



# STGP3NB60K - STGD3NB60K

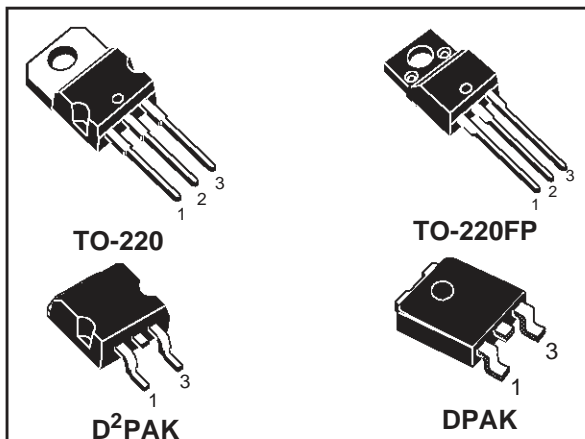
## STGP3NB60KD-STGP3NB60KDFP-STGB3NB60KD

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

### PowerMESH™ IGBT

TYPE	V <sub>CE(S)</sub>	V <sub>CE(sat)</sub> (Typ) @125°C	I <sub>C</sub> @125°C
STGP3NB60K	600 V	< 2 V	3 A
STGD3NB60K	600 V	< 2 V	3 A
STGP3NB60KD	600 V	< 2 V	3 A
STGP3NB60KDFP	600 V	< 2 V	3 A
STGB3NB60KD	600 V	< 2 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

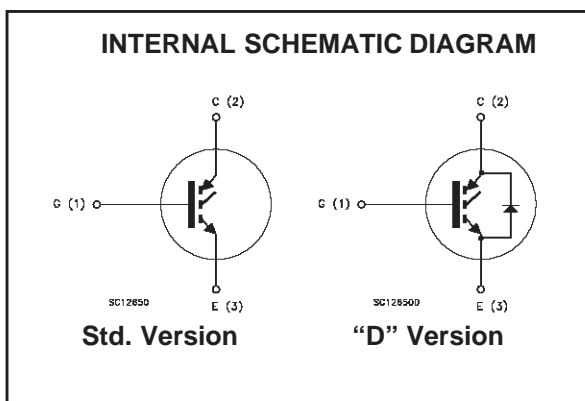


#### DESCRIPTION

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 "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 SWITCHING AND RESONANT TOPOLOGIES



#### ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGP3NB60K	GP3NB60K	TO-220	TUBE
STGD3NB60KT4	GD3NB60K	DPAK	TAPE & REEL
STGP3NB60KD	GP3NB60KD	TO-220	TUBE
STGP3NB60KDFP	GP3NB60KDFP	TO-220FP	TUBE
STGB3NB60KDT4	GB3NB60KD	D <sup>2</sup> PAK	TAPE & REEL

# STGP3NB60K/STGD3NB60K/STGP3NB60KD/STGP3NB60KDFP/STGB3NB60KD

## 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	6	6	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 100°C	3	3	3	A
I <sub>CM</sub> <sup>(n)</sup>	Collector Current (pulsed)	24	24	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	0.75			W/°C
V <sub>ISO</sub>	Insulation Withstand Voltage A.C.	--	2500	--	V
T <sub>stg</sub>	Storage Temperature	- 55 to 150 150			°C
T <sub>j</sub>	Max. Operating Junction Temperature				

<sup>(n)</sup> 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 (TCASE = 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			50 500	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
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> = 3 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 3 A, T <sub>J</sub> = 125°C		2.3 1.9	2.8	V V

## STGP3NB60K/STGD3NB60K/STGP3NB60KD/STGP3NB60KDFP/STGB3NB60KD

### SWITCHING PARAMETERS

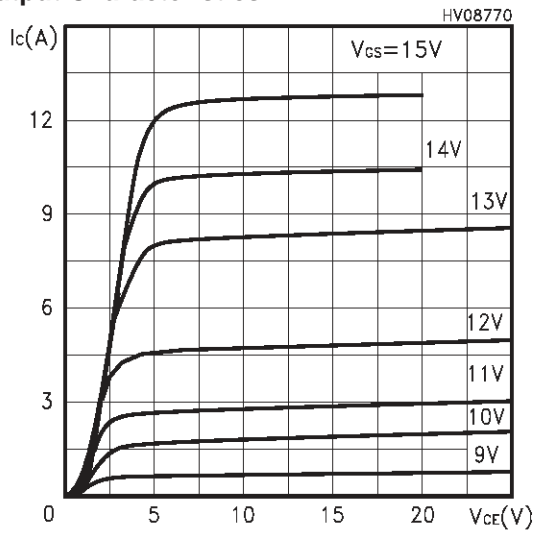
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25V, I_C = 3 A$		2.4		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25V, f = 1 MHz, V_{GE} = 0$		218 33 5.8		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480V, I_C = 3 A,$ $V_{GE} = 15V$		14 3.3 7.5	18	nC nC nC
$t_{scw}$	Short Circuit Withstand Time	$V_{ce} = 0.5 V_{BR(CES)}, V_{GE}=15V,$ $T_j = 125^\circ C, R_G = 10 \Omega$	10			$\mu s$
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{CC} = 480 V, I_C = 3 A$ $R_G = 10\Omega, V_{GE} = 15 V$		14 5		ns ns
$(di/dt)_{on}$ $E_{on}$	Turn-on Current Slope Turn-on Switching Losses	$V_{CC}= 480 V, I_C = 3 A R_G=10\Omega$ $V_{GE} = 15 V, T_j = 125^\circ C$		520 30		A/ $\mu s$ $\mu J$
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$ $E_{off(**)}$ $E_{ts}$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480 V, I_C = 3 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_j = 25^\circ C$		122 26.5 33 100 58 85		ns ns ns ns $\mu J$ $\mu J$
$t_c$ $t_r(V_{off})$ $t_{d(off)}$ $t_f$ $E_{off(**)}$ $E_{ts}$	Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss	$V_{CC} = 480 V, I_C = 3 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_j = 125^\circ C$		210 66 100 120 165 195		ns ns ns ns $\mu J$ $\mu J$

