STGP3NB60F - STGD3NB60F

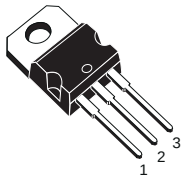
STGP3NB60FD-STGF3NB60FD-STGB3NB60FD

N-CHANNEL 3A - 600V - TO-220/TO-220FP/DPAK/D²PAK

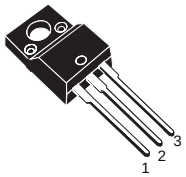
PowerMESH™ IGBT

TYPE	V_{CES}	$V_{CE(sat)}$ (Typ) @125°C	I_C @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

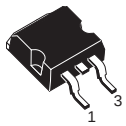
- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED



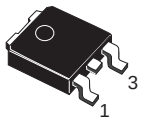
TO-220



TO-220FP

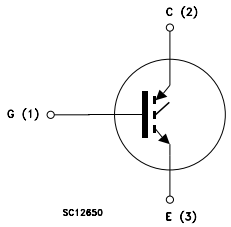


D²PAK

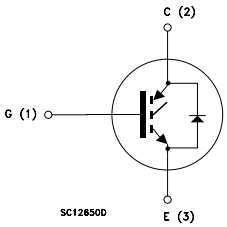


DPAK

INTERNAL SCHEMATIC DIAGRAM



Std. Version



"D" Version

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

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	D²PAK	TAPE & REEL

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value			Unit
		TO-220/D²PAK	TO-220FP	DPAK	
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°C	6			A
I_C	Collector Current (continuous) at T_C = 100°C	3			A
I_{CM} (▪)	Collector Current (pulsed)	24			A
I_f (1)	Forward Current	3			A
I_{fm} (1)	Forward Current Pulsed	24			A
P_{TOT}	Total Dissipation at T_C = 25°C	68	25	60	W
	Derating Factor	0.55	0.2	0.47	W/°C
V_{ISO}	Insulation Withstand Voltage A.C.	--	2500	--	V
T_{stg}	Storage Temperature	– 55 to 150			°C
T_j	Max. Operating Junction Temperature	150			°C

(▪) Pulse width limited by safe operating area

(1) For “D” version only

THERMAL DATA

		TO-220/D²PAK	TO-220FP	DPAK	
Rthj-case	Thermal Resistance Junction-case Max	1.8	5	2.1	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5		100	°C/W
Rthc-h	Thermal Resistance Case-heatsink Typ	0.5			°C/W

ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C UNLESS OTHERWISE SPECIFIED)

MAIN PARAMETERS

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	I_C = 250 µA, V_{GE} = 0	600			V
I_{CES}	Collector cut-off (V_{GE} = 0)	V_{CE} = Max Rating, T_C = 25°C V_{CE} = Max Rating, T_C = 125°C			50 100	µA µA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = ±20V , V_{CE} = 0			±100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 250 µA	3		5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15 V, I_C = 3 A V_{GE} = 15 V, I_C = 3 A, Tj =125°C		1.9 1.6	2.4	V V

SWITCHING PARAMETERS

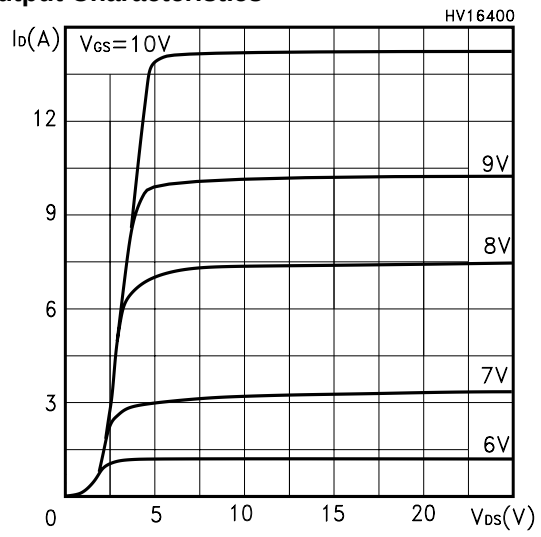
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward Transconductance	V_{CE} = 25 V, Ic = 3 A		2		S
C_{ies} C_{oes} C_{res}	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{CE} = 25 V, f = 1 MHz, V_{GE} = 0		230 33 6		pF pF pF
Q_g Q_{ge} Q_{gc}	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	V_{CE} = 480 V, I_C = 3 A, V_{GE} = 15 V		16 1.5 8	20	nC nC nC
$t_{d(on)}$ t_r	Turn-on Delay Time Rise Time	V_{CC} = 480 V, I_C = 3 A R_G = 10Ω, V_{GE} = 15 V		12.5 4		ns ns
$(di/dt)_{on}$ Eon	Turn-on Current Slope Turn-on Switching Losses	V_{CC}= 480 V, I_C = 3 A R_G=10Ω V_{GE} = 15 V,Tj = 125°C		840 31		A/µs µJ
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 V, I_C = 3 A, R_{GE} = 10 Ω , V_{GE} = 15 V Tj = 25 °C		220 60 105 150 125 149		ns ns ns ns µJ µJ
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 V, I_C = 3 A, R_{GE} = 10 Ω , V_{GE} = 15 V Tj = 125 °C		490 174 230 305 295 326		ns ns ns ns µJ µJ

COLLECTOR-EMITTER DIODE (“D” VERSION)

