



STGP12NB60KD - STGB12NB60KD

N-CHANNEL 18A - 600V TO-220/D²PAK

SHORT CIRCUIT PROOF PowerMESH™ IGBT

TYPE	V _{CES}	V _{CE(sat)} (Max) @ 25°C	I _C (#) @ 100°C
STGP12NB60KD	600 V	< 2.8 V	18 A
STGB12NB60KD	600 V	< 2.8 V	18 A

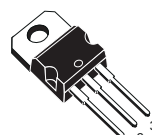
- HIGH INPUT IMPEDANCE
- LOW ON-LOSSES
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- VERY HIGH FREQUENCY OPERATION
- TYPICAL SHORT CIRCUIT WITHSTAND TIME 10 MICROS
- CO-PACKAGED ANTIPARALLEL DIODE

DESCRIPTION

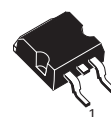
Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "K" identifies a family optimized for high frequency applications (up to 50kHz) and short circuit proof in order to achieve very high switching performances (reduced t_{fall}) maintaining a low voltage drop.

APPLICATIONS

- HIGH FREQUENCY MOTOR CONTROLS
- SMPS
- UPS

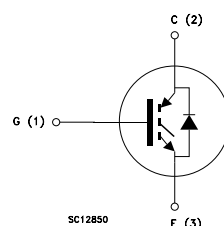


TO-220



D²PAK

INTERNAL SCHEMATIC DIAGRAM



ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP12NB60KD	GP12NB60KD	TO-220	TUBE
STGB12NB60KDT4	GB12NB60KD	D ² PAK	TAPE & REEL

STGP12NB60KD - STGB12NB60KD

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	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} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25\text{V}$, $f = 1\text{MHz}$, $V_{GE} = 0$		890 110 22		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480\text{V}$, $I_C = 12\text{A}$, $V_{GE} = 15\text{V}$		54 8 31		nC nC 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	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}$		25		ns
t_r	Rise Time	$R_G = 10 \Omega, V_{GE} = 15 \text{ V}$		14.5		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 480 \text{ V}, I_C = 12 \text{ A}, R_G = 10 \Omega$		590		A/ μs
E_{on}	Turn-on Switching Losses	$V_{GE} = 15 \text{ V}, T_j = 125^\circ\text{C}$		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)

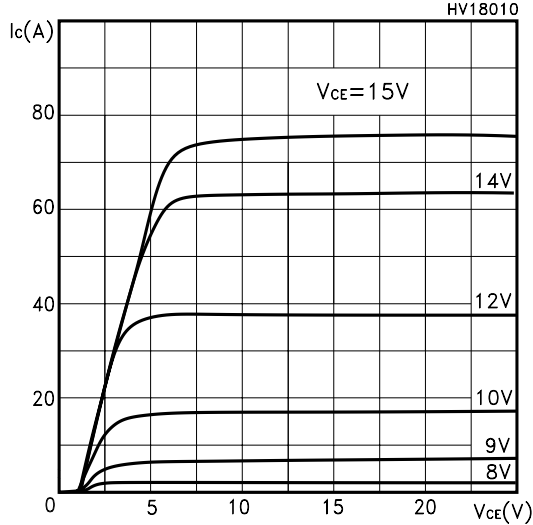
COLLECTOR-EMITTER DIODE

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

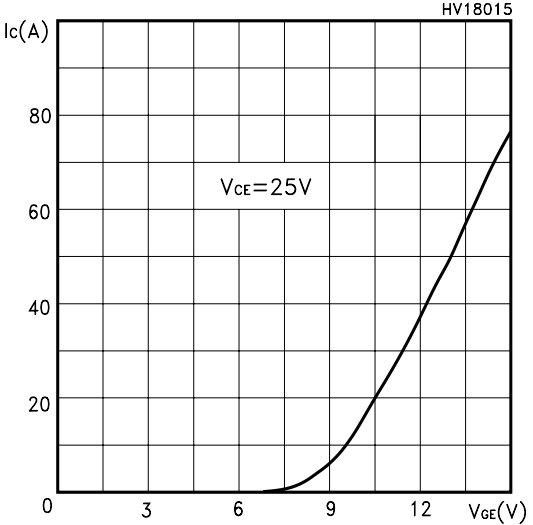
(#) Calculated according to the iterative formula:

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

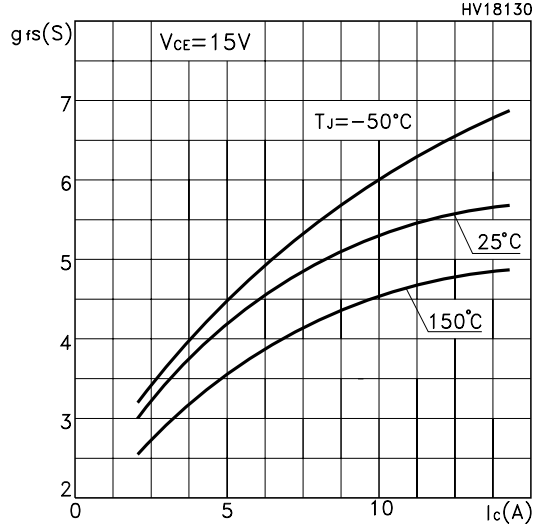
Output Characteristics



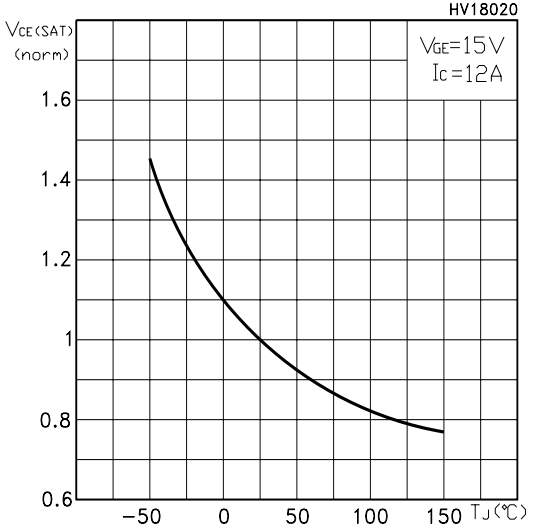
Transfer Characteristics



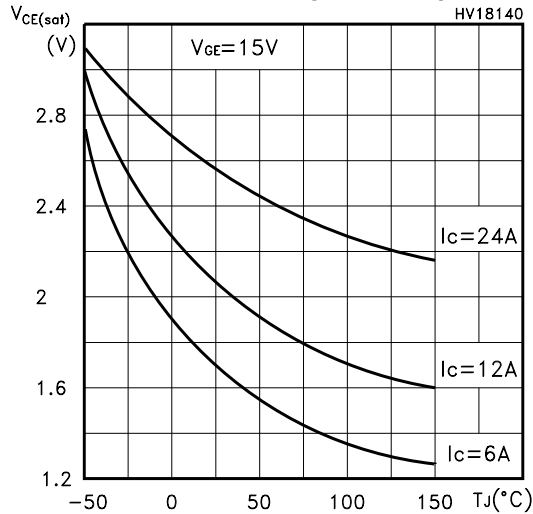
Transconductance



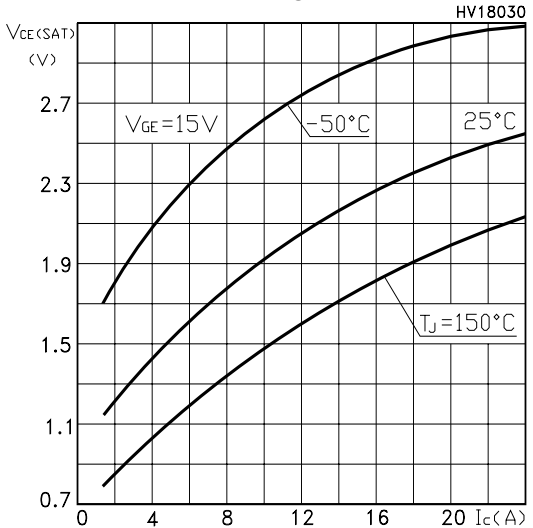
Normalized Collector-Emitter On Voltage vs Temp.



