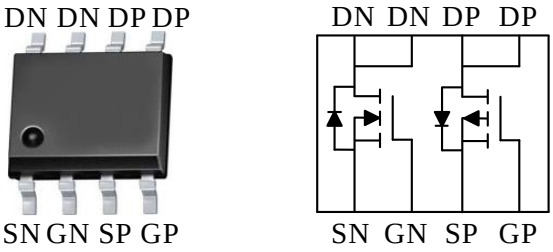
# 650V N-Channel and P-Channel Enhancement-Mode MOSFETs

## General Features

- 650V High Voltage Capability
- Independent N- and P-channels
- Fast Switching Characteristics
- Fast Switching Speed
- RoHS Compliant
- Halogen-free available

| $BV_{DSS}$ | $R_{DS(on)(Max.)}$ | $I_D$ |
|---|---|---|
| **650V** | **21Ω** | **0.15A** |
| **-650V** | **16Ω** | **-0.2A** |

**SOP-8**




## Applications

- High Voltage Pulsers
- Amplifiers
- Buffers
- Piezoelectric Transducer Drivers
- General Purpose Line Drivers

## Ordering Information

| Part Number | Package | Marking | Remark |
|---|---|---|---|
| FTE33C65D | SOP-8 | 33C65 | Halogen Free |

## Absolute Maximum Ratings

$T_A$=25℃ unless otherwise specified

| Symbol | Parameter | N-Channel | P-Channel | Unit |
|---|---|---|---|---|
| $V_{DSS}$ | Drain-to-Source Voltage [1] | 650 | -650 | V |
| $V_{GS}$ | Gate-to-Source Voltage | ±30 | ±20 | V |
| $I_D$ | Continuous Drain Current | 0.15 | -0.2 | A |
| $I_{DP}$ | 300us Pulsed Drain Current Tested [2] | 0.6 | -0.8 | A |
| $P_D$ | Power Dissipation | 2.5 | | W |
| $T_J$ and $T_{STG}$ | Operating and Storage Temperature Range | -55 to 150 | | ℃ |

**Drain Current limited by Maximum Junction Temperature.*
*Caution: Stresses beyond those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.*

## Thermal Characteristics

| Symbol | Parameter | FTE33C65D | Unit |
|---|---|---|---|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 50 | ℃/W |

## N-Channel Electrical Characteristics

### OFF Characteristics

$T_A$=25℃ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | 650 | -- | -- | V | $V_{GS}$ = 0V, $I_D$ = 250μA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | 1 | μA | $V_{DS}$ = 650V, $V_{GS}$ = 0V |
| $I_{GSS}$ | Gate-to-Source Leakage Current | -- | -- | 1 | μA | $V_{GS}$ = 30V, $V_{DS}$ = 0V |
| | | -- | -- | -1 | μA | $V_{GS}$ = -30V, $V_{DS}$ = 0V |

### ON Characteristics

$T_A$=25℃ unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | -- | 19 | 21 | Ω | $V_{GS}$ = 10V, $I_D$ = 0.4A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | 2.0 | 2.9 | 4.0 | V | $V_{GS}$ = $V_{DS}$, $I_D$ = 250μA |

### Dynamic Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | -- | 84 | -- | pF | $V_{GS}$ = 0V<br>$V_{DS}$ = 25V<br>f = 1.0MHz |
| $C_{oss}$ | Output Capacitance | -- | 15 | -- | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 4 | -- | | |
| $t_{d(on)}$ | Turn-on Delay Time | -- | 6.2 | -- | ns | $V_{GS}$ = 10V<br>$V_{DD}$ = 25V,<br>$I_D$ = 0.4A<br>$R_G$ = 25Ω |
| $t_r$ | Rise Time | -- | 3.2 | -- | | |
| $t_{d(off)}$ | Turn-off Delay Time | -- | 9.8 | -- | | |
| $t_f$ | Fall Time | -- | 3.6 | -- | | |

### Source-Drain Diode Characteristics

$T_A$=25℃ unless otherwise specified

| Symbol | Parameter | Min | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | -- | -- | 1.2 | V | $I_{SD}$ = 0.4A, $V_{GS}$ = 0V |

