



## STGP3NB60F - STGD3NB60F

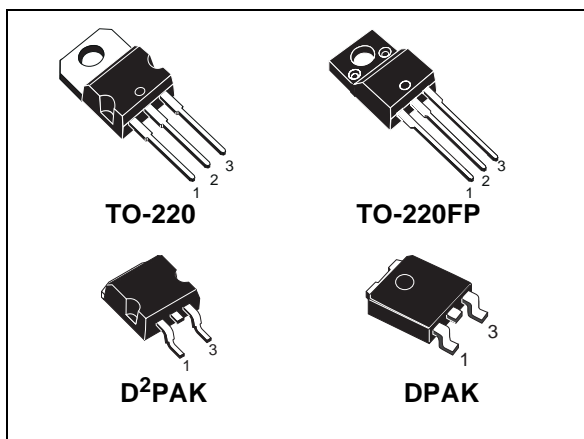
## STGP3NB60FD-STGF3NB60FD-STGB3NB60FD

N-CHANNEL 3A - 600V - TO-220/TO-220FP/DPAK/D<sup>2</sup>PAK

PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub> (Typ) @ 125°C	I <sub>C</sub> @ 125°C
STGP3NB60F	600 V	< 2.4 V	3 A
STGD3NB60F	600 V	< 2.4 V	3 A
STGP3NB60FD	600 V	< 2.4 V	3 A
STGF3NB60FD	600 V	< 2.4 V	3 A
STGB3NB60FD	600 V	< 2.4 V	3 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



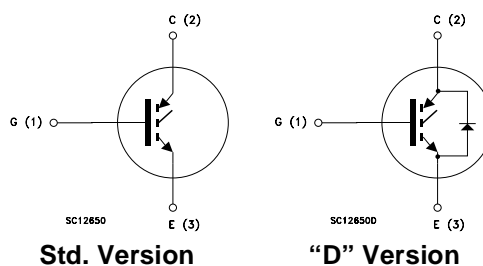
### DESCRIPTION

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 frequency applications (<40 KHz)

### APPLICATIONS

- MOTOR CONTROLS
- SMPS AND PFC IN BOTH HARD SWITCHING AND RESONANT TOPOLOGIES

### INTERNAL SCHEMATIC DIAGRAM



### ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP3NB60F	GP3NB60F	TO-220	TUBE
STGD3NB60FT4	GD3NB60F	DPAK	TAPE & REEL
STGP3NB60FD	GP3NB60FD	TO-220	TUBE
STGF3NB60FD	GF3NB60FD	TO-220FP	TUBE
STGB3NB60FDT4	GB3NB60FD	D <sup>2</sup> PAK	TAPE & REEL

**STGP3NB60F/STGD3NB60F/STGP3NB60FD/STGF3NB60FD/STGB3NB60FD****ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter	Value			Unit
		TO-220/D <sup>2</sup> PAK	TO-220FP	DPAK	
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	6			A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	3			A
I <sub>CM</sub> (■)	Collector Current (pulsed)	24			A
I <sub>f</sub> (1)	Forward Current	3			A
I <sub>fm</sub> (1)	Forward Current Pulsed	24			A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	68	25	60	W
	Derating Factor	0.55	0.2	0.47	W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage A.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

(1) For "D" version only

**THERMAL DATA**

		TO-220/D <sup>2</sup> PAK	TO-220FP	DPAK	
R <sub>thj-case</sub>	Thermal Resistance Junction-case Max	1.8	5	2.1	°C/W
R <sub>thj-amb</sub>	Thermal Resistance Junction-ambient Max	62.5		100	°C/W
R <sub>thc-h</sub>	Thermal Resistance Case-heatsink Typ	0.5			°C/W

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

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
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> = 15 V, I <sub>C</sub> = 3 A V <sub>GE</sub> = 15 V, I <sub>C</sub> = 3 A, T <sub>j</sub> = 125°C		1.9 1.6	2.4	V V

## STGP3NB60F/STGD3NB60F/STGP3NB60FD/STGF3NB60FD/STGB3NB60FD

### SWITCHING PARAMETERS

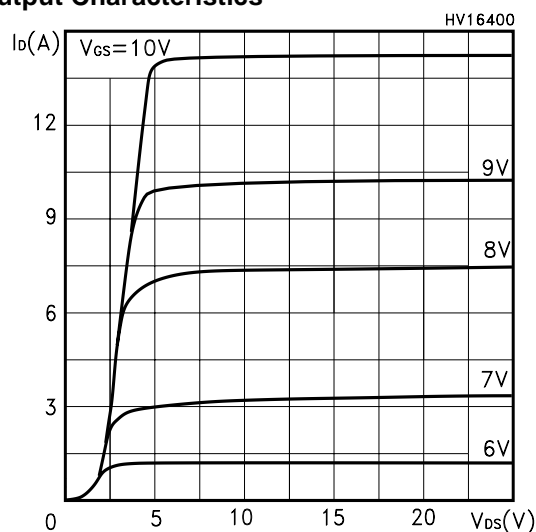
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25 \text{ V}$ , $I_C = 3 \text{ A}$		2		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		230 33 6		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480 \text{ V}$ , $I_C = 3 \text{ A}$ , $V_{GE} = 15 \text{ V}$		16 1.5 8	20	nC nC nC
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{CC} = 480 \text{ V}$ , $I_C = 3 \text{ A}$ $R_G = 10\Omega$ , $V_{GE} = 15 \text{ V}$		12.5 4		ns ns
$(di/dt)_{on}$ $E_{on}$	Turn-on Current Slope Turn-on Switching Losses	$V_{CC} = 480 \text{ V}$ , $I_C = 3 \text{ A}$ , $R_G = 10\Omega$ $V_{GE} = 15 \text{ V}$ , $T_j = 125^\circ\text{C}$		840 31		A/ $\mu\text{s}$ $\mu\text{J}$
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$ $E_{off(**)}$ $E_{ts}$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480 \text{ V}$ , $I_C = 3 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_j = 25^\circ\text{C}$		220 60 105 150 125 149		ns ns ns ns $\mu\text{J}$ $\mu\text{J}$
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$ $E_{off(**)}$ $E_{ts}$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480 \text{ V}$ , $I_C = 3 \text{ A}$ , $R_{GE} = 10 \Omega$ , $V_{GE} = 15 \text{ V}$ $T_j = 125^\circ\text{C}$		490 174 230 305 295 326		ns ns ns ns $\mu\text{J}$ $\mu\text{J}$

