

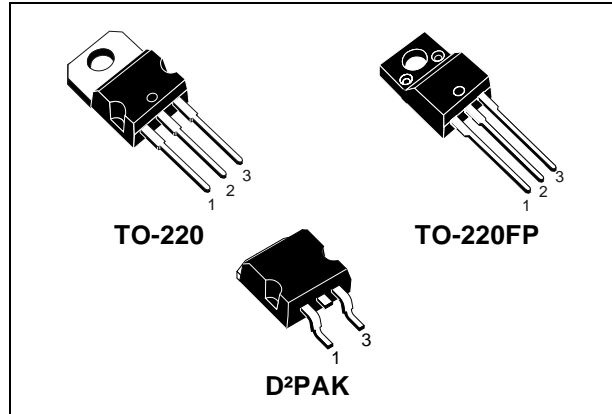


# STGP7NB60KD - STGB7NB60KD STGP7NB60KDFP

N-CHANNEL 7A - 600V - TO-220/TO-220FP/D<sup>2</sup>PAK  
SHORT CIRCUIT RATED PowerMESH™ IGBT

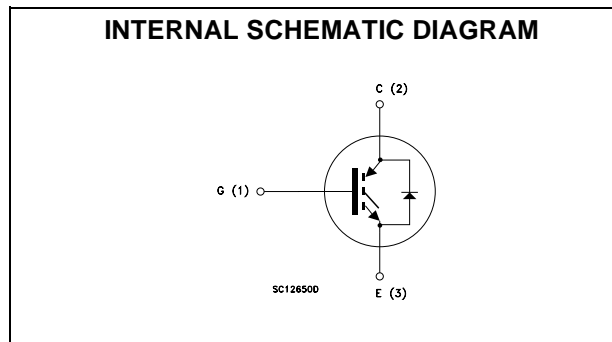
TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGP7NB60KD	600 V	< 2.8 V	7 A
STGP7NB60KDFP	600 V	< 2.8 V	7 A
STGB7NB60KD	600 V	< 2.8 V	7 A

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED
- 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 "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.



## APPLICATIONS

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

## ORDER CODES

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGP7NB60KD	GP7NB60KD	TO-220	TUBE
STGB7NB60KDT4	GB7NB60KD	D <sup>2</sup> PAK	TAPE & REEL
STGP7NB60KDFP	GP7NB60KDFP	TO-220FP	TUBE

## STGP7NB60KD - STGP7NB60KDFP - STGB7NB60KD

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value		Unit
		STGP7NB60KD STGB7NB60KD	STGP7NB60KDFP	
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	14		A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	7		A
I <sub>CM</sub> (■)	Collector Current (pulsed)	56		A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	80	25	W
	Derating Factor	0.64	0.20	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage A.C.(t= 1 sec; T <sub>c</sub> = 25°C)	--	2500	V
T <sub>stg</sub>	Storage Temperature	-55 to 150		°C
T <sub>j</sub>	Max. Operating Junction Temperature	150		°C

(■) Pulse width limited by safe operating area

### THERMAL DATA

		TO-220 D <sup>2</sup> PAK	TO-220FP	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	1.56	5	°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			50 500	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> = 250μA	5		7	V
V <sub>CE(sat)</sub>	Collector-Emitter Saturation Voltage	V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A, T <sub>j</sub> = 125°C		2.3 1.9	2.8	V V

## STGP7NB60KD - STGP7NB60KDFP - STGB7NB60KD

### ELECTRICAL CHARACTERISTICS (CONTINUED) DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 15\text{ V}, I_C = 7\text{ A}$		3.7		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25\text{ V}, f = 1\text{ MHz}, V_{GE} = 0$		495 77 13		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480\text{ V}, I_C = 7\text{ A},$ $V_{GE} = 15\text{ V}$		32.7 5.9 18.3	45	nC nC nC
tscw	Short Circuit Withstand Time	$V_{ce} = 0.5 V_{BR(CES)}, V_{GE} = 15\text{ V}$ $T_j = 125^\circ\text{C}, R_G = 10\ \Omega$	10			$\mu\text{s}$

### SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 480\text{ V}, I_C = 7\text{ A}$		15		ns
$t_r$	Rise Time	$R_G = 10\ \Omega, V_{GE} = 15\text{ V}$		6		ns
$(di/dt)_{on}$ Eon	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480\text{ V}, I_C = 7\text{ A}, R_G = 10\ \Omega$ $V_{GE} = 15\text{ V}, T_j = 125^\circ\text{C}$		980 95		A/ $\mu\text{s}$ $\mu\text{J}$

