

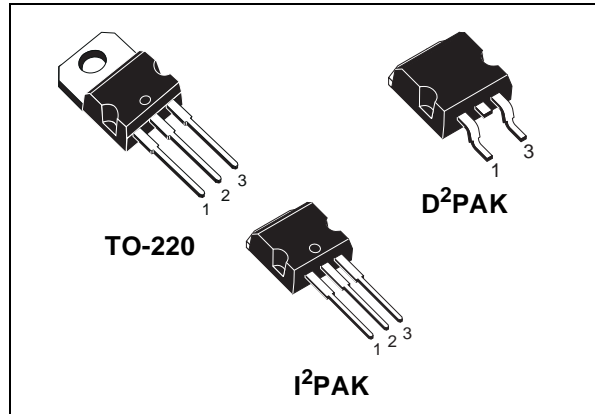


STP40NF10 STB40NF10 - STB40NF10-1

N-CHANNEL 100V - 0.024Ω - 50A TO-220/D²PAK/I²PAK
LOW GATE CHARGE STripFET™ II POWER MOSFET

| TYPE | V _{DSS} | R _{DS(on)} | I _D |
|-------------|------------------|---------------------|----------------|
| STP40NF10 | 100 V | < 0.028 Ω | 50 A |
| STB40NF10 | 100 V | < 0.028 Ω | 50 A |
| STB40NF10-1 | 100 V | < 0.028 Ω | 50 A |

- TYPICAL R_{DS(on)} = 0.024Ω
- EXCEPTIONAL dv/dt CAPABILITY
- 100% AVALANCHE TESTED
- APPLICATION ORIENTED CHARACTERIZATION
- ADD SUFFIX "T4" FOR ORDERING IN TAPE & REEL



DESCRIPTION

This Power MOSFET series realized with STMicroelectronics unique STripFET process has specifically been designed to minimize input capacitance and gate charge. It is therefore suitable as primary switch in advanced high-efficiency isolated DC-DC converters for Telecom and Computer application. It is also intended for any application with low gate charge drive requirements.

APPLICATIONS

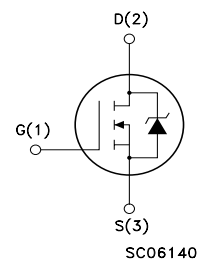
- HIGH-EFFICIENCY DC-DC CONVERTERS
- UPS AND MOTOR CONTROL

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 kΩ) | 100 | V |
| V _{GS} | Gate- source Voltage | ± 20 | V |
| I _D (*) | Drain Current (continuous) at T _C = 25°C | 50 | A |
| I _D | Drain Current (continuous) at T _C = 100°C | 35 | A |
| I _{DM} (●) | Drain Current (pulsed) | 200 | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 150 | W |
| | Derating Factor | 1 | W/°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 | °C |
| T _j | Operating Junction Temperature | | |

(●) Pulse width limited by safe operating area
(*) Limited by Package

INTERNAL SCHEMATIC DIAGRAM



(1) I_{SD} ≤ 40A, di/dt ≤ 600A/μs, V_{DD} ≤ V_{(BR)DSS}, T_j ≤ T_{JMAX}.
(2) Starting T_j = 25°C, I_D = 40A, V_{DD} = 50V

STP40NF10 - STB40NF10 - STB40NF10-1

THERMAL DATA

| | | | |
|----------------|--|------|------|
| Rthj-case | Thermal Resistance Junction-case Max | 1 | °C/W |
| Rthj-amb | Thermal Resistance Junction-ambient Max | 62.5 | °C/W |
| T _I | Maximum Lead Temperature For Soldering Purpose | 300 | °C |

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 | 100 | | | 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} = ± 20V | | | ±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 | 2 | 2.8 | 4 | V |
| R _{DS(on)} | Static Drain-source On Resistance | V _{GS} = 10V, I _D = 20 A | | 0.024 | 0.028 | Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---------------------|------------------------------|---|------|------|------|------|
| g _{fs} (1) | Forward Transconductance | V _{DS} = 25V, I _D = 20 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 |

