STGD5NB120SZ-1
STGD5NB120SZ

N-CHANNEL 5A - 1200V DPAK/IPAK
INTERNALLY CLAMPED PowerMESH™ IGBT

Table 1: General Features

TYPE	V_{CES}	$V_{CE(sat)}$	I_C
STGD5NB120SZ	1200 V	< 2.0 V	5 A
STGD5NB120SZ-1	1200 V	< 2.0 V	5 A

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- HIGHT CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH VOLTAGE CLAMPING FEATURES

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 "S" identifies a family optimized achieve minimum on-voltage drop for low frequency applications (<1kHz). The built in collector-gate zener exibits a very precise active clamping.

APPLICATIONS

- LIGHT DIMMER
- INRUSH CURRENT LIMITATION
- PRE-HEATING FOR ELECTRONIC LAMP BALLAST

Figure 1: Package

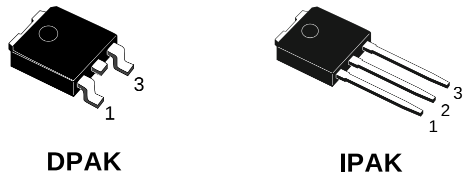


Figure 2: Internal Schematic Diagram

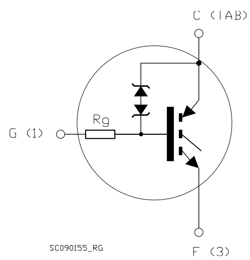


Table 2: Order Code

PART NUMBER	MARKING	PACKAGE	PACKAGING
STGD5NB120SZT4	GD5NB120SZ	DPAK	TAPE & REEL
STGD5NB120SZ-1	GD5NB120SZ	IPAK	TUBE

Rev. 2

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{CES}	Collector-Emitter Voltage (V_{GS} = 0)	1200	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	10	A
I_C	Collector Current (continuous) at T_C = 100°C	5	A
I_{CM} (■)	Collector Current (pulsed)	20	A
P_{TOT}	Total Dissipation at T_C = 25°C	55	W
	Derating Factor	0.44	W/°C
Eas (1)	Single Pulse Avalanche Energy at T_j = 25°C Single Pulse Avalanche Energy at T_j = 100°C	10 7	mJ mJ
T_{stg}	Storage Temperature	–55 to 150	°C
T_j	Operating Junction Temperature range	150	°C

(■) Pulse width limited by safe operating area
(1) V_{CE} = 50 V , I_{AV} = 3.3 A

Table 4: Thermal Data

		Min.	Typ.	Max.	
Rthj-case	Thermal Resistance Junction-case			2.27	°C/W
Rthj-amb	Thermal Resistance Junction-ambient			100	°C/W

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

Table 5: On/Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	I_C = 10 mA, V_{GE} = 0 V	1200			V
I_{CES}	Collector cut-off Current (V_{GE} = 0)	V_{CE} = 900 V V_{CE} = 900 V, T_j = 125 °C			50 250	µA µA
I_{GES}	Gate-Emitter Leakage Current (V_{CE} = 0)	V_{GE} = ±20V , V_{CE} = 0 V			±100	nA
$V_{GE(th)}$	Gate Threshold Voltage	V_{CE} = V_{GE}, I_C = 250 µA	2		5	V
V_{GE}	Gate Emitter Voltage	V_{CE} =2.5 V, I_C = 2 A, Tj = 25÷125°C			6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	V_{GE} = 15V, I_C = 5 A V_{GE} = 15V, I_C = 5 A, Tj =125°C		1.3 1.2	2.0	V V

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 6: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs}	Forward Transconductance	V_{CE} = 25 V , I_C = 5 A		5		S
C_{ies}(*) C_{oes}(*) C_{res}(*)	Input Capacitance Output Capacitance Reverse Transfer Capacitance	V_{CE} = 25V, f = 1 MHz, V_{GE} = 0V		430 40 7		pF pF pF
R_g	Gate Resistance			4		KΩ

