



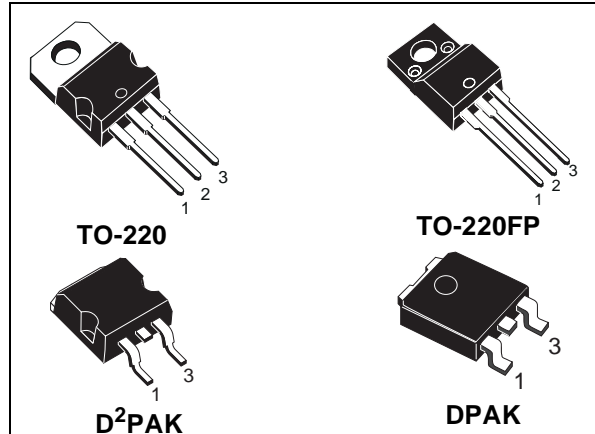
# STGP7NB60K-STGP7NB60KFP-STGD7NB60K STGP7NB60KD-STGP7NB60KDFP-STGB7NB60KD

N-CHANNEL 7A - 600V - TO-220/FP/DPAK/D<sup>2</sup>PAK

PowerMESH™ IGBT

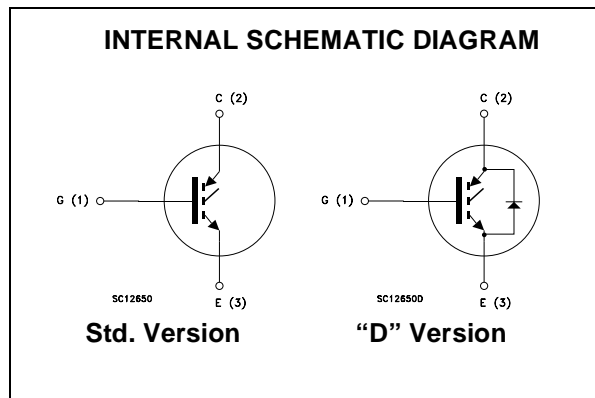
TYPE	V <sub>CE(s)</sub>	V <sub>CE(sat)</sub> (Typ) @ 125°C	I <sub>c</sub> @ 125°C
STGP7NB60K	600 V	< 2 V	7 A
STGD7NB60K	600 V	< 2 V	7 A
STGP7NB60KFP	600 V	< 2 V	7 A
STGP7NB60KD	600 V	< 2 V	7 A
STGP7NB60KDFP	600 V	< 2 V	7 A
STGB7NB60KD	600 V	< 2 V	7 A

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V<sub>cesat</sub>)
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- 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
STGP7NB60K	GP7NB60K	TO-220	TUBE
STGD7NB60KT4	GD7NB60K	DPAK	TAPE & REEL
STGP7NB60KFP	GP7NB60KFP	TO-220FP	TUBE
STGP7NB60KD	GP7NB60KD	TO-220	TUBE
STGP7NB60KDFP	GP7NB60KDFP	TO-220FP	TUBE
STGB7NB60KDT4	GB7NB60KD	D <sup>2</sup> PAK	TAPE & REEL

**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	14	14	14	A
I <sub>C</sub>	Collector Current (continuous) at T <sub>C</sub> = 125°C	7	7	7	A
I <sub>CM</sub> (■)	Collector Current (pulsed)	50	50	50	A
I <sub>f</sub> (1)	Forward Current	7			A
I <sub>fm</sub> (1)	Forward Current Pulsed	56			A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	95	30	90	W
	Derating Factor	0.64	0.28	0.64	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				

(■) 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	1.32	4.17	1.4	°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> = 7 A V <sub>GE</sub> = 15V, I <sub>C</sub> = 7 A, T <sub>c</sub> = 100°C		2.3 1.9	2.8	V V

