

## 200V N-Channel and P-Channel Enhancement-Mode MOSFETs

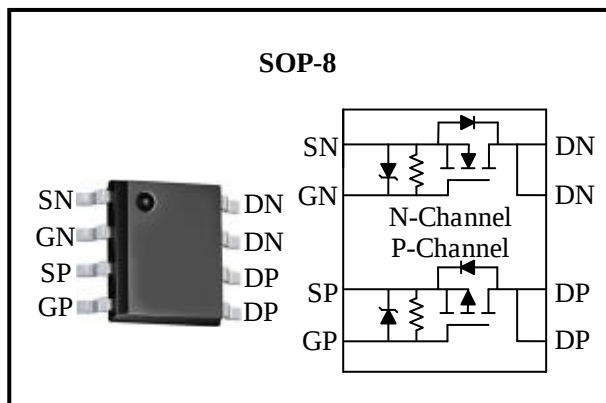
### General Features

- Rugged Polysilicon Gate Cell Structure
- Integrated Gate-to-Source Resistor
- Integrated Gate-to-Source Zener Diode
- Low On-Resistance
- Low Threshold
- Low Input Capacitance
- Low Input and Output Leakage
- Fast Switching Speeds
- Free from Secondary Breakdown
- Halogen-free Available
- RoHS Compliant

| $BV_{DSX}$ | $R_{DS(ON)} (Max.)$ | $I_D$ |
|------------|---------------------|-------|
| -200V      | 6Ω                  | -2A   |
| 200        | 3Ω                  | 2A    |

### Applications

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



### Ordering Information

| Part Number | Package | Marking | Remark       |
|-------------|---------|---------|--------------|
| FTE03R20D   | SOP-8   | 03R20   | Halogen Free |

### Absolute Maximum Ratings

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol                            | Parameter                                                           | N-Channel  | P-Channel | Unit |
|-----------------------------------|---------------------------------------------------------------------|------------|-----------|------|
| V <sub>DSX</sub>                  | Drain-to-Source Voltage <sup>[1]</sup>                              | 200        | -200      | V    |
| V <sub>DGX</sub>                  | Drain-to-Gate Voltage <sup>[1]</sup>                                | 200        | -200      | V    |
| I <sub>D</sub>                    | Continuous Drain Current                                            | 2          | -2        | A    |
| I <sub>DM</sub>                   | Pulsed Drain Current <sup>[2]</sup>                                 | 6          | -6        |      |
| P <sub>D</sub>                    | Power Dissipation                                                   | 2.5        |           | W    |
| T <sub>L</sub>                    | Soldering Temperature<br>Distance of 1.6mm from case for 10 seconds | 300        |           | °C   |
| T <sub>J</sub> & T <sub>STG</sub> | Operating and Storage Temperature Range                             | -55 to 150 |           |      |

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

### Thermal Characteristics

| Symbol          | Parameter                               | FTE03R20D | Unit               |
|-----------------|-----------------------------------------|-----------|--------------------|
| $R_{\theta JA}$ | Thermal Resistance, Junction-to-Ambient | 50        | $^\circ\text{C/W}$ |

## N-Channel Electrical Characteristics

### OFF Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol     | Parameter                         | Min. | Typ. | Max. | Unit      | Test Conditions              |
|------------|-----------------------------------|------|------|------|-----------|------------------------------|
| $BV_{DSX}$ | Drain-to-Source Breakdown Voltage | 200  | --   | --   | V         | $V_{GS}=0V$ , $I_D=250\mu A$ |
| $I_{DSS}$  | Drain-to-Source Leakage Current   | --   | --   | 10   | $\mu A$   | $V_{DS}=200V$ , $V_{GS}=0V$  |
| $R_{GS}$   | Gate-to-source Shunt Resistor     | 10   | --   | 50   | $k\Omega$ | $I_{GS}=100\mu A$            |
| $V_{ZGS}$  | Gate-to-Source Zener Voltage      | 13   | --   | 25   | V         | $I_{GS}=2mA$                 |