(1) Pulsed: Pulse duration= 300 µs, duty cycle 1.5%

Table 7: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$ t_r $(di/dt)_{on}$	Delay Time Current Rise Time Turn-on Current Slope	I_C = 5 A , V_{CC} = 960 V V_{GE} = 15 V , R_{drive} = 1KΩ Tj = 25°C		690 170 39.6		ns ns A/µs
$t_{d(on)}$ t_r $(di/dt)_{on}$	Dealy Time Current Rise Time Turn-on Current Slope	I_{CC} = 5 A , V_{CC} = 960 V V_{GE} = 15 V , R_{drive} = 1KΩ Tj = 125°C		600 185 39		ns ns A/µs

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c $t_r(V_{off})$ $t_d(_{off})$ t_f	Cross-over Time Off Voltage Rise Time Delay Time Current Fall Time	I_C = 5 A , V_{CC} = 960 V V_{GE} = 15 V , R_{drive} = 1KΩ Tj = 25°C		4 2.2 12.1 1.13		µs µs µs µs
t_c $t_r(V_{off})$ $t_d(_{off})$ t_f	Cross-over Time Off Voltage Rise Time Delay Time Current Fall Time	I_C = 5 A , V_{CC} = 960 V V_{GE} = 15 V , R_{drive} = 1KΩ Tj = 125°C		5 2.2 12.1 2		µs µs µs µs

Table 9: Switching Energy

Symbol	Parameterr	Test Conditions	Min.	Typ.	Max	Unit
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 25°C (see Figure 18)		2.59 9 11.59		mJ mJ mJ
Eon (2) E_{off} (3) E_{ts}	Turn-on Switching Losses Turn-off Switching Loss Total Switching Loss	V_{CC} = 800 V, I_C = 3 A R_G= 10 Ω, V_{GE}= 15V, Tj= 125°C (see Figure 18)		2.64 10.2 12.68		mJ mJ mJ

(2) Eon is the turn-on losses when a typical diode is used in the test circuit in figure 2.
(3) Turn-off losses include also the tail of the collector current.

Table 10: Functional Test

Symbol	Parameterr	Test Conditions	Min.	Typ.	Max	Unit
Ias	Unclamped inductive switching current	V_{CC} = 50 V, L= 1.8 mH T_{start} = 25°C, R_{drive} = 1KΩ	3.3			A
I_{CL}	Latching Current	V_{CLAMP} = 960 V, Tj =125°C R_{drive} = 1KΩ		10		A

