

FDT1600N10ALZ

N-Channel PowerTrench® MOSFET

100 V, 5.6 A, 160 mΩ

Features

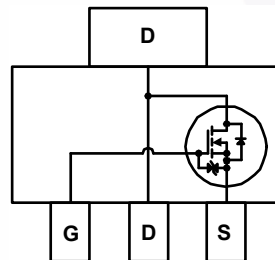
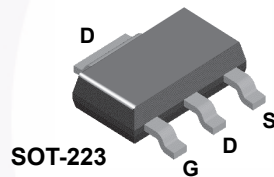
- $R_{DS(on)} = 121 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 10 \text{ V}$, $I_D = 2.8 \text{ A}$
- $R_{DS(on)} = 156 \text{ m}\Omega$ (Typ.) @ $V_{GS} = 5 \text{ V}$, $I_D = 1.8 \text{ A}$
- Low Gate Charge (Typ. 2.9 nC)
- Low C_{rss} (Typ. 2.04 pF)
- Fast Switching
- 100% Avalanche Tested
- Improved dv/dt Capability
- RoHS Compliant

Description

This N-Channel MOSFET is produced using Fairchild Semiconductor's advanced PowerTrench® process that has been tailored to minimize the on-state resistance and maintain superior switching performance.

Application

- Consumer Appliances
- LED TV and Monitor
- Synchronous Rectification
- Uninterruptible Power Supply
- Micro Solar Inverter



MOSFET Maximum Ratings $T_C = 25^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | FDT1600N10ALZ | Unit |
|----------------|--|--|------------------|
| V_{DSS} | Drain to Source Voltage | 100 | V |
| V_{GSS} | Gate to Source Voltage | ± 20 | V |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ\text{C}$) | 5.6 |
| | | - Continuous ($T_C = 100^\circ\text{C}$) | 3.5 |
| I_{DM} | Drain Current | - Pulsed (Note 2) | 11.2 |
| E_{AS} | Single Pulse Avalanche Energy | (Note 3) | 9.2 |
| dv/dt | Peak Diode Recovery dv/dt | (Note 4) | 6.0 |
| P_D | Power Dissipation | ($T_C = 25^\circ\text{C}$) | 10.42 |
| | | - Derate Above 25°C | 0.083 |
| T_J, T_{STG} | Operating and Storage Junction Temperature Range | -55 to +150 | $^\circ\text{C}$ |
| T_L | Maximum Lead Temperature for Soldering, 1/8" from Case for 5 Seconds | 300 | $^\circ\text{C}$ |

Thermal Characteristics

| | | | | |
|-----------------|---|-----------|----|---------------------------|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case, Max. | (Note 1) | 12 | $^\circ\text{C}/\text{W}$ |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient, Max. | (Note 1a) | 60 | |

Package Marking and Ordering Information

| Part Number | Top Mark | Package | Packing Method | Reel Size | Tape Width | Quantity |
|---------------|----------|---------|----------------|-----------|------------|------------|
| FDT1600N10ALZ | 16010ALZ | SOT-223 | Tape and Reel | 13" | 12 mm | 4000 units |

Electrical Characteristics $T_J = 25\text{ }^\circ\text{C}$ unless otherwise noted.

| Symbol | Parameter | Test Conditions | Min | Typ | Max | Unit |
|--------|-----------|-----------------|-----|-----|-----|------|
|--------|-----------|-----------------|-----|-----|-----|------|

Off Characteristics

| | | | | | | |
|--------------------------------|---|--|-----|-----|----------|---------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250\text{ }\mu\text{A}$, $V_{GS} = 0\text{ V}$ | 100 | - | - | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\text{ }\mu\text{A}$, referenced to $25\text{ }^\circ\text{C}$ | - | 0.1 | - | V/ $^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 80\text{ V}$, $V_{GS} = 0\text{ V}$ | - | - | 1 | μA |
| | | $V_{DS} = 80\text{ V}$, $V_{GS} = 0\text{ V}$, $T_C = 125\text{ }^\circ\text{C}$ | - | - | 500 | |
| I_{GSS} | Gate to Source Leakage Current | $V_{GS} = \pm 20\text{ V}$, $V_{DS} = 0\text{ V}$ | - | - | ± 10 | μA |