## P-Channel Electrical Characteristics

### OFF Characteristics

$T_A$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $BV_{DSS}$ | Drain-to-Source Breakdown Voltage | -650 | -- | -- | V | $V_{GS}$ = 0V, $I_D$ = -250μA |
| $I_{DSS}$ | Drain-to-Source Leakage Current | -- | -- | -10 | μA | $V_{DS}$ = -650V, $V_{GS}$ = 0V |
| $I_{GSS}$ | Gate-to-Source Leakage Current | -- | -- | 1 | μA | $V_{GS}$ = +20V, $V_{DS}$ = 0V |
| | | -- | -- | -1 | μA | $V_{GS}$ = -20V, $V_{DS}$ = 0V |

### ON Characteristics

$T_A$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $R_{DS(on)}$ | Static Drain-to-Source On-Resistance | -- | -- | 16 | Ω | $V_{GS}$ = -10V, $I_D$ = -0.5A [3] |
| $V_{GS(th)}$ | Gate Threshold Voltage | -4 | -- | -1 | V | $V_{GS}$ = $V_{DS}$, $I_D$ = -250μA |

### Dynamic Characteristics

Essentially independent of operating temperature

| Symbol | Parameter | Min. | Typ. | Max. | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| $C_{iss}$ | Input Capacitance | -- | 878 | -- | pF | $V_{GS}$ = 0V<br>$V_{DS}$ = -25V<br>f = 1.0MHz |
| $C_{oss}$ | Output Capacitance | -- | 36.1 | -- | | |
| $C_{rss}$ | Reverse Transfer Capacitance | -- | 14.5 | -- | | |
| $t_{d(on)}$ | Turn-on Delay Time | -- | 11 | -- | ns | $V_{GS}$ = -10V<br>$V_{DD}$ = -50V<br>$I_D$ = -0.25A<br>$R_G$ = 6 Ω |
| $t_r$ | Rise Time | -- | 4 | -- | | |
| $t_{d(off)}$ | Turn-off Delay Time | -- | 26 | -- | | |
| $t_f$ | Fall Time | -- | 45 | -- | | |

### Source-Drain Diode Characteristics

$T_A$=25°C unless otherwise specified

| Symbol | Parameter | Min. | Typ. | Max. | Units | Test Conditions |
|---|---|---|---|---|---|---|
| $V_{SD}$ | Diode Forward Voltage | -- | -- | -1.2 | V | $I_{SD}$ = -0.5A, $V_{GS}$ = 0V |

NOTE:

[1] $T_J$ = +25°C to +150°C
[2] Repetitive rating, pulse width limited by maximum junction temperature.
[3] Pulse width ≤ 380μs; duty cycle ≤ 2%.

