



YOUSHANG SEMICONDUCTOR

**设计研发新型功率器件**

**各类小信号开关**

**中低压及高压大电流等场效应管**

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## Product Summary

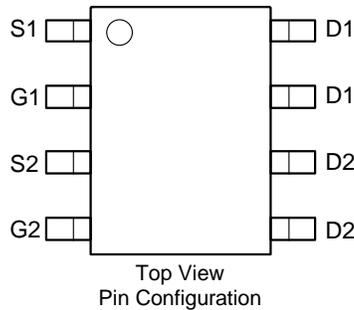
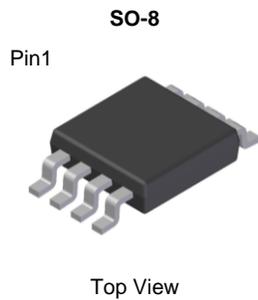
| Device | $V_{(BR)DSS}$ | $R_{DS(ON)}$ Max                       | $I_D$<br>$T_A = +25^\circ\text{C}$ |
|--------|---------------|--|------------------------------------|
| Q1     | 30V           | 16m $\Omega$ @ $V_{GS} = 10\text{V}$   | 8.2A                               |
|        |               | 20m $\Omega$ @ $V_{GS} = 4.5\text{V}$  | 7.3A                               |
| Q2     | -30V          | 28m $\Omega$ @ $V_{GS} = -10\text{V}$  | -6.2A                              |
|        |               | 38m $\Omega$ @ $V_{GS} = -4.5\text{V}$ | -5.2A                              |

## Description

This new generation MOSFET is designed to minimize the on-state resistance ( $R_{DS(ON)}$ ), yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

## Applications

- DC-DC Converters
- Power Management Functions
- Backlighting

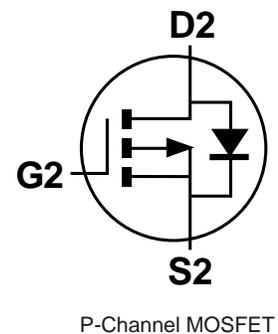
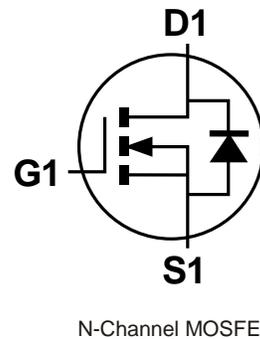


## Features and Benefits

- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed

## Mechanical Data

- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe Solderable per MIL-STD-202, Method 208 (3)
- Weight: 0.074 grams (Approximate)



**Maximum Ratings** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic   |                  | Symbol   | Value Q1    | Value Q2     | Units |
|--|------------------|--|-------------|--------------|-------|
| Drain-Source Voltage   |                  | $V_{DSS}$  | 30          | -30          | V     |
| Gate-Source Voltage  |                  | $V_{GSS}$  | $\pm 20$    | $\pm 20$     | V     |
| Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$        | Steady State     | $T_A = +25^\circ\text{C}$<br>$T_A = +70^\circ\text{C}$ | 8.2<br>6.5  | -6.2<br>-5.0 | A     |
|  | $t < 10\text{s}$ | $T_A = +25^\circ\text{C}$<br>$T_A = +70^\circ\text{C}$ | 10.5<br>8.4 | -8.0<br>-6.4 | A     |
| Maximum Body Diode Forward Current (Note 6)                    |                  | $I_S$  | 2.5         | -2.5         | A     |
| Pulsed Drain Current (10 $\mu\text{s}$ Pulse, Duty Cycle = 1%) |                  | $I_{DM}$   | 80          | -40          | A     |
| Avalanche Current (Note 7) $L = 0.1\text{mH}$                  |                  | $I_{AS}$   | 22          | -22          | A     |
| Avalanche Energy (Note 7) $L = 0.1\text{mH}$                   |                  | $E_{AS}$   | 25          | 25           | mJ    |

**Thermal Characteristics**

| Characteristic                                   |                           | Symbol          | Value       | Units              |
|--|---------------------------|-----------------|-------------|--------------------|
| Total Power Dissipation (Note 5)                 | $T_A = +25^\circ\text{C}$ | $P_D$           | 1.2         | W                  |
|  | $T_A = +70^\circ\text{C}$ |                 | 0.8         |                    |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State              | $R_{\theta JA}$ | 102         | $^\circ\text{C/W}$ |
|  | $t < 10\text{s}$          |                 | 62          |                    |
| Total Power Dissipation (Note 6)                 | $T_A = +25^\circ\text{C}$ | $P_D$           | 1.6         | W                  |
|  | $T_A = +70^\circ\text{C}$ |                 | 1.0         |                    |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State              | $R_{\theta JA}$ | 78          | $^\circ\text{C/W}$ |
|  | $t < 10\text{s}$          |                 | 47          |                    |
| Thermal Resistance, Junction to Case (Note 6)    |                           | $R_{\theta JC}$ | 12          |                    |
| Operating and Storage Temperature Range          |                           | $T_J, T_{STG}$  | -55 to +150 | $^\circ\text{C}$   |

