



# STGB10NB40LZ

## N-CHANNEL CLAMPED 20A - D<sup>2</sup>PAK INTERNALLY CLAMPED PowerMESH™ IGBT

TYPE	V <sub>CES</sub>	V <sub>CE(sat)</sub>	I <sub>C</sub>
STGB10NB40LZ	CLAMPED	< 1.8 V	20 A

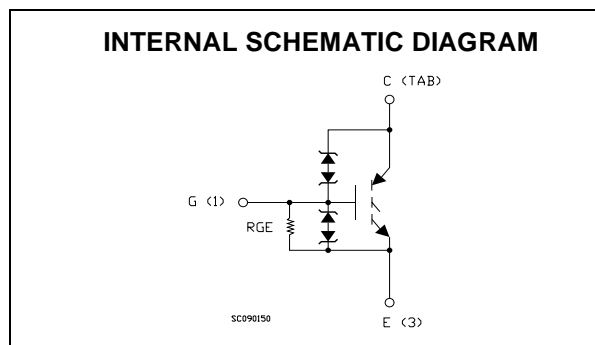
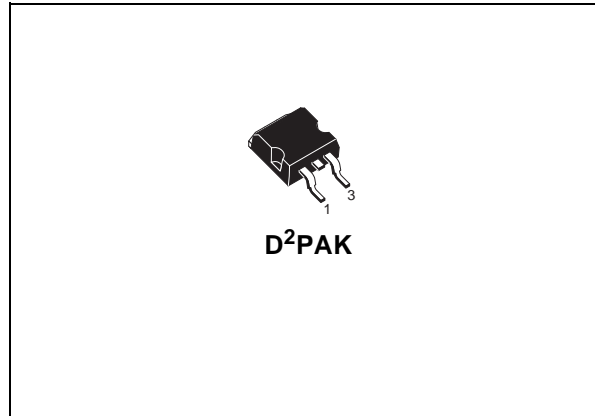
- POLYSILICON GATE VOLTAGE DRIVEN
- LOW THRESHOLD VOLTAGE
- LOW ON-VOLTAGE DROP
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- HIGH VOLTAGE CLAMPING FEATURE

### 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 built in collector-gate zener exhibits a very precise active clamping while the gate-emitter zener supplies an ESD protection.

### APPLICATIONS

- AUTOMOTIVE IGNITION



### ORDERING INFORMATION

SALES TYPE	MARKING	PACKAGE	PACKAGING
STGB10NB40LZT4	GB10NB40LZ	D <sup>2</sup> PAK	TAPE & REEL

## STGB10NB40LZ

### ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CES}$	Collector-Emitter Voltage ( $V_{GS} = 0$ )	CLAMPED	V
$V_{ECR}$	Emitter-Collector Voltage	18	V
$V_{GE}$	Gate-Emitter Voltage	CLAMPED	V
$I_C$	Collector Current (continuous) at $T_C = 25^\circ\text{C}$	20	A
$I_C$	Collector Current (continuous) at $T_C = 100^\circ\text{C}$	10	A
$I_{CM} (\blacksquare)$	Collector Current (pulsed)	40	A
$E_{as}$	Single Pulse Energy $T_c = 25^\circ\text{C}$	300	mJ
$P_{TOT}$	Total Dissipation at $T_C = 25^\circ\text{C}$	150	W
	Derating Factor	1	W/°C
$E_{SD}$	ESD (Human Body Model)	4	KV
$T_{stg}$	Storage Temperature	- 55 to 175	°C
$T_j$	Operating Junction Temperature		

(■) Pulse width limited by safe operating area

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case Max	1	°C/W
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	°C/W

