

Order code	Manufacturer code	Description
47-0536	n/a	STGD5NB120SZ-1 IGBT N 1200V 5A IPAK RC

The enclosed information is believed to be correct, Information may change 'without notice' due to product improvement. Users should ensure that the product is suitable for their use. E. & O. E.	Page 1 of 14
	Revision A 12/12/2006



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})
- HIGH 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 exhibits a very precise active clamping.

APPLICATIONS

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

Figure 1: Package

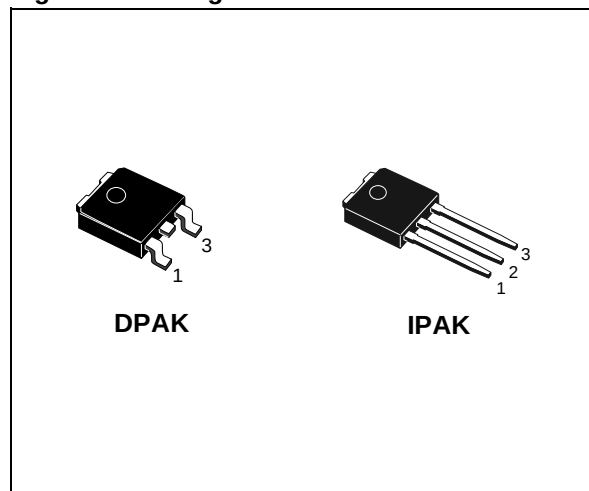


Figure 2: Internal Schematic Diagram

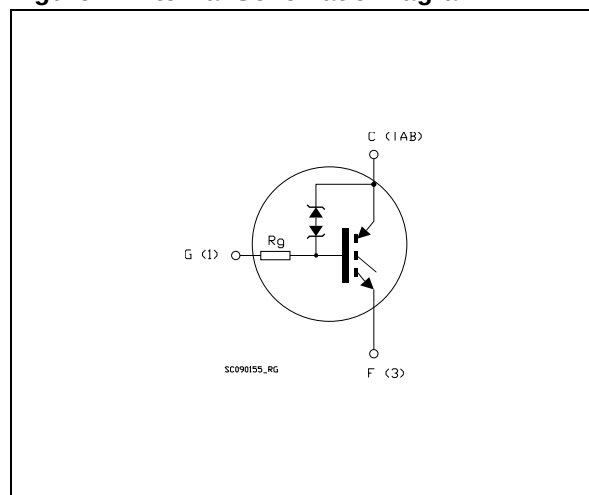


Table 2: Order Code

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

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 $T_C = 25^\circ\text{C}$	10	A
I_C	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	5	A
$I_{CM} (\blacksquare)$	Collector Current (pulsed)	20	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	55	W
	Derating Factor	0.44	W/ $^\circ\text{C}$
Eas (1)	Single Pulse Avalanche Energy at $T_j = 25^\circ\text{C}$	10	mJ
	Single Pulse Avalanche Energy at $T_j = 100^\circ\text{C}$	7	mJ
T_{stg}	Storage Temperature	-55 to 150	$^\circ\text{C}$
T_j	Operating Junction Temperature range	150	$^\circ\text{C}$

($\blacksquare$) Pulse width limited by safe operating area

(1) $V_{CE} = 50\text{ V}$, $I_{AV} = 3.3\text{ A}$

Table 4: Thermal Data

		Min.	Typ.	Max.	
Rthj-case	Thermal Resistance Junction-case			2.27	$^\circ\text{C/W}$
Rthj-amb	Thermal Resistance Junction-ambient			100	$^\circ\text{C/W}$