ELECTRICAL CHARACTERISTICS (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-------------|--------------------|---|------|------|------|------|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD} = 50\text{ V}, I_D = 20\text{ A}$ | | 28 | | ns |
| t_r | Rise Time | $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (see test circuit, Figure 3) | | 63 | | ns |
| Q_g | Total Gate Charge | $V_{DD} = 80\text{ V}, I_D = 40\text{ A}, V_{GS} = 10\text{ V}$ | | 60 | 80 | nC |
| Q_{gs} | Gate-Source Charge | | | 10 | | nC |
| Q_{gd} | Gate-Drain Charge | | | 23 | | nC |

SWITCHING OFF

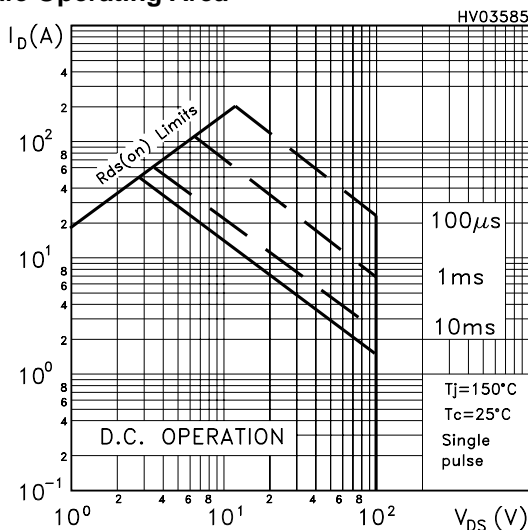
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|---------------------|---|------|------|------|------|
| $t_{d(off)}$ | Turn-off-Delay Time | $V_{DD} = 50\text{ V}, I_D = 20\text{ A},$ | | 84 | | ns |
| t_f | Fall Time | $R_G = 4.7\Omega, V_{GS} = 10\text{ V}$ (see test circuit, Figure 3) | | 28 | | ns |

SOURCE DRAIN DIODE

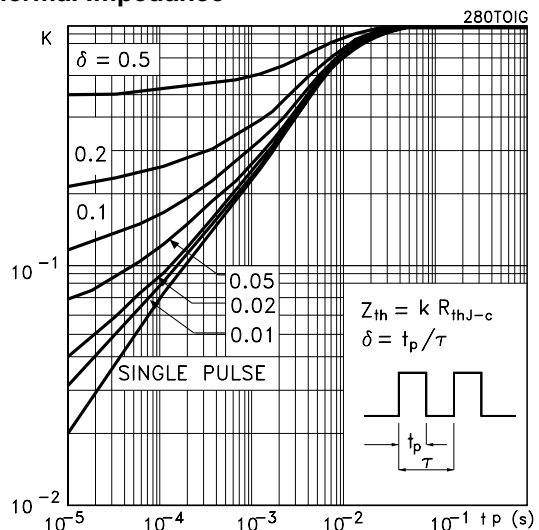
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|--------------|-------------------------------|---|------|------|------|------|
| I_{SD} | Source-drain Current | | | | 40 | A |
| $I_{SDM(2)}$ | Source-drain Current (pulsed) | | | | 160 | A |
| $V_{SD(1)}$ | Forward On Voltage | $I_{SD} = 40\text{ A}, V_{GS} = 0$ | | | 1.3 | V |
| t_{rr} | Reverse Recovery Time | $I_{SD} = 40\text{ A}, di/dt = 100\text{ A}/\mu\text{s},$ | | 114 | | ns |
| Q_{rr} | Reverse Recovery Charge | $V_{DD} = 25\text{ V}, T_j = 150^\circ\text{C}$ | | 456 | | nC |
| I_{RRM} | Reverse Recovery Current | (see test circuit, Figure 5) | | 8 | | A |

