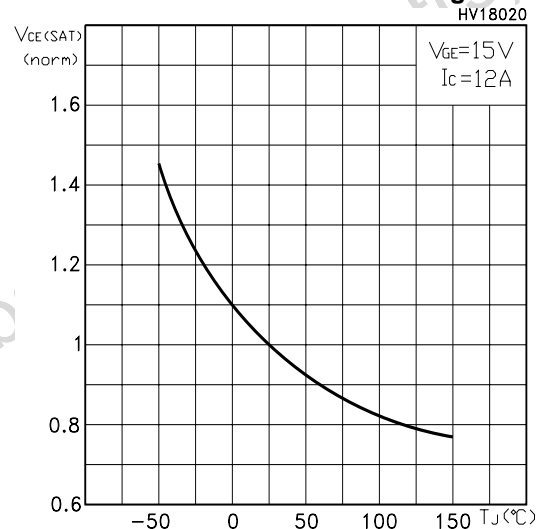
Transfer Characteristics



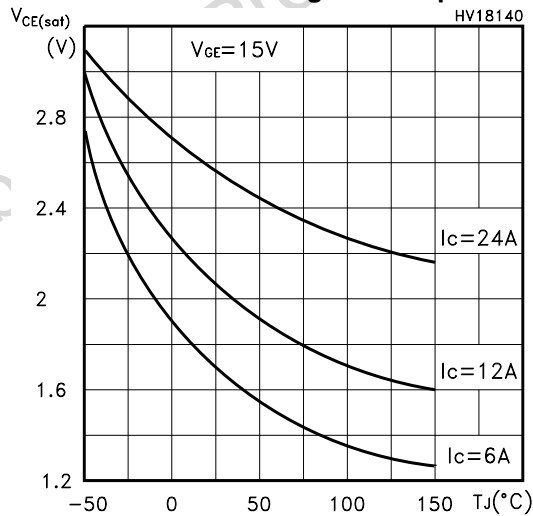
Transconductance



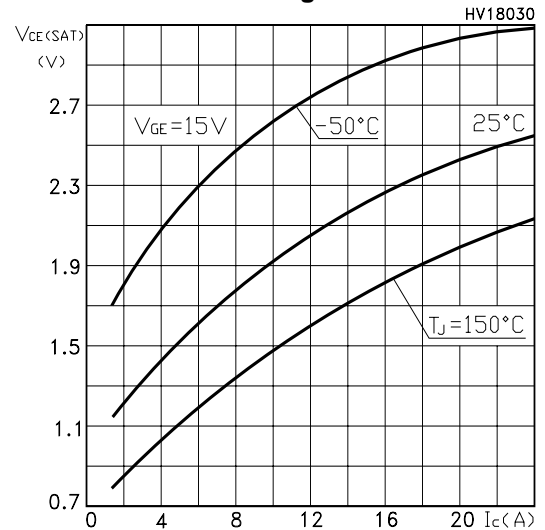
Normalized Collector-Emitter On Voltage vs Temp.



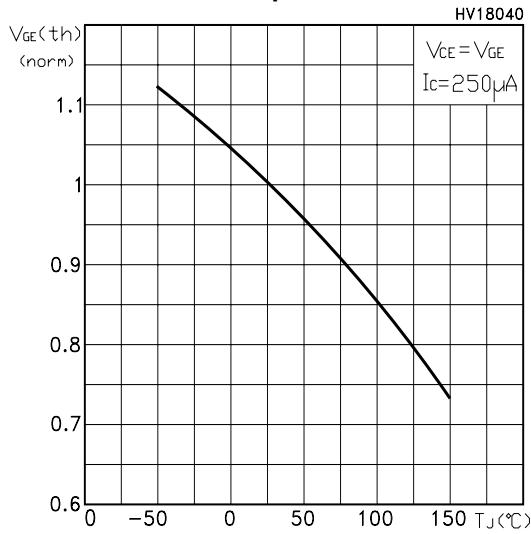
Collector-Emitter On Voltage vs Temperature



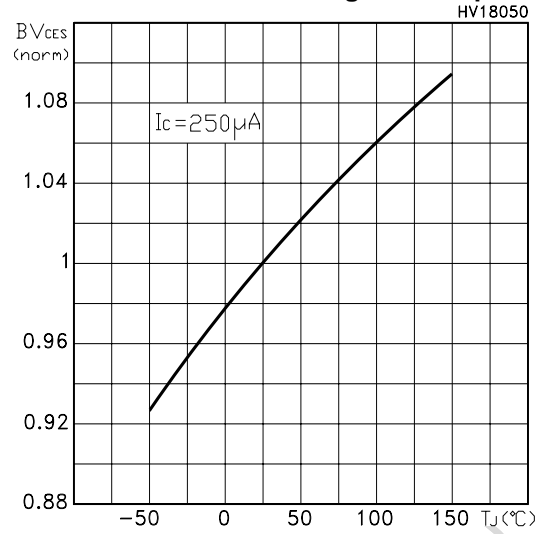
Collector-Emitter On Voltage vs Collector Current