ELECTRICAL CHARACTERISTICS ($T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)**Table 5: On/Off**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{BR(CES)}$	Collector-Emitter Breakdown Voltage	$I_C = 10\text{ mA}$, $V_{GE} = 0\text{ V}$	1200			V
I_{CES}	Collector cut-off Current ($V_{GE} = 0$)	$V_{CE} = 900\text{ V}$ $V_{CE} = 900\text{ V}$, $T_j = 125^\circ\text{C}$			50 250	μA μA
I_{GES}	Gate-Emitter Leakage Current ($V_{CE} = 0$)	$V_{GE} = \pm 20\text{ V}$, $V_{CE} = 0\text{ V}$			± 100	nA
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$, $I_C = 250\text{ }\mu\text{A}$	2		5	V
V_{GE}	Gate Emitter Voltage	$V_{CE} = 2.5\text{ V}$, $I_C = 2\text{ A}$, $T_j = 25 \div 125^\circ\text{C}$			6.5	V
$V_{CE(sat)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$ $V_{GE} = 15\text{ V}$, $I_C = 5\text{ A}$, $T_j = 125^\circ\text{C}$		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	$V_{CE} = 25\text{ V}$, $I_C = 5\text{ A}$		5		S
$C_{ies}^{(*)}$	Input Capacitance	$V_{CE} = 25\text{ V}$, $f = 1\text{ MHz}$, $V_{GE} = 0\text{ V}$		430		pF
$C_{oes}^{(*)}$	Output Capacitance			40		pF
$C_{res}^{(*)}$	Reverse Transfer Capacitance			7		pF
R_g	Gate Resistance			4		K Ω

(1) Pulsed: Pulse duration= 300 μs , duty cycle 1.5%**Table 7: Switching On**

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

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
t_c	Cross-over Time	$I_C = 5\text{ A}$, $V_{CC} = 960\text{ V}$ $V_{GE} = 15\text{ V}$, $R_{drive} = 1\text{ K}\Omega$ $T_j = 25^\circ\text{C}$		4		μs
$t_r(V_{off})$	Off Voltage Rise Time			2.2		μs
$t_{d(off)}$	Delay Time			12.1		μs
t_f	Current Fall Time			1.13		μs
t_c	Cross-over Time	$I_C = 5\text{ A}$, $V_{CC} = 960\text{ V}$ $V_{GE} = 15\text{ V}$, $R_{drive} = 1\text{ K}\Omega$ $T_j = 125^\circ\text{C}$		5		μs
$t_r(V_{off})$	Off Voltage Rise Time			2.2		μs
$t_{d(off)}$	Delay Time			12.1		μs
t_f	Current Fall Time			2		μs

Table 9: Switching Energy

Symbol	Parameter	Test Conditions	Min.	Typ.	Max	Unit
$E_{on} (2)$	Turn-on Switching Losses	$V_{CC} = 800\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, $T_j = 25^\circ\text{C}$ (see Figure 18)		2.59		mJ
$E_{off} (3)$	Turn-off Switching Loss			9		mJ
E_{ts}	Total Switching Loss			11.59		mJ
$E_{on} (2)$	Turn-on Switching Losses	$V_{CC} = 800\text{ V}$, $I_C = 3\text{ A}$ $R_G = 10\text{ }\Omega$, $V_{GE} = 15\text{ V}$, $T_j = 125^\circ\text{C}$ (see Figure 18)		2.64		mJ
$E_{off} (3)$	Turn-off Switching Loss			10.2		mJ
E_{ts}	Total Switching Loss			12.68		mJ

(2) E_{on} 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	Parameter	Test Conditions	Min.	Typ.	Max	Unit
I _{as}	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, T _j = 125°C R _{drive} = 1KΩ		10		A

