



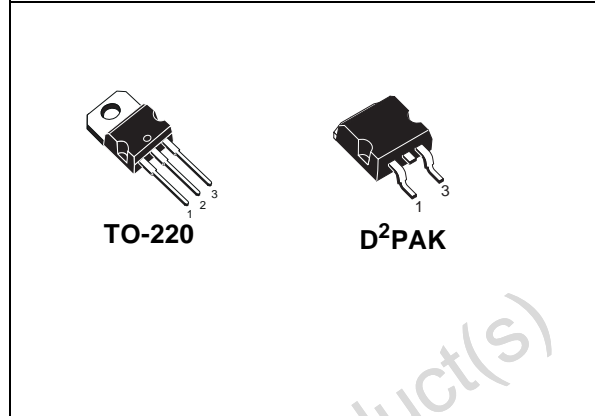
# STGP7NB60FD - STGB7NB60FD

N-CHANNEL 7A - 600V TO-220 / D<sup>2</sup>PAK

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Max) @25°C	I <sub>c</sub> @100°C
STGP7NB60FD	600 V	< 2.4 V	7 A
STGB7NB60FD	600 V	< 2.4 V	7 A

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

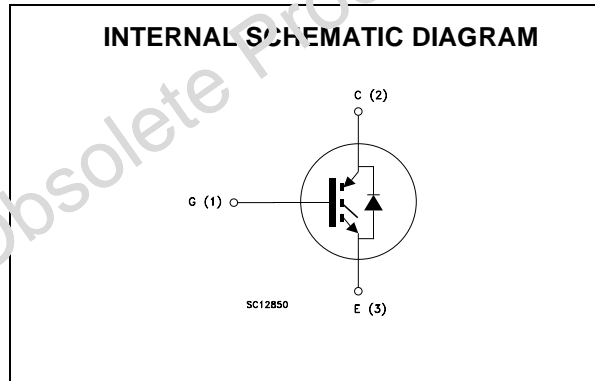


## DESCRIPTION

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 "F" identifies a family optimized to achieve very low switching times for high frequency applications (<40KHZ)

## APPLICATIONS

- MOTOR CONTROLS
- SMPS AND PFC AND BOTH HARD SWITCH AND RESONANT TOPOLOGIES



## ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP7NB60FD	GP7NB60FD	TO-220	TUBE
STGB7NB60FDT4	GB7NB60FD	D <sup>2</sup> PAK	TAPE & REEL

## STGP7NB60FD - STGB7NB60FD

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	600	V
$V_{GE}$	Gate-Emitter Voltage	$\pm 20$	V
$I_C$	Collector Current (continuous) at $T_C = 25^\circ\text{C}$	14	A
$I_C$	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	7	A
$I_{CM}$ (■)	Collector Current (pulsed)	56	A
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	80	W
	Derating Factor	0.64	W/°C
$T_{stg}$	Storage Temperature	- 55 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	1.56	°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	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	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	$V_{CE} = V_{GE}$ , $I_C = 250\ \mu\text{A}$	3		5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{V}$ , $I_C = 7\ \text{A}$ $V_{GE} = 15\text{V}$ , $I_C = 7\ \text{A}$ , $T_j = 125^\circ\text{C}$		2.0 1.6	2.4	V V

**ELECTRICAL CHARACTERISTICS (CONTINUED)**  
**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$ (1)	Forward Transconductance	$V_{CE} = 25 \text{ V}$ , $I_C = 7 \text{ A}$		6		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		540		pF
$C_{oes}$	Output Capacitance			80		pF
$C_{res}$	Reverse Transfer Capacitance			13		pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ , $V_{GE} = 15 \text{ V}$		37 4 18	50	nC nC nC
$I_{CL}$	Latching Current	$V_{clamp} = 480 \text{ V}$ $T_j = 125^\circ\text{C}$ , $R_G = 10 \Omega$		28		A

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ $R_G = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		17 6		ns ns
$(di/dt)_{on}$ $E_{on}$	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ $R_G = 10 \Omega$ $V_{GE} = 15 \text{ V}$ , $T_j = 125^\circ\text{C}$		890 59		A/ $\mu\text{s}$ $\mu\text{J}$