### COLLECTOR-EMITTER DIODE ("D" VERSION)

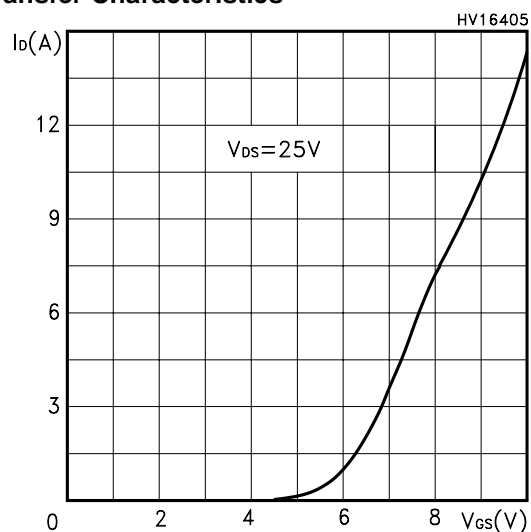
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_f$	Forward On-Voltage	$I_f = 1.5 \text{ A}$ $I_f = 1.5 \text{ A}$ , $T_j = 125^\circ\text{C}$		1.31 0.95	1.8	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 3 \text{ A}$ , $V_R = 35 \text{ V}$ , $T_j = 125^\circ\text{C}$ , $di/dt = 100 \text{ A}/\mu\text{s}$		45 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)

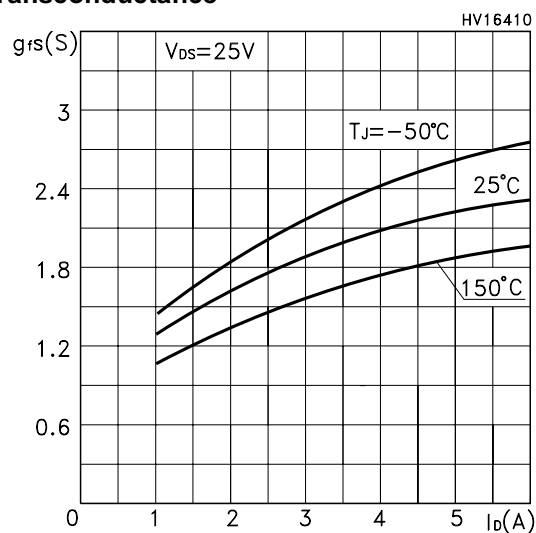
## Output Characteristics



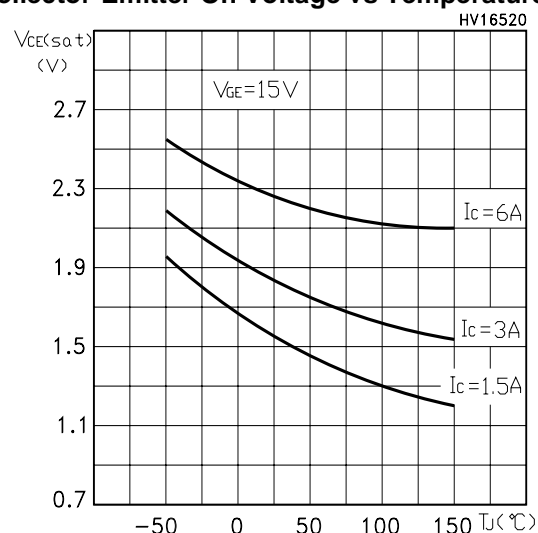
## Transfer Characteristics



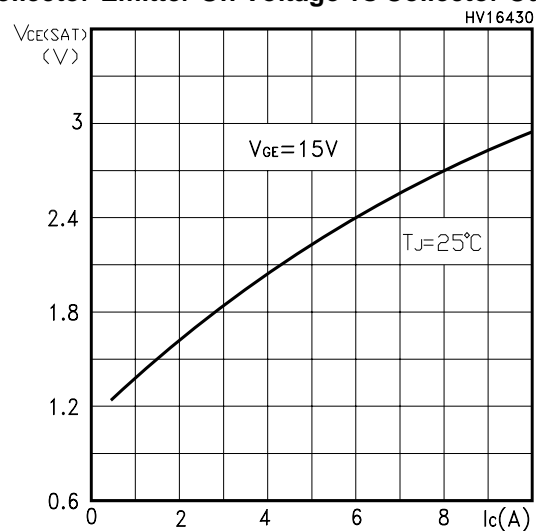
## Transconductance



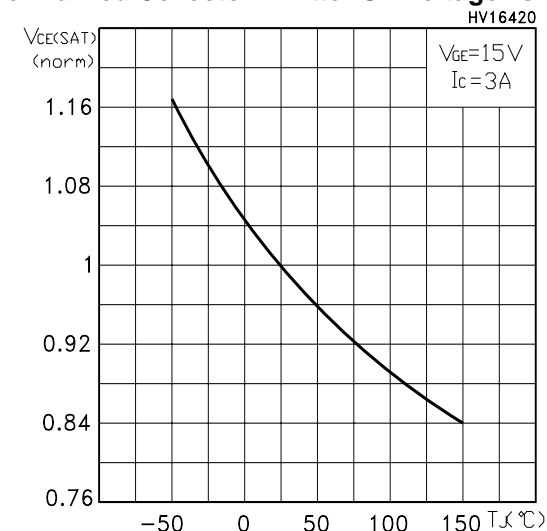
## Collector-Emitter On Voltage vs Temperature



