



STGP12NB60HD

N-CHANNEL 18A - 600V TO-220

PowerMESH™ IGBT

TYPE	V _{CES}	V _{CE(sat)} (Max) @25°C	I _C @ 100°C
STGP12NB60HD	600 V	< 2.8 V	18 A

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V_{cesat})
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCH™ ANTIPARALLEL DIODE

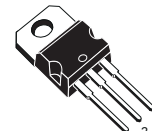
DESCRIPTION

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 "H" identifies a family optimized for high frequency applications (up to 50kHz) in order to achieve very high switching performances (reduced t_{fall}) maintaining a low voltage drop.

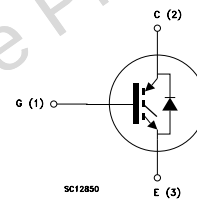
APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS and PFC IN BOTH HARD SWITCH AND RESONANT TOPOLOGIES
- UPS



TO-220

INTERNAL SCHEMATIC DIAGRAM



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP12NB60HD	GP12NB60HD	TO-220	TUBE

STGP12NB60HD

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} (■)	Collector Current (pulsed)	60	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	125	W
	Derating Factor	1.0	W/°C
T_{stg}	Storage Temperature	-65 to 150	°C
T_j	Max. Operating Junction Temperature	150	°C

(■) Pulse width limited by safe operating area

THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1.0	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/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	$V_{CE} = V_{GE}$, $I_C = 250\ \mu\text{A}$	3		5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$, $I_C = 12\text{A}$ $V_{GE} = 15\text{V}$, $I_C = 12\text{A}$, $T_j = 125^\circ\text{C}$		2.0 1.7	2.8	V V

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward Transconductance	$V_{CE} = 15\text{V}$, $I_C = 12\text{A}$		10		S
C_{ies}	Input Capacitance	$V_{CE} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GE} = 0$		920		pF
C_{oes}	Output Capacitance			120		pF
C_{res}	Reverse Transfer Capacitance			27		pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480\text{V}$, $I_C = 12\text{A}$, $V_{GE} = 15\text{V}$		68 10 30		nC nC nC
I_{CL}	Latching Current	$V_{clamp} = 480\text{V}$, $T_j = 150^\circ\text{C}$ $R_G = 10\ \Omega$	48			A

ELECTRICAL CHARACTERISTICS (CONTINUED)**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\Omega$, $V_{GE} = 15\text{ V}$		5 46		ns ns
$(di/dt)_{on}$ E_{on}	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$ $R_G = 10\Omega$, $V_{GE} = 15\text{ V}$, $T_J = 125^\circ\text{C}$		700 290		A/ μs μJ

SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(**)}$ E_{ts}	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_{GE} = 10\Omega$, $V_{GE} = 15\text{ V}$		150 27 91 100 0.21 0.49		ns ns ns ns mJ mJ
t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(**)}$ E_{ts}	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480\text{ V}$, $I_C = 12\text{ A}$, $R_{GE} = 10\Omega$, $V_{GE} = 15\text{ V}$ $T_J = 125^\circ\text{C}$		230 76 95 200 0.45 0.74		ns ns ns ns mJ mJ

COLLECTOR-EMITTER DIODE

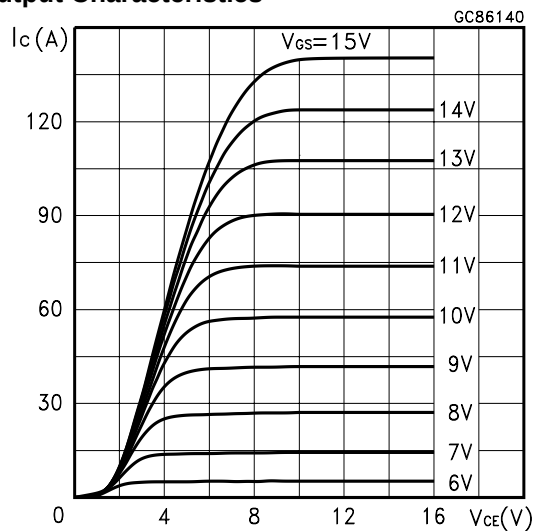
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_f I_{fm}	Forward Current Forward Current pulsed				12 48	A A
V_f	Forward On-Voltage	$I_f = 6\text{ A}$ $I_f = 6\text{ A}$, $T_J = 125^\circ\text{C}$		1.3 1.1	1.9	V V
t_{rr} Q_{rr} I_{rrm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 6\text{ A}$, $V_R = 50\text{ V}$, $T_J = 125^\circ\text{C}$, $di/dt = 100\text{ A}/\mu\text{s}$		80 240 5.5		ns nC A