Figure 3: Output Characteristics

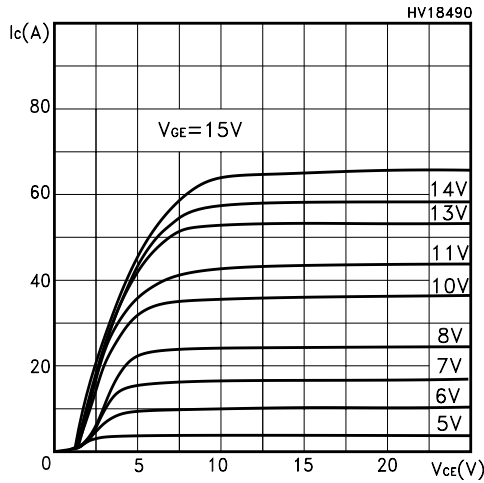


Figure 4: Transconductance

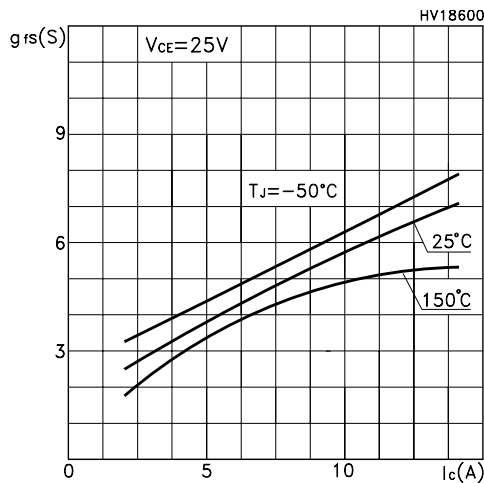


Figure 5: Collector-Emitter On Voltage vs Collector Current

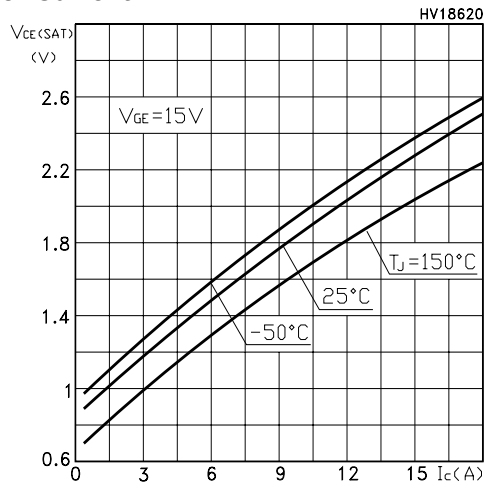


Figure 6: Transfer Characteristics

