



STGP3NB60K - STGD3NB60K

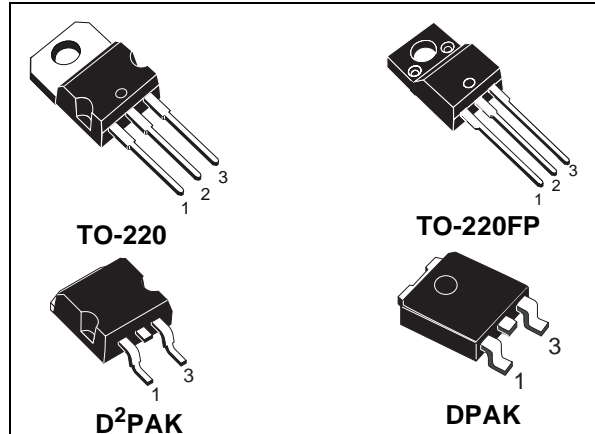
STGP3NB60KD-STGP3NB60KDFP-STGB3NB60KD

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

PowerMESH™ IGBT

| TYPE | V _{CEs} | V _{CE(sat)} (Typ) @ 125°C | I _c @ 125°C |
|---------------|------------------|---------------------------------------|---------------------------|
| STGP3NB60K | 600 V | < 2 V | 3 A |
| STGD3NB60K | 600 V | < 2 V | 3 A |
| STGP3NB60KD | 600 V | < 2 V | 3 A |
| STGP3NB60KDFP | 600 V | < 2 V | 3 A |
| STGB3NB60KD | 600 V | < 2 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

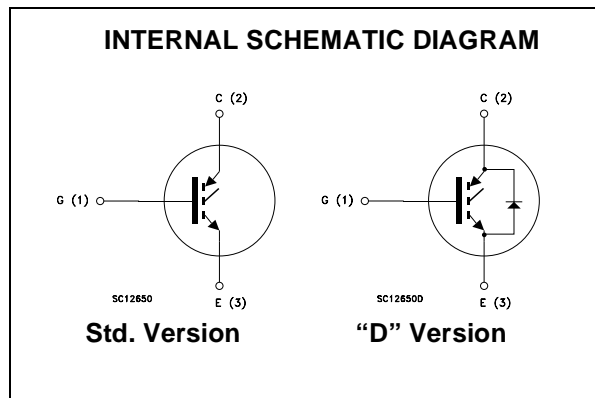


DESCRIPTION

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 "K" identifies a family optimized for high frequency motor control applications with short circuit withstand capability.

APPLICATIONS

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



ORDERING INFORMATION

| SALES TYPE | MARKING | PACKAGE | PACKAGING |
|---------------|-------------|--------------------|-------------|
| STGP3NB60K | GP3NB60K | TO-220 | TUBE |
| STGD3NB60KT4 | GD3NB60K | DPAK | TAPE & REEL |
| STGP3NB60KD | GP3NB60KD | TO-220 | TUBE |
| STGP3NB60KDFP | GP3NB60KDFP | TO-220FP | TUBE |
| STGB3NB60KDT4 | GB3NB60KD | D ² PAK | TAPE & REEL |

STGP3NB60K/STGD3NB60K/STGP3NB60KD/STGP3NB60KDFP/STGB3NB60KD

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 | 6 | 6 | A |
| I _C | Collector Current (continuous) at T _C = 100°C | 3 | 3 | 3 | A |
| I _{CM} (■) | Collector Current (pulsed) | 24 | 24 | 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 | 0.75 | | | W/°C |
| V _{ISO} | Insulation Withstand Voltage A.C. | -- | 2500 | -- | V |
| T _{stg} | Storage Temperature | - 55 to 150 150 | | | °C |
| T _j | Max. Operating Junction Temperature | | | | |

(■) 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 (TCASE = 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 | | | 50 500 | 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 = 250μA | 5 | | 7 | V |
| V _{CE(sat)} | Collector-Emitter Saturation Voltage | V _{GE} = 15V, I _C = 3 A V _{GE} = 15V, I _C = 3 A, T _j = 125°C | | 2.3 1.9 | 2.8 | V V |