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

Safe Operating Area

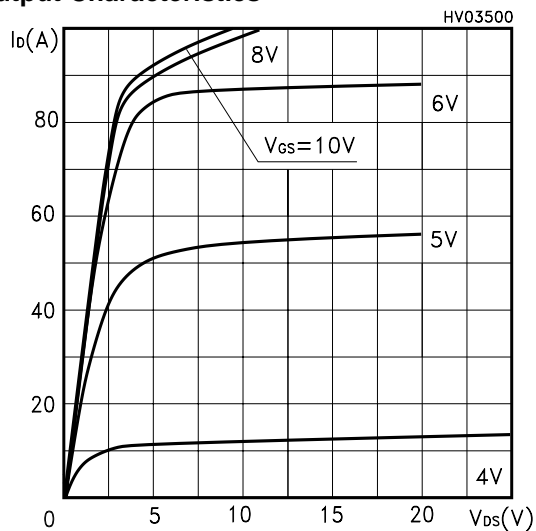


Thermal Impedance

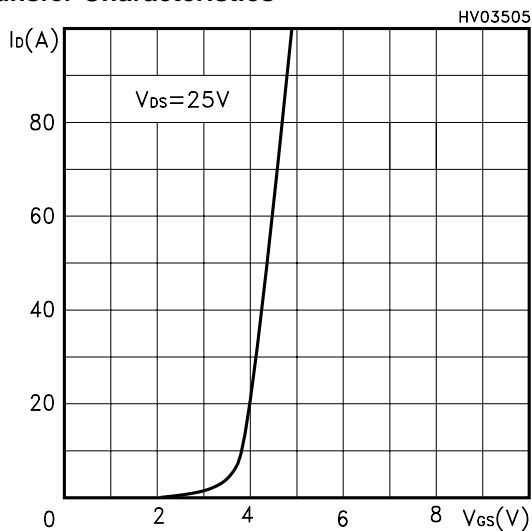


STP40NF10 - STB40NF10 - STB40NF10-1

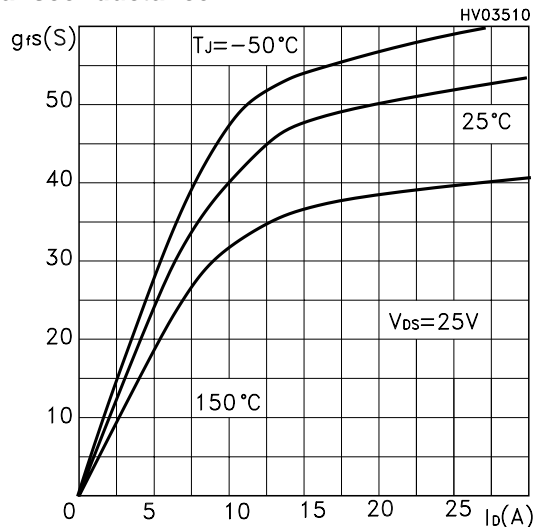
Output Characteristics



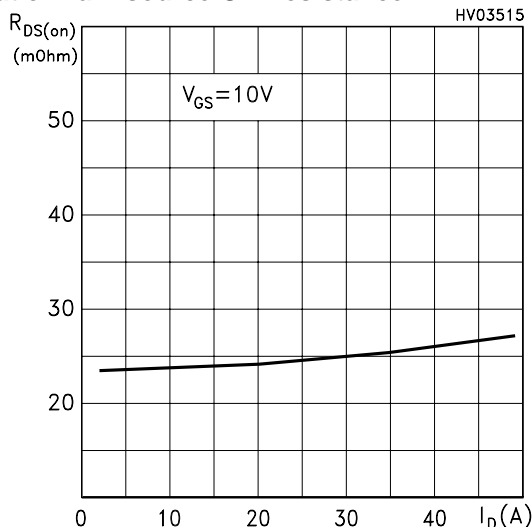
Transfer Characteristics