### SWITCHING OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}, I_C = 7\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$		105		ns
$t_r(V_{off})$	Off Voltage Rise Time			30		ns
$t_{d(off)}$	Delay Time			50		ns
$t_f$	Fall Time			100		ns
$E_{off(**)}$	Turn-off Switching Loss			140		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			200		$\mu\text{J}$
$t_c$	Cross-over Time	$V_{CC} = 480\text{ V}, I_C = 7\text{ A},$ $R_{GE} = 10\ \Omega, V_{GE} = 15\text{ V}$ $T_j = 125^\circ\text{C}$		227		ns
$t_r(V_{off})$	Off Voltage Rise Time			68		ns
$t_{d(off)}$	Delay Time			52		ns
$t_f$	Fall Time			150		ns
$E_{off(**)}$	Turn-off Switching Loss			300		$\mu\text{J}$
$E_{ts}$	Total Switching Loss			395		$\mu\text{J}$

(\*\*) Losses include Also the Tail (Jedec Standardization)

### COLLECTOR-EMITTER DIODE

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_f$	Forward Current				7	A
$I_{fm}$	Forward Current pulsed				56	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 1.2	1.9	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 7\text{ A}, V_R = 35\text{ V},$ $T_j = 125^\circ\text{C}, di/dt = 100\text{ A}/\mu\text{s}$		50 70 2.7		ns nC A

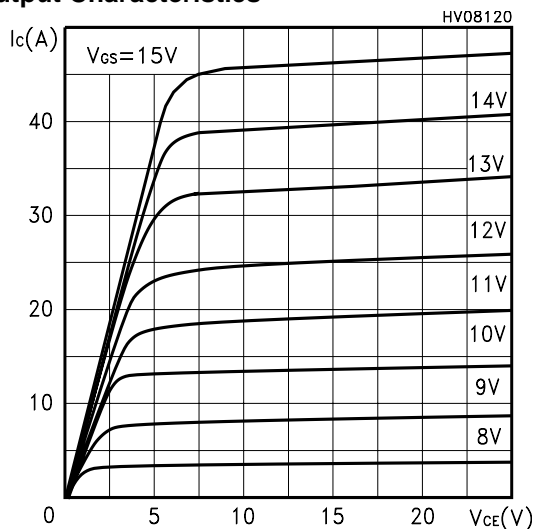
Note: 1. Pulsed: Pulse duration = 300  $\mu\text{s}$ , duty cycle 1.5 %.

2. Pulse width limited by max. junction temperature.

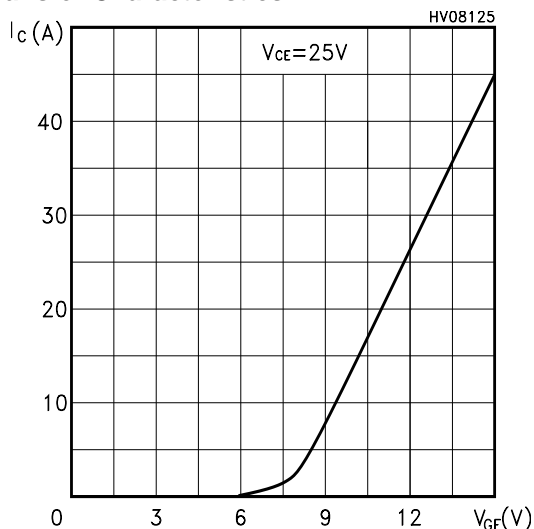
(\*\*) Losses include Also the Tail (Jedec Standardization)