STGP3NB60K/STGD3NB60K/STGP3NB60KD/STGP3NB60KDFP/STGB3NB60KD

SWITCHING PARAMETERS

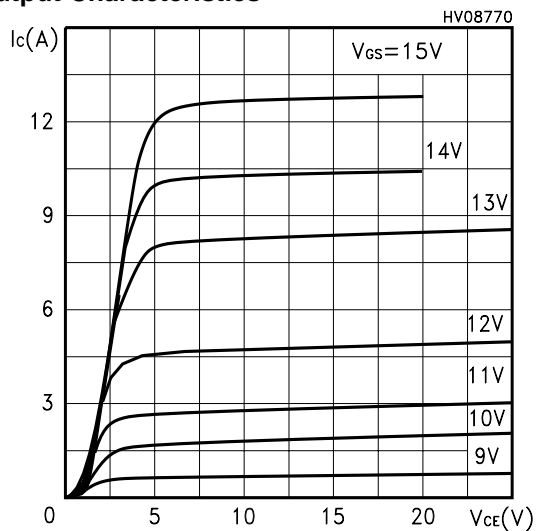
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|--|--|------|---------------------------------------|------|--|
| g_{fs} | Forward Transconductance | $V_{CE} = 25V, I_C = 3 A$ | | 2.4 | | S |
| C_{ies} C_{oes} C_{res} | Input Capacitance Output Capacitance Reverse Transfer Capacitance | $V_{CE} = 25V, f = 1 MHz, V_{GE} = 0$ | | 218 33 5.8 | | pF pF pF |
| Q_g Q_{ge} Q_{gc} | Total Gate Charge Gate-Emitter Charge Gate-Collector Charge | $V_{CE} = 480V, I_C = 3 A,$ $V_{GE} = 15V$ | | 14 3.3 7.5 | 18 | nC nC nC |
| t_{scw} | Short Circuit Withstand Time | $V_{ce} = 0.5 V_{BR(CES)}, V_{GE}=15V,$ $T_j = 125^\circ C, R_G = 10 \Omega$ | 10 | | | μs |
| $t_{d(on)}$ t_r | Turn-on Delay Time Rise Time | $V_{CC} = 480 V, I_C = 3 A$ $R_G = 10\Omega, V_{GE} = 15 V$ | | 14 5 | | ns ns |
| $(di/dt)_{on}$ E_{on} | Turn-on Current Slope Turn-on Switching Losses | $V_{CC}= 480 V, I_C = 3 A R_G=10\Omega$ $V_{GE} = 15 V, T_j = 125^\circ C$ | | 520 30 | | 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 | $V_{CC} = 480 V, I_C = 3 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_j = 25^\circ C$ | | 122 26.5 33 100 58 85 | | 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 | $V_{CC} = 480 V, I_C = 3 A,$ $R_{GE} = 10 \Omega, V_{GE} = 15 V$ $T_j = 125^\circ C$ | | 210 66 100 120 165 195 | | ns ns ns ns μJ μJ |

COLLECTOR-EMITTER DIODE ("D" VERSION)

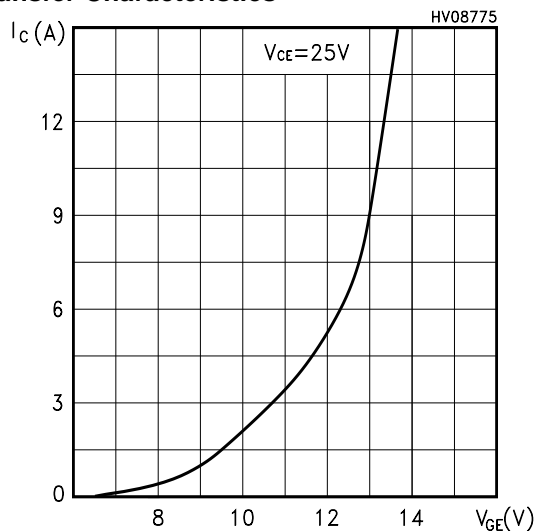
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|-----------------------------------|--|---|------|-----------------|------|---------------|
| V_f | Forward On-Voltage | $I_f = 1.5 A$ $I_f = 1.5 A, T_j = 125^\circ C$ | | 1.31 0.95 | 1.8 | V V |
| t_{rr} Q_{rr} I_{rrm} | Reverse Recovery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

