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FQT1N60C

N-Channel QFET® MOSFET

600V, 0.2 A, 11.5 Ω

March 2013

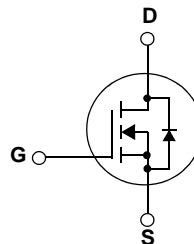
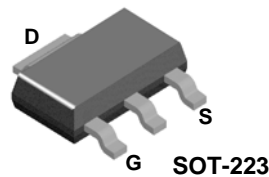


Description

This N-Channel enhancement mode power MOSFET is produced using Fairchild Semiconductor®'s proprietary planar stripe and DMOS technology. This advanced MOSFET technology has been especially tailored to reduce on-state resistance, and to provide superior switching performance and high avalanche energy strength. These devices are suitable for switched mode power supplies, active power factor correction (PFC), and electronic lamp ballasts.

Features

- 0.2 A, 600 V, $R_{DS(on)}=9.3 \Omega(V^{-1})$ @ $V_{GS}=10 V, I_D=0.1 A$
- Low Gate Charge (Typ. $1.5 nC$)
- Low C_{rss} (Typ. $1.5 pF$)
- 100% Avalanche Tested
- RoHS Compliant



MOSFET Maximum Ratings $T_C = 25^\circ C$ unless otherwise noted*

| Symbol | Parameter | FQT1N60C | Unit |
|----------------|--|--------------------------------------|------------|
| V_{DSS} | Drain to Source Voltage | 600 | V |
| V_{GSS} | Gate to Source Voltage | ± 30 | V |
| I_D | Drain Current | - Continuous ($T_C = 25^\circ C$) | 0.2 |
| | | - Continuous ($T_C = 100^\circ C$) | 0.12 |
| I_{DM} | Drain Current | - Pulsed (Note 1) | 0.8 |
| E_{AS} | Single Pulsed Avalanche Energy | (Note 2) | 33 |
| I_{AR} | Avalanche Current | (Note 1) | 0.2 |
| E_{AR} | Repetitive Avalanche Energy | (Note 1) | 0.2 |
| dv/dt | Peak Diode Recovery dv/dt | (Note 3) | 4.5 |
| P_D | Power Dissipation | ($T_C = 25^\circ C$) | 2.1 |
| | | - Derate above $25^\circ C$ | 0.02 |
| T_J, T_{STG} | Operating and Storage Temperature Range | -55 to +150 | $^\circ C$ |
| T_L | Maximum Lead Temperature for Soldering Purpose, 1/8" from Case for 5 Seconds | 300 | $^\circ C$ |

Thermal Characteristics

| Symbol | Parameter | Min. | Max. | Unit |
|-----------------|--|------|------|--------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient* | - | 60 | $^\circ C/W$ |

* When mounted on the minimum pad size recommended (PCB Mount)

Package Marking and Ordering Information $T_C = 25^\circ\text{C}$ unless otherwise noted

| Device Marking | Device | Package | Reel Size | Tape Width | Quantity |
|----------------|----------|---------|-----------|------------|----------|
| FQT1N60C | FQT1N60C | SOT-223 | 330mm | 12mm | 4000 |

Electrical Characteristics

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

Off Characteristics

| | | | | | | |
|--------------------------------|---|---|-----|-----|-----------|---------------------------|
| BV_{DSS} | Drain to Source Breakdown Voltage | $I_D = 250\mu\text{A}, V_{GS} = 0\text{V}, T_J = 25^\circ\text{C}$ | 600 | - | - | V |
| $\Delta BV_{DSS} / \Delta T_J$ | Breakdown Voltage Temperature Coefficient | $I_D = 250\mu\text{A}$, Referenced to 25°C | - | 0.6 | - | $\text{V}/^\circ\text{C}$ |
| I_{DSS} | Zero Gate Voltage Drain Current | $V_{DS} = 600\text{V}, V_{GS} = 0\text{V}$ $V_{DS} = 480\text{V}, T_C = 125^\circ\text{C}$ | - | - | 25 250 | μA |
| I_{GSS} | Gate to Body Leakage Current | $V_{GS} = \pm 30\text{V}, V_{DS} = 0\text{V}$ | - | - | ± 100 | nA |