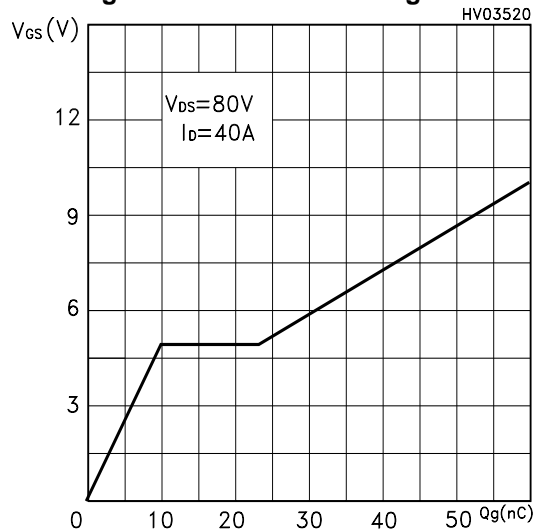
Transconductance



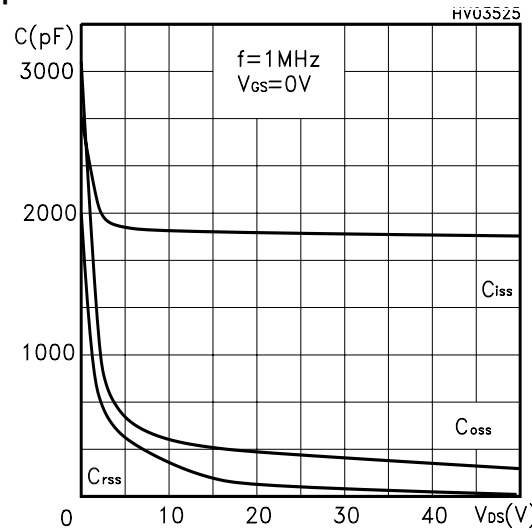
Static Drain-source On Resistance



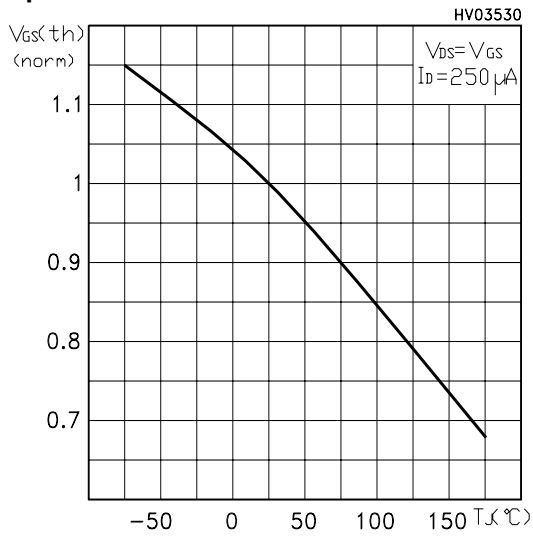
Gate Charge vs Gate-source Voltage



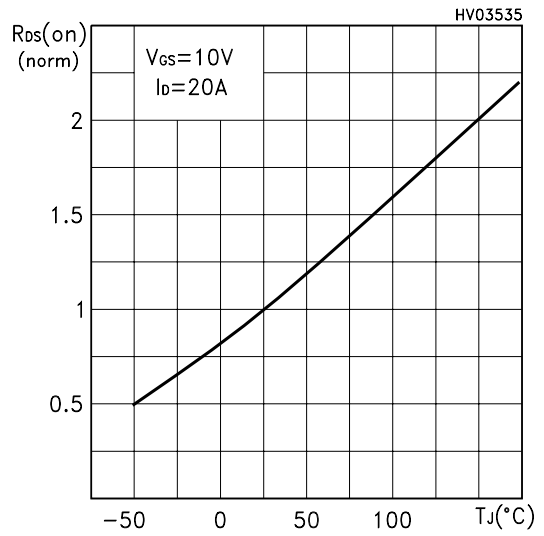
Capacitance Variations



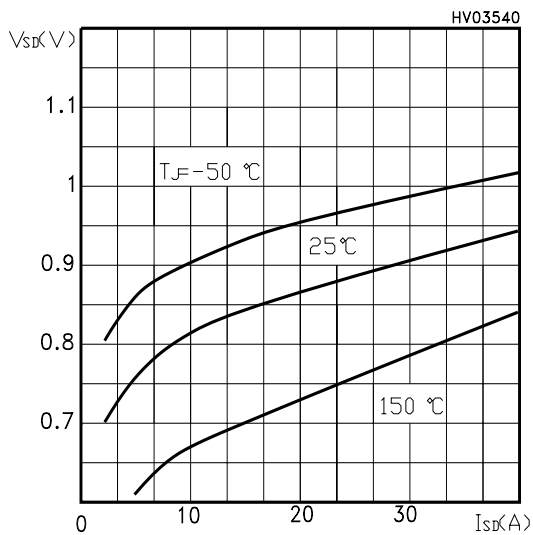
Normalized Gate Threshold Voltage vs Temperature