## N-Channel Typical Characteristics

**Figure 1. Typical Output Characteristics**

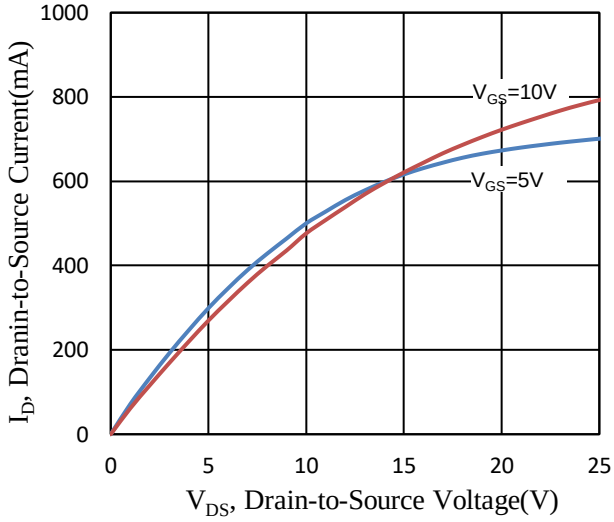



**Figure 2. Typical Transfer Characteristics**

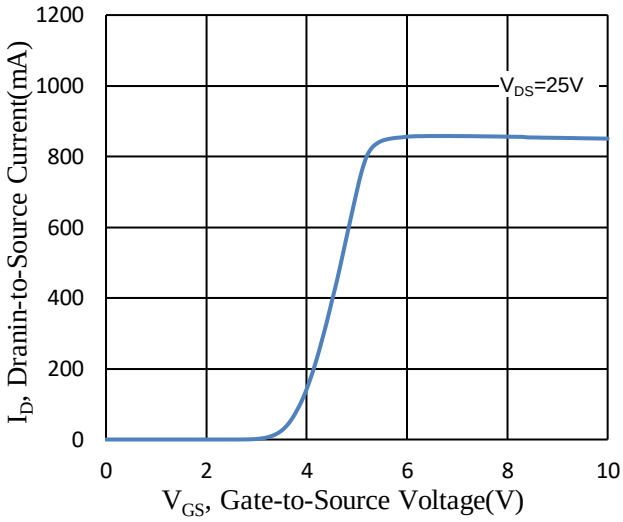



**Figure 3. Typical Capacitance vs. Drain-to-Source Voltage**

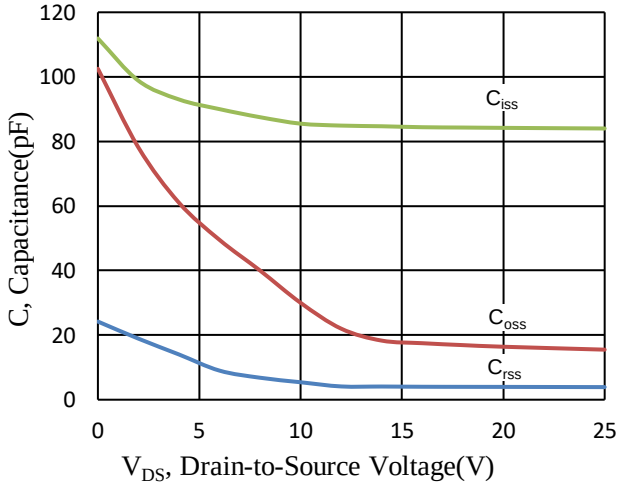



**Figure 4. Threshold Voltage vs. Temperature**

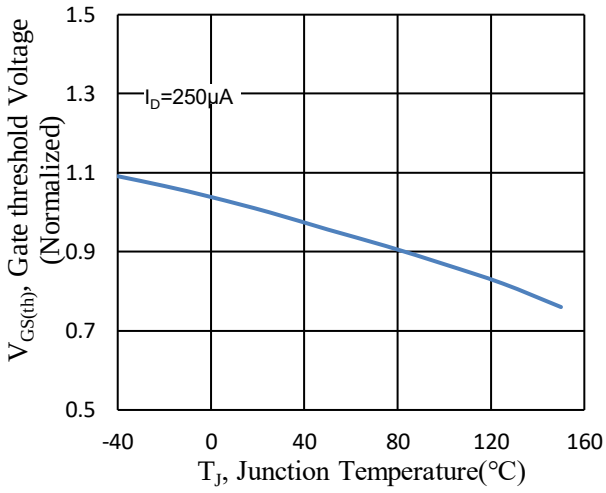



**Figure 5. Normalized On-Resistance vs. Junction Temperature**

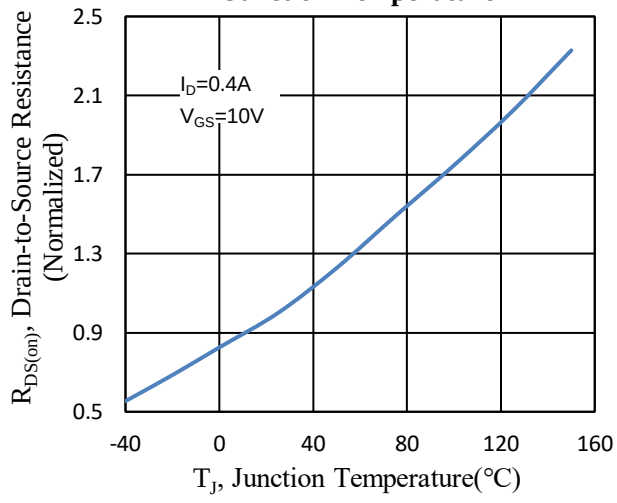
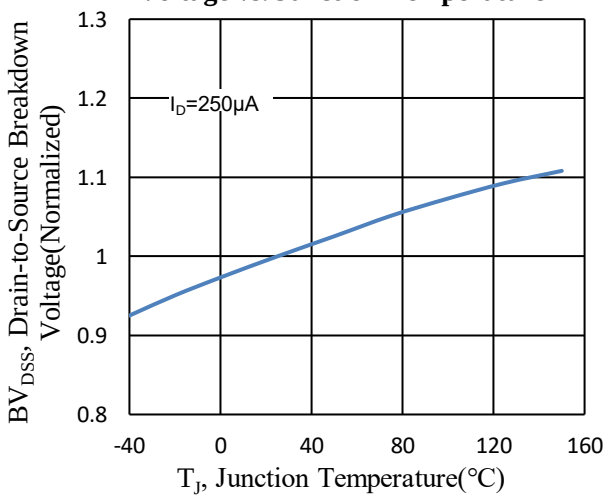