On Characteristics

| | | | | | | |
|--------------|--------------------------------------|---|-----|------|------|----------|
| $V_{GS(th)}$ | Gate Threshold Voltage | $V_{GS} = V_{DS}, I_D = 250\mu\text{A}$ | 2.0 | - | 4.0 | V |
| $R_{DS(on)}$ | Static Drain to Source On Resistance | $V_{GS} = 10\text{V}, I_D = 0.1\text{A}$ | - | 9.3 | 11.5 | Ω |
| g_{FS} | Forward Transconductance | $V_{DS} = 40\text{V}, I_D = 0.1\text{A}$ (Note 4) | - | 0.75 | - | S |

Dynamic Characteristics

| | | | | | | |
|-----------|-------------------------------|--|---|-----|-----|----|
| C_{iss} | Input Capacitance | $V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1\text{MHz}$ | - | 130 | 170 | pF |
| C_{oss} | Output Capacitance | | - | 19 | 25 | pF |
| C_{rss} | Reverse Transfer Capacitance | | - | 3.5 | 6 | pF |
| Q_g | Total Gate Charge at 10V | $V_{DS} = 480\text{V}, I_D = 1\text{A}$ $V_{GS} = 10\text{V}$ (Note 4, 5) | - | 4.8 | 6.2 | nC |
| Q_{gs} | Gate to Source Gate Charge | | - | 0.7 | - | nC |
| Q_{gd} | Gate to Drain "Miller" Charge | | - | 2.7 | - | nC |

Switching Characteristics

| | | | | | | |
|--------------|---------------------|---|---|----|----|----|
| $t_{d(on)}$ | Turn-On Delay Time | $V_{DD} = 300\text{V}, I_D = 1\text{A}$ $R_G = 25\Omega$ (Note 4, 5) | - | 7 | 24 | ns |
| t_r | Turn-On Rise Time | | - | 21 | 52 | ns |
| $t_{d(off)}$ | Turn-Off Delay Time | | - | 13 | 36 | ns |
| t_f | Turn-Off Fall Time | | - | 27 | 64 | ns |

Drain-Source Diode Characteristics

| | | | | | | |
|----------|--|--|---|------|-----|---------------|
| I_S | Maximum Continuous Drain to Source Diode Forward Current | - | - | 0.2 | A | |
| I_{SM} | Maximum Pulsed Drain to Source Diode Forward Current | - | - | 0.8 | A | |
| V_{SD} | Drain to Source Diode Forward Voltage | $V_{GS} = 0\text{V}, I_{SD} = 0.2\text{A}$ | - | - | 1.4 | V |
| t_{rr} | Reverse Recovery Time | $V_{GS} = 0\text{V}, I_{SD} = 1\text{A}$ | - | 190 | - | ns |
| Q_{rr} | Reverse Recovery Charge | $di_F/dt = 100\text{A}/\mu\text{s}$ (Note 4) | - | 0.53 | - | μC |

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature
2. $L = 59\text{mH}, I_{AS} = 1.1\text{A}, V_{DD} = 50\text{V}, R_G = 25\Omega$, Starting $T_J = 25^\circ\text{C}$
3. $I_{SD} \leq 0.2\text{A}, di/dt \leq 200\text{A}/\mu\text{s}, V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$
4. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$
5. Essentially Independent of Operating Temperature Typical Characteristics