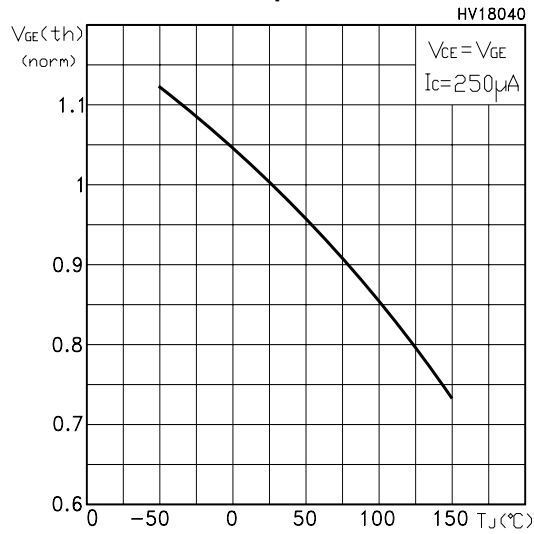
Collector-Emitter On Voltage vs Temperature



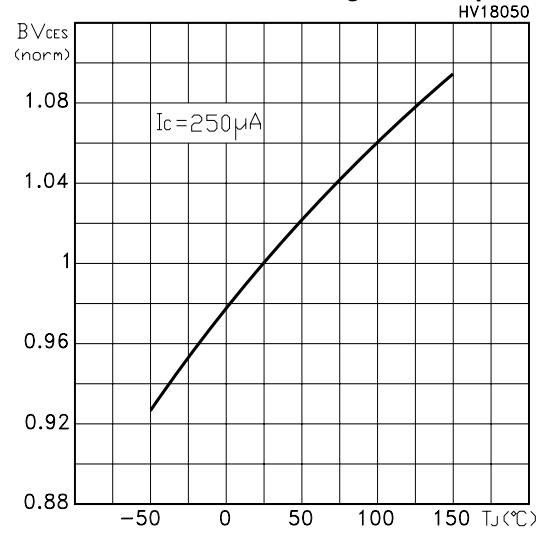
Collector-Emitter On Voltage vs Collector Current



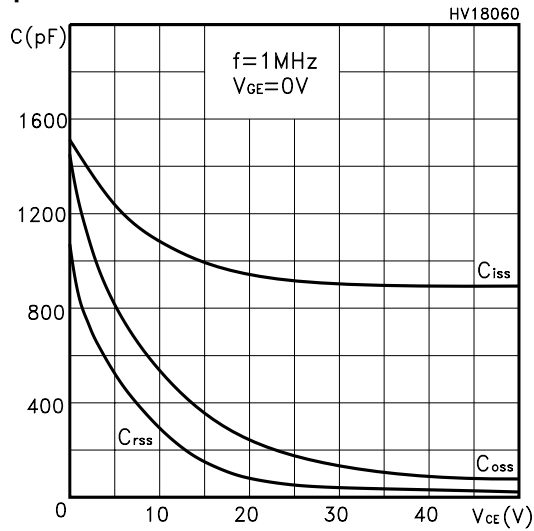
Gate Threshold vs Temperature



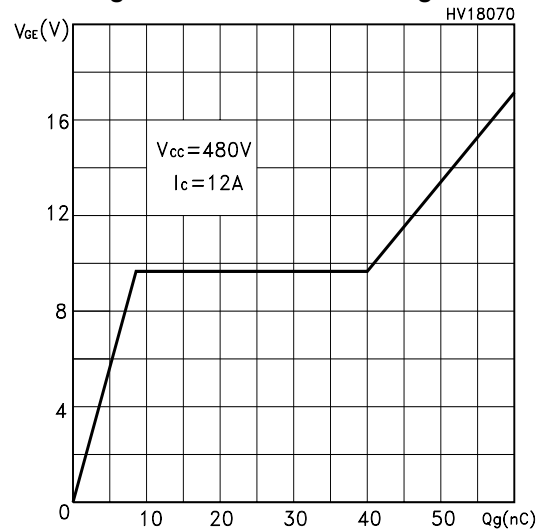
Normalized Breakdown Voltage vs Temperature