**Figure 6. Drain-to-Source Breakdown Voltage vs. Junction Temperature**



## P-Channel Typical Characteristics

**Figure 7. Typical Output Characteristics**

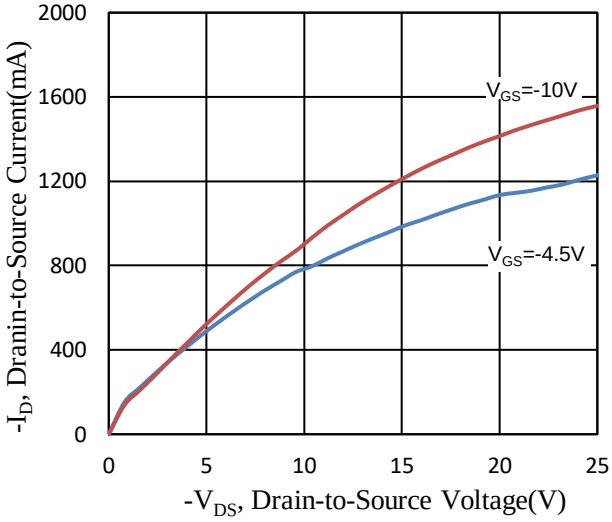



**Figure 8. Typical Transfer Characteristics**

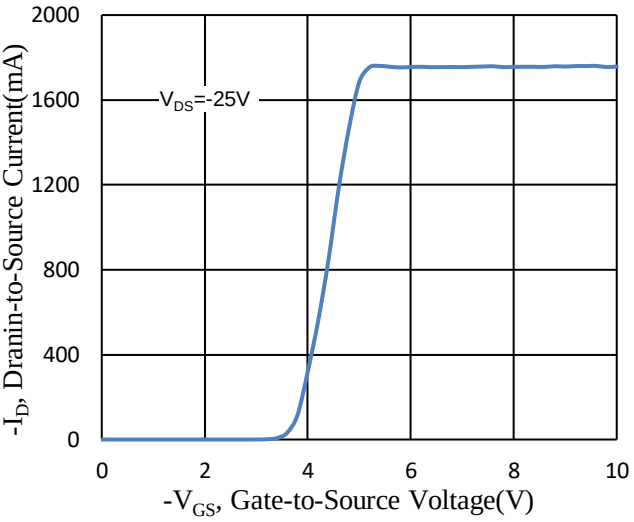



