

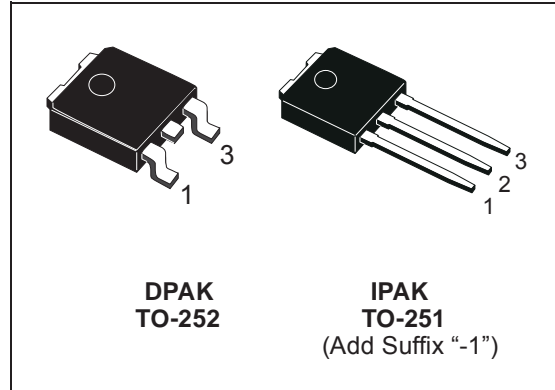


STD5NM50 STD5NM50-1

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

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|------------|------------------|---------------------|----------------|
| STD5NM50 | 500V | <0.8Ω | 7.5 A |
| STD5NM50-1 | 500V | <0.8Ω | 7.5 A |

- TYPICAL R_{DS(on)} = 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



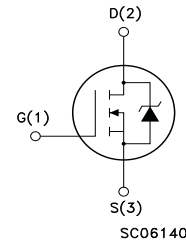
DESCRIPTION

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

(•) Pulse width limited by safe operating area

(1) I_{SD} ≤ 5A, di/dt ≤ 400A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

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 _l | Maximum Lead Temperature For Soldering Purpose | | 300 | °C |

AVALANCHE CHARACTERISTICS

| Symbol | Parameter | Max Value | Unit |
|-----------------|--|-----------|------|
| I _{AR} | Avalanche Current, Repetitive or Not-Repetitive (pulse width limited by T _j max) | 2.5 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V) | 300 | mJ |

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

OFF

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

ON (1)

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

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------------------|-------------------------------|--|------|------|------|------|
| g _{fs} (1) | Forward Transconductance | V _{DS} = 25V _x , I _D = 2.5A | | 3.5 | | S |
| C _{iSS} | Input Capacitance | V _{DS} = 25V, f = 1 MHz, V _{GS} = 0 | | 415 | | pF |
| C _{oSS} | Output Capacitance | | | 88 | | pF |
| C _{rSS} | Reverse Transfer Capacitance | | | 12 | | pF |
| C _{oSS eq.} (2) | Equivalent Output Capacitance | V _{GS} = 0V, V _{DS} = 0V to 400V | | 50 | | pF |
| R _G | 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_{oSS eq.} is defined as a constant equivalent capacitance giving the same charging time as C_{oSS} when V_{DS} increases from 0 to 80% V_{DSS}.

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

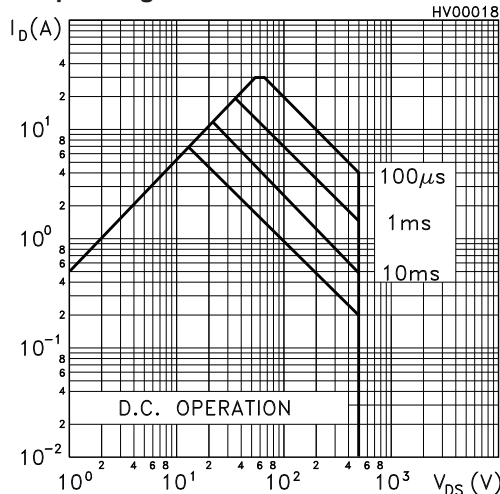
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|-----------------------|---|------|------|------|------|
| $t_{r(voff)}$ | Off-voltage Rise Time | $V_{DD} = 400V, I_D = 5A,$ $R_G = 4.7\Omega, V_{GS} = 10V$ | | 14 | | ns |
| t_f | Fall Time | (see test circuit, Figure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

