



# THE DATASHEET OF STD5NM50T4



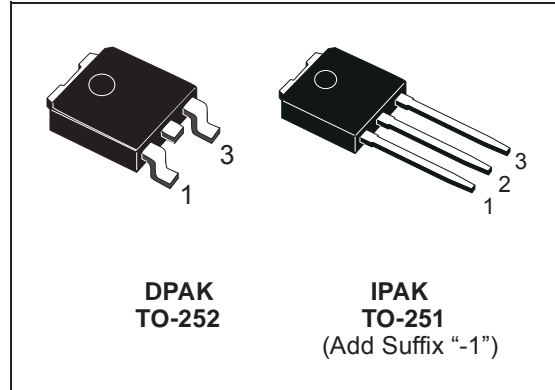


# STD5NM50 STD5NM50-1

N-CHANNEL 500V - 0.7Ω - 7.5A DPAK/IPAK  
MDmesh™ Power MOSFET

TYPE	V <sub>DSS</sub>	R <sub>DS(on)</sub>	I <sub>D</sub>
STD5NM50	500V	<0.8Ω	7.5 A
STD5NM50-1	500V	<0.8Ω	7.5 A

- TYPICAL R<sub>DS(on)</sub> = 0.7Ω
- HIGH dv/dt AND AVALANCHE CAPABILITIES
- 100% AVALANCHE TESTED
- LOW INPUT CAPACITANCE AND GATE CHARGE
- LOW GATE INPUT RESISTANCE
- TIGHT PROCESS CONTROL AND HIGH MANUFACTURING YIELDS



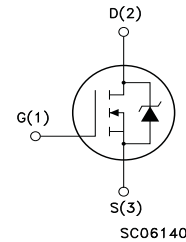
## DESCRIPTION

The MDmesh™ is a new revolutionary MOSFET technology that associates the Multiple Drain process with the Company's PowerMESH™ horizontal layout. The resulting product has an outstanding low on-resistance, impressively high dv/dt and excellent avalanche characteristics. The adoption of the Company's proprietary strip technique yields overall dynamic performance that is significantly better than that of similar competition's products.

## APPLICATIONS

The MDmesh™ family is very suitable for increasing power density of high voltage converters allowing system miniaturization and higher efficiencies.

## INTERNAL SCHEMATIC DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V <sub>DS</sub>	Drain-source Voltage (V <sub>GS</sub> = 0)	500	V
V <sub>DGR</sub>	Drain-gate Voltage (R <sub>GS</sub> = 20 kΩ)	500	V
V <sub>GS</sub>	Gate- source Voltage	±30	V
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 25°C	7.5	A
I <sub>D</sub>	Drain Current (continuous) at T <sub>C</sub> = 100°C	4.7	A
I <sub>DM</sub> (•)	Drain Current (pulsed)	30	A
P <sub>TOT</sub>	Total Dissipation at T <sub>C</sub> = 25°C	100	W
	Derating Factor	0.8	W/°C
dv/dt (1)	Peak Diode Recovery voltage slope	15	V/ns
T <sub>stg</sub>	Storage Temperature	- 55 to 150	°C
T <sub>j</sub>	Max. Operating Junction Temperature		

(•) Pulse width limited by safe operating area

(1) I<sub>SD</sub> ≤ 5A, di/dt ≤ 400A/μs, V<sub>DD</sub> ≤ V<sub>(BR)DSS</sub>, T<sub>j</sub> ≤ T<sub>JMAX</sub>.

## STD5NM50/STD5NM50-1

### THERMAL DATA

Rthj-case	Thermal Resistance Junction-case	Max	1.25	°C/W
Rthj-amb	Thermal Resistance Junction-ambient	Max	100	°C/W
T <sub>l</sub>	Maximum Lead Temperature For Soldering Purpose		300	°C

### AVALANCHE CHARACTERISTICS

Symbol	Parameter	Max Value	Unit
I <sub>AR</sub>	Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T <sub>j</sub> max)	2.5	A
E <sub>AS</sub>	Single Pulse Avalanche Energy (starting T <sub>j</sub> = 25 °C, I <sub>D</sub> = I <sub>AR</sub> , V <sub>DD</sub> = 50 V)	300	mJ