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

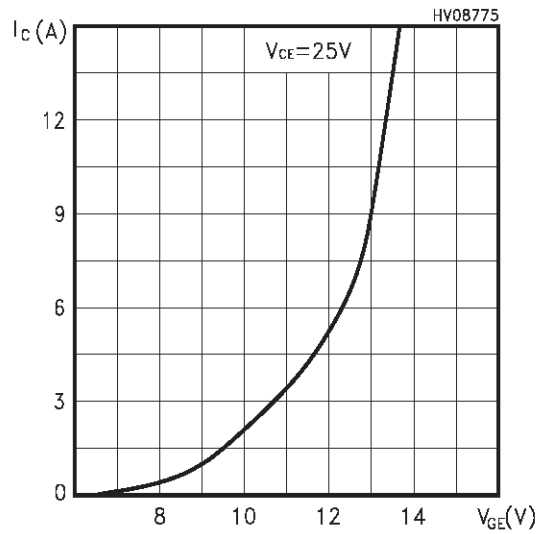
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_f$	Forward On-Voltage	$I_f = 1.5 A$ $I_f = 1.5 A, T_j = 125^\circ C$		1.31 0.95	1.8	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 3 A, V_R = 35 V,$ $T_j = 125^\circ C, di/dt = 100A/\mu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

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by max. junction temperature.  
(\*\*)Losses include Also the Tail (Jedec Standardization)