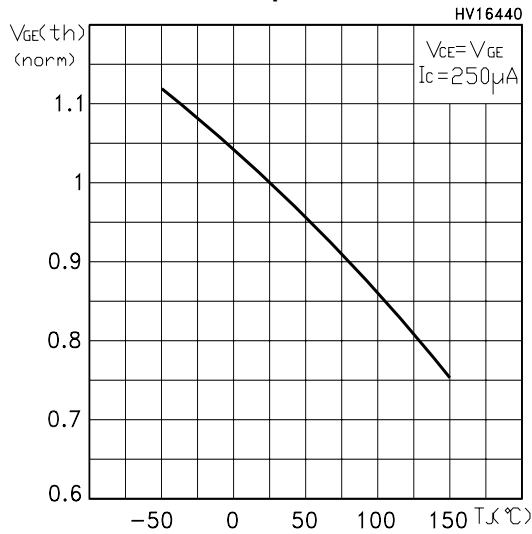
## Collector-Emitter On Voltage vs Collector Current



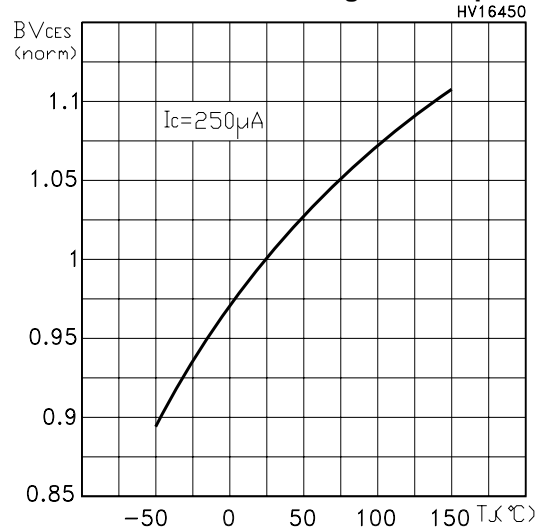
## Normalized Collector-Emitter On Voltage vs Temp.



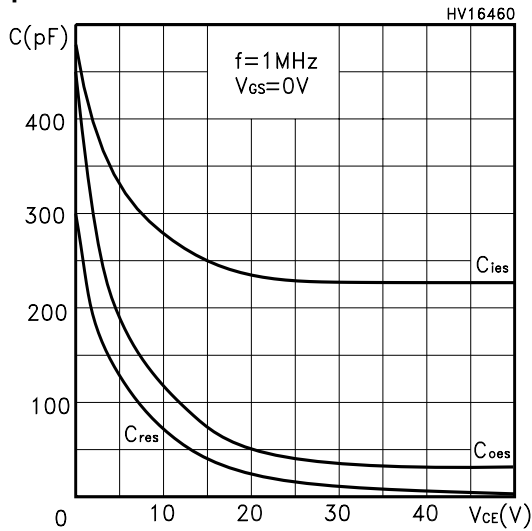
Gate Threshold vs Temperature



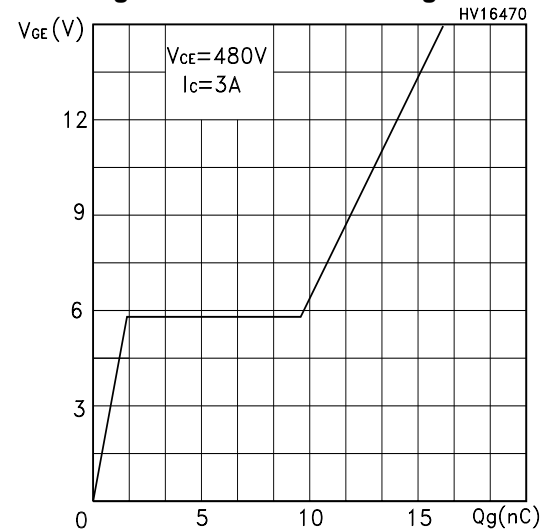
Normalized Breakdown Voltage vs Temperature



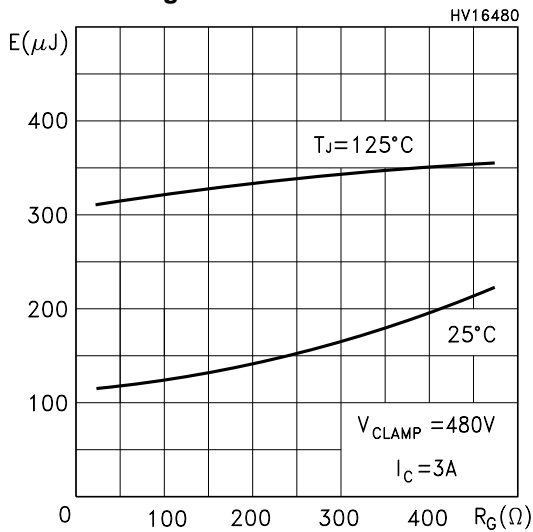
Capacitance Variations



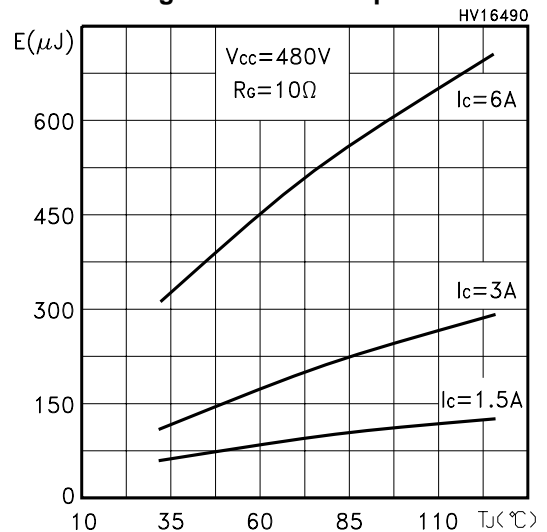
Gate Charge vs Gate-Emitter Voltage



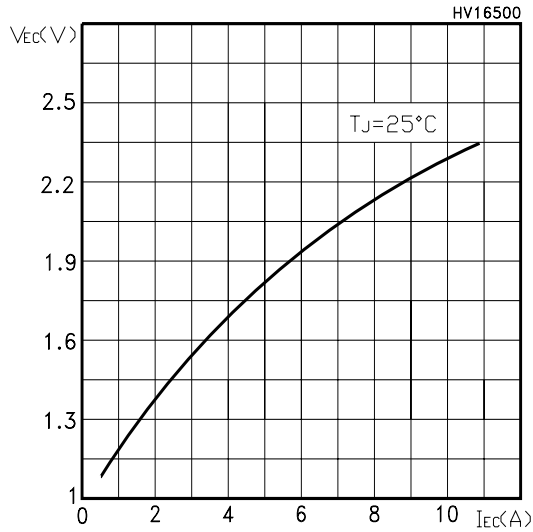
Total Switching Losses vs Gate Resistance