SOURCE DRAIN DIODE

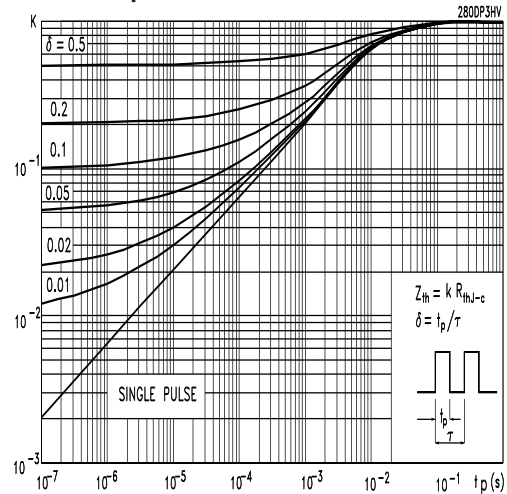
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------|-------------------------------|--|------|------|------|---------|
| I_{SD} | Source-drain Current | | | | 7.5 | A |
| $I_{SDM} (2)$ | Source-drain Current (pulsed) | | | | 30 | A |
| $V_{SD} (1)$ | Forward On Voltage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

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

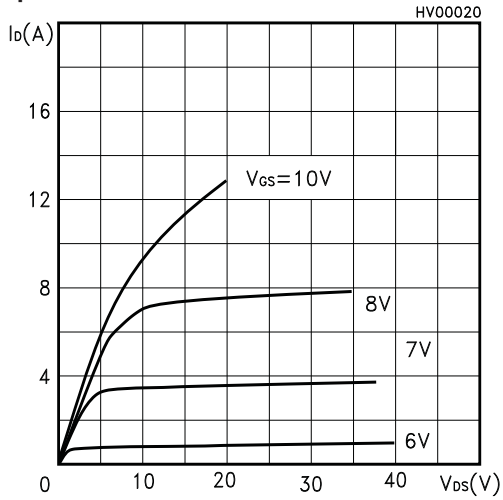
Safe Operating Area



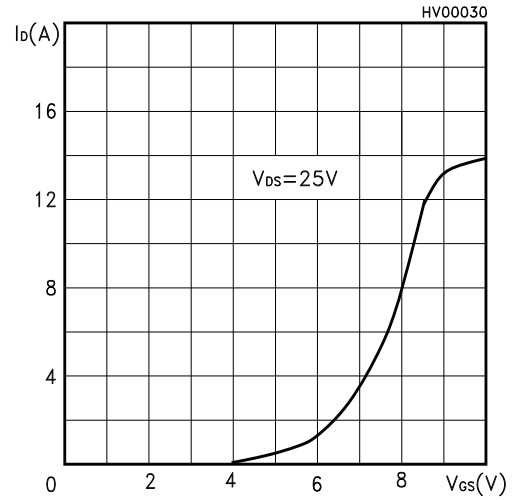