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)

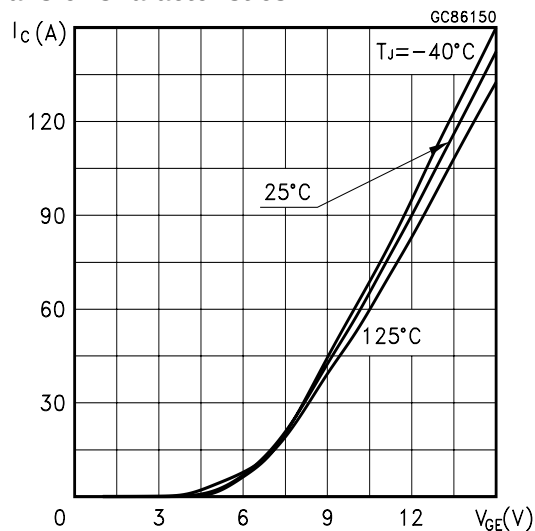
(#) Calculated according to the iterative formula:

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

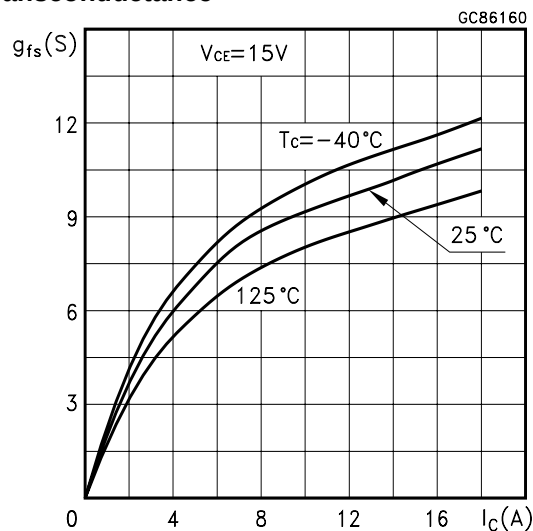
Output Characteristics



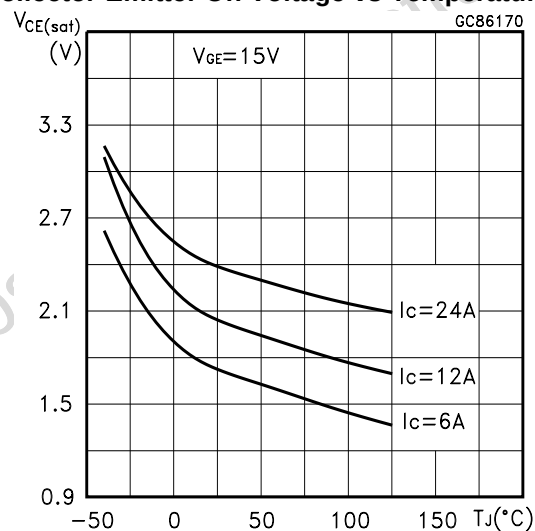
Transfer Characteristics



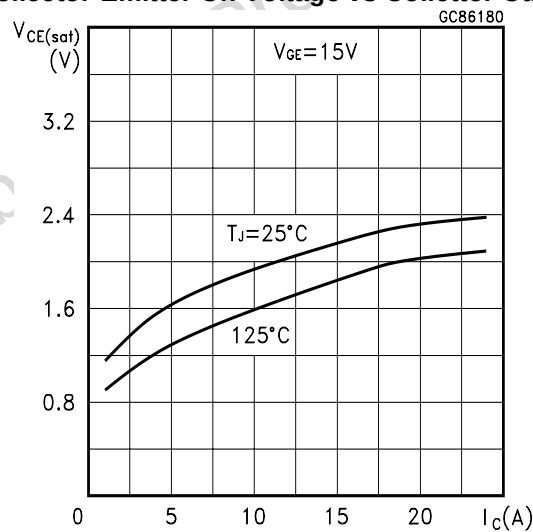