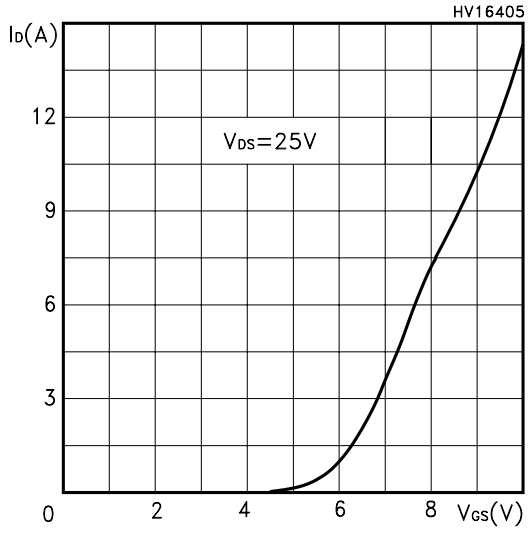
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V_f	Forward On-Voltage	I_f = 1.5 A I_f = 1.5 A, Tj = 125 °C		1.31 0.95	1.8	V V
t_{rr} Q_{rr} I_{rrm}	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	I_f = 3 A ,V_R = 35 V, Tj =125°C, di/dt = 100 A/µs		45 70 2.7		ns nC A

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)

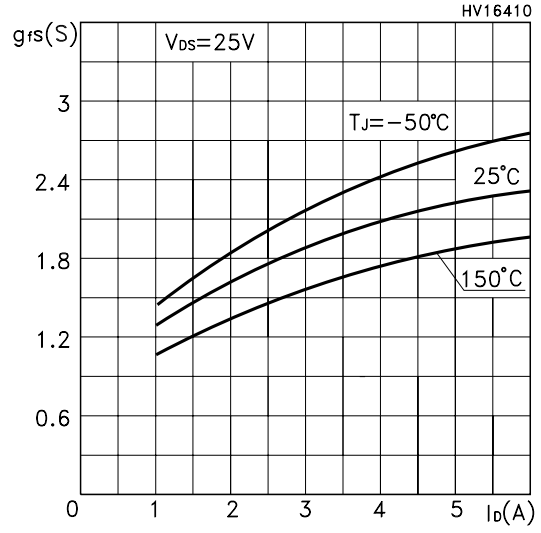
Output Characteristics



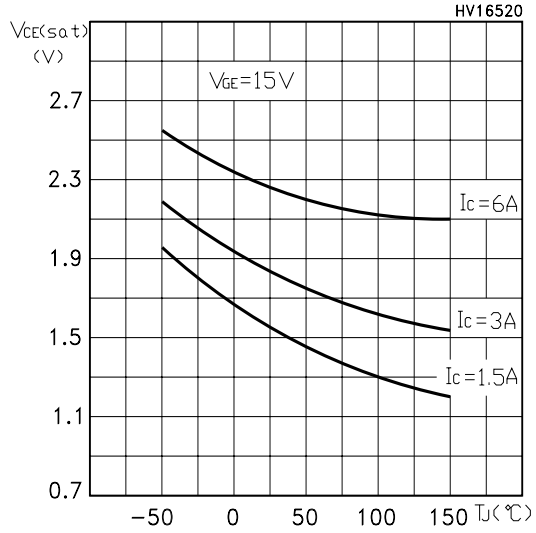
Transfer Characteristics



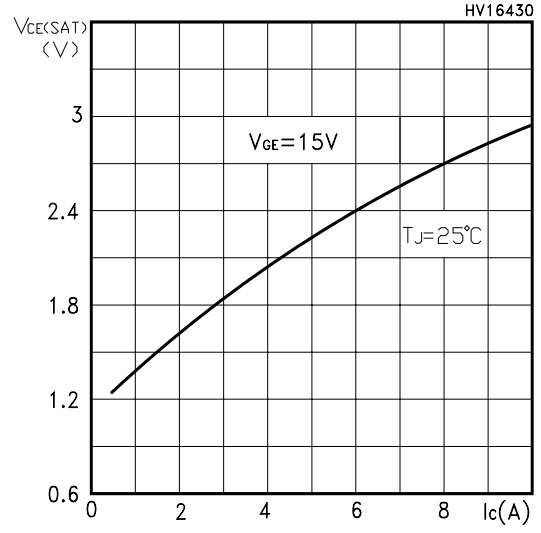
Transconductance



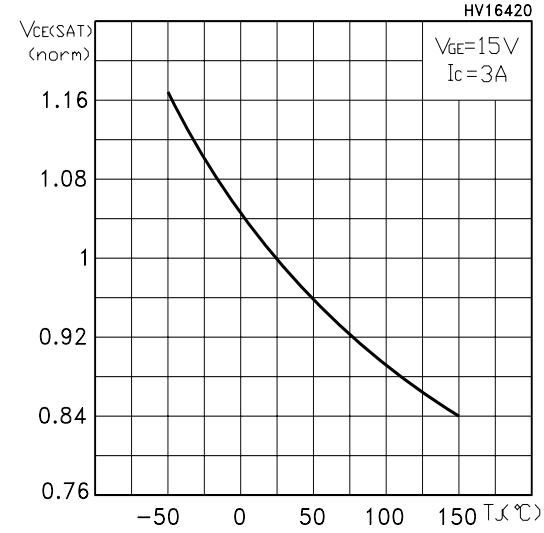
Collector-Emitter On Voltage vs Temperature