**Electrical Characteristics** (N-Channel Q1) (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

| Characteristic                               | Symbol       | Min | Typ   | Max       | Unit          | Test Condition   |
|--|--------------|-----|-------|-----------|---------------|--|
| <b>OFF CHARACTERISTICS</b> (Note 8)          |              |     |       |           |               |  |
| Drain-Source Breakdown Voltage               | $BV_{DSS}$   | 30  | —     | —         | V             | $V_{GS} = 0\text{V}, I_D = 250\mu\text{A}$                                   |
| Zero Gate Voltage Drain Current              | $I_{DSS}$    | —   | —     | 1         | $\mu\text{A}$ | $V_{DS} = 30\text{V}, V_{GS} = 0\text{V}$                                    |
| Gate-Source Leakage                          | $I_{GSS}$    | —   | —     | $\pm 100$ | nA            | $V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$                                |
| <b>ON CHARACTERISTICS</b> (Note 8)           |              |     |       |           |               |  |
| Gate Threshold Voltage                       | $V_{GS(th)}$ | 1.0 | —     | 3.0       | V             | $V_{DS} = V_{GS}, I_D = 250\mu\text{A}$                                      |
| Static Drain-Source On-Resistance            | $R_{DS(ON)}$ | —   | 12    | 16        | m $\Omega$    | $V_{GS} = 10\text{V}, I_D = 12\text{A}$                                      |
|  |              | —   | 15    | 20        |               | $V_{GS} = 4.5\text{V}, I_D = 10\text{A}$                                     |
| Diode Forward Voltage                        | $V_{SD}$     | —   | 0.7   | 1.0       | V             | $V_{GS} = 0\text{V}, I_S = 1\text{A}$  |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 9)      |              |     |       |           |               |  |
| Input Capacitance                            | $C_{ISS}$    | —   | 1,415 | —         | pF            | $V_{DS} = 15\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$                 |
| Output Capacitance                           | $C_{OSS}$    | —   | 119   | —         |               |  |
| Reverse Transfer Capacitance                 | $C_{RSS}$    | —   | 82    | —         |               |  |
| Gate Resistance                              | $R_G$        | —   | 2.6   | 3.2       | $\Omega$      | $V_{DS} = 0\text{V}, V_{GS} = 0\text{V}, f = 1.0\text{MHz}$                  |
| Total Gate Charge ( $V_{GS} = 4.5\text{V}$ ) | $Q_G$        | —   | 11.3  | —         | nC            | $V_{DS} = 15\text{V}, I_D = 12\text{A}$                                      |
| Total Gate Charge ( $V_{GS} = 10\text{V}$ )  | $Q_G$        | —   | 25.1  | —         |               |  |
| Gate-Source Charge                           | $Q_{GS}$     | —   | 3.5   | —         |               |  |
| Gate-Drain Charge                            | $Q_{GD}$     | —   | 3.6   | —         |               |  |
| Turn-On Delay Time                           | $t_{D(ON)}$  | —   | 4.8   | —         | ns            | $V_{DD} = 15\text{V}, V_{GS} = 10\text{V}, R_L = 1.25\Omega, R_G = 3\Omega,$ |
| Turn-On Rise Time                            | $t_R$        | —   | 16.5  | —         |               |  |
| Turn-Off Delay Time                          | $t_{D(OFF)}$ | —   | 26.1  | —         |               |  |
| Turn-Off Fall Time                           | $t_F$        | —   | 5.6   | —         |               |  |

- Notes:
- Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1-inch square copper plate.
  - UIS in production with  $L = 0.1\text{mH}$ , starting  $T_A = +25^\circ\text{C}$ .
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

**Electrical Characteristics** (Continued) (P-Channel Q2) (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                              | Symbol              | Min  | Typ   | Max  | Unit | Test Condition  |
|---|---------------------|------|-------|------|------|---|
| <b>OFF CHARACTERISTICS</b> (Note 8)         |                     |      |       |      |      |   |
| Drain-Source Breakdown Voltage              | BV <sub>DSS</sub>   | -30  | —     | —    | V    | V <sub>GS</sub> = 0V, I <sub>D</sub> = -250μA   |
| Zero Gate Voltage Drain Current             | I <sub>DSS</sub>    | —    | —     | -1   | μA   | V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V  |
| Gate-Source Leakage                         | I <sub>GSS</sub>    | —    | —     | ±100 | nA   | V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V  |
| <b>ON CHARACTERISTICS</b> (Note 8)          |                     |      |       |      |      |   |
| Gate Threshold Voltage                      | V <sub>GS(th)</sub> | -1.0 | —     | -3.0 | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = -250μA                                 |
| Static Drain-Source On-Resistance           | R <sub>DS(ON)</sub> | —    | 21    | 28   | mΩ   | V <sub>GS</sub> = -10V, I <sub>D</sub> = -7A  |
|   |                     | —    | 30    | 38   |      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -6.2A   |
| Diode Forward Voltage                       | V <sub>SD</sub>     | —    | -0.7  | -1.2 | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = -2.1A  |
| <b>DYNAMIC CHARACTERISTICS</b> (Note 9)     |                     |      |       |      |      |   |
| Input Capacitance                           | C <sub>ISS</sub>    | —    | 1,241 | —    | pF   | V <sub>DS</sub> = -15V, V <sub>GS</sub> = 0V<br>f = 1.0MHz                                  |
| Output Capacitance                          | C <sub>OSS</sub>    | —    | 147   | —    |      |   |
| Reverse Transfer Capacitance                | C <sub>RSS</sub>    | —    | 110   | —    |      |   |
| Gate Resistance                             | R <sub>G</sub>      | —    | 15    | —    | Ω    | V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz                                      |
| Total Gate Charge (V <sub>GS</sub> = -4.5V) | Q <sub>G</sub>      | —    | 10.9  | —    | nC   | V <sub>DS</sub> = -15V, I <sub>D</sub> = -7A  |
| Total Gate Charge (V <sub>GS</sub> = -10V)  | Q <sub>G</sub>      | —    | 22    | —    |      |   |
| Gate-Source Charge                          | Q <sub>GS</sub>     | —    | 3.5   | —    |      |   |
| Gate-Drain Charge                           | Q <sub>GD</sub>     | —    | 4.7   | —    |      |   |
| Turn-On Delay Time                          | t <sub>D(ON)</sub>  | —    | 9.7   | —    | ns   | V <sub>DS</sub> = -15V, I <sub>D</sub> = -7A<br>V <sub>GS</sub> = -10V, R <sub>G</sub> = 6Ω |
| Turn-On Rise Time                           | t <sub>R</sub>      | —    | 17.1  | —    |      |   |
| Turn-Off Delay Time                         | t <sub>D(OFF)</sub> | —    | 60.5  | —    |      |   |
| Turn-Off Fall Time                          | t <sub>F</sub>      | —    | 40.4  | —    |      |   |