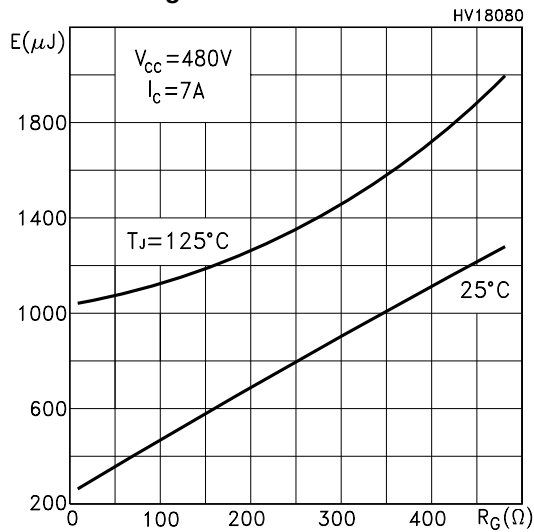
Capacitance Variations



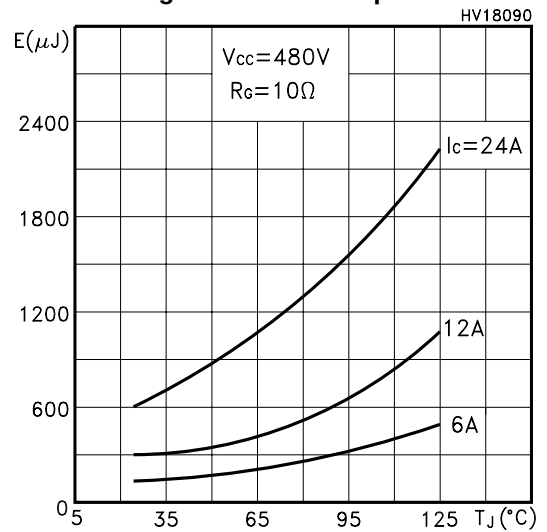
Gate Charge vs Gate-Emmitter Voltage



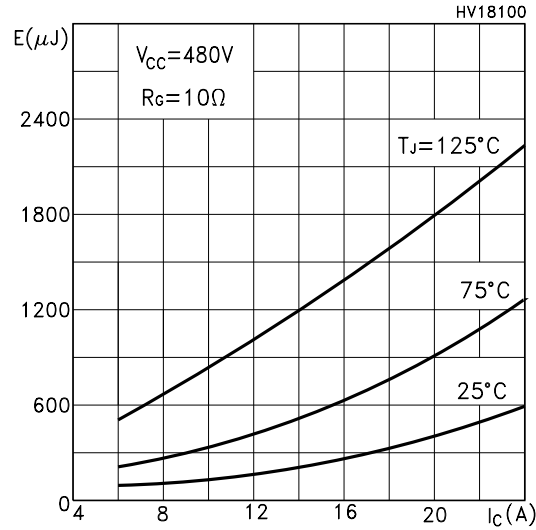
Total Switching Losses vs Gate Resistance