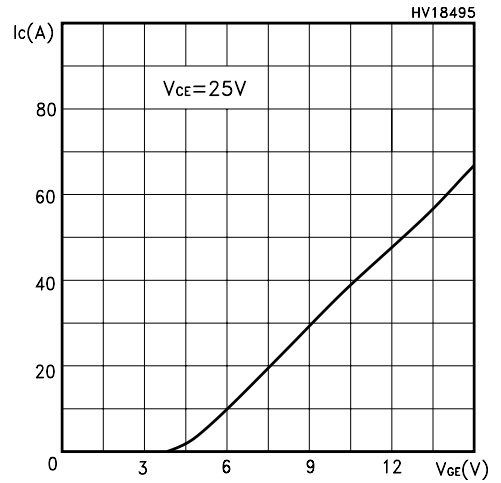


Figure 7: Collector-Emitter On Voltage vs Temperature

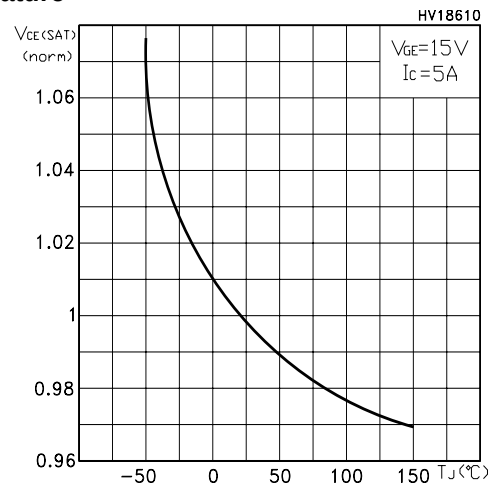


Figure 8: Normalized Gate Threshold vs Temperature

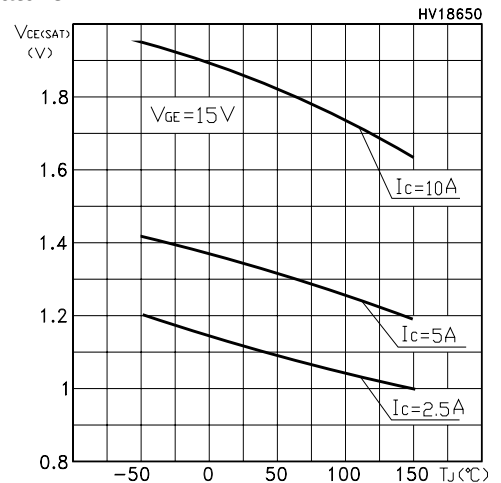


Figure 9: Gate Threshold vs Temperature

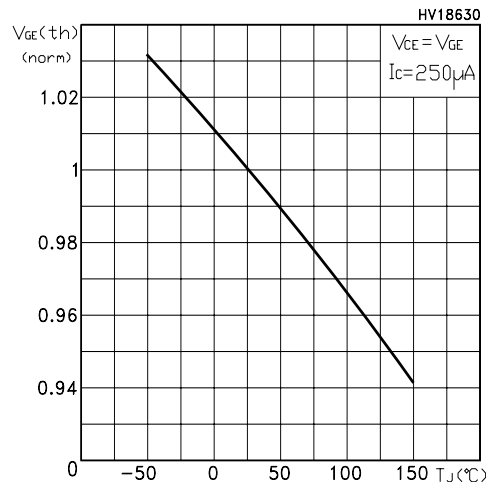