**SWITCHING OFF**

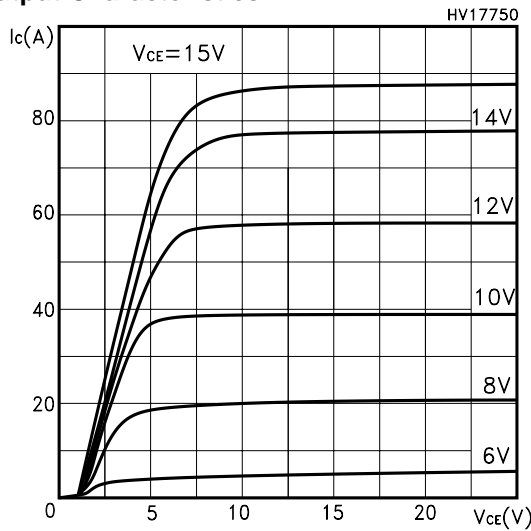
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit	
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time	$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ , $R_G = 10 \Omega$ , $V_{GE} = 15 \text{ V}$		190 45 107 140		ns ns ns ns	
$E_{off(**)}$ $E_{ts}$	Turn-off Switching Loss Total Switching Loss			240 300		$\mu\text{J}$ $\mu\text{J}$	
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time		$V_{CC} = 480 \text{ V}$ , $I_C = 7 \text{ A}$ , $R_G = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_j = 125^\circ\text{C}$		410 195 204 650		ns ns ns ns
$E_{off(**)}$ $E_{ts}$	Turn-off Switching Loss Total Switching Loss				565 625		$\mu\text{J}$ $\mu\text{J}$

**COLLECTOR-EMITTER DIODE**

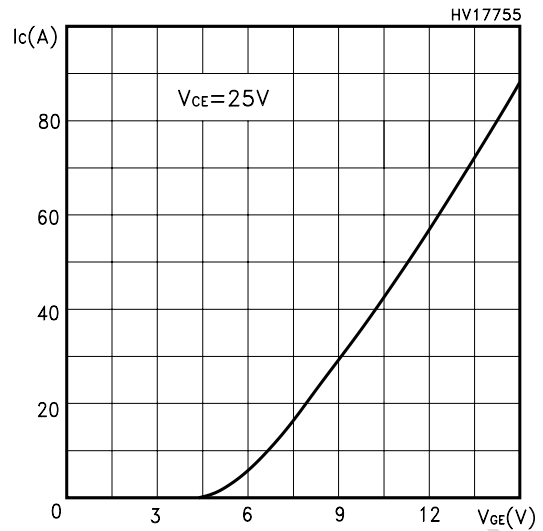
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$ $I_{fm}$	Forward Current Forward Current pulsed				7 56	A A
$V_f$	Forward On-Voltage	$I_f = 3.5 \text{ A}$ $I_f = 3.5 \text{ A}$ , $T_j = 125^\circ\text{C}$		1.4 1.1	1.9	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 7 \text{ A}$ , $V_R = 40 \text{ V}$ , $T_j = 125^\circ\text{C}$ , $di/dt = 100 \text{ A}/\mu\text{s}$		50 70 2.7		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)