### ELECTRICAL CHARACTERISTICS (T<sub>CASE</sub> = 25 °C UNLESS OTHERWISE SPECIFIED)

OFF

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>(BR)DSS</sub>	Drain-source Breakdown Voltage	I <sub>D</sub> = 250 μA, V <sub>GS</sub> = 0	500			V
I <sub>DSS</sub>	Zero Gate Voltage Drain Current (V <sub>GS</sub> = 0)	V <sub>DS</sub> = Max Rating V <sub>DS</sub> = Max Rating, T <sub>C</sub> = 125 °C			1 10	μA μA
I <sub>GSS</sub>	Gate-body Leakage Current (V <sub>DS</sub> = 0)	V <sub>GS</sub> = ±30V			±100	nA

ON (1)

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	3	4	5	V
R <sub>DS(on)</sub>	Static Drain-source On Resistance	V <sub>GS</sub> = 10V, I <sub>D</sub> = 2.5A		0.7	0.8	Ω

DYNAMIC

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
g <sub>fs</sub> (1)	Forward Transconductance	V <sub>DS</sub> = 25V <sub>x</sub> , I <sub>D</sub> = 2.5A		3.5		S
C <sub>iSS</sub>	Input Capacitance	V <sub>DS</sub> = 25V, f = 1 MHz, V <sub>GS</sub> = 0		415		pF
C <sub>oSS</sub>	Output Capacitance			88		pF
C <sub>rSS</sub>	Reverse Transfer Capacitance			12		pF
C <sub>oSS eq.</sub> (2)	Equivalent Output Capacitance	V <sub>GS</sub> = 0V, V <sub>DS</sub> = 0V to 400V		50		pF
R <sub>G</sub>	Gate Input Resistance	f=1 MHz Gate DC Bias = 0 Test Signal Level = 20mV Open Drain		3		Ω

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

2. C<sub>oSS eq.</sub> is defined as a constant equivalent capacitance giving the same charging time as C<sub>oSS</sub> when V<sub>DS</sub> increases from 0 to 80% V<sub>DSS</sub>.

**ELECTRICAL CHARACTERISTICS (CONTINUED)**  
SWITCHING ON

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{d(on)}$	Turn-on Delay Time	$V_{DD} = 250V, I_D = 2.5A$		16		ns
$t_r$	Rise Time	$R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 3)		8		ns
$Q_g$	Total Gate Charge	$V_{DD} = 400V, I_D = 7.5A$		13		nC
$Q_{gs}$	Gate-Source Charge	$V_{GS} = 10V$		5		nC
$Q_{gd}$	Gate-Drain Charge			6		nC

SWITCHING OFF

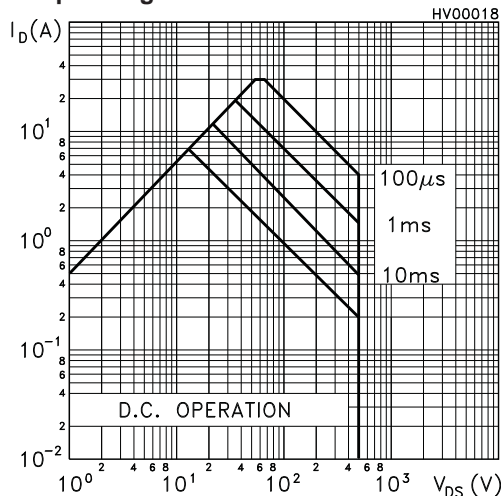
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$t_{r(voff)}$	Off-voltage Rise Time	$V_{DD} = 400V, I_D = 5A,$		14		ns
$t_f$	Fall Time	$R_G = 4.7\Omega, V_{GS} = 10V$ (see test circuit, Figure 5)		6		ns
$t_c$	Cross-over Time			13		ns