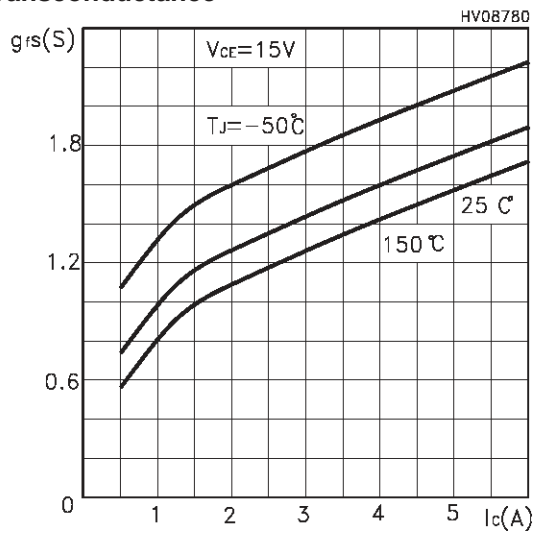
Output Characteristics



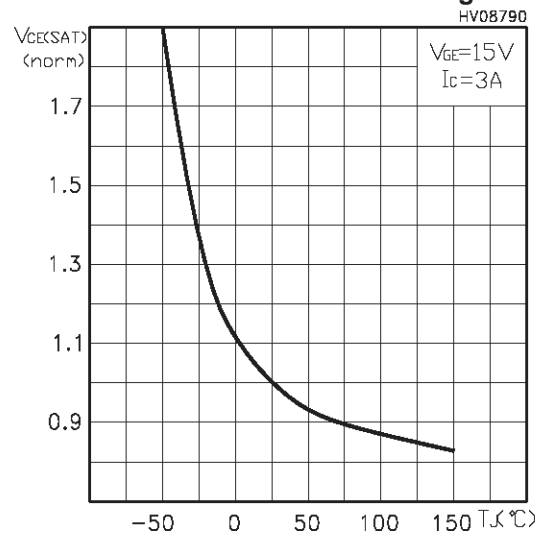
Transfer Characteristics



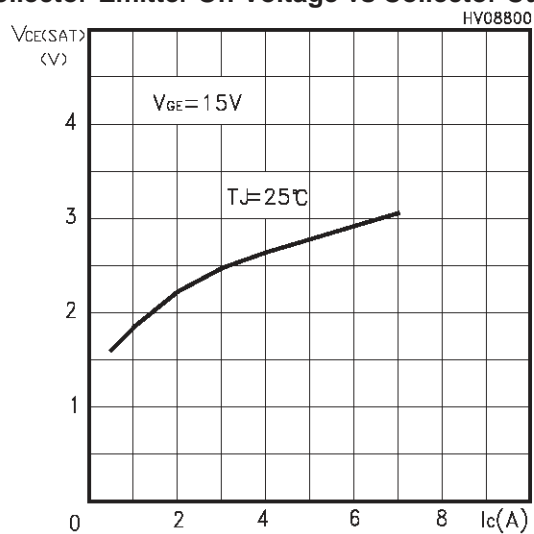
Transconductance



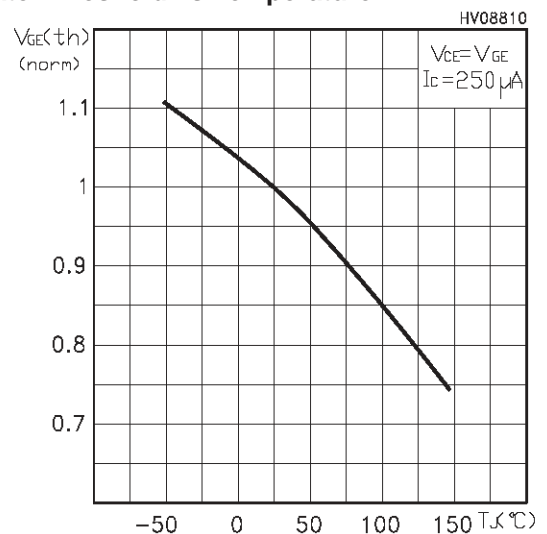
Normalized Collector-Emitter On Voltage vs Temp.



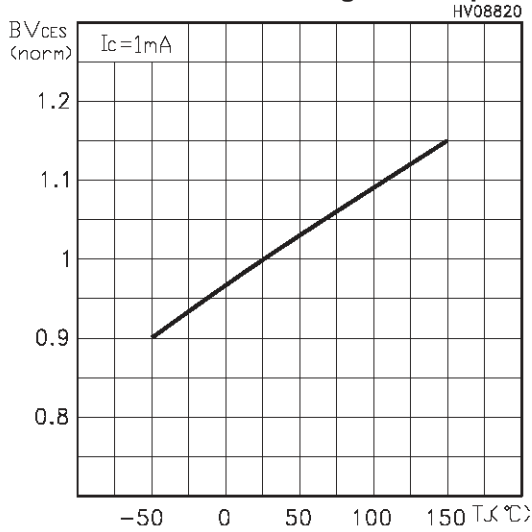
Collector-Emitter On Voltage vs Collector Current



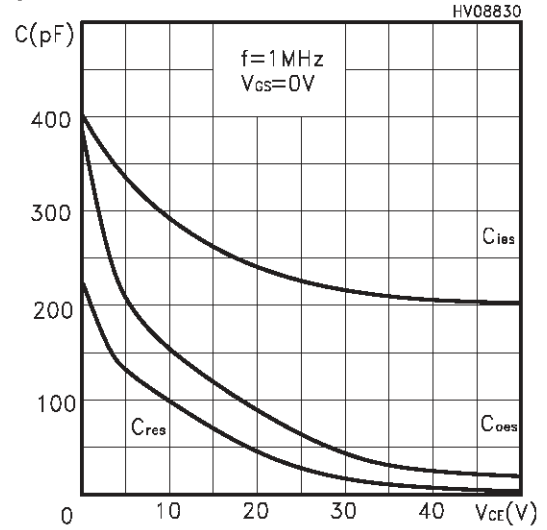
Gate Threshold vs Temperature



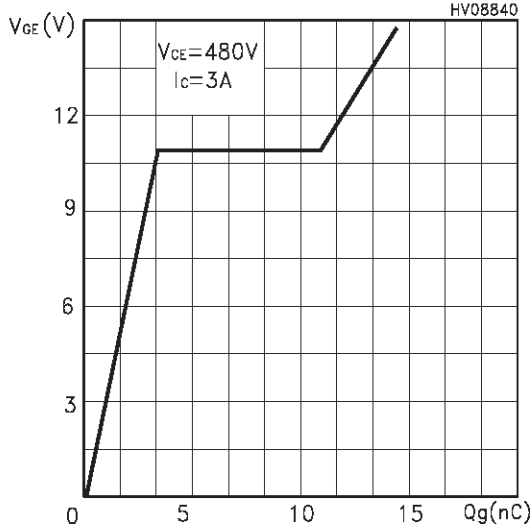
Normalized Breakdown Voltage vs Temperature