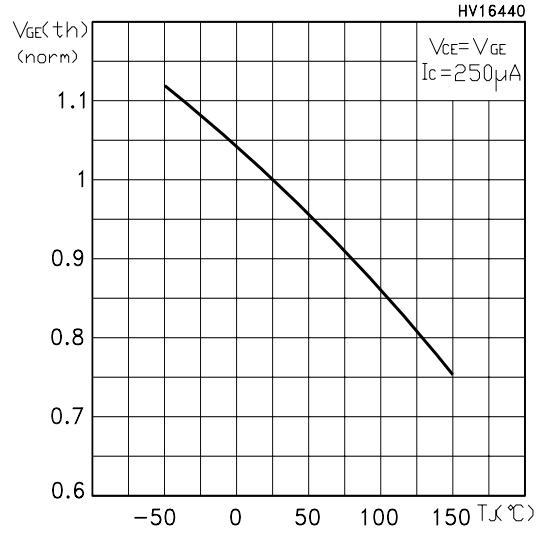
Collector-Emitter On Voltage vs Collector Current



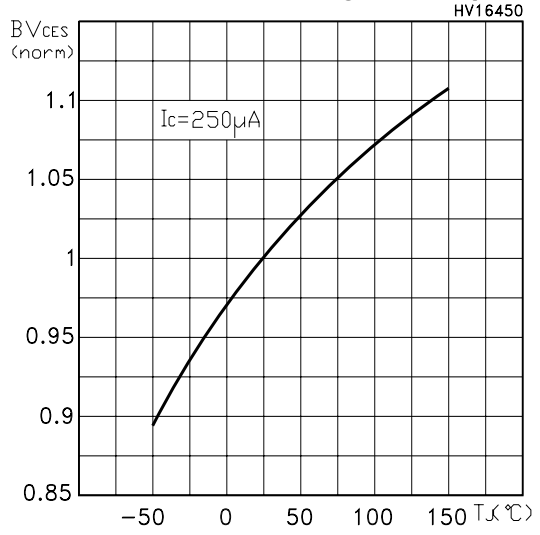
Normalized Collector-Emitter On Voltage vs Temp.



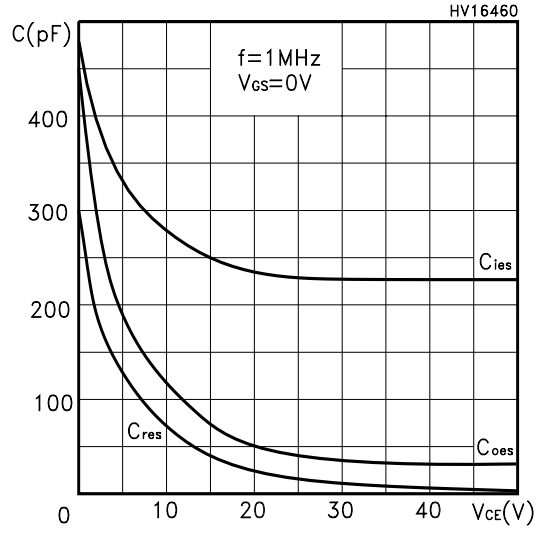
Gate Threshold vs Temperature



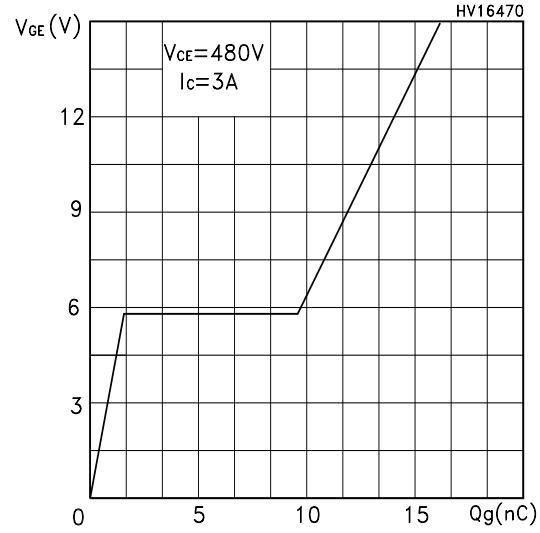
Normalized Breakdown Voltage vs Temperature



