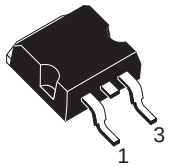
# STB90NF03L

## N-CHANNEL 30V - 0.0056Ω - 90A $D^2PAK$
## LOW GATE CHARGE STripFET™ POWER MOSFET

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ |
|---|---|---|---|
| STB90NF03L | 30 V | < 0.0065 Ω | 90 A |

- TYPICAL $R_{DS}(on)$ = 0.0056 Ω
- TYPICAL $Q_g$ = 35 nC @ 5V
- OPTIMAL $R_{DS}(on)$ x $Q_g$ TRADE-OFF
- CONDUCTION LOSSES REDUCED
- SWITCHING LOSSES REDUCED

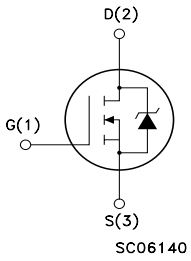



**$D^2PAK$**

### DESCRIPTION

This application specific Power Mosfet is the third generation of STMicroelectronics unique "Single Feature Size™" strip-based process. The resulting transistor shows the best trade-off between on-resistance and gate charge. When used as high and low side in buck regulators, it gives the best performance in terms of both conduction and switching losses. This is extremely important for motherboards where fast switching and high efficiency are of paramount importance.

**INTERNAL SCHEMATIC DIAGRAM**




### APPLICATIONS

- SPECIFICALLY DESIGNED AND OPTIMISED FOR HIGH EFFICIENCY CPU CORE DC/DC CONVERTERS

### ABSOLUTE MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---|---|---|---|
| $V_{DS}$ | Drain-source Voltage ($V_{GS}$ = 0) | 30 | V |
| $V_{DGR}$ | Drain-gate Voltage ($R_{GS}$ = 20 kΩ) | 30 | V |
| $V_{GS}$ | Gate- source Voltage | ± 18 | V |
| $I_D$ | Drain Current (continuos) at $T_C$ = 25°C | 90 | A |
| $I_D$ | Drain Current (continuos) at $T_C$ = 100°C | 65 | A |
| $I_{DM}$ (●) | Drain Current (pulsed) | 360 | A |
| $P_{TOT}$ | Total Dissipation at $T_C$ = 25°C | 150 | W |
| | Derating Factor | 0.73 | W/°C |
| $T_{stg}$ | Storage Temperature | – 55 to 175 | °C |
| $T_j$ | Max. Operating Junction Temperature | | |

(●) Pulse width limited by safe operating area

## THERMAL DATA

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

## 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 | 30 | | | V |
| $I_{DSS}$ | Zero Gate Voltage Drain Current ($V_{GS}$ = 0) | $V_{DS}$ = Max Rating | | | 1 | µA |
| | | $V_{DS}$ = Max Rating, $T_C$ = 125 °C | | | 10 | µA |
| $I_{GSS}$ | Gate-body Leakage Current ($V_{DS}$ = 0) | $V_{GS}$ = ± 18 V | | | ±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 | 1 | | | V |
| $R_{DS(on)}$ | Static Drain-source On Resistance | $V_{GS}$ = 10V, $I_D$ = 45 A | | 0.0056 | 0.0065 | Ω |
| | | $V_{GS}$ = 5V, $I_D$ = 45 A | | 0.007 | 0.012 | Ω |

DYNAMIC

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $g_{fs}$ (1) | Forward Transconductance | $V_{DS}$ > $I_{D(on)}$ x $R_{DS(on)max}$, $I_D$ = 45 A | | 40 | | S |
| $C_{iss}$ | Input Capacitance | $V_{DS}$ = 25V, f = 1 MHz, $V_{GS}$ = 0 | | 2700 | | pF |
| $C_{oss}$ | Output Capacitance | | | 860 | | pF |
| $C_{rss}$ | Reverse Transfer Capacitance | | | 170 | | pF |

