



STGP3NB60F - STGD3NB60F

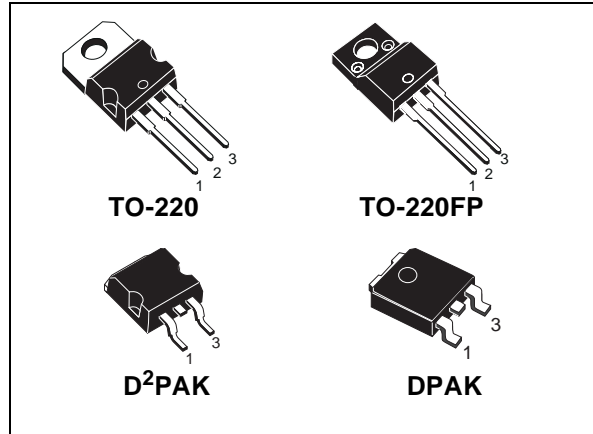
STGP3NB60FD-STGF3NB60FD-STGB3NB60FD

N-CHANNEL 3A - 600V - TO-220/TO-220FP/DPAK/D²PAK

PowerMESH™ IGBT

| TYPE | V _{CES} | V _{CE(sat)} (Typ) @125°C | I _c @125°C |
|-------------|------------------|--------------------------------------|--------------------------|
| STGP3NB60F | 600 V | < 2.4 V | 3 A |
| STGD3NB60F | 600 V | < 2.4 V | 3 A |
| STGP3NB60FD | 600 V | < 2.4 V | 3 A |
| STGF3NB60FD | 600 V | < 2.4 V | 3 A |
| STGB3NB60FD | 600 V | < 2.4 V | 3 A |

- HIGH INPUT IMPEDANCE (VOLTAGE DRIVEN)
- LOW ON-VOLTAGE DROP (V_{cesat})
- LOW GATE CHARGE
- HIGH CURRENT CAPABILITY
- OFF LOSSES INCLUDE TAIL CURRENT
- HIGH FREQUENCY OPERATION
- SHORT CIRCUIT RATED

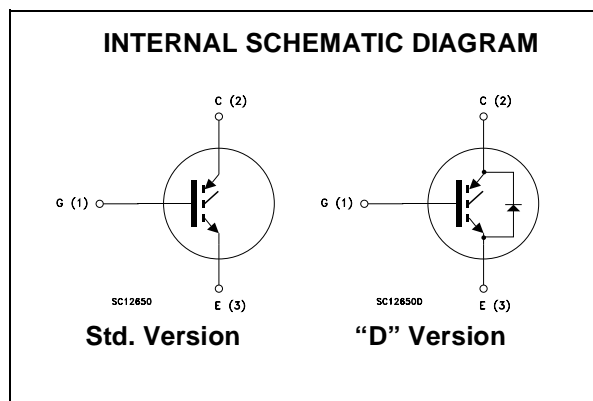


DESCRIPTION

Using the latest high voltage technology based on a patented strip layout, STMicroelectronics has designed an advanced family of IGBTs, the PowerMESH™ IGBTs, with outstanding performances. The suffix "F" identifies a family optimized to achieve very low switching times for frequency applications (<40 KHz)

APPLICATIONS

- MOTOR CONTROLS
- SMPS AND PFC IN BOTH HARD SWITCHING AND RESONANT TOPOLOGIES



ORDERING INFORMATION

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|---------------|-----------|--------------------|-------------|
| STGP3NB60F | GP3NB60F | TO-220 | TUBE |
| STGD3NB60FT4 | GD3NB60F | DPAK | TAPE & REEL |
| STGP3NB60FD | GP3NB60FD | TO-220 | TUBE |
| STGF3NB60FD | GF3NB60FD | TO-220FP | TUBE |
| STGB3NB60FDT4 | GB3NB60FD | D ² PAK | TAPE & REEL |

STGP3NB60F/STGD3NB60F/STGP3NB60FD/STGF3NB60FD/STGB3NB60FD

ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | | | Unit |
|---------------------|--|---------------------------|----------|------|------|
| | | TO-220/D ² PAK | TO-220FP | DPAK | |
| V _{CES} | Collector-Emitter Voltage (V _{GS} = 0) | 600 | | | V |
| V _{ECR} | Emitter-Collector Voltage | 20 | | | V |
| V _{GE} | Gate-Emitter Voltage | ±20 | | | V |
| I _C | Collector Current (continuous) at T _C = 25°C | 6 | | | A |
| I _C | Collector Current (continuous) at T _C = 100°C | 3 | | | A |
| I _{CM} (■) | Collector Current (pulsed) | 24 | | | A |
| I _f (1) | Forward Current | 3 | | | A |
| I _{fm} (1) | Forward Current Pulsed | 24 | | | A |
| P _{TOT} | Total Dissipation at T _C = 25°C | 68 | 25 | 60 | W |
| | Derating Factor | 0.55 | 0.2 | 0.47 | W/°C |
| V _{ISO} | Insulation Withstand Voltage A.C. | -- | 2500 | -- | V |
| T _{stg} | Storage Temperature | - 55 to 150 | | | °C |
| T _j | Max. Operating Junction Temperature | 150 | | | °C |

(■) Pulse width limited by safe operating area

(1) For "D" version only

THERMAL DATA

| | | TO-220/D ² PAK | TO-220FP | DPAK | |
|-----------------------|---|---------------------------|----------|------|------|
| R _{thj-case} | Thermal Resistance Junction-case Max | 1.8 | 5 | 2.1 | °C/W |
| R _{thj-amb} | Thermal Resistance Junction-ambient Max | 62.5 | | 100 | °C/W |
| R _{thc-h} | Thermal Resistance Case-heatsink Typ | 0.5 | | | °C/W |

