



STP22NS25Z STB22NS25Z

N-CHANNEL 250V - 0.13Ω - 22A TO-220/D²PAK Zener-Protected MESH OVERLAY™ MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|------------|------------------|---------------------|----------------|
| STP22NS25Z | 250 V | < 0.15 Ω | 22 A |
| STB22NS25Z | 250 V | < 0.15 Ω | 22 A |

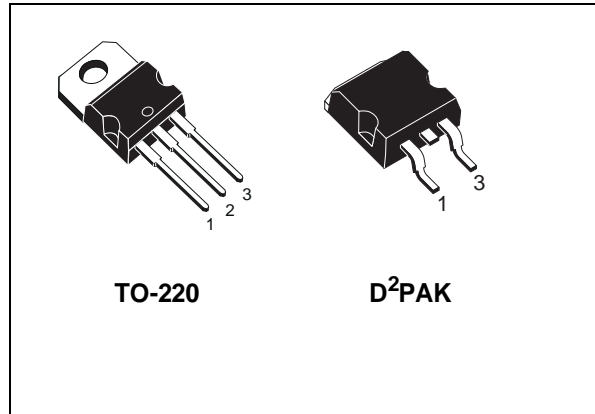
- TYPICAL R_{DS(on)} = 0.13 Ω
- EXTREMELY HIGH dv/dt CAPABILITY
- 100% AVALANCHE TESTED

DESCRIPTION

Using the latest high voltage MESH OVERLAY™ process, STMicroelectronics has designed an advanced family of power MOSFETs with outstanding performance. The new patented STrip layout coupled with the Company's proprietary edge termination structure, makes it suitable in converters for lighting applications.

APPLICATIONS

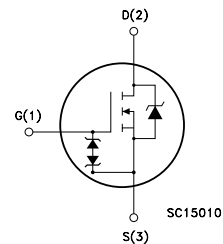
- HIGH CURRENT, HIGH SPEED SWITCHING
- SWITCH MODE POWER SUPPLIES (SMPS)
- DC-DC CONVERTERS FOR TELECOM, INDUSTRIAL, AND LIGHTING EQUIPMENT



TO-220

D²PAK

INTERNAL SCHEMATIC DIAGRAM



ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|-----------------------|--|------------|------|
| V _{DS} | Drain-source Voltage (V _{GS} = 0) | 250 | V |
| V _{DGR} | Drain-gate Voltage (R _{GS} = 20 kΩ) | 250 | V |
| V _{GS} | Gate- source Voltage | ± 20 | V |
| I _D | Drain Current (continuous) at T _C = 25°C | 22 | A |
| I _D | Drain Current (continuous) at T _C = 100°C | 13.9 | A |
| I _{DM} (•) | Drain Current (pulsed) | 88 | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 135 | W |
| | Derating Factor | 1.07 | W/°C |
| V _{ESD(G-S)} | Gate source ESD(HBM-C=100pF, R=1.5KΩ) | 2500 | V |
| dv/dt (1) | Peak Diode Recovery voltage slope | 5 | 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} ≤ 22A, di/dt ≤ 200A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.

STP22NS25Z / STB22NS25Z

THERMAL DATA

| | | | |
|----------------|--|------|------|
| Rthj-case | Thermal Resistance Junction-case Max | 0.93 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | °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) | 22 | A |
| E _{AS} | Single Pulse Avalanche Energy (starting T _j = 25 °C, I _D = I _{AR} , V _{DD} = 50 V, R _g = 47 Ohm) | 350 | mJ |

ELECTRICAL CHARACTERISTICS (TCASE = 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 | 250 | | | V |
| I _{DSS} | Zero Gate Voltage Drain Current (V _{GS} = 0) | V _{DS} = Max Rating V _{DS} = Max Rating, T _C = 125 °C | | | 10 100 | μA μA |
| I _{GSS} | Gate-body Leakage Current (V _{DS} = 0) | V _{GS} = ±18V | | | ±10 | μA |

ON (1)