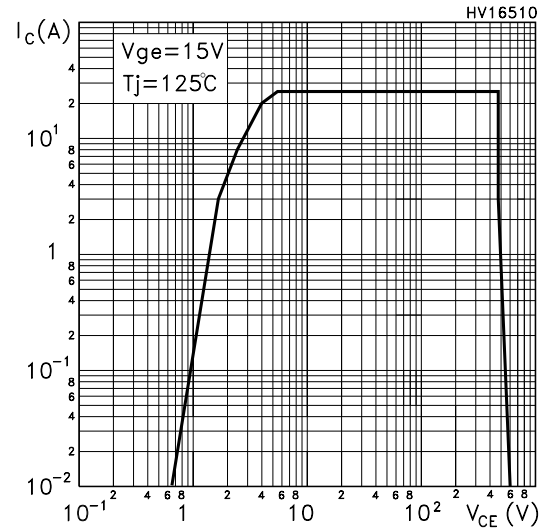
Total Switching Losses vs Temperature



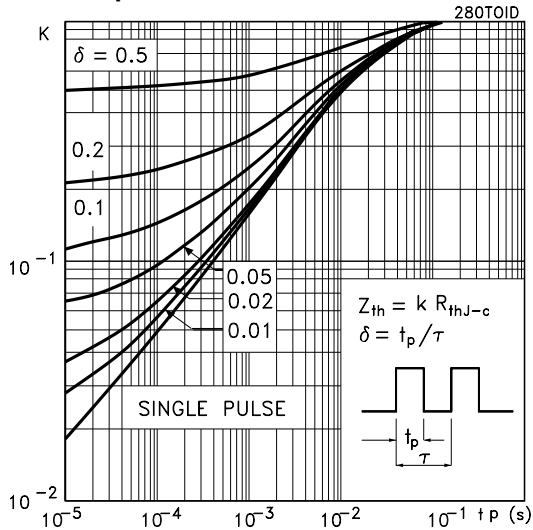
Emitter-collector Diode Characteristics



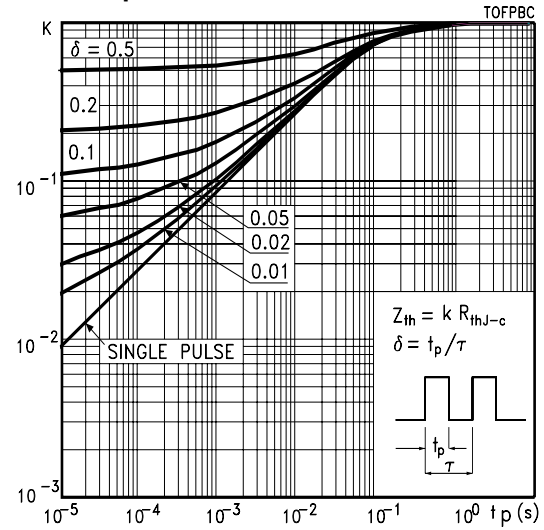
Turn-Off SOA



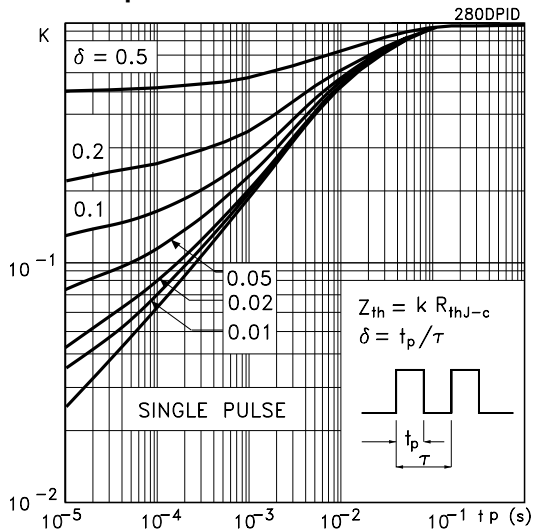
Thermal Impedance for TO-220 / D2PAK



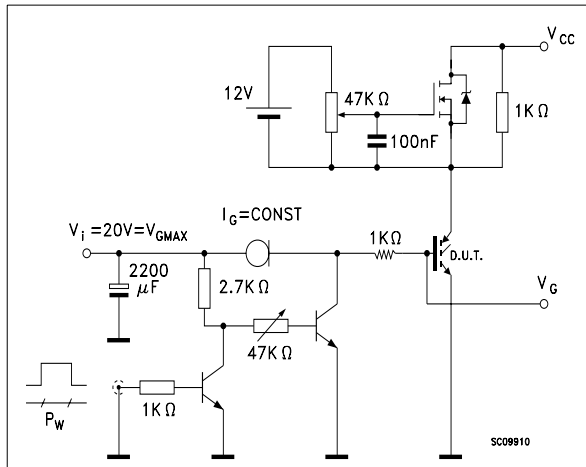
Thermal Impedance for TO-220FP



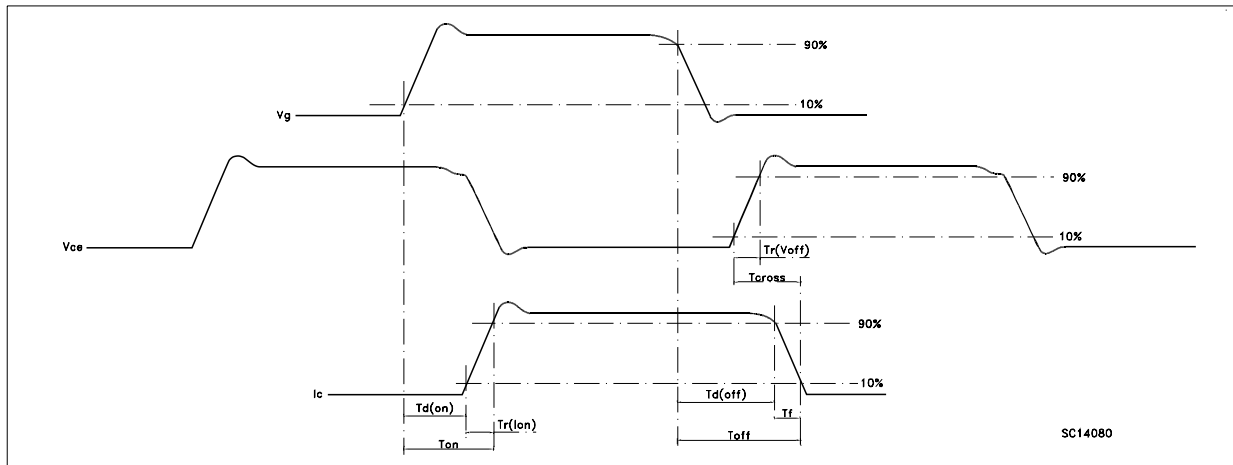
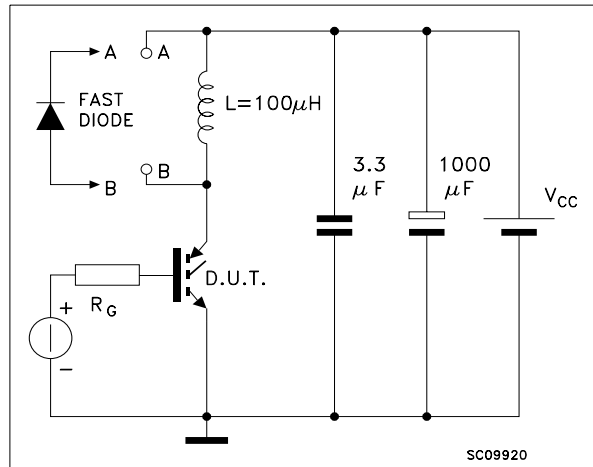
Thermal Impedance for DPAK