Thermal Impedance



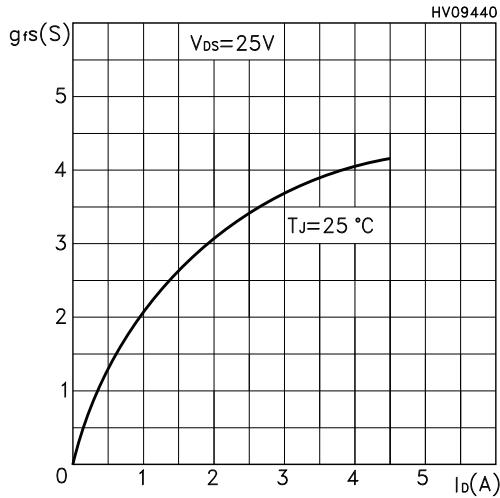
Output Characteristics



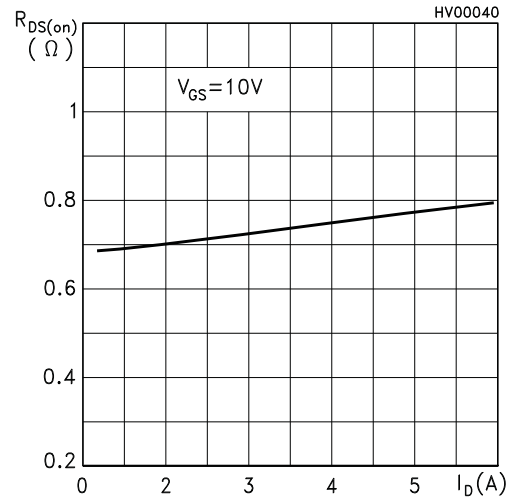
Transfer Characteristics



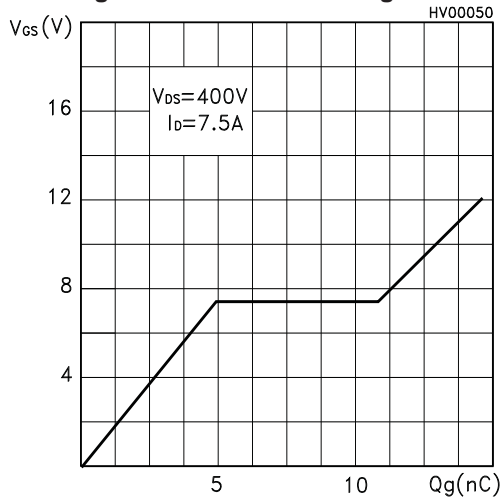
Transconductance



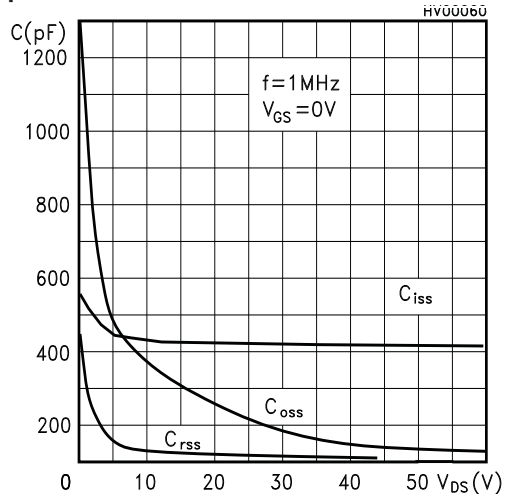
Static Drain-source On Resistance



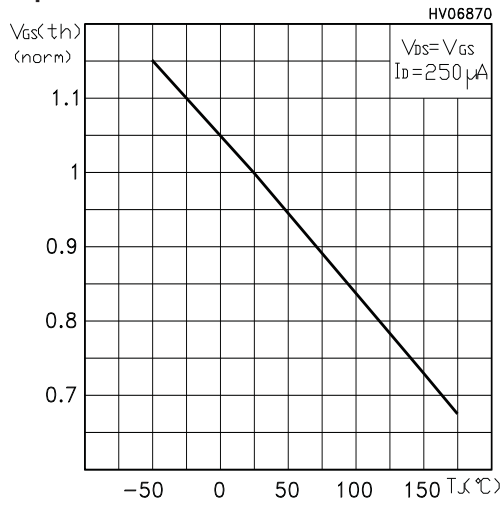
Gate Charge vs Gate-source Voltage



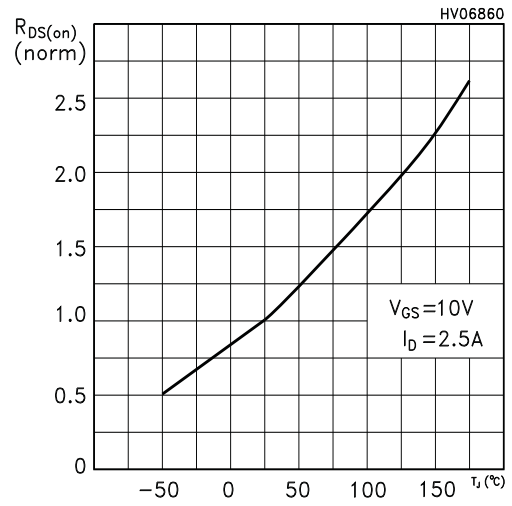
Capacitance Variations



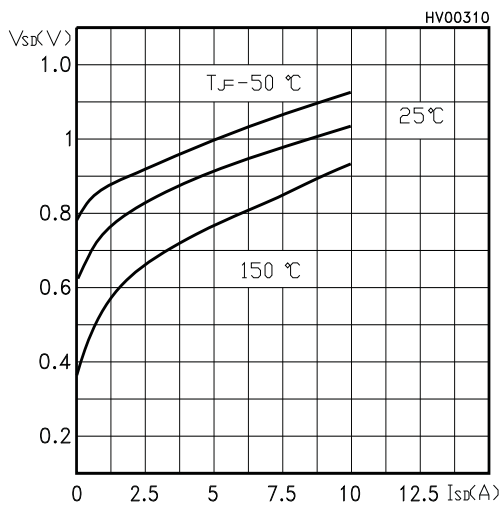
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized BVDSS vs Temperature