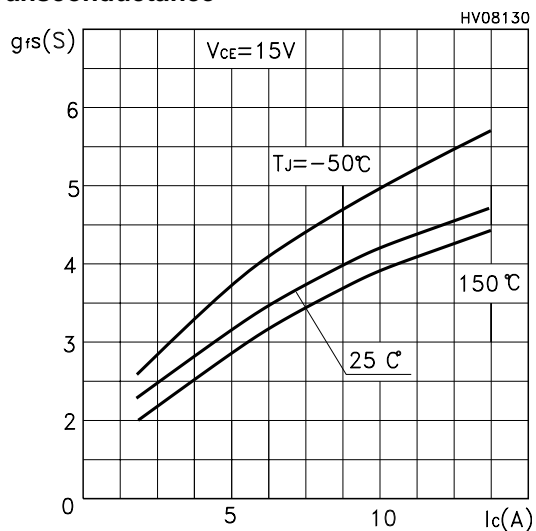
Output Characteristics



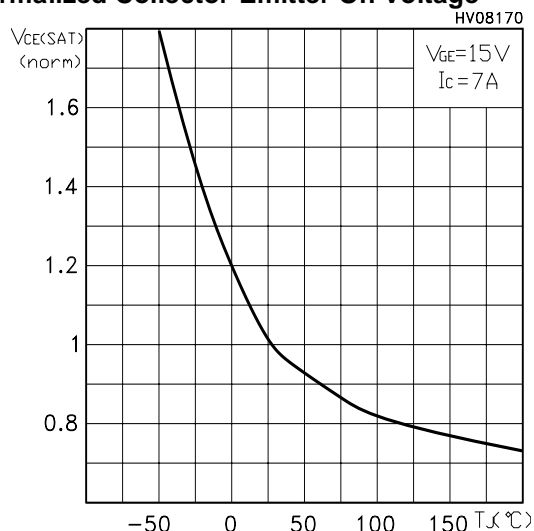
Transfer Characteristics



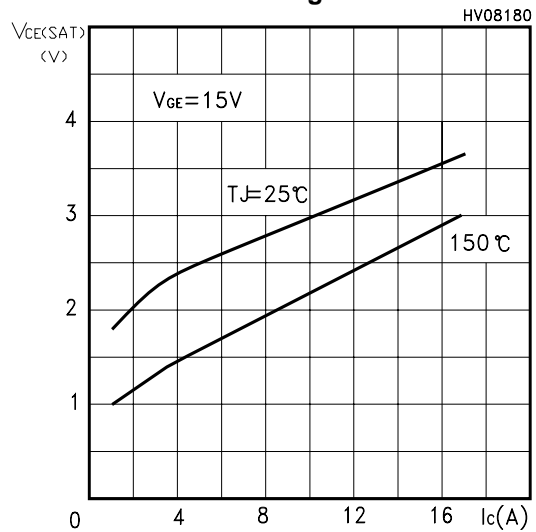
Transconductance



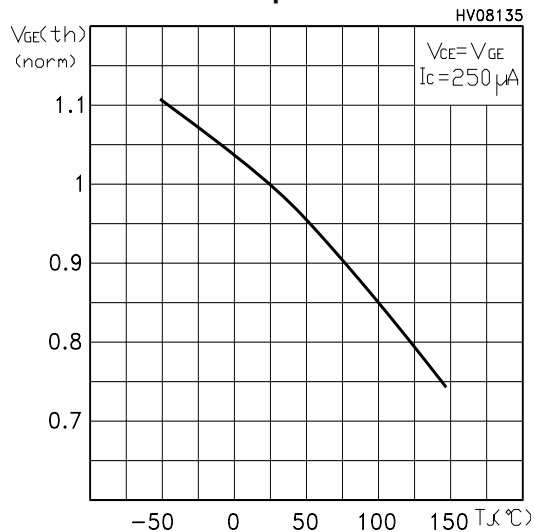
Normalized Collector-Emitter On Voltage



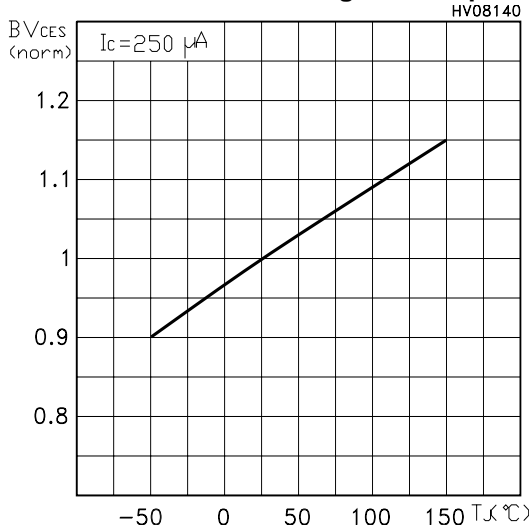
Collector-Emitter On Voltage vs Collector Current