SOURCE DRAIN DIODE

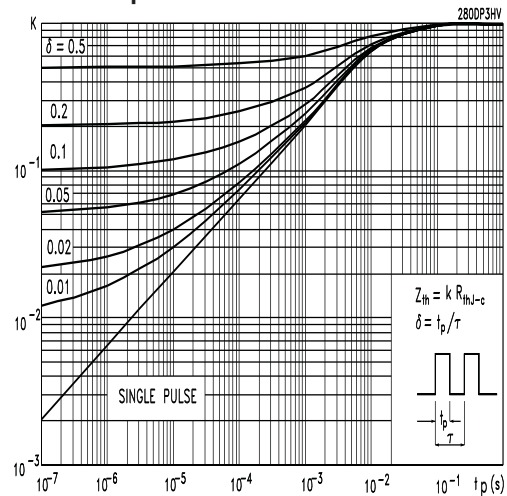
Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$I_{SD}$	Source-drain Current				7.5	A
$I_{SDM} (2)$	Source-drain Current (pulsed)				30	A
$V_{SD} (1)$	Forward On Voltage	$I_{SD} = 7.5A, V_{GS} = 0$			1.5	V
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 5A, di/dt = 100A/\mu s,$		185		ns
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = 100V, T_j = 25^\circ C$ (see test circuit, Figure 5)		1.1		$\mu C$
$I_{RRM}$	Reverse Recovery Current			11.5		A
$t_{rr}$	Reverse Recovery Time	$I_{SD} = 5A, di/dt = 100A/\mu s,$		270		ns
$Q_{rr}$	Reverse Recovery Charge	$V_{DD} = 100V, T_j = 150^\circ C$ (see test circuit, Figure 5)		1.6		$\mu C$
$I_{RRM}$	Reverse Recovery Current			12		A

Note: 1. Pulsed: Pulse duration = 300  $\mu s$ , duty cycle 1.5 %.  
2. Pulse width limited by safe operating area.