### ELECTRICAL CHARACTERISTICS ( $T_{CASE} = 25^\circ\text{C}$ UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$BV_{(CES)}$	Clamped Voltage	$I_C = 2\text{ mA}$ , $V_{GE} = 0$ , $T_j = -40^\circ\text{C}$ to $150^\circ\text{C}$	380	410	440	V
$BV_{(ECR)}$	Emitter Collector Break-down Voltage	$I_C = 75\text{ mA}$ , $T_j = 25^\circ\text{C}$	18			V
$BV_{GE}$	Gate Emitter Break-down Voltage	$I_G = \pm 2\text{ mA}$	12		16	V
$I_{CES}$	Collector cut-off Current ( $V_{GE} = 0$ )	$V_{CE} = 15\text{ V}$ , $V_{GE} = 0$ , $T_j = 150^\circ\text{C}$ $V_{CE} = 200\text{ V}$ , $V_{GE} = 0$ , $T_j = 150^\circ\text{C}$			10 100	$\mu\text{A}$ $\mu\text{A}$
$I_{GES}$	Gate-Emitter Leakage Current ( $V_{CE} = 0$ )	$V_{GE} = \pm 10\text{ V}$ , $V_{CE} = 0$			$\pm 700$	$\mu\text{A}$
$R_{GE}$	Gate Emitter Resistance			20		K $\Omega$

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{GE(th)}$	Gate Threshold Voltage	$V_{CE} = V_{GE}$ , $I_C = 250\ \mu\text{A}$ , $T_C = -40^\circ\text{C}$ to $150^\circ\text{C}$	0.6		2.2	V
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage	$V_{GE} = 4.5\text{ V}$ , $I_C = 10\text{ A}$ , $T_j = 25^\circ\text{C}$ $V_{GE} = 4.5\text{ V}$ , $I_C = 20\text{ A}$ , $T_j = 25^\circ\text{C}$		1.2 1.3	1.8	V V

**ELECTRICAL CHARACTERISTICS (CONTINUED)**  
**DYNAMIC**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$g_{fs}$	Forward Transconductance	$V_{CE} = 15 \text{ V}$ , $I_C = 10 \text{ A}$		18		S
$C_{ies}$	Input Capacitance	$V_{CE} = 25 \text{ V}$ , $f = 1 \text{ MHz}$ , $V_{GE} = 0$		1300		pF
$C_{oes}$	Output Capacitance			105		pF
$C_{res}$	Reverse Transfer Capacitance			12		pF
$Q_g$	Gate Charge	$V_{CE} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ , $V_{GE} = 5 \text{ V}$		28		nC

**FUNCTIONAL CHARACTERISTICS**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
II	Latching Current	$V_{Clamp} = 328 \text{ V}$ , $T_C = 125 \text{ }^\circ\text{C}$ $R_{GOFF} = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$		40		A
U.I.S.	Functional Test Open Secondary Coil	$R_{GOFF} = 1 \text{ K}\Omega$ , $L = 1 \text{ mH}$ , $T_C = 125 \text{ }^\circ\text{C}$	13			A

**SWITCHING ON**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{CC} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ $R_G = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$		1300		ns
$t_r$	Rise Time			270		ns
$(di/dt)_{on}$	Turn-on Current Slope	$V_{CC} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ $R_G = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$		60		A/ $\mu\text{s}$
$E_{on}$	Turn-on Switching Losses	$V_{CC} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ , $T_C = 25 \text{ }^\circ\text{C}$ $R_G = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$ , $T_C = 125 \text{ }^\circ\text{C}$		2.4 2.6		mJ mJ