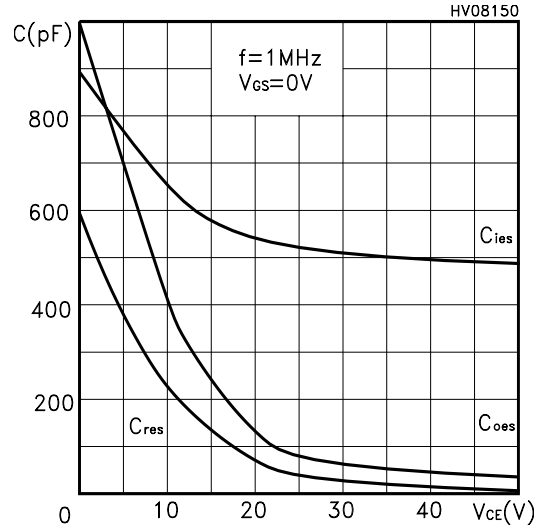
Gate Threshold vs Temperature



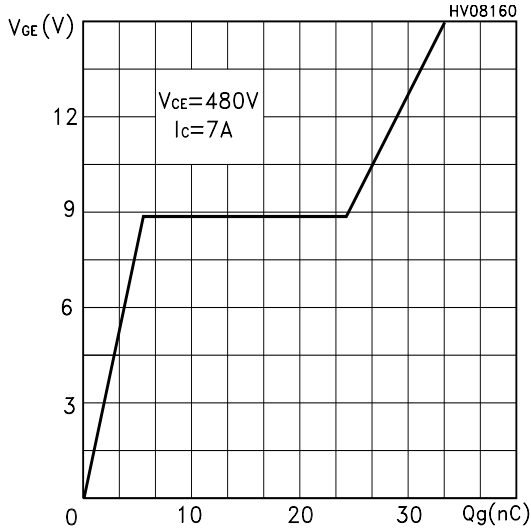
Normalized Breakdown Voltage vs Temperature



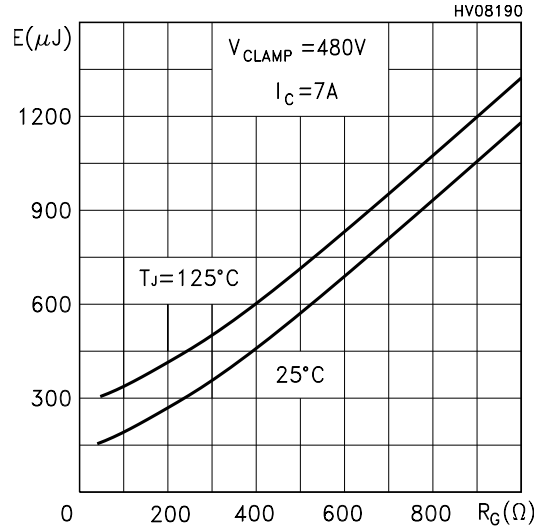
Capacitance Variations



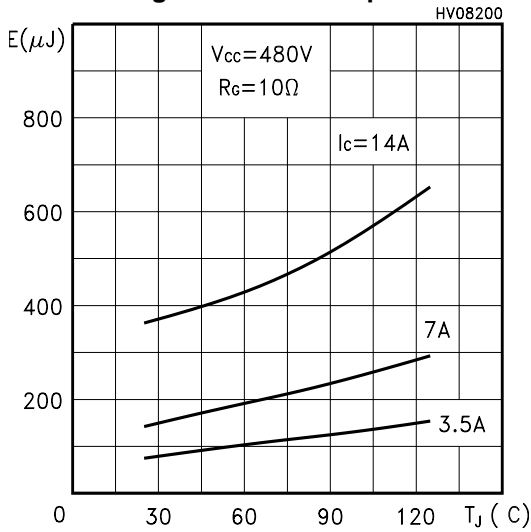
Gate Charge vs Gate-Emitter Voltage



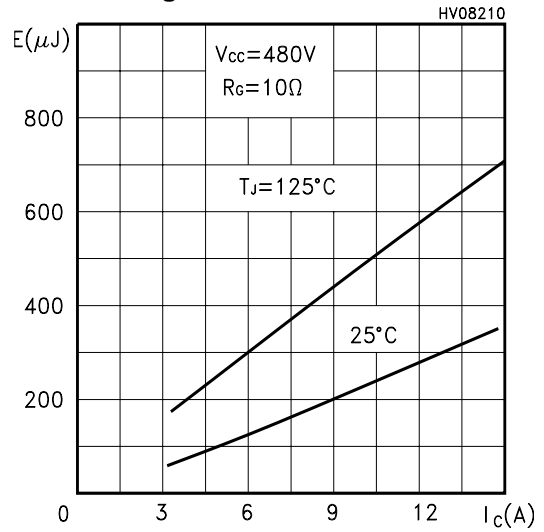
Total Switching Losses vs Gate Resistance