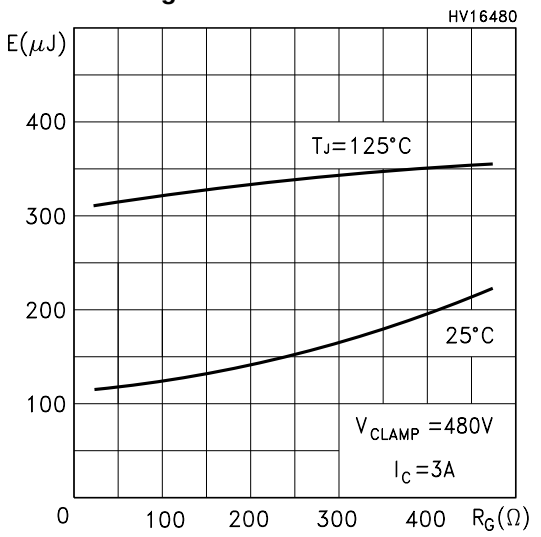
Capacitance Variations



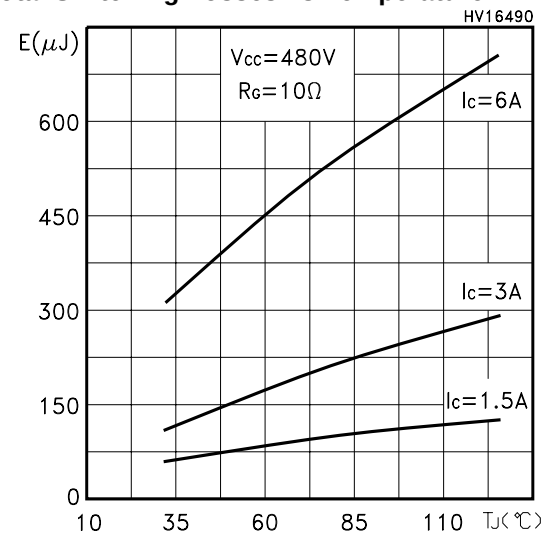
Gate Charge vs Gate-Emitter Voltage



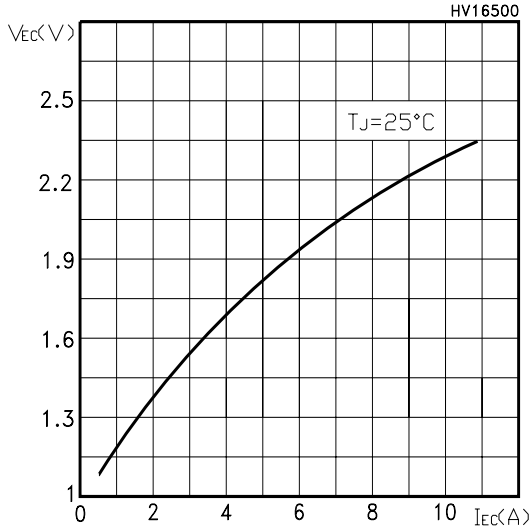
Total Switching Losses vs Gate Resistance