### ON Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol       | Parameter                            | Min. | Typ. | Max. | Unit     | Test Conditions                 |
|--------------|--------------------------------------|------|------|------|----------|---------------------------------|
| $I_{D(ON)}$  | On-state Drain-to-Source Current     | 1    | --   | --   | A        | $V_{GS}=4.5V$ , $V_{DS}=25V$    |
|              |                                      | 2    | --   | --   | A        | $V_{GS}=10V$ , $V_{DS}=25V$     |
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | --   | --   | 3    | $\Omega$ | $V_{GS}=4.5V$ , $I_D=150mA$ [3] |
|              |                                      | --   | --   | 4    | $\Omega$ | $V_{GS}=10V$ , $I_D=1A$ [3]     |
| $V_{GS(TH)}$ | Gate Threshold Voltage               | 1.0  | --   | 2.4  | V        | $V_{GD}=0V$ , $I_D=250\mu A$    |
| $g_{fs}$     | Forward Transconductance             | --   | 1.0  | --   | S        | $V_{DS}=25V$ , $I_D=500mA$      |

### Dynamic Characteristics

Essentially independent of operating temperature

| Symbol    | Parameter                     | Min. | Typ.  | Max. | Unit | Test Conditions                           |
|-----------|-------------------------------|------|-------|------|------|-------------------------------------------|
| $C_{iss}$ | Input Capacitance             | --   | 178.2 | --   | pF   | $V_{GS}=0V$<br>$V_{DS}=25V$<br>$f=1.0MHz$ |
| $C_{oss}$ | Output Capacitance            | --   | 34.0  | --   |      |                                           |
| $C_{rss}$ | Reverse Transfer Capacitance  | --   | 3.82  | --   |      |                                           |
| $Q_g$     | Total Gate Charge             | --   | 5.15  | --   | nC   | $V_{GS}=10V$<br>$V_{DD}=25V$<br>$I_D=1A$  |
| $Q_{gs}$  | Gate-to-Source Charge         | --   | 0.76  | --   |      |                                           |
| $Q_{gd}$  | Gate-to-Drain (Miller) Charge | --   | 0.52  | --   |      |                                           |

### Resistive Switching Characteristics

Essentially independent of operating temperature

| Symbol       | Parameter           | Min. | Typ. | Max. | Unit | Test Conditions                                            |
|--------------|---------------------|------|------|------|------|------------------------------------------------------------|
| $t_{d(on)}$  | Turn-on Delay Time  | --   | 5.2  | --   | ns   | $V_{GS}=10V$<br>$V_{DD}=25V$<br>$I_D=1A$<br>$R_G=25\Omega$ |
| $t_{rise}$   | Rise Time           | --   | 2.6  | --   |      |                                                            |
| $t_{d(off)}$ | Turn-off Delay Time | --   | 15   | --   |      |                                                            |
| $t_{fall}$   | Fall Time           | --   | 4.4  | --   |      |                                                            |

### Source-Drain Diode Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol   | Parameter             | Min. | Typ. | Max. | Unit | Test Conditions              |
|----------|-----------------------|------|------|------|------|------------------------------|
| $V_{SD}$ | Diode Forward Voltage | --   | --   | 1.8  | V    | $I_{SD}=500mA$ , $V_{GS}=0V$ |

## P-Channel Electrical Characteristics

### OFF Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol     | Parameter                         | Min. | Typ. | Max. | Unit       | Test Conditions               |
|------------|-----------------------------------|------|------|------|------------|-------------------------------|
| $BV_{DSX}$ | Drain-to-Source Breakdown Voltage | -200 | --   | --   | V          | $V_{GS}=0V$ , $I_D=-250\mu A$ |
| $I_{DSS}$  | Drain-to-Source Leakage Current   | --   | --   | -10  | $\mu A$    | $V_{DS}=-200V$ , $V_{GS}=0V$  |
| $R_{GS}$   | Gate-to-source Shunt Resistor     | 10   | --   | 50   | k $\Omega$ | $I_{GS}=100\mu A$             |
| $V_{ZGS}$  | Gate-to-Source Zener Voltage      | 13   | --   | 25   | V          | $I_{GS}=-2mA$                 |