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|-----------------------------------|--|------|------|------|------|
| V _{GS(th)} | Gate Threshold Voltage | V _{DS} = V _{GS} , I _D = 250μA | 2 | 3 | 4 | V |
| R _{DS(on)} | Static Drain-source On Resistance | V _{GS} = 10V, I _D = 11 A | | 0.13 | 0.15 | Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g _{fs} (1) | Forward Transconductance | V _{DS} > I _{D(on)} × R _{DS(on)max} , I _D = 11A | | 22 | | S |
| C _{iss} | Input Capacitance | V _{DS} = 25V, f = 1 MHz, V _{GS} = 0 | | 2400 | | pF |
| C _{OSS} | Output Capacitance | | | 340 | | pF |
| C _{rSS} | Reverse Transfer Capacitance | | | 120 | | pF |

ELECTRICAL CHARACTERISTICS (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 125\text{ V}$, $I_D = 11\text{ A}$ $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3) | | 20 | | ns |
| t_r | Rise Time | | | 30 | | ns |
| Q_g | Total Gate Charge | $V_{DD} = 200\text{ V}$, $I_D = 20\text{ A}$, $V_{GS} = 10\text{ V}$ | | 108 | 151 | nC |
| Q_{gs} | Gate-Source Charge | | | 11 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 40 | | nC |

SWITCHING OFF

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------------------|---|---|--|-----------|-----------------|----------|
| $t_{d(Voff)}$ t_f | Turn-off- Delay Time Fall Time | $V_{DD} = 125\text{ V}$, $I_D = 11\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see test circuit, Figure 3) | | 100 78 | | ns ns |
| $t_{r(Voff)}$ t_f t_c | Off-voltage Rise Time Fall Time Cross-over Time | | $V_{clamp} = 200\text{ V}$, $I_D = 22\text{ A}$, $R_G = 4.7\Omega$, $V_{GS} = 10\text{ V}$ (see test circuit, Figure 5) | | 37 65 110 | |

SOURCE DRAIN DIODE

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|---|------|------|------|------|
| I_{SD} | Source-drain Current | | | | 22 | A |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) | | | | 88 | A |
| $V_{SD(1)}$ | Forward On Voltage | $I_{SD} = 22\text{ A}$, $V_{GS} = 0$ | | | 1.6 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 22\text{ A}$, $di/dt = 100\text{ A}/\mu\text{s}$ $V_{DD} = 50\text{ V}$, $T_J = 150^\circ\text{C}$ (see test circuit, Figure 5) | | 292 | | ns |
| Q_{rr} | Reverse Recovery Charge | | | 3065 | | nC |
| I_{RRM} | Reverse Recovery Current | | | 21 | | A |

GATE-SOURCE ZENER DIODE

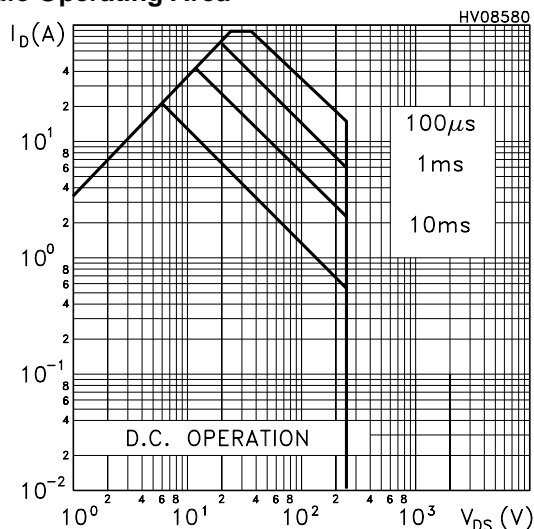
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|------------|-------------------------------|--|------|------|------|------|
| BV_{GSO} | Gate-Source Breakdown Voltage | $I_{GS} = \pm 500\mu\text{A}$ (Open Drain) | 20 | | | V |