Typical Performance Characteristics

Figure 1. On-Region Characteristics

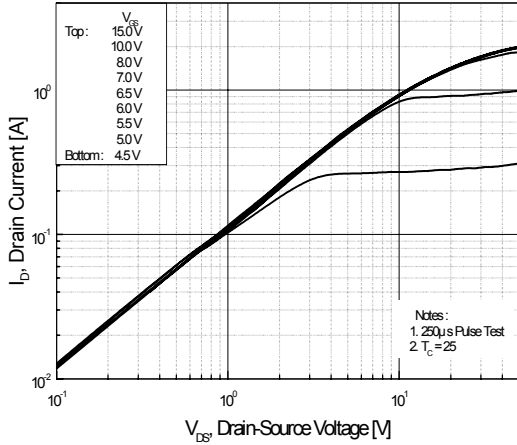


Figure 2. Transfer Characteristics

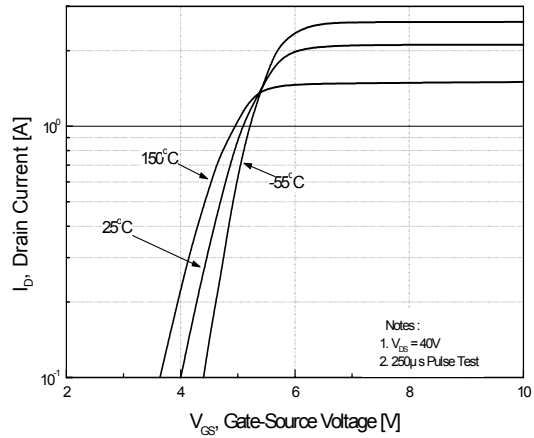


Figure 3. On-Resistance Variation vs. Drain Current and Gate Voltage

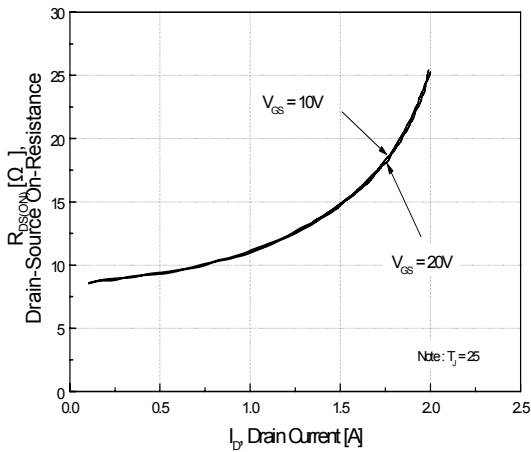


Figure 4. Body Diode Forward Voltage Variation vs. Source Current and Temperature

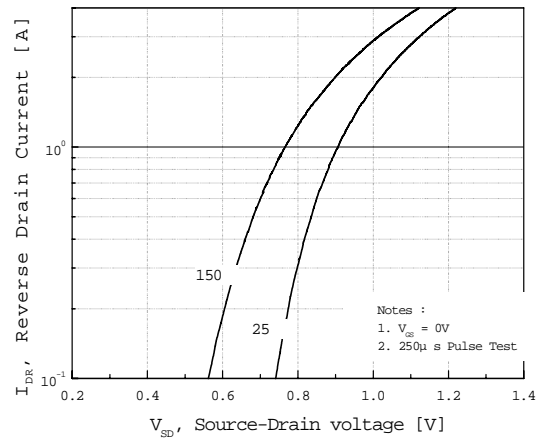


Figure 5. Capacitance Characteristics

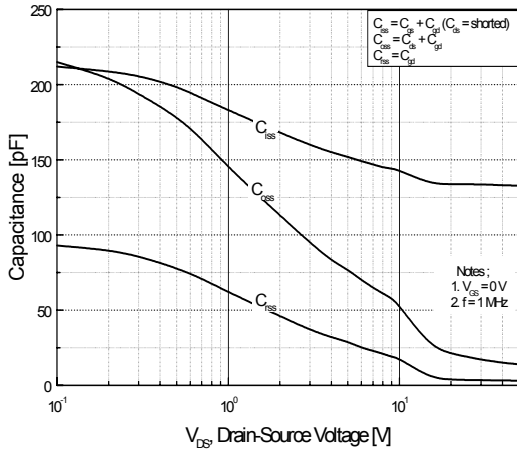
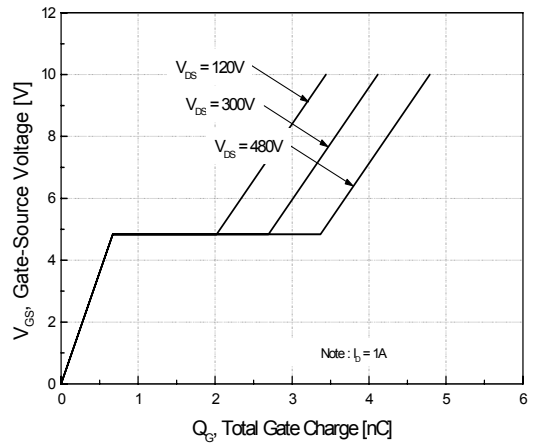


