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# STGP12NB60HD

N-CHANNEL 18A - 600V TO-220

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max) @25°C	I <sub>C</sub> @ 100°C
STGP12NB60HD	600 V	< 2.8 V	18 A

- HIGH INPUT IMPEDANCE
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- OFF LOSSES INCLUDE TAIL CURRENT
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- VERY HIGH FREQUENCY OPERATION
- CO-PACKAGED WITH TURBOSWITCH ANTIPARALLEL DIODE

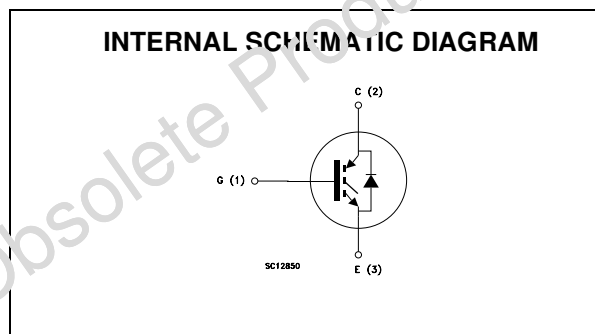
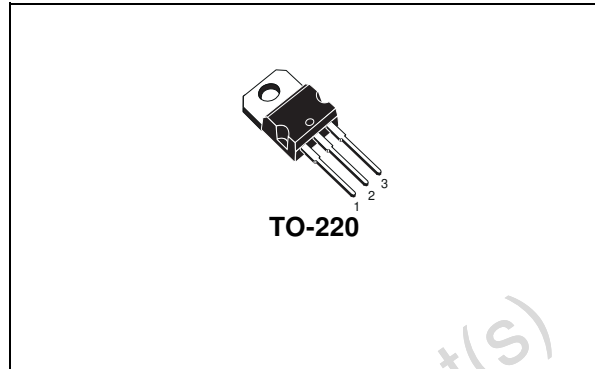
## DESCRIPTION

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 fall) maintaining a low voltage drop.

## APPLICATIONS

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



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP12NB60HD	GP12NB60HD	TO-220	TUBE

# STGP12NB60HD

## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>CES</sub>	Collector-Emitter Voltage (V <sub>GS</sub> = 0)	600	V
V <sub>ECR</sub>	Emitter-Collector Voltage	20	V
V <sub>GE</sub>	Gate-Emitter Voltage	± 20	V
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 25°C (#)	30	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C (#)	18	A
I <sub>CM</sub> (■)	Collector Current (pulsed)	60	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	125	W
	Derating Factor	1.0	W/°C
T <sub>stg</sub>	Storage Temperature	-65 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature	150	°C

(■) Pulse width limited by safe operating area

## THERMAL DATA

R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	1.0	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5	°C/W

## ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>BR(CES)</sub>	Collector-Emitter Breakdown Voltage	I <sub>C</sub> = 250 μA, V <sub>GE</sub> = 0	600			V
I <sub>CES</sub>	Collector cut-off (V <sub>GE</sub> = 0)	V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 25 °C V <sub>CE</sub> = Max Rating, T <sub>C</sub> = 125 °C			50 100	μA μA
I <sub>GES</sub>	Gate-Emitter Leakage Current (V <sub>CE</sub> = 0)	V <sub>GE</sub> = ± 20V, V <sub>CE</sub> = 0			±100	nA

## ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GE(th)</sub>	Gate Threshold Voltage	V <sub>CE</sub> = V <sub>GE</sub> , I <sub>C</sub> = 250 μA	3		5	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 12 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 12 A, T <sub>j</sub> = 125°C		2.0 1.7	2.8	V V

## DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub>	Forward Transconductance	V <sub>CE</sub> = 15 V, I <sub>C</sub> = 12 A		10		S
C <sub>ies</sub>	Input Capacitance	V <sub>CE</sub> = 25V, f = 1 MHz, V <sub>GE</sub> = 0		920		pF
C <sub>oes</sub>	Output Capacitance			120		pF
C <sub>res</sub>	Reverse Transfer Capacitance			27		pF
Q <sub>g</sub> Q <sub>ge</sub> Q <sub>gc</sub>	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V <sub>CE</sub> = 480V, I <sub>C</sub> = 12 A, V <sub>GE</sub> = 15V		68 10 30		nC nC nC
I <sub>CL</sub>	Latching Current	V <sub>clamp</sub> = 480 V, T <sub>j</sub> = 150°C R <sub>G</sub> = 10 Ω	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/ $\mu\text{s}$ $\mu\text{J}$