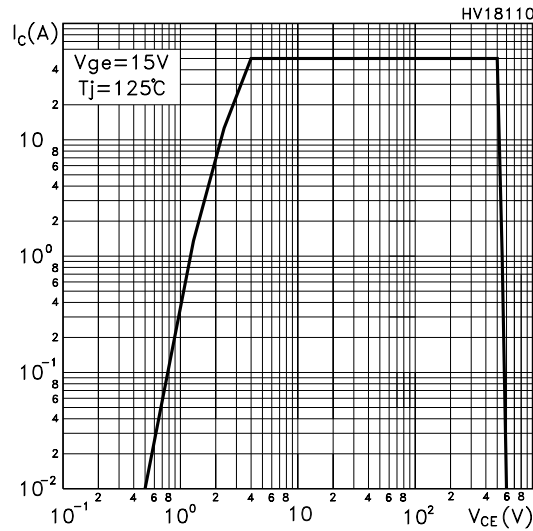
Total Switching Losses vs Temperature



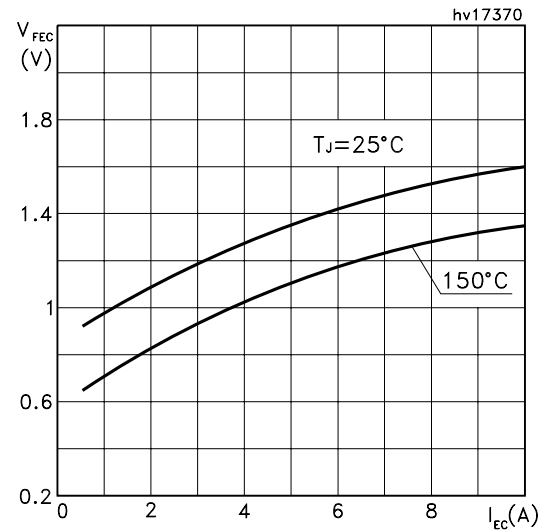
Total Switching Losses vs Collector Current