Transconductance



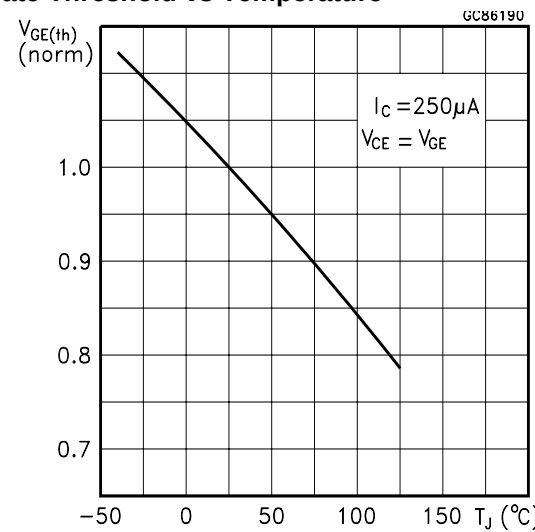
Collector-Emitter On Voltage vs Temperature



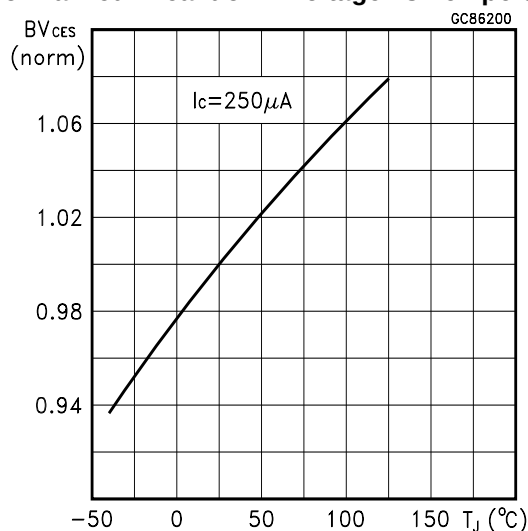
Collector-Emitter On Voltage vs Collector Current



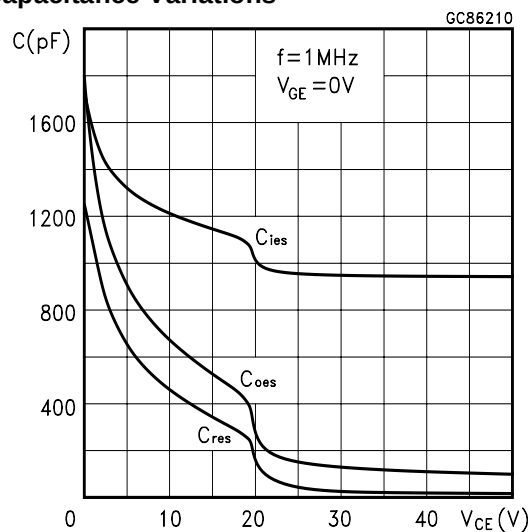
Gate Threshold vs Temperature



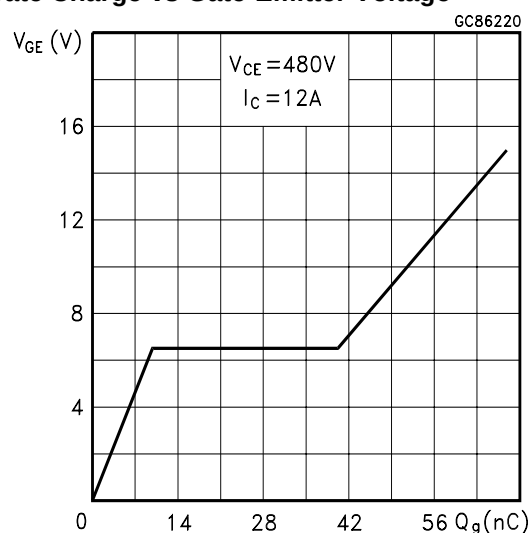
Normalized Breakdown Voltage vs Temperature