Figure 6. Gate Charge Characteristics



Typical Performance Characteristics (Continued)

Figure 7. Breakdown Voltage Variation vs. Temperature

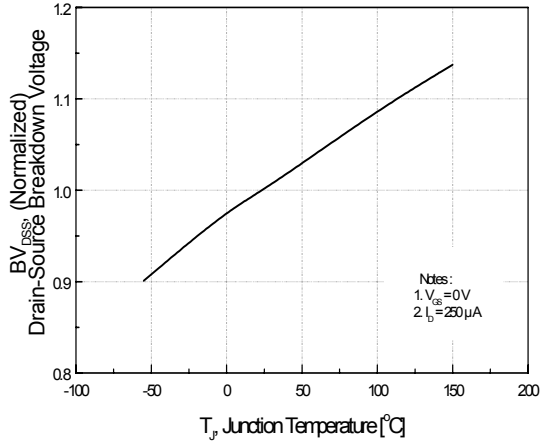


Figure 8. On-Resistance Variation vs. Temperature

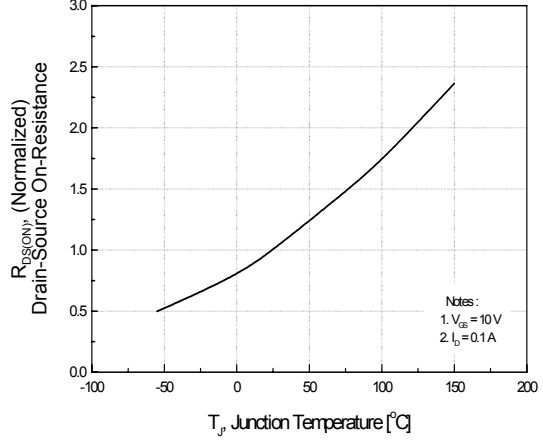


Figure 9. Maximum Safe Operating Area

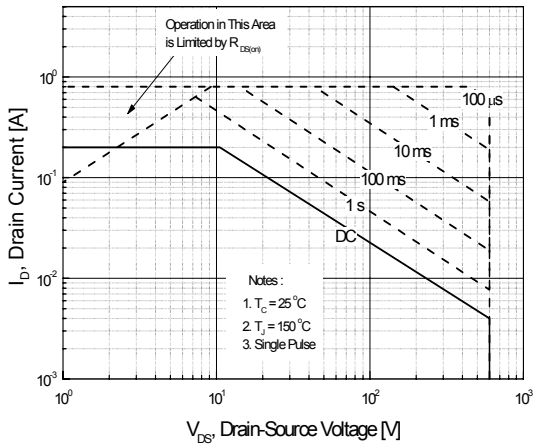


Figure 10. Maximum Drain Current vs. Case Temperature

