



STB40NF10

N-CHANNEL 100V - 0.025Ω - 50A - D²PAK LOW GATE CHARGE STripFET™II MOSFET

Table 1: General Features

TYPE	V _{DSS}	R _{DS(on)}	I _D
STB40NF10T4	100 V	< 0.028 Ω	50 A

- TYPICAL R_{DS(on)} = 0.025Ω
- EXCEPTIONAL dv/dt CAPABILITY
- LOW GATE CHARGE AT 100°C
- APPLICATION ORIENTED CHARACTERIZATION
- 100% AVALANCHE TESTED

DESCRIPTION

This MOSFET is the latest development of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows extremely high packing density for low on-resistance, rugged avalanche characteristics and less critical alignment steps therefore a remarkable manufacturing reproducibility.

APPLICATIONS

- DC-DC & DC-AC CONVERTERS
- MOTOR CONTROL, AUDIO AMPLIFIERS
- HIGH CURRENT, HIGH SPEED SWITCHING
- SOLENOID AND RELAY DRIVERS
- AUTOMOTIVE ENVIRONMENT

Figure 1: Package

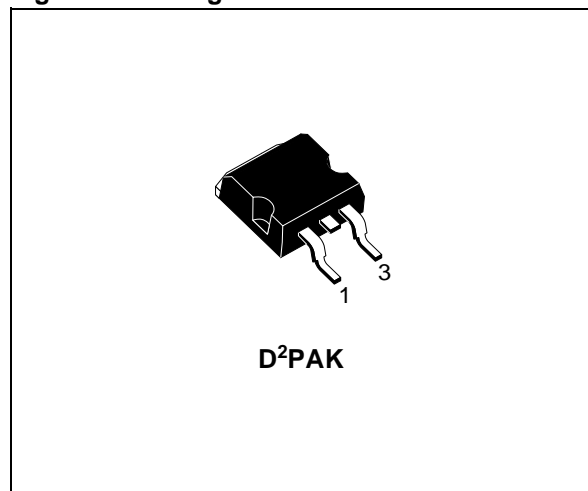


Figure 2: Internal Schematic Diagram

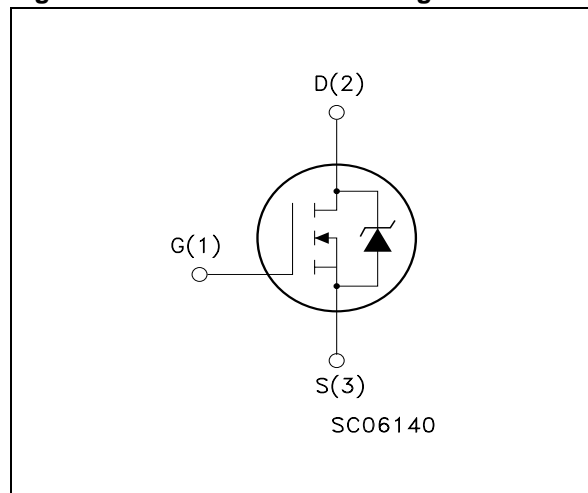


Table 2: Order Codes

SALES TYPE	MARKING	PACKAGE	PACKAGING
STB40NF10T4	B40NF10	D ² PAK	TAPE & REEL

Table 3: Absolute Maximum ratings

Symbol	Parameter	Value	Unit
V_{DS}	Drain-source Voltage ($V_{GS} = 0$)	100	V
V_{DGR}	Drain-gate Voltage ($R_{GS} = 20 \text{ k}\Omega$)	100	V
V_{GS}	Gate- source Voltage	± 20	V
$I_D^{(*)}$	Drain Current (continuous) at $T_C = 25^\circ\text{C}$	50	A
I_D	Drain Current (continuous) at $T_C = 100^\circ\text{C}$	35	A
$I_{DM}^{(*)}$	Drain Current (pulsed)	200	A
P_{TOT}	Total Dissipation at $T_C = 25^\circ\text{C}$	150	W
	Derating Factor	1	W/ $^\circ\text{C}$
dv/dt (1)	Peak Diode Recovery voltage slope	20	V/ns
E_{AS} (2)	Single Pulse Avalanche Energy	150	mJ
T_{stg}	Storage Temperature	- 55 to 175	$^\circ\text{C}$
T_j	Operating Junction Temperature		