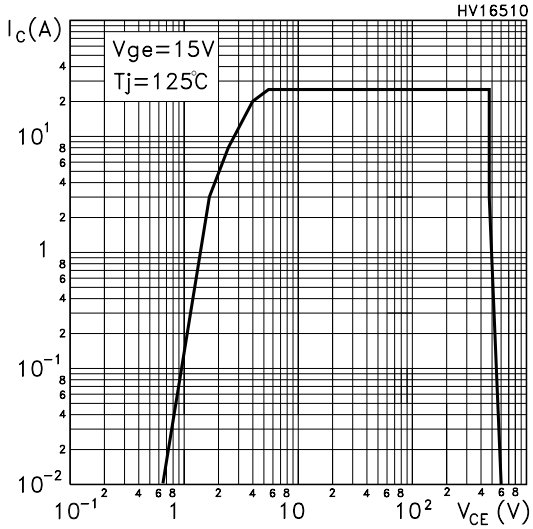
Total Switching Losses vs Temperature



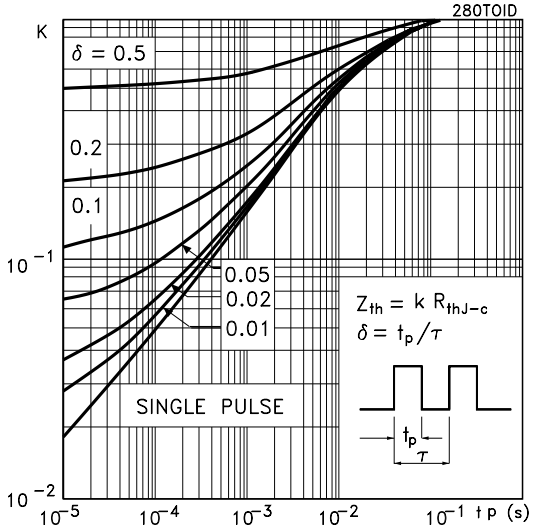
Emitter-collector Diode Characteristics



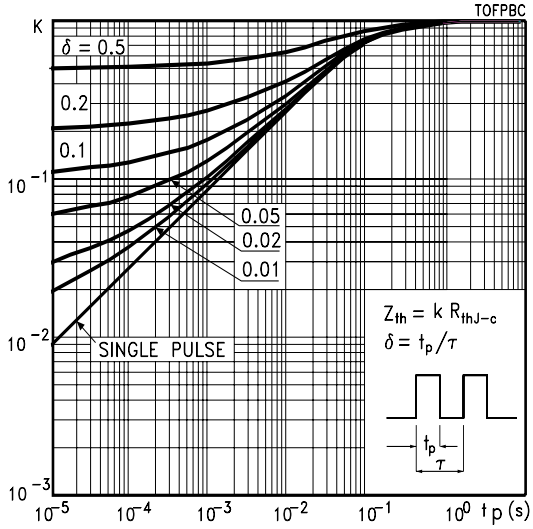
Turn-Off SOA



Thermal Impedance for TO-220 / D2PAK



Thermal Impedance for TO-220FP



Thermal Impedance for DPAK