**ELECTRICAL CHARACTERISTICS** (CONTINUED)

SWITCHING ON

| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(on)}$ | Turn-on Delay Time | $V_{DD}$ = 15V, $I_D$ = 45 A | | 30 | | ns |
| $t_r$ | Rise Time | $R_G$ = 4.7Ω $V_{GS}$ = 4.5 V (see test circuit, Figure 3) | | 200 | | ns |
| $Q_g$ | Total Gate Charge | $V_{DD}$ = 24V, $I_D$ =90A,$V_{GS}$ = 5V | | 35 | 47 | nC |
| $Q_{gs}$ | Gate-Source Charge | | | 10 | | nC |
| $Q_{gd}$ | Gate-Drain Charge | | | 18 | | nC |

SWITCHING OFF

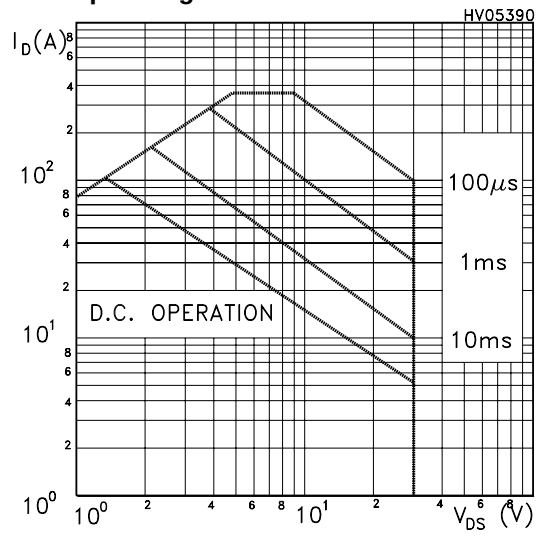
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $t_{d(off)}$ | Turn-off-Delay Time | $V_{DD}$ = 15V, $I_D$ = 45 A, $R_G$ = 4.7Ω, $V_{GS}$ = 4.5 V (see test circuit, Figure 3) | | 50 | | ns |
| $t_f$ | Fall Time | | | 105 | | ns |

SOURCE DRAIN DIODE

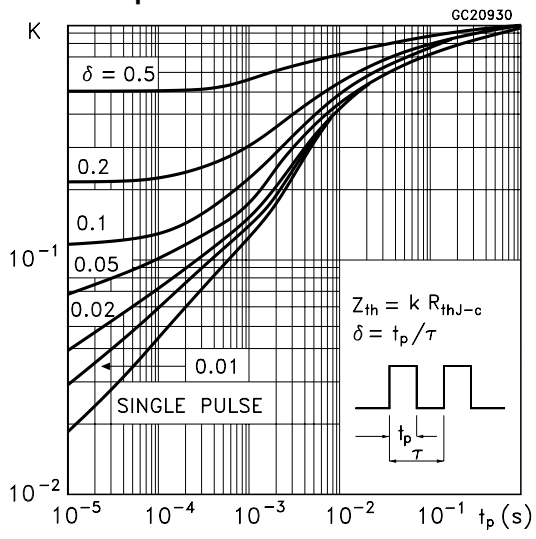
| Symbol | Parameter | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $I_{SD}$ | Source-drain Current | | | | 90 | A |
| $I_{SDM}$ (1) | Source-drain Current (pulsed) | | | | 360 | A |
| $V_{SD}$ (2) | Forward On Voltage | $I_{SD}$ = 90 A, $V_{GS}$ = 0 | | | 1.3 | V |
| $t_{rr}$ | Reverse Recovery Time | $I_{SD}$ = 90 A, di/dt = 100A/µs, $V_{DD}$ = 15V, $T_j$ = 150°C (see test circuit, Figure 5) | | 80 | | ns |
| $Q_{rr}$ | Reverse Recovery Charge | | | 90 | | nC |
| $I_{RRM}$ | Reverse Recovery Current | | | 2.5 | | A |