**STGP7NB60K/STGP7NB60KFP/STGD7NB60K/STGP7NB60KD/STGB7NB60KD/STGP7NB60KDFP**

**SWITCHING PARAMETERS**

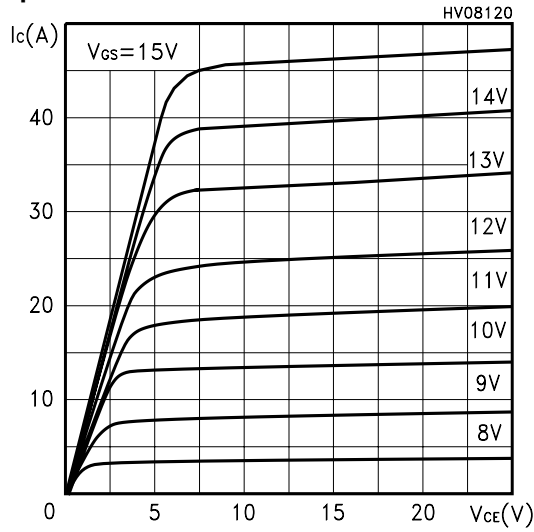
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 25V, I_C = 7 A$		TBD		S
$C_{ies}$ $C_{oes}$ $C_{res}$	Input Capacitance Output Capacitance Reverse Transfer Capacitance	$V_{CE} = 25V, f = 1 MHz, V_{GE} = 0$		495 77 13		pF pF pF
$Q_g$ $Q_{ge}$ $Q_{gc}$	Total Gate Charge Gate-Emitter Charge Gate-Collector Charge	$V_{CE} = 480V, I_C = 7 A,$ $V_{GE} = 15V$		32.7 5.9 18.3	45	nC nC nC
$t_{scw}$	Short Circuit Withstand Time	$V_{ce} = 0.5 V_{BR}(CES), V_{GE}=15V,$ $T_c = 125^\circ C, R_G = 10 \Omega$	10			$\mu s$
$t_{d(on)}$ $t_r$	Turn-on Delay Time Rise Time	$V_{CC} = 480 V, I_C = 7 A$ $R_G = 10\Omega, V_{GE} = 15 V$		15 6		ns ns
$(di/dt)_{on}$ $E_{on}$	Turn-on Current Slope Turn-on Switching Losses	$V_{CC}= 480 V, I_C = 7 A R_G=10\Omega$ $V_{GE} = 15 V, T_c = 125^\circ C$		980 94		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	$V_{CC} = 480 V, I_C = 7 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_c = 25^\circ C$		85 20 75 100 85 235		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	$V_{CC} = 480 V, I_C = 7 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_c = 125^\circ C$		150 50 110 150 220 314		ns ns ns ns $\mu J$ $\mu J$

**COLLECTOR-EMITTER DIODE (“D” VERSION)**

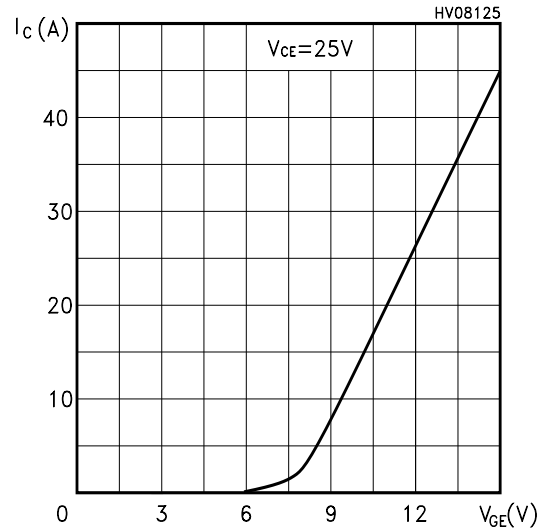
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_f$	Forward On-Voltage	$I_f = 3.5 A$ $I_f = 3.5 A, T_c = 125^\circ C$		1.4 1.15	1.9	V V
$t_{rr}$ $Q_{rr}$ $I_{rrm}$	Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current	$I_f = 7 A, V_R = 35 V,$ $T_c=125^\circ C, di/dt = 100A/\mu s$		50 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)

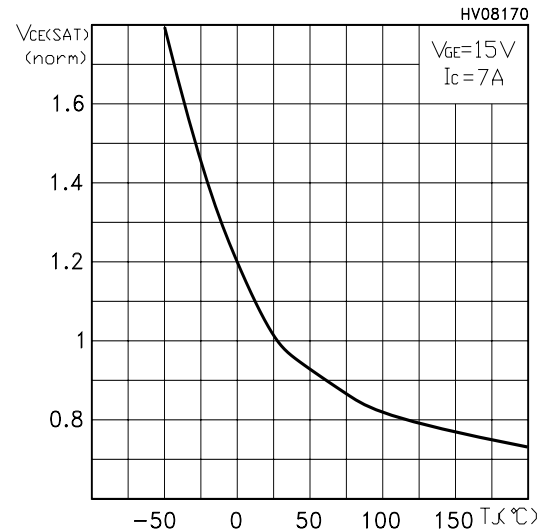
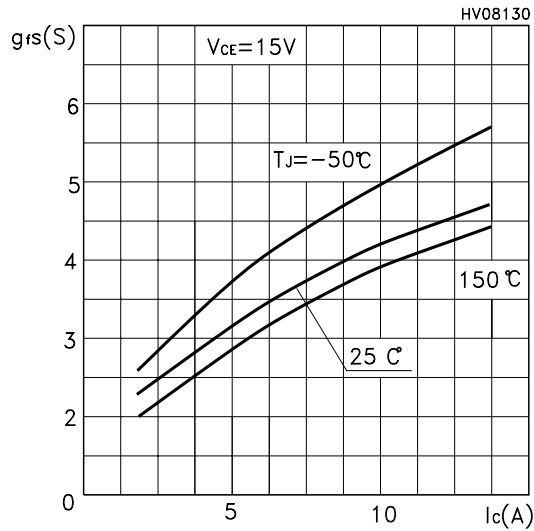
**Output Characteristics**