(•) Pulse width limited by safe operating area

(*) Limited by Package

(1) $I_{SD} \leq 50\text{A}$, $di/dt \leq 600 \text{ A}/\mu\text{s}$, $V_{DD} \leq V_{(BR)DSS}$, $T_j \leq T_{JMAX}$.

(2) Starting $T_j = 25^\circ\text{C}$, $I_D = 50\text{A}$, $V_{DD} = 25\text{V}$

Table 4: Thermal Data

Rthj-case	Thermal Resistance Junction-case Max	1	$^\circ\text{C}/\text{W}$
Rthj-amb	Thermal Resistance Junction-ambient Max	62.5	$^\circ\text{C}/\text{W}$
T_l	Maximum Lead Temperature For Soldering Purpose	300	$^\circ\text{C}$

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

Table 5: On/Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{(BR)DSS}$	Drain-source Breakdown Voltage	$I_D = 250 \mu\text{A}$, $V_{GS} = 0$	100			V
I_{DSS}	Zero Gate Voltage Drain Current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating}$ $V_{DS} = \text{Max Rating}$, $T_C = 125^\circ\text{C}$			1 10	μA μA
I_{GSS}	Gate-body Leakage Current ($V_{DS} = 0$)	$V_{GS} = \pm 20\text{V}$			± 100	nA
$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 250 \mu\text{A}$	2	2.8	4	V
$R_{DS(on)}$	Static Drain-source On Resistance	$V_{GS} = 10\text{V}$, $I_D = 25 \text{ A}$		0.024	0.028	Ω

ELECTRICAL CHARACTERISTICS (CONTINUED)

Table 6: Dynamic

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g_{fs} (1)	Forward Transconductance	$V_{DS} = 25V, I_D = 25 A$		20		S
C_{iss}	Input Capacitance	$V_{DS} = 25V, f = 1 MHz, V_{GS} = 0$		1780		pF
C_{oss}	Output Capacitance			265		pF
C_{rss}	Reverse Transfer Capacitance			112		pF

Table 7: Switching On

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 50 V, I_D = 25 A$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		28		ns
t_r	Rise Time			63		ns
Q_g	Total Gate Charge	$V_{DD} = 80V, I_D = 50A, V_{GS} = 10V$		60.6	80	nC
Q_{gs}	Gate-Source Charge			9.6		nC
Q_{gd}	Gate-Drain Charge			22.8		nC

Table 8: Switching Off

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(off)}$	Turn-off-Delay Time	$V_{DD} = 50 V, I_D = 25 A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		84		ns
t_f	Fall Time			28		ns

Table 9: Source Drain Diode

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
I_{SD}	Source-drain Current				50	A
I_{SDM} (2)	Source-drain Current (pulsed)				200	A
V_{SD} (1)	Forward On Voltage	$I_{SD} = 50 A, V_{GS} = 0$			1.3	V
t_{rr}	Reverse Recovery Time	$I_{SD} = 50 A, di/dt = 100A/\mu s, V_{DD} = 25V, T_j = 150^\circ C$ (see test circuit, Figure 5)		114		ns
Q_{rr}	Reverse Recovery Charge			456		nC
I_{RRM}	Reverse Recovery Current			8		A

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

(2) Pulse width limited by safe operating area.