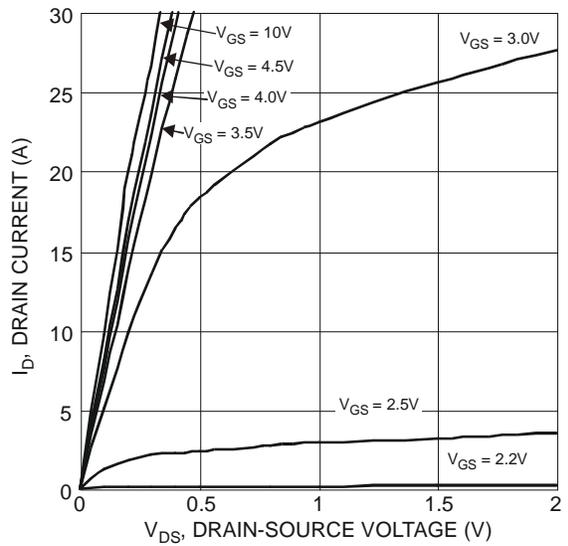


Figure 1 Typical Output Characteristics

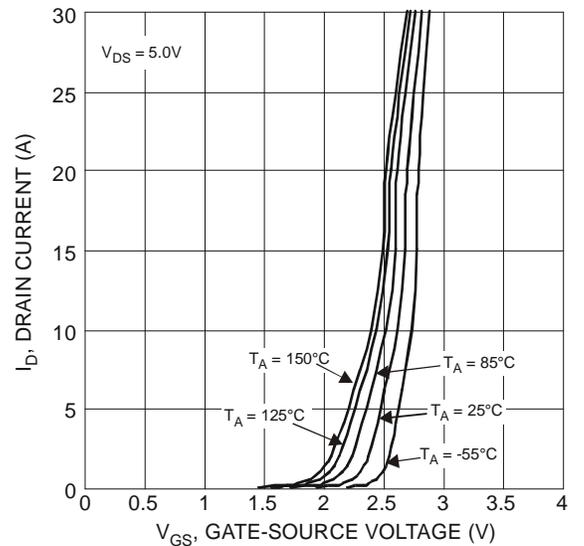


Figure 2 Typical Transfer Characteristics

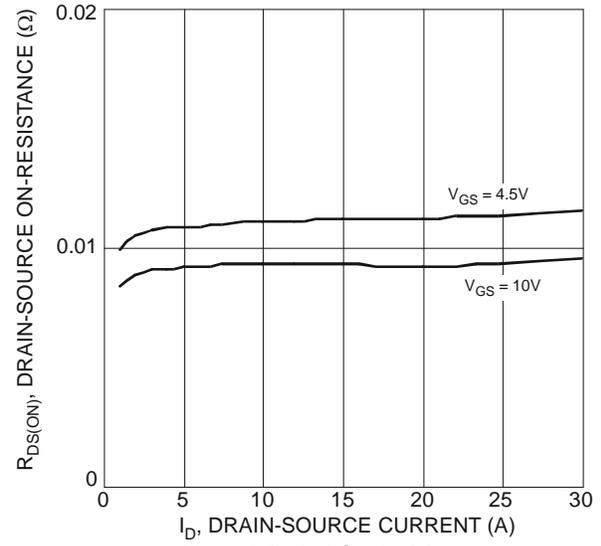


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

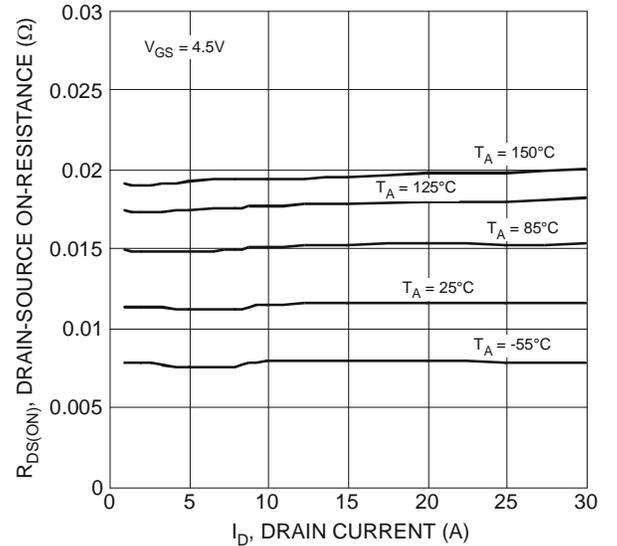