On Characteristics

| | | | | | | |
|--------------|--------------------------------------|--|-----|------|-----|------------------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}$, $I_D = 250\text{ }\mu\text{A}$ | 1.4 | - | 2.8 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{ V}$, $I_D = 2.8\text{ A}$ | - | 121 | 160 | $\text{m}\Omega$ |
| | | $V_{GS} = 5\text{ V}$, $I_D = 1.8\text{ A}$ | - | 156 | 375 | $\text{m}\Omega$ |
| g_{FS} | Forward Transconductance | $V_{DS} = 10\text{ V}$, $I_D = 5.6\text{ A}$ | - | 26.1 | - | S |

Dynamic Characteristics

| | | | | | | |
|---------------|-----------------------------------|--|----------|------|------|-------------|
| C_{iss} | Input Capacitance | $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$, $f = 1\text{ MHz}$ | - | 169 | 225 | pF |
| C_{oss} | Output Capacitance | | - | 43 | 55 | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 2.04 | - | pF |
| $C_{oss(er)}$ | Energy Related Output Capacitance | $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$ | - | 85 | - | pF |
| $Q_{g(tot)}$ | Total Gate Charge at 10V | $V_{GS} = 10\text{ V}$ | - | 2.9 | 3.77 | nC |
| $Q_{g(tot)}$ | Total Gate Charge at 5V | $V_{GS} = 5\text{ V}$ | | | | |
| Q_{gs} | Gate to Source Gate Charge | $V_{DD} = 50\text{ V}$, $I_D = 5.6\text{ A}$ | - | 0.7 | - | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | - | 0.64 | - | nC |
| $V_{plateau}$ | Gate Plateau Voltage | | (Note 5) | - | 3.81 | - |
| Q_{sync} | Total Gate Charge Sync. | $V_{DS} = 0\text{ V}$, $I_D = 2.8\text{ A}$ | - | 2.45 | - | nC |
| Q_{oss} | Output Charge | $V_{DS} = 50\text{ V}$, $V_{GS} = 0\text{ V}$ | - | 5.2 | - | nC |
| ESR | Equivalent Series Resistance(G-S) | $f = 1\text{ MHz}$ | - | 2.1 | - | Ω |

Switching Characteristics

| | | | | | | |
|--------------|---------------------|---|----------|------|------|------|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 50\text{ V}$, $I_D = 5.6\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 4.7\text{ }\Omega$ | - | 7.4 | 24.8 | ns |
| t_r | Rise Time | | - | 2.5 | 15 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 13.5 | 37 | ns |
| t_f | Turn-Off Fall Time | | (Note 5) | - | 2.4 | 14.8 |

Drain-Source Diode Characteristics

| | | | | | | |
|----------|--|--|---|------|-----|-------------|
| I_S | Maximum Continuous Drain to Source Diode Forward Current | - | - | 5.6 | A | |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | - | - | 11.2 | A | |
| V_{SD} | Source to Drain Diode Forward Voltage | $V_{GS} = 0\text{ V}$, $I_{SD} = 5.6\text{ A}$ | - | - | 1.3 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0\text{ V}$, $I_{SD} = 5.6\text{ A}$, $V_{DD} = 50\text{ V}$, $di_F/dt = 100\text{ A}/\mu\text{s}$ | - | 34.1 | - | ns |
| Q_{rr} | Reverse Recovery Charge | | - | 32.7 | - | nC |

NOTES:

- $R_{\theta JA}$ is the sum of the junction-to-case and case-to-ambient thermal resistance where the case thermal reference is defined as the solder mounting surface of the drain pins. $R_{\theta JC}$ is guaranteed by design while $R_{\theta CA}$ is determined by the user's board design.



a) $60\text{ }^\circ\text{C/W}$ when mounted on a 1 in^2 pad of 2-oz copper.



b) $118\text{ }^\circ\text{C/W}$ when mounted on a minimum pad of 2 oz copper.

- Repetitive rating: pulse-width limited by maximum junction temperature.
- Starting $T_J = 25\text{ }^\circ\text{C}$, $L = 3\text{ mH}$, $I_{AS} = 2.47\text{ A}$.
- $I_{SD} \leq 5.6\text{ A}$, $di/dt \leq 200\text{ A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, starting $T_J = 25\text{ }^\circ\text{C}$.
- Essentially independent of operating temperature typical characteristics.