Normalized On Resistance vs Temperature



Source-drain Diode Forward Characteristics



Normalized Drain-Source Breakdown vs Temperature

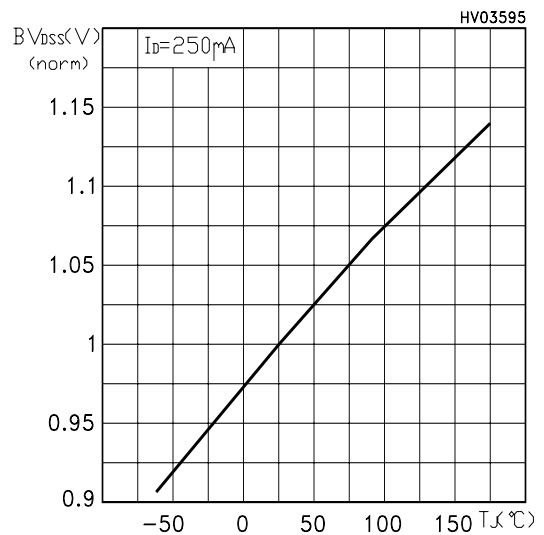


Fig. 1: Unclamped Inductive Load Test Circuit



Fig. 2: Unclamped Inductive Waveform



Fig. 3: Switching Times Test Circuit For Resistive Load



Fig. 4: Gate Charge test Circuit

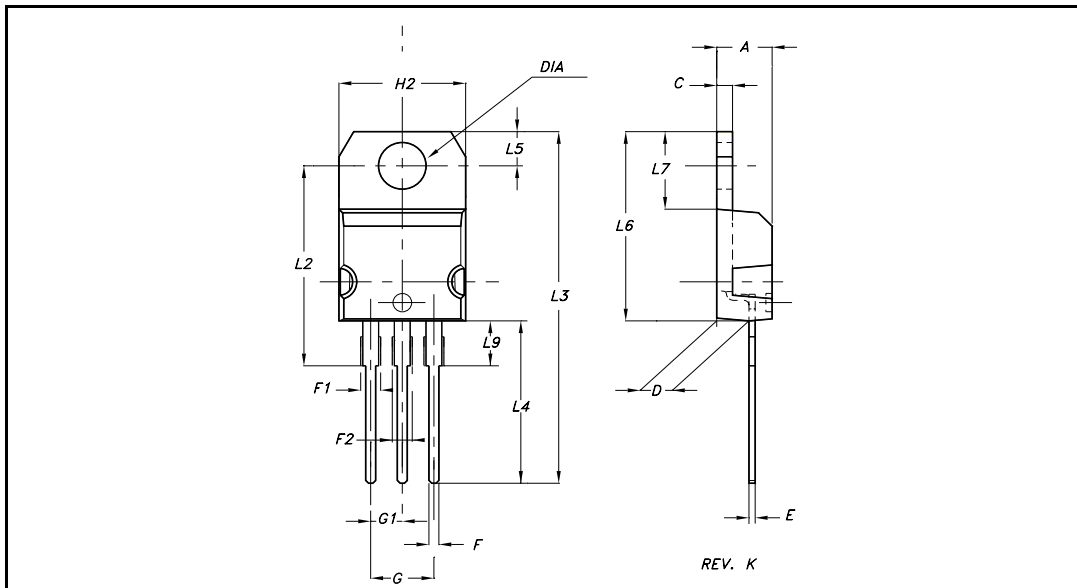


Fig. 5: Test Circuit For Inductive Load Switching And Diode Recovery Times



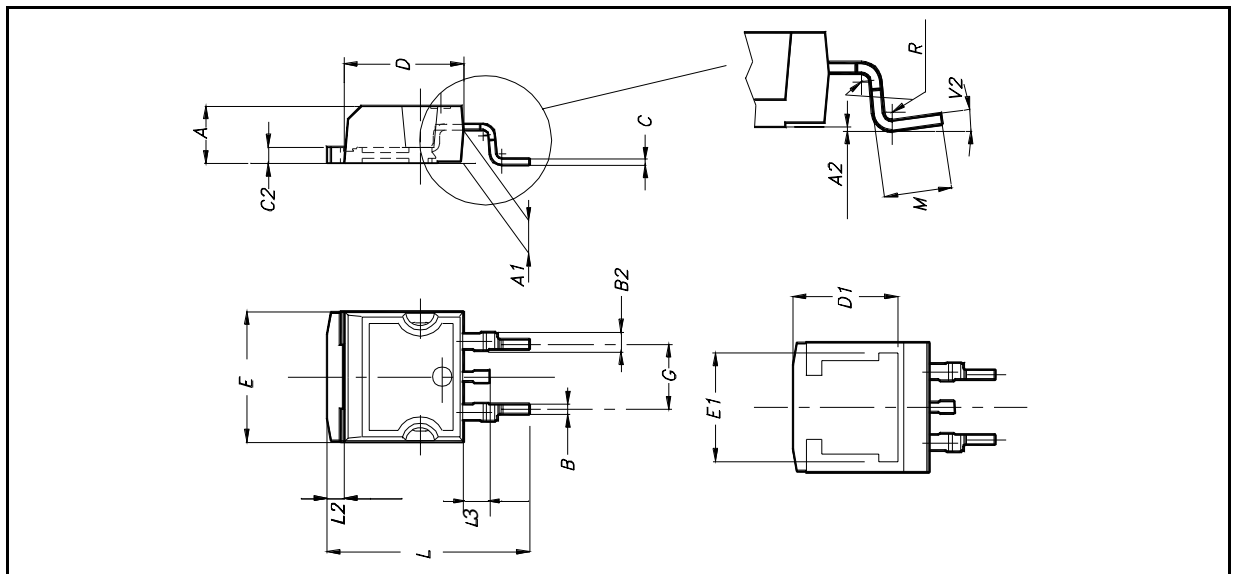
TO-220 MECHANICAL DATA

| 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 |
| 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 | | 0.066 |
| F2 | 1.14 | | 1.70 | 0.044 | | 0.066 |
| G | 4.95 | | 5.15 | 0.194 | | 0.202 |
| G1 | 2.40 | | 2.70 | 0.094 | | 0.106 |
| H2 | 10 | | 10.40 | 0.393 | | 0.409 |
| L2 | | 16.40 | | | 0.645 | |
| L3 | | 28.90 | | | 1.137 | |
| L4 | 13 | | 14 | 0.511 | | 0.551 |
| L5 | 2.65 | | 2.95 | 0.104 | | 0.116 |
| L6 | 15.25 | | 15.75 | 0.600 | | 0.620 |
| L7 | 6.20 | | 6.60 | 0.244 | | 0.259 |
| L9 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| DIA | 3.75 | | 3.85 | 0.147 | | 0.151 |