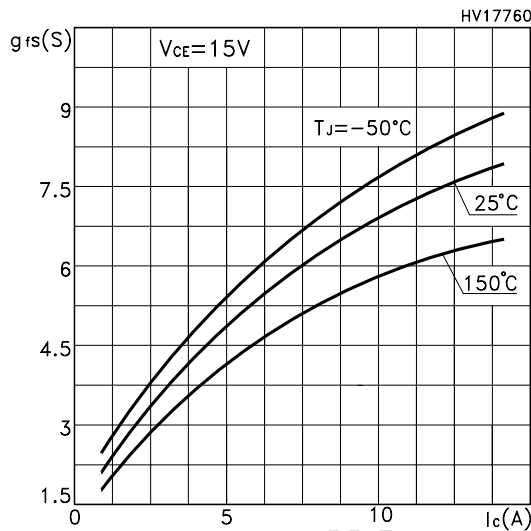
Output Characteristics



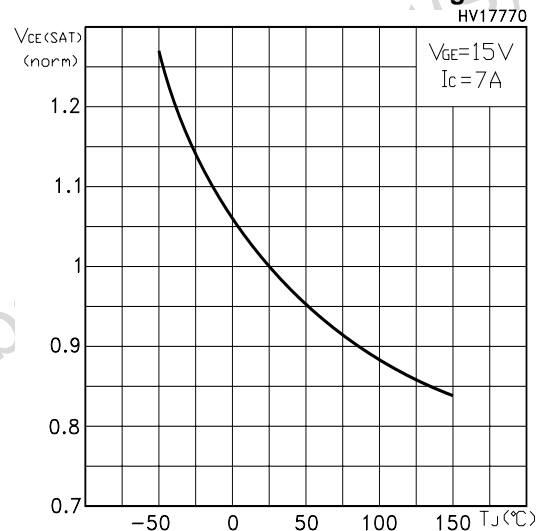
Transfer Characteristics



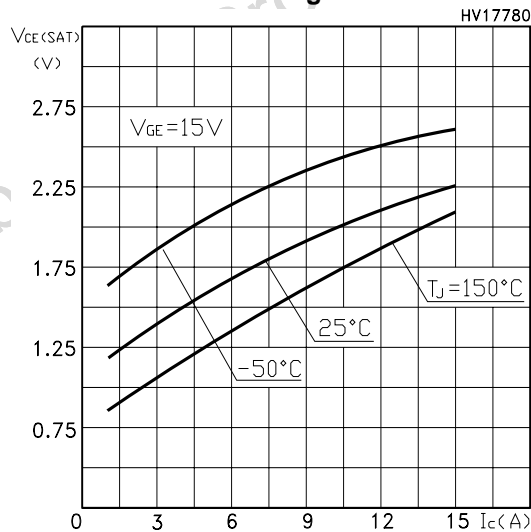
Transconductance



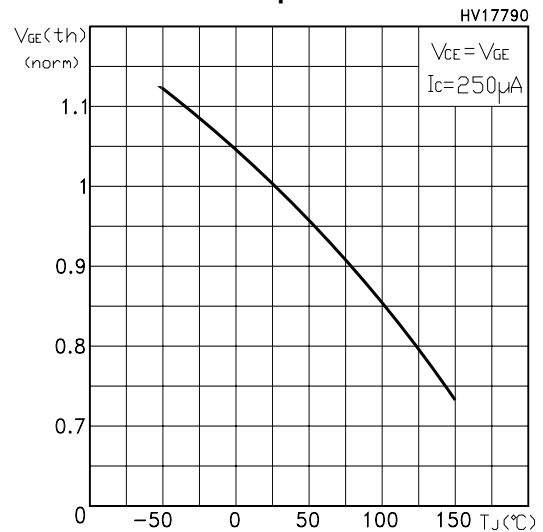
Normalized Collector-Emitter On Voltage vs Temp.



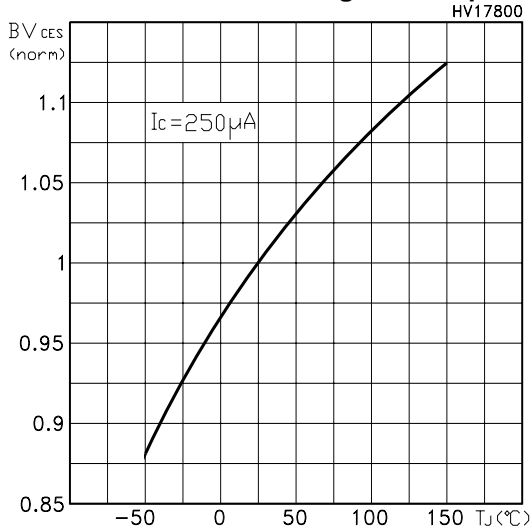
Collector-Emitter On Voltage vs Collector Current