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

MAIN PARAMETERS

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|----------------------|--|--|------|------------|-----------|----------|
| V _{BR(CES)} | Collector-Emitter Breakdown Voltage | I _C = 250 μA, V _{GE} = 0 | 600 | | | V |
| I _{CES} | Collector cut-off (V _{GE} = 0) | V _{CE} = Max Rating, T _C = 25°C V _{CE} = Max Rating, T _C = 125°C | | | 50 100 | μA μA |
| I _{GES} | Gate-Emitter Leakage Current (V _{CE} = 0) | V _{GE} = ±20V, V _{CE} = 0 | | | ±100 | nA |
| V _{GE(th)} | Gate Threshold Voltage | V _{CE} = V _{GE} , I _C = 250 μA | 3 | | 5 | V |
| V _{CE(sat)} | Collector-Emitter Saturation Voltage | V _{GE} = 15 V, I _C = 3 A V _{GE} = 15 V, I _C = 3 A, T _j = 125°C | | 1.9 1.6 | 2.4 | V V |

STGP3NB60F/STGD3NB60F/STGP3NB60FD/STGF3NB60FD/STGB3NB60FD

SWITCHING PARAMETERS

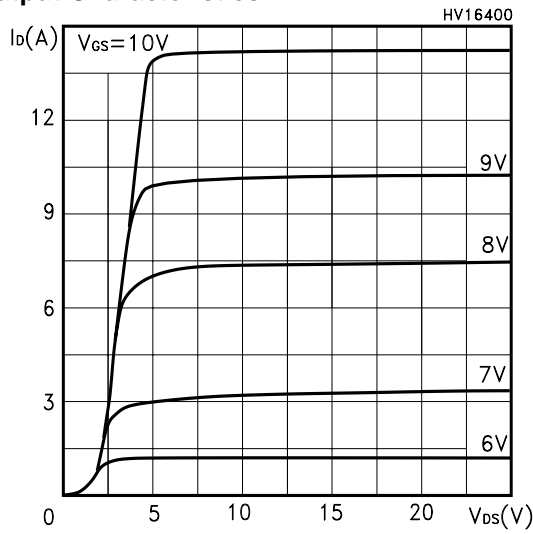
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|------|--|------|--|
| g_{fs} | Forward Transconductance | $V_{CE} = 25 \text{ V}, I_C = 3 \text{ A}$ | | 2 | | S |
| C_{ies} C_{oes} C_{res} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | $V_{CE} = 25 \text{ V}, f = 1 \text{ MHz}, V_{GE} = 0$ | | 230 33 6 | | pF pF pF |
| Q_g Q_{ge} Q_{gc} | Total Gate Charge Gate-Emitter Charge Gate-Collector Charge | $V_{CE} = 480 \text{ V}, I_C = 3 \text{ A},$ $V_{GE} = 15 \text{ V}$ | | 16 1.5 8 | 20 | nC nC nC |
| $t_{d(on)}$ t_r | Turn-on Delay Time Rise Time | $V_{CC} = 480 \text{ V}, I_C = 3 \text{ A}$ $R_G = 10\Omega, V_{GE} = 15 \text{ V}$ | | 12.5 4 | | ns ns |
| $(di/dt)_{on}$ E_{on} | Turn-on Current Slope Turn-on Switching Losses | $V_{CC} = 480 \text{ V}, I_C = 3 \text{ A}, R_G = 10\Omega$ $V_{GE} = 15 \text{ V}, T_j = 125^\circ\text{C}$ | | 840 31 | | A/ μs μJ |
| t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(**)}$ E_{ts} | Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss | $V_{CC} = 480 \text{ V}, I_C = 3 \text{ A},$ $R_{GE} = 10 \Omega, V_{GE} = 15 \text{ V}$ $T_j = 25^\circ\text{C}$ | | 220 60 105 150 125 149 | | ns ns ns ns μJ μJ |
| t_c $t_r(V_{off})$ $t_{d(off)}$ t_f $E_{off(**)}$ E_{ts} | Cross-over Time Off Voltage Rise Time Delay Time Fall Time Turn-off Switching Loss Total Switching Loss | $V_{CC} = 480 \text{ V}, I_C = 3 \text{ A},$ $R_{GE} = 10 \Omega, V_{GE} = 15 \text{ V}$ $T_j = 125^\circ\text{C}$ | | 490 174 230 305 295 326 | | ns ns ns ns μJ μJ |

COLLECTOR-EMITTER DIODE (“D” VERSION)

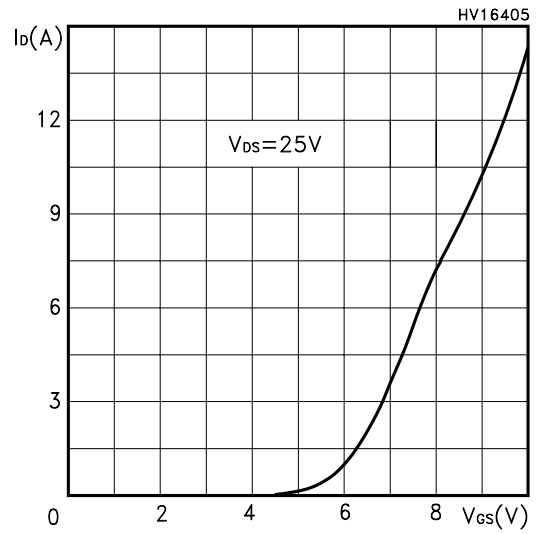
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|--|------|-----------------|------|---------------|
| V_f | Forward On-Voltage | $I_f = 1.5 \text{ A}$ $I_f = 1.5 \text{ A}, T_j = 125^\circ\text{C}$ | | 1.31 0.95 | 1.8 | V V |
| t_{rr} Q_{rr} I_{rrm} | Reverse Recovery Time Reverse Recovery Charge Reverse Recovery Current | $I_f = 3 \text{ A}, V_R = 35 \text{ V},$ $T_j = 125^\circ\text{C}, di/dt = 100 \text{ A}/\mu\text{s}$ | | 45 70 2.7 | | ns nC A |

Note: 1. Pulsed: Pulse duration = 300 μs , duty cycle 1.5 %.
 2. Pulse width limited by max. junction temperature.
 (**)Losses include Also the Tail (Jedec Standardization)