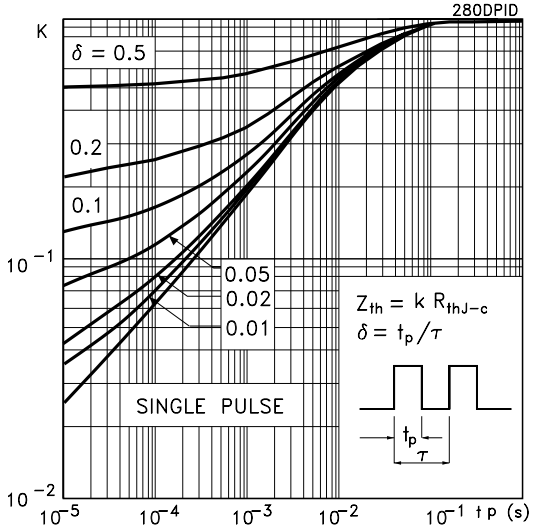


Fig. 1: Gate Charge test Circuit

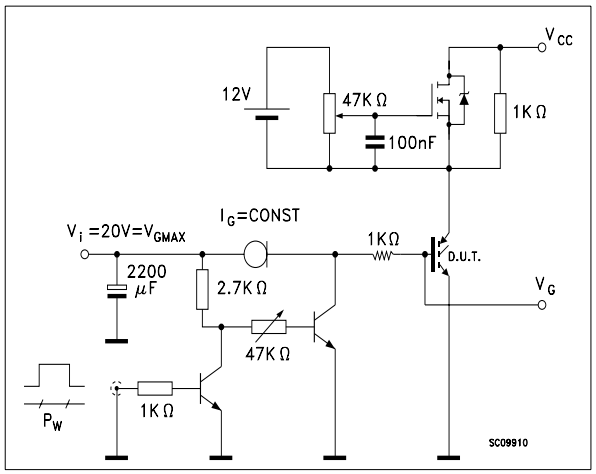
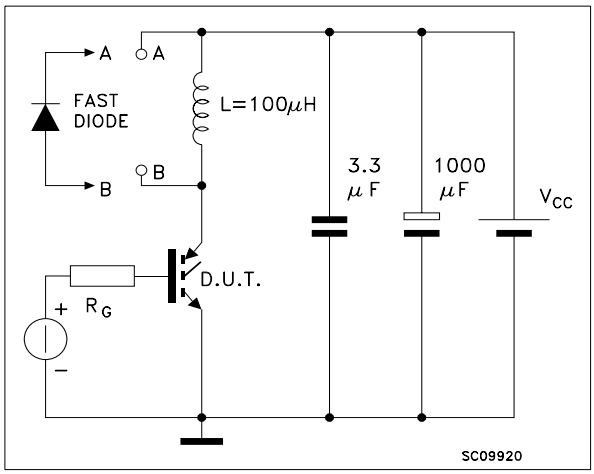
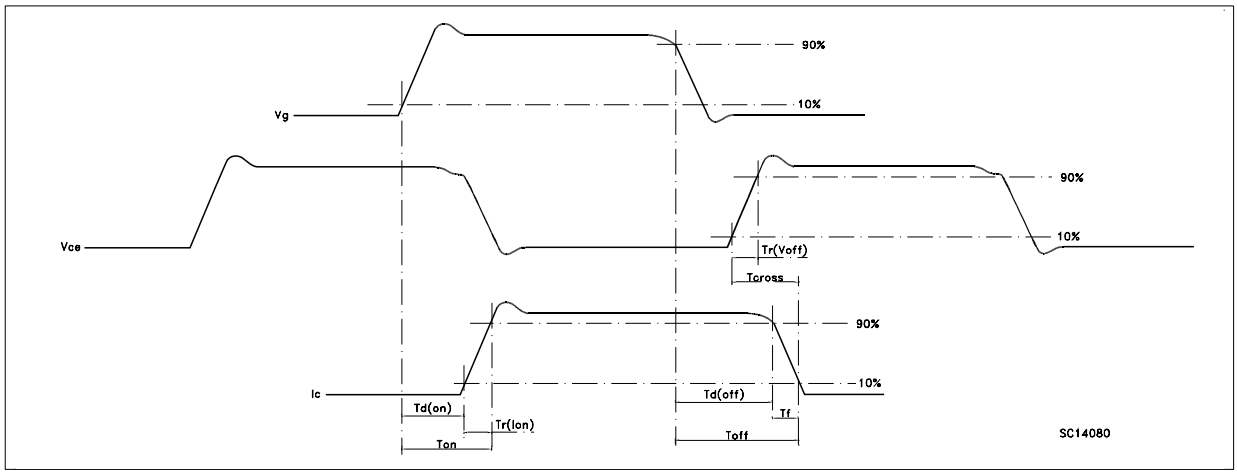


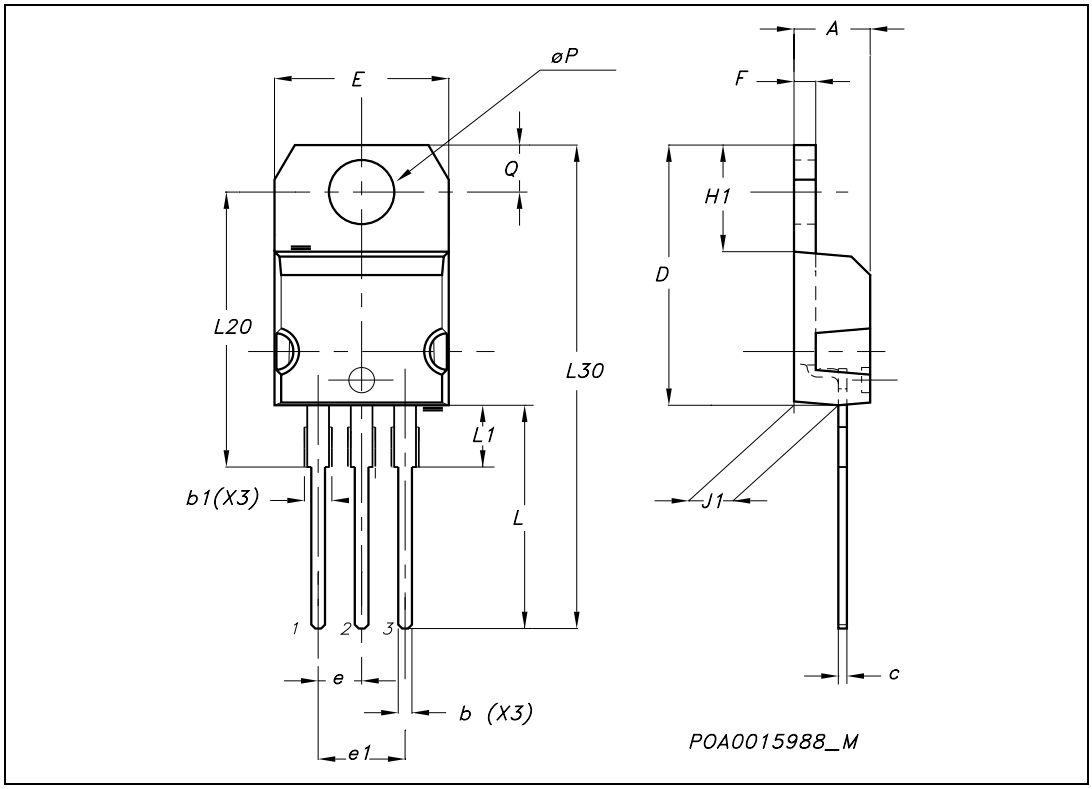
Fig. 2: Test Circuit For Inductive Load Switching