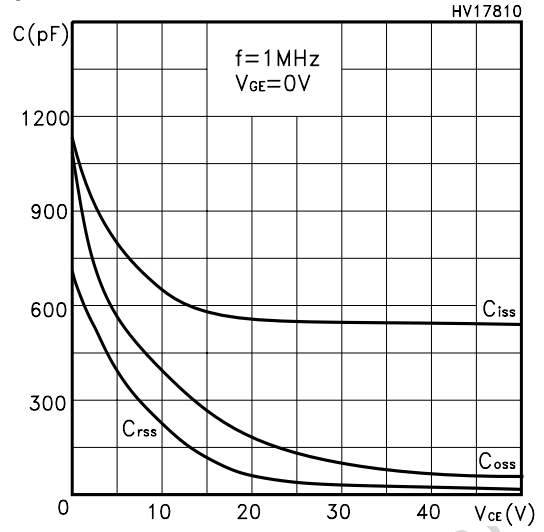
Gate Threshold vs Temperature



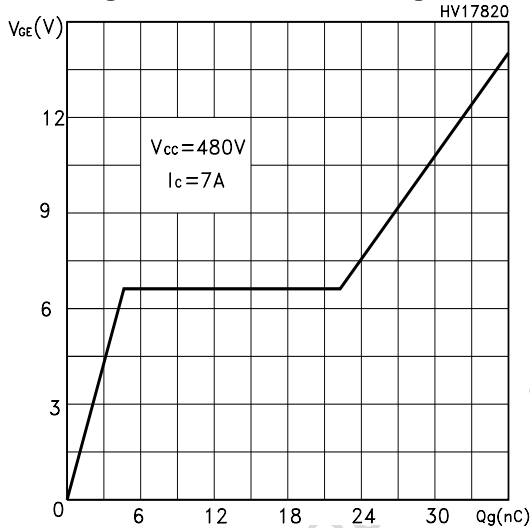
Normalized Breakdown Voltage vs Temperature