### ON Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol       | Parameter                            | Min. | Typ. | Max. | Unit     | Test Conditions                   |
|--------------|--------------------------------------|------|------|------|----------|-----------------------------------|
| $I_{D(ON)}$  | On-state Drain-to-Source Current     | -1   | --   | --   | A        | $V_{GS}=-4.5V$ , $V_{DS}=-25V$    |
|              |                                      | -2   | --   | --   | A        | $V_{GS}=-10V$ , $V_{DS}=-25V$     |
| $R_{DS(ON)}$ | Static Drain-to-Source On-Resistance | --   | --   | 6    | $\Omega$ | $V_{GS}=-4.5V$ , $I_D=-150mA$ [3] |
|              |                                      | --   | --   | 5    | $\Omega$ | $V_{GS}=-10V$ , $I_D=-1A$ [3]     |
| $V_{GS(TH)}$ | Gate Threshold Voltage               | -1.0 | --   | -2.4 | V        | $V_{GD}=0V$ , $I_D=-250\mu A$     |
| gfs          | Forward Transconductance             | --   | 1.0  | --   | S        | $V_{DS}=-25V$ , $I_D=-500mA$      |

### Dynamic Characteristics

Essentially independent of operating temperature

| Symbol    | Parameter                     | Min. | Typ.  | Max. | Unit | Test Conditions                             |
|-----------|-------------------------------|------|-------|------|------|---------------------------------------------|
| $C_{iss}$ | Input Capacitance             | --   | 228.3 | --   | pF   | $V_{GS}=0V$<br>$V_{DS}=-25V$<br>$f=1.0MHz$  |
| $C_{oss}$ | Output Capacitance            | --   | 35.5  | --   |      |                                             |
| $C_{rss}$ | Reverse Transfer Capacitance  | --   | 6.4   | --   |      |                                             |
| $Q_g$     | Total Gate Charge             | --   | 6.5   | --   | nC   | $V_{GS}=-10V$<br>$V_{DS}=-25V$<br>$I_D=-1A$ |
| $Q_{gs}$  | Gate-to-Source Charge         | --   | 0.87  | --   |      |                                             |
| $Q_{gd}$  | Gate-to-Drain (Miller) Charge | --   | 0.6   | --   |      |                                             |

### Resistive Switching Characteristics

Essentially independent of operating temperature

| Symbol       | Parameter           | Min. | Typ. | Max. | Unit | Test Conditions                                               |
|--------------|---------------------|------|------|------|------|---------------------------------------------------------------|
| $t_{d(on)}$  | Turn-on Delay Time  | --   | 3.8  | --   | ns   | $V_{GS}=-10V$<br>$V_{DD}=-25V$<br>$I_D=-1A$<br>$R_G=25\Omega$ |
| $t_{rise}$   | Rise Time           | --   | 8.9  | --   |      |                                                               |
| $t_{d(off)}$ | Turn-off Delay Time | --   | 18.8 | --   |      |                                                               |
| $t_{fall}$   | Fall Time           | --   | 6.6  | --   |      |                                                               |

### Source-Drain Diode Characteristics

 $T_A = 25^\circ\text{C}$  unless otherwise specified

| Symbol   | Parameter             | Min. | Typ. | Max. | Unit | Test Conditions               |
|----------|-----------------------|------|------|------|------|-------------------------------|
| $V_{SD}$ | Diode Forward Voltage | --   | --   | -2.0 | V    | $I_{SD}=-500mA$ , $V_{GS}=0V$ |

NOTE:

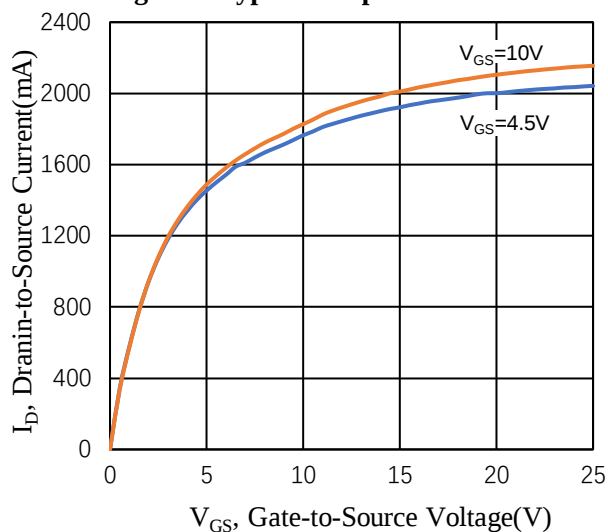
[1]  $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$ .