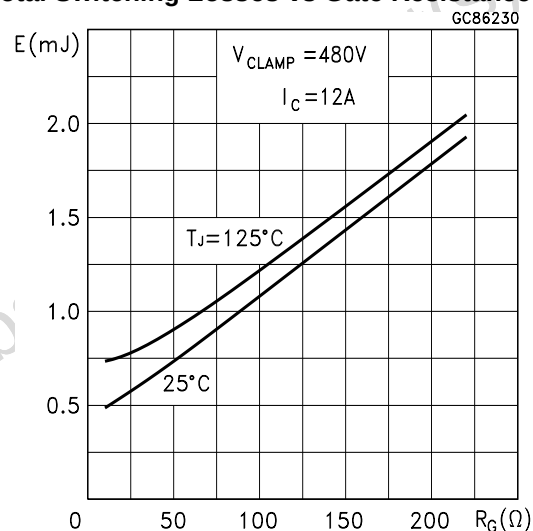
Capacitance Variations



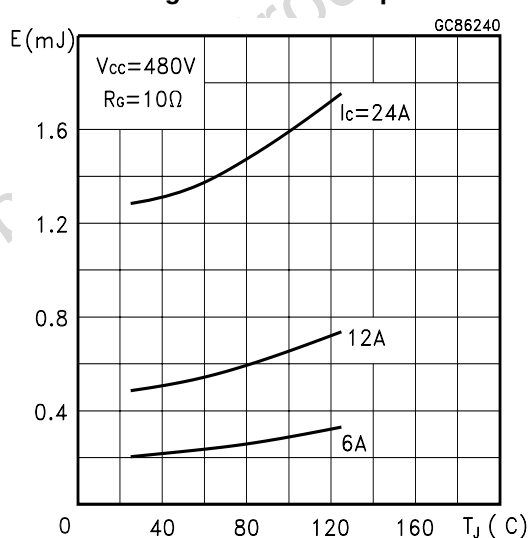
Gate Charge vs Gate-Emitter Voltage



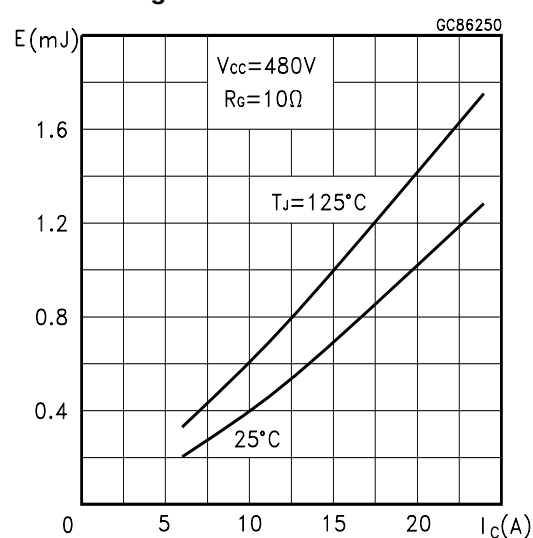
Total Switching Losses vs Gate Resistance