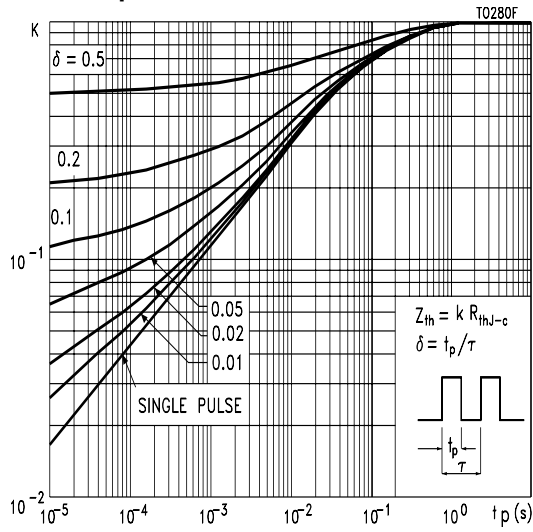
Total Switching Losses vs Temperature



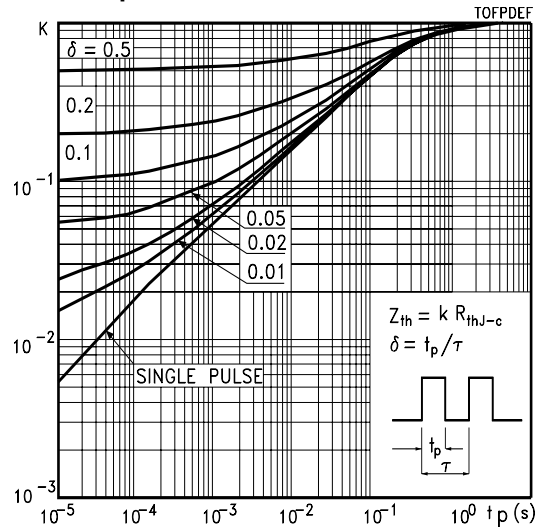
Total Switching Losses vs Collector Current