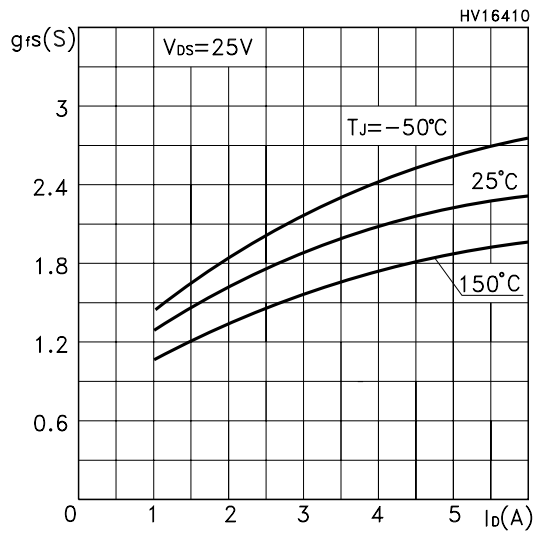
Output Characteristics



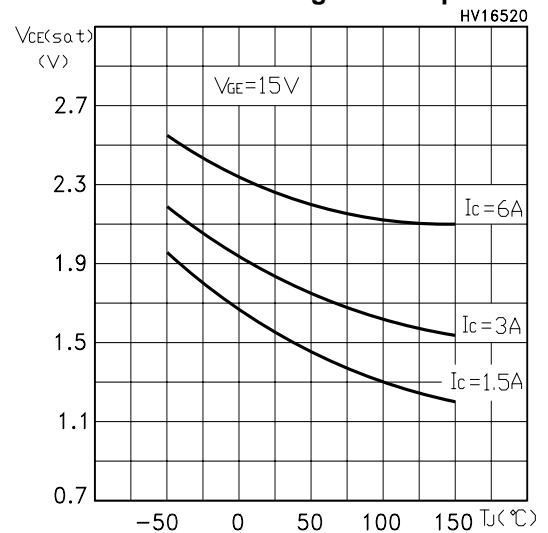
Transfer Characteristics



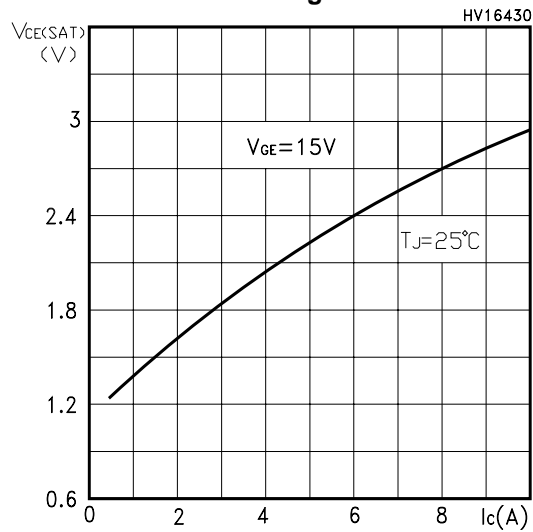
Transconductance



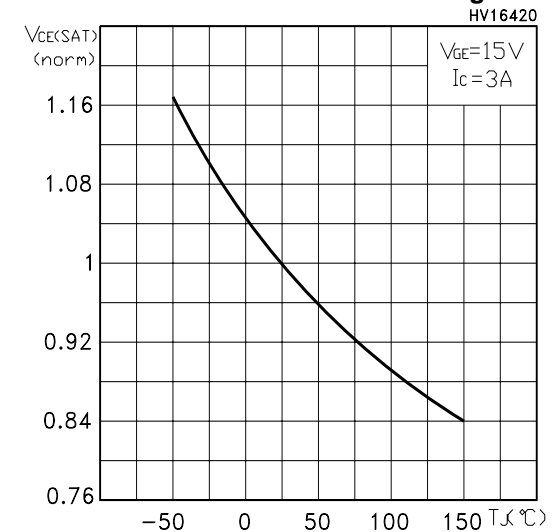
Collector-Emitter On Voltage vs Temperature



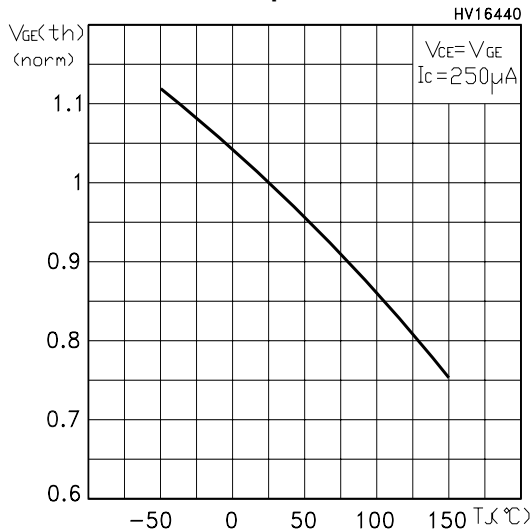
Collector-Emitter On Voltage vs Collector Current



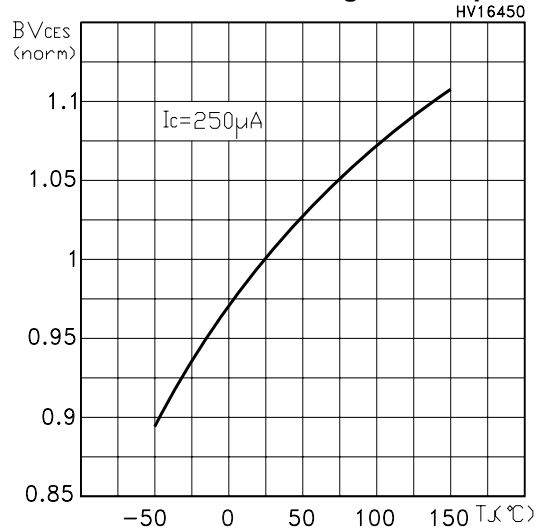
Normalized Collector-Emitter On Voltage vs Temp.