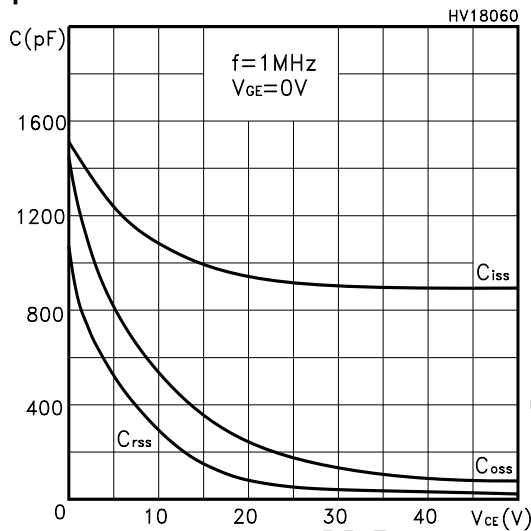
Gate Threshold vs Temperature



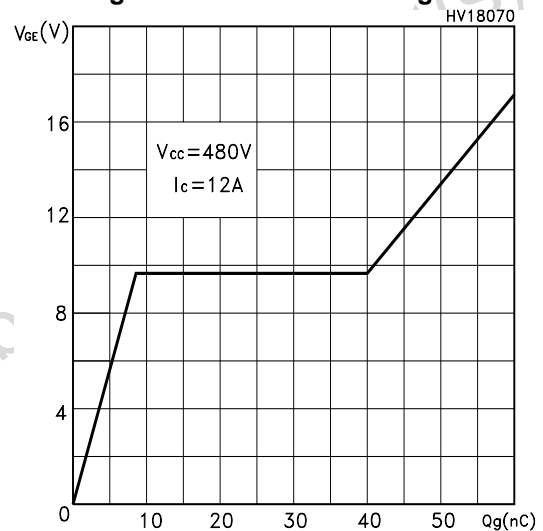
Normalized Breakdown Voltage vs Temperature