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

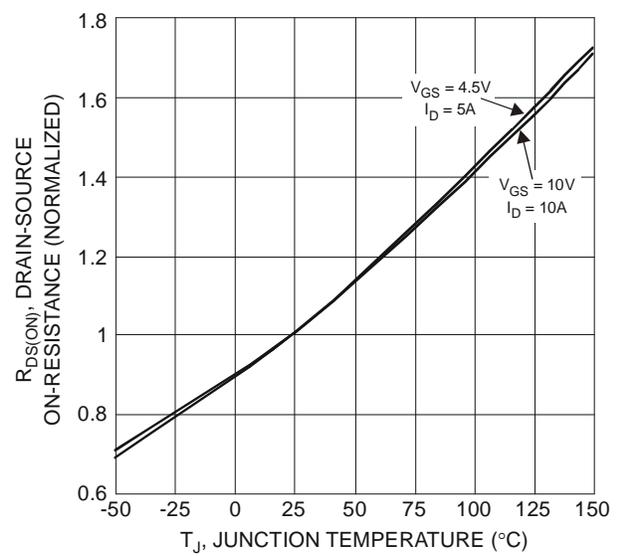


Figure 5 On-Resistance Variation with Temperature

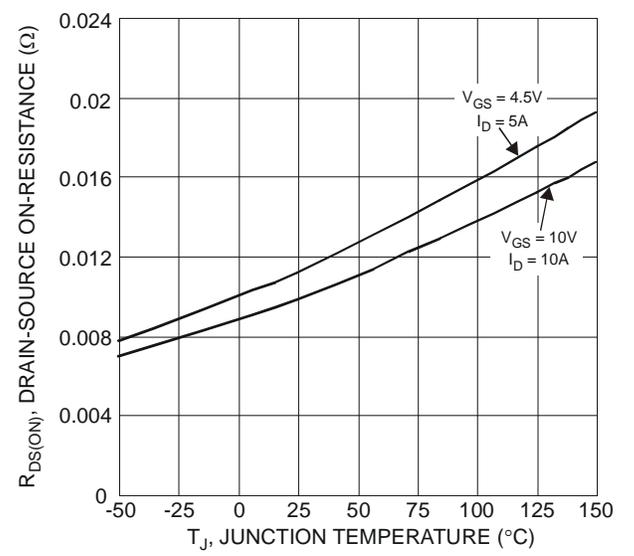


Figure 6 On-Resistance Variation with Temperature

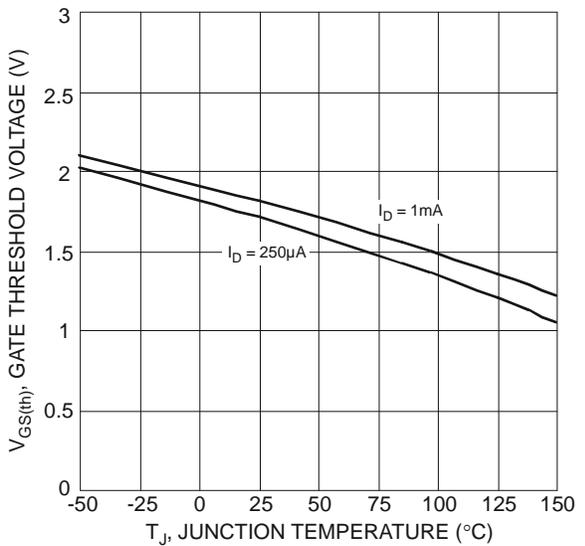


Figure 7 Gate Threshold Variation vs. Ambient Temperature