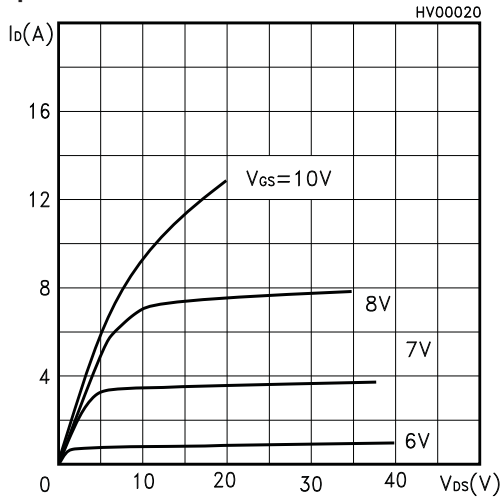
Safe Operating Area



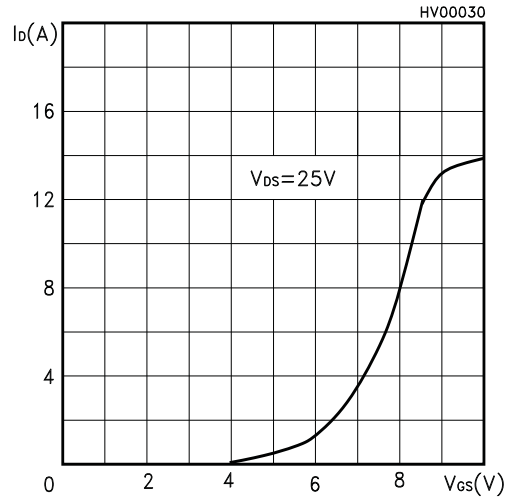
Thermal Impedance



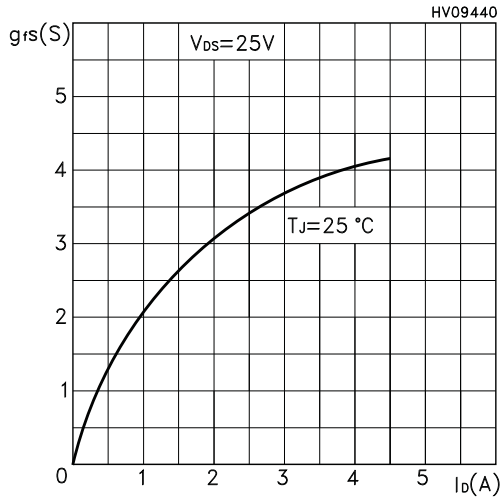
Output Characteristics



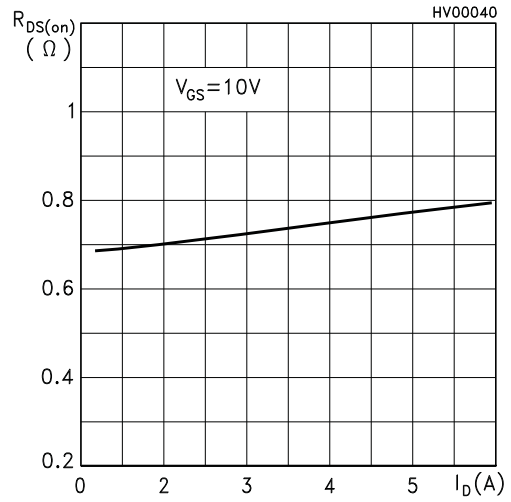
Transfer Characteristics



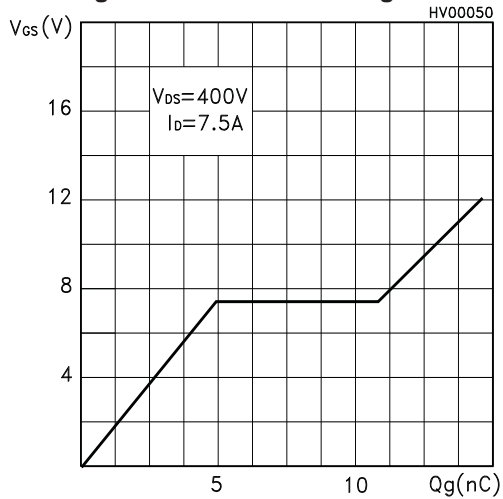
Transconductance