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



Thermal Impedance for TO-220FP



Turn-Off SOA

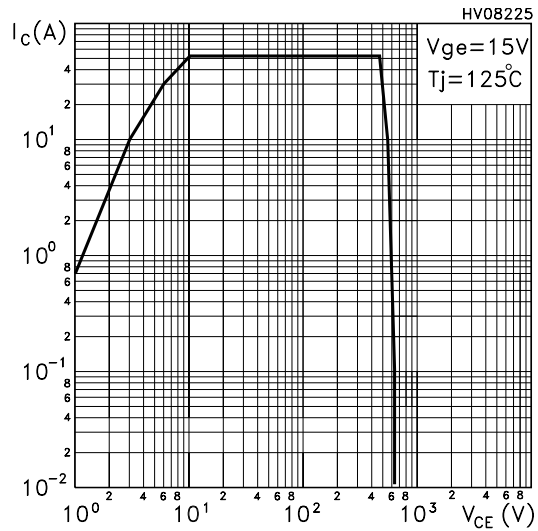


Fig. 1: Gate Charge test Circuit

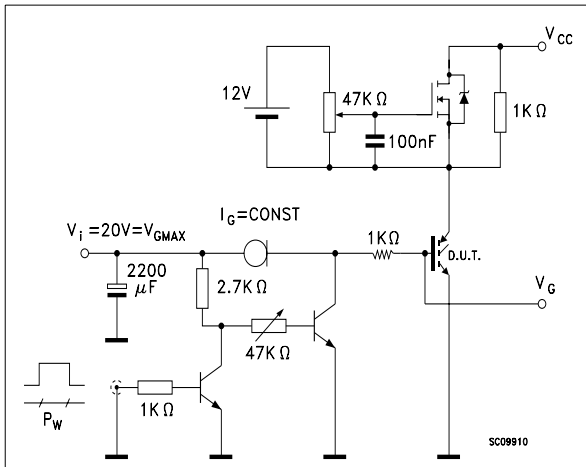
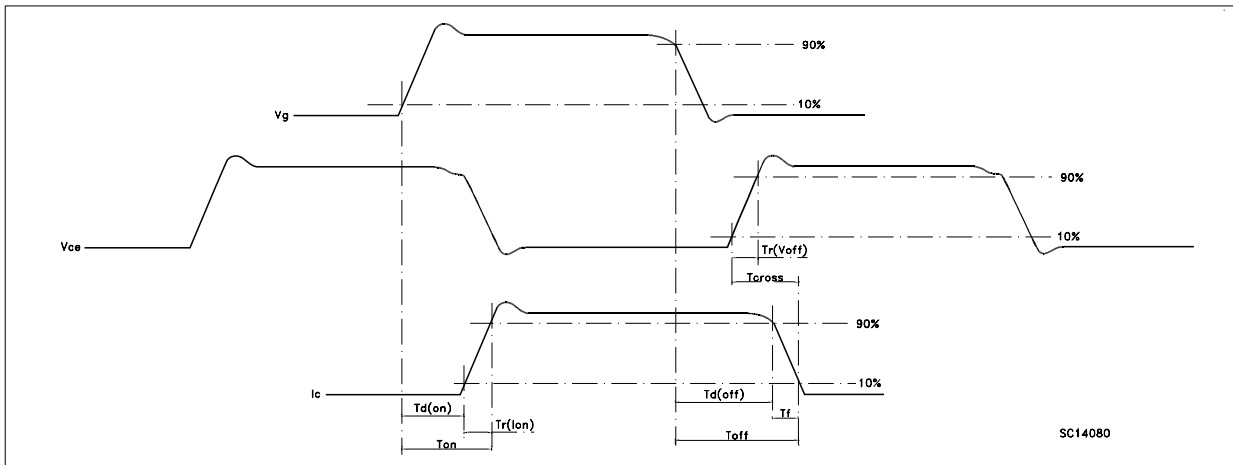
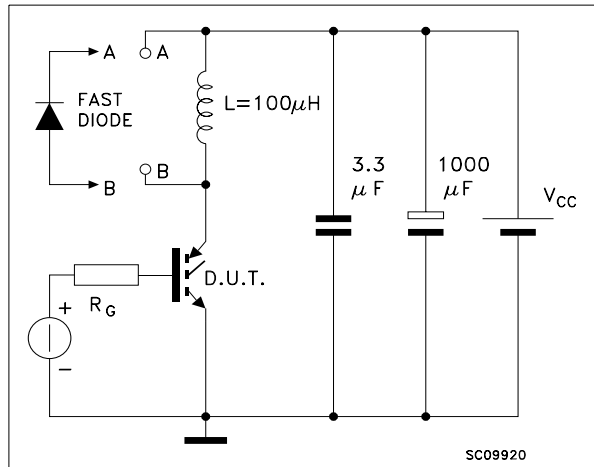
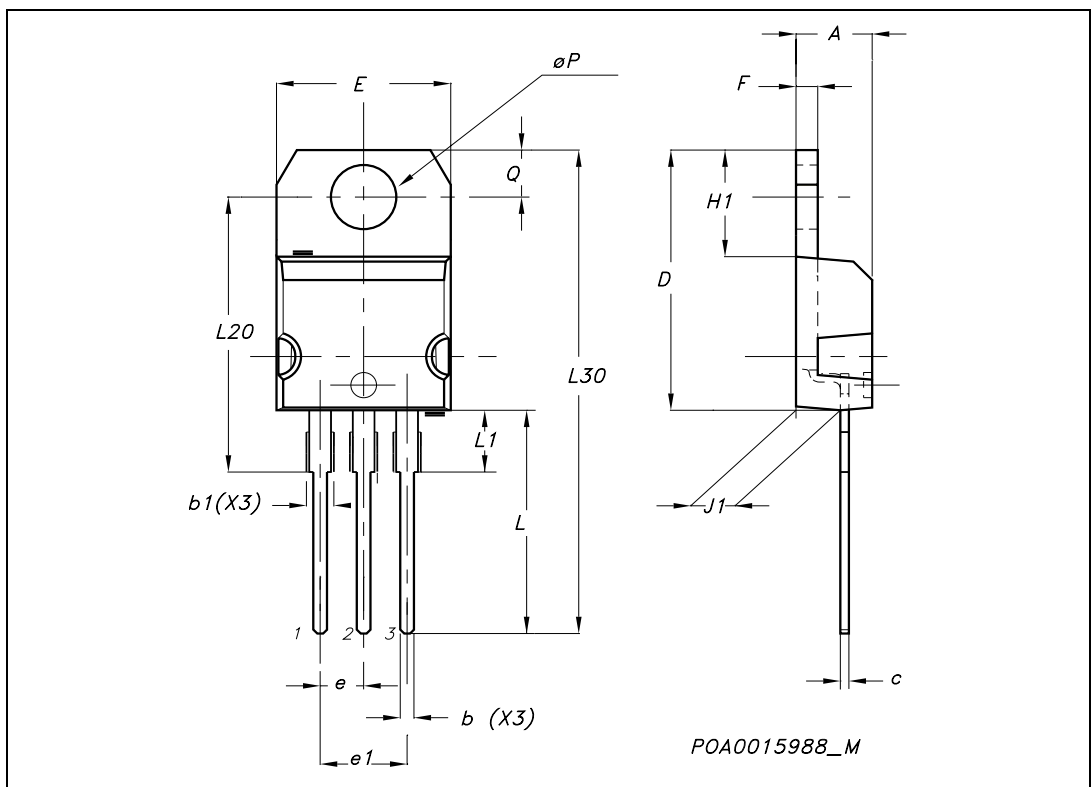