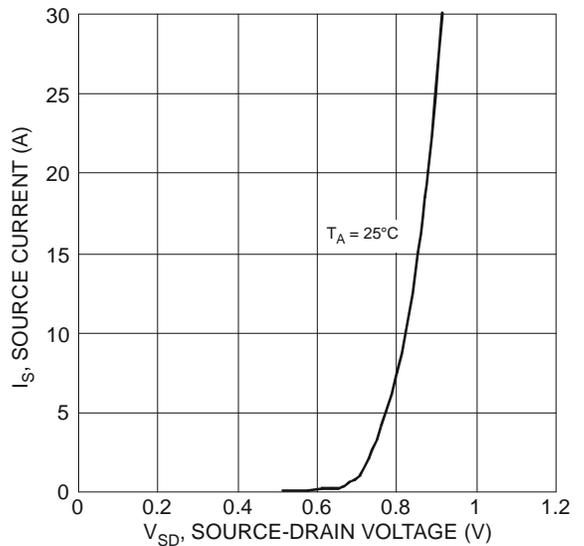


Figure 8 Diode Forward Voltage vs. Current

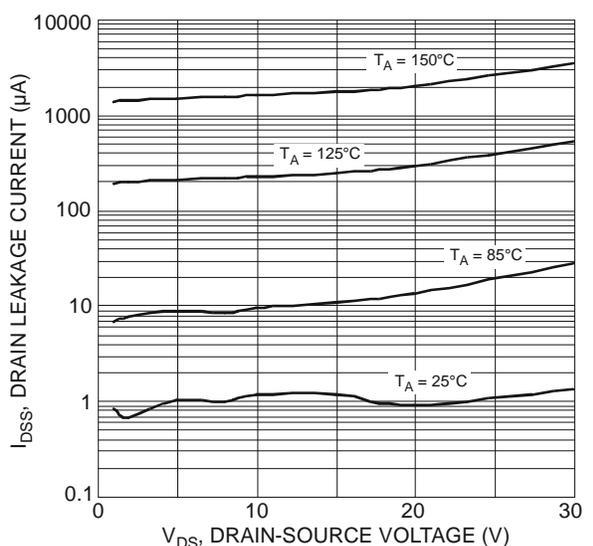


Figure 9 Typical Drain-Source Leakage Current vs. Voltage

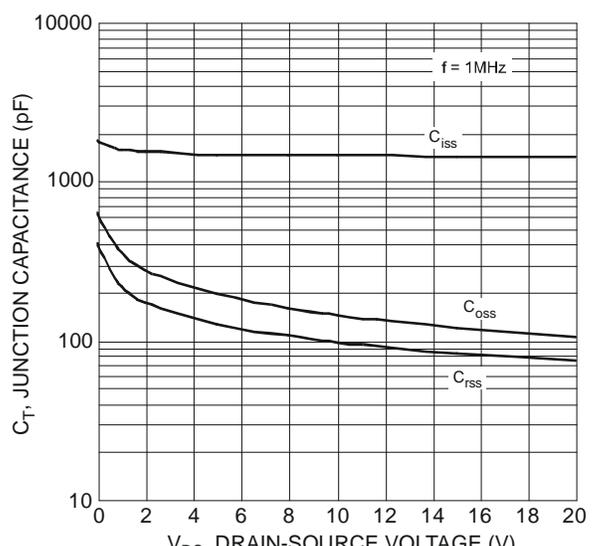


Figure 10 Typical Junction Capacitance

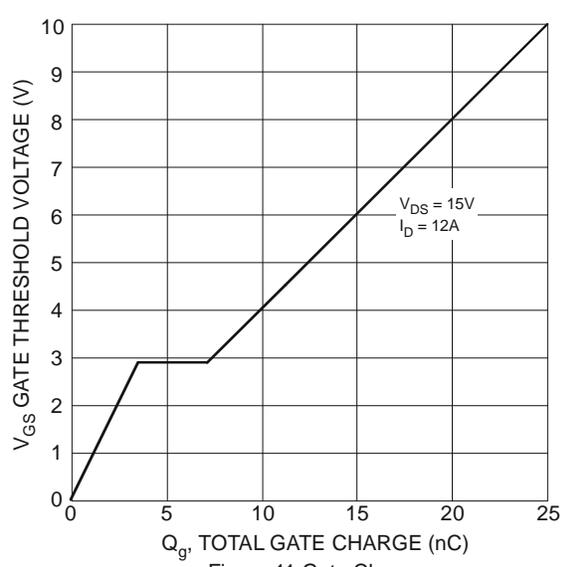