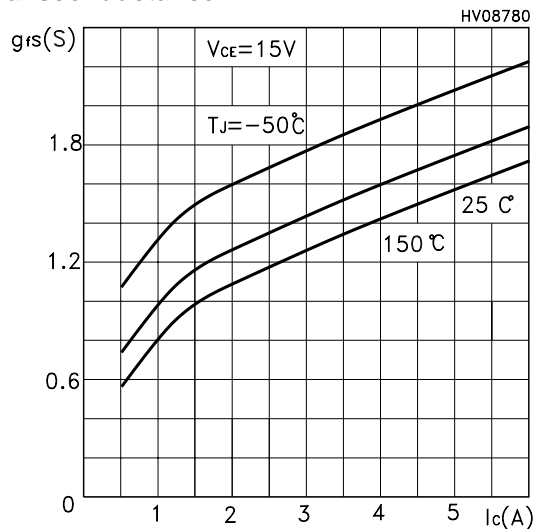
Output Characteristics



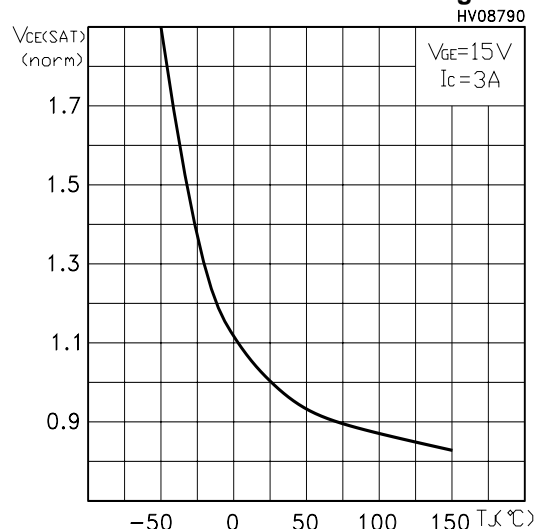
Transfer Characteristics



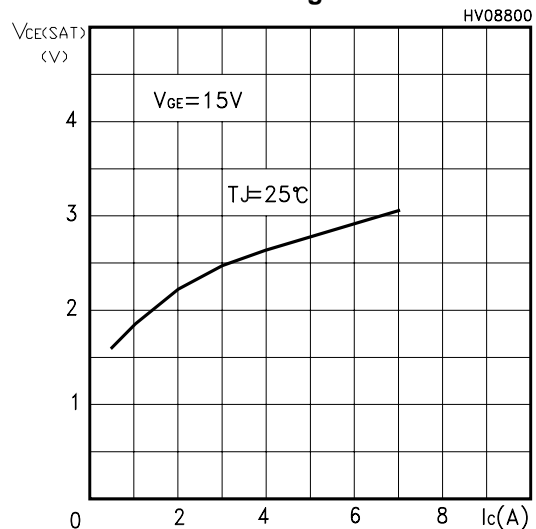
Transconductance



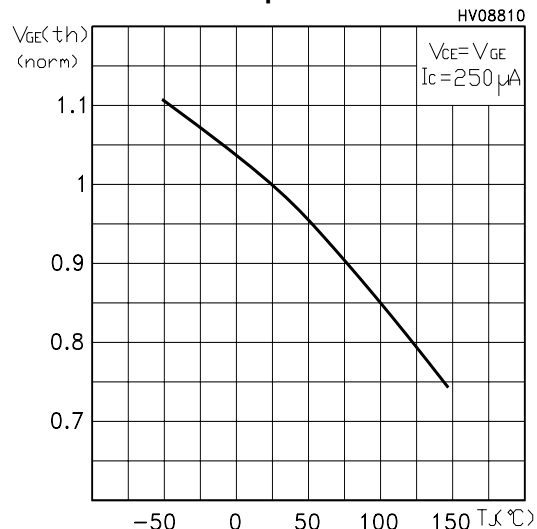
Normalized Collector-Emitter On Voltage vs Temp.



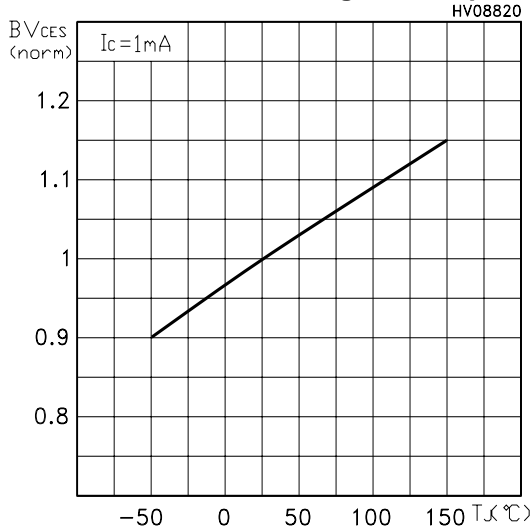
Collector-Emitter On Voltage vs Collector Current



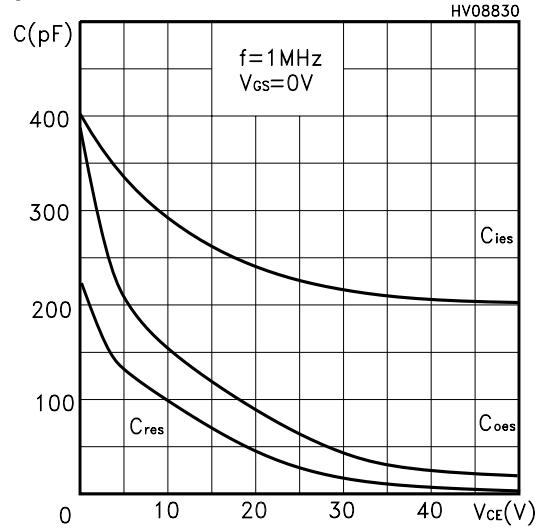
Gate Threshold vs Temperature



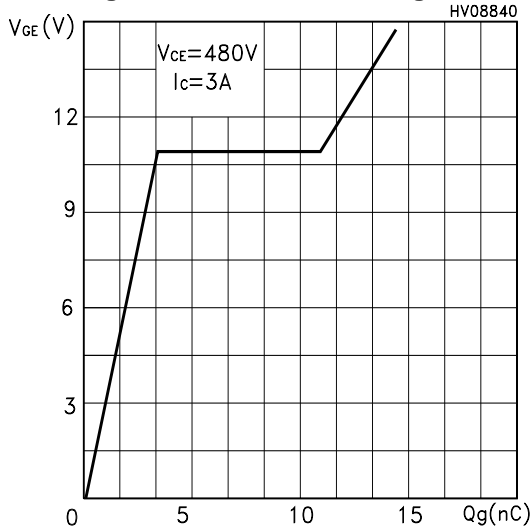
Normalized Breakdown Voltage vs Temperature