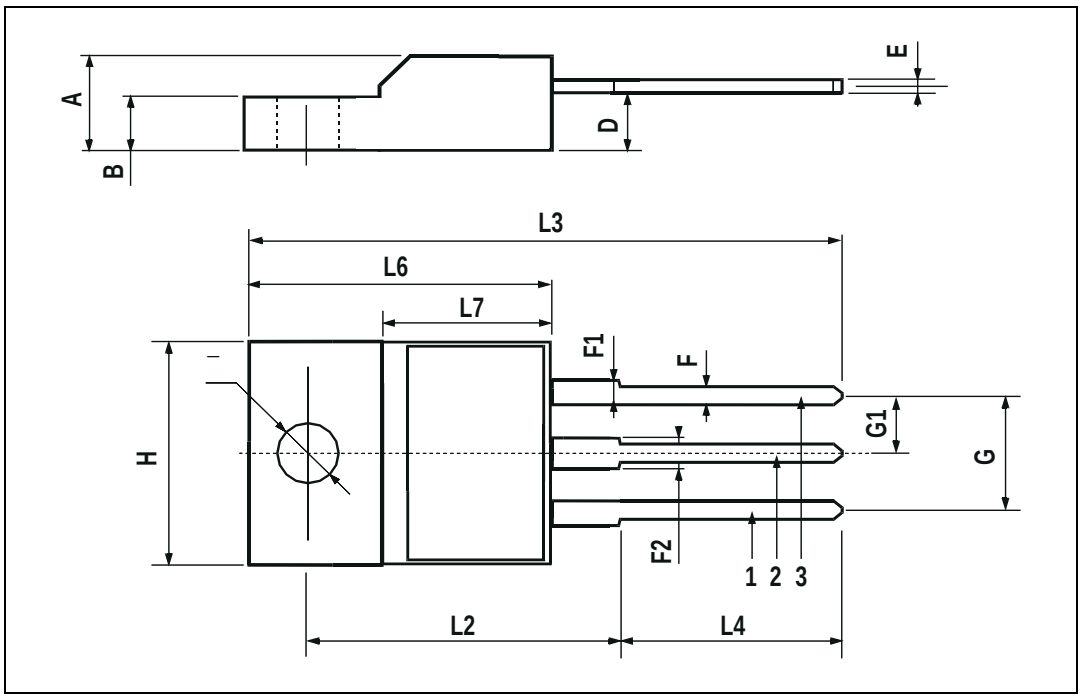
TO-220 MECHANICAL DATA

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



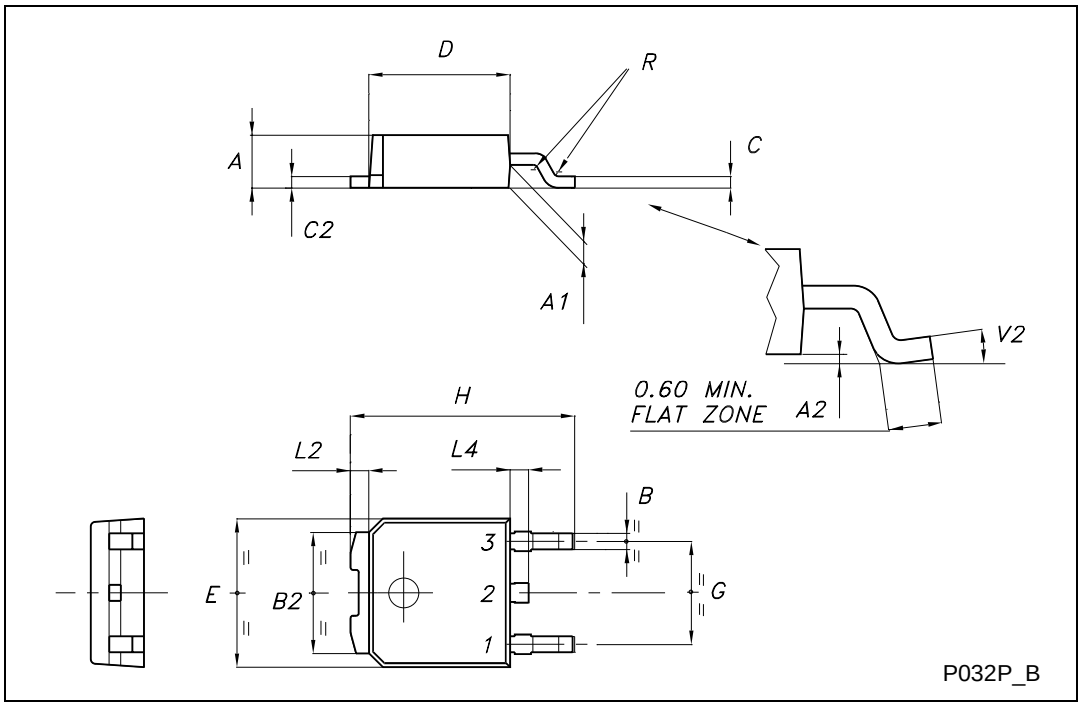
TO-220FP MECHANICAL DATA

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



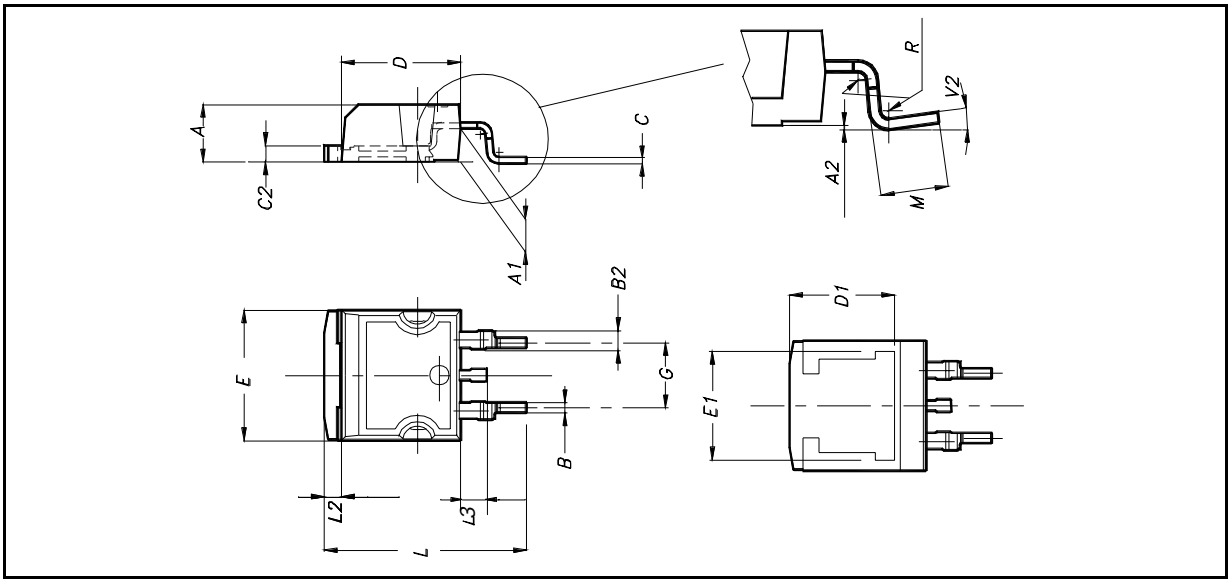
TO-252 (DPAK) MECHANICAL DATA

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^o		8^o	0^o		0^o

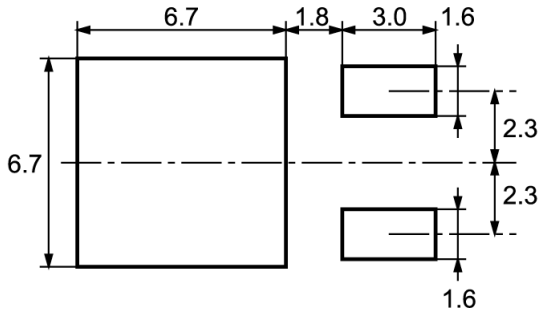


D²PAK MECHANICAL DATA

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	0º		8º			

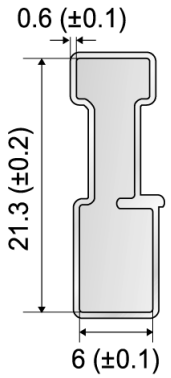


DPAK FOOTPRINT



All dimensions are in millimeters

TUBE SHIPMENT (no suffix)*



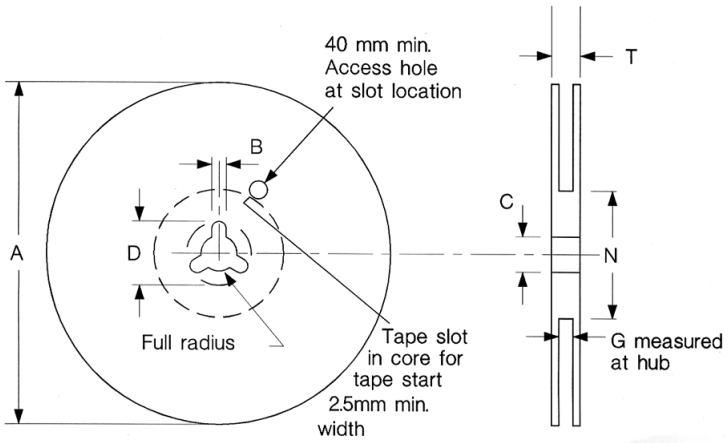
BASE QTY
75

BULK QTY
3000

Tube length 532 (±0.5)