Fig. 2: Test Circuit For Inductive Load Switching



**TO-220 MECHANICAL DATA**

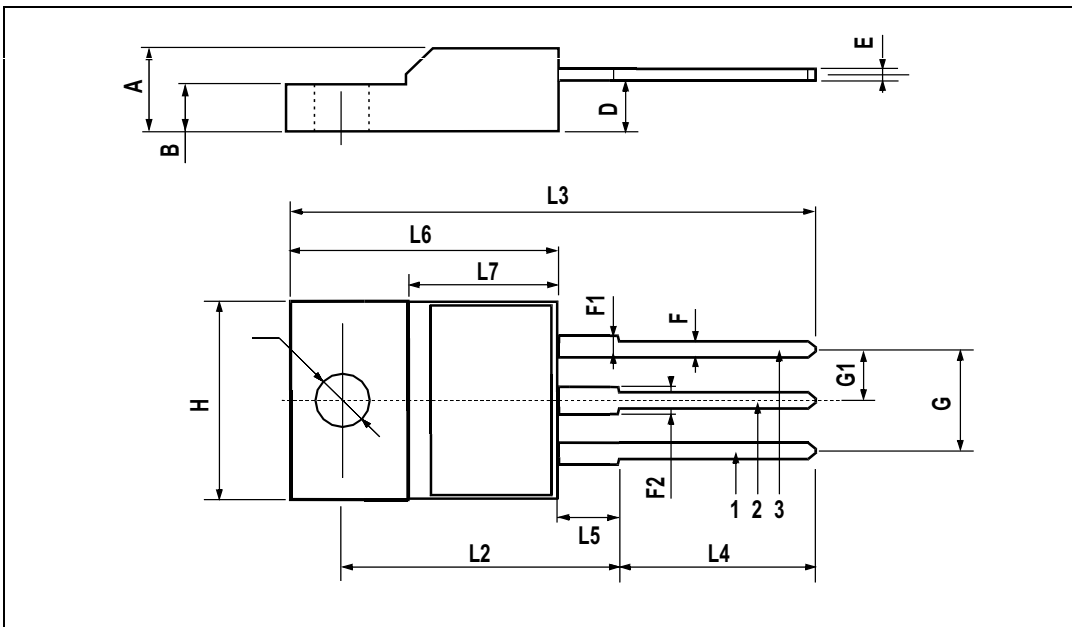
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244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