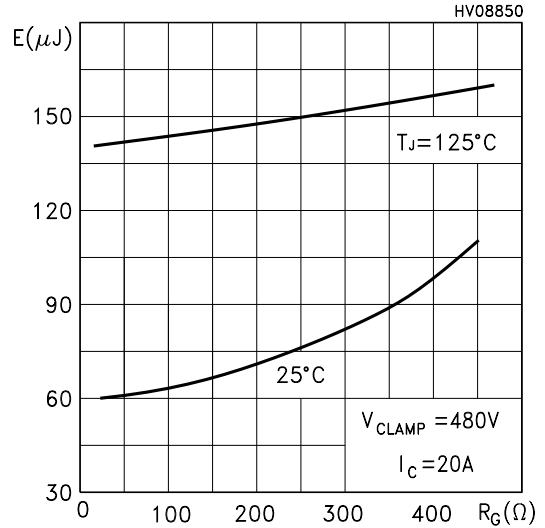
Capacitance Variations



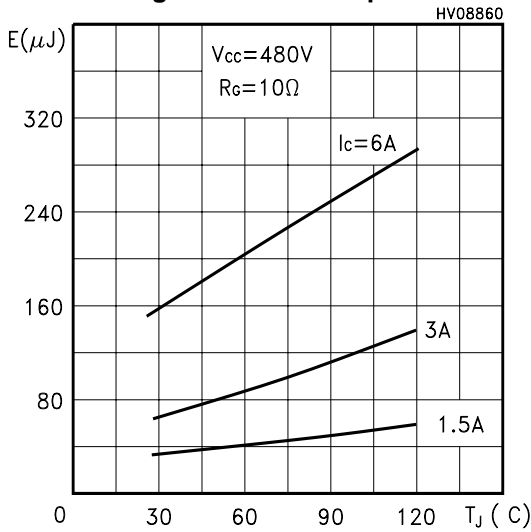
Gate Charge vs Gate-Emitter Voltage



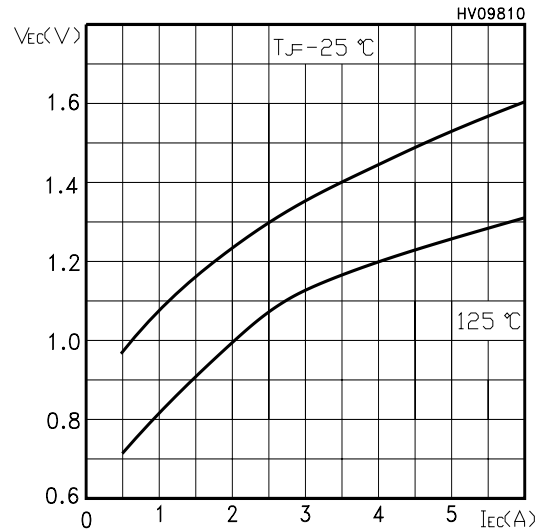
Total Switching Losses vs Gate Resistance



