

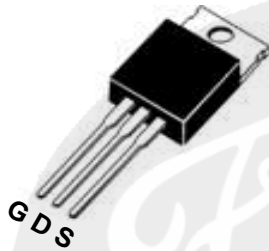
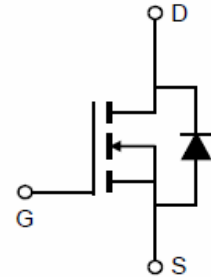
**Features**

- Uses split-gate technology
- Extremely low on-resistance $R_{DS(on)}$
- Excellent $Q_g \times R_{DS(on)}$ product
- Qualified according to JEDEC criteria

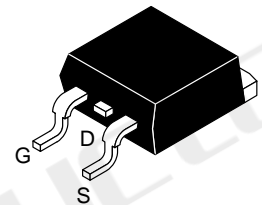
| | |
|-------------------------|---------------|
| VDS | 98V |
| $R_{DS(on)}@V_{GS}=10V$ | 5.2m Ω |
| I_D | 140A |

Application

- Motor Drivers
- UPS (Uninterruptible Power Supplies)
- DC/DC converter
- General purpose applications



TO-220AB



TO-263

Order Information

| Part No. | Package | Marking | Shipping | Qty |
|--------------|----------|-------------|----------|----------|
| FIR140N098PG | TO-220AB | FIR140N098P | Reel | 800 PCS |
| FIR140N098RG | TO-263 | FIR140N098R | Tube | 1000 PCS |

Maximum Ratings

| Parameter | Symbol | Value | Unit |
|---|----------------|------------|------------------|
| Drain-source voltage | V_{DS} | 98 | V |
| Continuous drain current $T_C = 25^\circ\text{C}$ $T_C = 100^\circ\text{C}$ | I_D | 140 100 | A |
| Pulsed drain current $T_C = 25^\circ\text{C}$, t_p limited by T_{jmax} | $I_{D\ pulse}$ | 480 | |
| Avalanche energy, single pulse | E_{AS} | 689 | mJ |
| Gate-Source voltage | V_{GS} | ± 20 | V |
| Power dissipation $T_C = 25^\circ\text{C}$ | P_{tot} | 200 | W |
| Operating junction and storage temperature | T_j, T_{stg} | -55...+150 | $^\circ\text{C}$ |



Thermal Resistance

| Parameter | Symbol | Value | Unit |
|---|------------|-------|------|
| Thermal resistance, junction – case. Max | R_{thJC} | 0.62 | °C/W |
| Thermal resistance, junction – ambient. Max | R_{thJA} | 62.0 | |

Electrical Characteristic, at Tj = 25 °C, unless otherwise specified

| Parameter | Symbol | Test Condition | Value | | | Unit |
|----------------------------------|---------------|--|-------|------|------|------|
| | | | min. | typ. | max. | |
| Static Characteristic | | | | | | |
| Drain-source breakdown voltage | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=250\mu A$ | | 98 | | V |
| Gate threshold voltage | $V_{GS(th)}$ | $V_{DS}=V_{GS}, I_D=250\mu A$ $T_j=25^\circ C$ | 2.5 | | 4.0 | |
| Zero gate voltage drain current | I_{DSS} | $V_{IS}=80V, V_{GS}=0V$ $T_j=25^\circ C$ $T_A=125^\circ C$ | - | 0.05 | 1 | μA |
| Gate-source leakage current | I_{GSS} | $V_{GS}=20V, V_{DS}=0V$ | - | 1 | 100 | |
| Drain-source on-state resistance | $R_{DS(on)}$ | $V_{GS}=10V, I_D=50A,$ $T_j=25^\circ C$ $T_j=125^\circ C$ | - | 5.2 | - | mΩ |
| Transconductance | g_{fs} | $V_{DS}=5V, I_D=50A$ | - | 84.2 | - | |