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

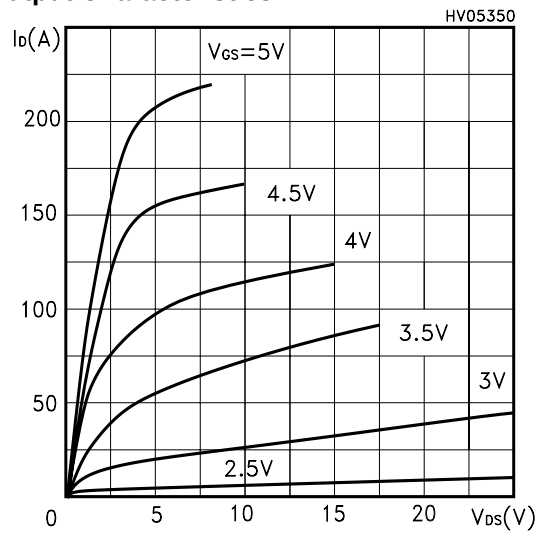
**Safe Operating Area**



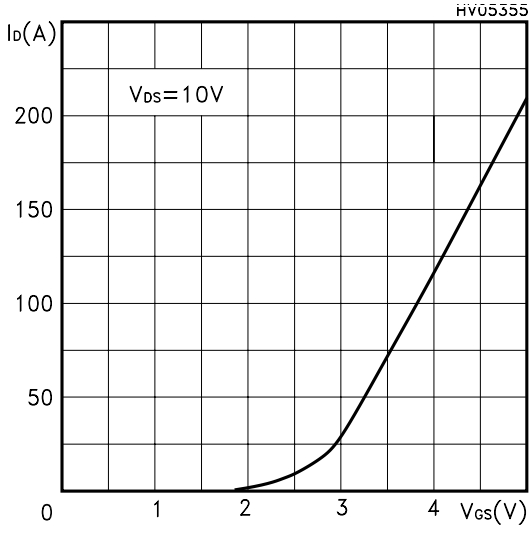

**Thermal Impedence**



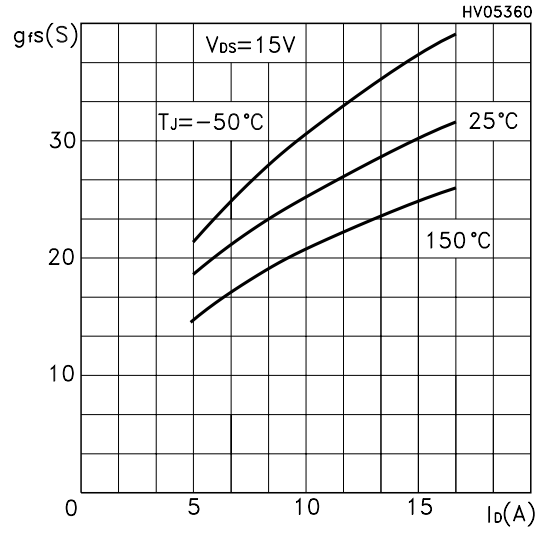
### Output Characteristics



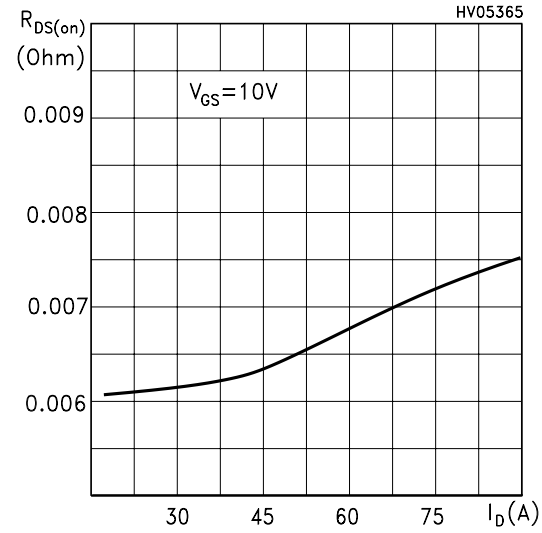

### Transfer Characteristics



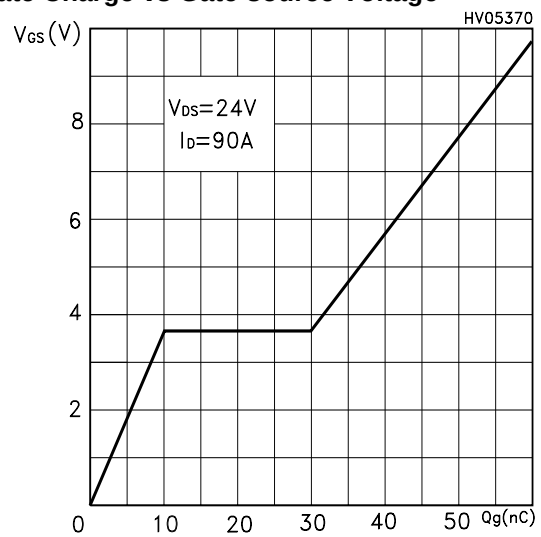

### Transconductance



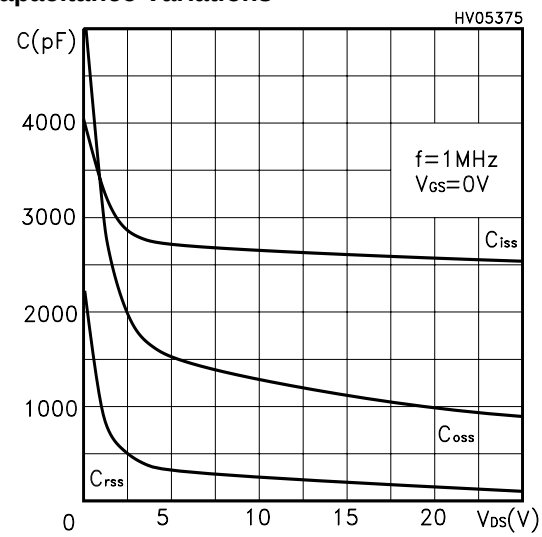