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

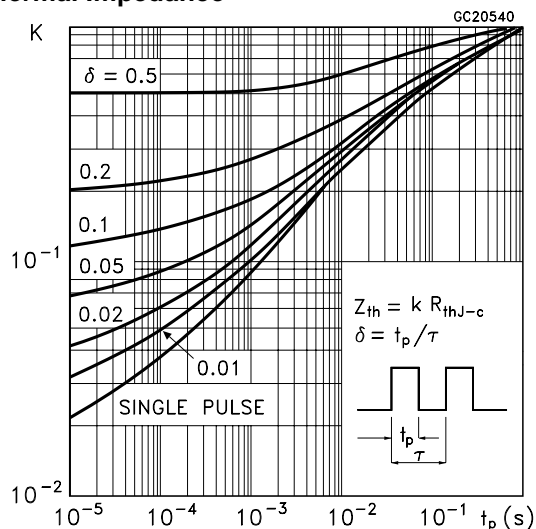
PROTECTION FEATURES OF GATE-TO-SOURCE ZENER DIODES

The built-in back-to-back Zener diodes have specifically been designed to enhance not only the device's ESD capability, but also to make them safely absorb possible voltage transients that may occasionally be applied from gate to source. In this respect the Zener voltage is appropriate to achieve an efficient and cost-effective intervention to protect the device's integrity. These integrated Zener diodes thus avoid the usage of external components.