[2] Repetitive rating, pulse width limited by maximum junction temperature.

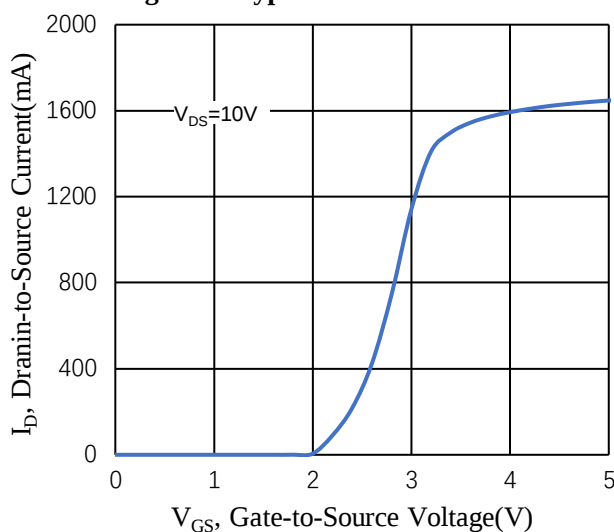
[3] Pulse width  $\leq 380\mu s$ , duty cycle  $\leq 2\%$ .

### N-Channel Typical Characteristics

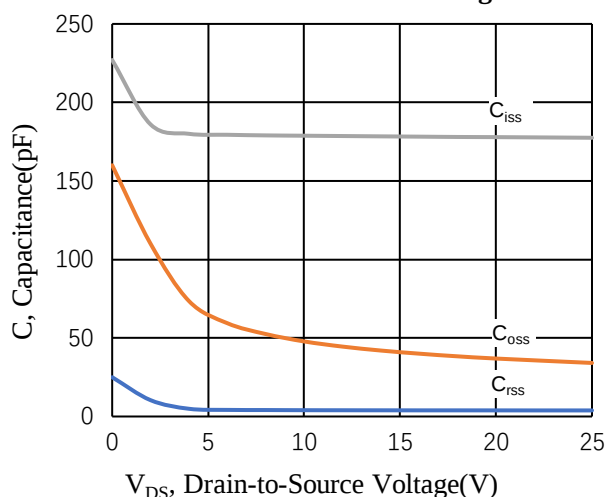
**Figure 1. Typical Output Characteristics**



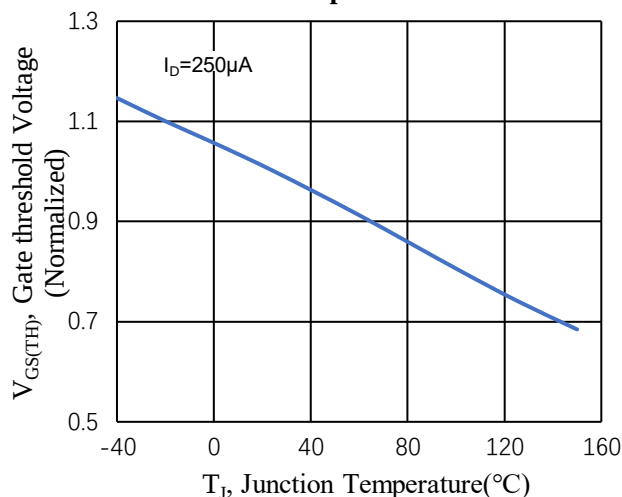
**Figure 2. Typical Transfer Characteristics**