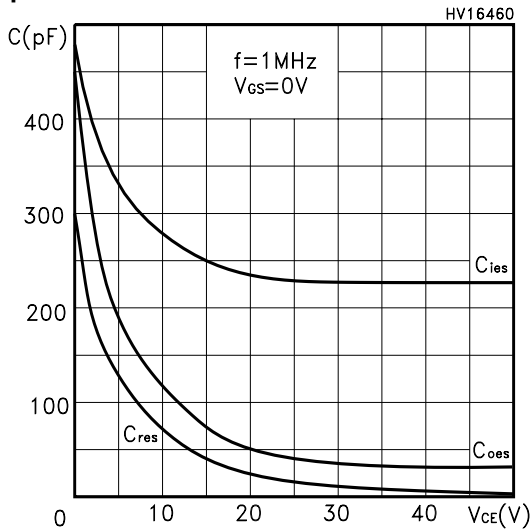
Gate Threshold vs Temperature



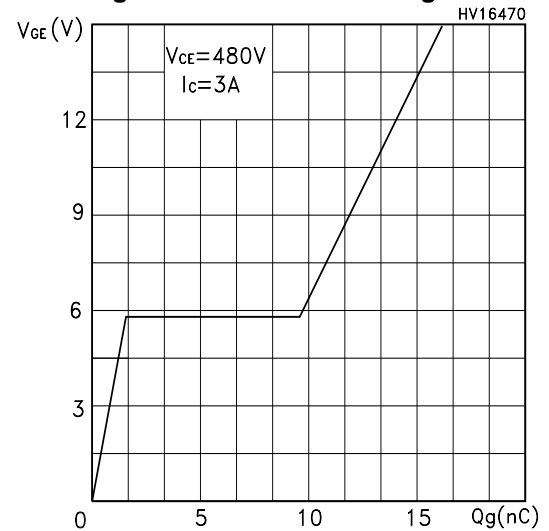
Normalized Breakdown Voltage vs Temperature



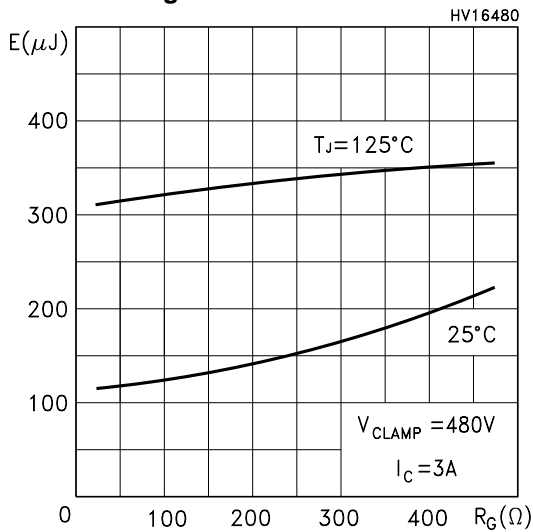
Capacitance Variations



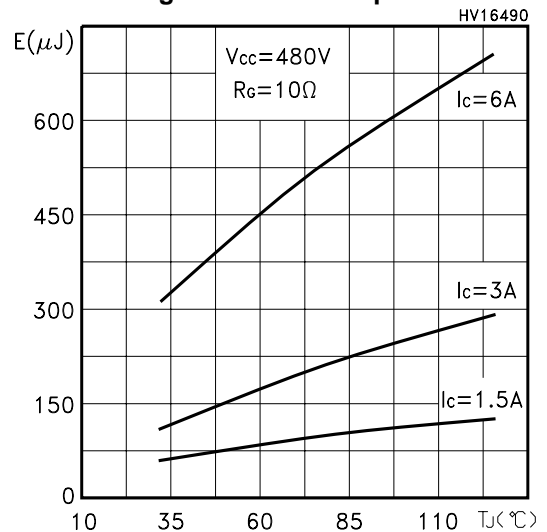
Gate Charge vs Gate-Emitter Voltage



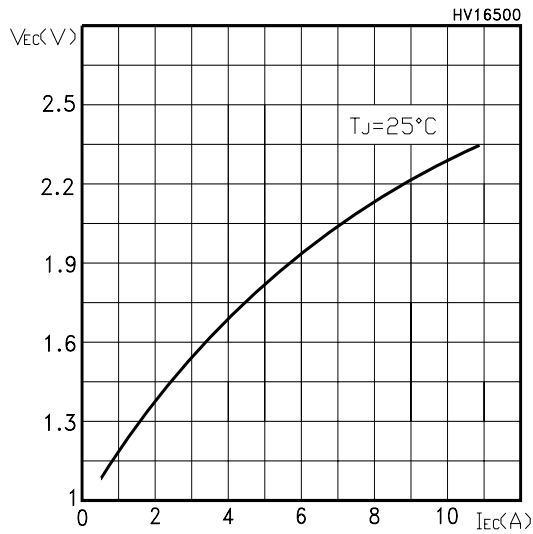
Total Switching Losses vs Gate Resistance