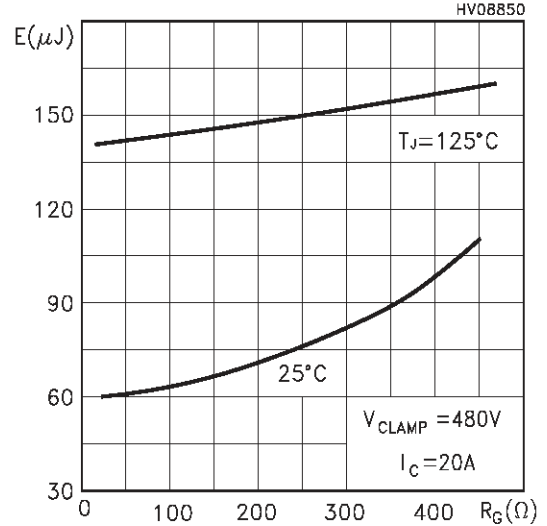
Capacitance Variations



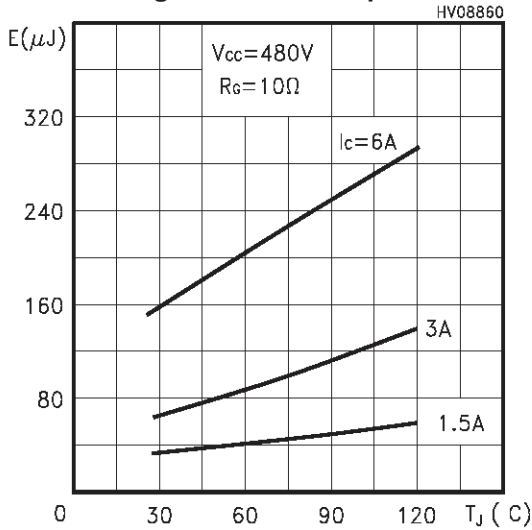
Gate Charge vs Gate-Emitter Voltage



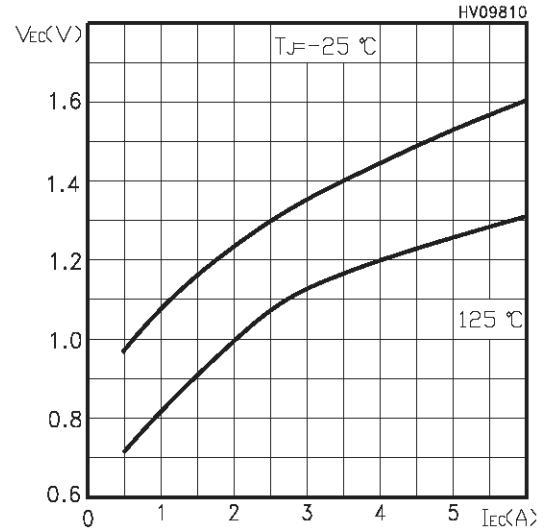
Total Switching Losses vs Gate Resistance