**Figure 9. Typical Capacitance vs. Drain-to-Source Voltage**

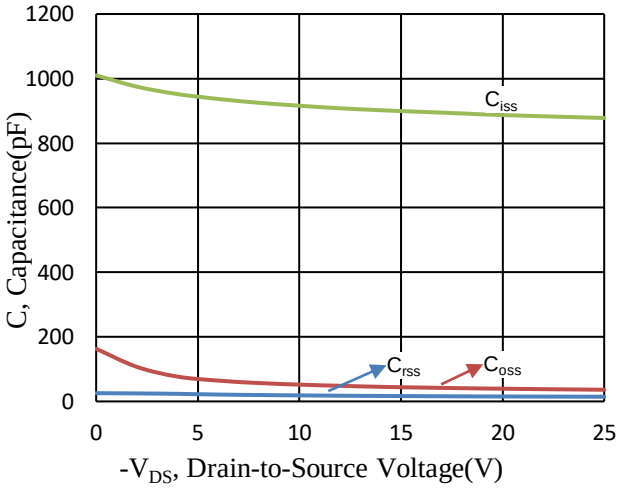



**Figure 10. Threshold Voltage vs. Temperature**

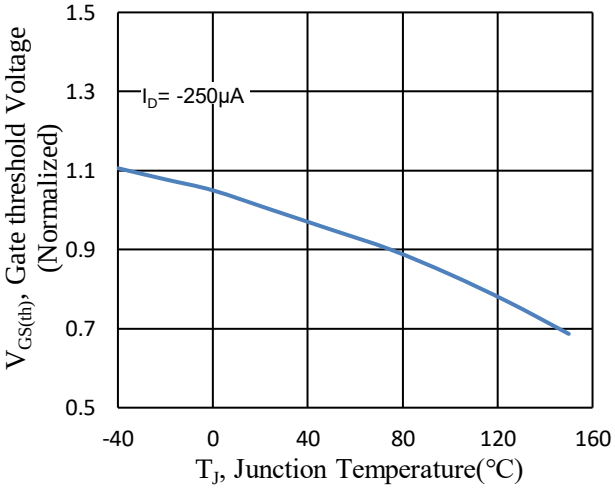



**Figure 11. Normalized On-Resistance vs. Junction Temperature**

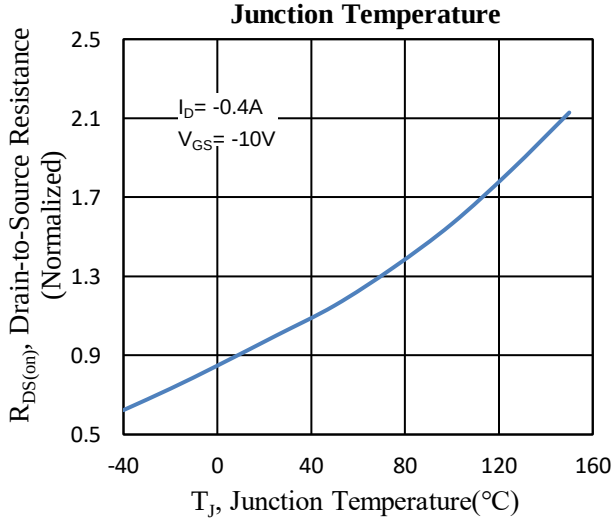