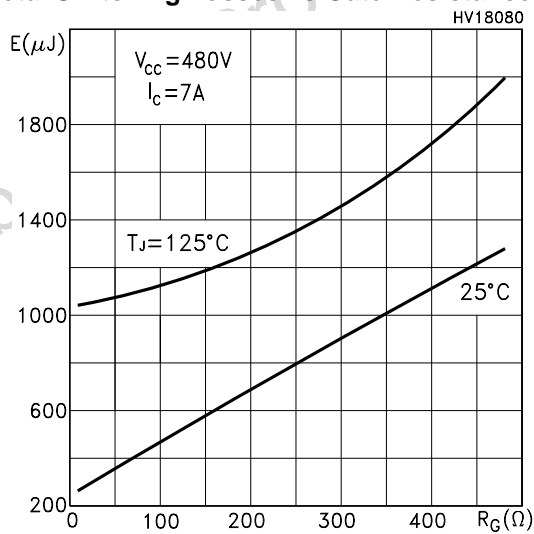
Capacitance Variations



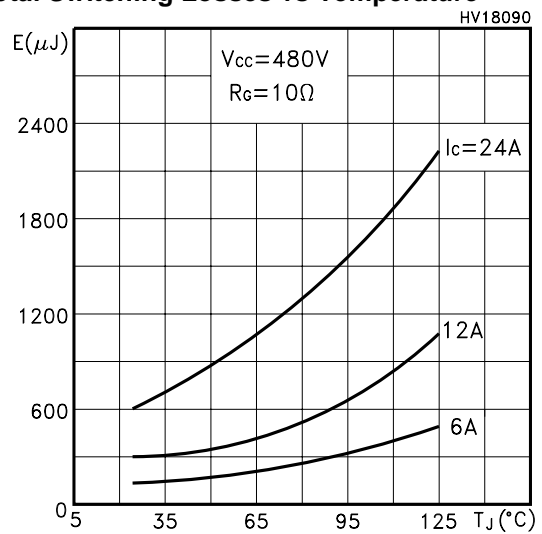
Gate Charge vs Gate-Emitter Voltage



Total Switching Losses vs Gate Resistance

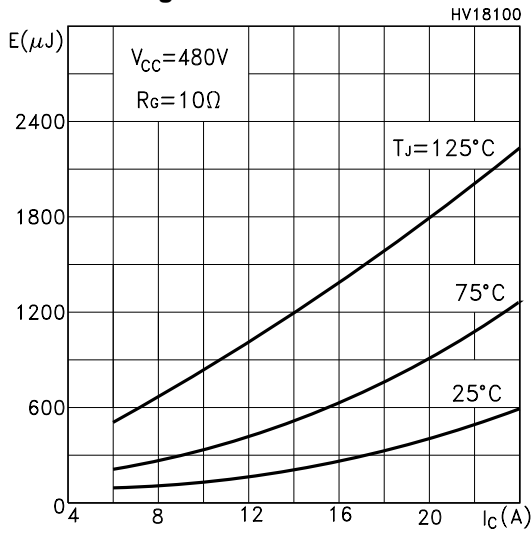


Total Switching Losses vs Temperature

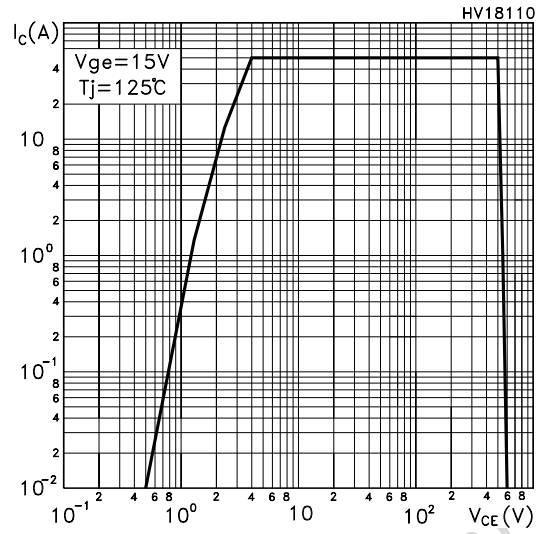


STGP12NB60K

Total Switching Losses vs Collector Current



Turn-Off SOA



Thermal Impedance