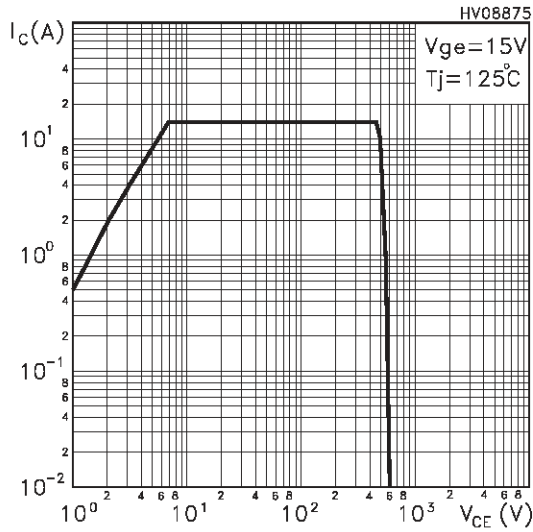
Total Switching Losses vs Temperature



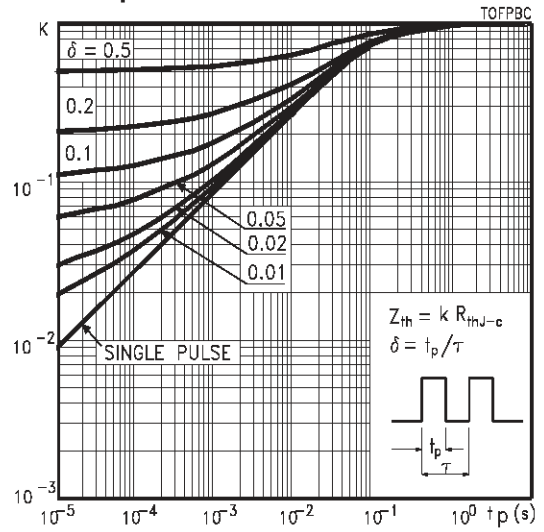
Emitter-collector Diode Characteristics



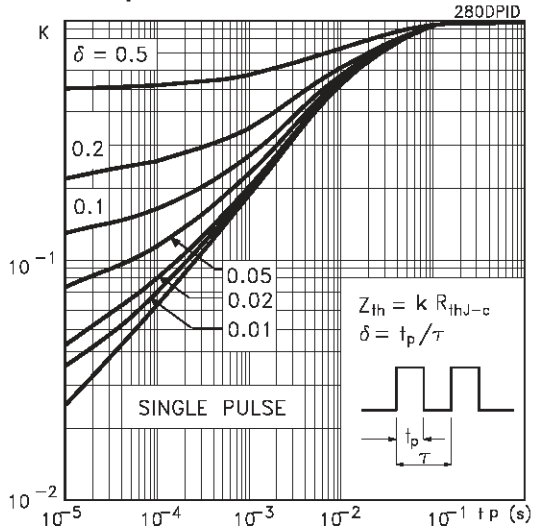
Turn-Off SOA



Thermal Impedance for TO-220FP



Thermal Impedance for DPAK