Typical Performance Characteristics

Figure 1. On-Region Characteristics

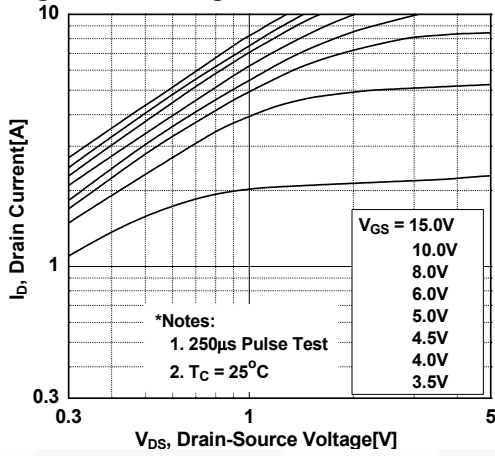


Figure 2. Transfer Characteristics

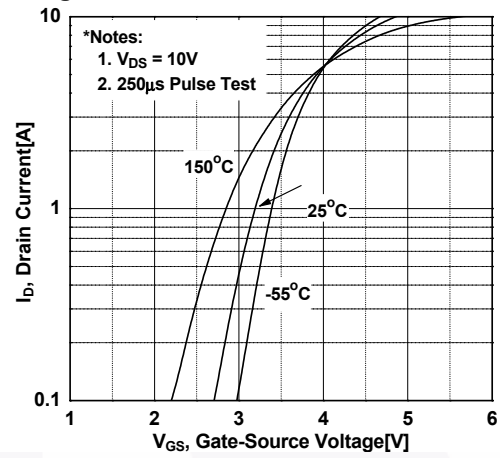


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

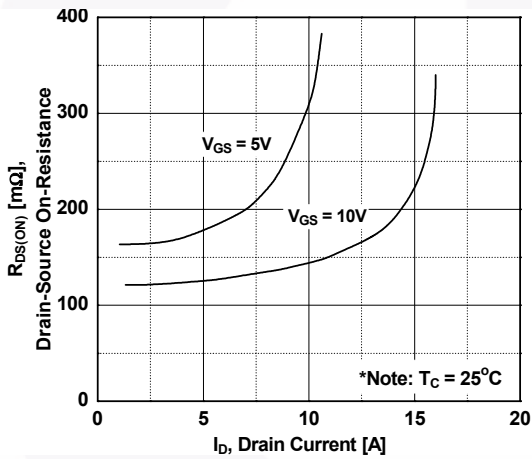


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

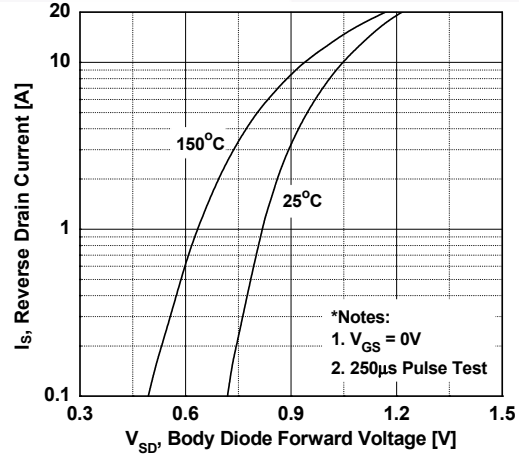


Figure 5. Capacitance Characteristics

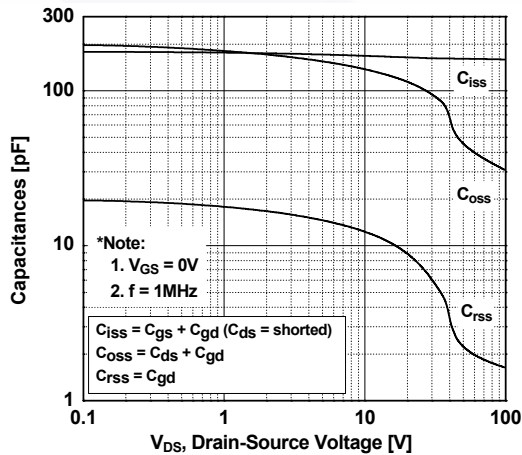
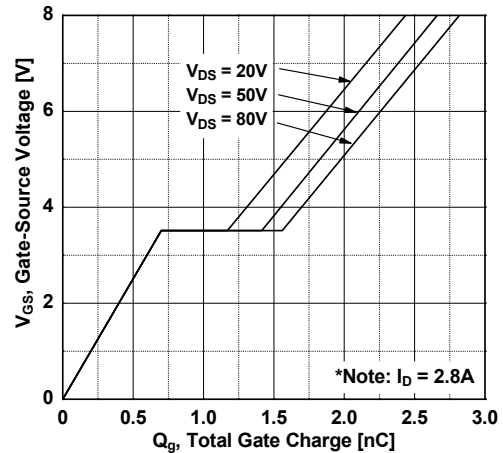