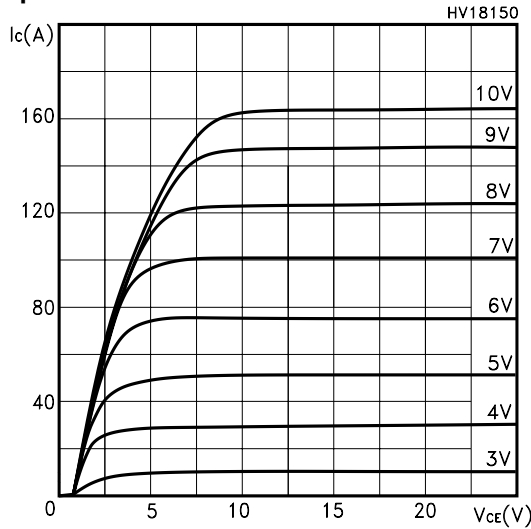
**SWITCHING OFF**

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_c$	Cross-over Time	$V_{CC} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ , $R_{GE} = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$		3.6		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			2		$\mu\text{s}$
$t_{d(off)}$	Delay Time			8		$\mu\text{s}$
$t_f$	Fall Time			1.4		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			5		mJ
$t_c$	Cross-over Time	$V_{CC} = 328 \text{ V}$ , $I_C = 10 \text{ A}$ , $R_{GE} = 1 \text{ K}\Omega$ , $V_{GE} = 5 \text{ V}$ $T_j = 125 \text{ }^\circ\text{C}$		5.7		$\mu\text{s}$
$t_r(V_{off})$	Off Voltage Rise Time			2.7		$\mu\text{s}$
$t_{d(off)}$	Delay Time			9.2		$\mu\text{s}$
$t_f$	Fall Time			2.8		$\mu\text{s}$
$E_{off(**)}$	Turn-off Switching Loss			8.7		mJ

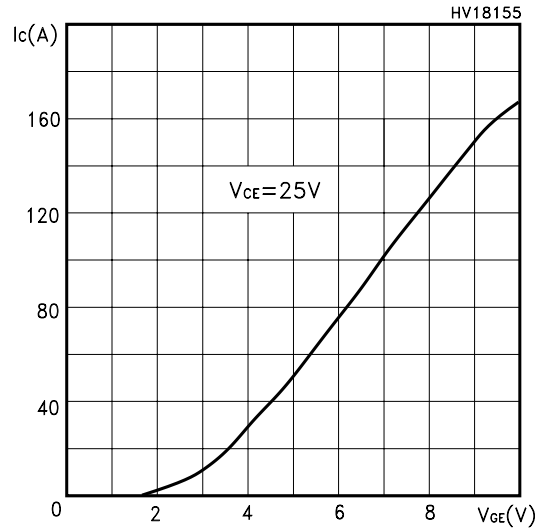
(1) Pulse width limited by max. junction temperature.