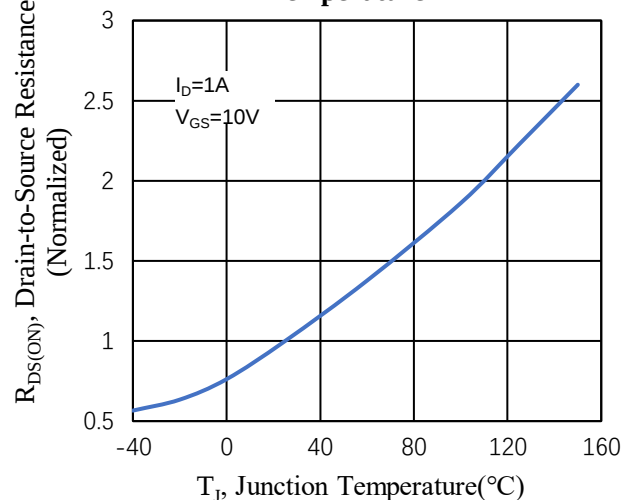
**Figure 3. Typical Capacitance vs. Drain-to-Source Voltage**



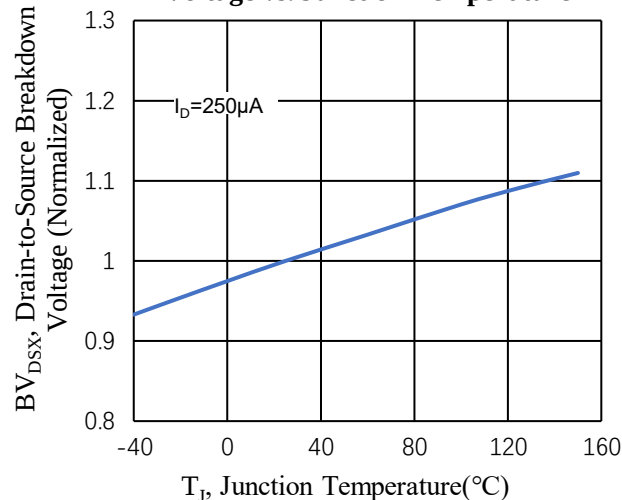
**Figure 4. Threshold Voltage vs. Temperature**