Dynamic Characteristic

| | | | | | | |
|------------------------------|--------------|--|---|------|---|----|
| Input Capacitance | C_{iss} | $V_{GS}=0V, V_{DS}=40V,$ $f=1MHz$ | - | 3900 | - | pF |
| Output Capacitance | C_{oss} | | - | 1100 | - | |
| Reverse Transfer Capacitance | C_{rss} | | - | 35 | - | |
| Gate Total Charge | Q_G | $V_{GS}=10V, V_{DS}=40V,$ $I_D=50A, f=1MHz$ | - | 75.0 | - | nC |
| Gate-Source charge | Q_{gs} | | - | 15.0 | - | |
| Gate-Drain charge | Q_{gd} | | - | 13.0 | - | |
| Turn-on delay time | $t_{d(on)}$ | $T_j=25^\circ C, V_{GS}=10V,$ $V_{DS}=40V, R_L=3\Omega$ | - | 20.1 | - | ns |
| Rise time | t_r | | - | 38.9 | - | |
| Turn-off delay time | $t_{d(off)}$ | | - | 45.1 | - | |
| Fall time | t_f | | - | 22.8 | - | |
| Gate resistance | R_G | $V_{GS}=0V, V_{DS}=0V,$ $f=1MHz$ | - | 3.3 | - | Ω |

Body Diode Characteristic

| | | | | | | |
|------------------------------------|----------|----------------------------------|---|------|-----|----|
| Body Diode Forward Voltage | V_{SD} | $V_{GS}=0V, I_{SD}=50A$ | - | 0.95 | 1.4 | V |
| Body Diode Reverse Recovery Time | t_{rr} | $I_F=20A,$ $dI/dt=500A/\mu s$ | | 60 | | ns |
| Body Diode Reverse Recovery Charge | Q_{rr} | $I_F=20A,$ $dI/dt=50A/\mu s$ | | 52 | | nC |



Typical Performance Characteristics

Figure 1. Typ. Output Characteristics ($T_j=25^\circ\text{C}$)

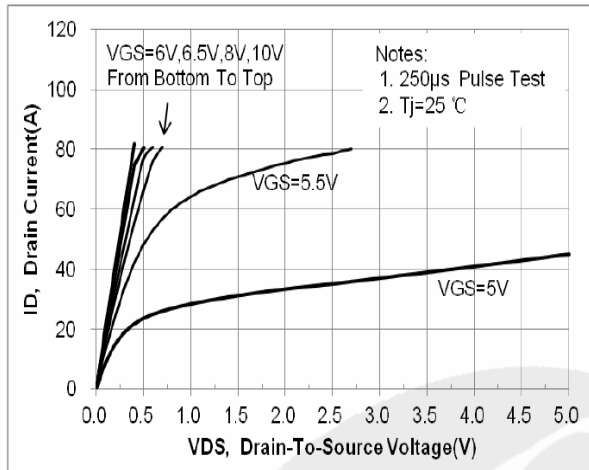


Figure 2. Transfer Characteristics (Junction Temperature)