Thermal Impedance for TO-220 / D2PAK

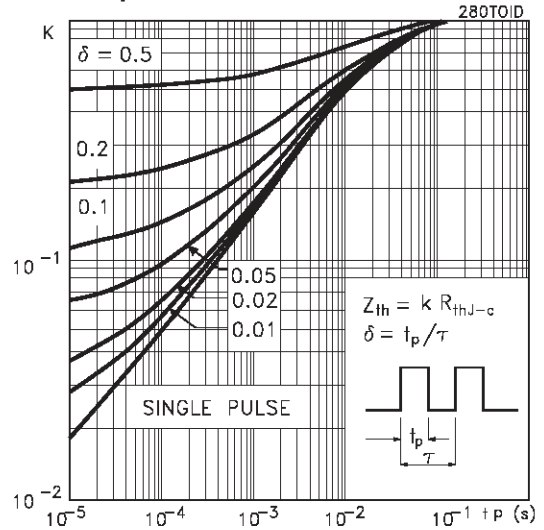


Fig. 1: Gate Charge test Circuit

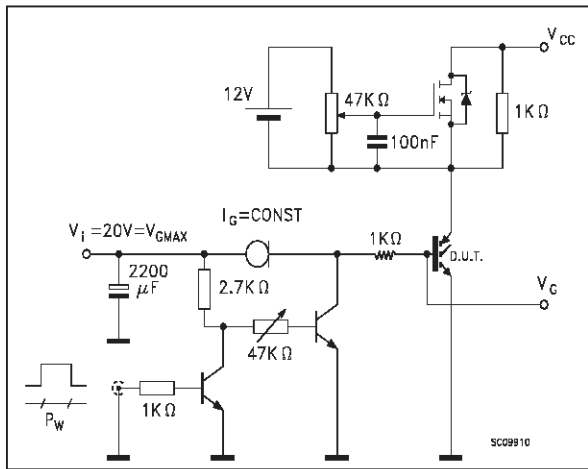
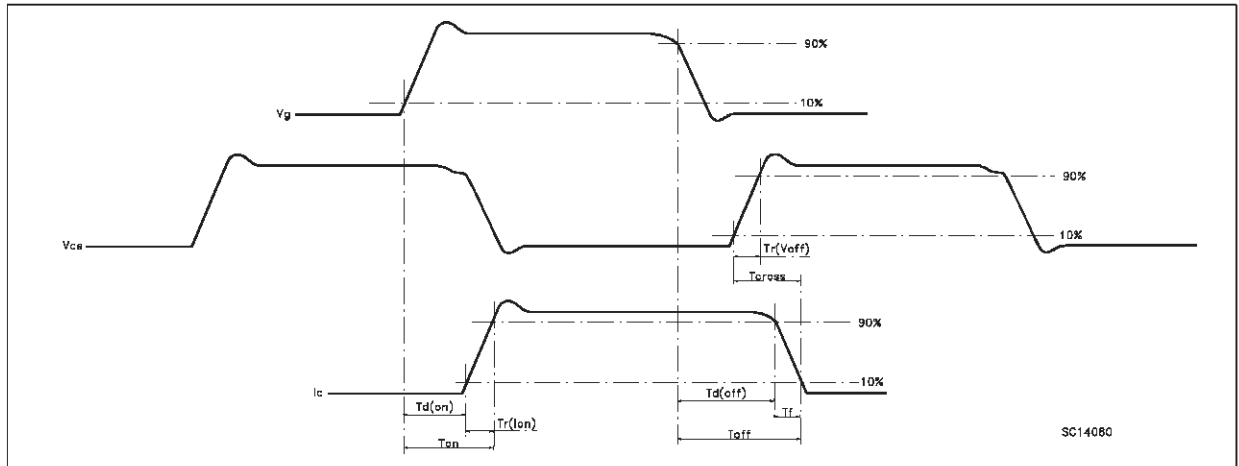
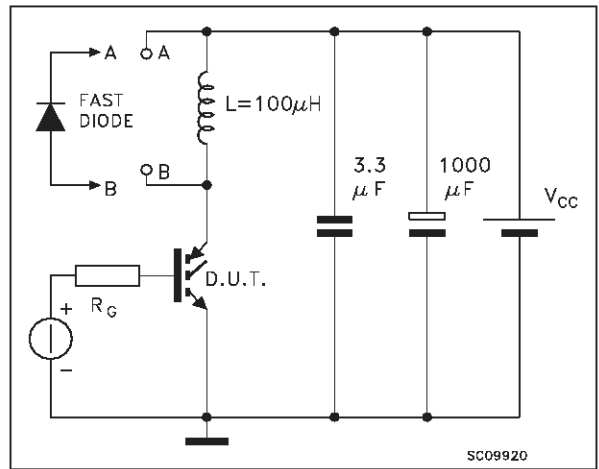
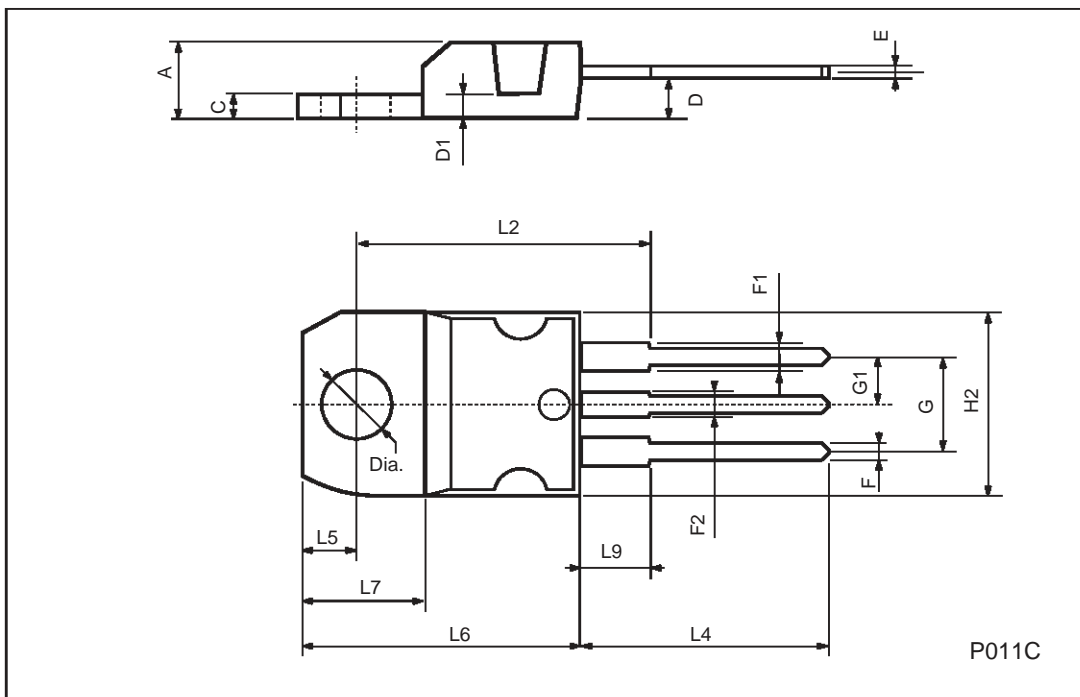