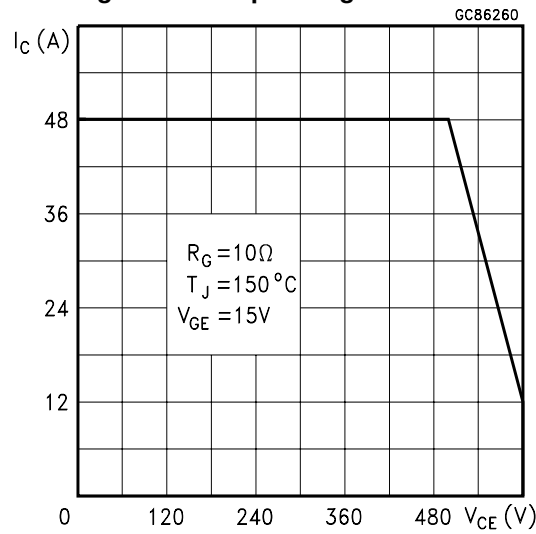
Total Switching Losses vs Temperature



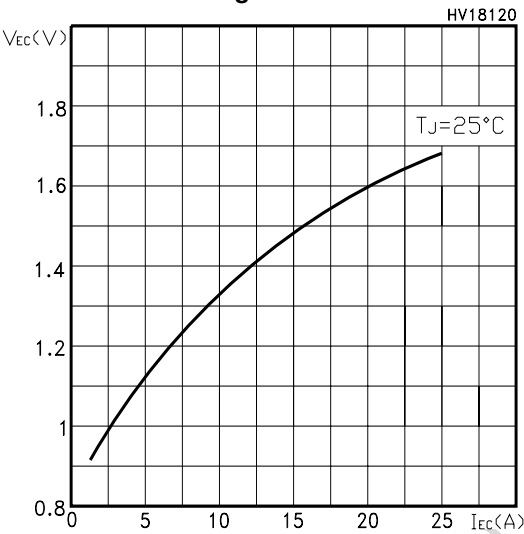
Total Switching Losses vs Collector Current