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

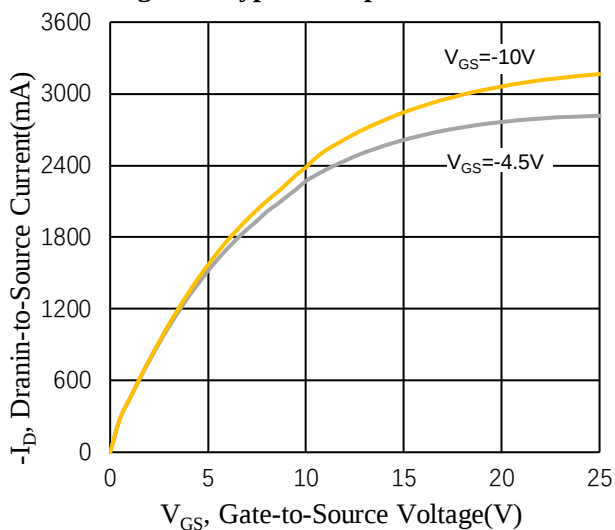


**Figure 6. Drain-to-Source Breakdown Voltage vs. Junction Temperature**

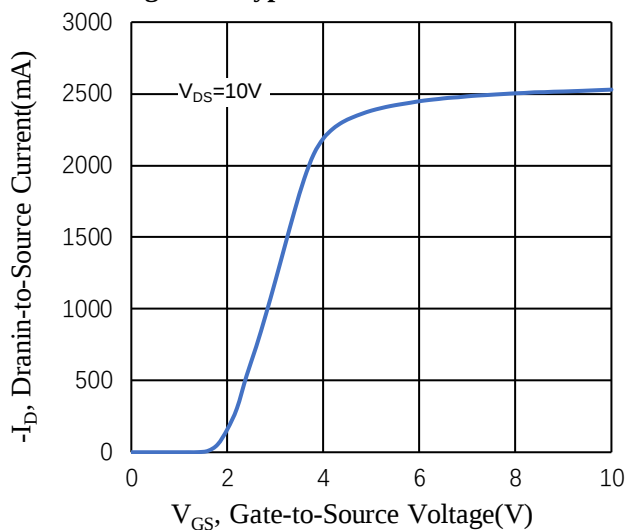


### P-Channel Typical Characteristics

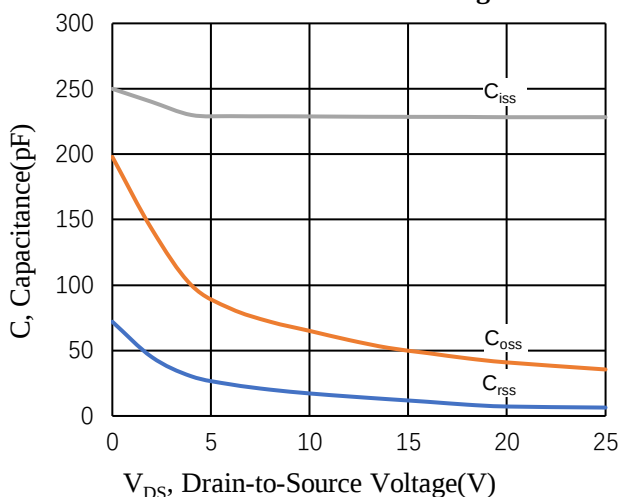
**Figure 7. Typical Output Characteristics**



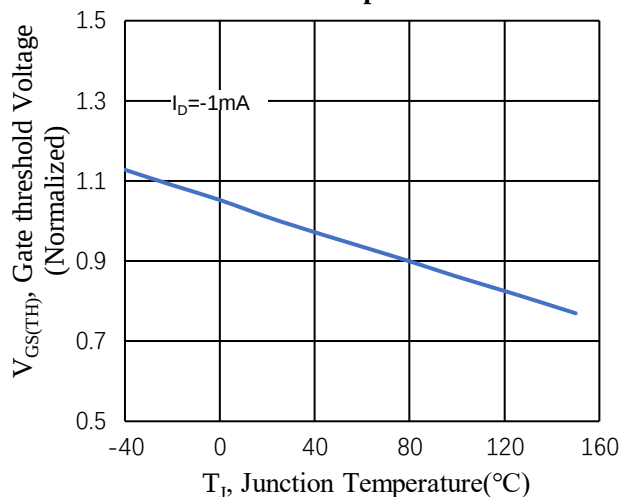
**Figure 8. Typical Transfer Characteristics**



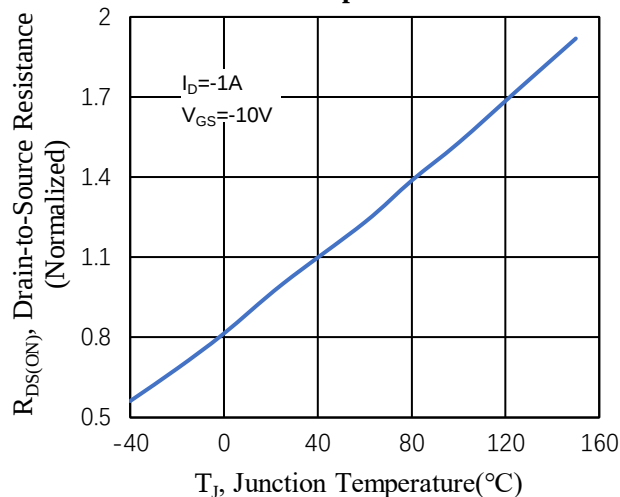
**Figure 9. Typical Capacitance vs. Drain-to-Source Voltage**



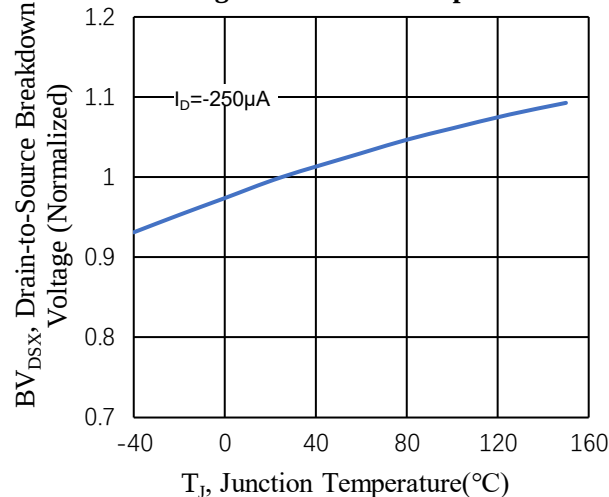
**Figure 10. Threshold Voltage vs. Temperature**