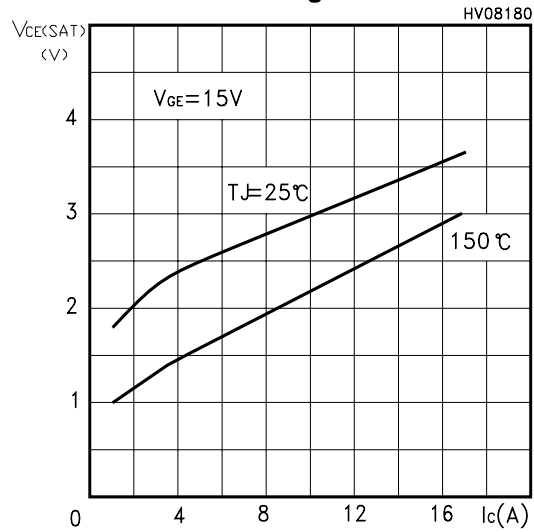
**Transfer Characteristics**



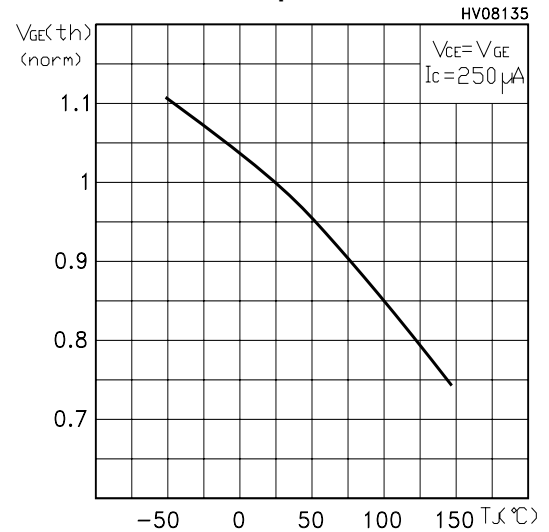
**Transconductance**



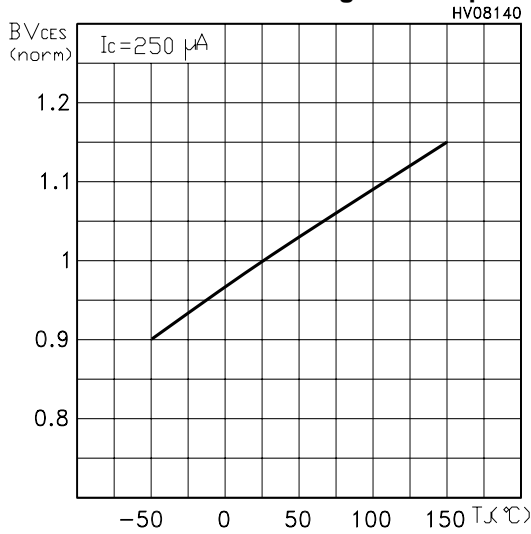
**Collector-Emitter On Voltage vs Collector Current**



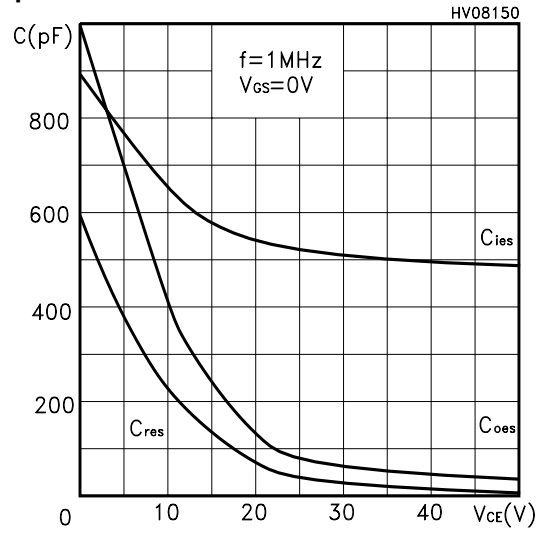
**Gate Threshold vs Temperature**



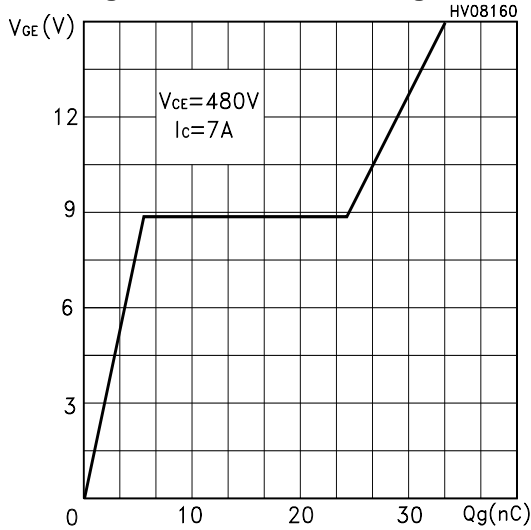
Normalized Breakdown Voltage vs Temperature