Switching Off Safe Operating Area



Diode Forward Voltage



Thermal Impedance

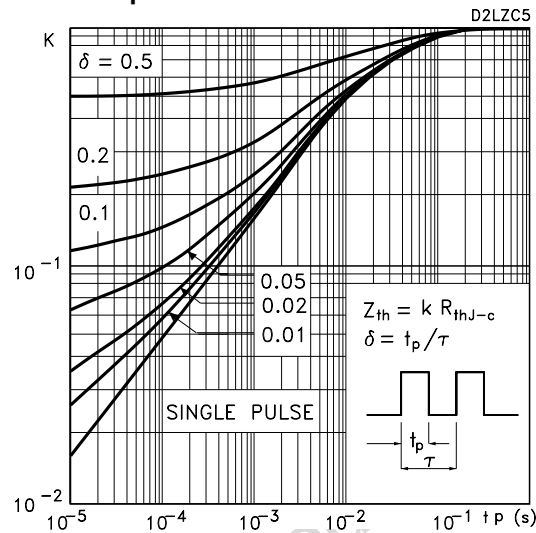
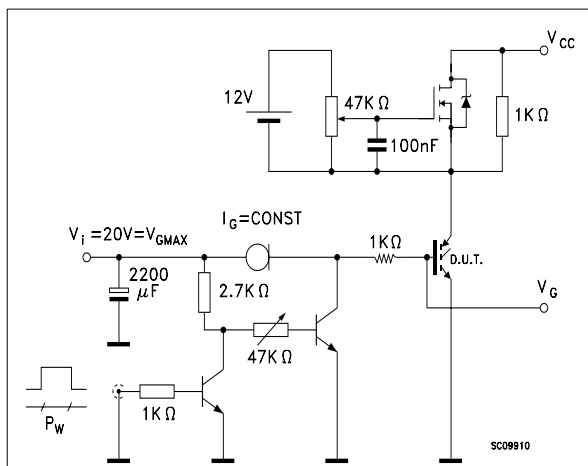
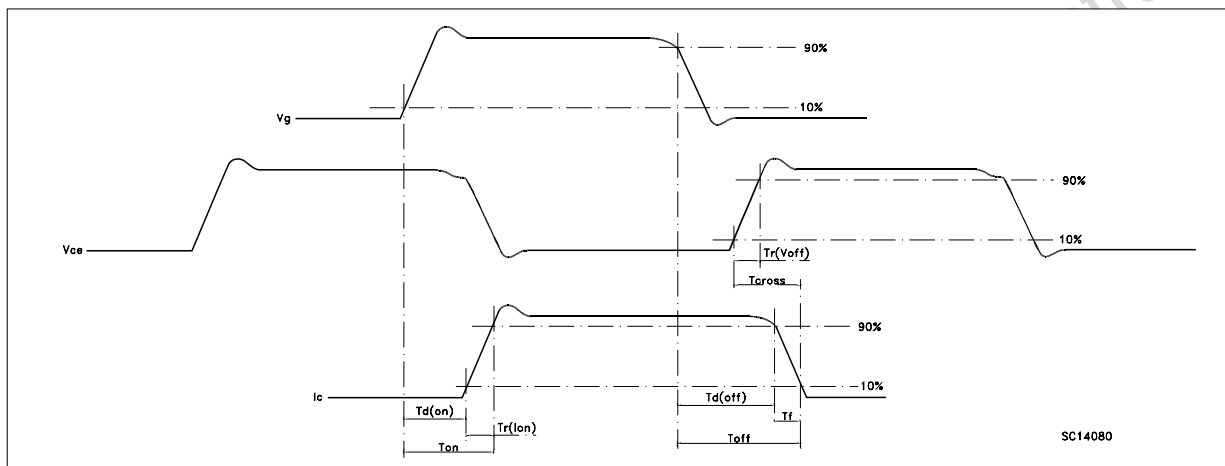
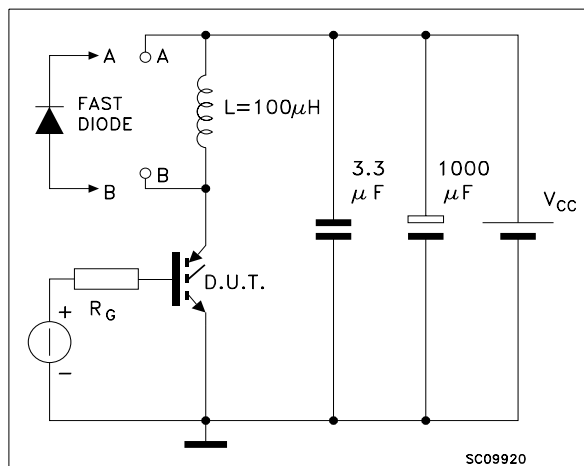
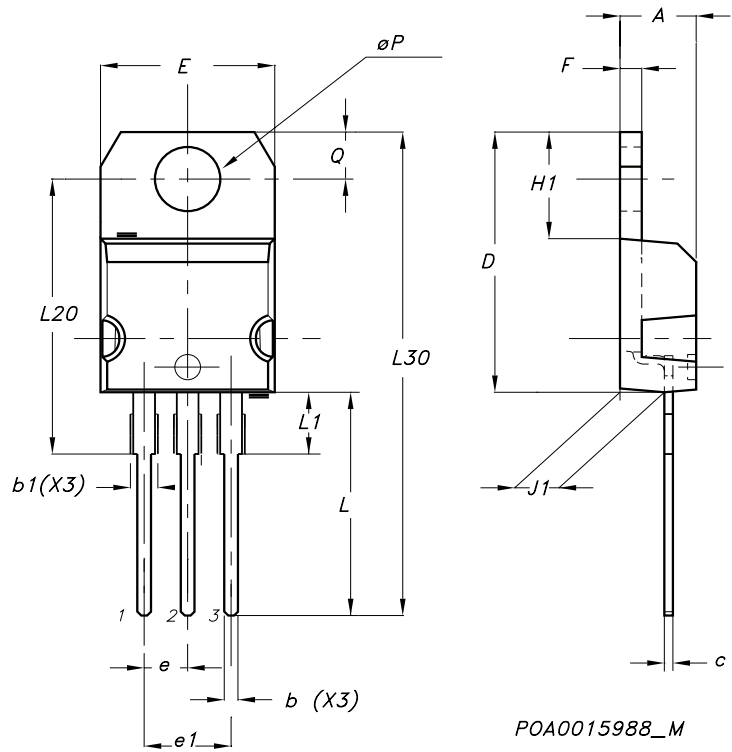


Fig. 1: Gate Charge test Circuit**Fig. 2: Test Circuit For Inductive Load Switching**

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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