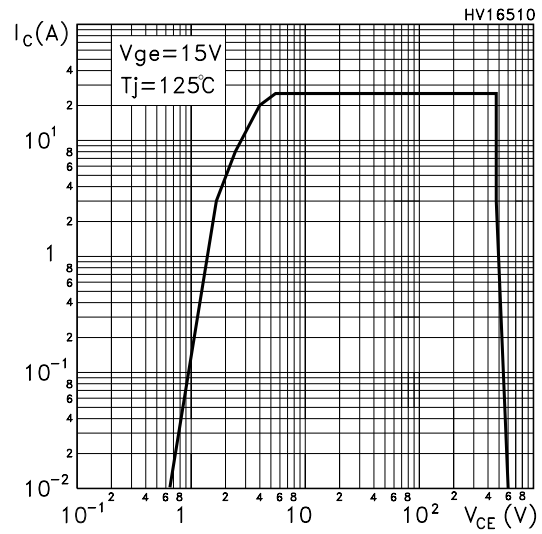
Total Switching Losses vs Temperature



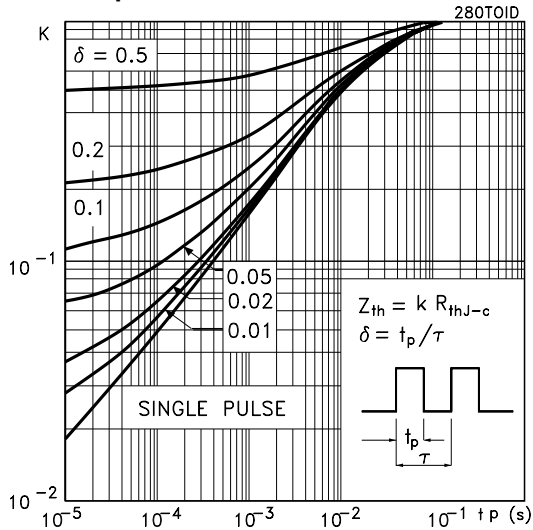
Emitter-collector Diode Characteristics



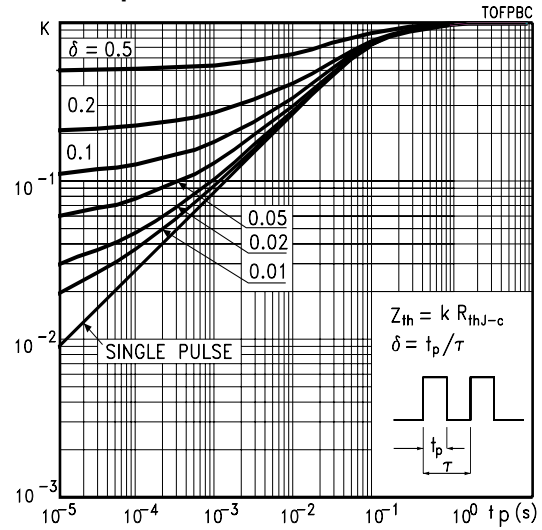
Turn-Off SOA



Thermal Impedance for TO-220 / D2PAK



Thermal Impedance for TO-220FP