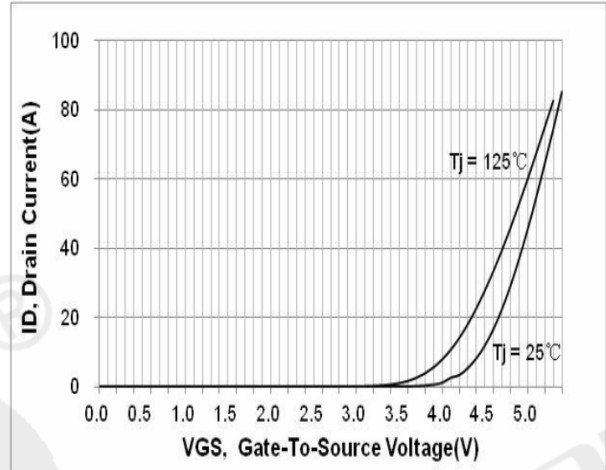


Figure 3. On-Resistance vs. Drain Current and Gate Voltage Figure

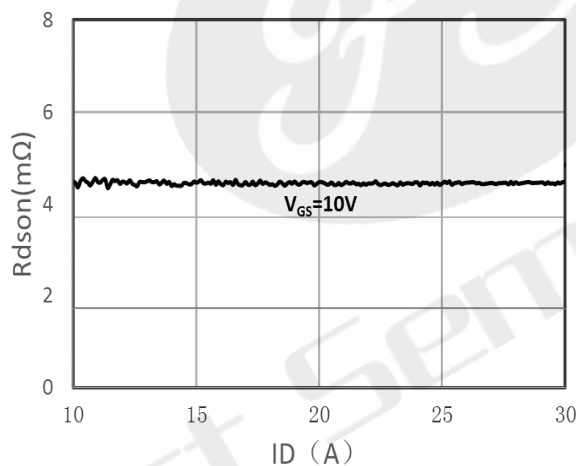


Figure 4. On-Resistance vs. Junction Temperature

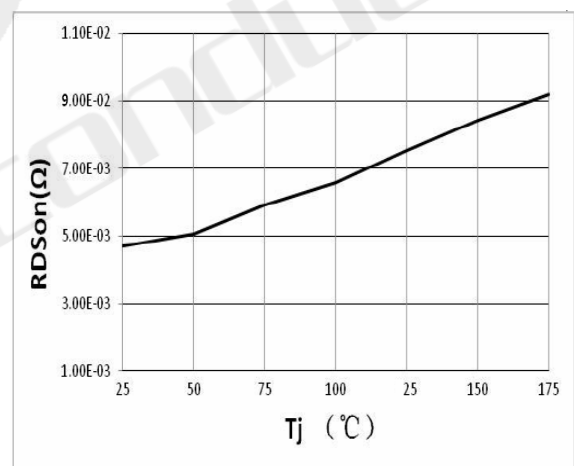


Figure 5. On-Resistance vs. Gate-Source Voltage (Junction Temperature)

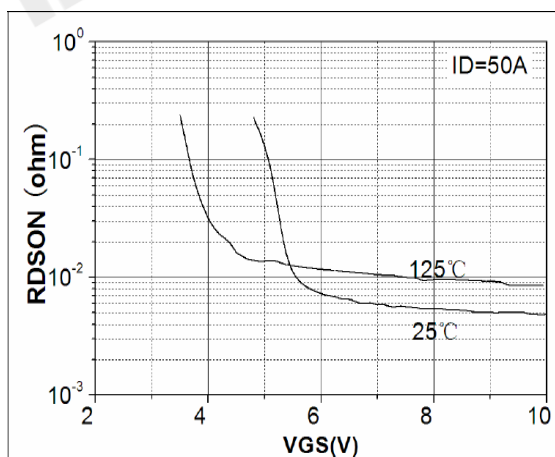


Figure 6. Body-Diode Characteristics (Junction Temperature)