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

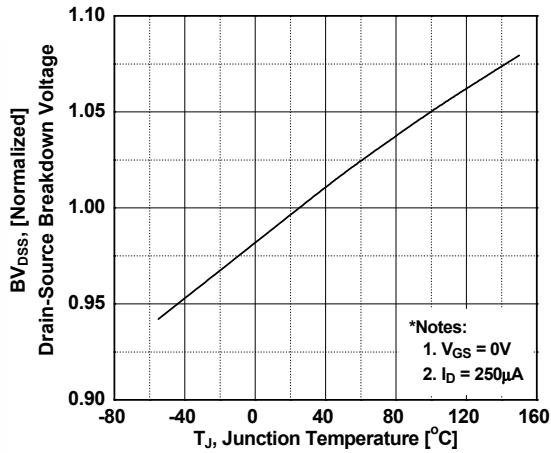


Figure 8. On-Resistance Variation vs. Temperature

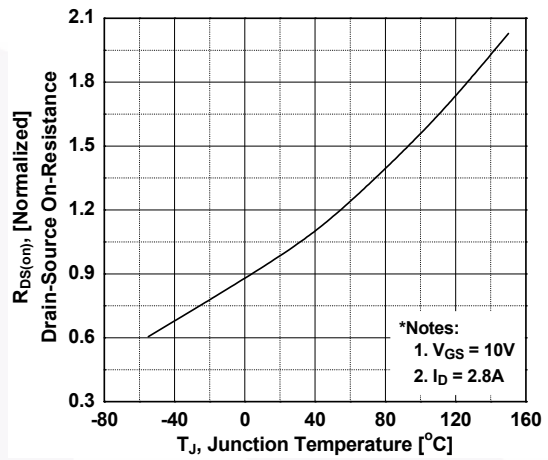


Figure 9. Maximum Safe Operating Area

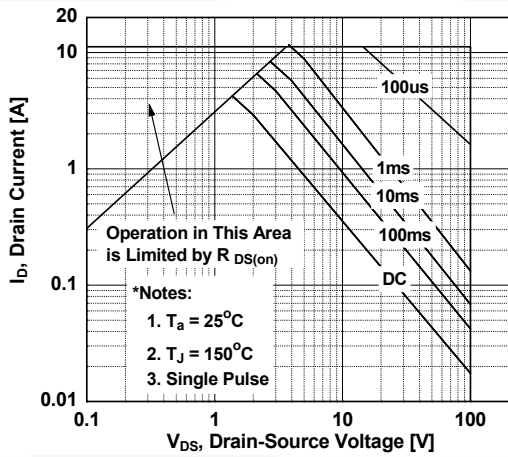


Figure 10. Maximum Drain Current vs. Case Temperature

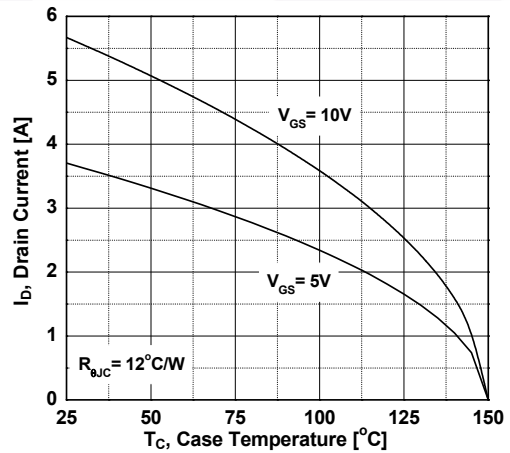


Figure 11. E_oss vs. Drain to Source Voltage

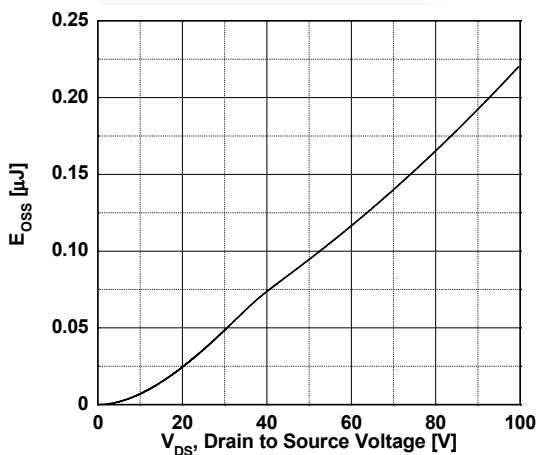
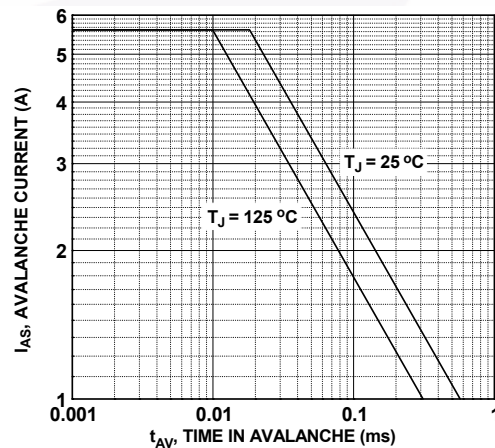


Figure 12. Unclamped Inductive Switching Capability



Typical Performance Characteristics (Continued)