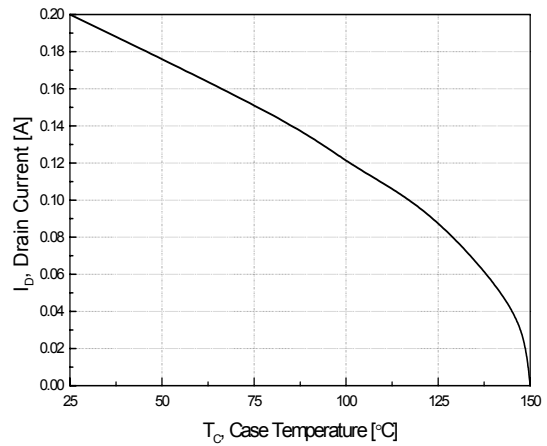
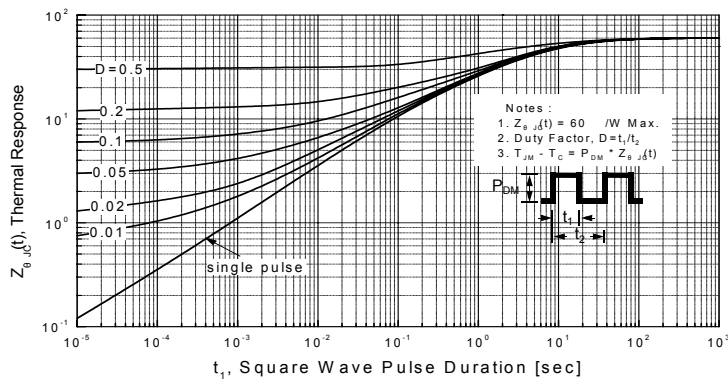
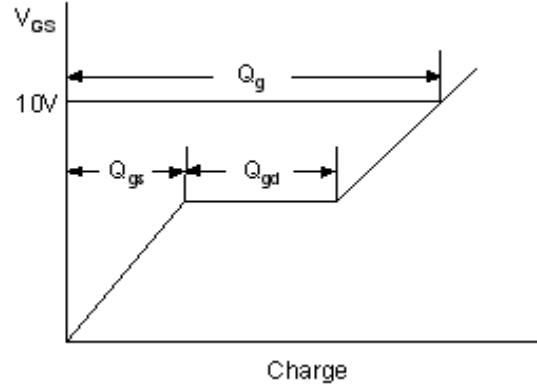
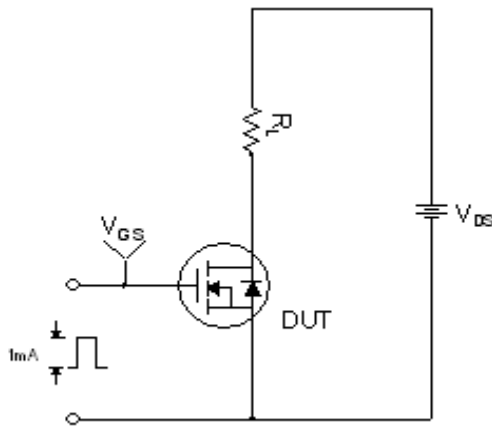


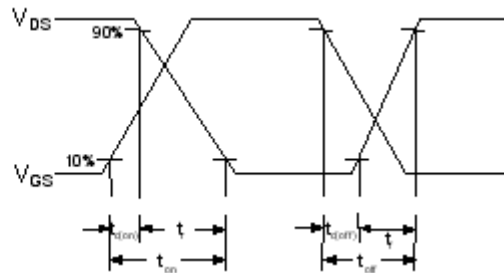
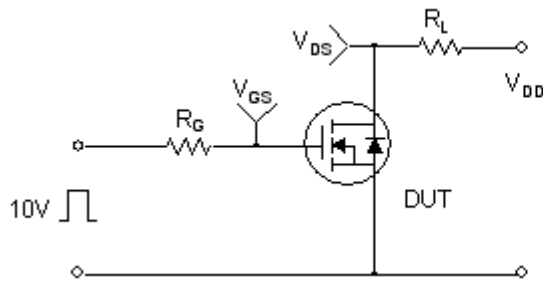
Figure 11. Transient Thermal Response Curve



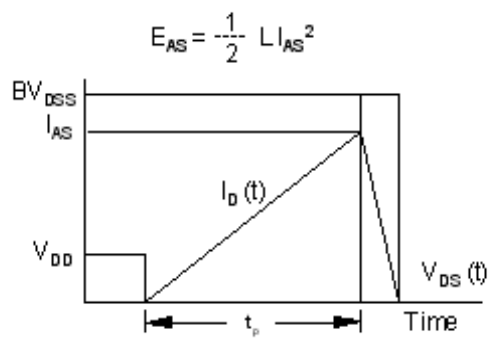
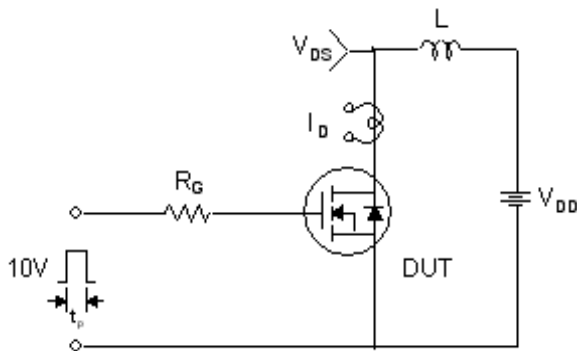
Gate Charge Test Circuit & Waveform