**Fig. 1: Gate Charge test Circuit**

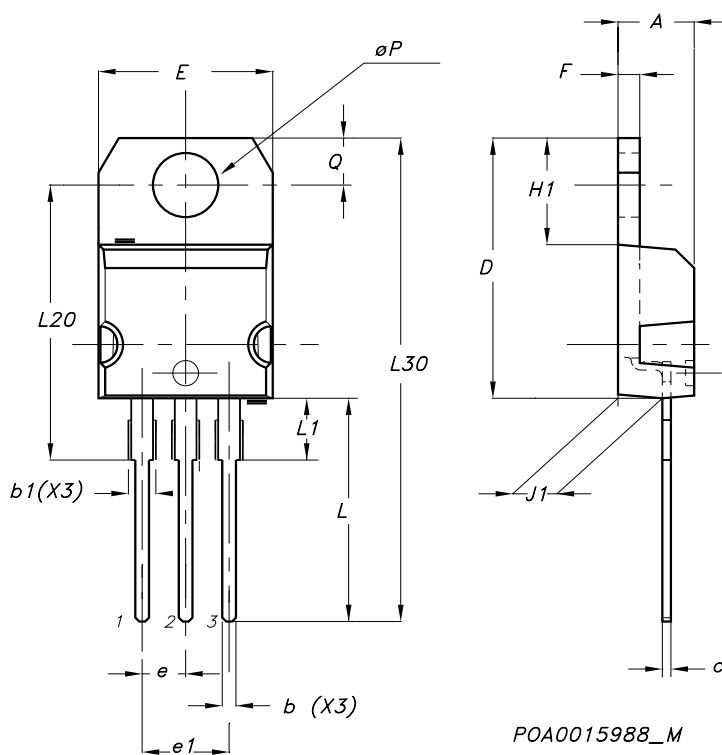


**Fig. 2: Test Circuit For Inductive Load Switching**



## TO-220 MECHANICAL DATA

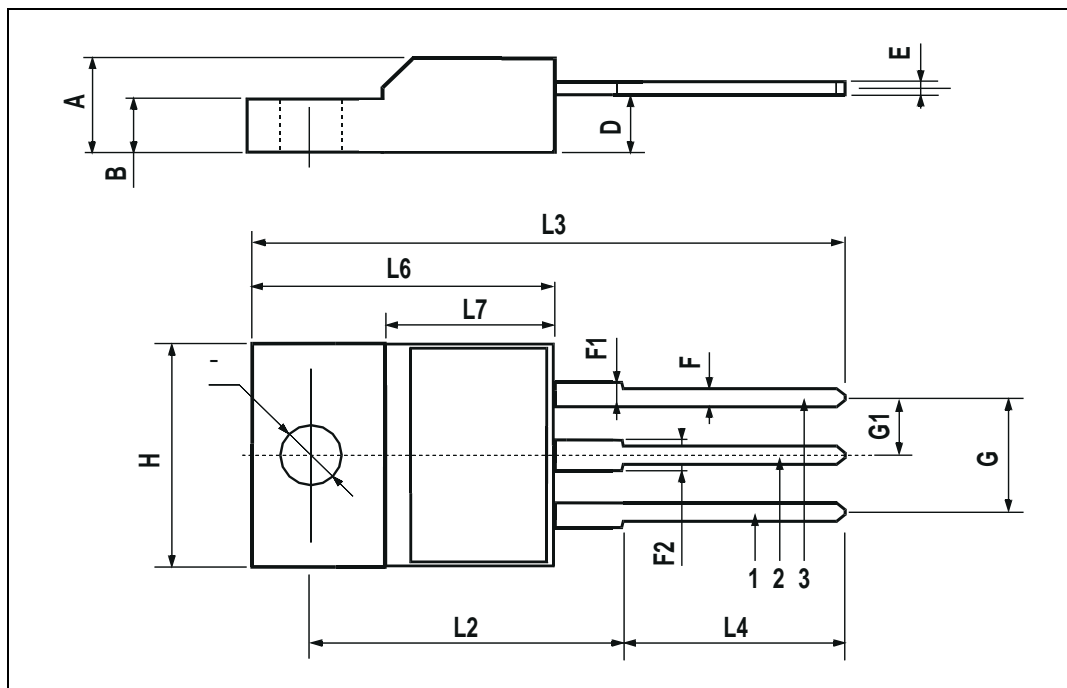
DIM.	mm.			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
b	0.61		0.88	0.024		0.034
b1	1.15		1.70	0.045		0.066
c	0.49		0.70	0.019		0.027
D	15.25		15.75	0.60		0.620
E	10		10.40	0.393		0.409
e	2.40		2.70	0.094		0.106
e1	4.95		5.15	0.194		0.202
F	1.23		1.32	0.048		0.052
H1	6.20		6.60	0.244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