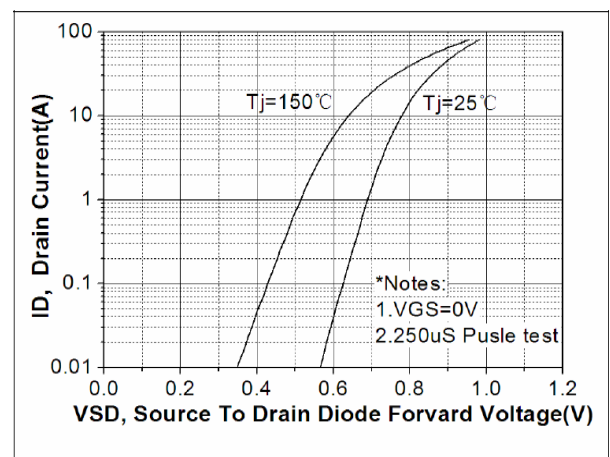


Figure 7. Gate-Charge Characteristics

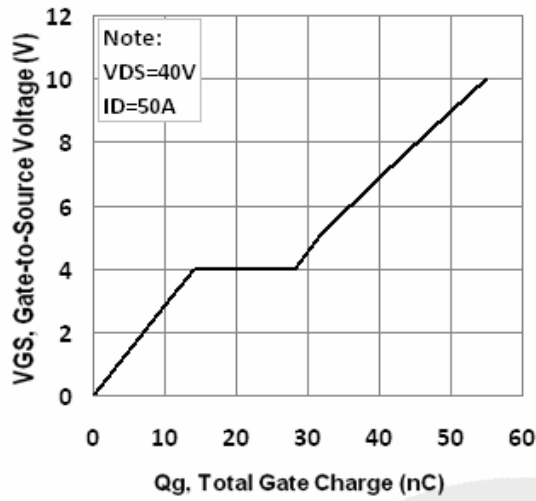


Figure 8. Capacitance Characteristics

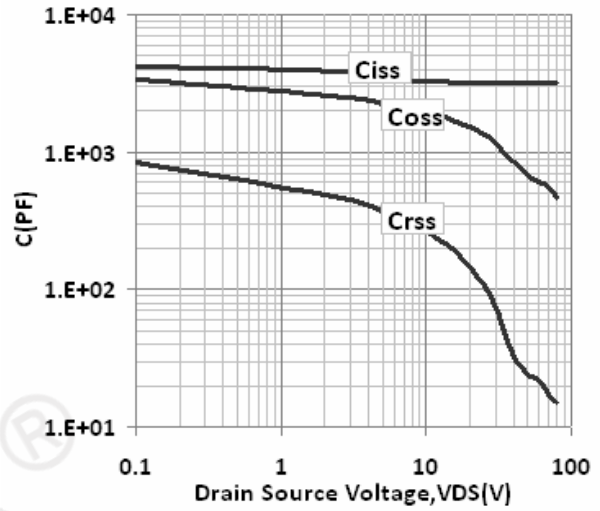


Figure 9: Normalized Maximum Transient Thermal Impedance (R_{thJC})

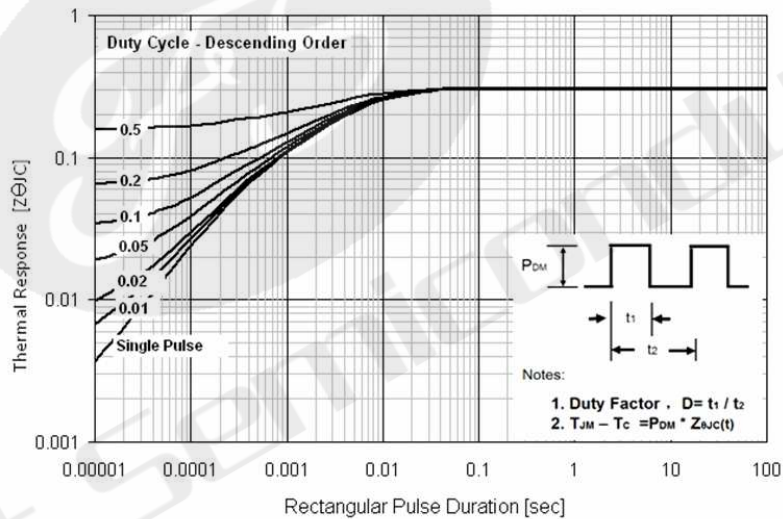
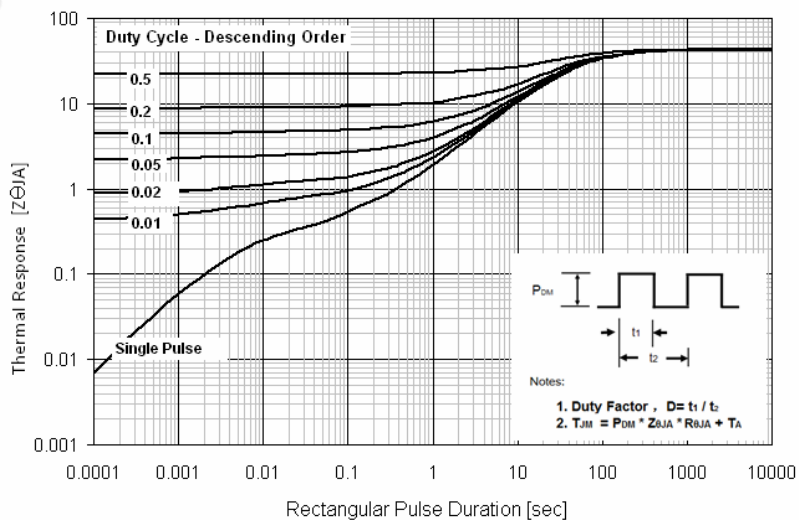
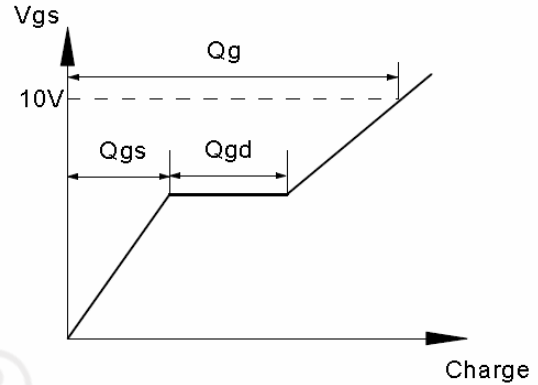
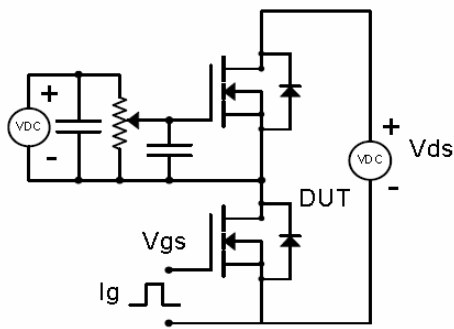