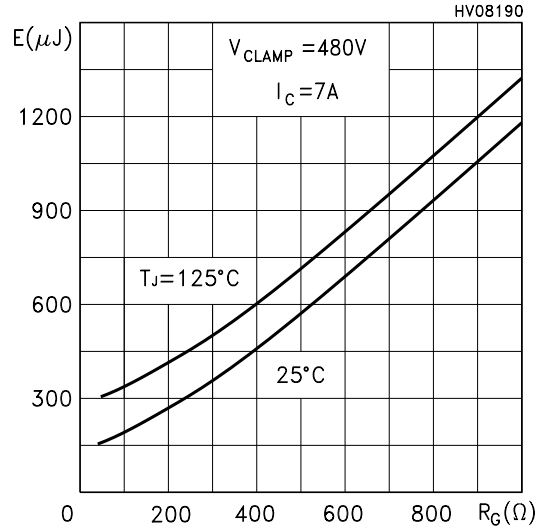
Capacitance Variations



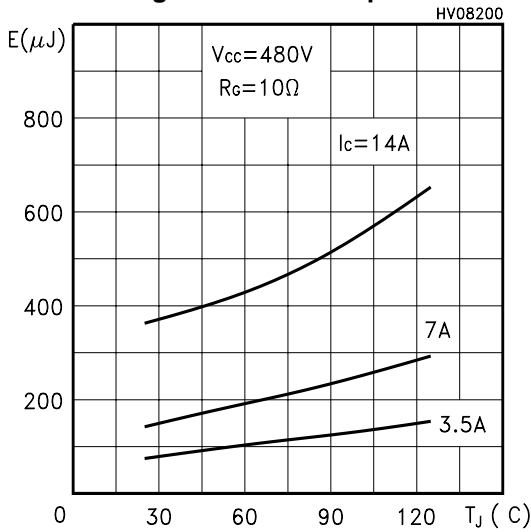
Gate Charge vs Gate-Emitter Voltage



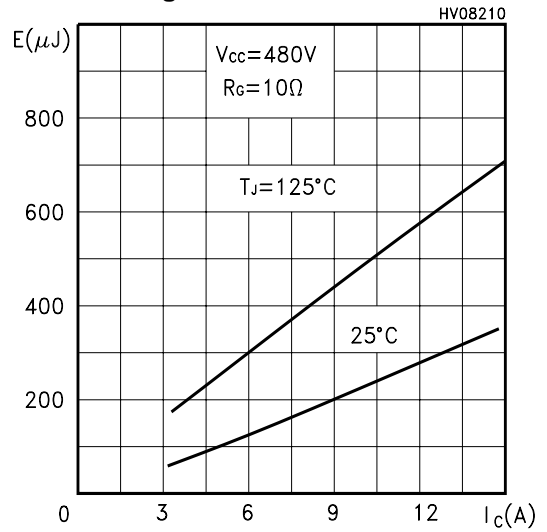
Total Switching Losses vs Gate Resistance



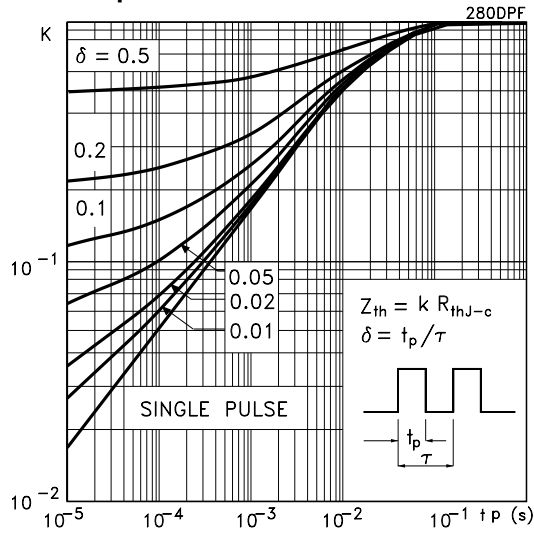
Total Switching Losses vs Temperature



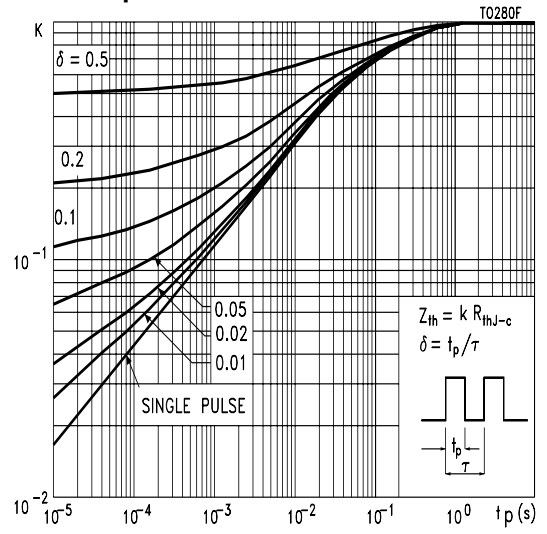
Total Switching Losses vs Collector Current