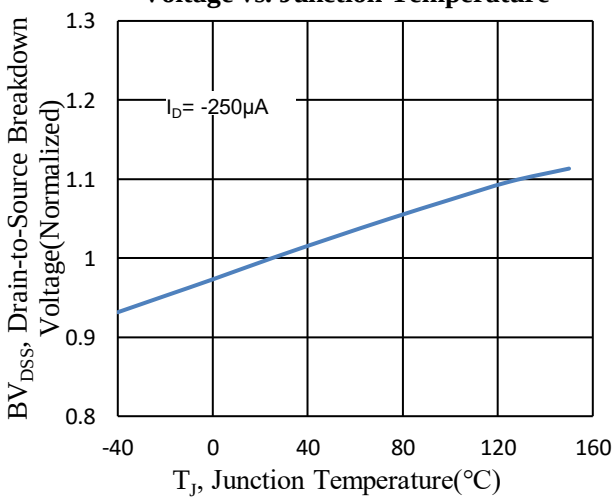
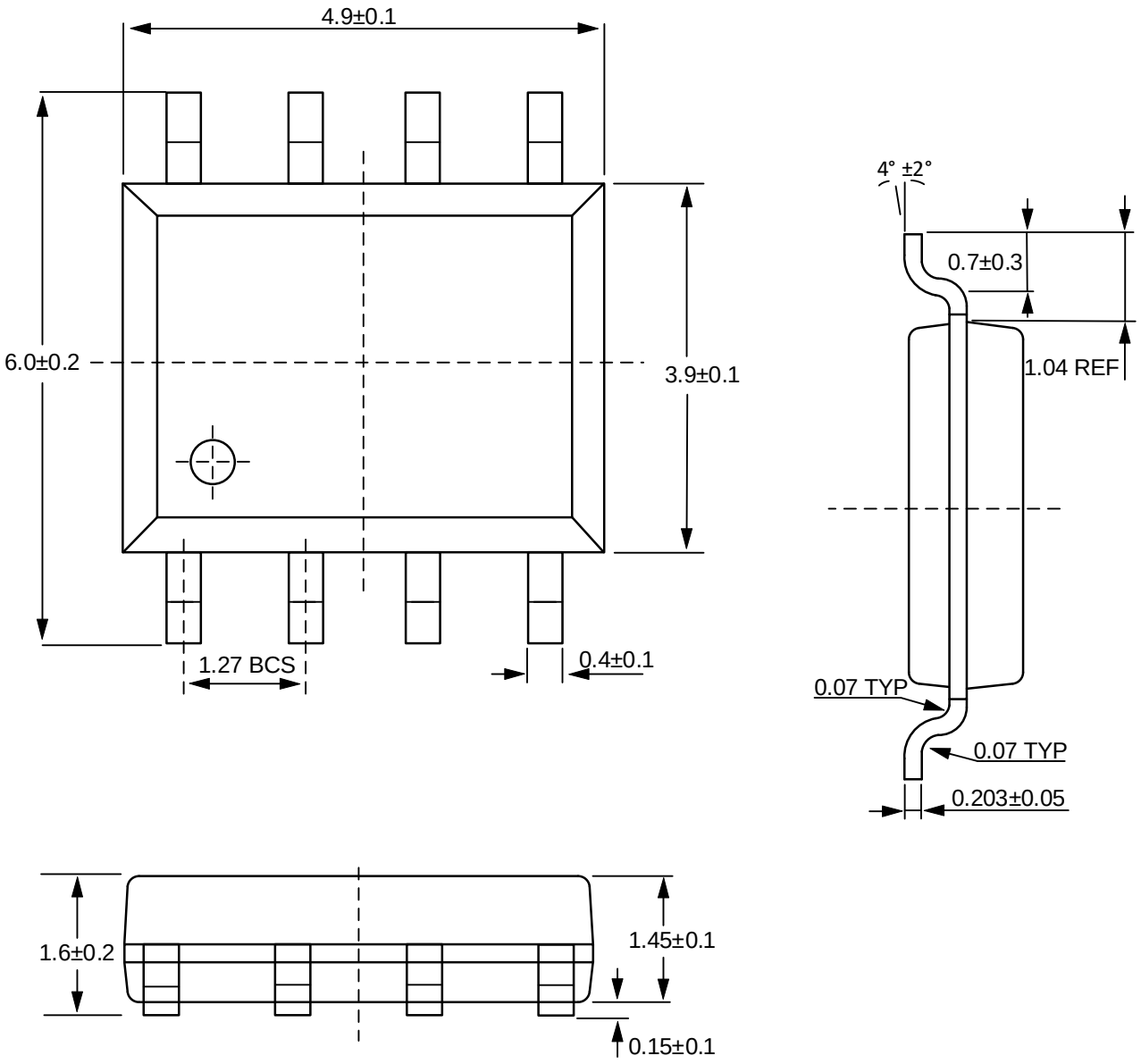



**Figure 12. Drain-to-Source Breakdown Voltage vs. Junction Temperature**



## Package Dimensions

**SOP-8**




Unit：mm

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