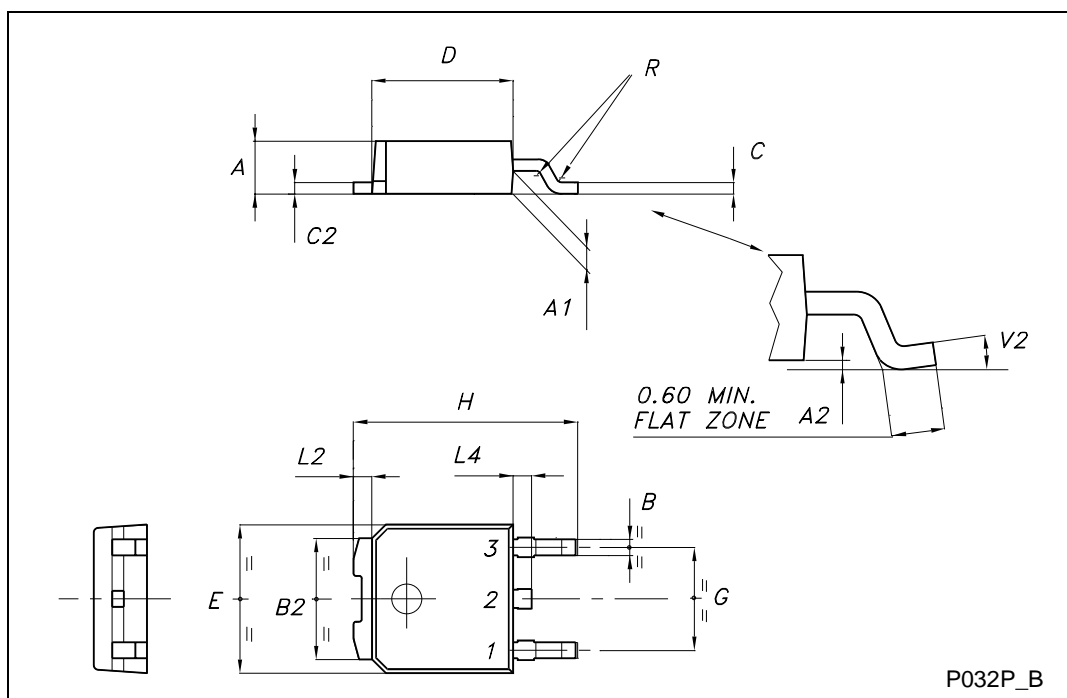
TO-220FP MECHANICAL DATA

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	0.385		0.417
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



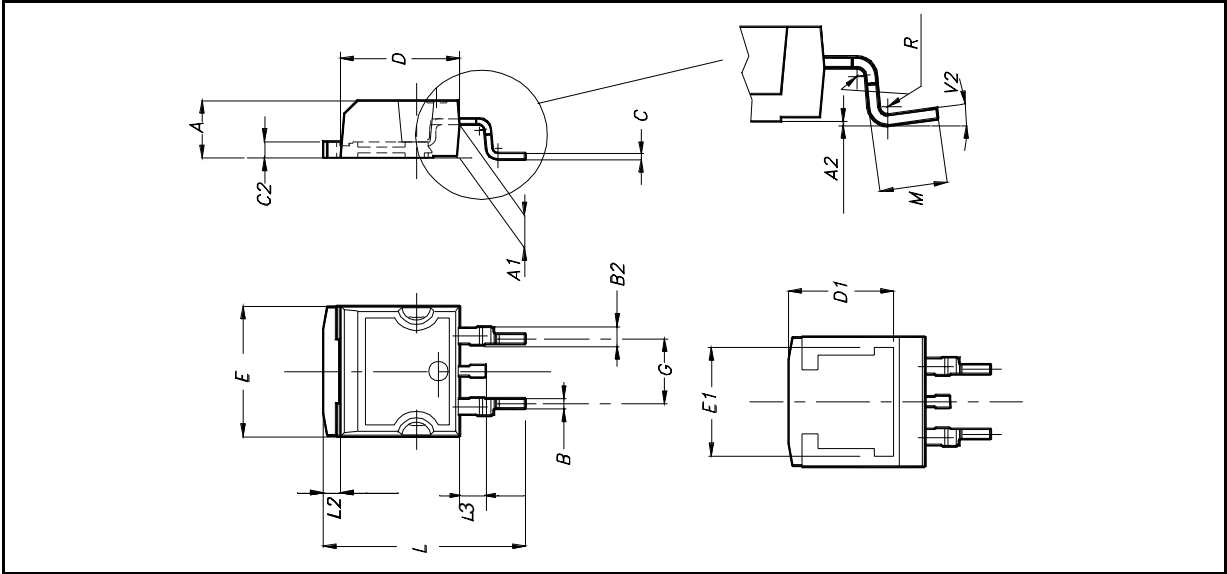
TO-252 (DPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.20		2.40	0.087		0.094
A1	0.90		1.10	0.035		0.043
A2	0.03		0.23	0.001		0.009
B	0.64		0.90	0.025		0.035
B2	5.20		5.40	0.204		0.213
C	0.45		0.60	0.018		0.024
C2	0.48		0.60	0.019		0.024
D	6.00		6.20	0.236		0.244
E	6.40		6.60	0.252		0.260
G	4.40		4.60	0.173		0.181
H	9.35		10.10	0.368		0.398
L2		0.8			0.031	
L4	0.60		1.00	0.024		0.039
V2	0°		8°	0°		0°