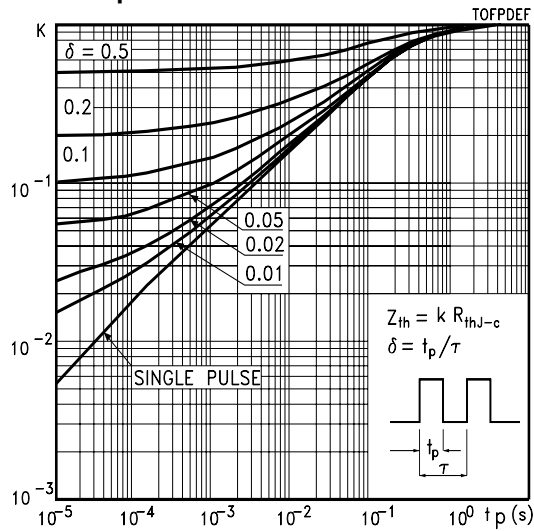
**Thermal Impedance for DPAK**



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



**Thermal Impedance for TO-220FP**



**Turn-Off SOA**

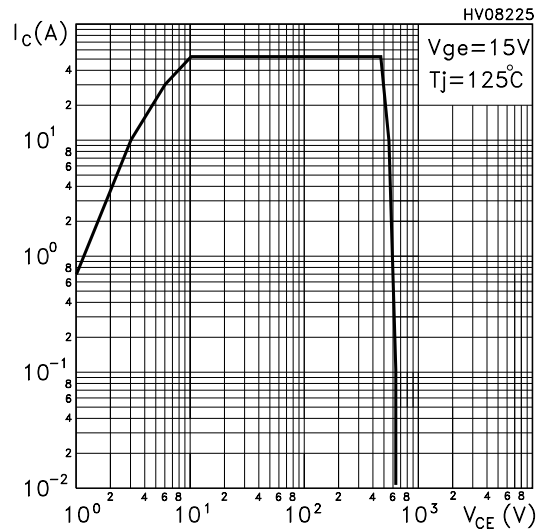


Fig. 1: Gate Charge test Circuit

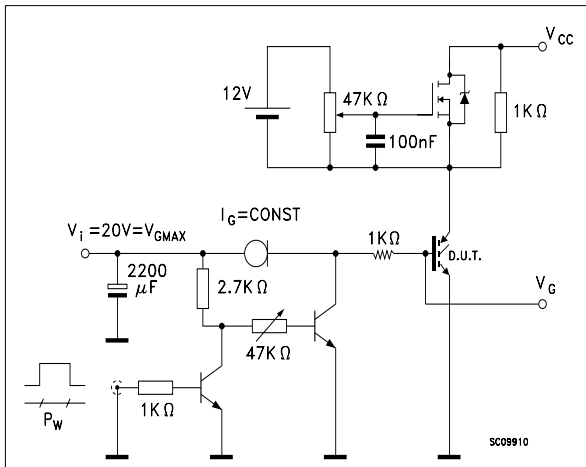
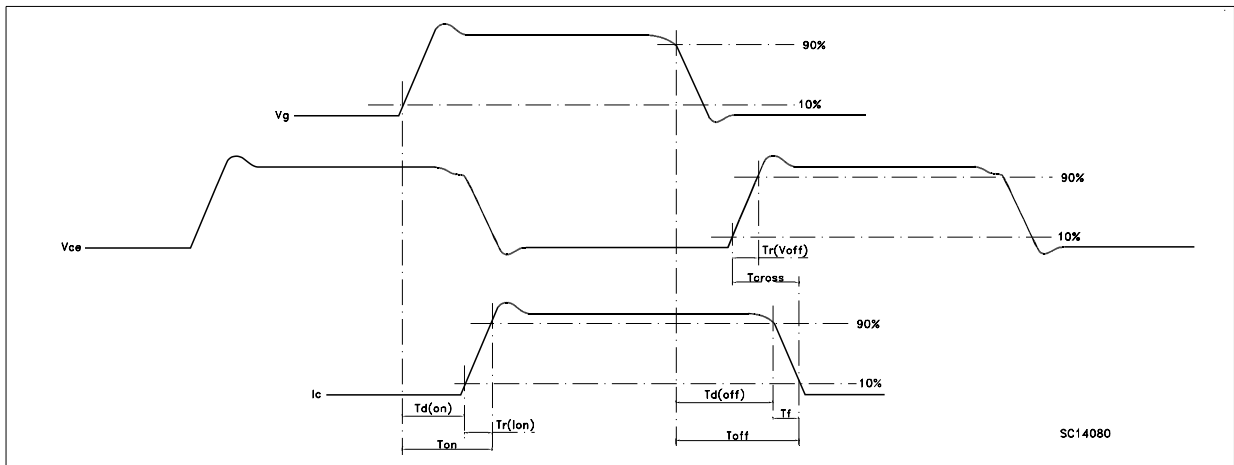
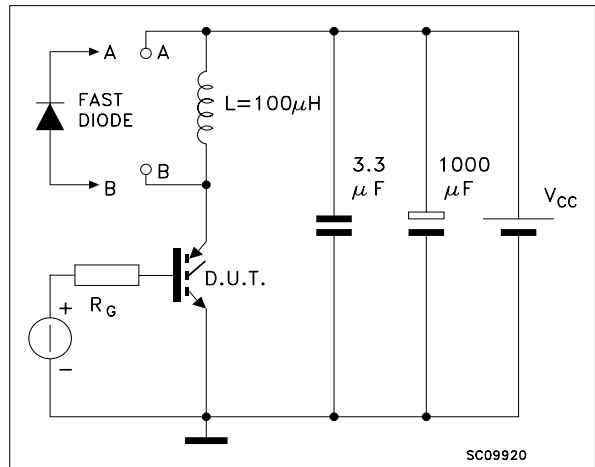
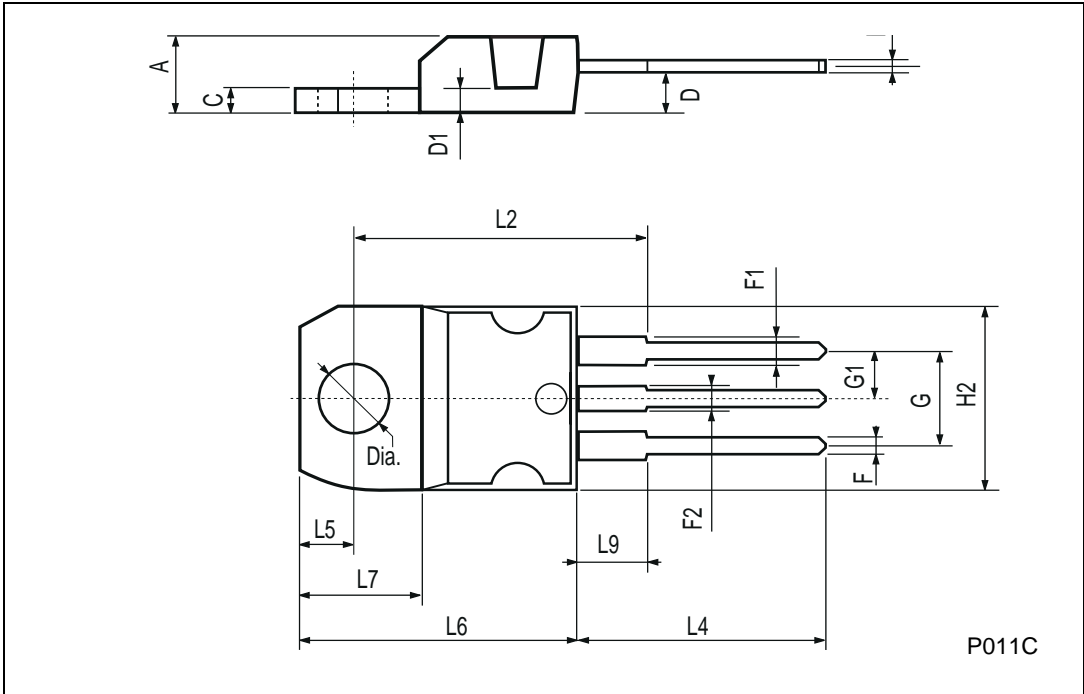