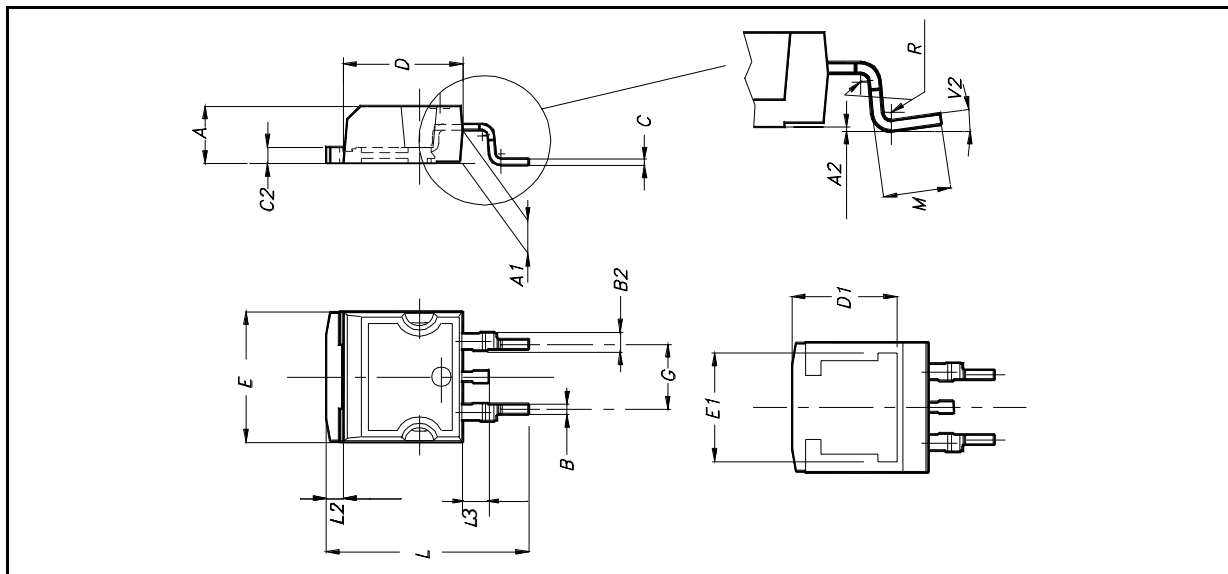
**TO-220FP MECHANICAL DATA**

DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
B	2.5		2.7	0.098		0.106
D	2.5		2.75	0.098		0.108
E	0.45		0.7	0.017		0.027
F	0.75		1	0.030		0.039
F1	1.15		1.7	0.045		0.067
F2	1.15		1.7	0.045		0.067
G	4.95		5.2	0.195		0.204
G1	2.4		2.7	0.094		0.106
H	10		10.4	0.393		0.409
L2		16			0.630	
L3	28.6		30.6	1.126		1.204
L4	9.8		10.6	.0385		0.417
L5	2.9		3.6	0.114		0.141
L6	15.9		16.4	0.626		0.645
L7	9		9.3	0.354		0.366
Ø	3		3.2	0.118		0.126

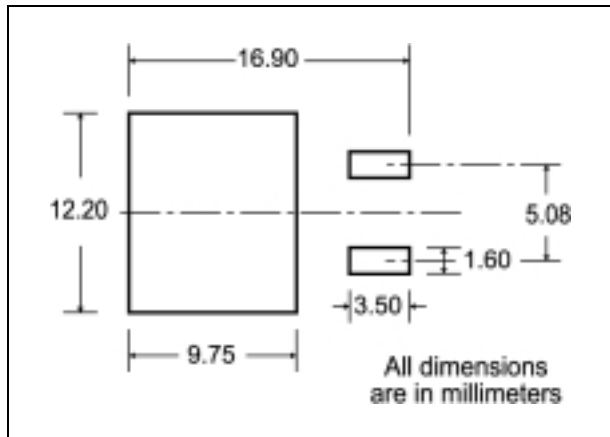


**D<sup>2</sup>PAK MECHANICAL DATA**

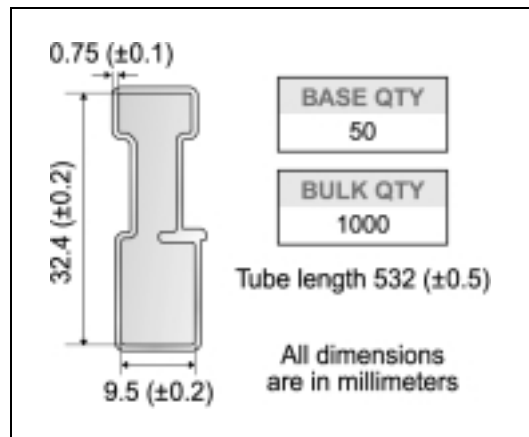
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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°		8°			



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



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



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

40 mm min. Access hole at slot location

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

Full radius

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

TOP COVER TAPE

User Direction of Feed

Center line of cavity

Feeding radius

Bending radius R min.

\* on sales type



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