Figure 11 Gate Charge

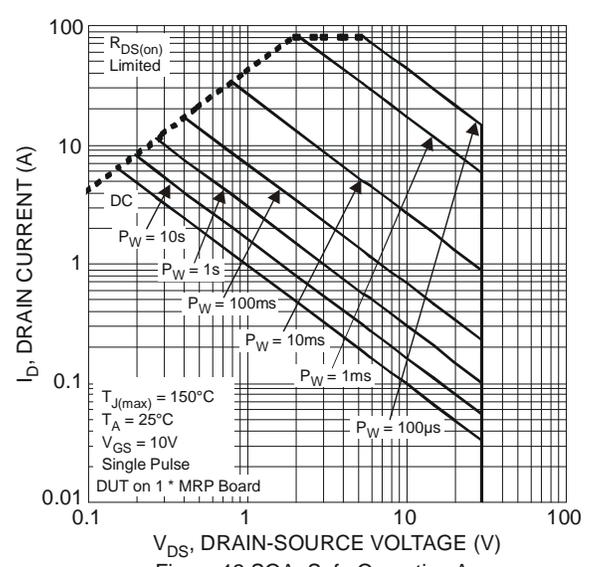
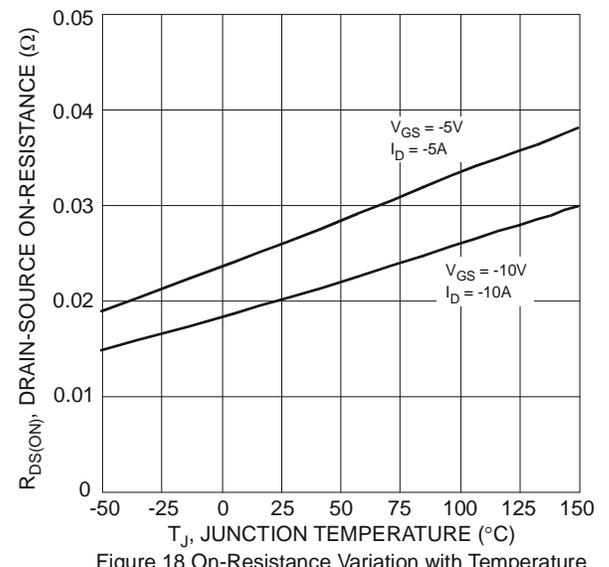
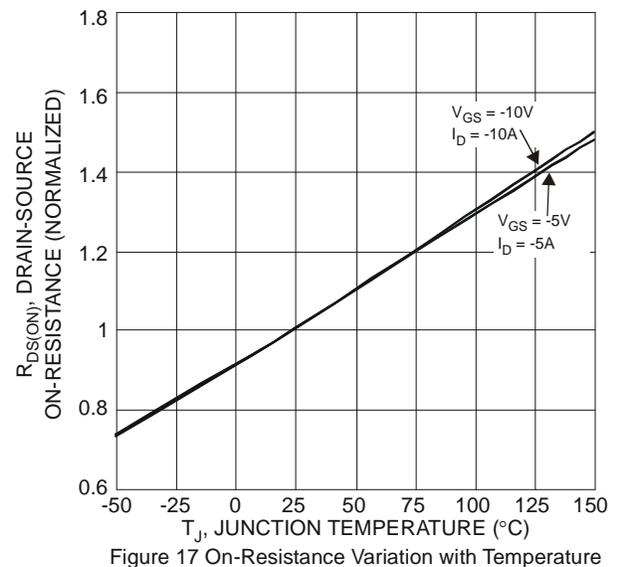
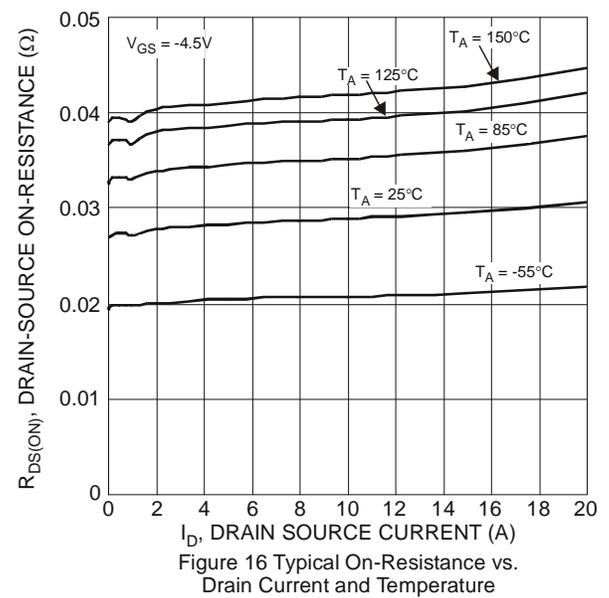
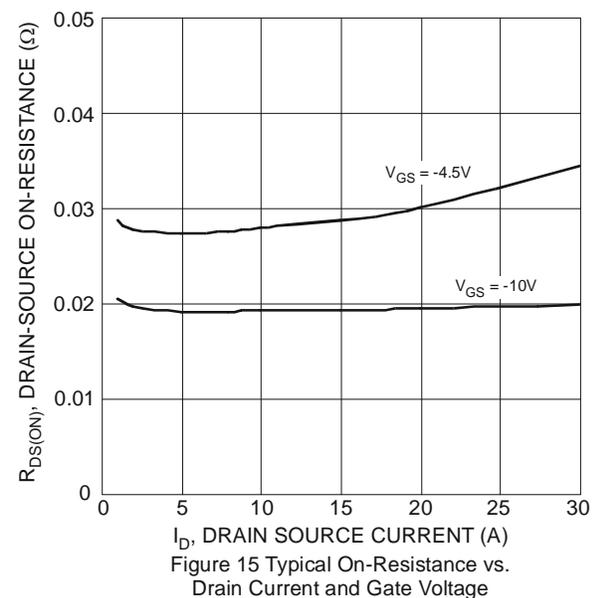
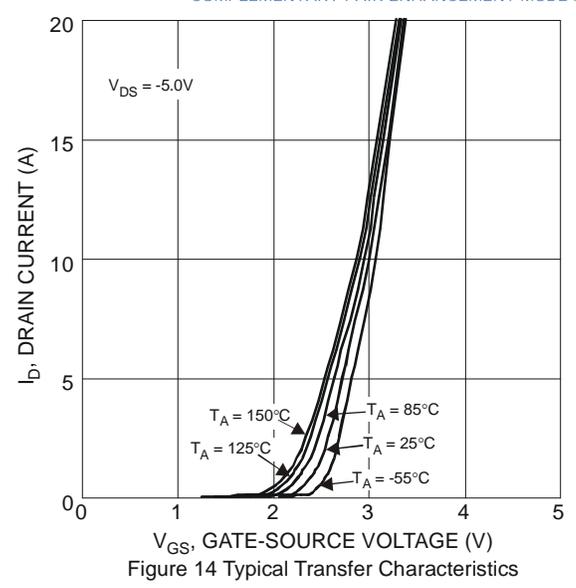
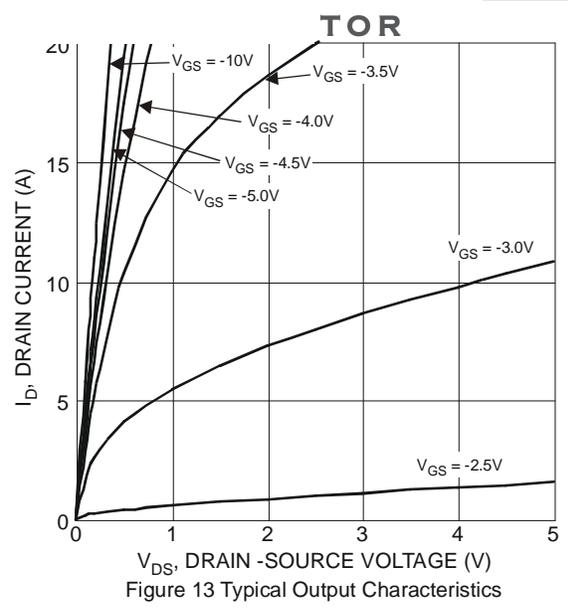