Figure 13. Transient Thermal Response Curve

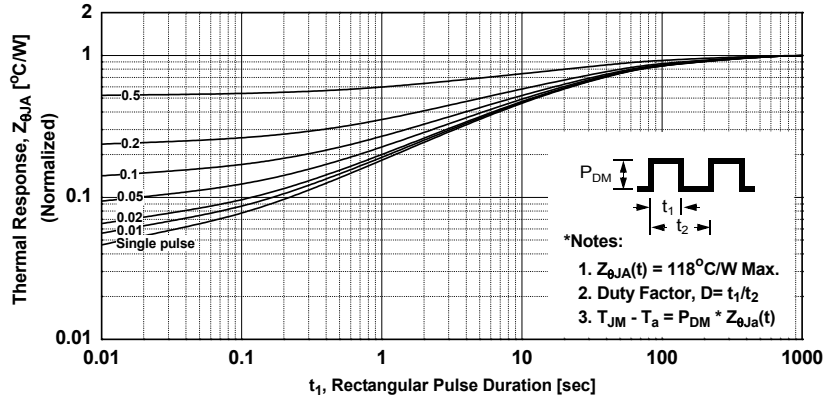




Figure 14. Gate Charge Test Circuit & Waveform



Figure 15. Resistive Switching Test Circuit & Waveforms



Figure 16. Unclamped Inductive Switching Test Circuit & Waveforms