Figure 3: Safe Operating Area

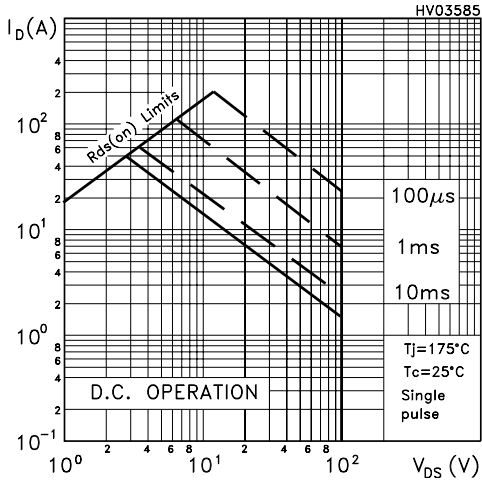


Figure 4: Output Characteristics

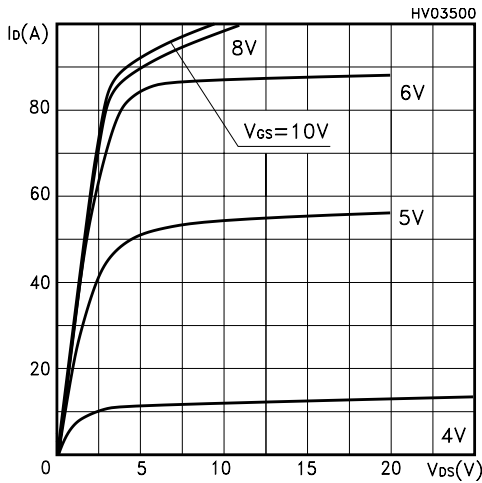


Figure 5: Transconductance

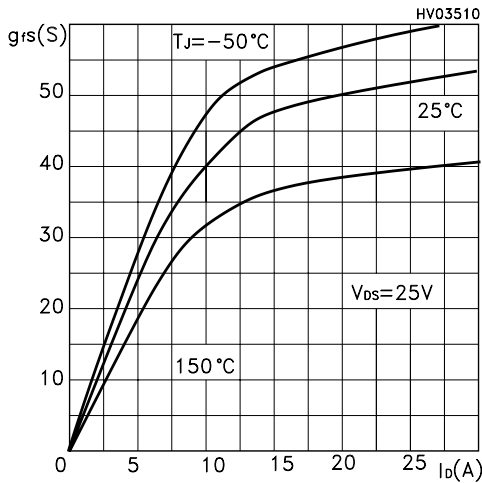


Figure 6: Thermal Impedance

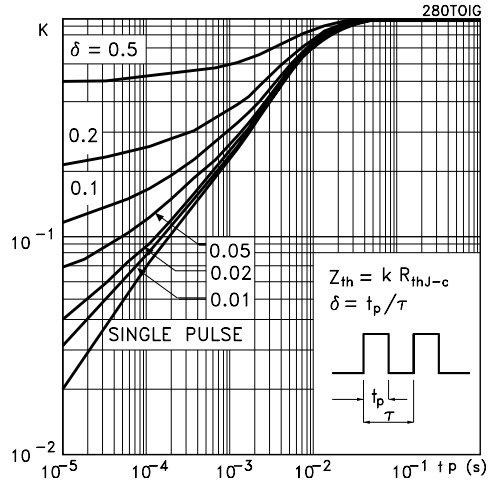


Figure 7: Transfer Characteristics

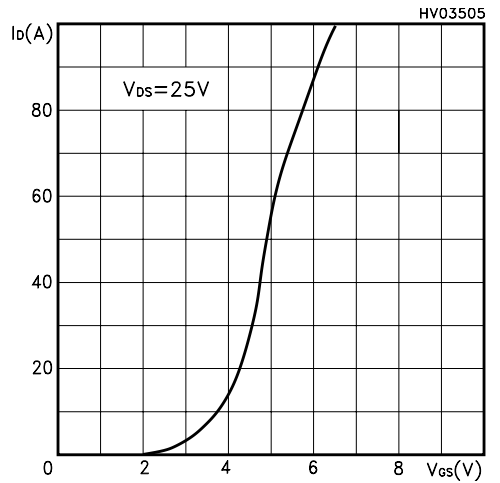