(\*\*) Losses Include Also the Tail

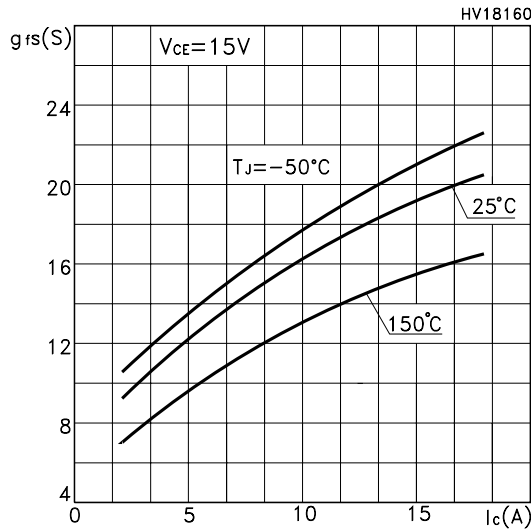
Output Characteristics



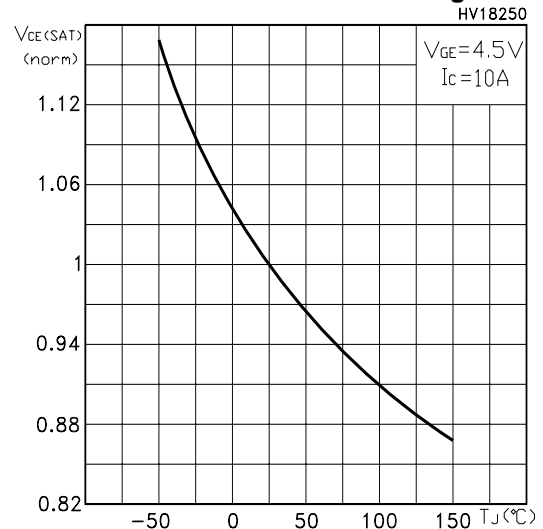
Transfer Characteristics



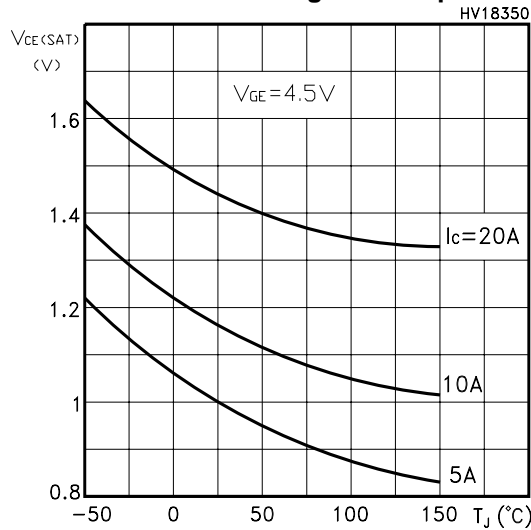
Transconductance



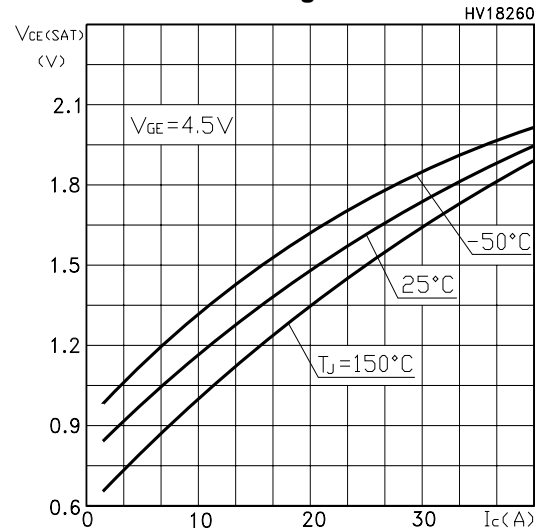
Normalized Collector-Emitter On Voltage vs Temp.



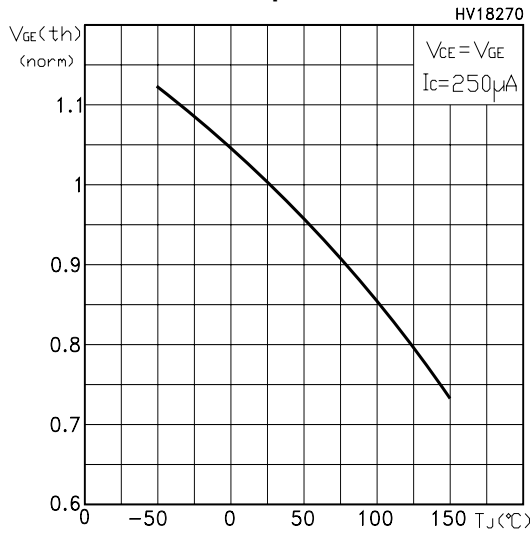
Collector-Emitter On Voltage vs Temperature



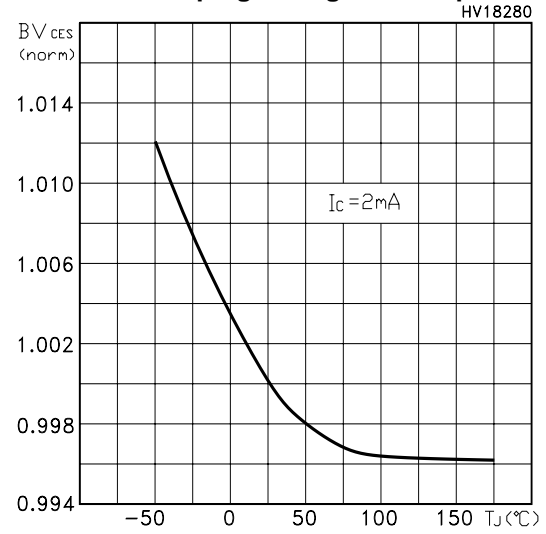
Collector-Emitter On Voltage vs Collector Current