### Static Drain-source On Resistance



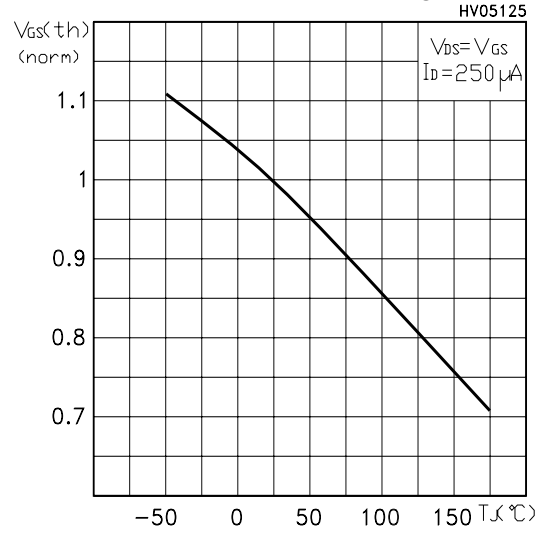

### Gate Charge vs Gate-source Voltage



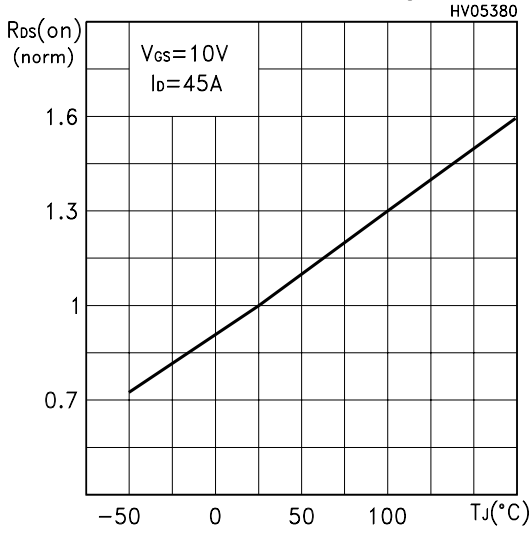

### Capacitance Variations



**Normalized Gate Thereshold Voltage vs Temp.**




**Normalized On Resistance vs Temperature**




**Source-drain Diode Forward Characteristics**

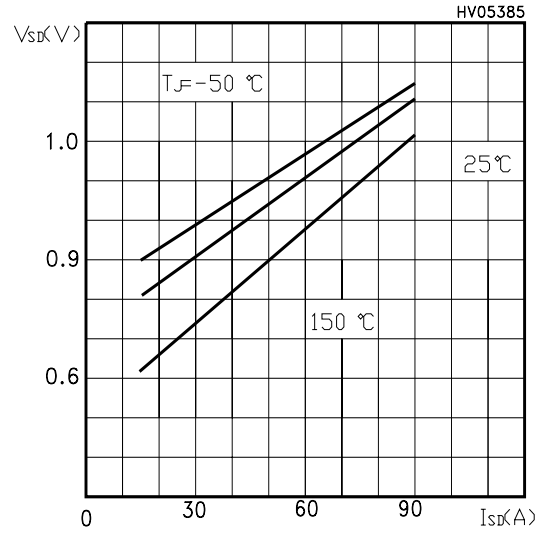


**Fig. 1:** Unclamped Inductive Load Test Circuit

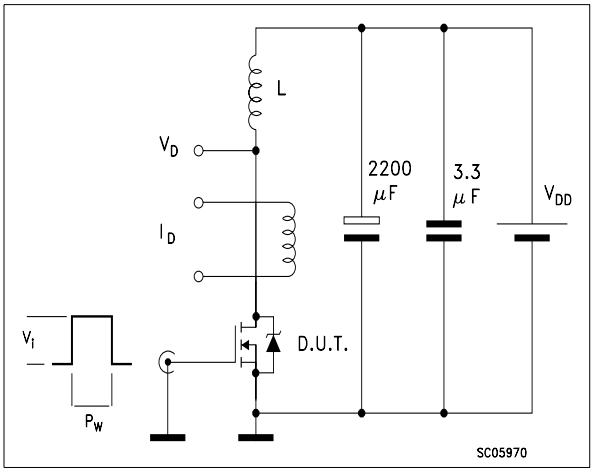