Figure 3: Output Characteristics

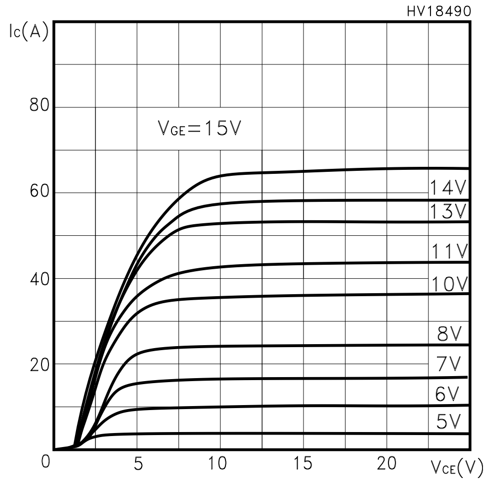


Figure 6: Transfer Characteristics

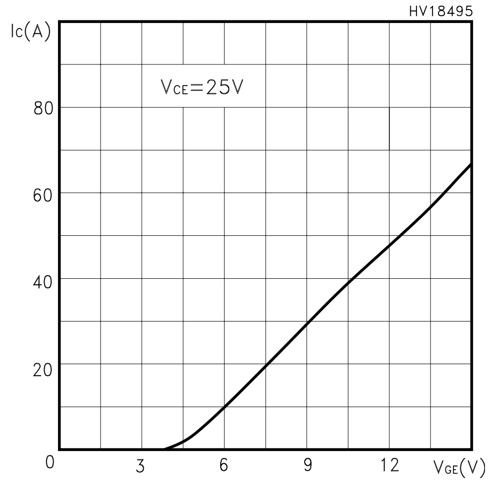


Figure 4: Transconductance

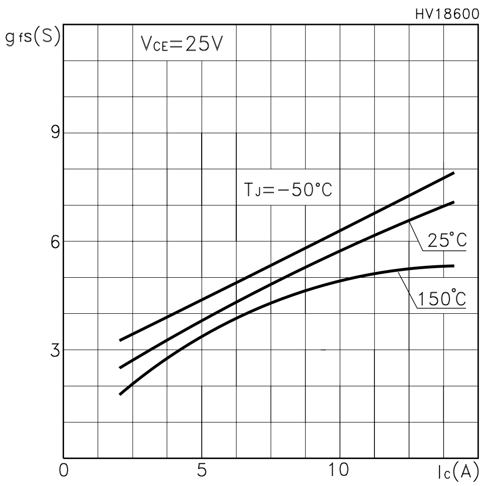


Figure 7: Collector-Emitter On Voltage vs Temperature

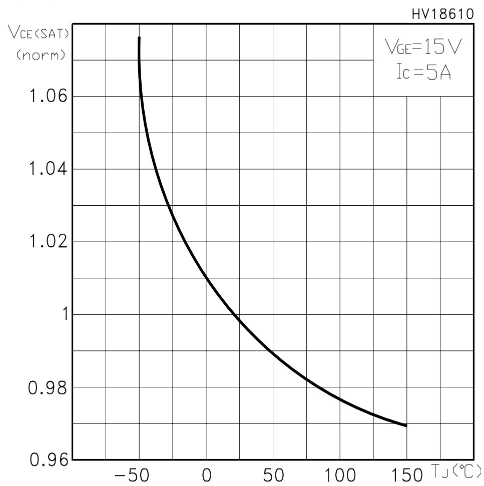


Figure 5: Collector-Emitter On Voltage vs Collector Current