Thermal Impedance for DPAK

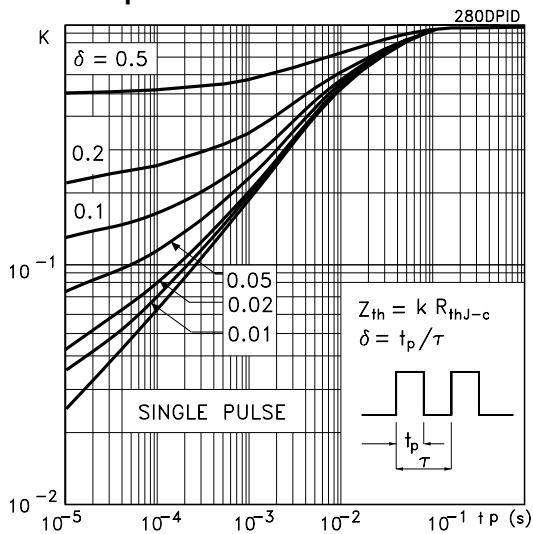


Fig. 1: Gate Charge test Circuit

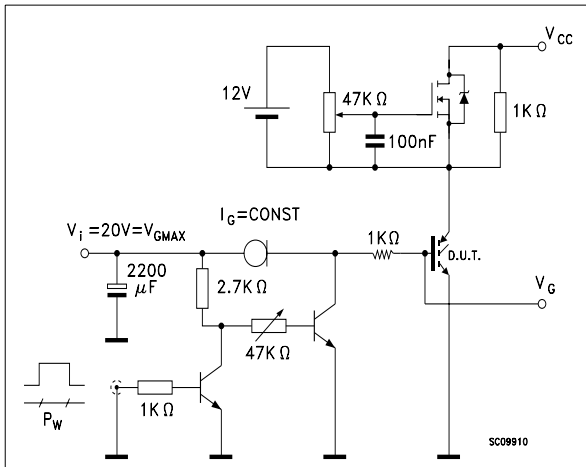
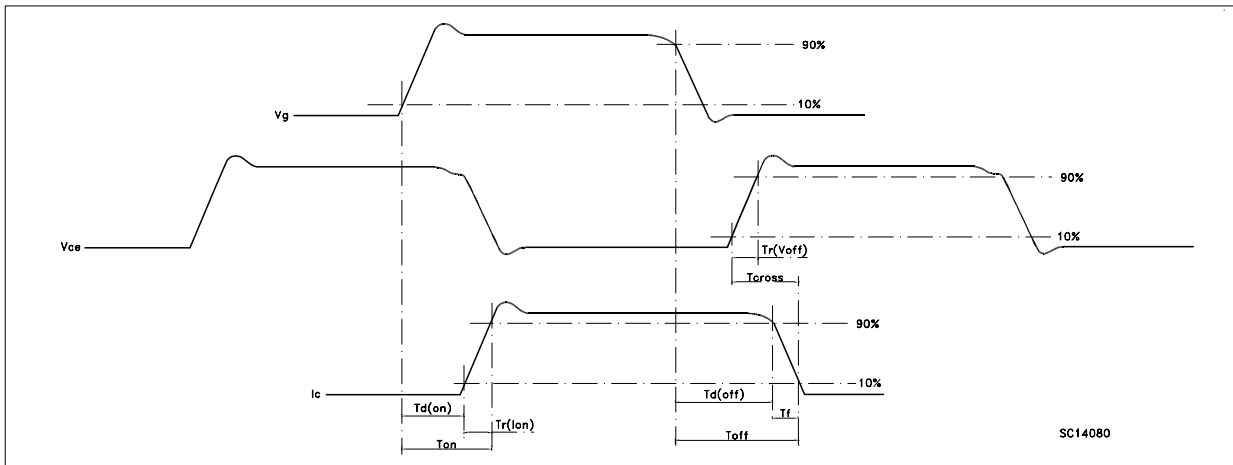
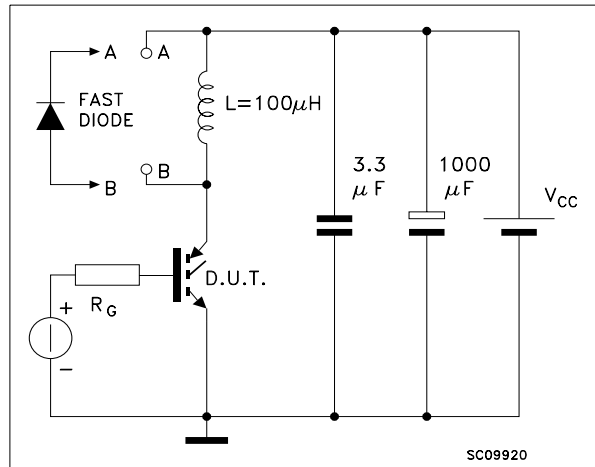
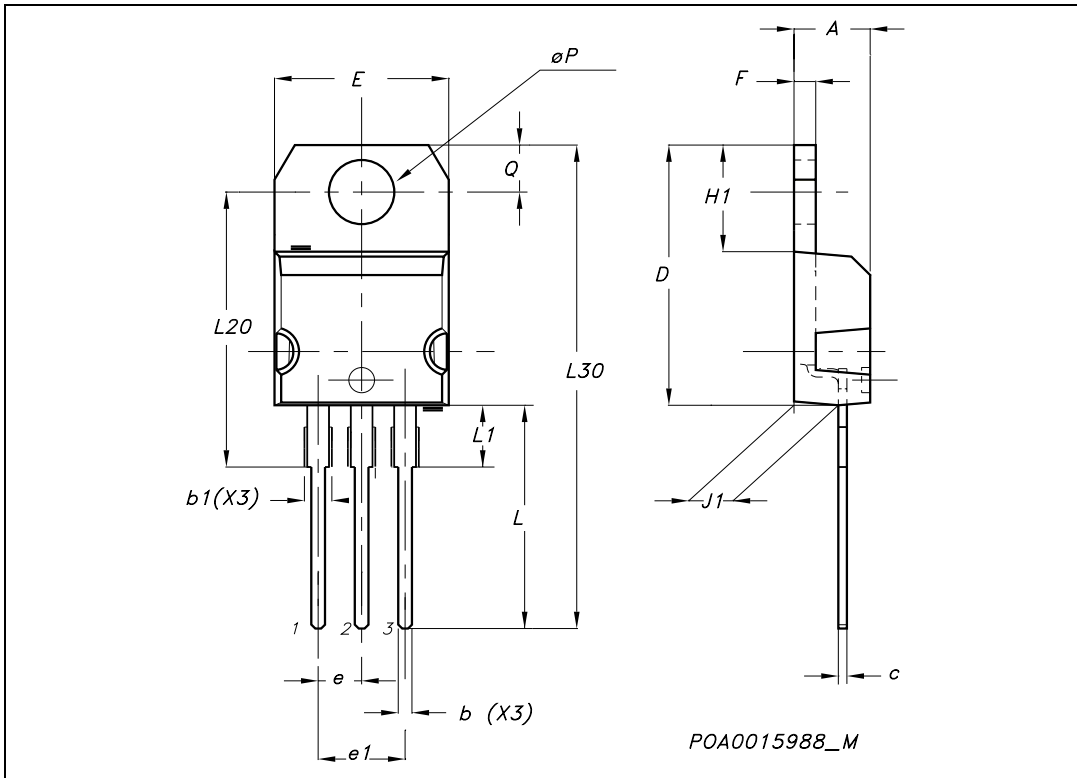