Figure 8: Static Drain-source On Resistance

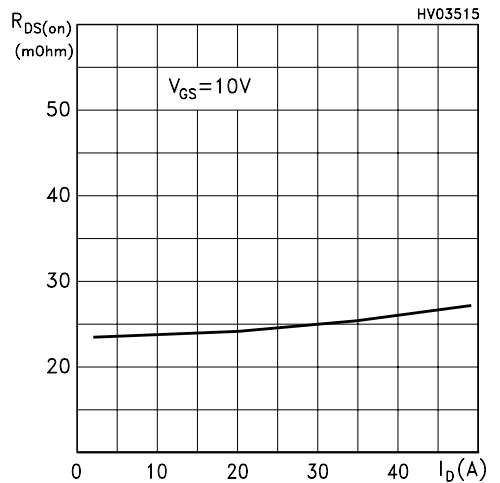


Figure 9: Gate Charge vs Gate-source Voltage

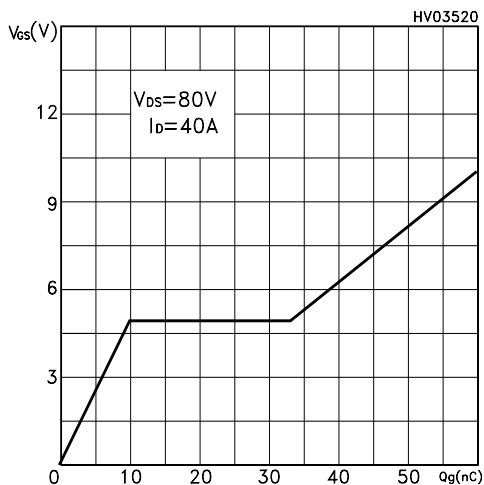


Figure 10: Normalized Gate Threshold Voltage vs Temperature

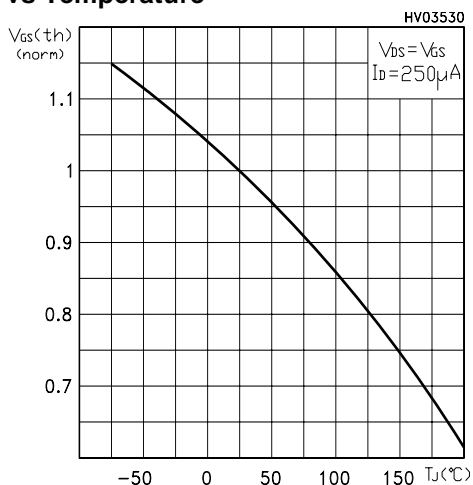


Figure 11: Source-Drain Diode Forward Characteristics

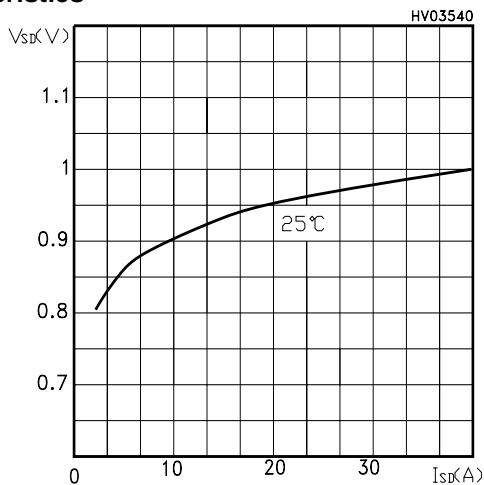