Figure 10: Normalized Maximum Transient Thermal Impedance (R_{thJA})

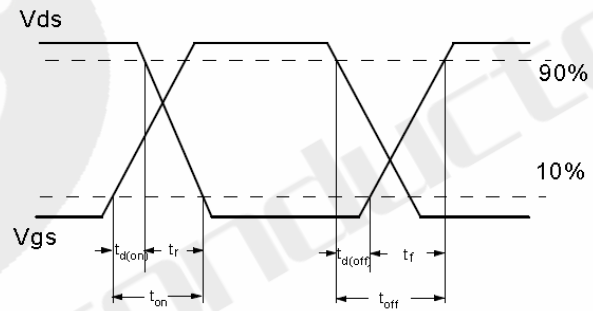
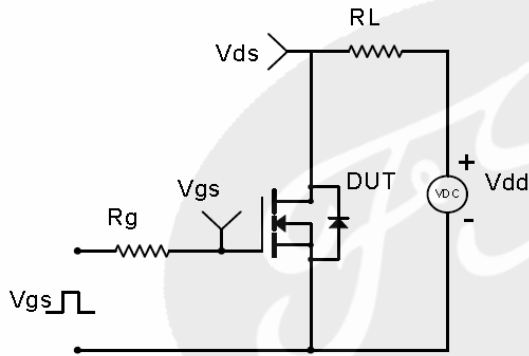


Test Circuit & Waveform

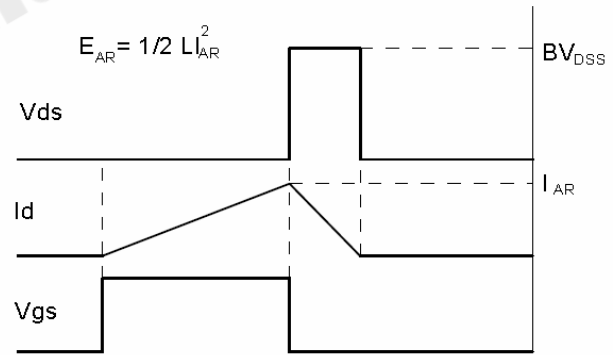
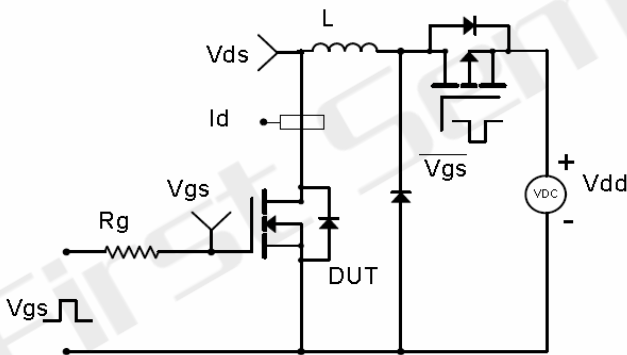
Gate Charge Test Circuit & Waveform