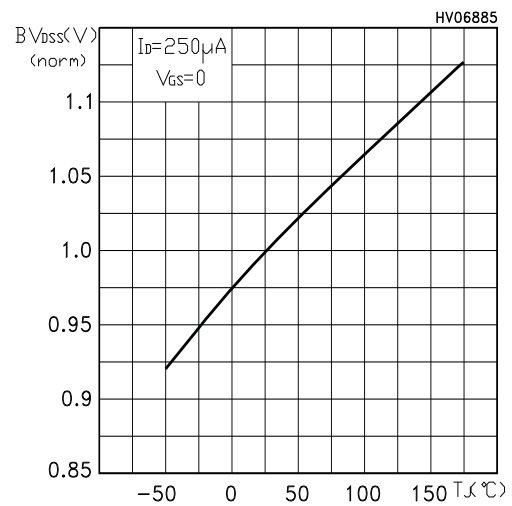


Fig. 1: Unclamped Inductive Load Test Circuit

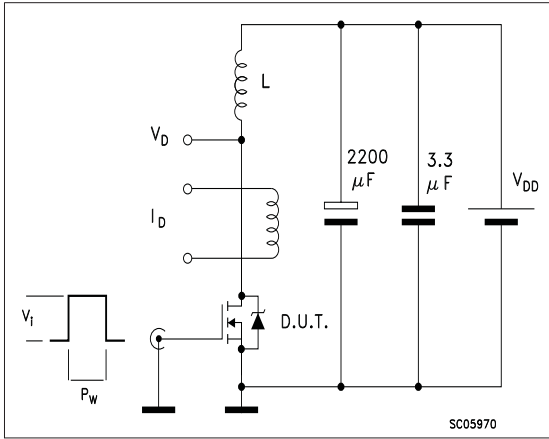


Fig. 2: Unclamped Inductive Waveform

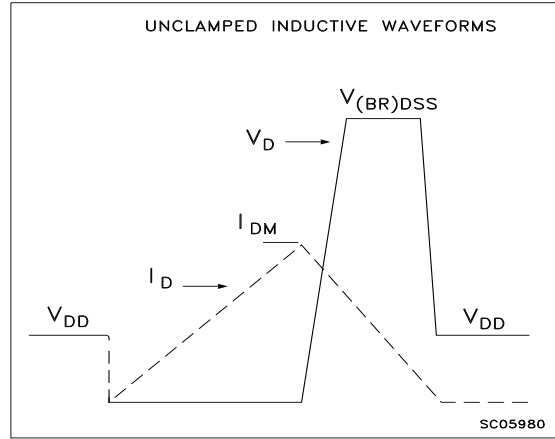