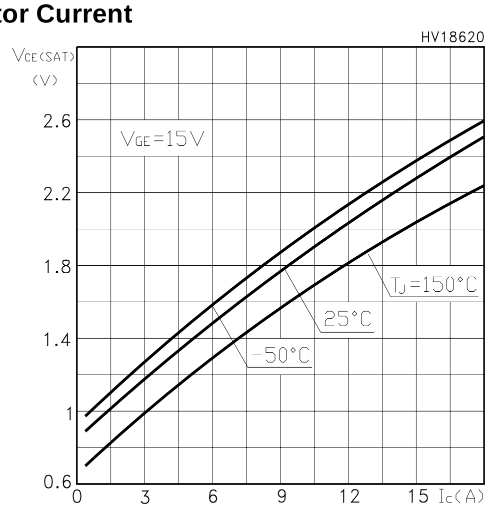


Figure 8: Normalized Gate Threshold vs Temperature

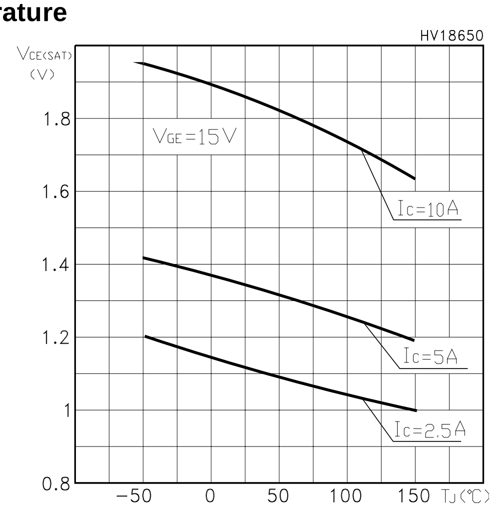


Figure 9: Gate Threshold vs Temperature

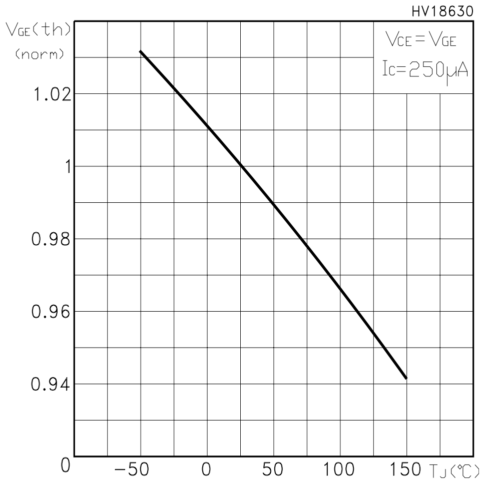


Figure 12: Breakdown Voltage vs Temperature

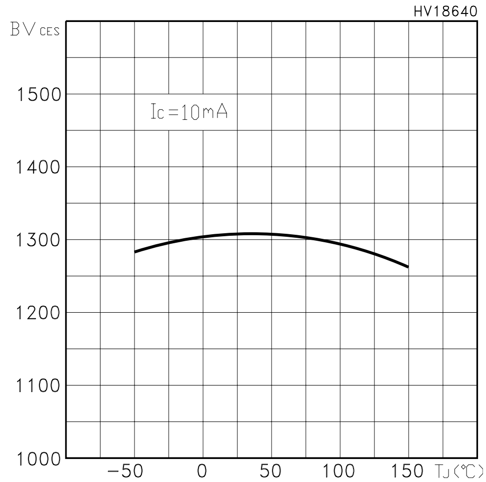


Figure 10: Capacitance Variations

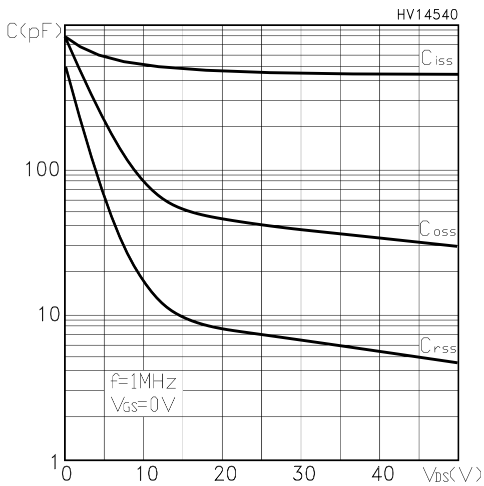