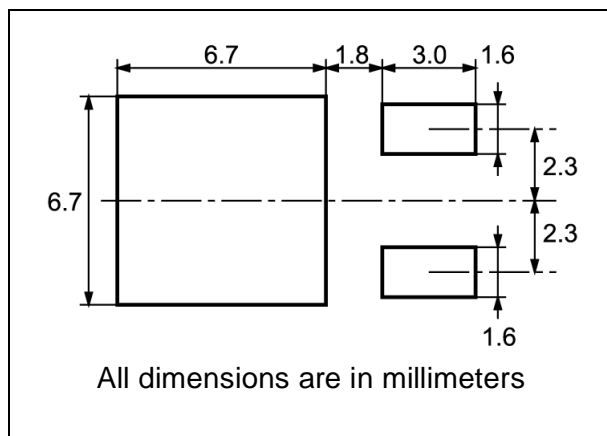


D<sup>2</sup>PAK MECHANICAL DATA

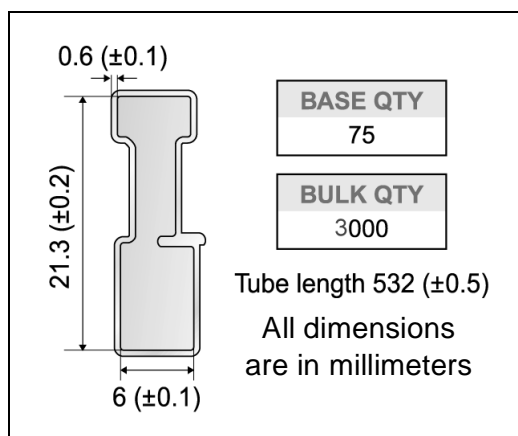
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334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