Fig. 3: Switching Times Test Circuit For Resistive Load

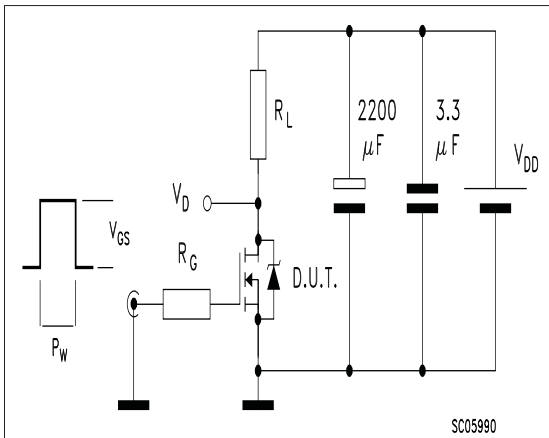


Fig. 4: Gate Charge test Circuit

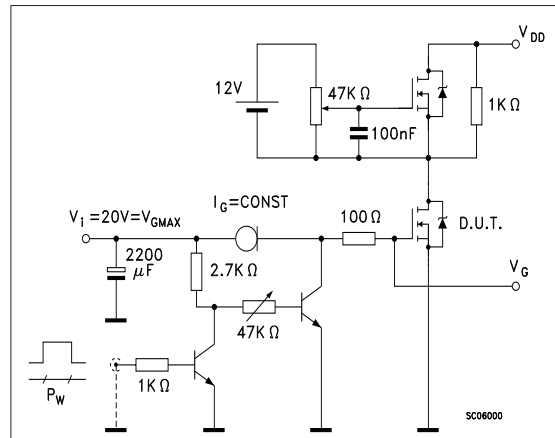
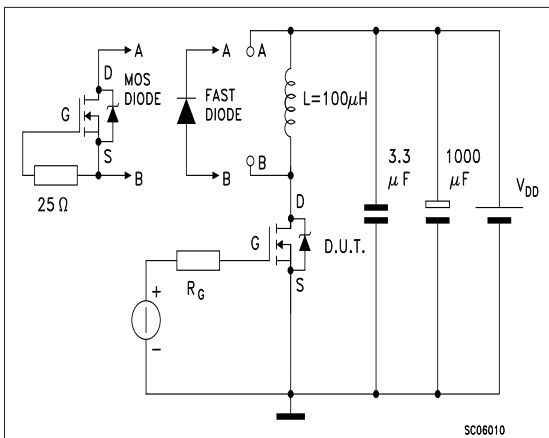
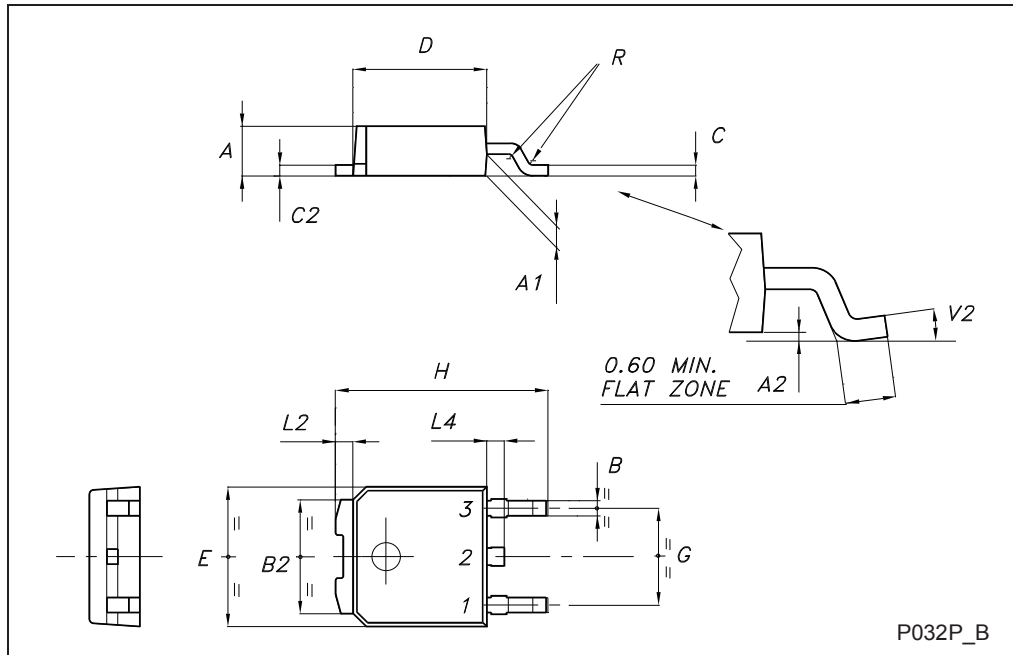