Figure 12 SOA, Safe Operation Area



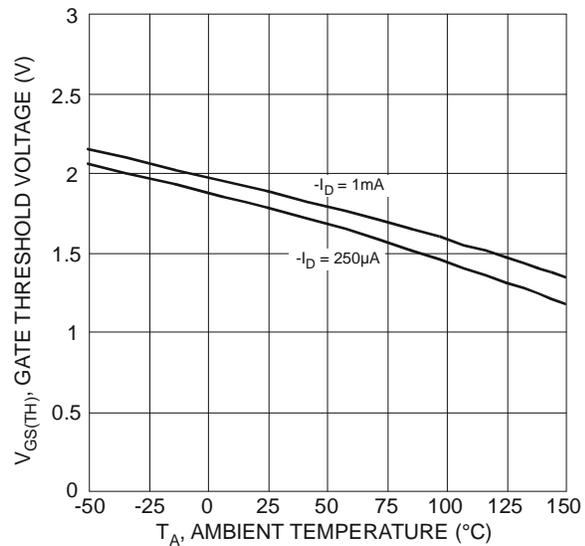


Figure 19 Gate Threshold Variation vs. Ambient Temperature

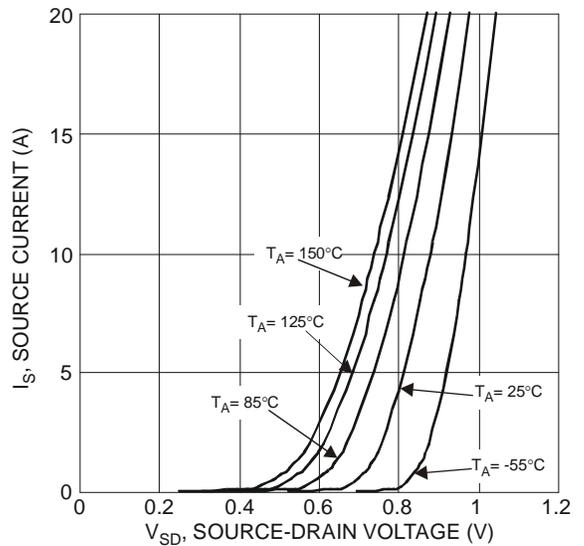


Figure 20 Diode Forward Voltage vs. Current

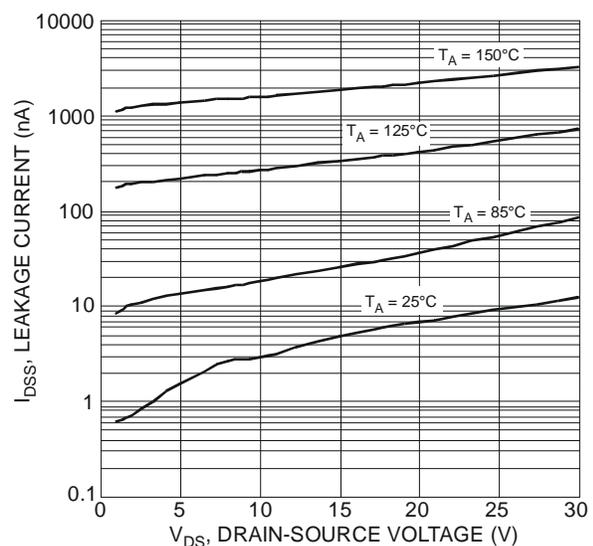


Figure 21 Typical Drain-Source Leakage Current vs. Voltage

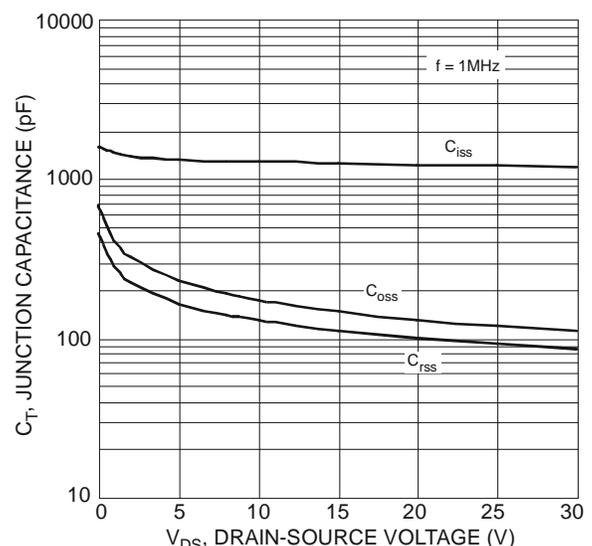


Figure 22 Typical Junction Capacitance

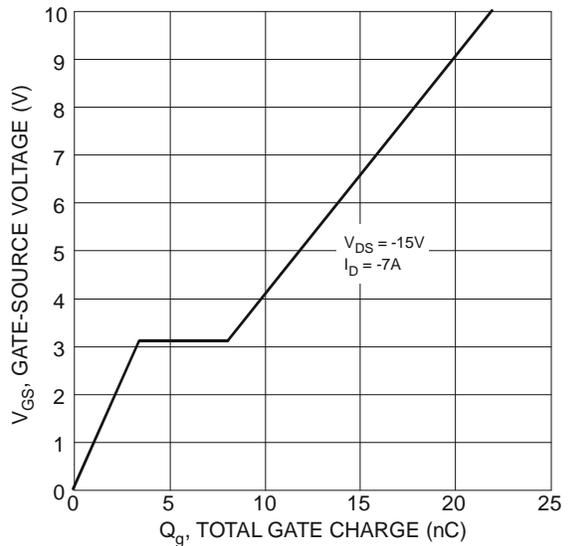


Figure 23 Gate-Charge Characteristics

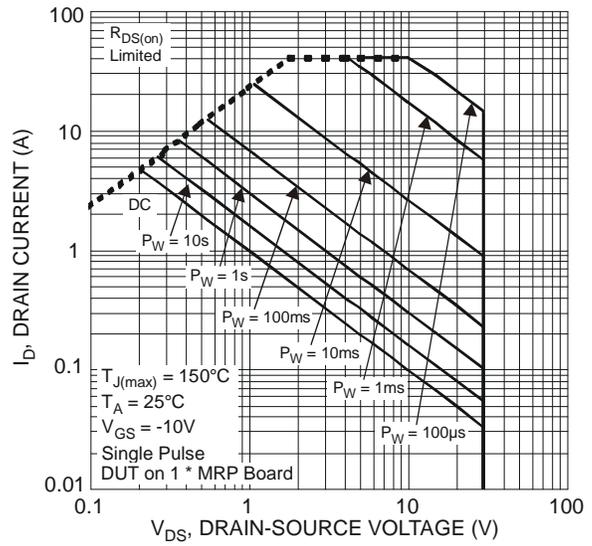


Figure 24 SOA, Safe Operation Area

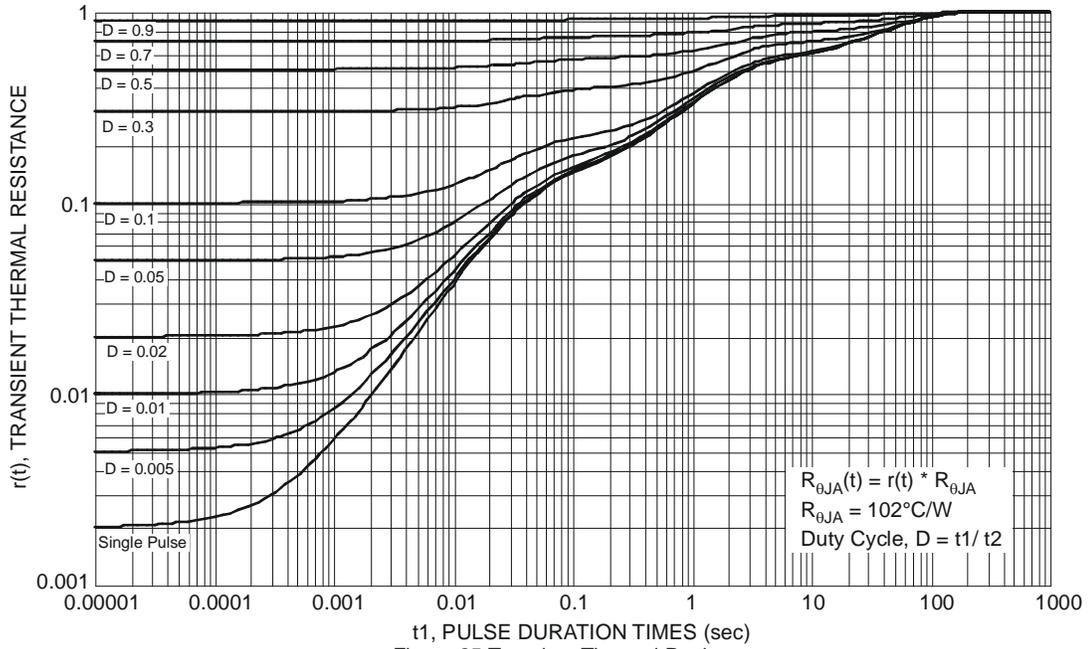
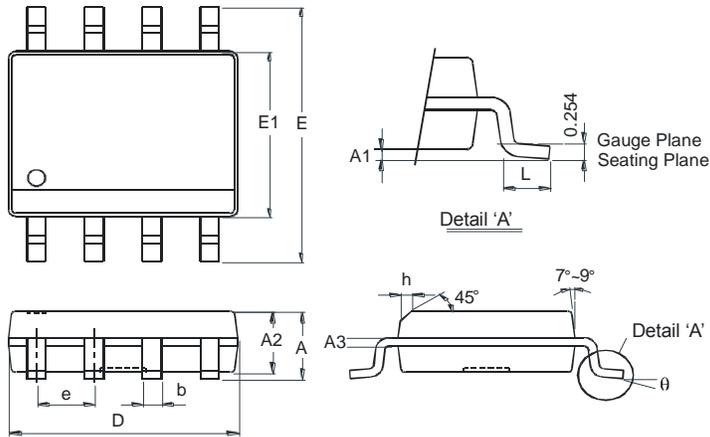


Figure 25 Transient Thermal Resistance

### Package Outline Dimensions

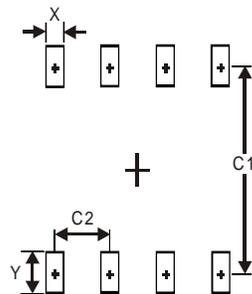
SO-8



| SO-8                 |          |      |
|----------------------|----------|------|
| Dim                  | Min      | Max  |
| A                    | —        | 1.75 |
| A1                   | 0.10     | 0.20 |
| A2                   | 1.30     | 1.50 |
| A3                   | 0.15     | 0.25 |
| b                    | 0.3      | 0.5  |
| D                    | 4.85     | 4.95 |
| E                    | 5.90     | 6.10 |
| E1                   | 3.85     | 3.95 |
| e                    | 1.27 Typ |      |
| h                    | —        | 0.35 |
| L                    | 0.62     | 0.82 |
| θ                    | 0°       | 8°   |
| All Dimensions in mm |          |      |

### Suggested Pad Layout

SO-8



| Dimensions | Value (in mm) |
|------------|---------------|
| X          | 0.60          |
| Y          | 1.55          |
| C1         | 5.4           |
| C2         | 1.27          |