Figure 12: Capacitance Variations

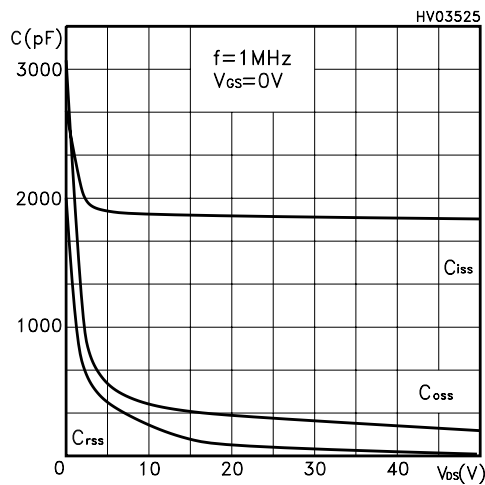


Figure 13: Normalized On Resistance vs Temperature

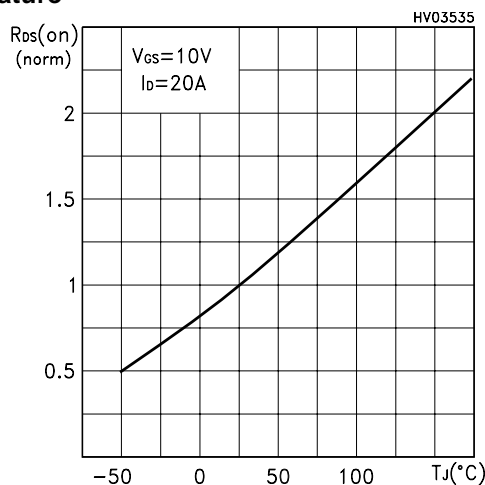


Figure 14: Normalized Breakdown Voltage vs Temperature

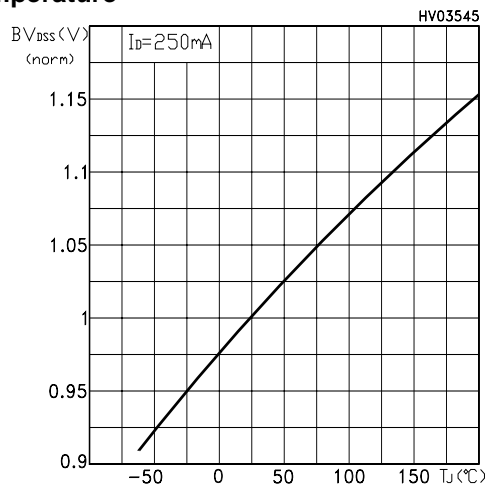


Figure 15: Unclamped Inductive Load Test Circuit

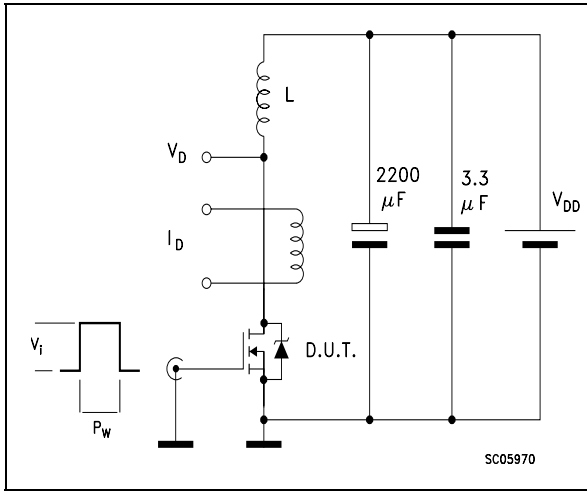