**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**

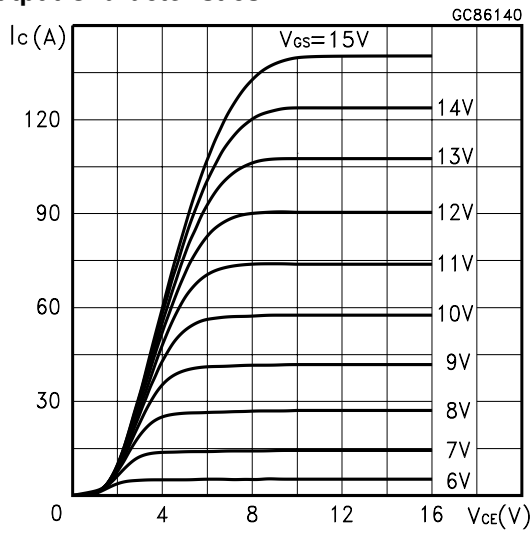
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$ $I_{fm}$	Forward Current Forward Current pulsed				12 48	A A
$V_f$	Forward On-Voltage	$I_f = 6 \text{ A}$ $I_f = 6 \text{ A}$ , $T_J = 125^\circ\text{C}$		1.3 1.1	1.9	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge 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  $\mu\text{s}$ , duty cycle 1.5 %.  
 2. Pulse width limited by max. junction temperature.  
 (\*\*)) Losses include Also the Tail (Jedec Standardization)

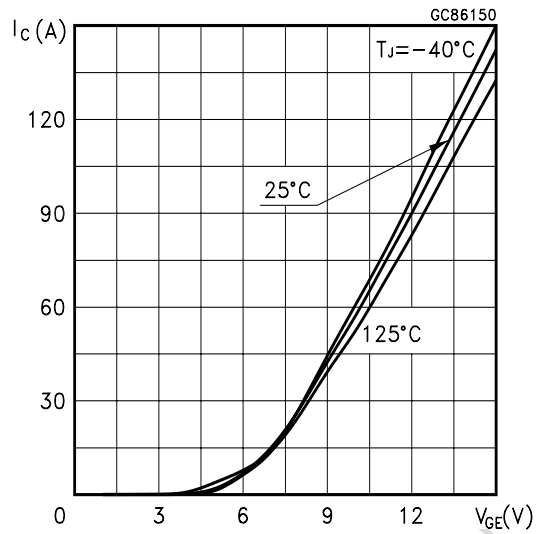
(#) Calculated according to the iterative formula:

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

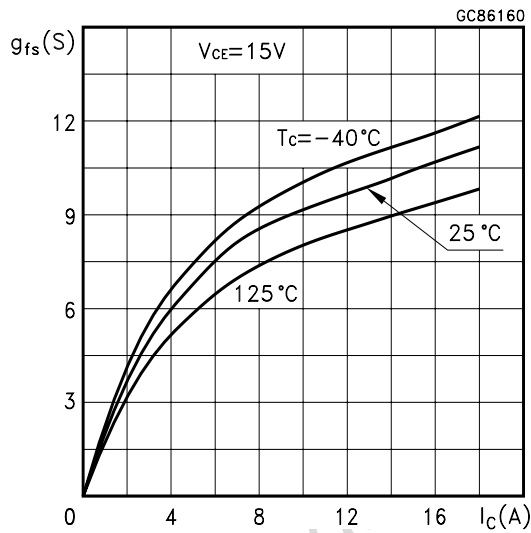
Output Characteristics



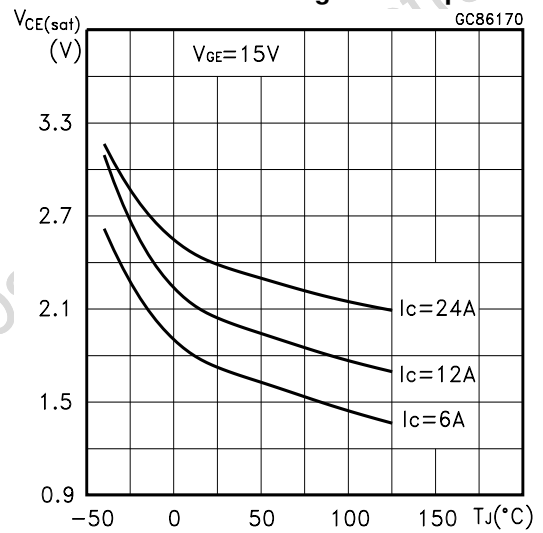
Transfer Characteristics



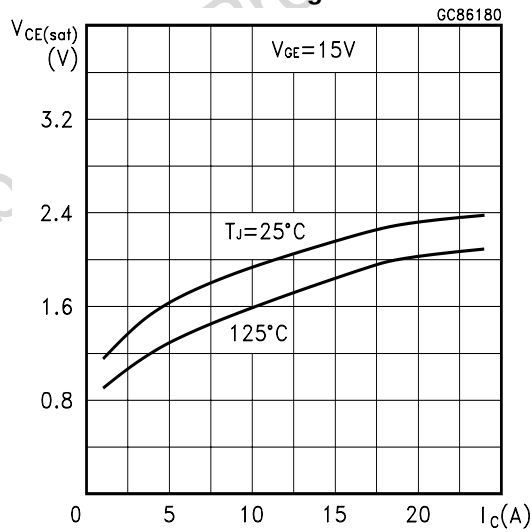
Transconductance



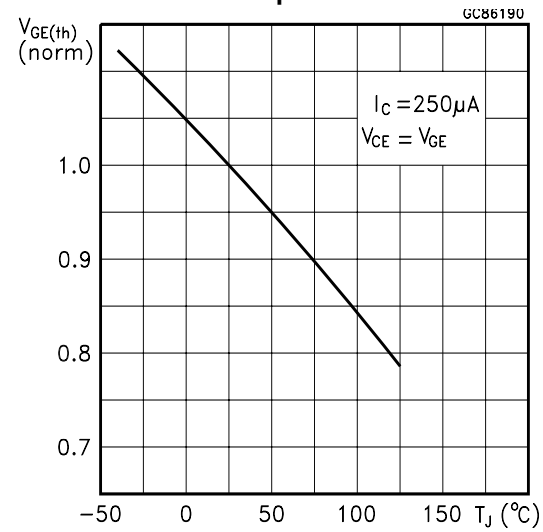
Collector-Emitter On Voltage vs Temperature



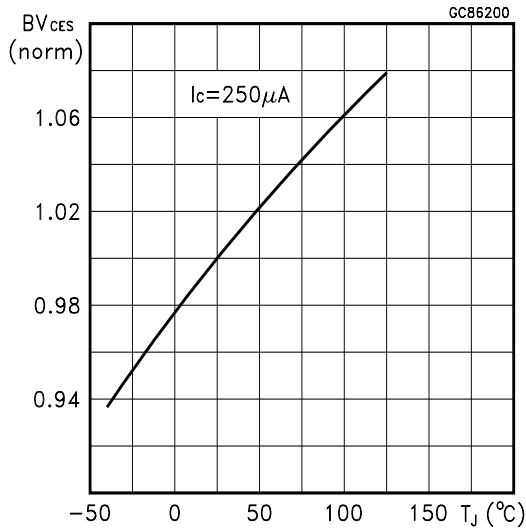
Collector-Emitter On Voltage vs Collector Current



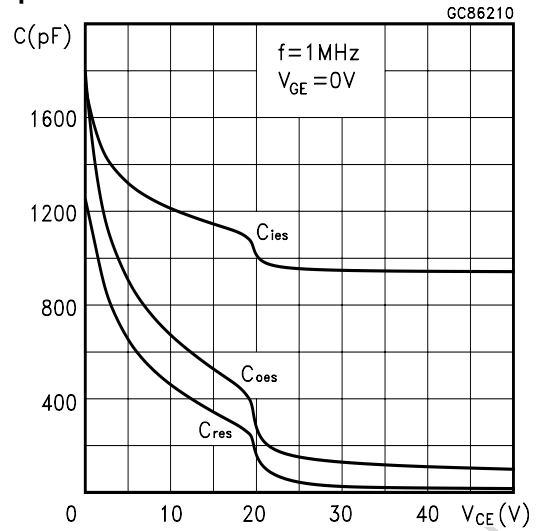
Gate Threshold vs Temperature



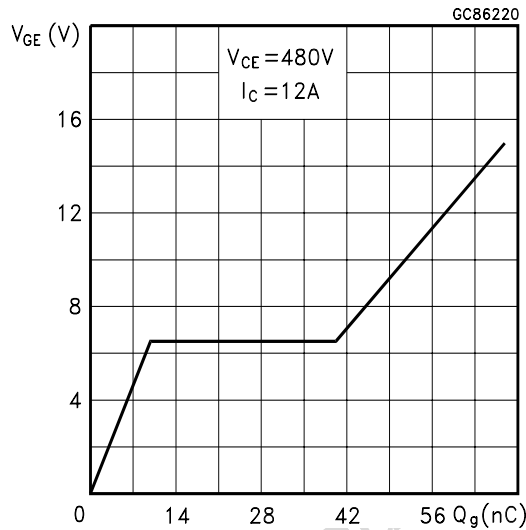
Normalized Breakdown Voltage vs Temperature