Figure 13: Gate-Charge vs Gate-Emitter Voltage

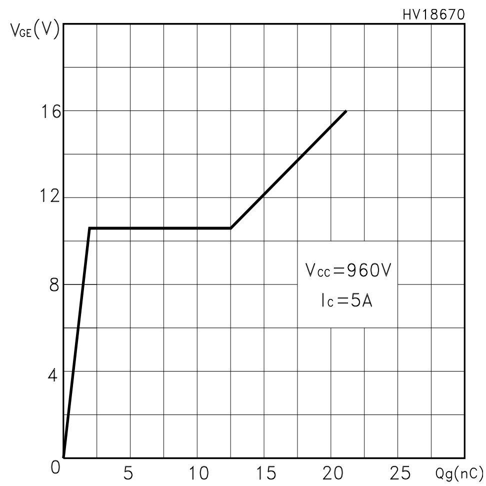


Figure 11: Switching Losses vs Gate Resistance

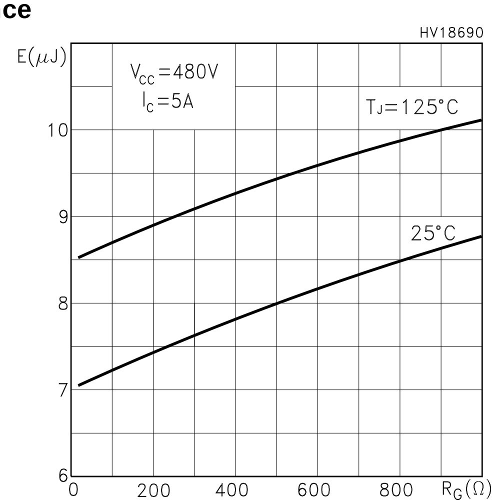


Figure 14: Switching Losses vs Collector Current

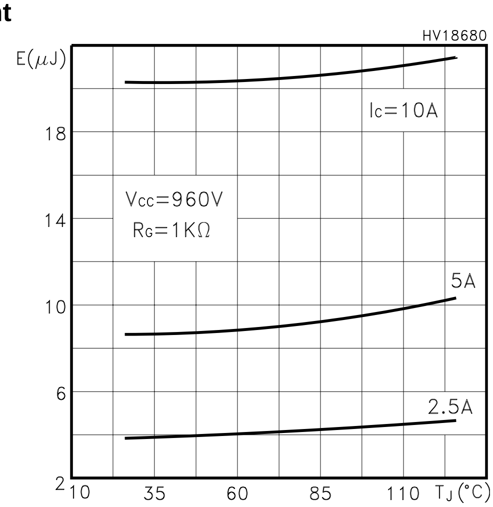


Figure 15: Thermal Impedance

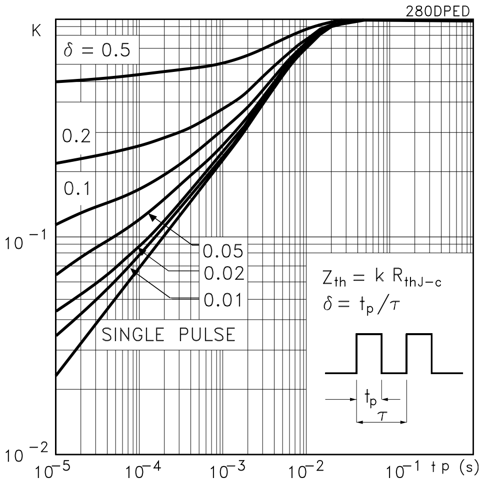


Figure 16: Turn-Off SOA