Fig. 2: Test Circuit For Inductive Load Switching



**TO-220 MECHANICAL DATA**

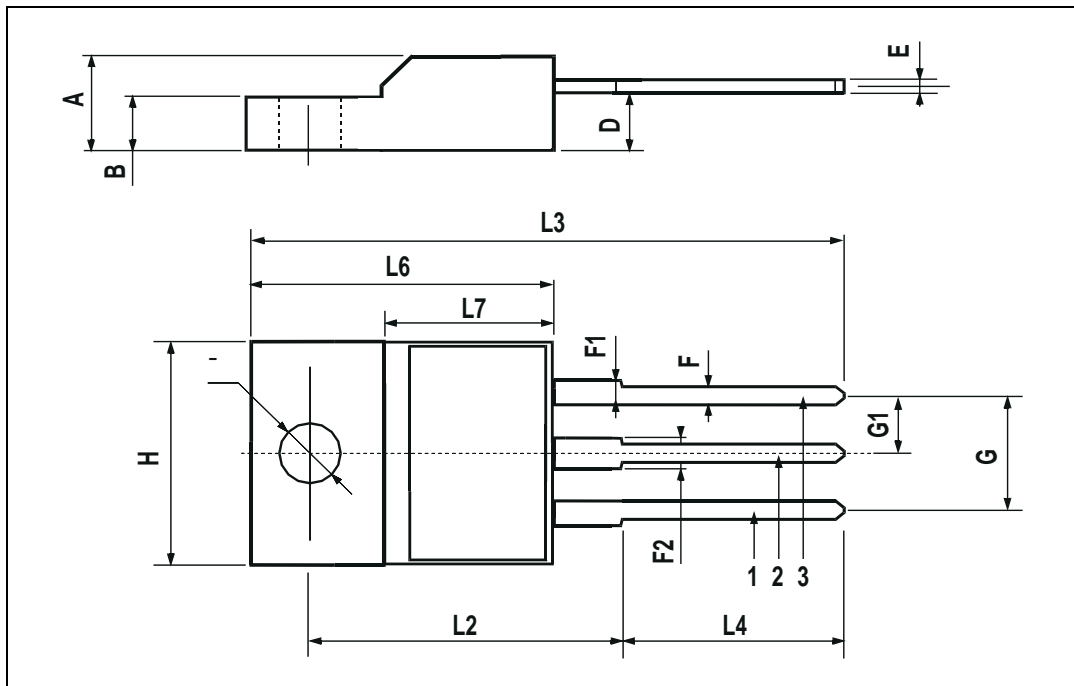
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	4.40		4.60	0.173		0.181
C	1.23		1.32	0.048		0.051
D	2.40		2.72	0.094		0.107
D1		1.27			0.050	
E	0.49		0.70	0.019		0.027
F	0.61		0.88	0.024		0.034
F1	1.14		1.70	0.044		0.067
F2	1.14		1.70	0.044		0.067
G	4.95		5.15	0.194		0.203
G1	2.4		2.7	0.094		0.106
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