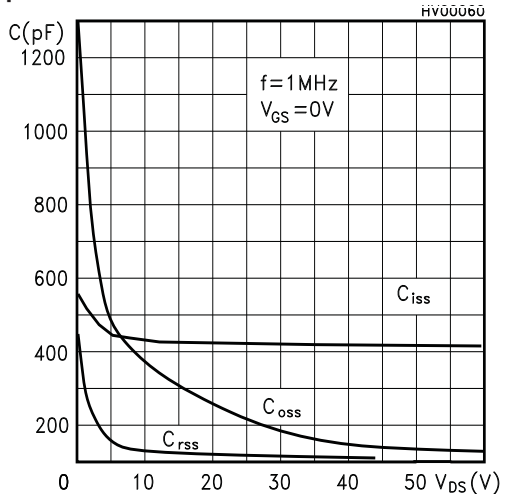
Static Drain-source On Resistance



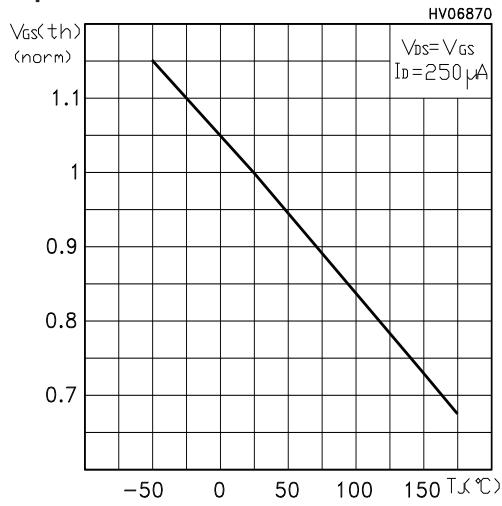
Gate Charge vs Gate-source Voltage



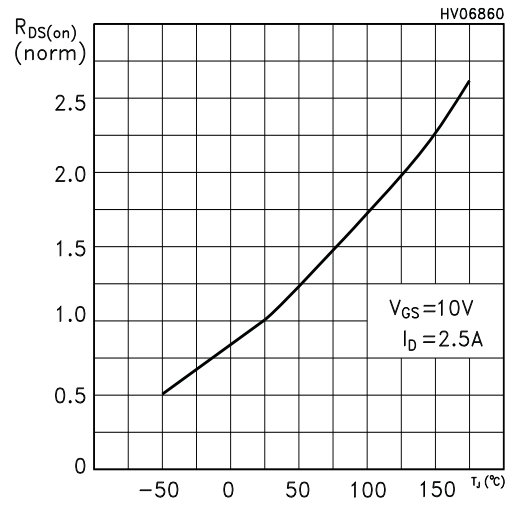
Capacitance Variations



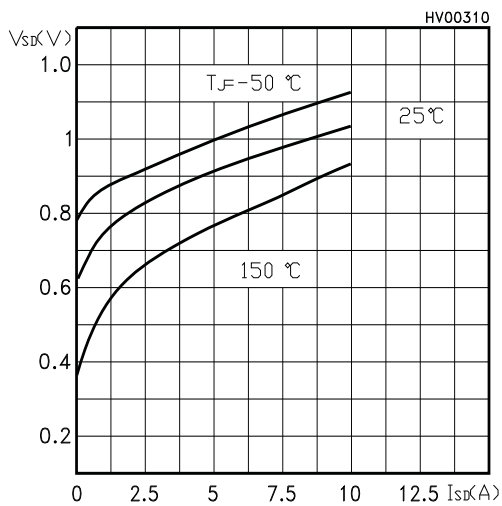
**Normalized Gate Threshold Voltage vs Temperature**