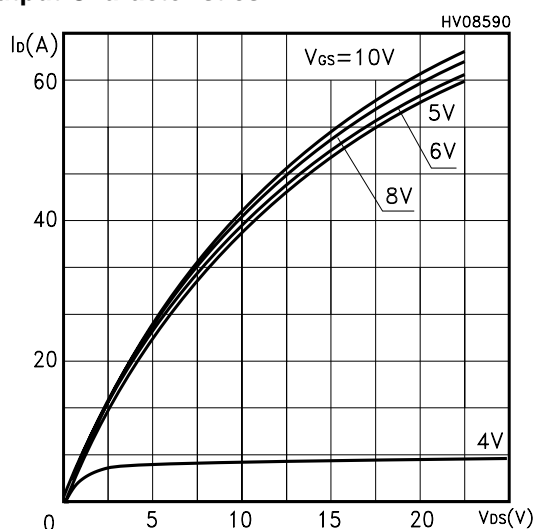
Safe Operating Area



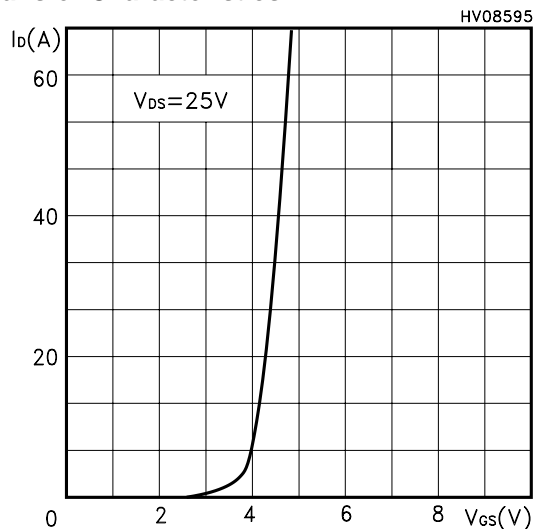
Thermal Impedance



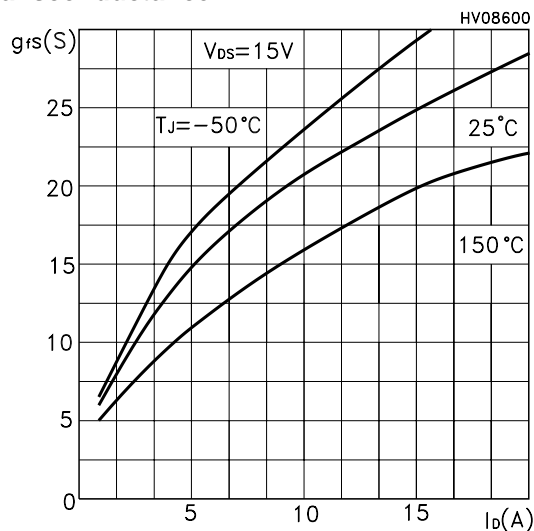
Output Characteristics



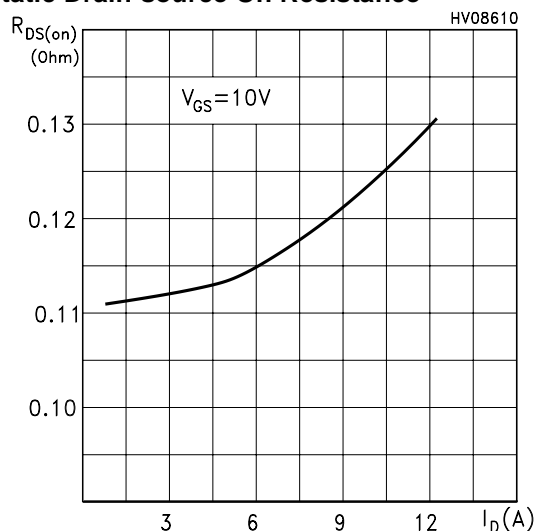
Transfer Characteristics



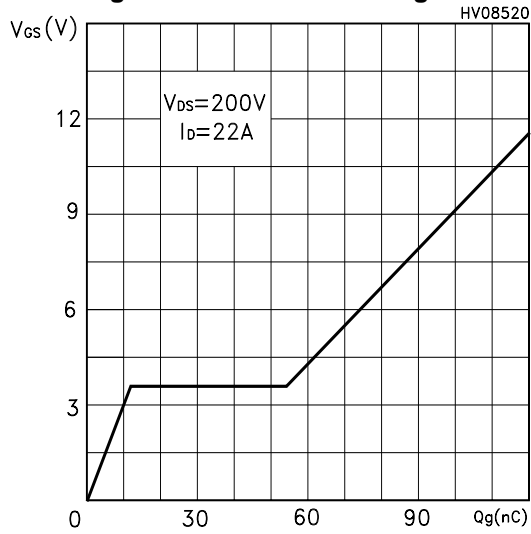
Transconductance



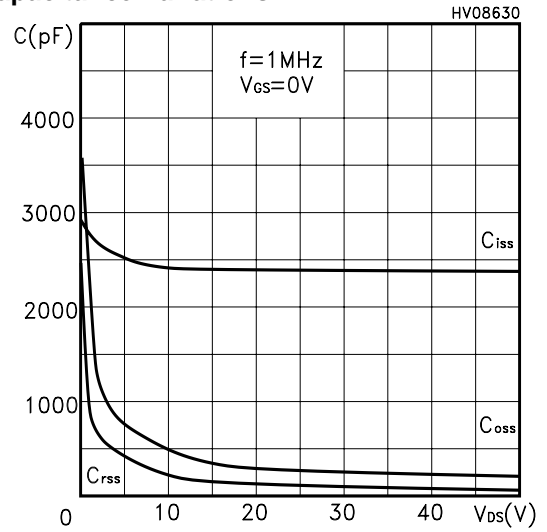
Static Drain-source On Resistance



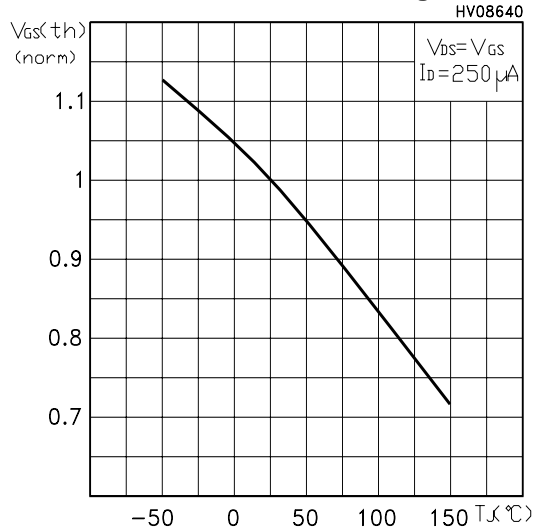