Fig. 2: Test Circuit For Inductive Load Switching



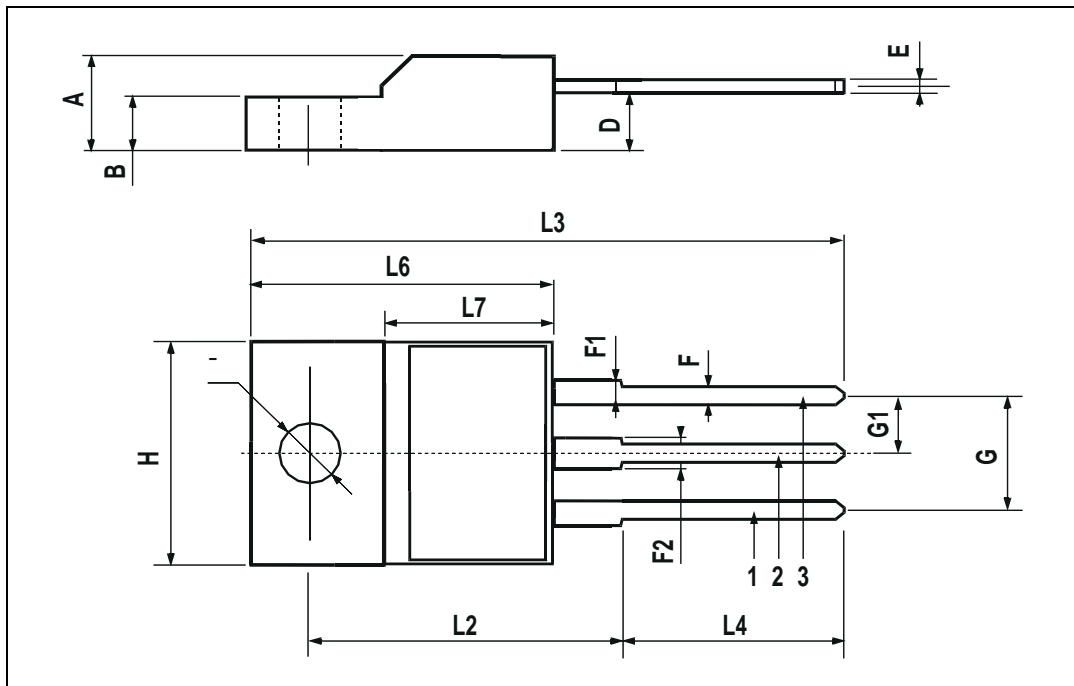
TO-220 MECHANICAL DATA

| DIM. | mm. | | | inch | | |
|------|-------|-------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| b | 0.61 | | 0.88 | 0.024 | | 0.034 |
| b1 | 1.15 | | 1.70 | 0.045 | | 0.066 |
| c | 0.49 | | 0.70 | 0.019 | | 0.027 |
| D | 15.25 | | 15.75 | 0.60 | | 0.620 |
| E | 10 | | 10.40 | 0.393 | | 0.409 |
| e | 2.40 | | 2.70 | 0.094 | | 0.106 |
| e1 | 4.95 | | 5.15 | 0.194 | | 0.202 |
| F | 1.23 | | 1.32 | 0.048 | | 0.052 |
| H1 | 6.20 | | 6.60 | 0.244 | | 0.256 |
| J1 | 2.40 | | 2.72 | 0.094 | | 0.107 |
| L | 13 | | 14 | 0.511 | | 0.551 |
| L1 | 3.50 | | 3.93 | 0.137 | | 0.154 |
| L20 | | 16.40 | | | 0.645 | |
| L30 | | 28.90 | | | 1.137 | |
| øP | 3.75 | | 3.85 | 0.147 | | 0.151 |
| Q | 2.65 | | 2.95 | 0.104 | | 0.116 |



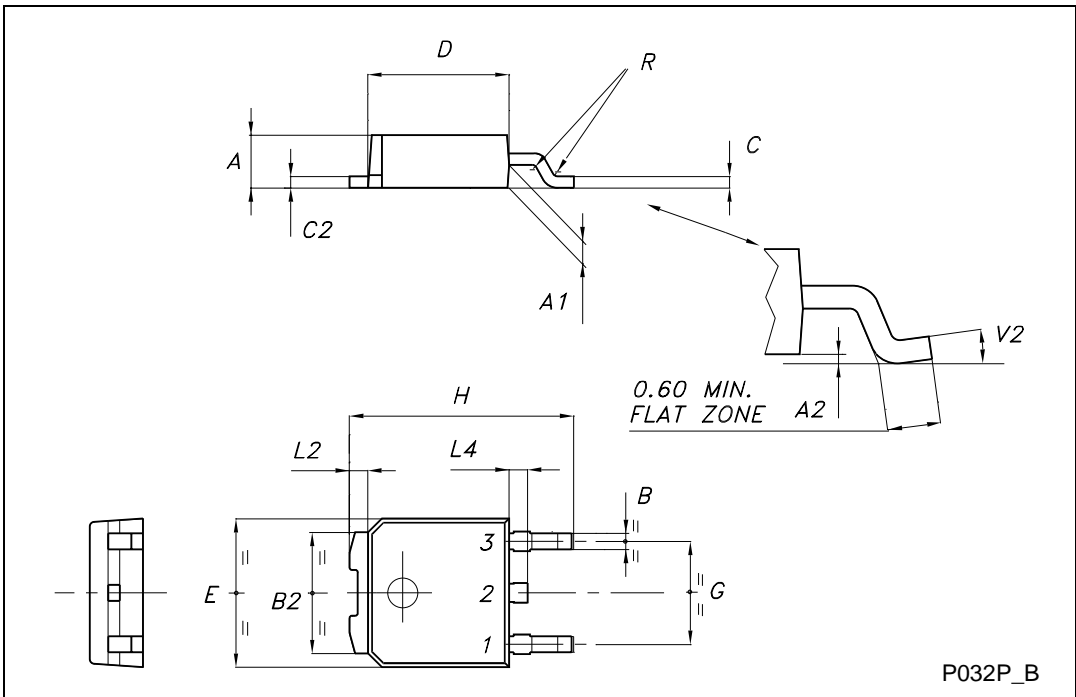
TO-220FP MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|------|------|------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| B | 2.5 | | 2.7 | 0.098 | | 0.106 |
| D | 2.5 | | 2.75 | 0.098 | | 0.108 |
| E | 0.45 | | 0.7 | 0.017 | | 0.027 |
| F | 0.75 | | 1 | 0.030 | | 0.039 |
| F1 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| F2 | 1.15 | | 1.7 | 0.045 | | 0.067 |
| G | 4.95 | | 5.2 | 0.195 | | 0.204 |
| G1 | 2.4 | | 2.7 | 0.094 | | 0.106 |
| H | 10 | | 10.4 | 0.393 | | 0.409 |
| L2 | | 16 | | | 0.630 | |
| L3 | 28.6 | | 30.6 | 1.126 | | 1.204 |
| L4 | 9.8 | | 10.6 | 0.385 | | 0.417 |
| L6 | 15.9 | | 16.4 | 0.626 | | 0.645 |
| L7 | 9 | | 9.3 | 0.354 | | 0.366 |
| ∅ | 3 | | 3.2 | 0.118 | | 0.126 |