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

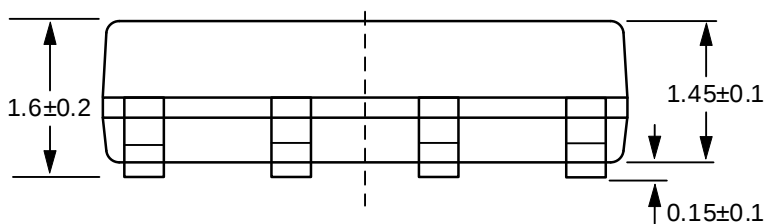
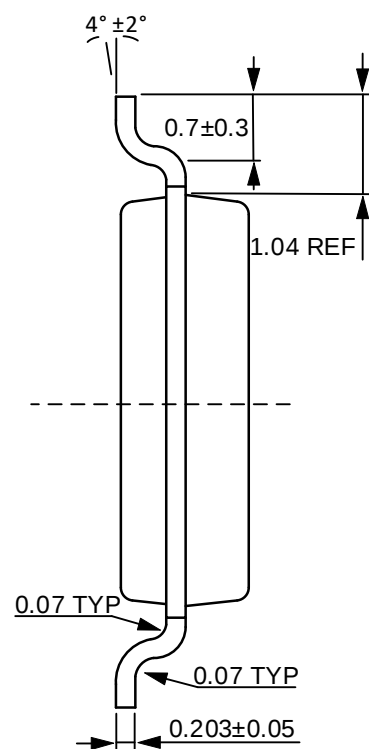
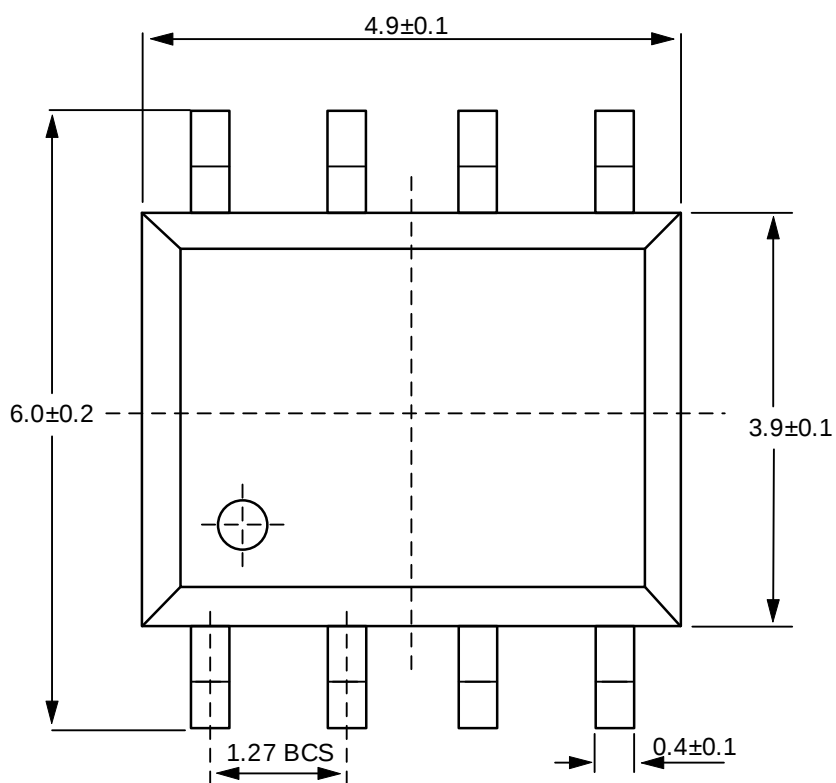


**Figure 12. Drain-to-Source Breakdown Voltage vs. Junction Temperature**



## Package Dimensions

### SOP-8





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    - b. support or sustain life,
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