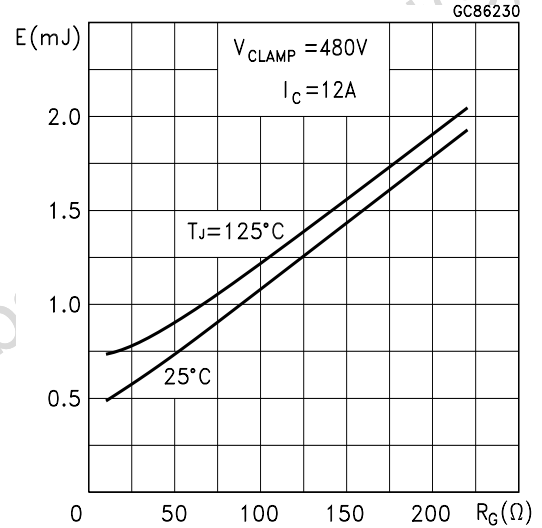
Capacitance Variations



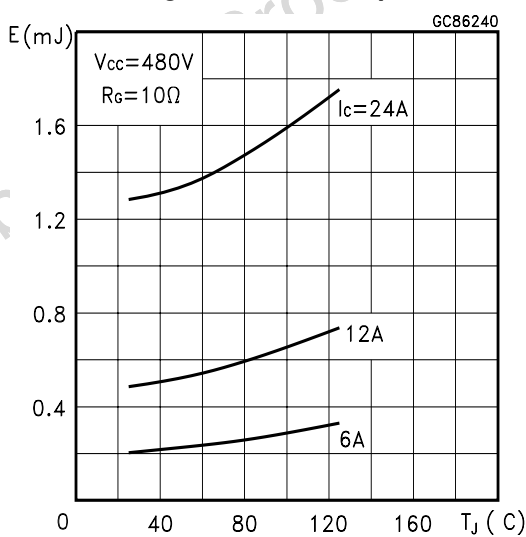
Gate Charge vs Gate-Emitter Voltage



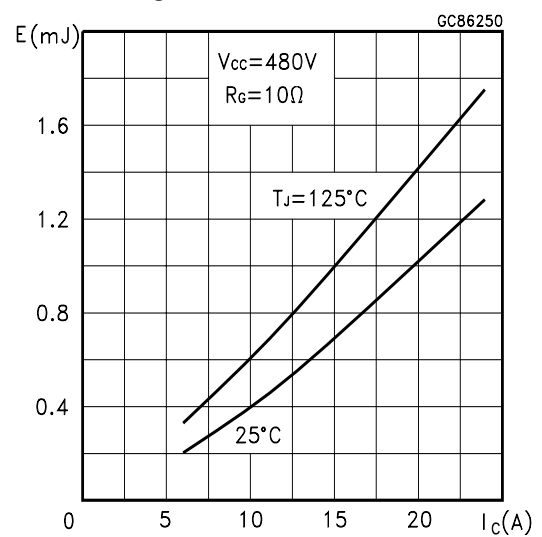
Total Switching Losses vs Gate Resistance