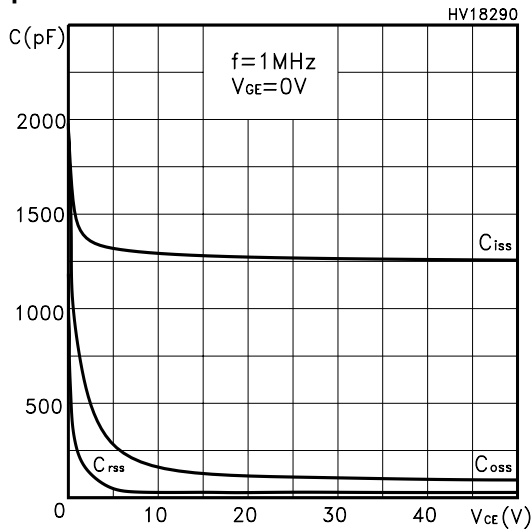
Gate Threshold vs Temperature



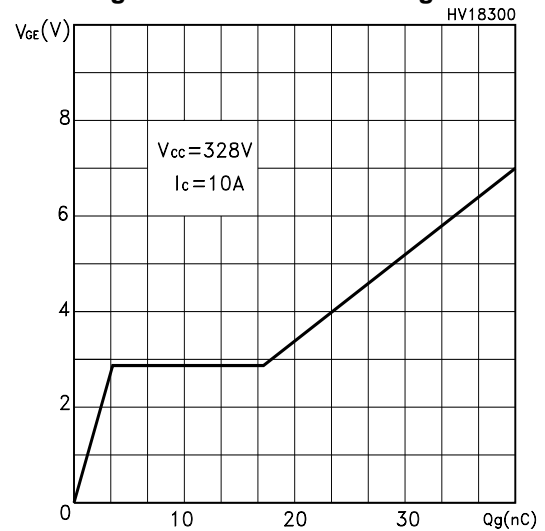
Normalized Clamping Voltage vs Temperature