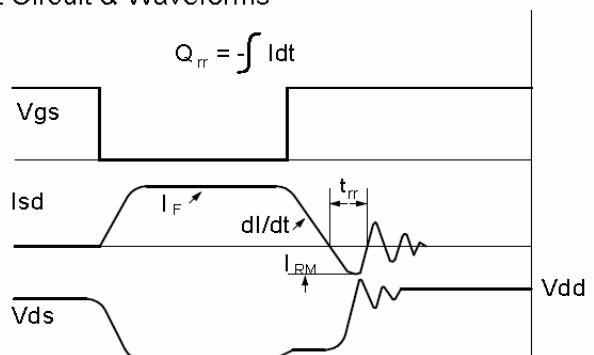
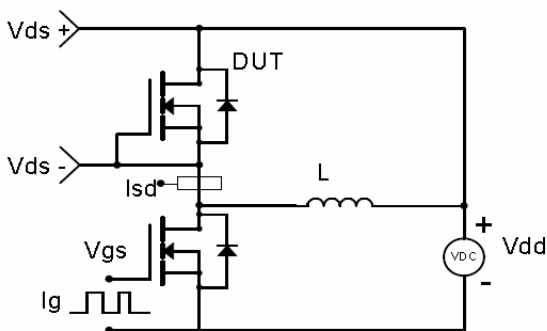
Resistive Switching Test Circuit & Waveforms



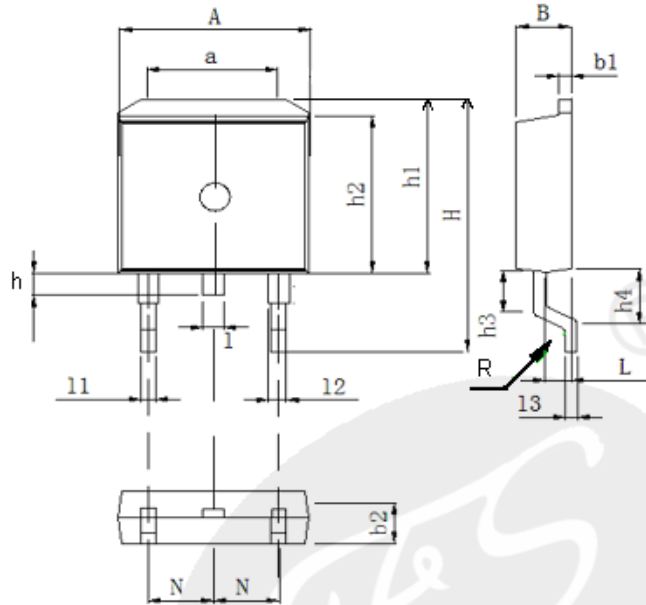
Unclamped Inductive Switching (UIS) Test Circuit & Waveforms