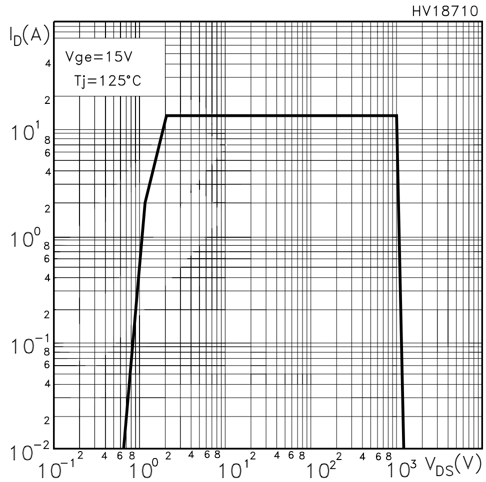


Figure 17: Test Circuit for Inductive Load Switching

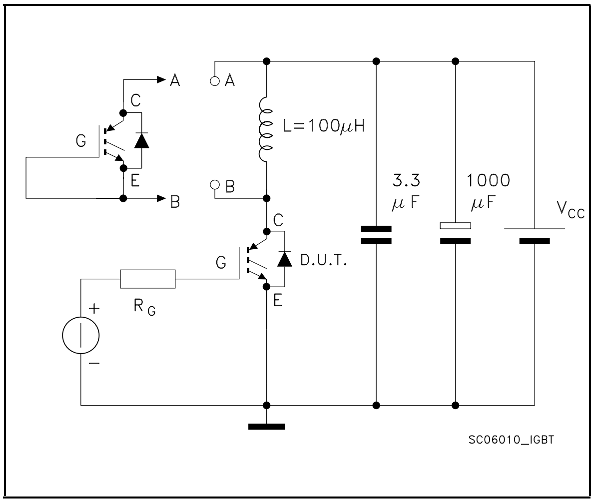


Figure 18: Switching Waveforms

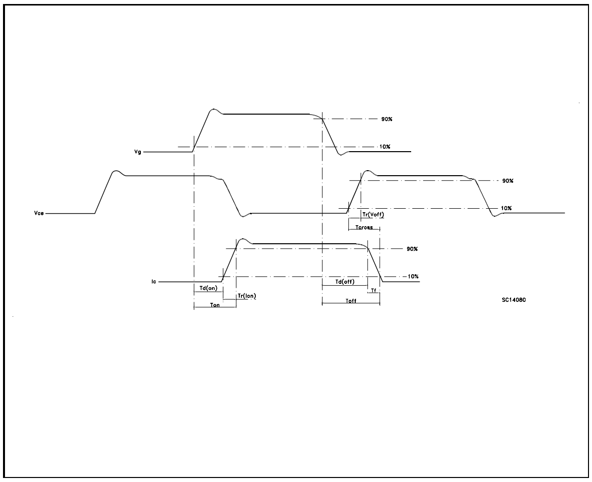


Figure 19: Gate Charge Test Circuit

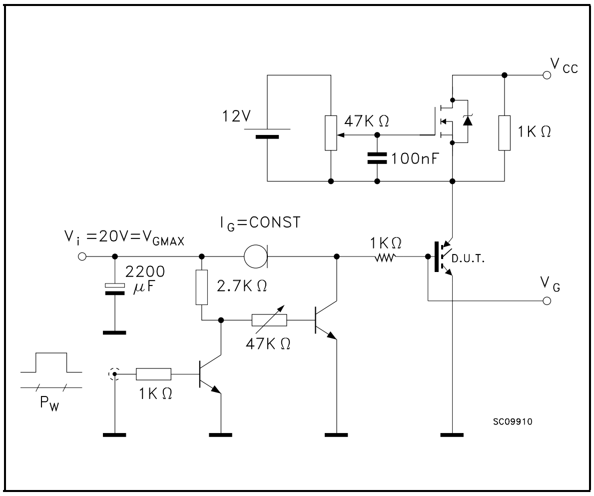
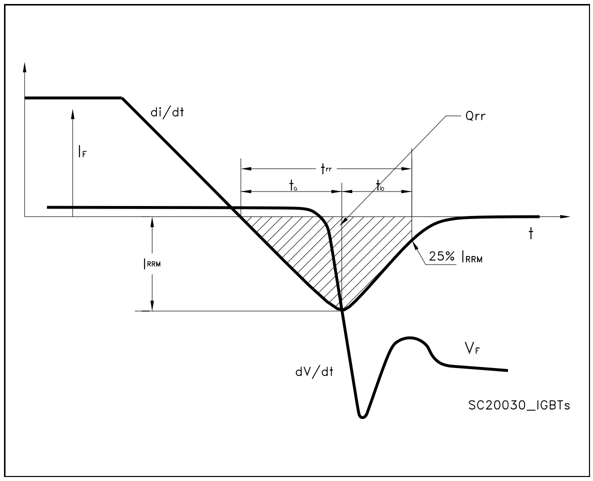
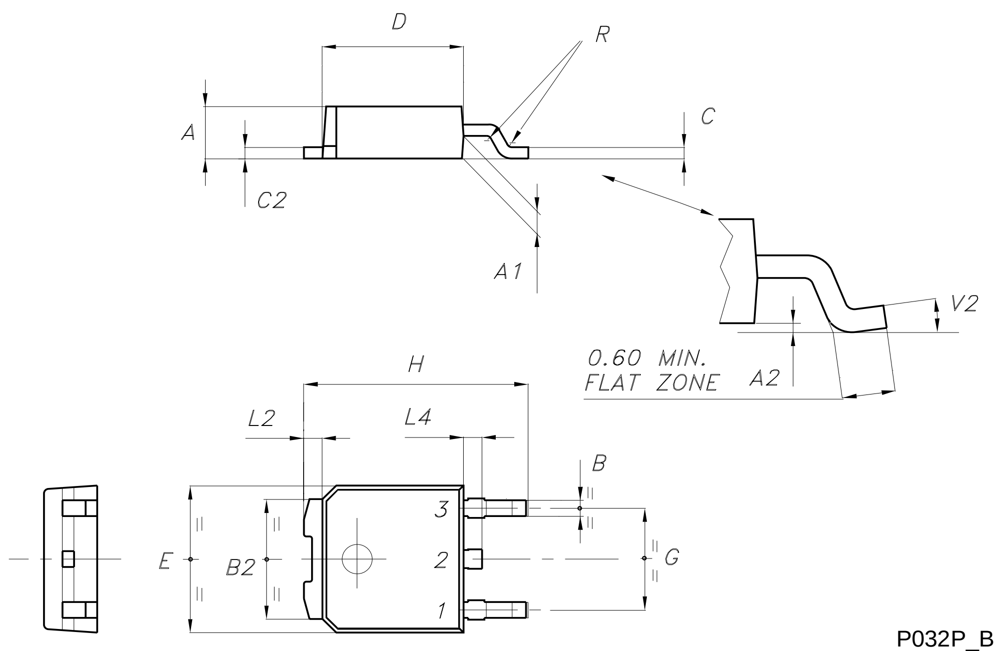