Fig. 2: Test Circuit For Inductive Load Switching



TO-220 MECHANICAL DATA

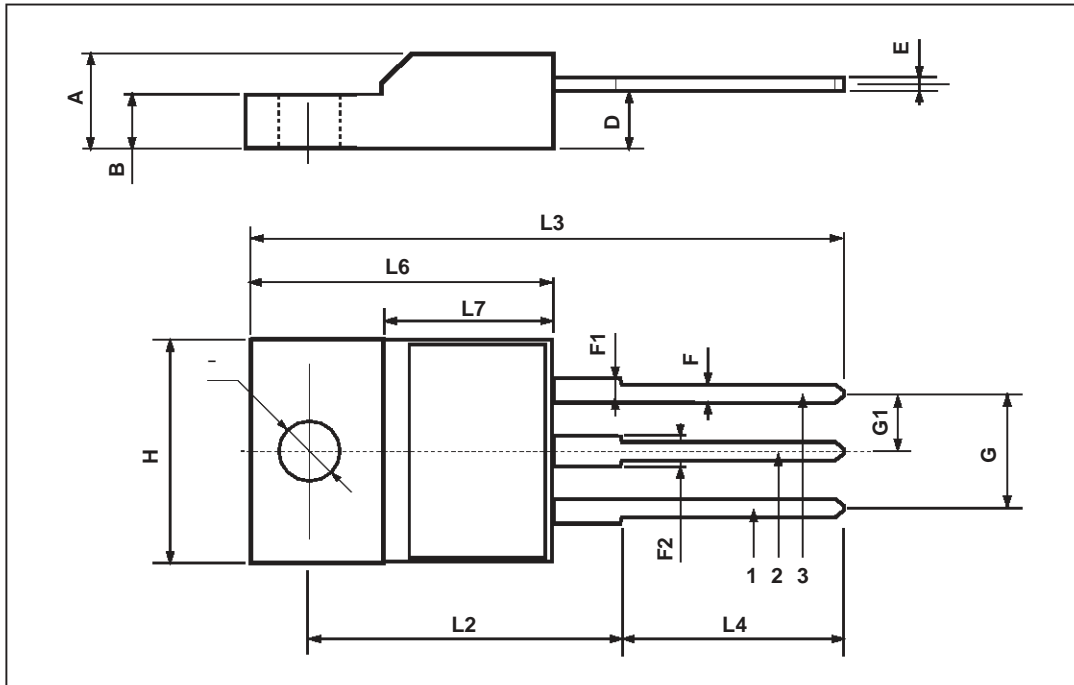
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
H2	10.0		10.40	0.393		0.409
L2		16.4			0.645	
L4	13.0		14.0	0.511		0.551
L5	2.65		2.95	0.104		0.116
L6	15.25		15.75	0.600		0.620
L7	6.2		6.6	0.244		0.260
L9	3.5		3.93	0.137		0.154
DIA.	3.75		3.85	0.147		0.151