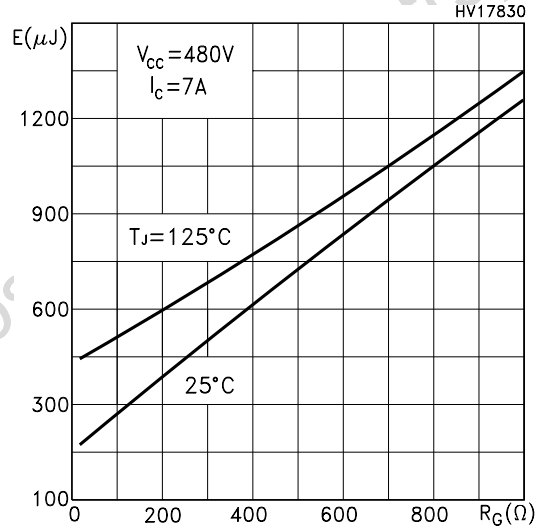
Capacitance Variations



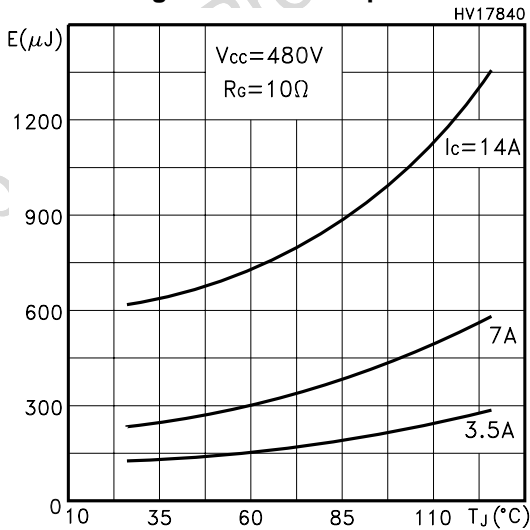
Gate Charge vs Gate-Emitter Voltage



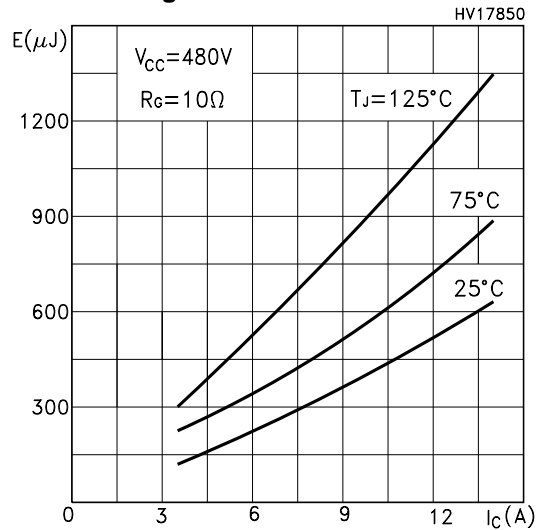
Total Switching Losses vs Gate Resistance



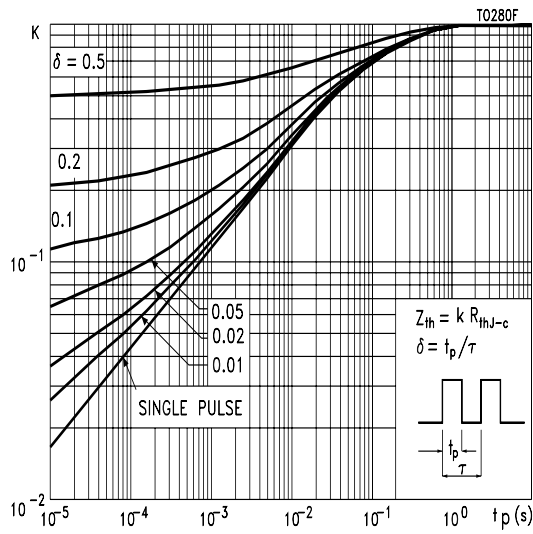
Total Switching Losses vs Temperature



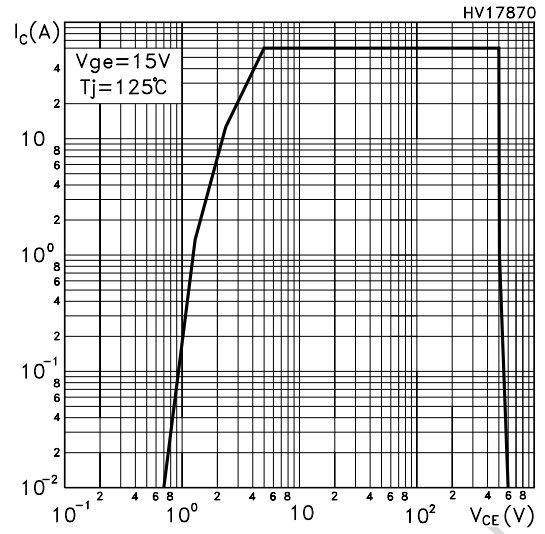
Total Switching Losses vs Collector Current