Figure 10: Capacitance Variations

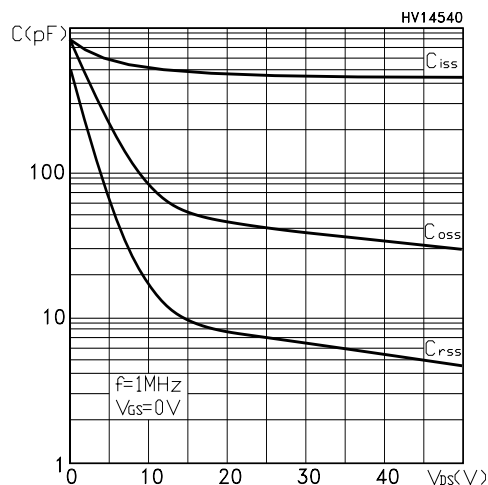


Figure 11: Switching Losses vs Gate Resistance

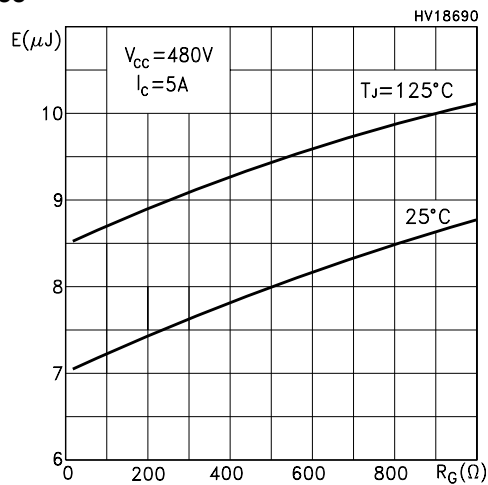


Figure 12: Breakdown Voltage vs Temperature

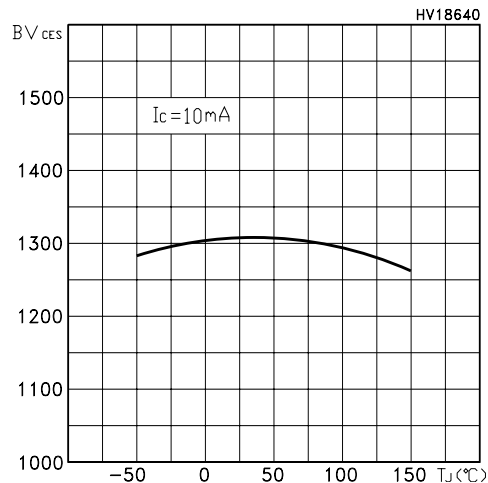


Figure 13: Gate-Charge vs Gate-Emitter Voltage