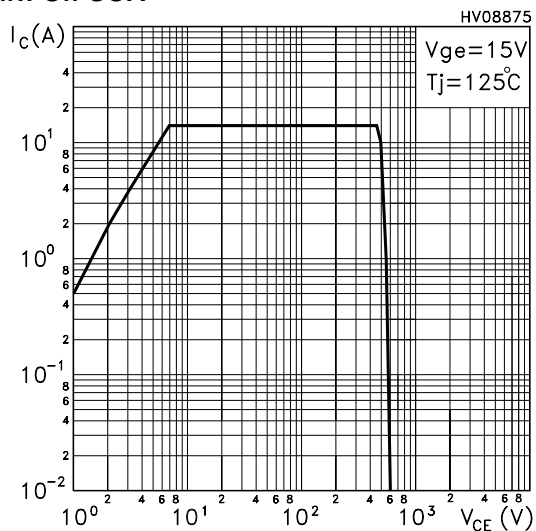
Total Switching Losses vs Temperature



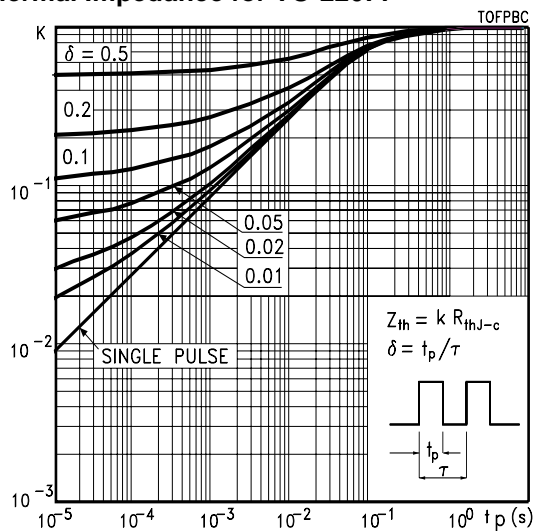
Emitter-collector Diode Characteristics



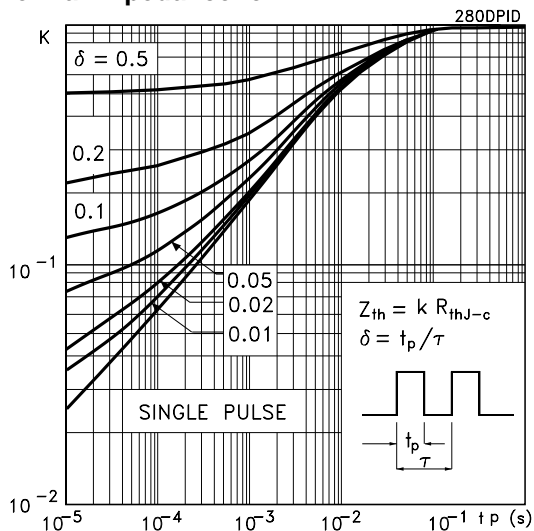
Turn-Off SOA



Thermal Impedance for TO-220FP



Thermal Impedance for DPAK