Turn-Off SOA



Diode Forward Voltage



Thermal Impedance

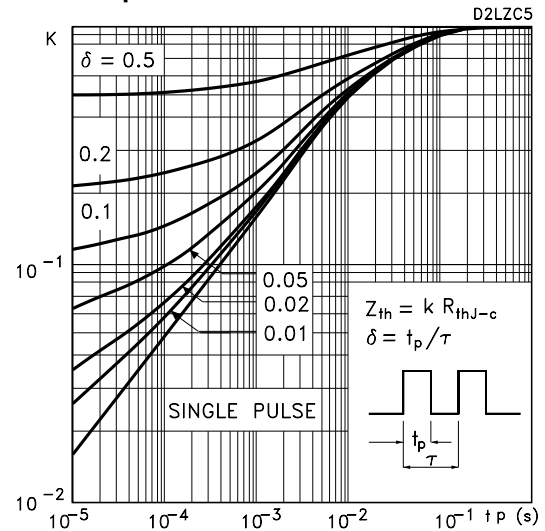


Fig. 1: Gate Charge test Circuit

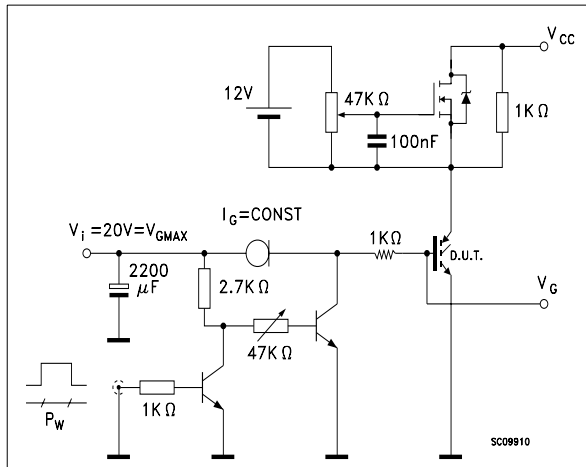
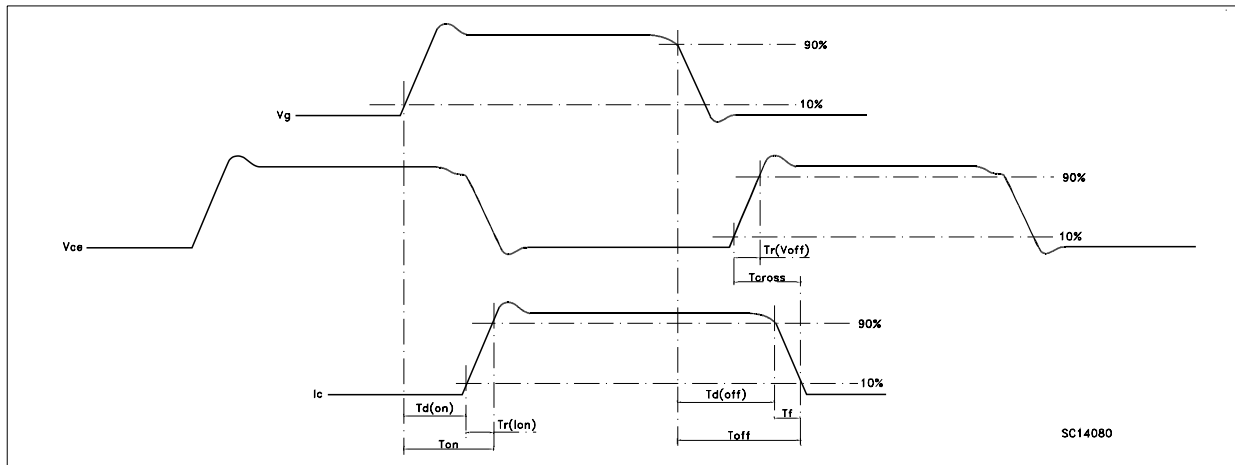
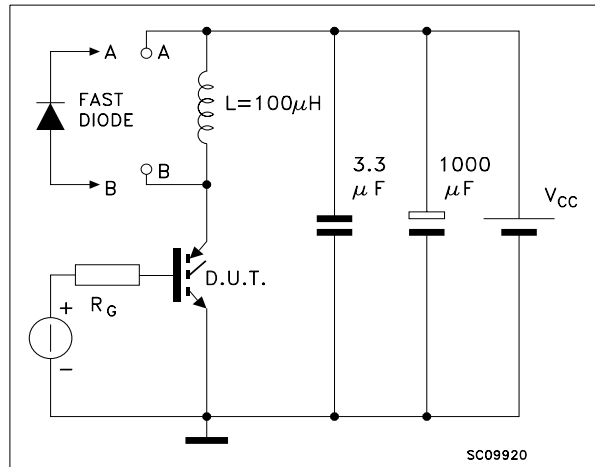
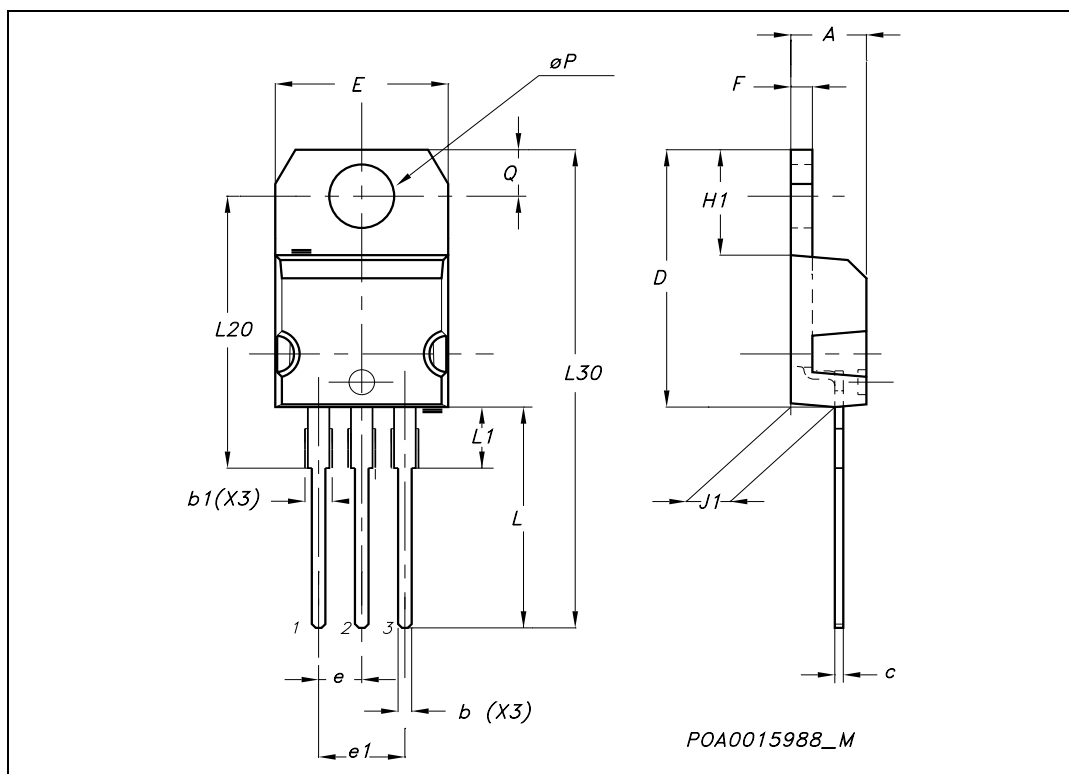