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



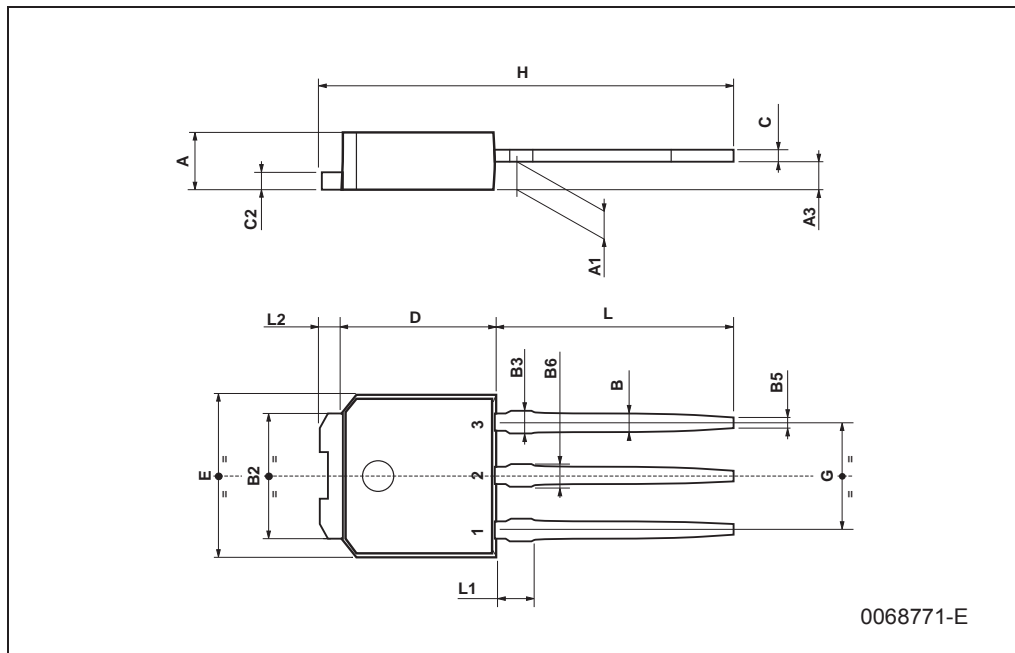
TO-252 (DPAK) MECHANICAL DATA

| 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° |

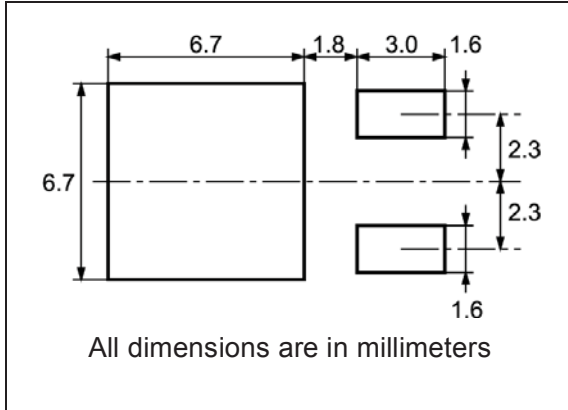


TO-251 (IPAK) MECHANICAL DATA

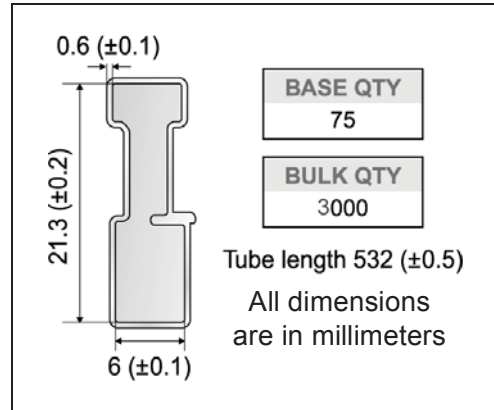
| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.2 | | 2.4 | 0.086 | | 0.094 |
| A1 | 0.9 | | 1.1 | 0.035 | | 0.043 |
| A3 | 0.7 | | 1.3 | 0.027 | | 0.051 |
| B | 0.64 | | 0.9 | 0.025 | | 0.031 |
| B2 | 5.2 | | 5.4 | 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 |



DKPAK 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 |

| | |
|-----------------|-----------------|
| 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 |

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

TRL

FEED DIRECTION

Bending radius

R min.

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

* on sales type



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