Thermal Impedance for TO-220/D<sup>2</sup>PAK



Turn-Off SOA



Emitter-Collector Diode Characteristics

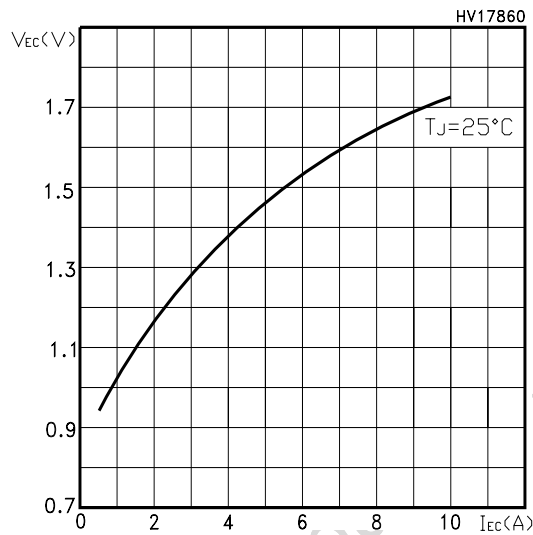


Fig. 1: Gate Charge test Circuit

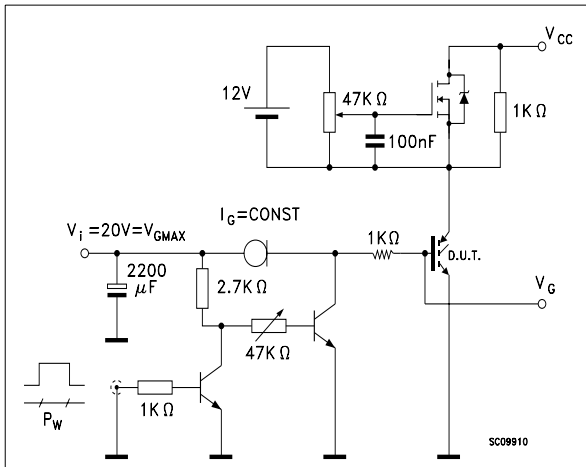
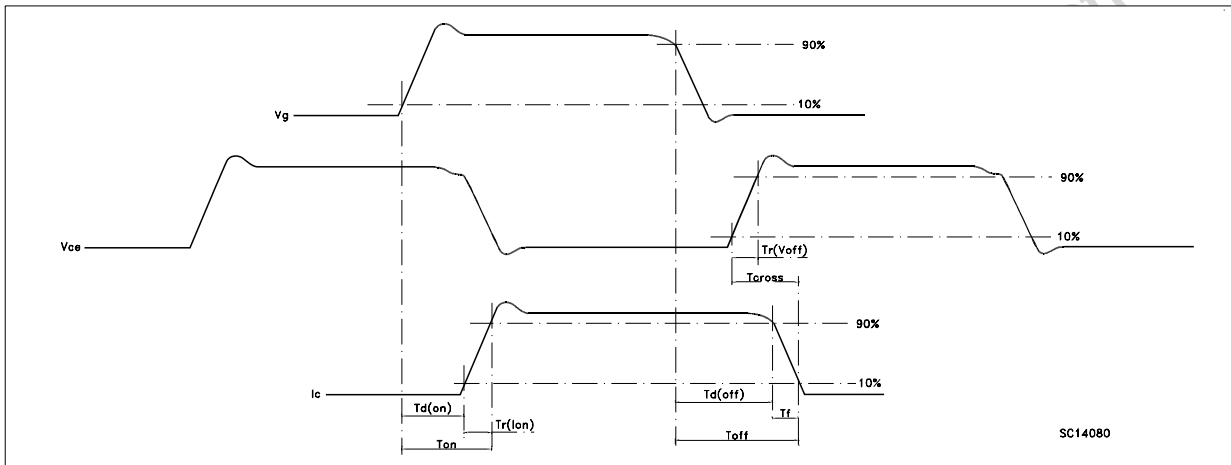
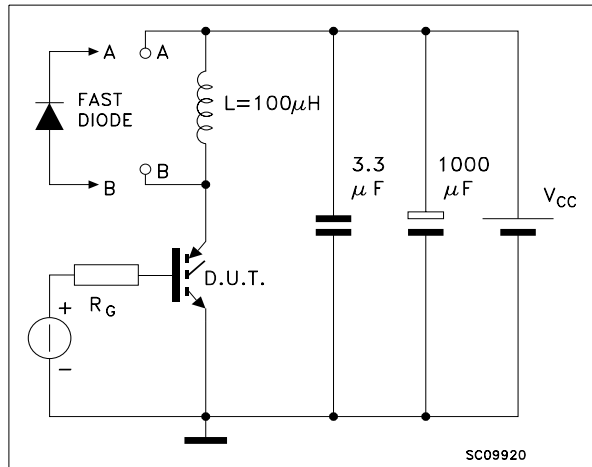