All dimensions are in millimeters

TAPE AND REEL SHIPMENT (suffix "T4")*



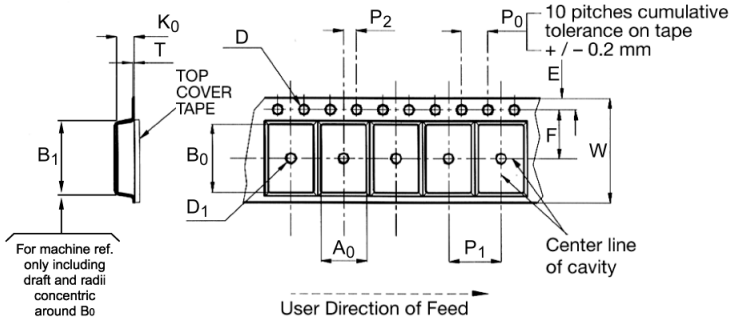
REEL MECHANICAL DATA

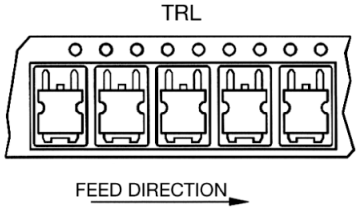
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A		330		12.992
B	1.5		0.059	
C	12.8	13.2	0.504	0.520
D	20.2		0.795	
G	16.4	18.4	0.645	0.724
N	50		1.968	
T		22.4		0.881

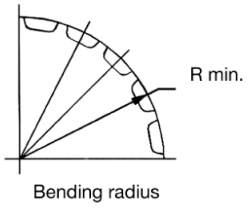
BASE QTY	BULK QTY
2500	2500

TAPE MECHANICAL DATA

DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618	0.641

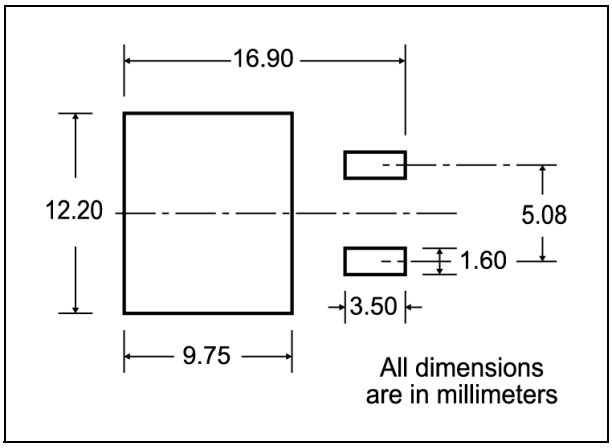




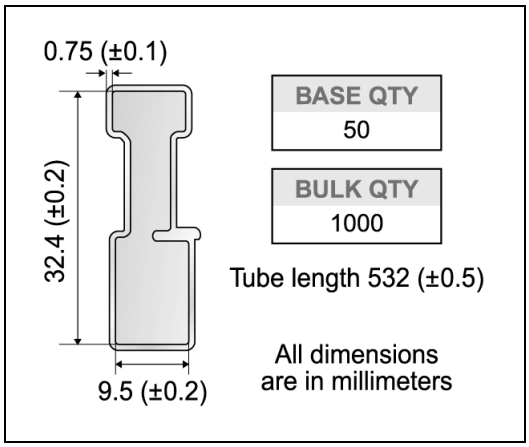


* on sales type

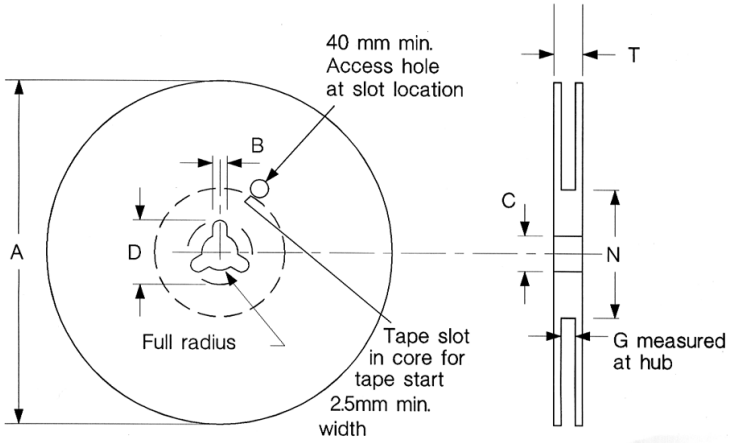
D^2PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*



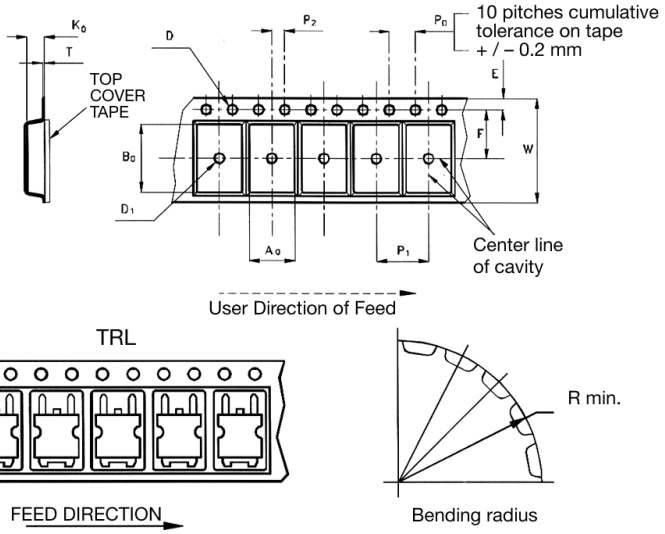
REEL MECHANICAL DATA

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		0795	
G	24.4	26.4	0.960	1.039
N	100		3.937	
T		30.4		1.197

BASE QTY	BULK QTY
1000	1000

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



* on sales