Thermal Impedance for TO-220 / D2PAK

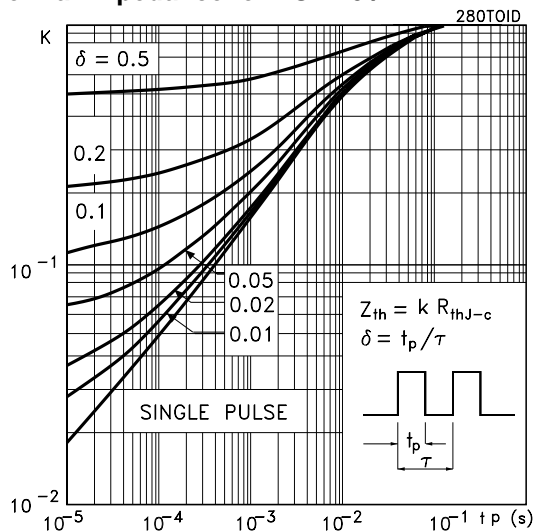


Fig. 1: Gate Charge test Circuit

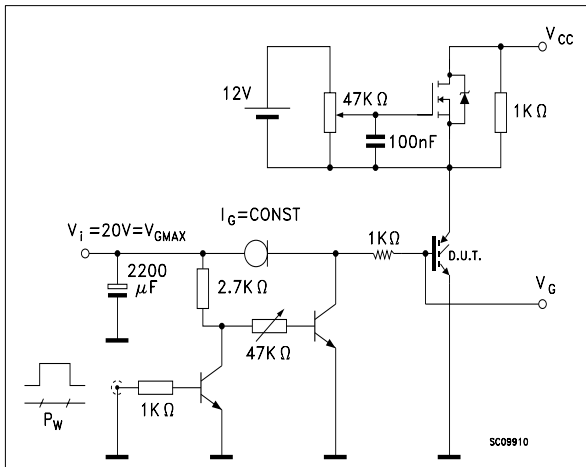
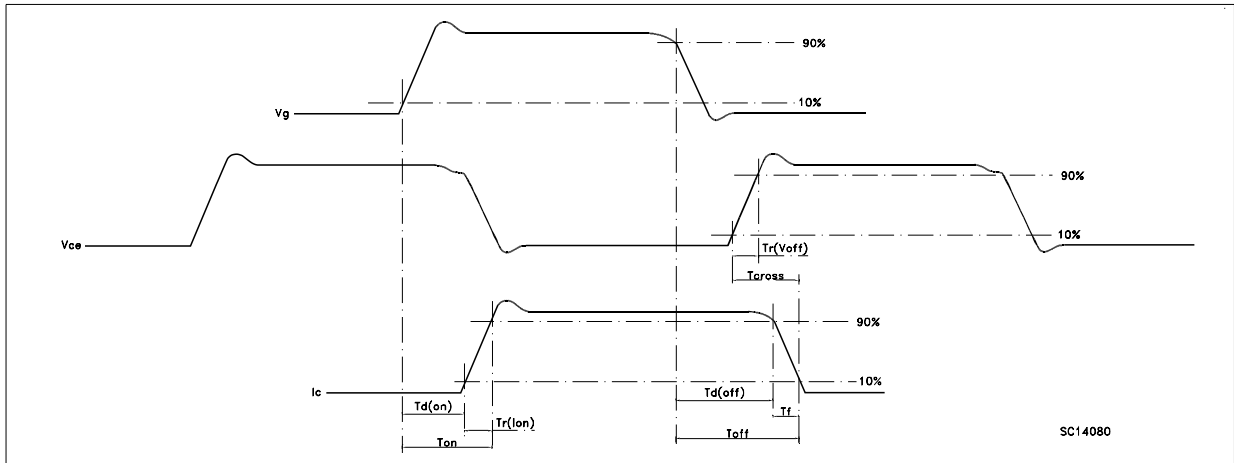
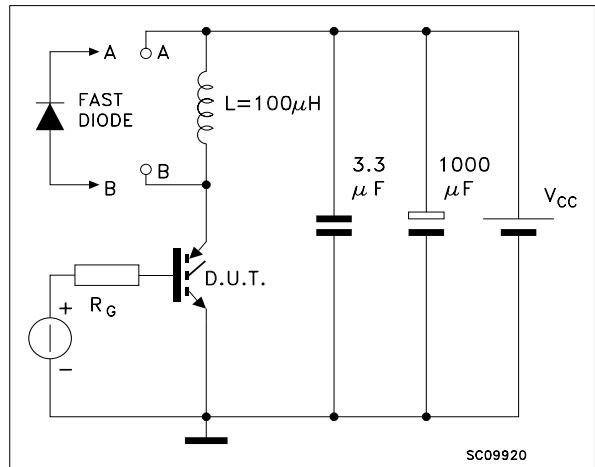
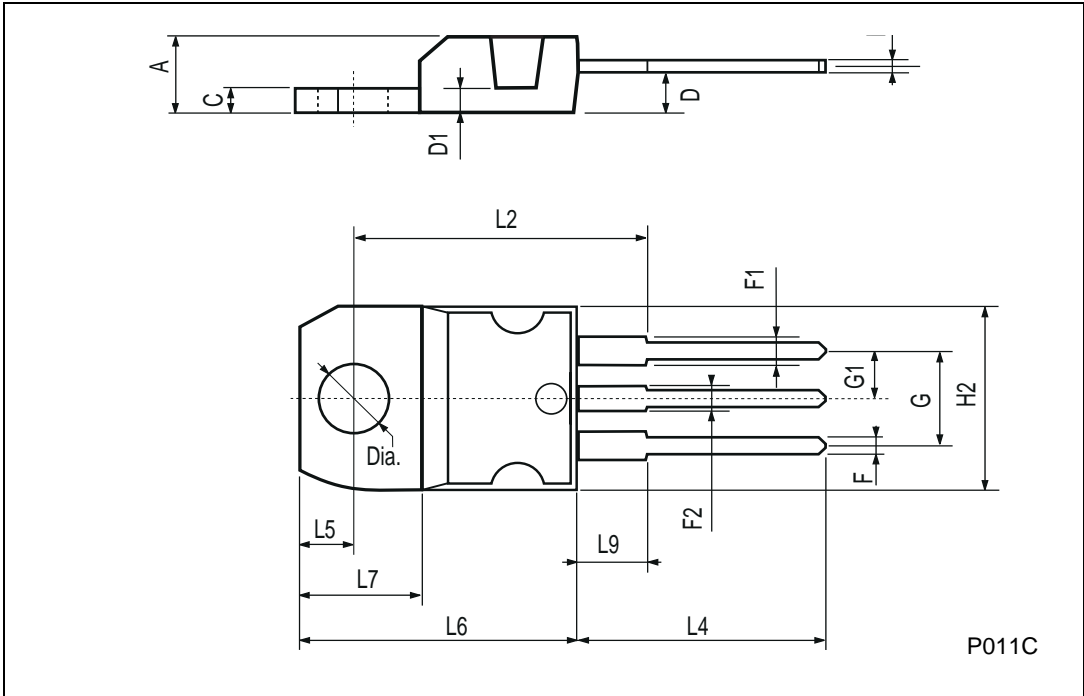