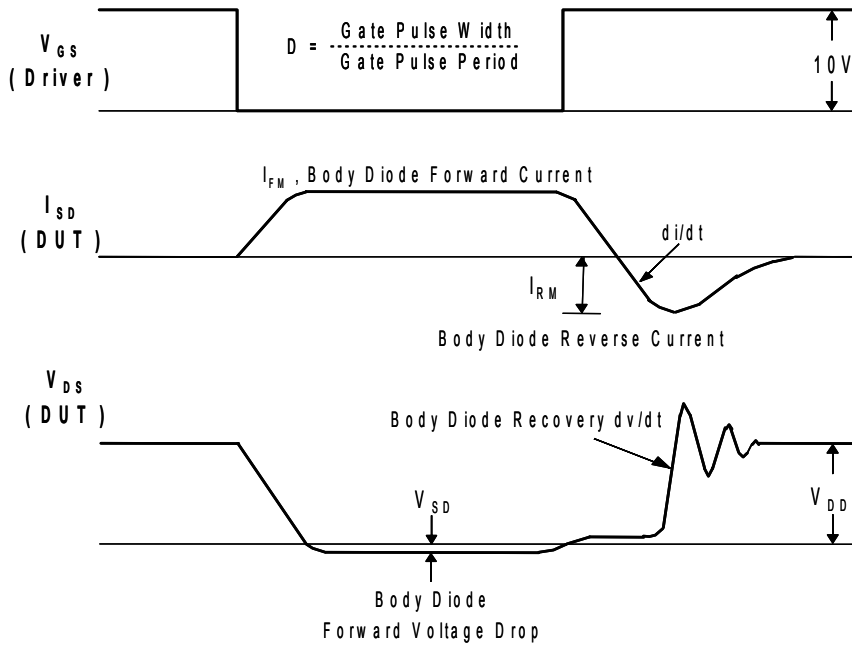
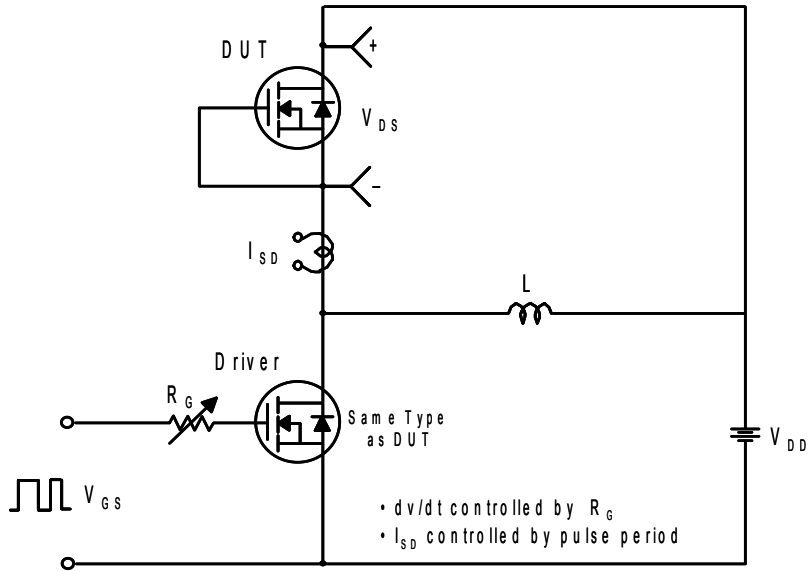
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching Test Circuit & Waveforms