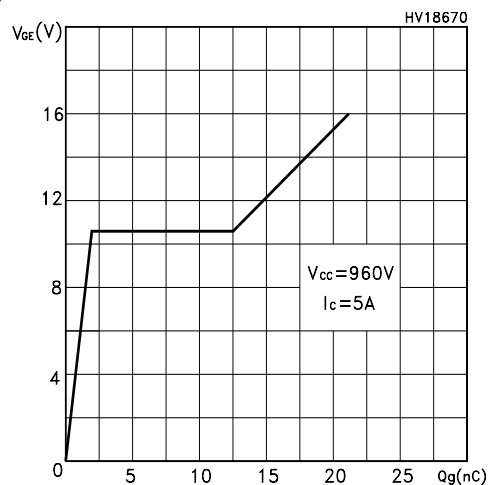


Figure 14: Switching Losses vs Collector Current

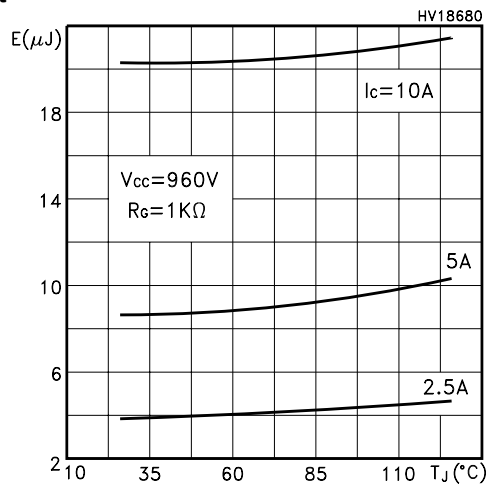


Figure 15: Thermal Impedance

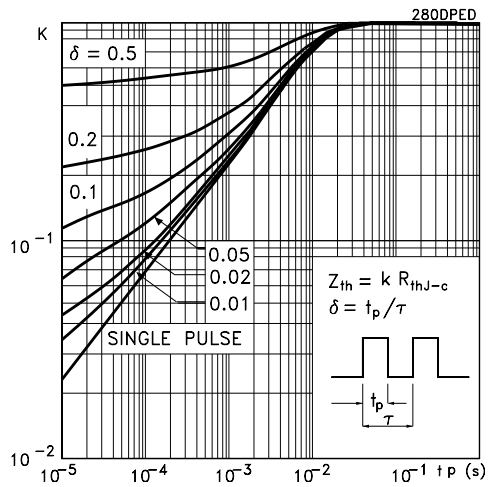


Figure 16: Turn-Off SOA

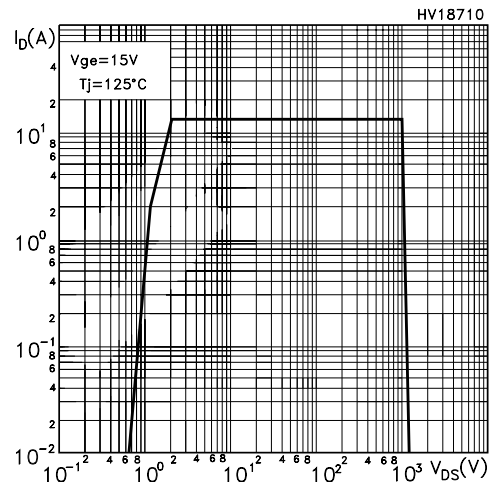


Figure 17: Test Circuit for Inductive Load Switching