Fig. 2: Test Circuit For Inductive Load Switching



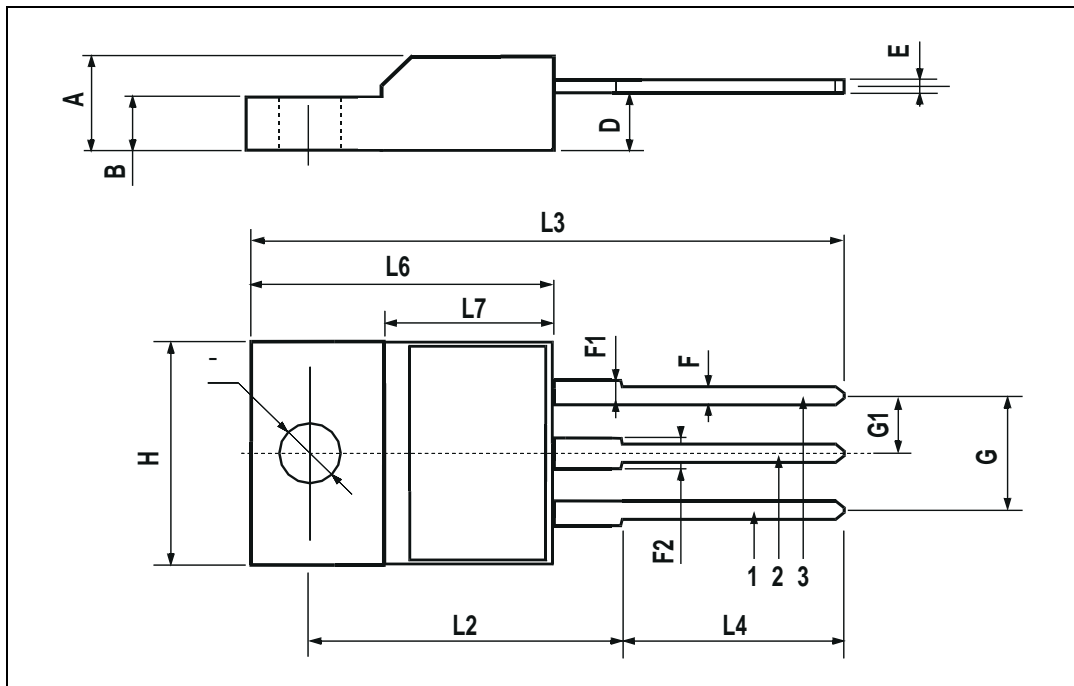
TO-220 MECHANICAL DATA

| DIM. | mm | | | inch | | |
|------|-------|------|-------|-------|-------|-------|
| | MIN. | TYP. | MAX. | MIN. | TYP. | MAX. |
| A | 4.40 | | 4.60 | 0.173 | | 0.181 |
| 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 |