Fig. 2: Test Circuit For Inductive Load Switching



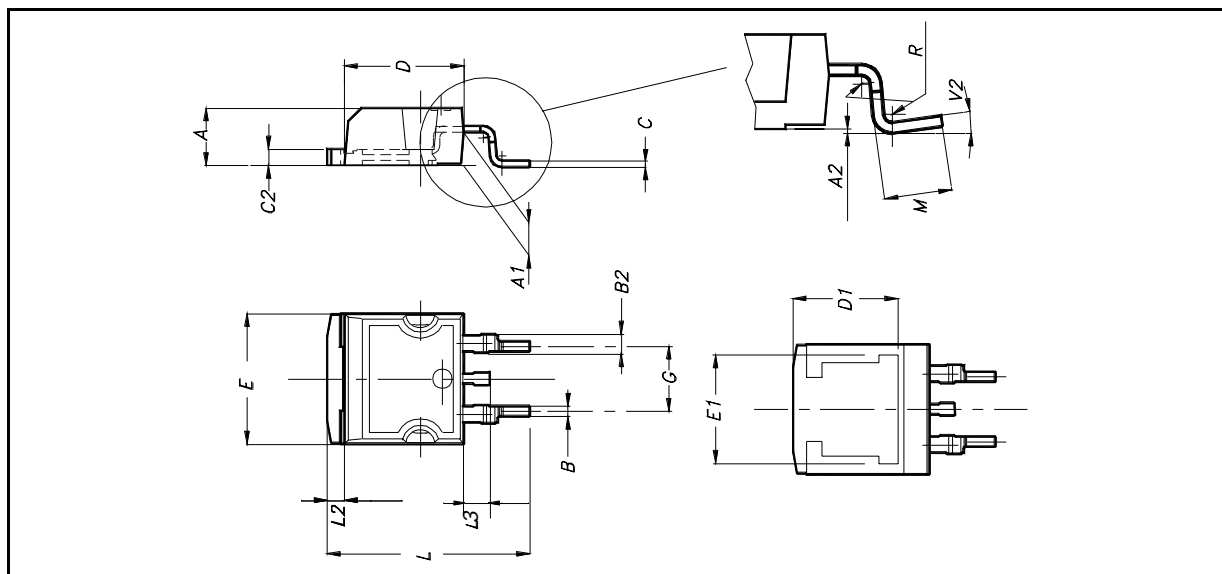
TO-220 MECHANICAL DATA

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

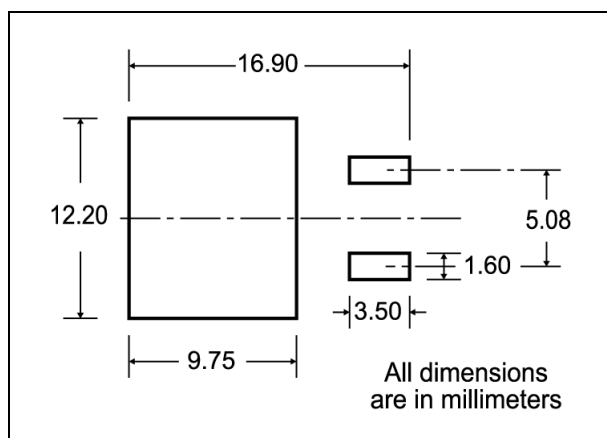


D²PAK MECHANICAL DATA

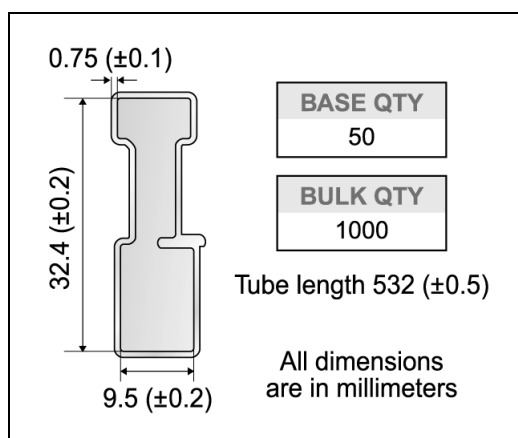
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334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