Figure 16: Switching Times Test Circuit For Resistive Load

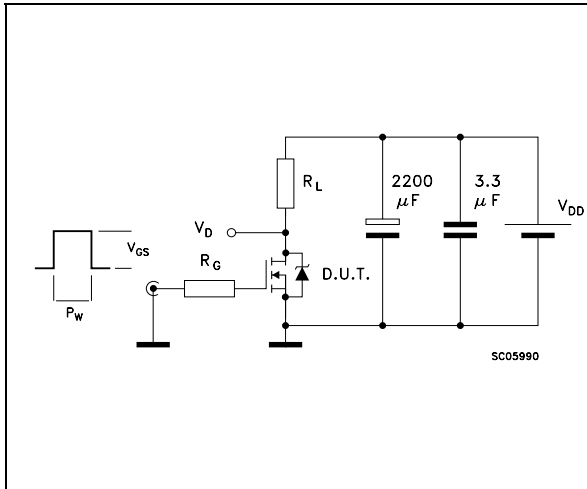


Figure 17: Test Circuit For Inductive Load Switching and Diode Recovery Times

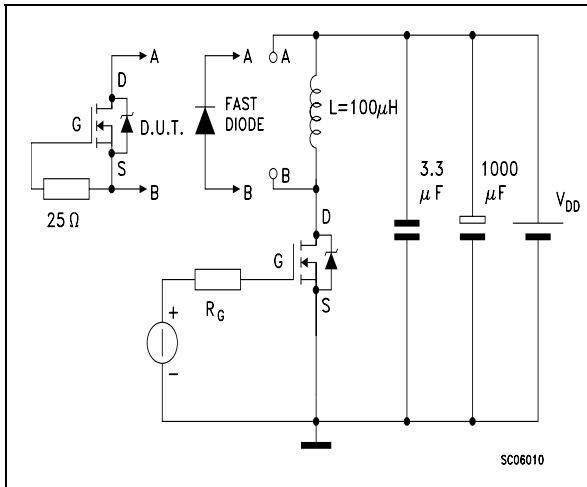


Figure 18: Unclamped Inductive Waferform

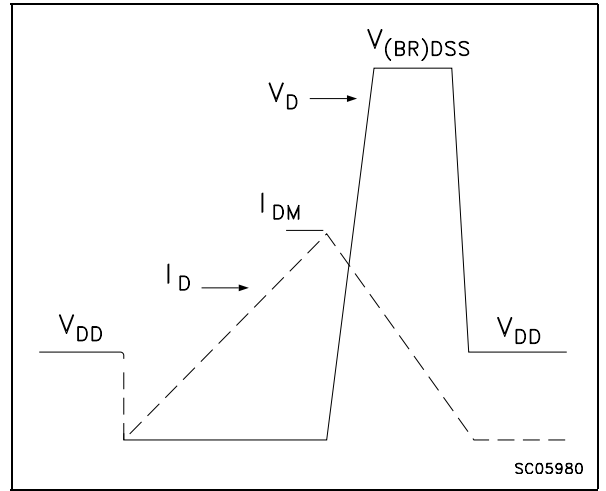
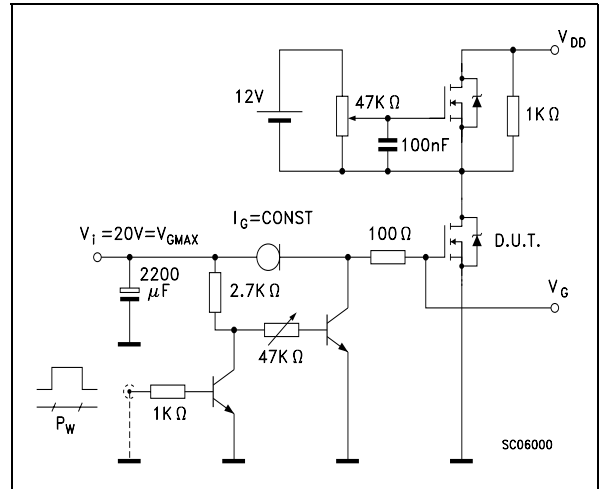
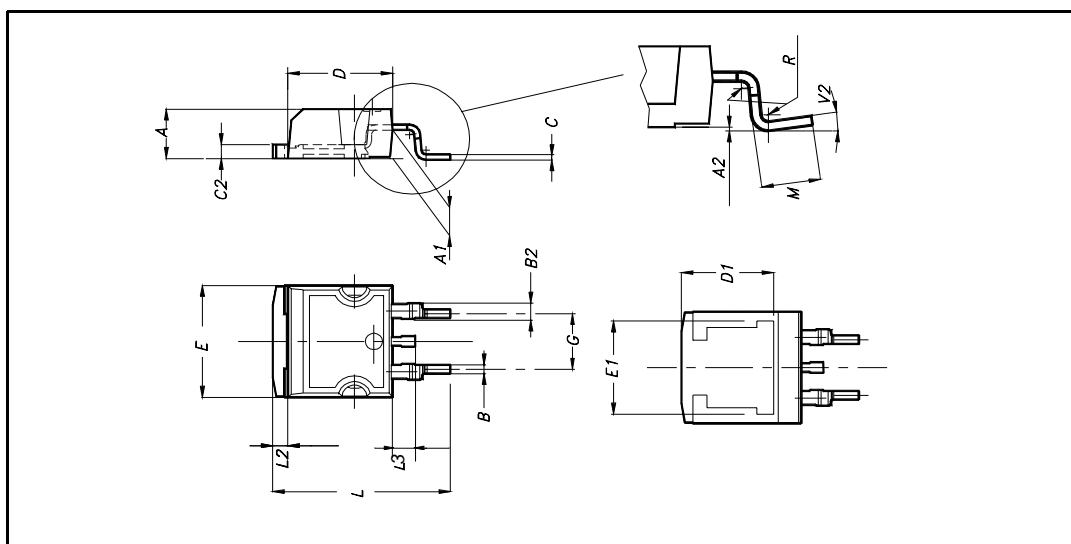