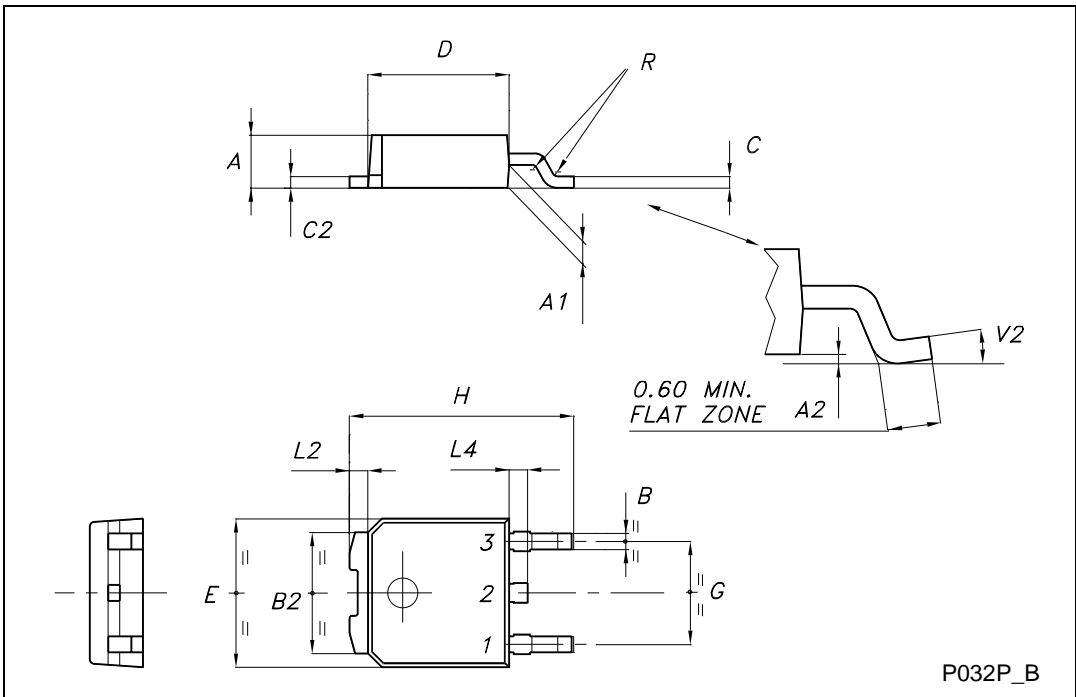
TO-220FP MECHANICAL DATA

| 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 |



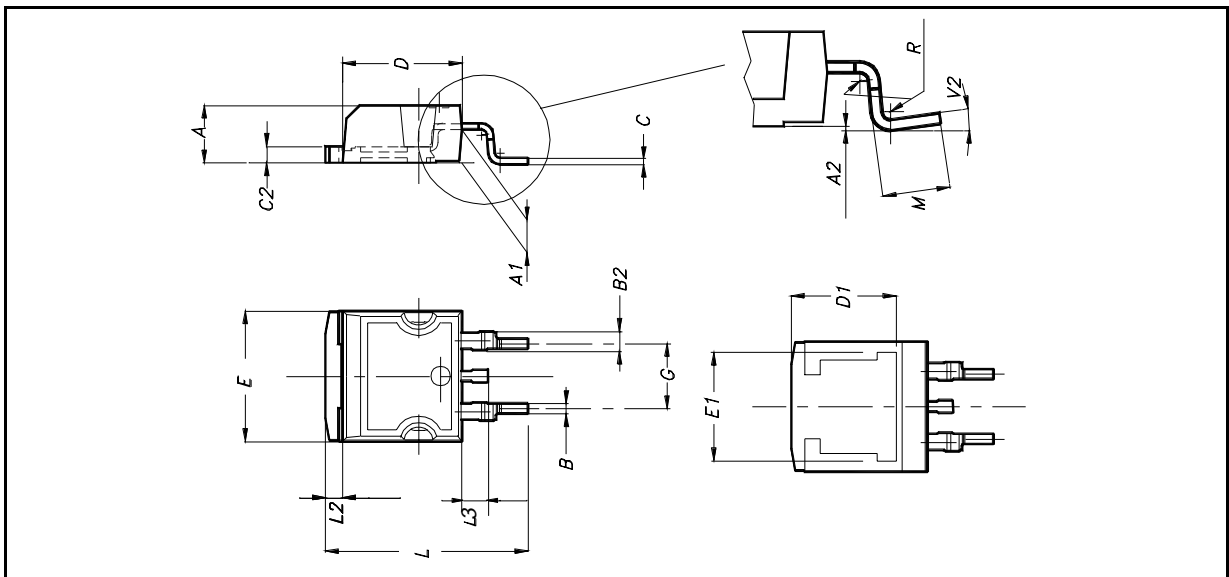
TO-252 (DPAK) MECHANICAL DATA

| 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° |

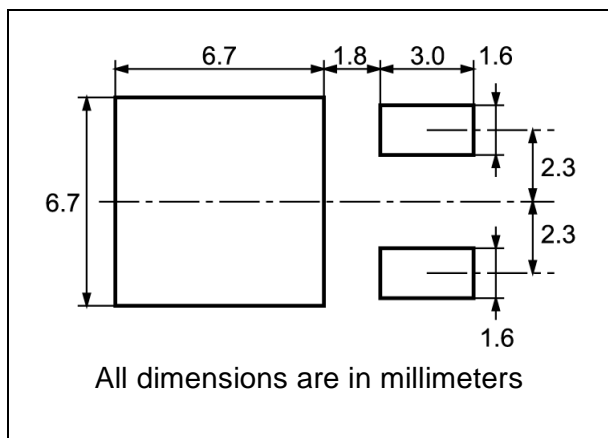


D²PAK MECHANICAL DATA

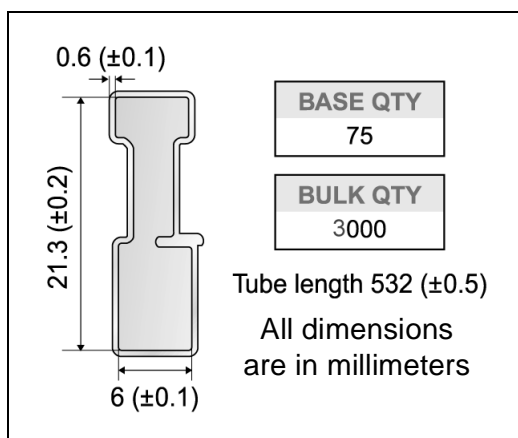
| DIM. | mm. | | | inch | | |
|------|------|-----|-------|-------|-------|-------|
| | MIN. | TYP | MAX. | MIN. | TYP. | MAX. |
| A | 4.4 | | 4.6 | 0.173 | | 0.181 |
| A1 | 2.49 | | 2.69 | 0.098 | | 0.106 |
| A2 | 0.03 | | 0.23 | 0.001 | | 0.009 |
| B | 0.7 | | 0.93 | 0.027 | | 0.036 |
| B2 | 1.14 |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

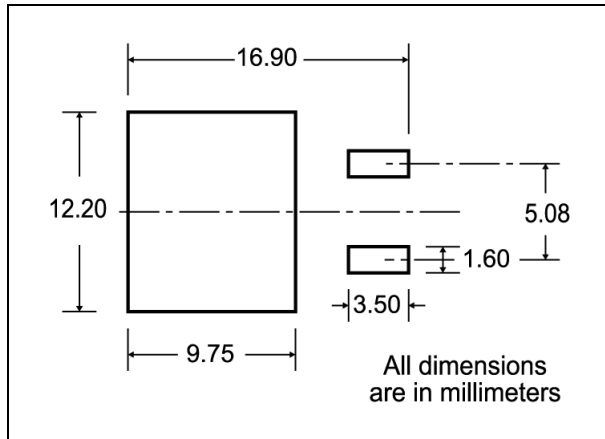
TAPE MECHANICAL DATA

| 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 |

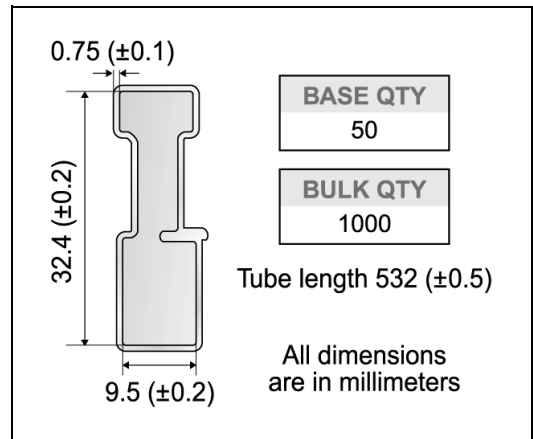
* on sales type



D²PAK FOOTPRINT



TUBE SHIPMENT (no suffix)*



TAPE AND REEL SHIPMENT (suffix "T4")*

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 |

TRAILER (TRL)

* on sales



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