Gate Charge vs Gate-source Voltage



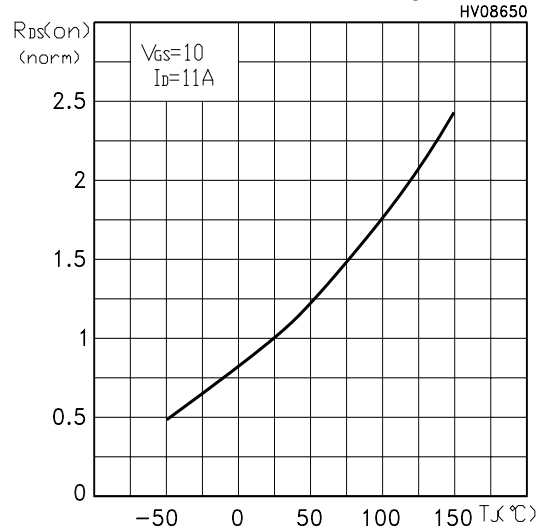
Capacitance Variations



Normalized Gate Threshold Voltage vs Temp.



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics

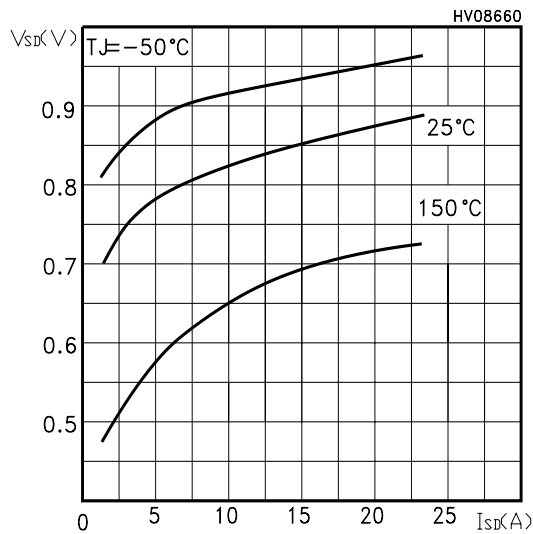


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform

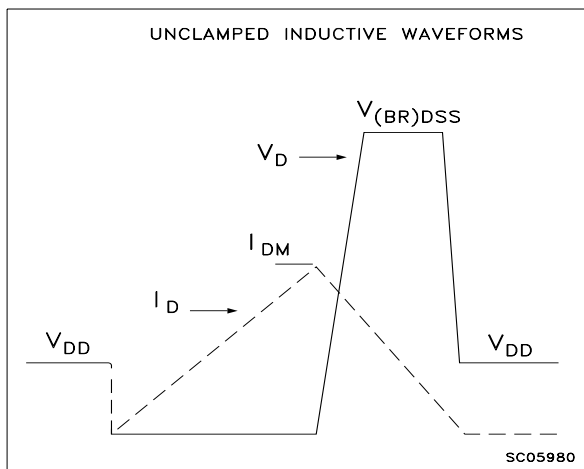


Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 4: Gate Charge test Circuit