**Fig. 2:** Unclamped Inductive Waveform

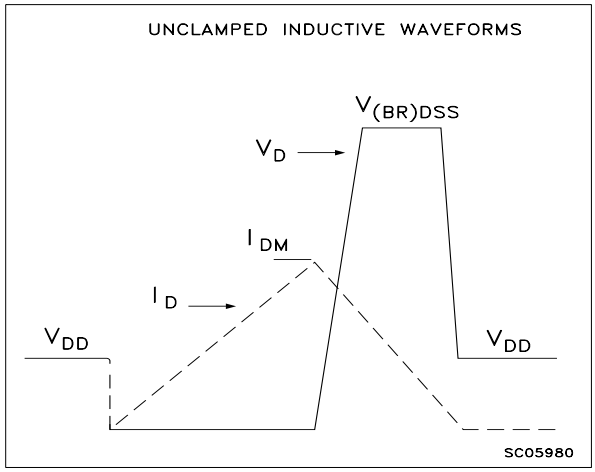



**Fig. 3:** Switching Times Test Circuit For Resistive Load

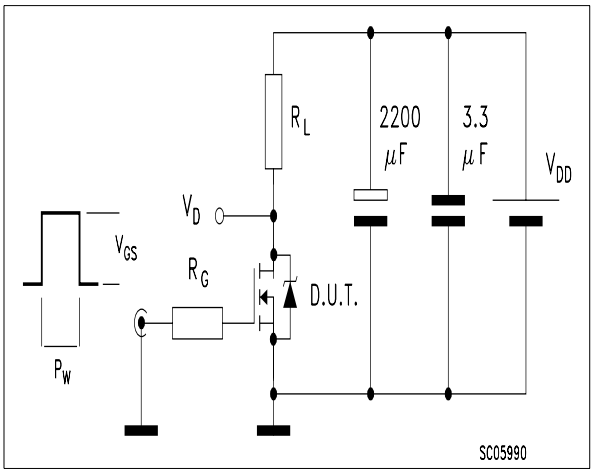



**Fig. 4:** Gate Charge test Circuit

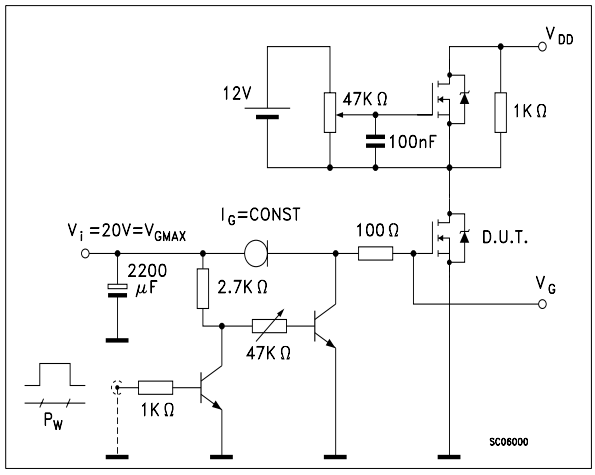
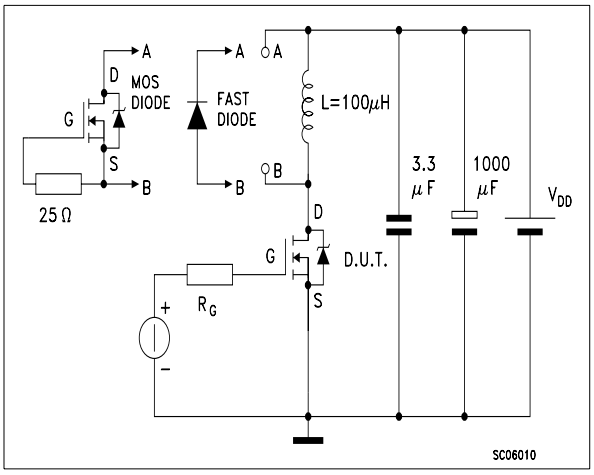
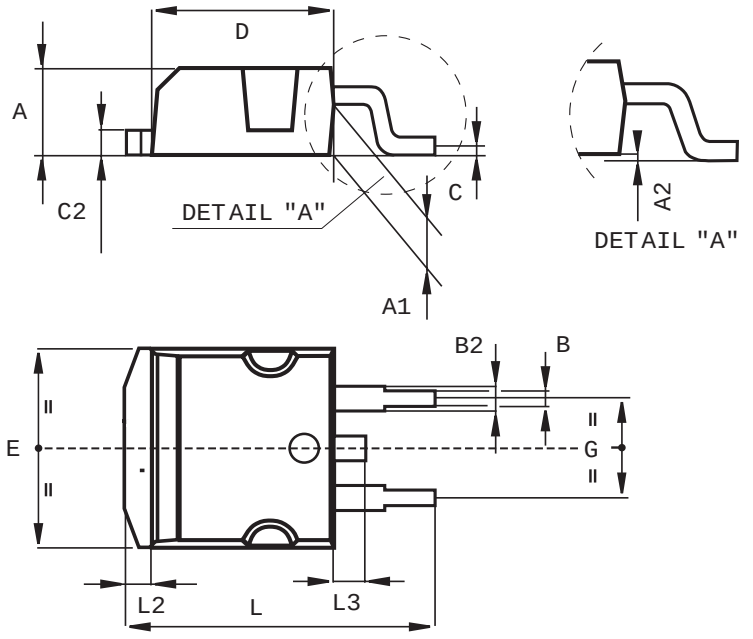



**Fig. 5:** Test Circuit For Inductive Load Switching And Diode Recovery Times



## TO-263 ($D^2$PAK) 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 | 1.21 | | 1.36 | 0.047 | | 0.053 |
| D | 8.95 | | 9.35 | 0.352 | | 0.368 |
| E | 10 | | 10.4 | 0.393 | | 0.409 |
| G | 4.88 | | 5.28 | 0.192 | | 0.208 |
| L | 15 | | 15.85 | 0.590 | | 0.624 |
| L2 | 1.27 | | 1.4 | 0.050 | | 0.055 |
| L3 | 1.4 | | 1.75 | 0.055 | | 0.068 |

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