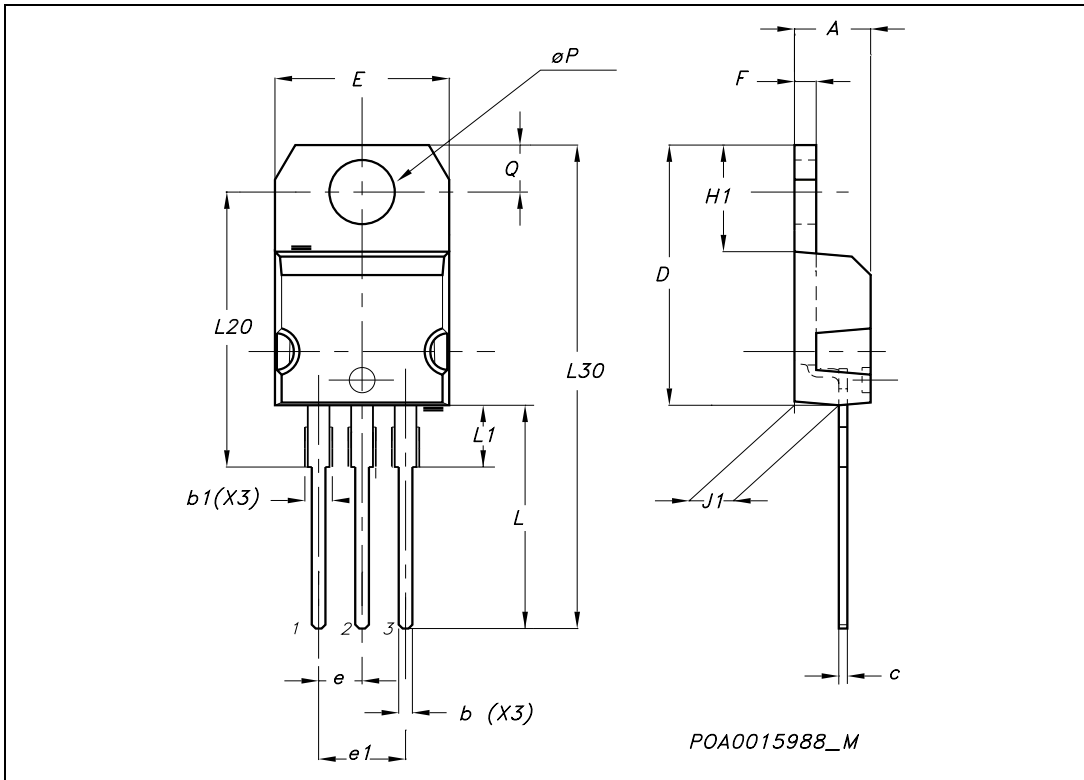
Fig. 2: Test Circuit For Inductive Load Switching



Obsolete Product

**TO-220 MECHANICAL DATA**

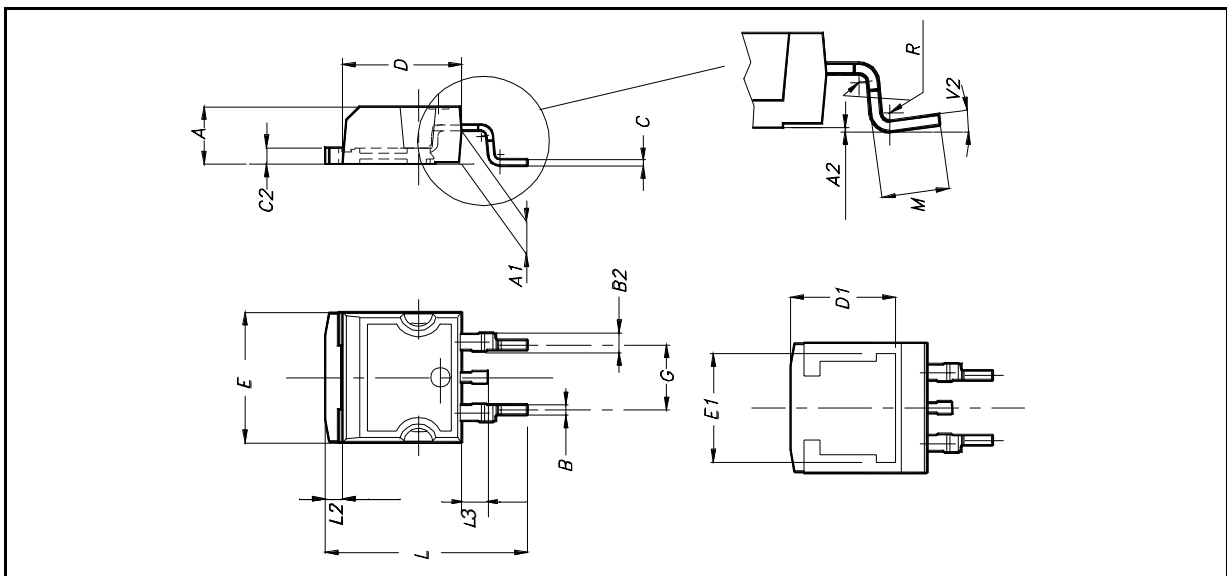
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244		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