Figure 17. Peak Diode Recovery dv/dt Test Circuit & Waveforms

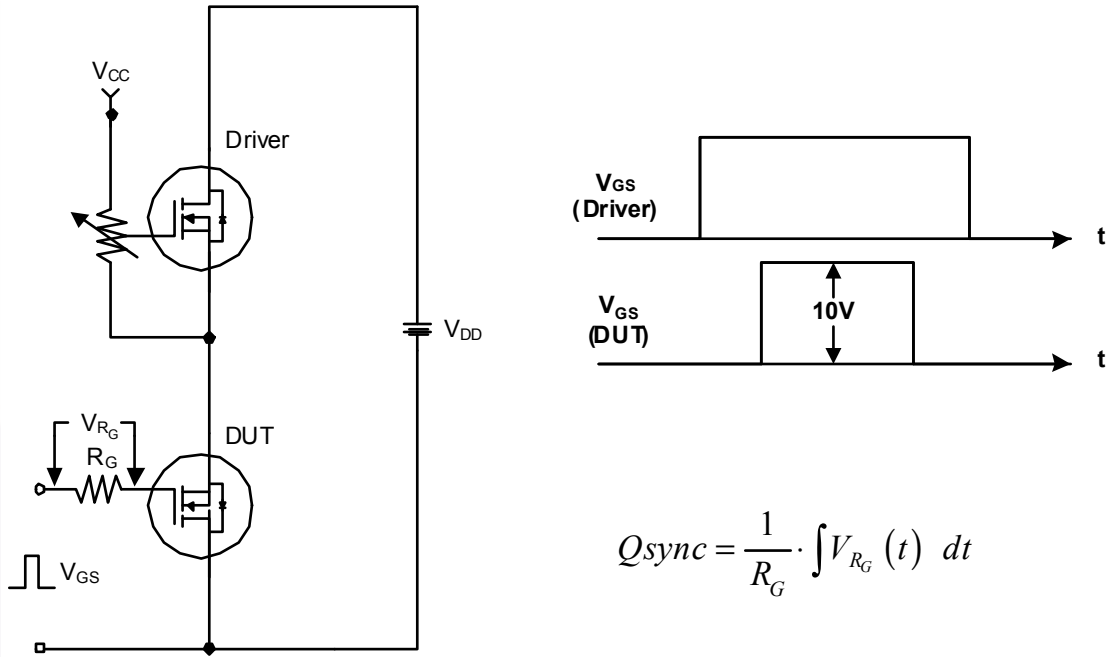


Figure 18. Total Gate Charge Q_{sync} . Test Circuit & Waveforms

Mechanical Dimensions

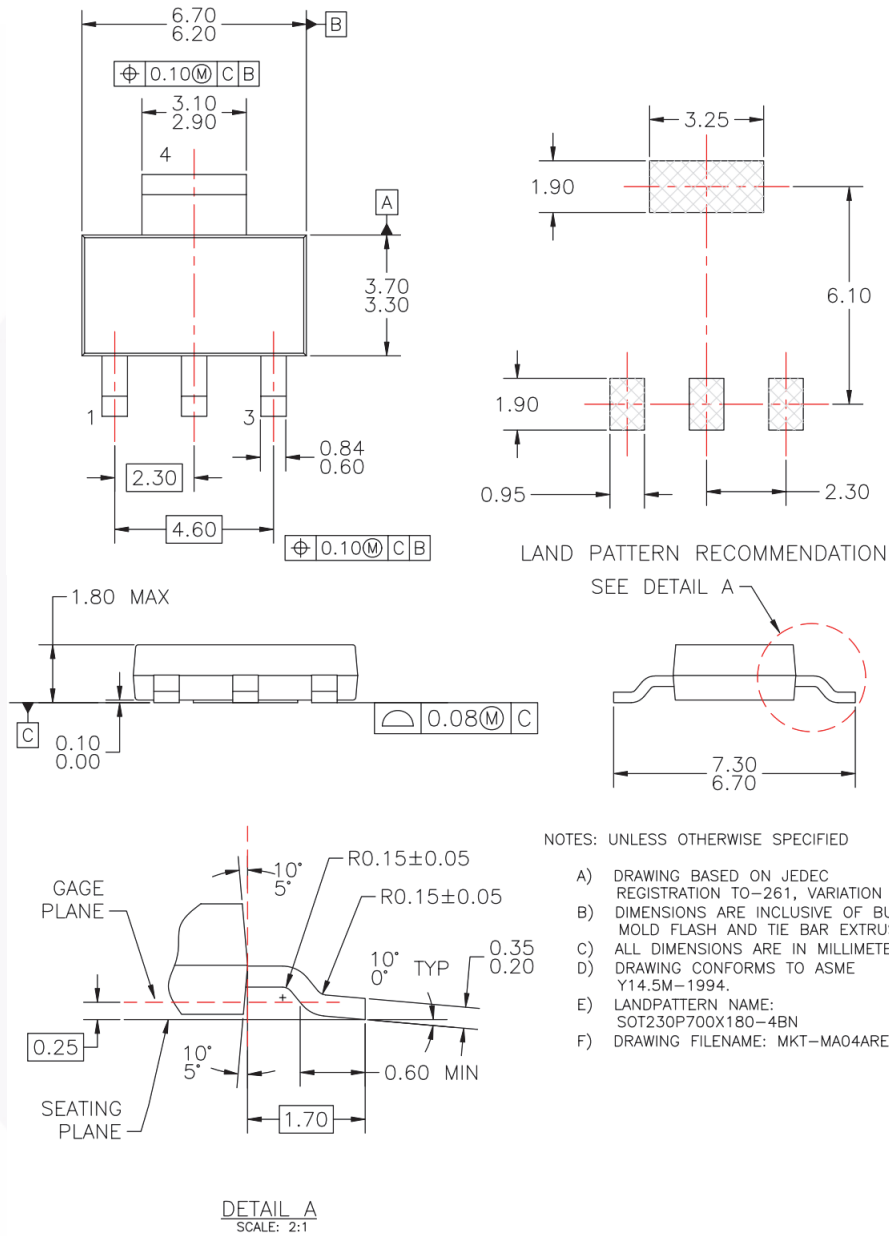


Figure 19. SOT-223, Molded, 4-Lead

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