Diode Recovery Test Circuit & Waveforms

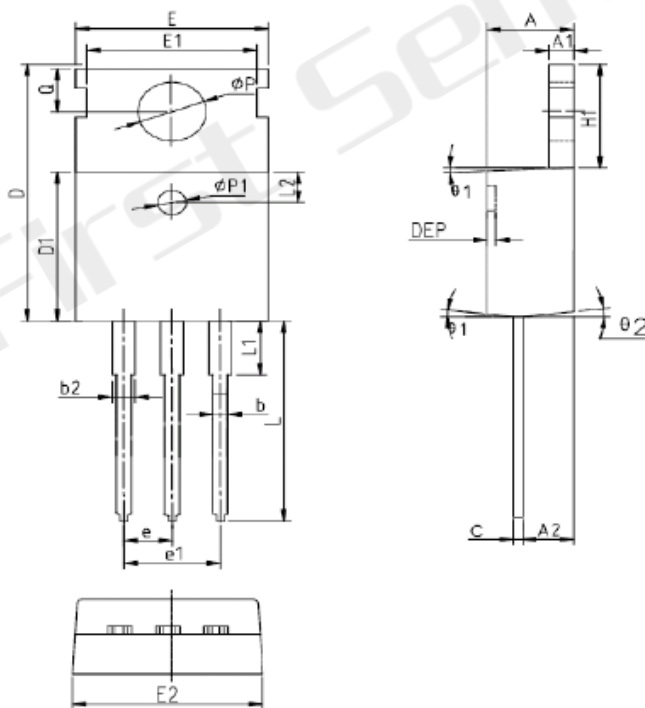


TO-263 Package Outline



| DIM | MILLIMETERS |
|-----|----------------|
| A | 9.8 ± 0.2 |
| a | 7.4 ± 0.2 |
| B | 4.5 ± 0.2 |
| b1 | 1.3 ± 0.05 |
| b2 | 2.4 ± 0.2 |
| H | 15.5 ± 0.3 |
| h | 1.54 ± 0.2 |
| h1 | 10.5 ± 0.2 |
| h2 | 9.2 ± 0.1 |
| h3 | 1.54 ± 0.2 |
| h4 | 2.7 ± 0.2 |
| L | 2.4 ± 0.2 |
| 1 | 1.3 ± 0.1 |
| 11 | 0.8 ± 0.1 |
| 12 | 1.3 ± 0.1 |
| 13 | 0.5 ± 0.1 |
| N | 2.45 |

TO-220 Package Outline



| SYMBOL | MM | | |
|------------|----------|-------|-------|
| | MIN | NOM | MAX |
| A | 4.40 | 4.57 | 4.70 |
| A1 | 1.27 | 1.30 | 1.33 |
| A2 | 2.35 | 2.40 | 2.50 |
| b | 0.77 | - | 0.90 |
| b2 | 1.23 | - | 1.36 |
| C | 0.48 | 0.50 | 0.52 |
| D | 15.40 | 15.60 | 15.80 |
| D1 | 9.00 | 9.10 | 9.20 |
| DEP | 0.05 | 0.10 | 0.20 |
| E | 9.70 | 9.90 | 10.10 |
| E1 | - | 8.70 | - |
| E2 | 9.80 | 10.00 | 10.20 |
| ϕP | 1.40 | 1.50 | 1.60 |
| e | 2.54BSC | | |
| e1 | 5.08BSC | | |
| H1 | 6.40 | 6.50 | 6.60 |
| L | 12.75 | - | 13.17 |
| L1 | - | - | 3.95 |
| L2 | 2.50REF. | | |
| θP | 3.57 | 3.60 | 3.63 |
| Q | 2.73 | 2.80 | 2.87 |
| $\theta 1$ | 5° | 7° | 9° |
| $\theta 2$ | 1° | 3° | 5° |



Declaration

- FIRST reserves the right to change the specifications, the same specifications of products due to different packaging line mold, the size of the appearance will be slightly different, shipped in kind, without notice! Customers should obtain the latest version information before ordering, and verify whether the relevant information is complete and up-to-date.
- Any semiconductor product under certain conditions has the possibility of failure or failure, The buyer has the responsibility to comply with safety standards and take safety measures when using FIRST products for system design and manufacturing, To avoid To avoid potential failure risks, which may cause personal injury or property damage!
- Product promotion endless, our company will wholeheartedly provide customers with better products!

ATTACHMENT

Revision History

| Date | REV | Description | Page |
|------------|-----|-----------------|------|
| 2018.01.01 | 1.0 | Initial release | |