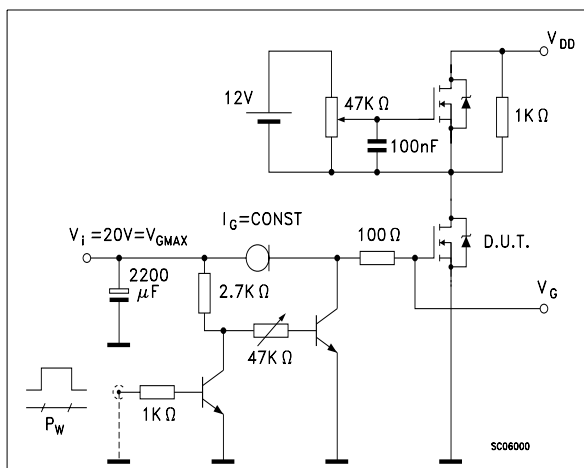
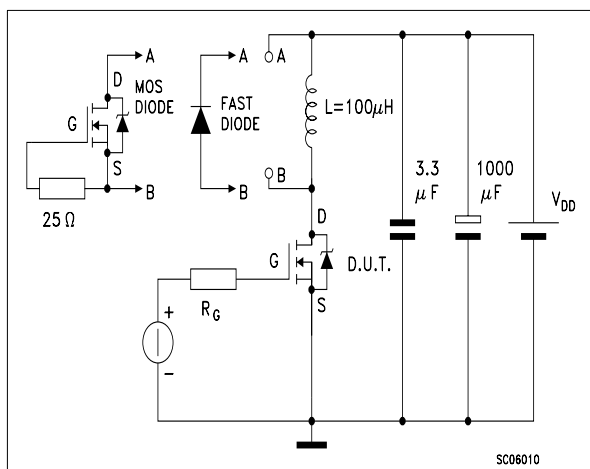
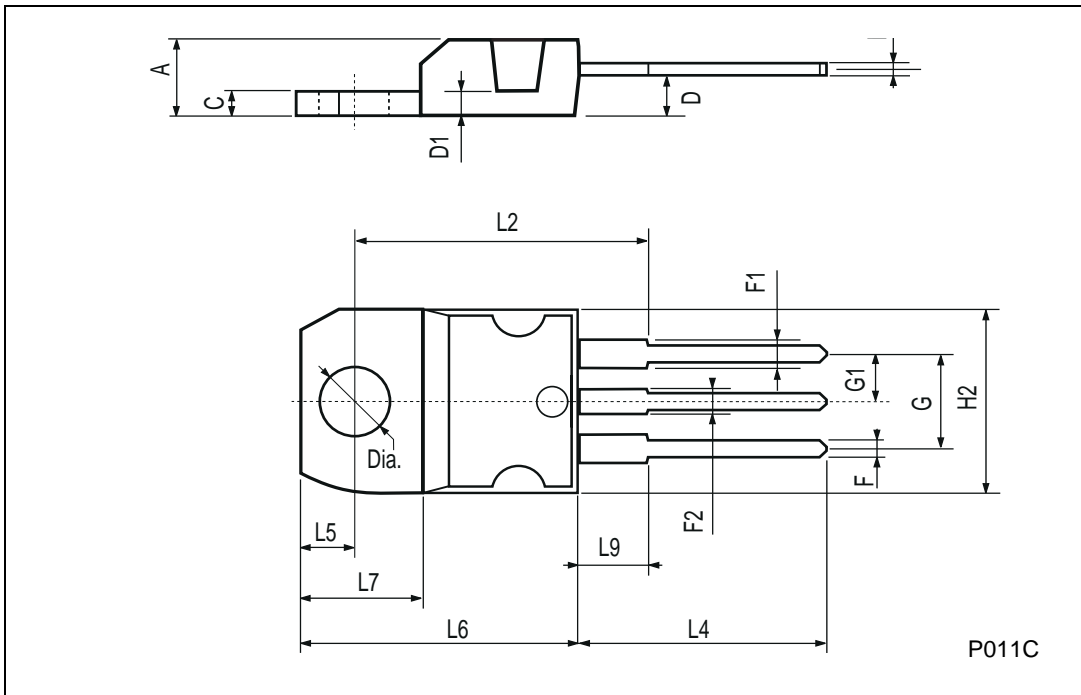