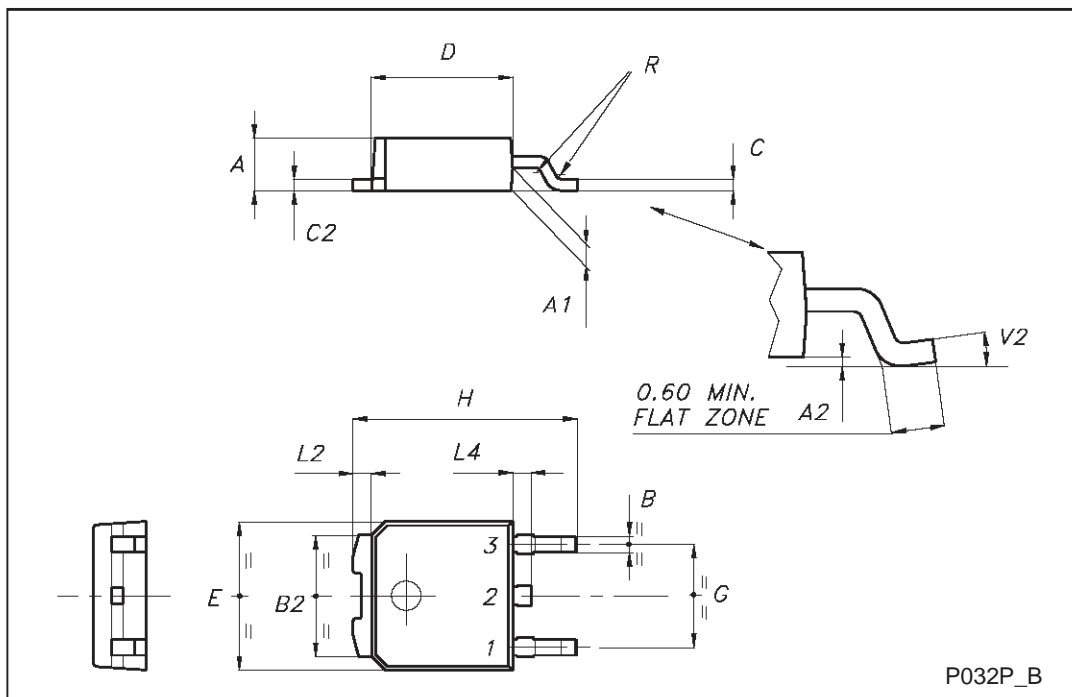
TO-220FP MECHANICAL DATA

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
∅	3		3.2	0.118		0.126



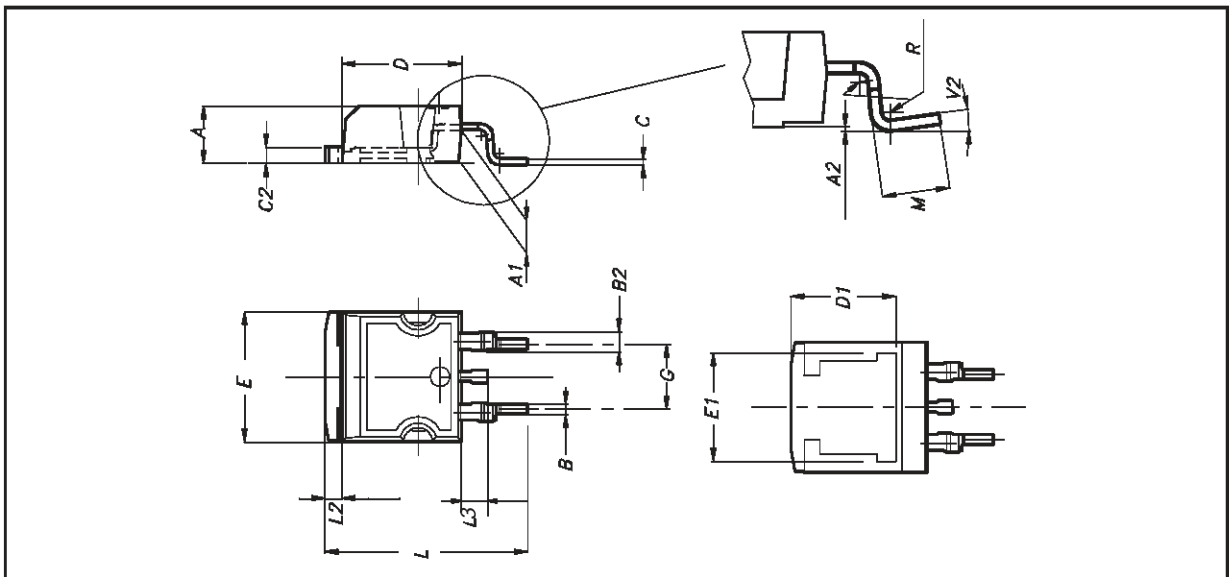
TO-252 (DPAK) MECHANICAL DATA

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°

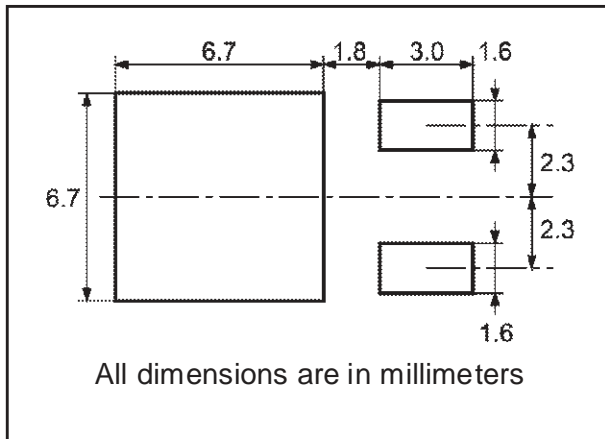


**D<sup>2</sup>PAK MECHANICAL DATA**

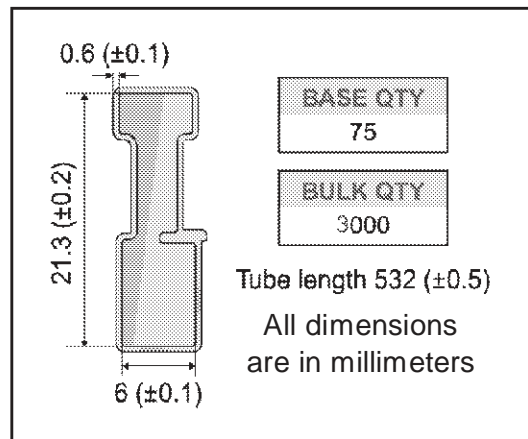
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334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

**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

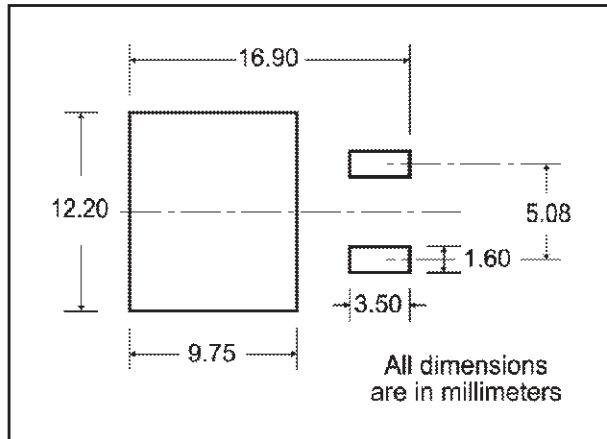
BASE QTY	BULK QTY
2500	2500

**TAPE MECHANICAL DATA**

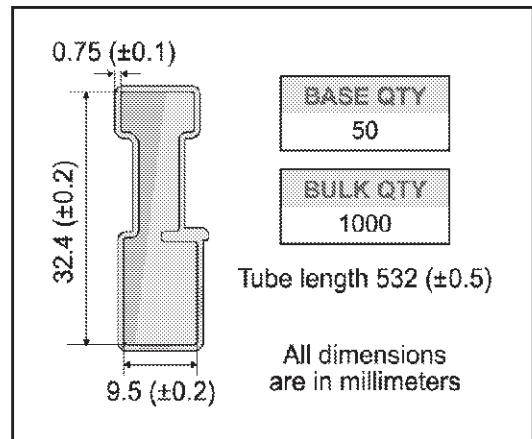
DIM.	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A0	6.8	7	0.267	0.275
B0	10.4	10.6	0.409	0.417
B1		12.1		0.476
D	1.5	1.6	0.059	0.063
D1	1.5		0.059	
E	1.65	1.85	0.065	0.073
F	7.4	7.6	0.291	0.299
K0	2.55	2.75	0.100	0.108
P0	3.9	4.1	0.153	0.161
P1	7.9	8.1	0.311	0.319
P2	1.9	2.1	0.075	0.082
R	40		1.574	
W	15.7	16.3	0.618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

\* on sales type

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



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



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

Diagram showing the tape mechanical data. Dimensions include A (overall width), B (width of the tape slot), C (width of the carrier), D (width of the tape), E (width of the carrier), F (width of the carrier), G (width of the carrier), and T (width of the carrier). A 40 mm min. access hole is required at the slot location. The tape slot in the core for tape start has a 2.5 mm min. width. The full radius is also indicated.

**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

**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

Diagram showing the carrier and reel mechanical data. Dimensions include K<sub>0</sub> (width of the carrier), B (width of the carrier), F<sub>0</sub> (width of the carrier), P<sub>0</sub> (width of the carrier), E (width of the carrier), D<sub>1</sub> (width of the carrier), A<sub>0</sub> (width of the carrier), P<sub>1</sub> (width of the carrier), and W (width of the carrier). The carrier is labeled "TOP COVER TAPE". The reel is labeled "User Direction of Feed" and "FEED DIRECTION". The carrier has a "Center line of cavity" and a "Bending radius" of R min.

\* on sales



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