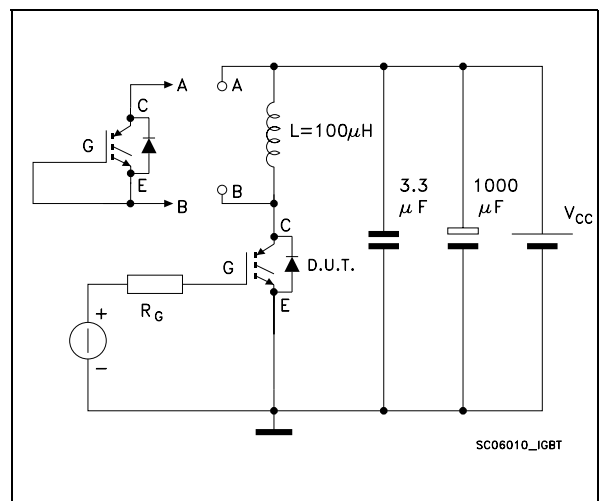


Figure 18: Switching Waveforms

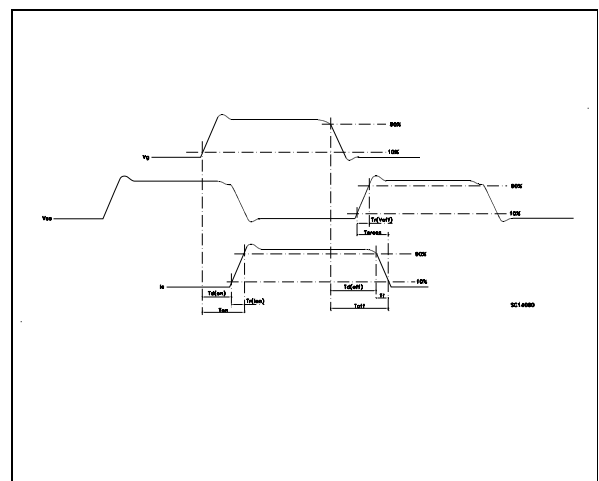


Figure 19: Gate Charge Test Circuit

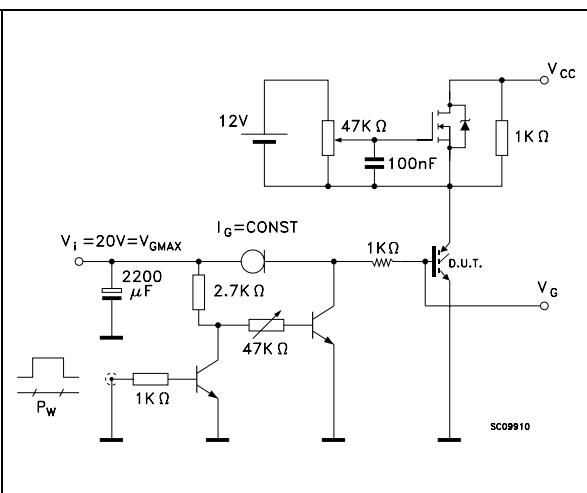
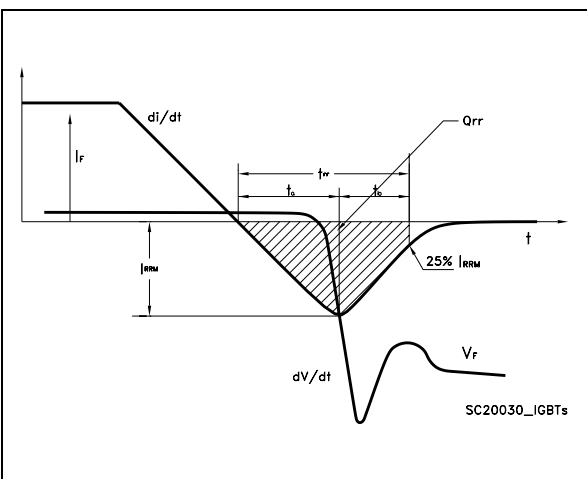
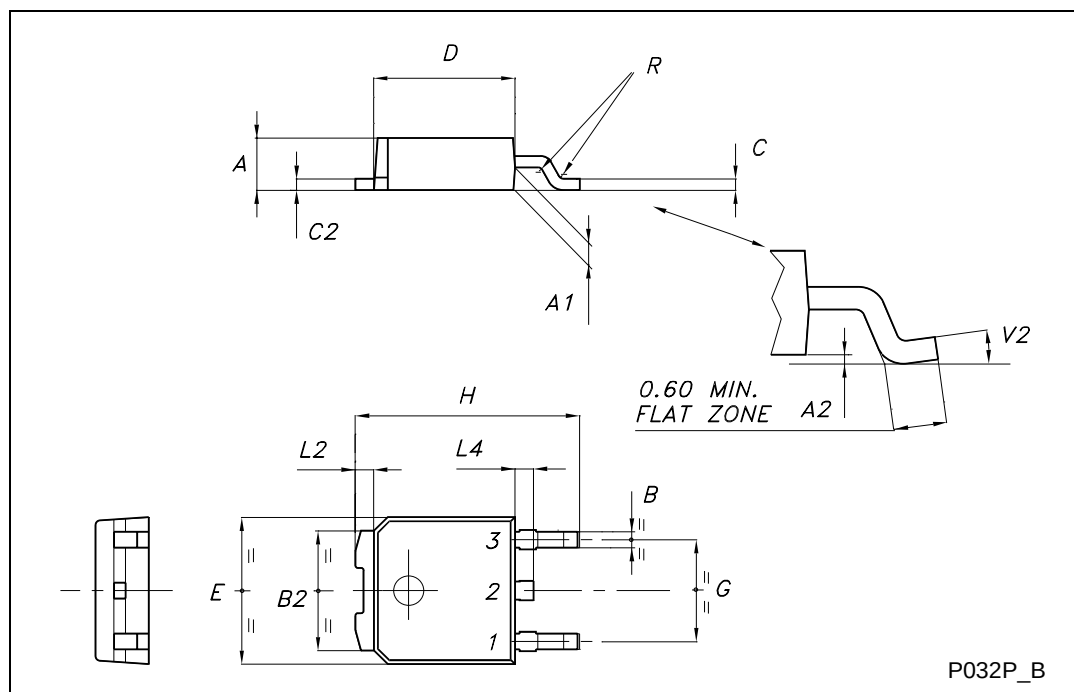