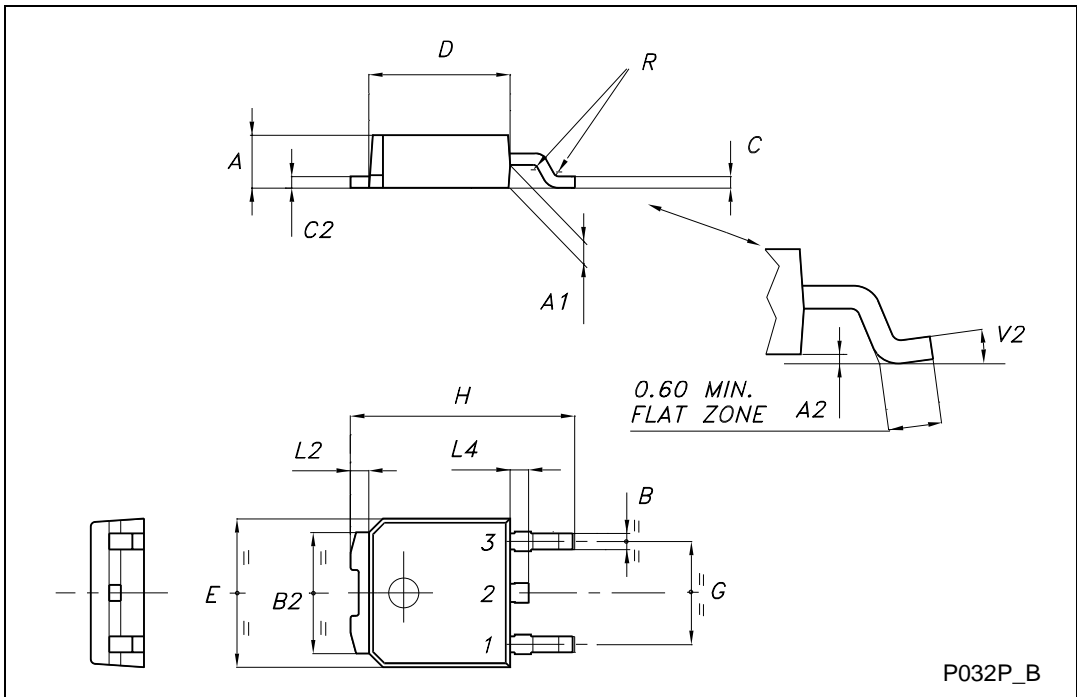
TO-220FP MECHANICAL DATA

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



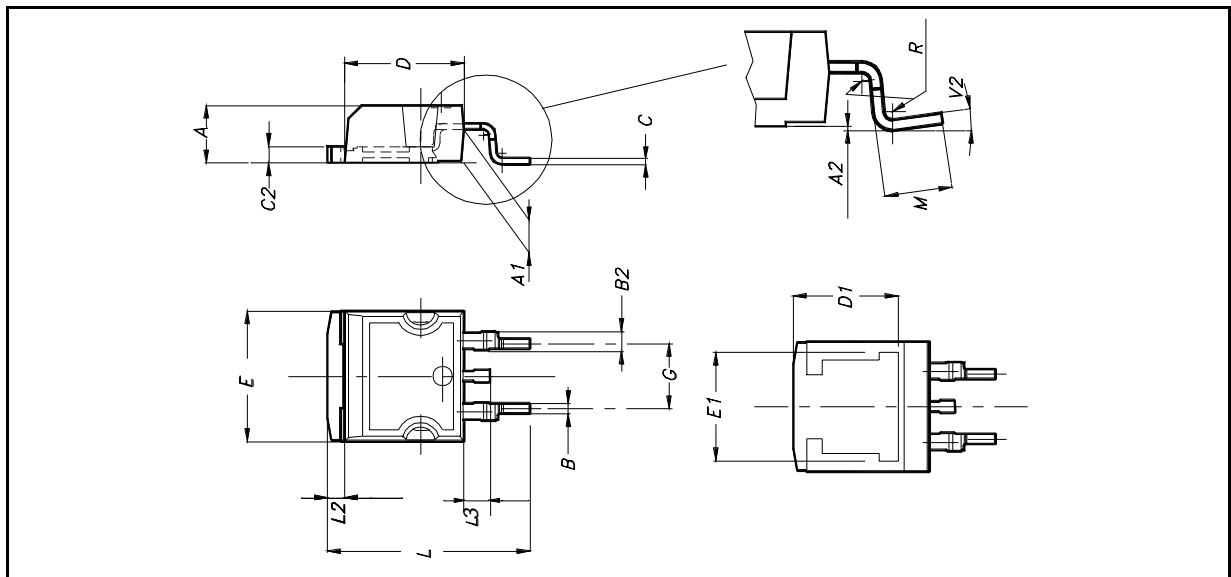
**TO-252 (DPAK) MECHANICAL DATA**

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°

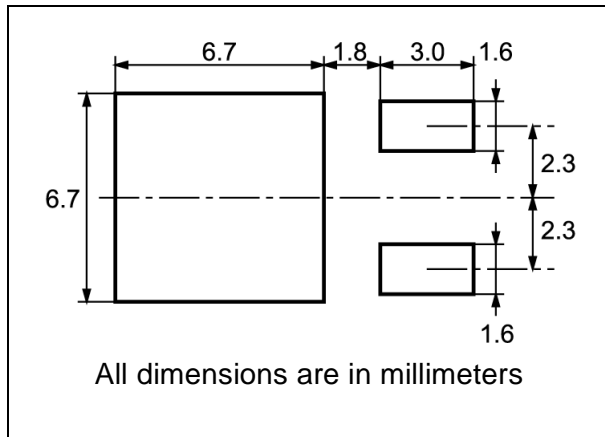


**D<sup>2</sup>PAK MECHANICAL DATA**

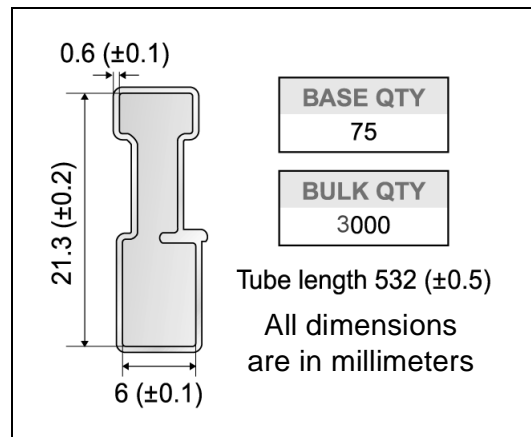
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334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

40 mm min. Access hole at slot location

Full radius

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

**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

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

Bending radius R min.

FEED DIRECTION

User Direction of Feed

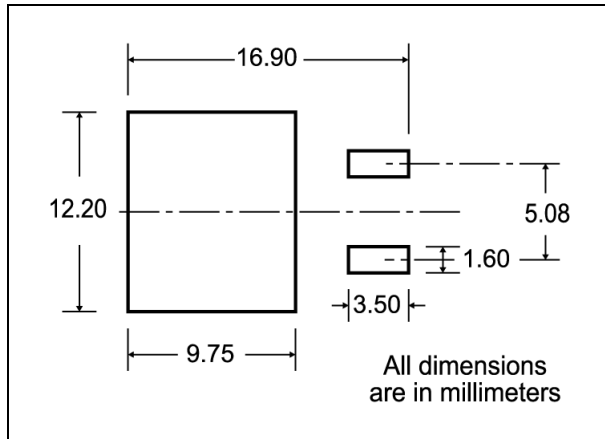
For machine ref. only including draft and radii concentric around B0

TOP COVER TAPE

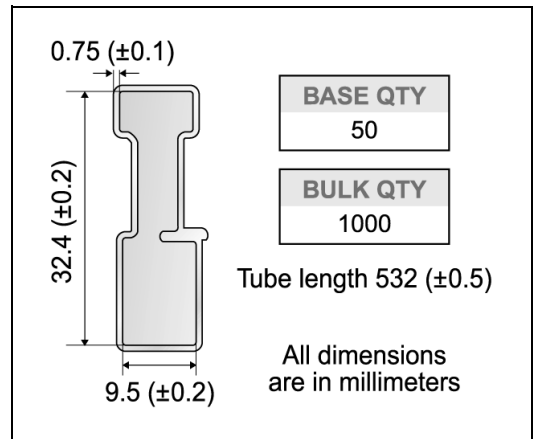
TRL

\* 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. It includes a circular core with a diameter of 40 mm min. and a slot for tape start with a width of 2.5 mm min. The full radius is indicated. Dimensions A, B, C, D, and G are labeled. G is measured at the hub. The tape thickness is T.

**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 tape and reel shipment details. It includes a top cover tape with dimensions K<sub>0</sub>, D, P<sub>2</sub>, P<sub>0</sub>, E, F, W, B<sub>0</sub>, D<sub>1</sub>, A<sub>0</sub>, P<sub>1</sub>. The center line of the cavity is shown. The user direction of feed is indicated. The bending radius is R min. The feed direction is also indicated.

\* on sales



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2002 STMicroelectronics - Printed in Italy - All Rights Reserved  
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco  
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>