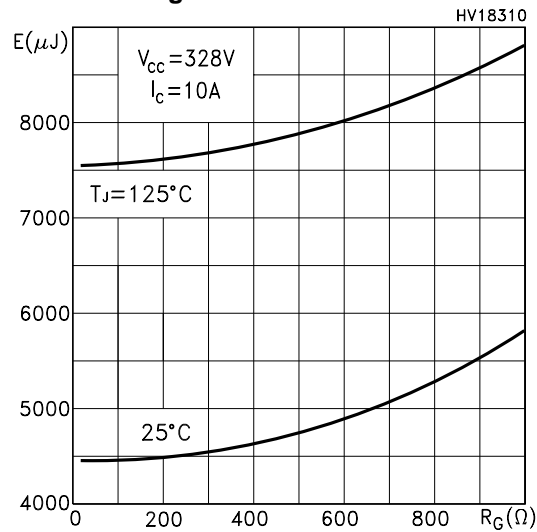
Capacitance Variations



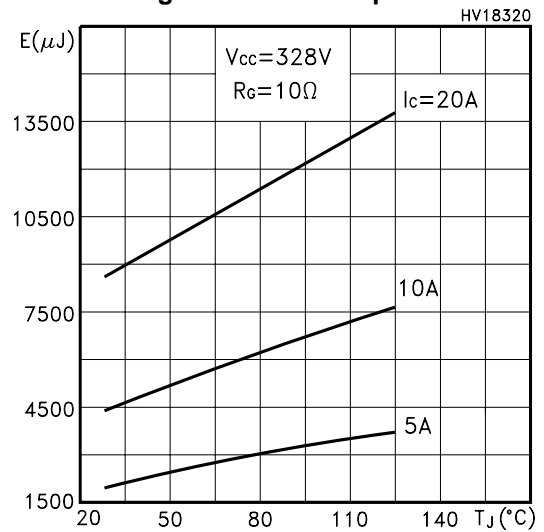
Gate Charge vs Gate-Emitter Voltage



Total Switching Losses vs Gate Resistance

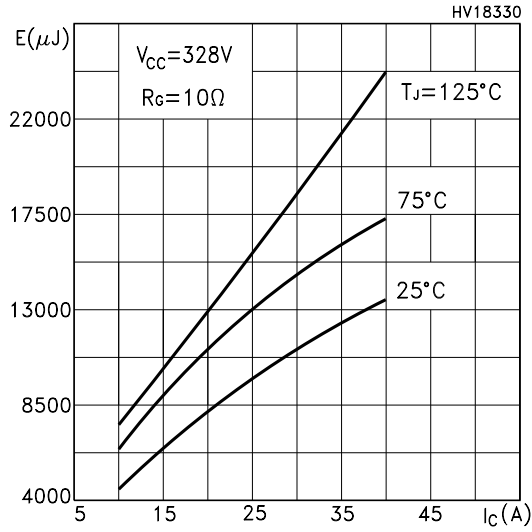


Total Switching Losses vs Temperature

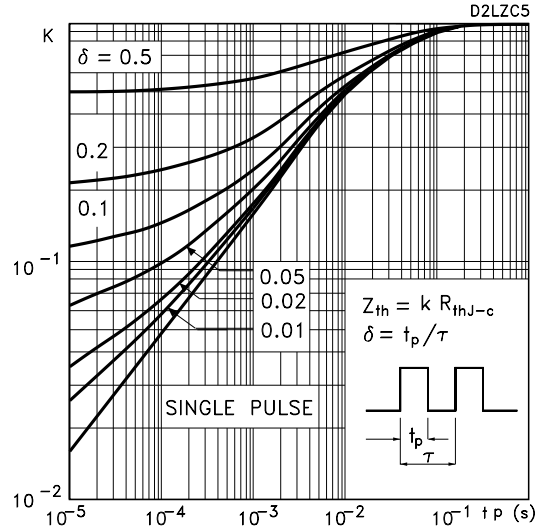


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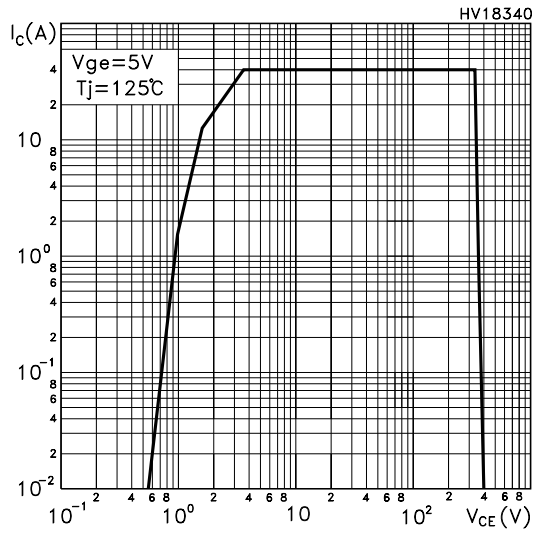
## Total Switching Losses vs Collector Current