**Normalized On Resistance vs Temperature**



**Source-drain Diode Forward Characteristics**



**Normalized BVDSS vs Temperature**

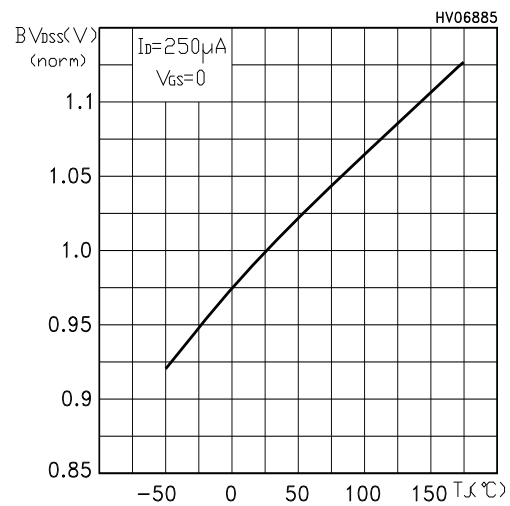


Fig. 1: Unclamped Inductive Load Test Circuit

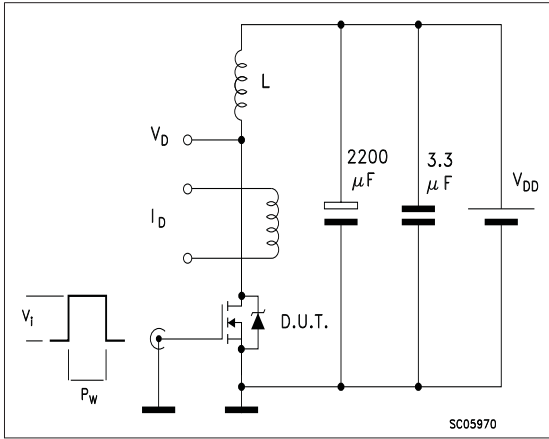


Fig. 2: Unclamped Inductive Waveform

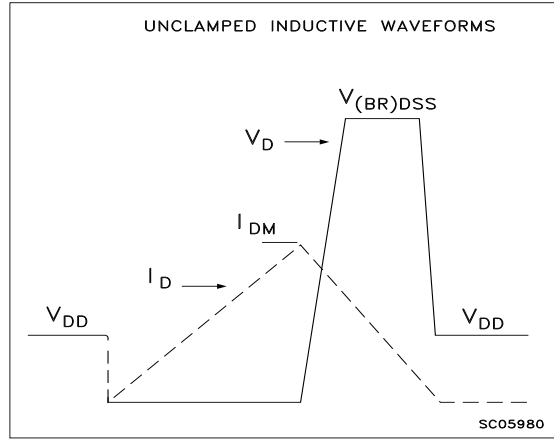


Fig. 3: Switching Times Test Circuit For Resistive Load

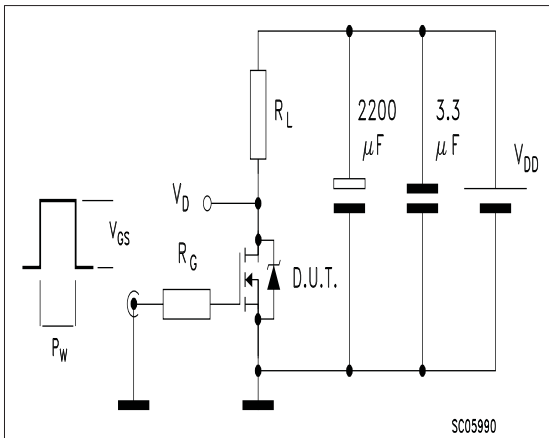


Fig. 4: Gate Charge test Circuit

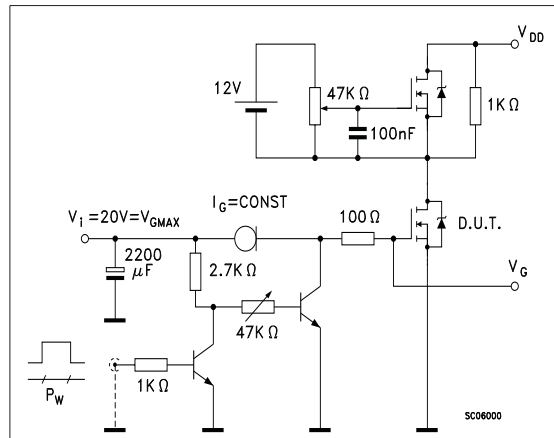
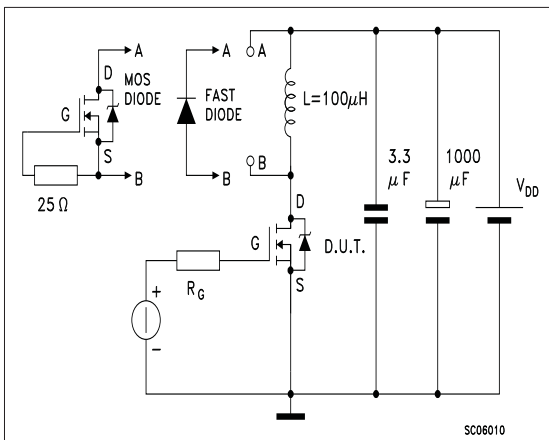
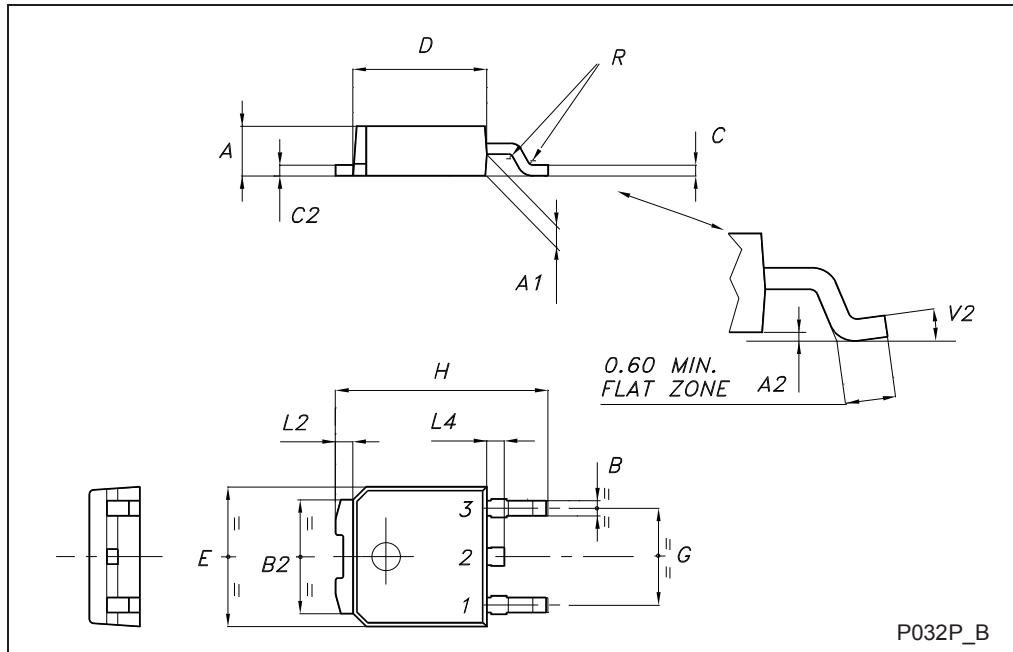