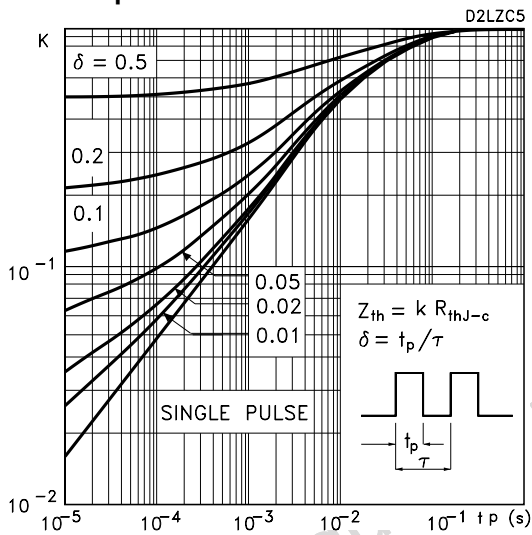


Fig. 1: Gate Charge test Circuit

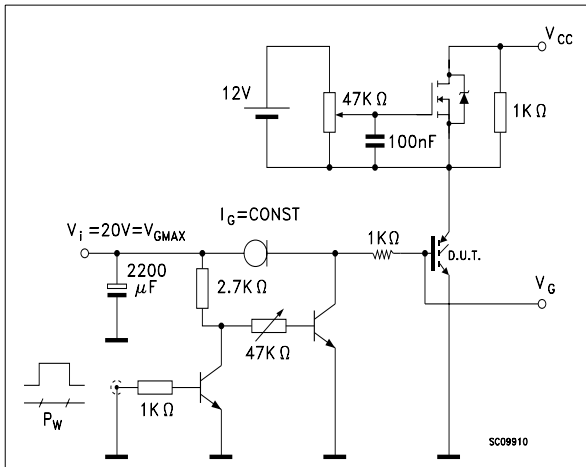
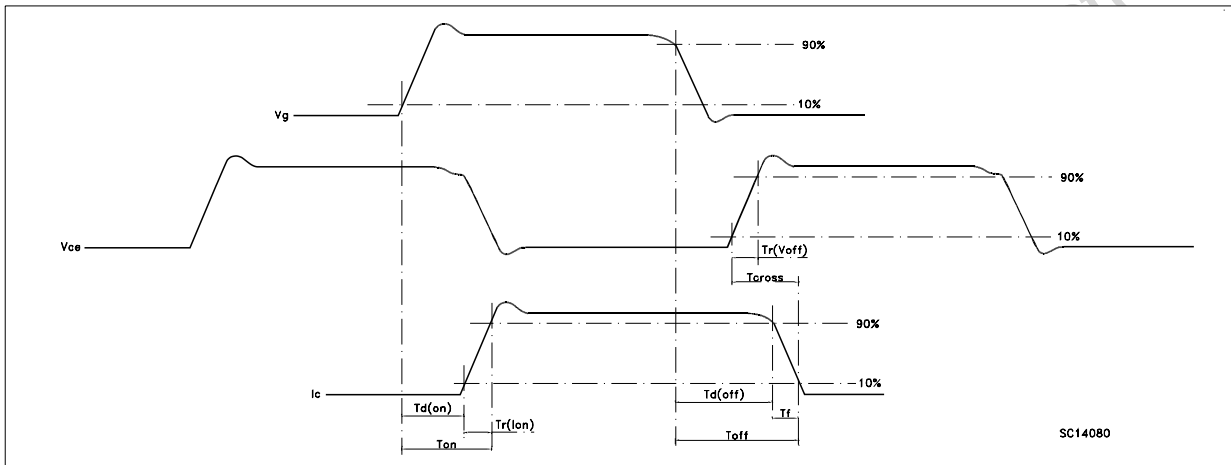
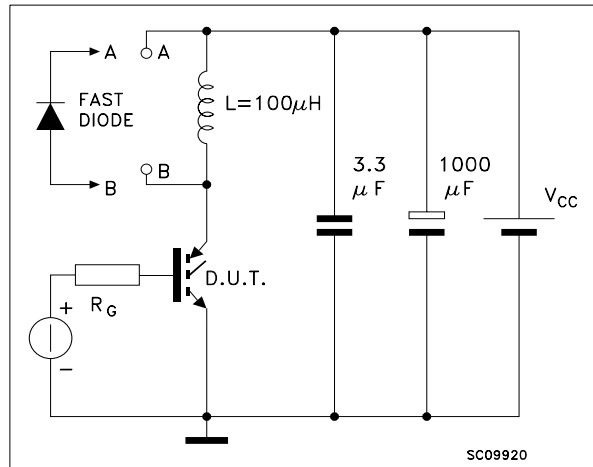


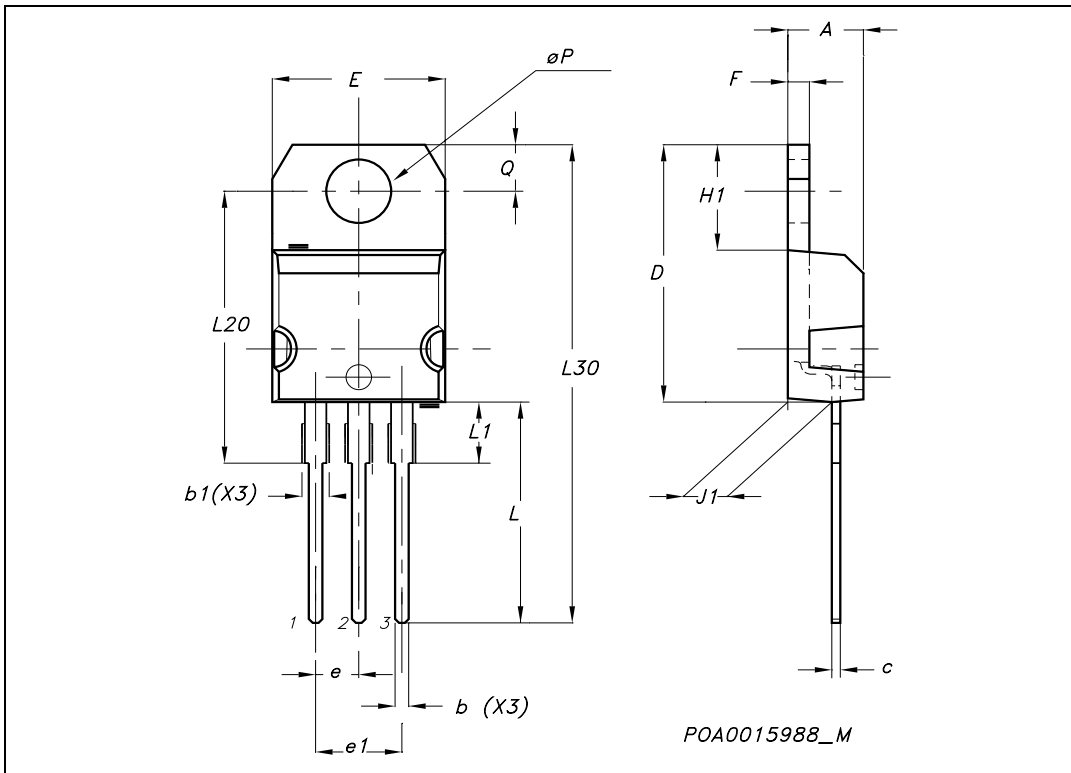
Fig. 2: Test Circuit For Inductive Load Switching



Obsolete Product

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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