Figure 20: Diode Recovery Time Waveforms



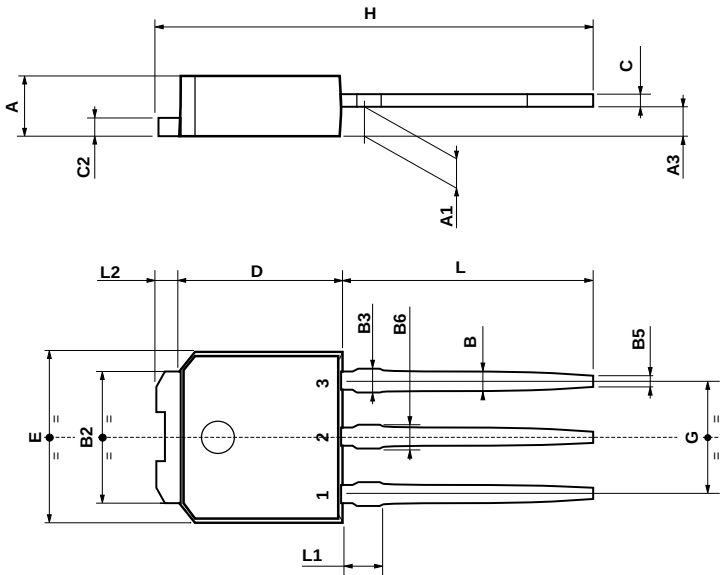
TO-252 (DPAK) MECHANICAL DATA

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°



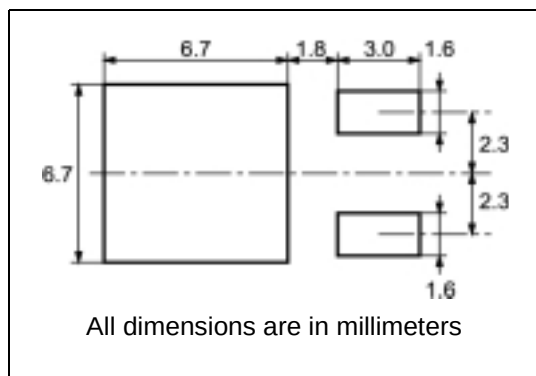
TO-251 (IPAK) MECHANICAL DATA

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

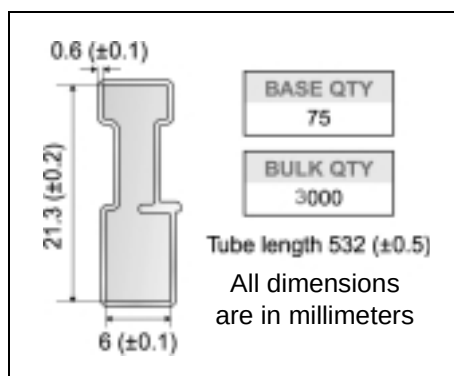
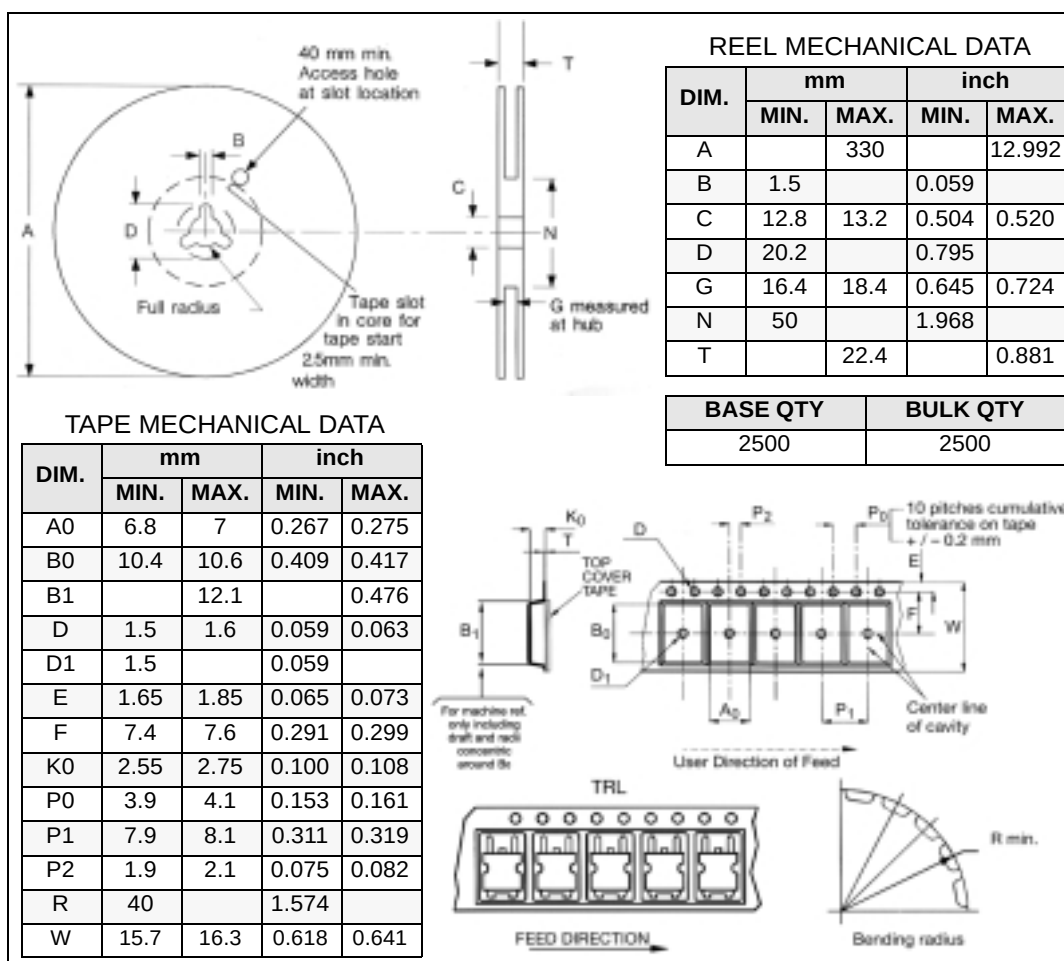


0068771-E

DPAK FOOTPRINT



TUBE SHIPMENT (no suffix)*

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

* on sales type

Table 11: Revision History

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

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