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



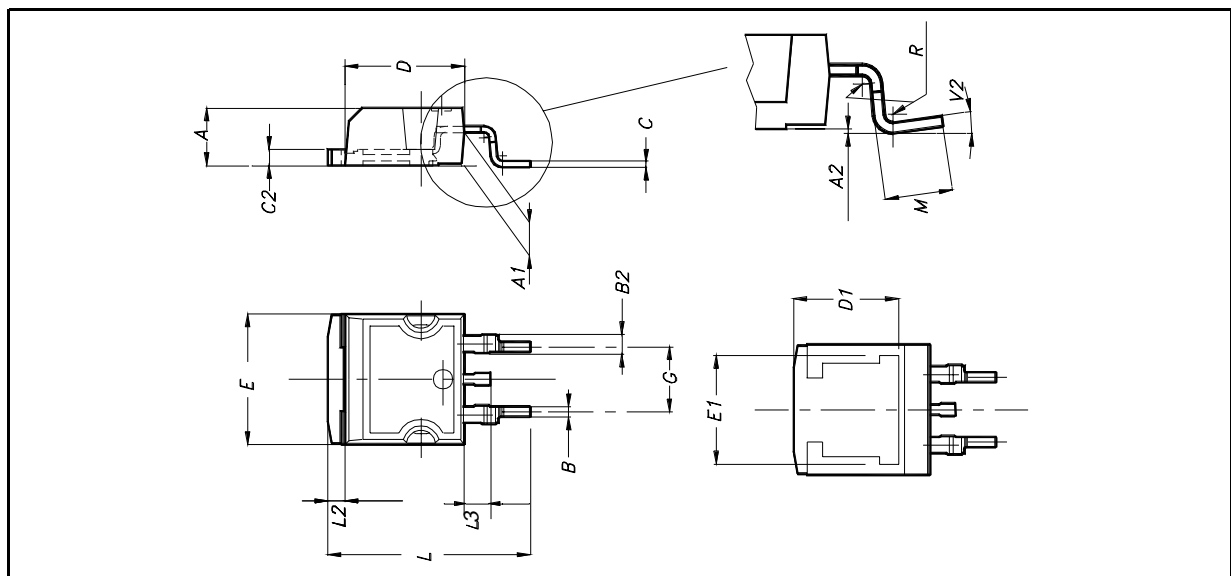
TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| C | 1.23 | | 1.32 | 0.048 | | 0.051 |
| D | 2.40 | | 2.72 | 0.094 | | 0.107 |
| D1 | | 1.27 | | | 0.050 | |
| E | 0.49 | | 0.70 | 0.019 | | 0.027 |
| F | 0.61 | | 0.88 | 0.024 | | 0.034 |
| F1 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.067 |
| G | 4.95 | | 5.15 | 0.194 | | 0.203 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H2 | 10.0 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.4 | | | 0.645 | |
| L4 | 13.0 | | 14.0 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.2 | | 6.6 | 0.244 | | 0.260 |
| L9 | 3.5 | | 3.93 | 0.137 | | 0.154 |
| DIA. | 3.75 | | 3.85 | 0.147 | | 0.151 |

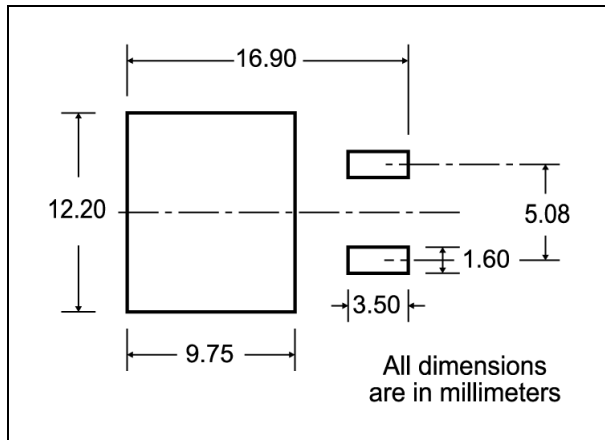


D²PAK MECHANICAL DATA

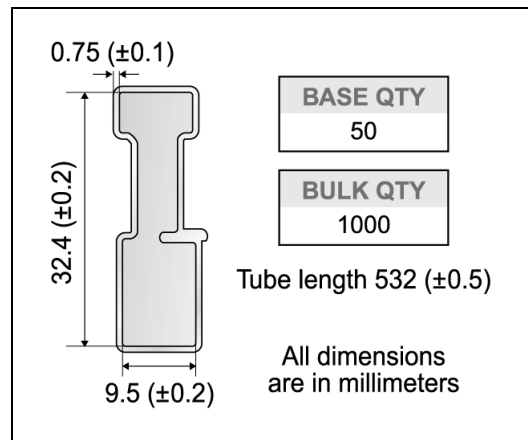
| DIM. | mm. | | | inch | | |
|------|------|-----|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 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° | | 8° | | | |



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 |

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