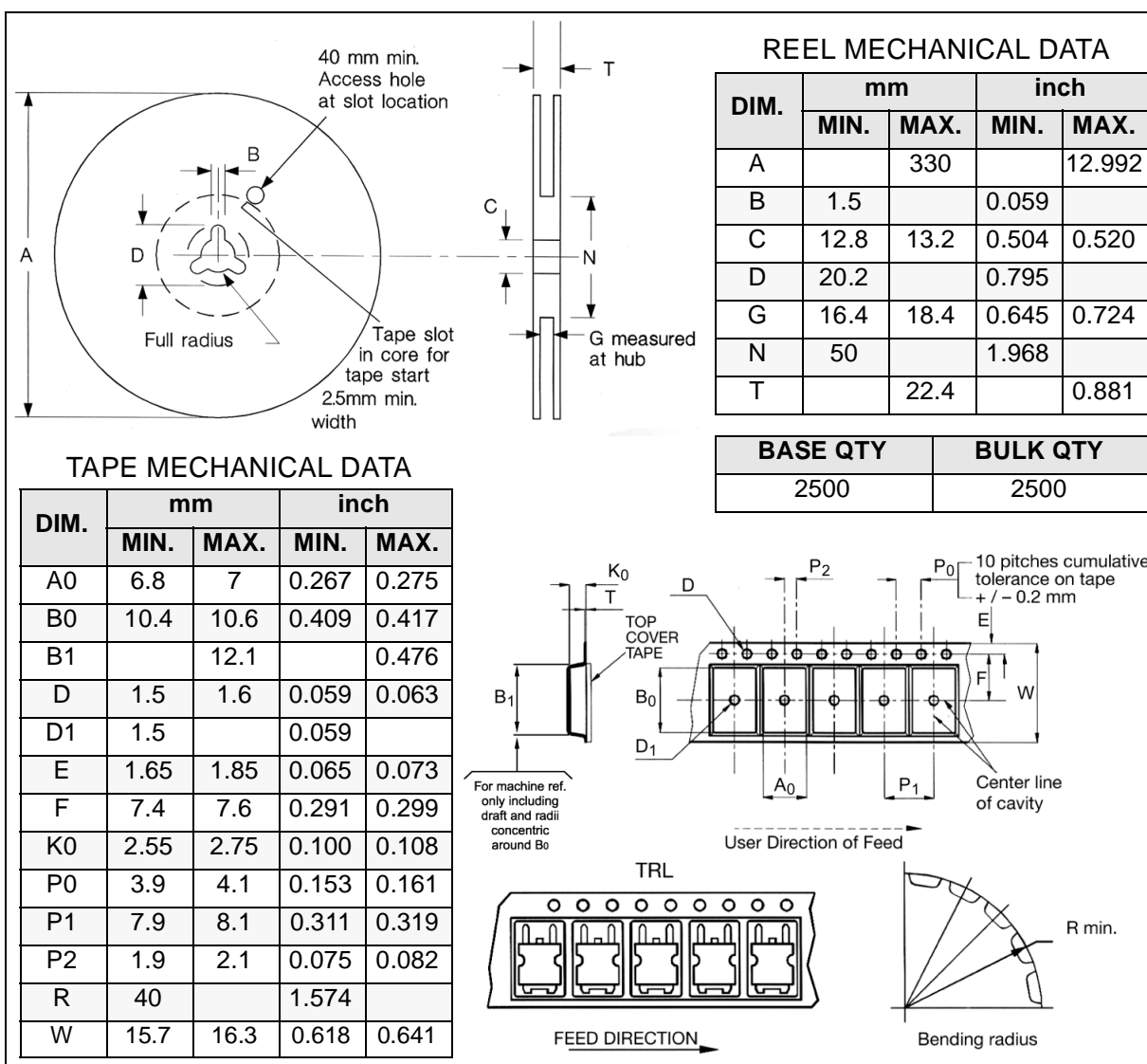
## DPAK FOOTPRINT



## TUBE SHIPMENT (no suffix)\*

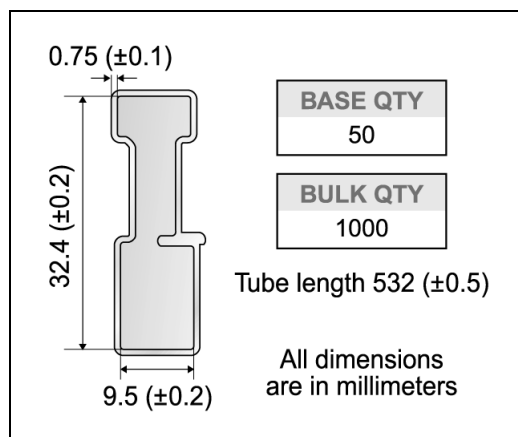
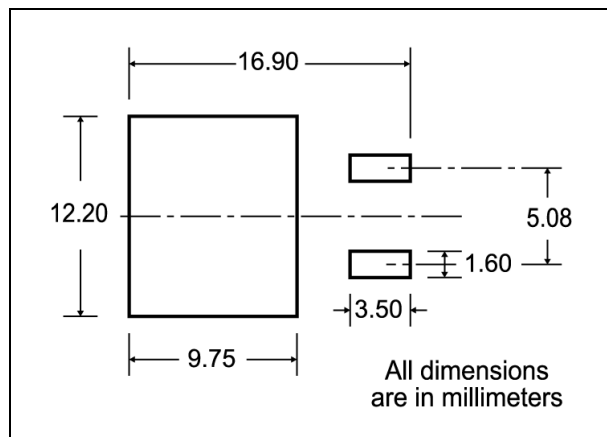


## TAPE AND REEL SHIPMENT (suffix "T4")\*

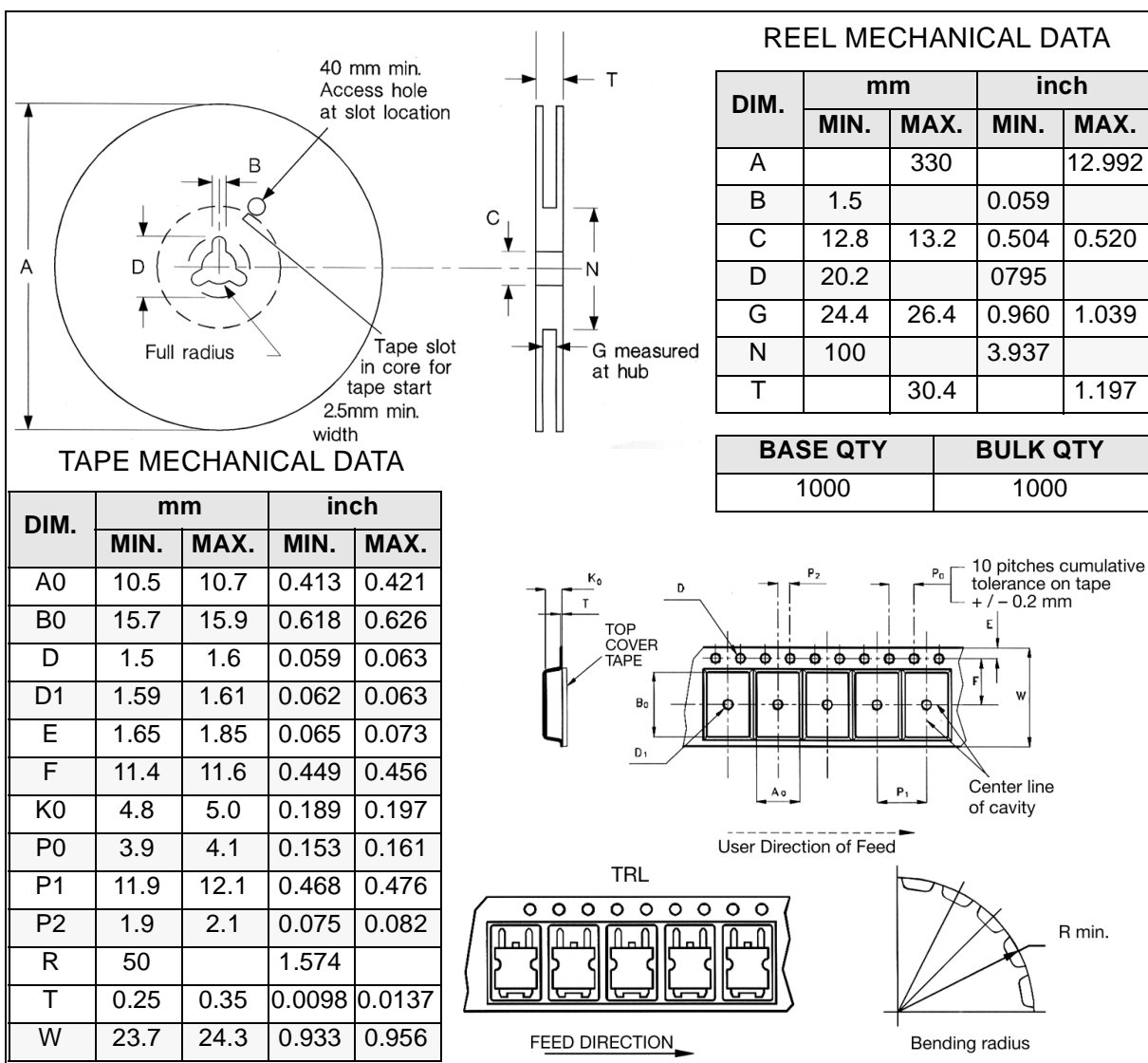


\* on sales type

**STGP3NB60F/STGD3NB60F/STGP3NB60FD/STGF3NB60FD/STGB3NB60FD**  
**D<sup>2</sup>PAK FOOTPRINT**      **TUBE SHIPMENT (no suffix)\***



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



\* on sales



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