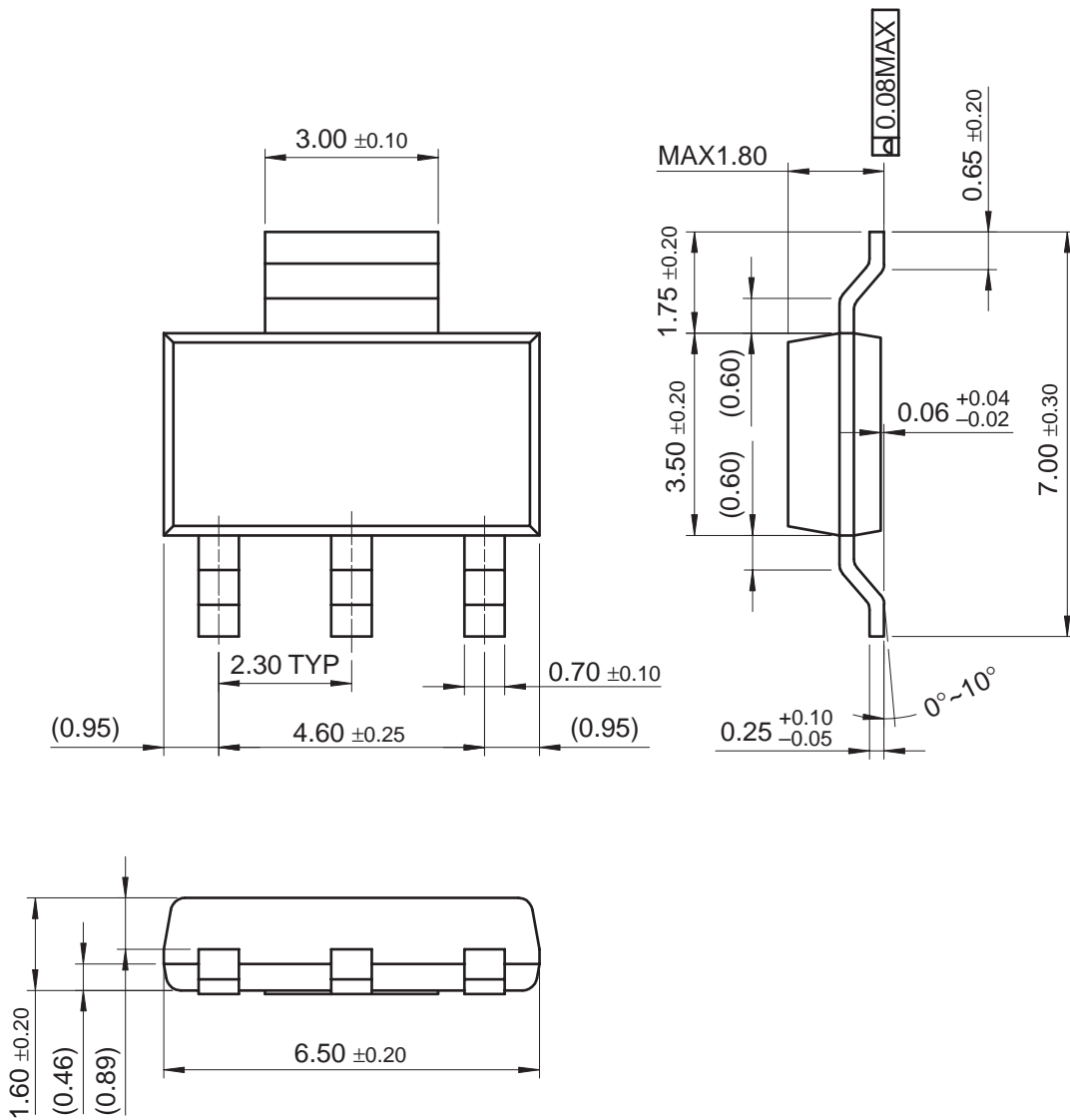


Peak Diode Recovery dv/dt Test Circuit & Waveforms



Mechanical Dimensions

SOT-223





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