Total Switching Losses vs Temperature

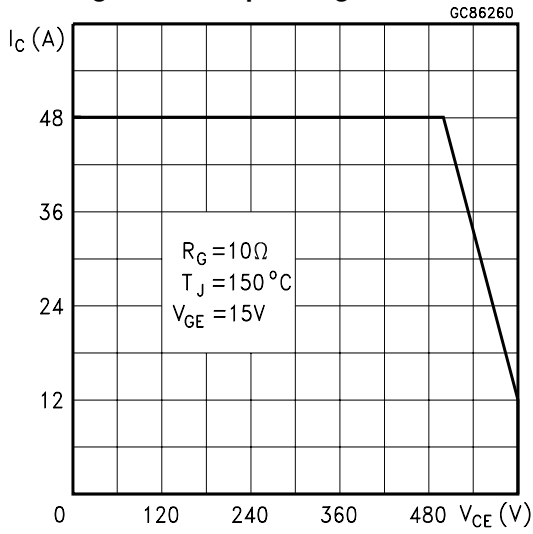


Total Switching Losses vs Collector Current

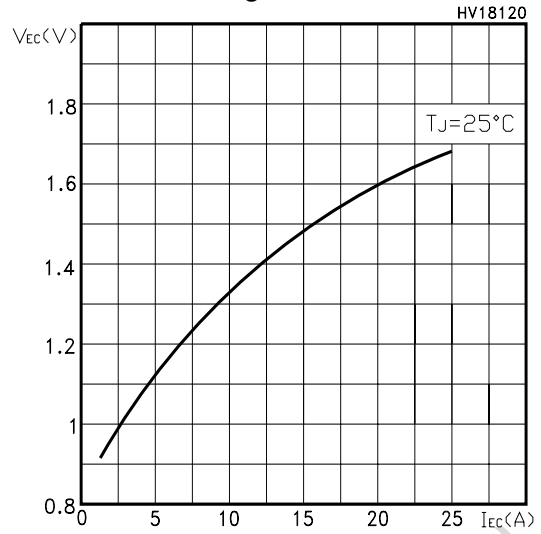


# STGP12NB60HD

## Switching Off Safe Operating Area



## Diode Forward Voltage



## Thermal Impedance

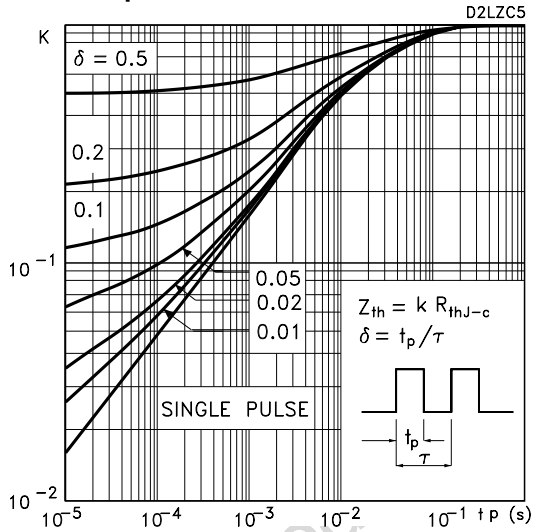


Fig. 1: Gate Charge test Circuit

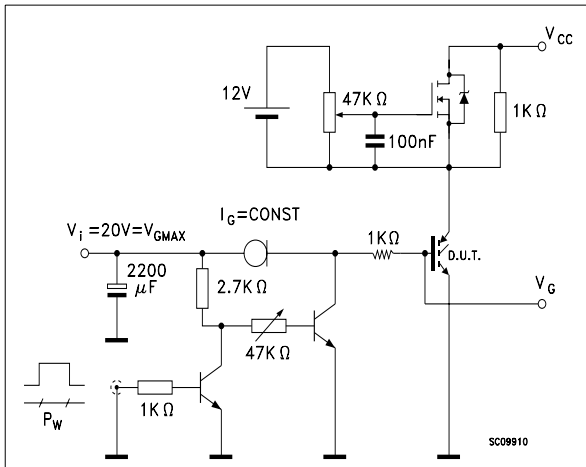
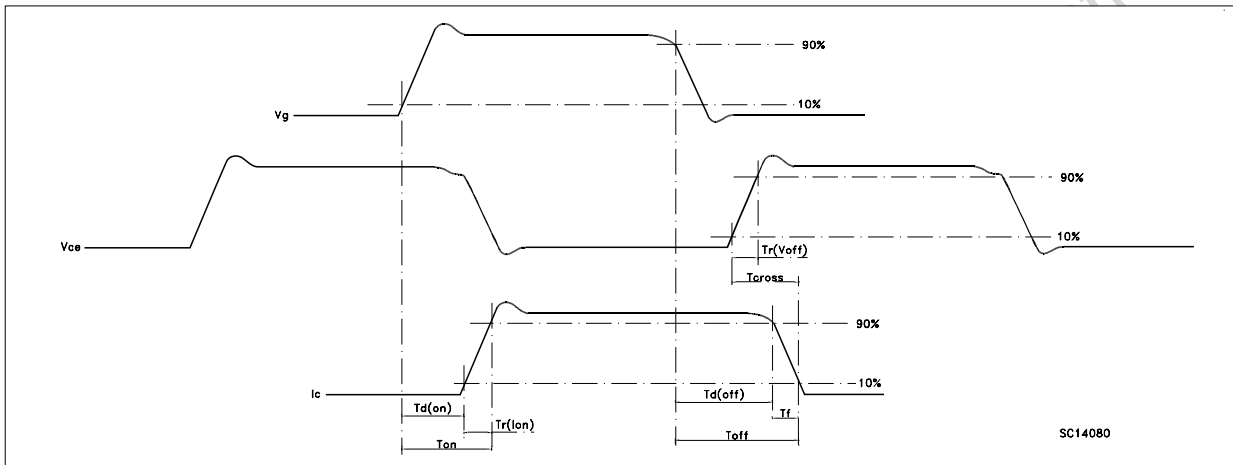
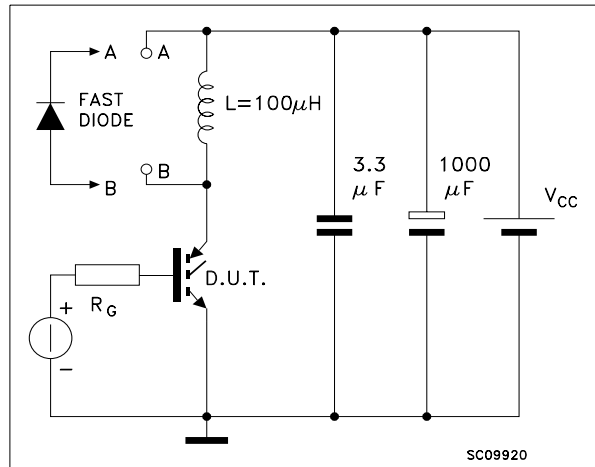