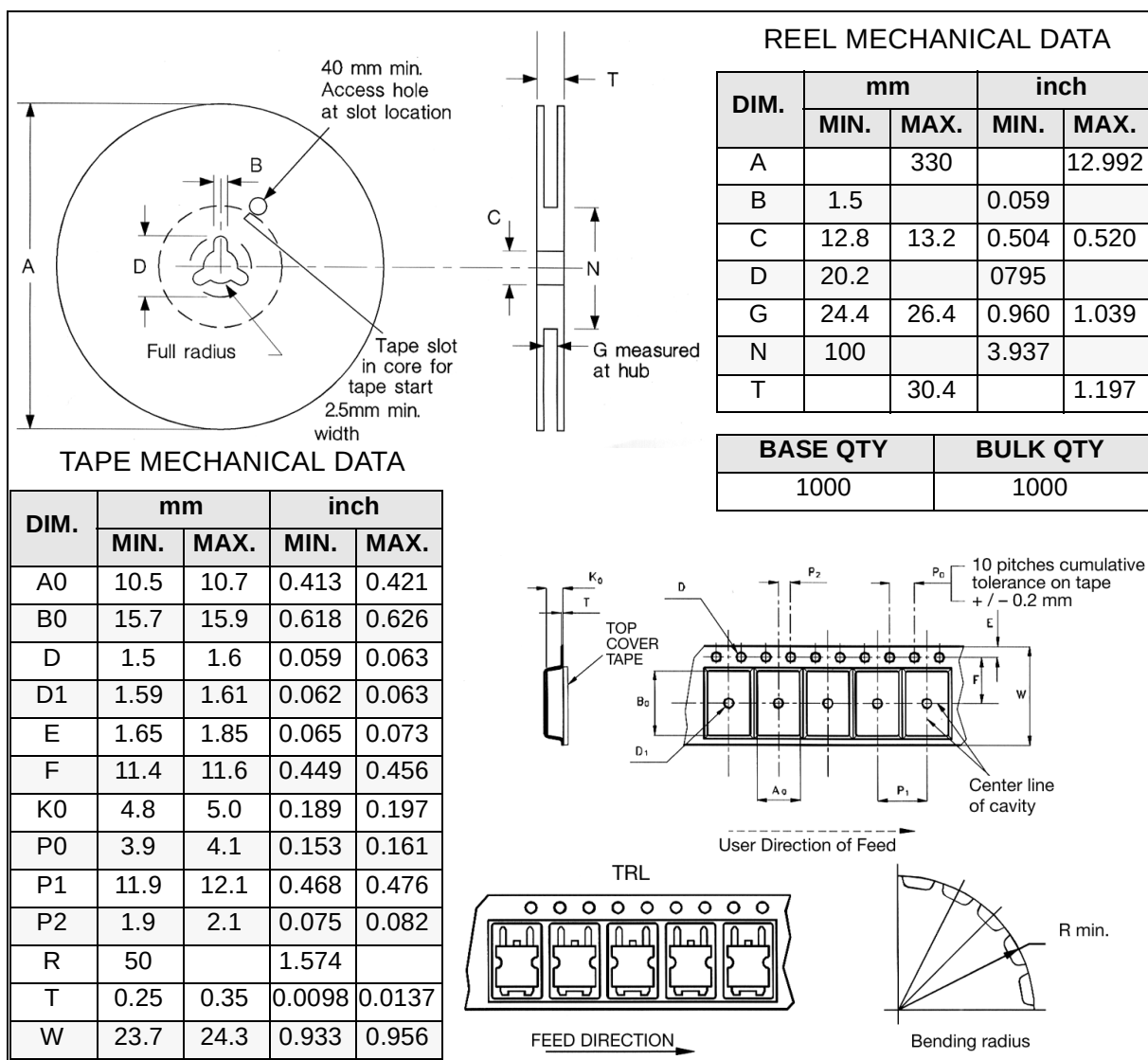
D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



* on sales type

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