Figure 19: Gate Charge Test Circuit

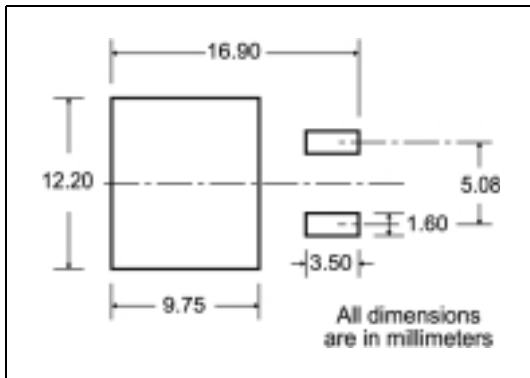


D²PAK MECHANICAL DATA

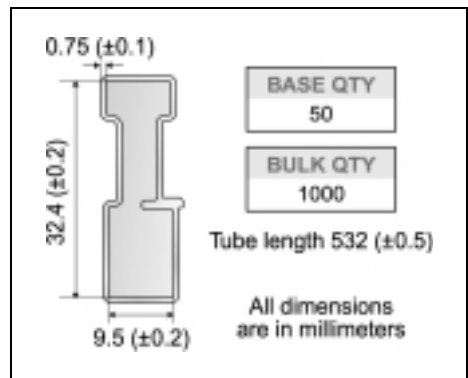
DIM.	mm.			inch		
	MIN.	TYP	MAX.	MIN.	TYP.	MAX.
A	4.4		4.6	0.173		0.181
A1	2.49		2.69	0.098		0.106
A2	0.03		0.23	0.001		0.009
B	0.7		0.93	0.027		0.036
B2	1.14		1.7	0.044		0.067
C	0.45		0.6	0.017		0.023
C2	1.23		1.36	0.048		0.053
D	8.95		9.35	0.352		0.368
D1		8			0.315	
E	10		10.4	0.393		
E1		8.5			0.334	
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°		4°			



D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

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	BULK QTY
1000	1000

* on sales type

Table 10: Revision History

Date	Revision	Description of Changes
14-Dec-2004	2	New Stylesheet

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