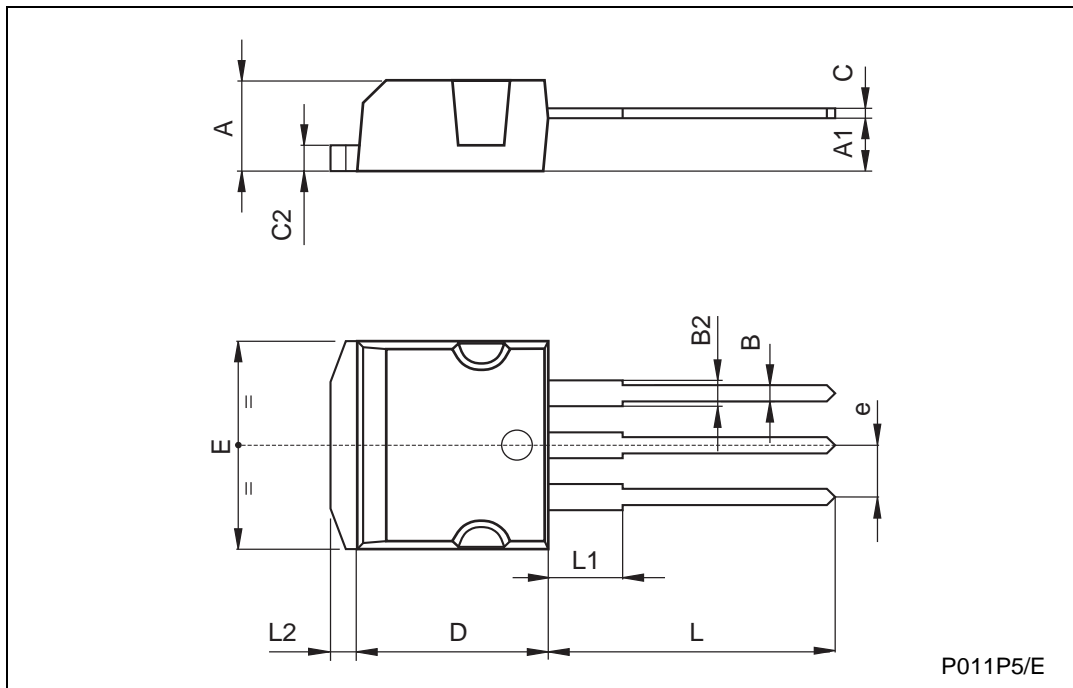
D²PAK MECHANICAL DATA

| 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° | | | |

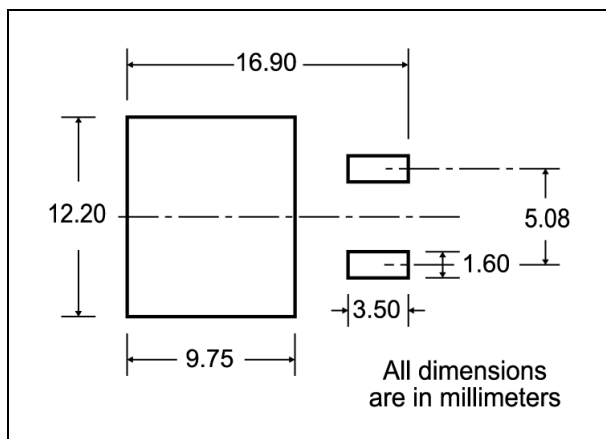


TO-262 (I²PAK) MECHANICAL DATA

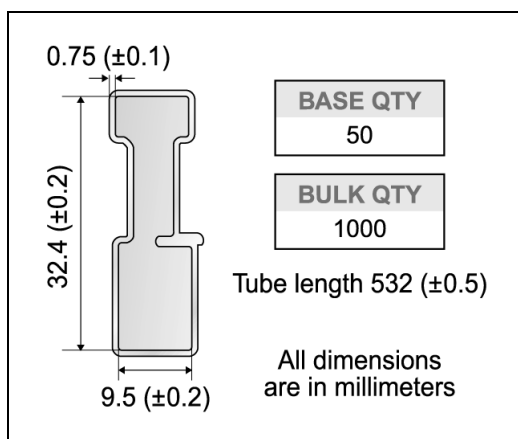
| DIM. | mm | | | inch | | |
|------|------|------|------|-------|------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 | | 1.7 | 0.044 | | 0.067 |
| C | 0.45 | | 0.6 | 0.017 | | 0.023 |
| C2 | 1.23 | | 1.36 | 0.048 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| e | 2.4 | | 2.7 | 0.094 | | 0.106 |
| E | 10 | | 10.4 | 0.393 | | 0.409 |
| L | 13.1 | | 13.6 | 0.515 | | 0.531 |
| L1 | 3.48 | | 3.78 | 0.137 | | 0.149 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |



D²PAK 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

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 |

TOP COVER TAPE

10 pitches cumulative tolerance on tape +/- 0.2 mm

Center line of cavity

User Direction of Feed

FEED DIRECTION

Bending radius R min.

* on sales type



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