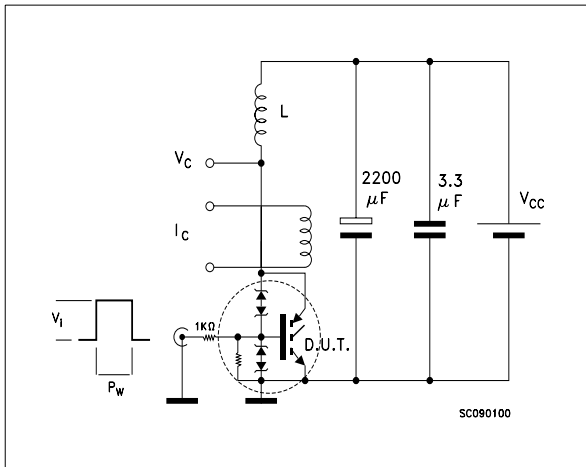
## Thermal Impedance



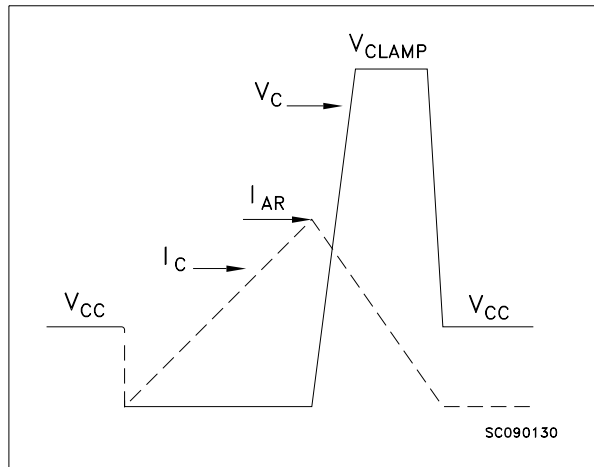
## Turn-Off SOA



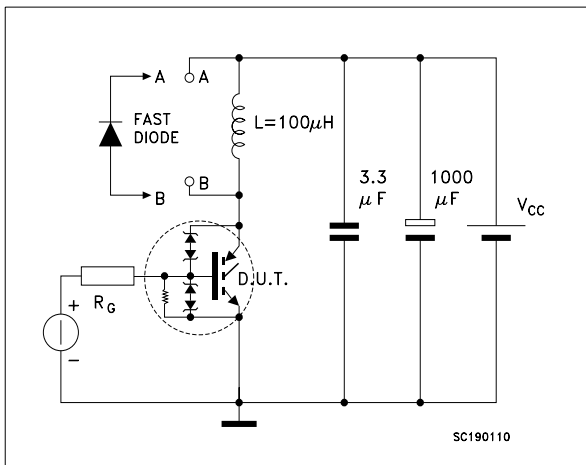
**Fig. 1: Unclamped Inductive Load Test Circuit**



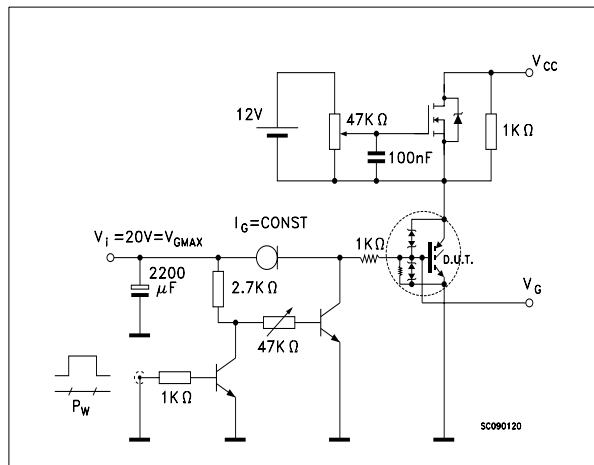
**Fig. 2: Unclamped Inductive Waveform**