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



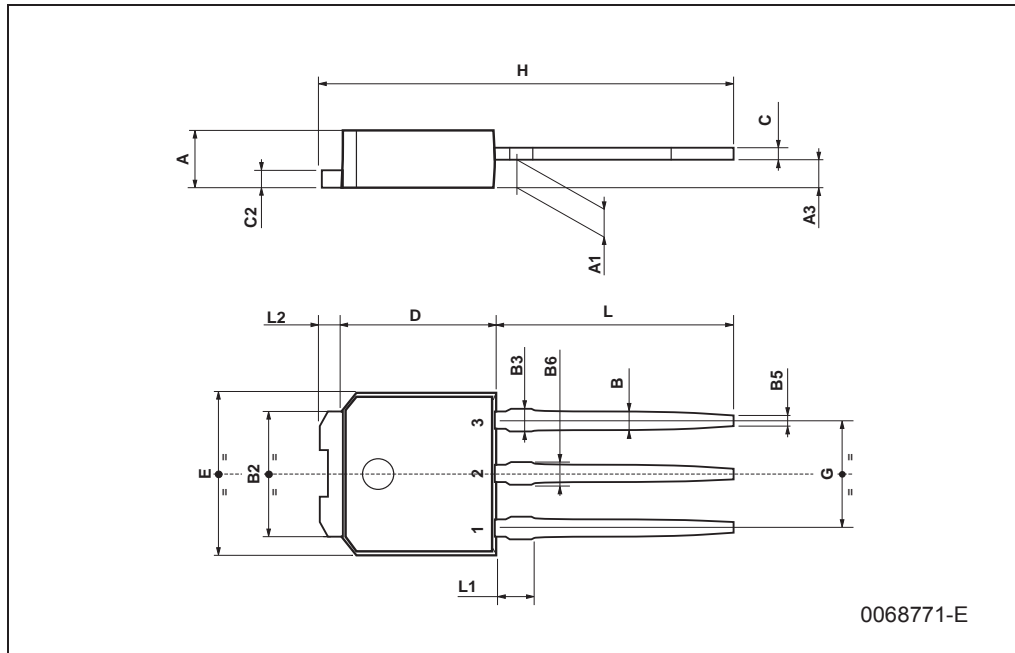
TO-252 (DPAK) MECHANICAL DATA

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°

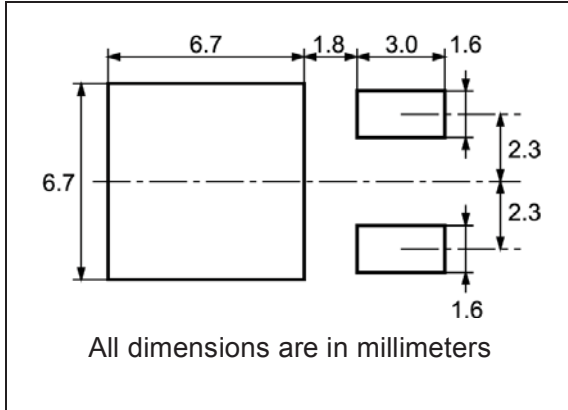


TO-251 (IPAK) MECHANICAL DATA

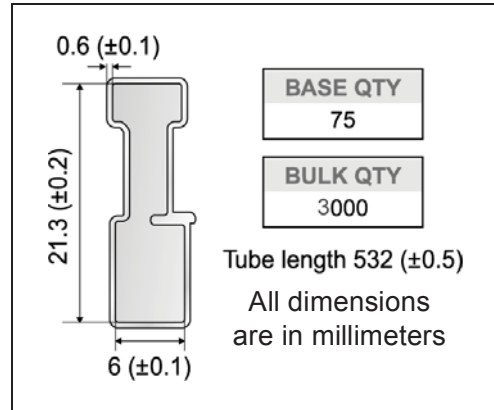
DIM.	mm			inch		
	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.
A	2.2		2.4	0.086		0.094
A1	0.9		1.1	0.035		0.043
A3	0.7		1.3	0.027		0.051
B	0.64		0.9	0.025		0.031
B2	5.2		5.4	0.204		0.212
B3			0.85			0.033
B5		0.3			0.012	
B6			0.95			0.037
C	0.45		0.6	0.017		0.023
C2	0.48		0.6	0.019		0.023
D	6		6.2	0.236		0.244
E	6.4		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**



**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

G measured at hub

**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

<b>BASE QTY</b>	<b>BULK QTY</b>
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.

TRL

FEED DIRECTION

User Direction of Feed

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

\* on sales type



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