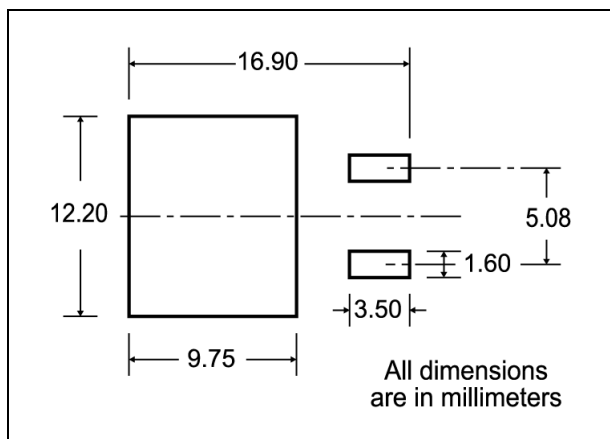


**D<sup>2</sup>PAK MECHANICAL DATA**

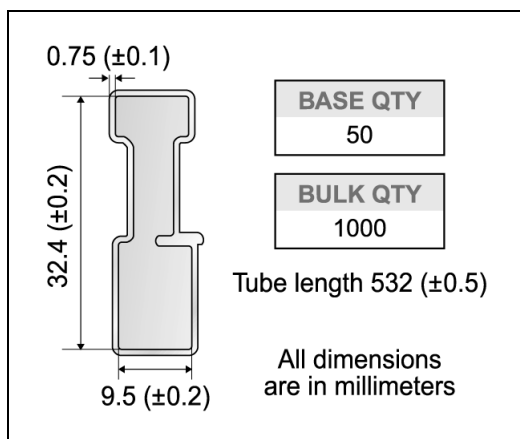
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
G	4.88		5.28	0.192		0.208
L	15		15.85	0.590		0.625
L2	1.27		1.4	0.050		0.055
L3	1.4		1.75	0.055		0.068
M	2.4		3.2	0.094		0.126
R		0.4			0.015	
V2	0°		4°			



**D<sup>2</sup>PAK FOOTPRINT**



**TUBE SHIPMENT (no suffix)\***



**TAPE AND REEL SHIPMENT (suffix "T4")\***

40 mm min. Access hole at slot location

Full radius

Tape slot in core for tape start 2.5mm min. width

G measured at hub

**TAPE MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	10.5	10.7	0.413	0.421
B0	15.7	15.9	0.618	0.626
D	1.5	1.6	0.059	0.063
D1	1.59	1.61	0.062	0.063
E	1.65	1.85	0.065	0.073
F	11.4	11.6	0.449	0.456
K0	4.8	5.0	0.189	0.197
P0	3.9	4.1	0.153	0.161
P1	11.9	12.1	0.468	0.476
P2	1.9	2.1	0.075	0.082
R	50		1.574	
T	0.25	0.35	0.0098	0.0137
W	23.7	24.3	0.933	0.956

**REEL MECHANICAL DATA**

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

**TRL**

FEED DIRECTION

Bending radius R min.

\* on sales type

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