TO-252 (DPAK) MECHANICAL DATA

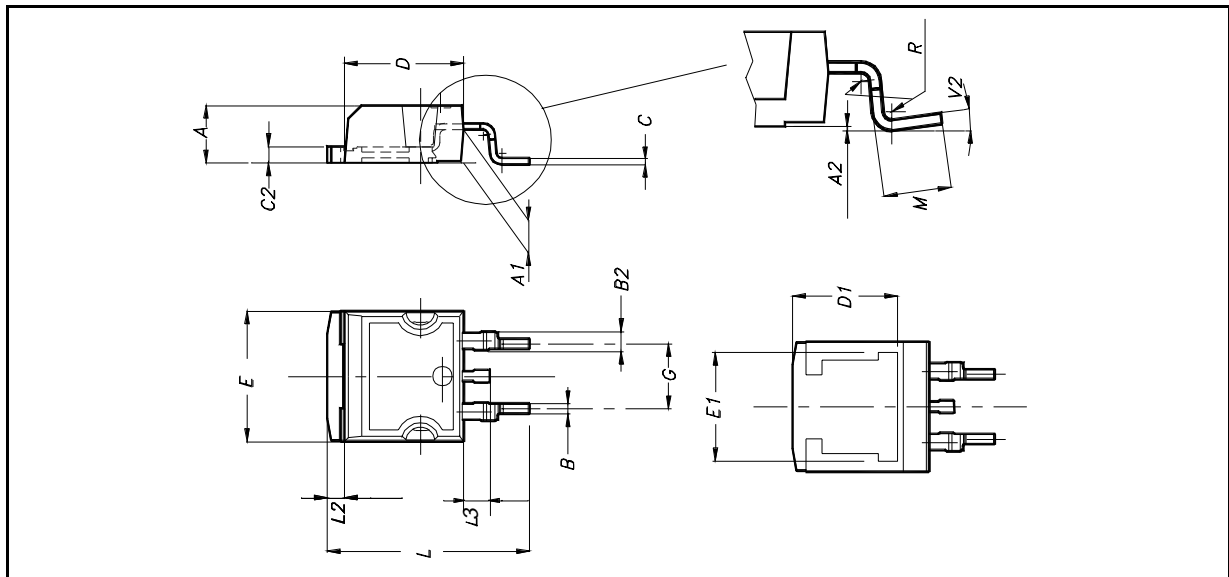
| DIM. | mm | | | inch | | |
|------|------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 2.20 | | 2.40 | 0.087 | | 0.094 |
| A1 | 0.90 | | 1.10 | 0.035 | | 0.043 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.64 | | 0.90 | 0.025 | | 0.035 |
| B2 | 5.20 | | 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° |



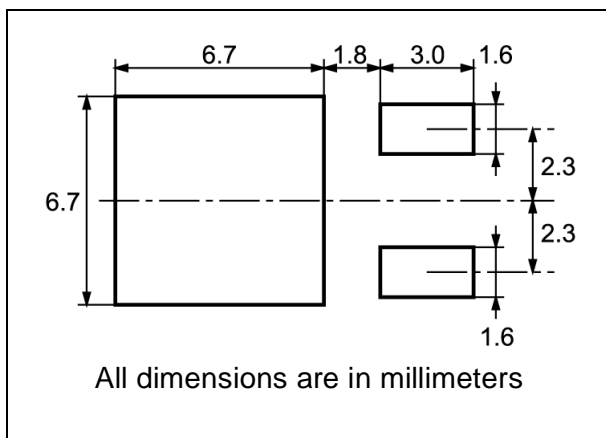
P032P_B

D²PAK MECHANICAL DATA

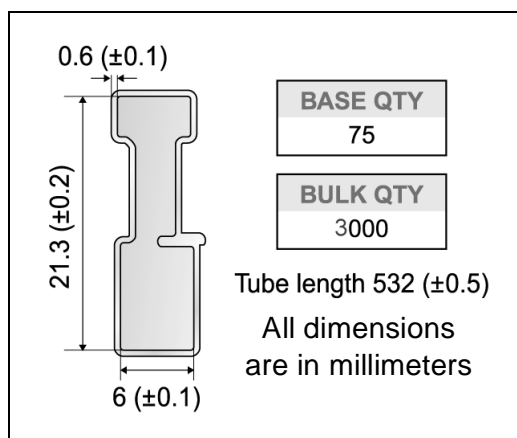
| DIM. | mm. | | | inch | | |
|------|------|-----|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 |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



DPAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

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 |

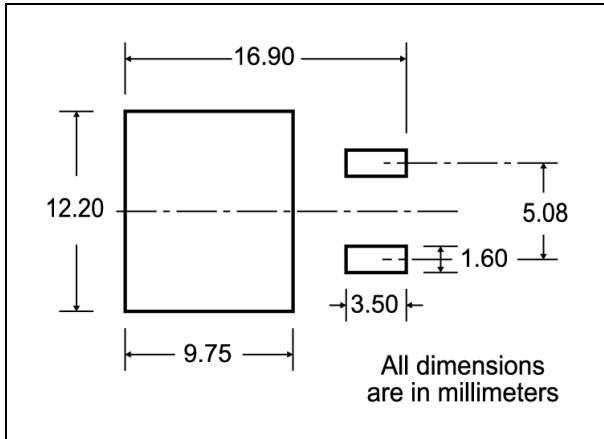
TAPE MECHANICAL DATA

| 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 |

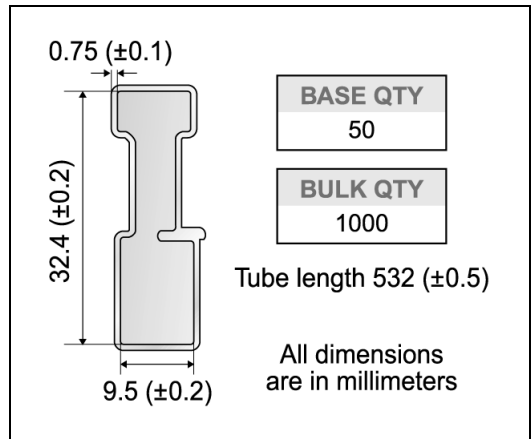
* on sales type



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

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 |

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 |

10 pitches cumulative tolerance on tape + / - 0.2 mm

Center line of cavity

TRL

FEED DIRECTION

Bending radius

R min.

* on sales



Information furnished is believed to be accurate and reliable. However, STMicroelectronics assumes no responsibility for the consequences of use of such information nor for any infringement of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of STMicroelectronics. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. STMicroelectronics products are not authorized for use as critical components in life support devices or systems without express written approval of STMicroelectronics.

© The ST logo is a registered trademark of STMicroelectronics

© 2003 STMicroelectronics - Printed in Italy - All Rights Reserved
STMicroelectronics GROUP OF COMPANIES

Australia - Brazil - Canada - China - Finland - France - Germany - Hong Kong - India - Israel - Italy - Japan - Malaysia - Malta - Morocco
Singapore - Spain - Sweden - Switzerland - United Kingdom - United States.

© <http://www.st.com>