**Fig. 3: Test Circuit For Inductive Load Switching And Diode Recovery Times**

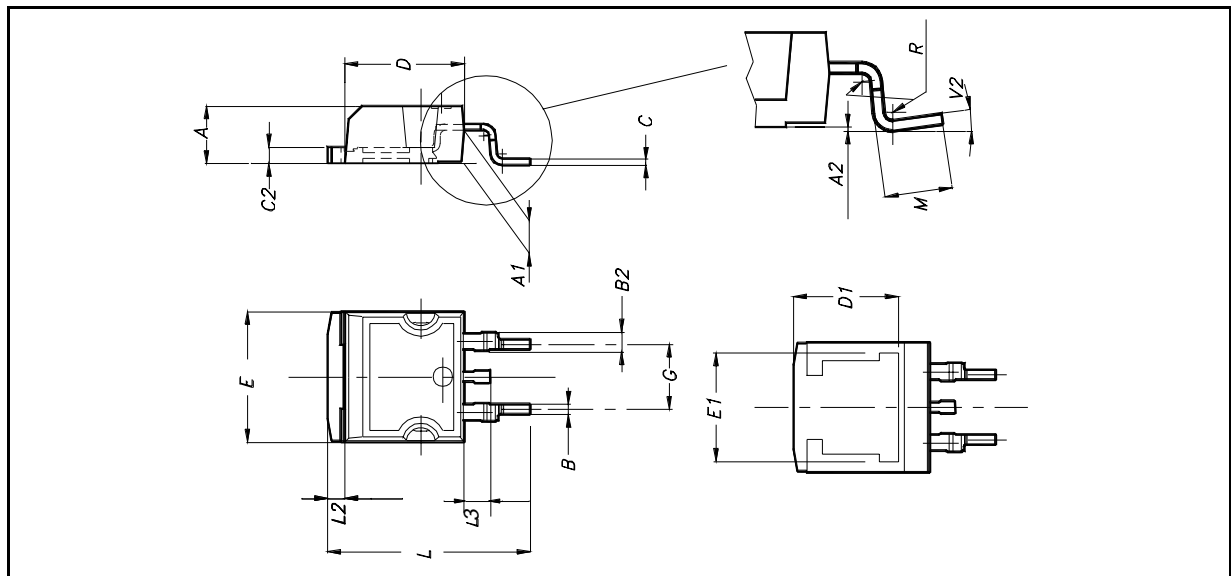


**Fig. 4: Gate Charge test Circuit**



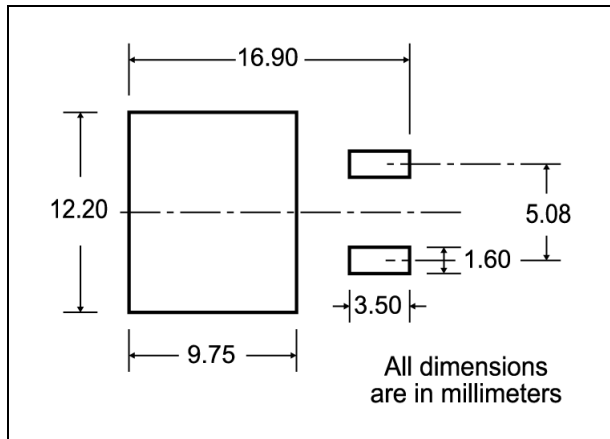
**D<sup>2</sup>PAK MECHANICAL DATA**

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°			

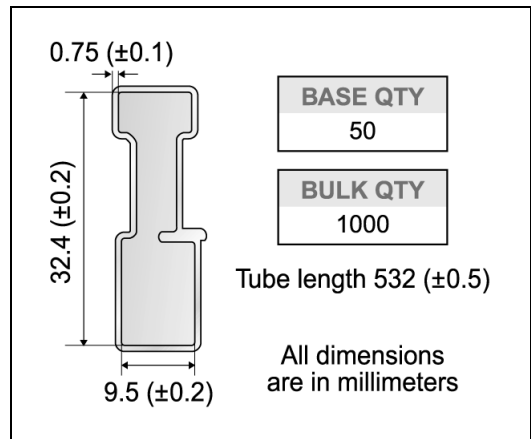




**D<sup>2</sup>PAK FOOTPRINT**



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



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

Diagram showing the tape mechanical data. It includes a circular hub with a diameter of A, a central slot with a width of D, and a full radius. A 40 mm min. access hole is located at the slot position. The tape slot in the core for tape start has a width of 2.5 mm min. The distance from the center of the hub to the center of the slot is B. The distance from the center of the hub to the center of the tape slot is C. The distance from the center of the hub to the center of the tape slot is N. The distance from the center of the hub to the center of the tape slot is G, measured at the hub. The thickness of the tape is T.

**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

**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**: 1000  
**BULK QTY**: 1000

Diagram showing the reel mechanical data. It includes a top cover tape with a thickness of K<sub>0</sub> and a width of T. The distance from the center of the hub to the center of the tape slot is B<sub>0</sub>. The distance from the center of the hub to the center of the tape slot is D<sub>1</sub>. The distance from the center of the hub to the center of the tape slot is D. The distance from the center of the hub to the center of the tape slot is P<sub>2</sub>. The distance from the center of the hub to the center of the tape slot is P<sub>0</sub>. The distance from the center of the hub to the center of the tape slot is E. The distance from the center of the hub to the center of the tape slot is F. The distance from the center of the hub to the center of the tape slot is W. The distance from the center of the hub to the center of the tape slot is A<sub>0</sub>. The distance from the center of the hub to the center of the tape slot is P<sub>1</sub>. The center line of the cavity is shown. The user direction of feed is indicated. The reel is shown with a bending radius of R min. The feed direction is indicated.

\* on sales type



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