Figure 20: Diode Recovery Time Waveforms



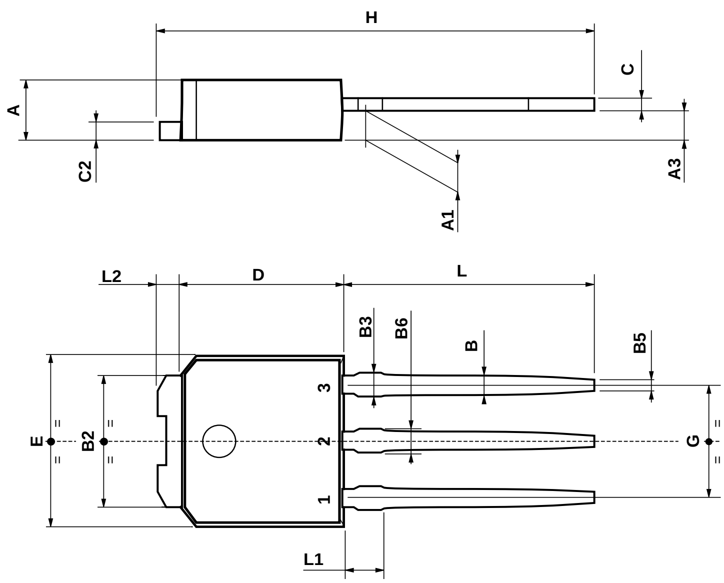
TO-252 (DPAK) MECHANICAL DATA

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°

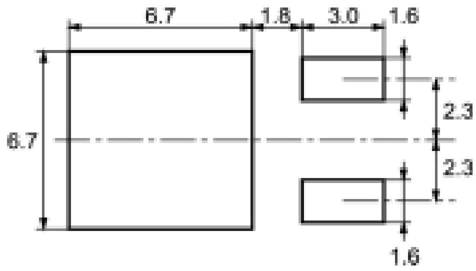


TO-251 (IPAK) MECHANICAL DATA

DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		6.6	0.252		0.260
G	4.4		4.6	0.173		0.181
H	15.9		16.3	0.626		0.641
L	9		9.4	0.354		0.370
L1	0.8		1.2	0.031		0.047
L2		0.8	1		0.031	0.039

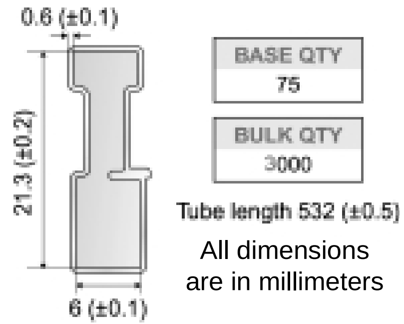


DPAK FOOTPRINT



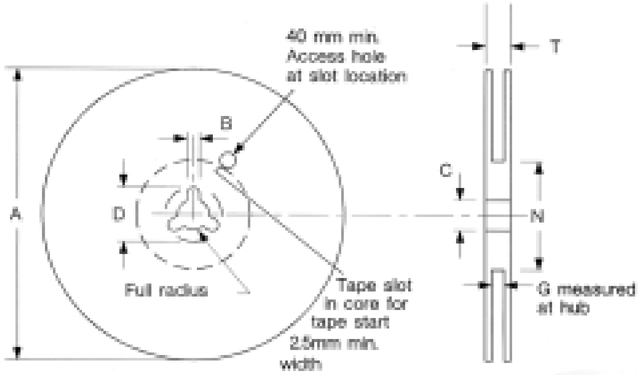
All dimensions are in millimeters

TUBE SHIPMENT (no suffix)*



All dimensions are in millimeters

TAPE AND REEL SHIPMENT (suffix "T4")*



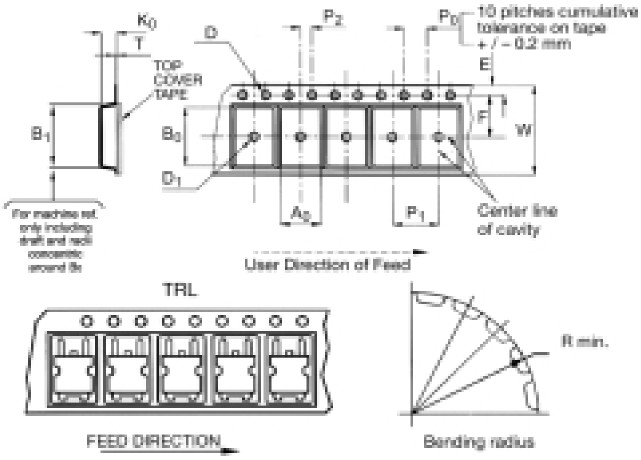
REEL MECHANICAL DATA

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

Table 11: Revision History

Date	Revision	Description of Changes
06-Oct-2003	1	First release
18-Jan-2005	2	Final datasheet