Fig. 2: Test Circuit For Inductive Load Switching

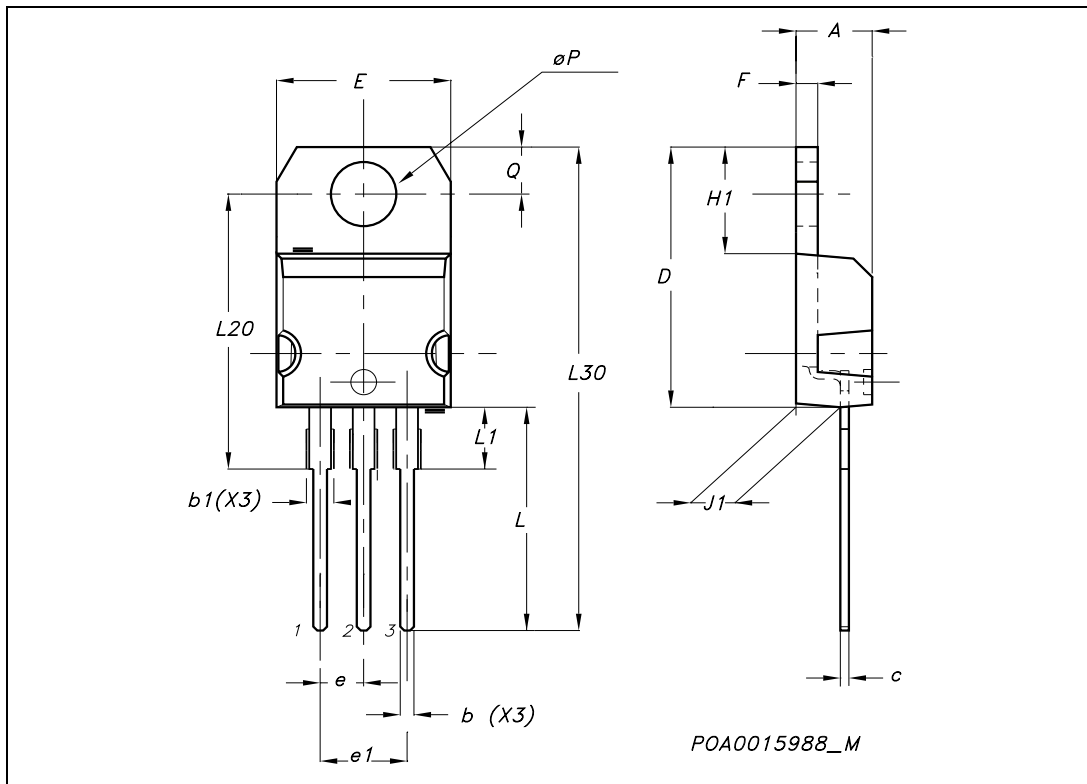


Obsolete Product



**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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