优尚

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

0755-83047638
ysbdt@szyoushang.cn
www.szyoushang.cn

企业微信二维码

企业QQ二维码

## Product Summary

| Device | $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max $T_A = +25°C$ |
|---|---|---|---|
| Q1 | 20V | 0.5Ω @ $V_{GS}$ = 4.5V | 1030mA |
| | | 0.9Ω @ $V_{GS}$ = 1.8V | 740mA |
| Q2 | -20V | 1.0Ω @ $V_{GS}$ = -4.5V | -700mA |
| | | 2.0Ω @ $V_{GS}$ = -1.8V | -460mA |

## Description

This new generation MOSFET has been 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

- Power management functions
- Battery operated systems and solid-state relays
- Load switches

## Features and Benefits

- Low On-Resistance
- Low Gate Threshold Voltage $V_{GS(TH)}$ <1V
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Complementary Pair MOSFET
- Ultra-Small Surface Mount Package

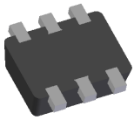
## Mechanical Data

- Package: SOT563
- Package 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 e3
- Weight: 0.003 grams (Approximate)

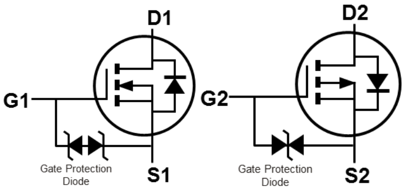
SOT563

ESD PROTECTED

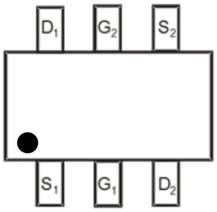
Top View



Bottom View



Internal Schematic



Top View
Pin Out

## Maximum Ratings - Q1 N-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±12 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = 4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | 1030<br>800 | mA |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | $I_{DM}$ | 3 | A |
| Maximum Body Diode Continuous Current | | | $I_S$ | 800 | mA |

## Maximum Ratings - Q2 P-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±8 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = -4.5V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -700<br>-550 | mA |
| Pulsed Drain Current (10µs Pulse, Duty Cycle = 1%) | | | $I_{DM}$ | -2 | A |
| Maximum Body Diode Continuous Current | | | $I_S$ | -800 | mA |

## Thermal Characteristics (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation (Note 5) | | $P_D$ | 0.45 | W |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | $R_{\theta JA}$ | 281 | °C/W |
| Total Power Dissipation (Note 6) | | $P_D$ | 1 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State | $R_{\theta JA}$ | 129 | °C/W |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

Notes: 5. Device mounted on FR-4 substrate PC board, 2oz copper, with minimum recommended pad layout.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper plate.

## Electrical Characteristics - Q1 N-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | 20 | — | — | V | $V_{GS}$ = 0V, $I_D$ = 1mA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | 100 | nA | $V_{DS}$ = 20V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1 | µA | $V_{GS}$ = ±5V, $V_{DS}$ = 0V |
| | | — | — | ±4.0 | | $V_{GS}$ = ±8V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | 0.5 | — | 0.9 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 0.3 | 0.48 | Ω | $V_{GS}$ = 5.0V, $I_D$ = 200mA |
| | | — | 0.35 | 0.5 | | $V_{GS}$ = 4.5V, $I_D$ = 200mA |
| | | — | 0.45 | 0.7 | | $V_{GS}$ = 2.5V, $I_D$ = 200mA |
| | | — | 0.55 | 0.9 | | $V_{GS}$ = 1.8V, $I_D$ = 100mA |
| | | — | 0.65 | 1.5 | | $V_{GS}$ = 1.5V, $I_D$ = 50mA |
| Diode Forward Voltage | $V_{SD}$ | — | 0.7 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 500mA |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 37.1 | — | pF | $V_{DS}$ = 10V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 6.5 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 4.8 | — | | |
| Gate Resistance | $R_g$ | — | 68 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V |
| Total Gate Charge | $Q_g$ | — | 0.5 | — | nC | $V_{GS}$ = 4.5V, $V_{DS}$ = 10V, $I_D$ = 250mA |
| Gate-Source Charge | $Q_{gs}$ | — | 0.07 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.1 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 4.06 | — | ns | $V_{DD}$ = 10V, $V_{GS}$ = 4.5V, $R_L$ = 47Ω, $R_G$ = 10Ω, $I_D$ = 200mA |
| Turn-On Rise Time | $t_R$ | — | 7.28 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 13.74 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 10.54 | — | | |

Notes:
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

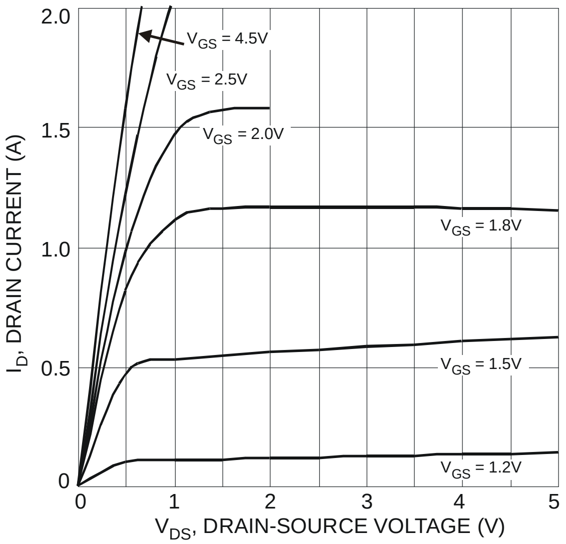


Fig. 1 Typical Output Characteristics

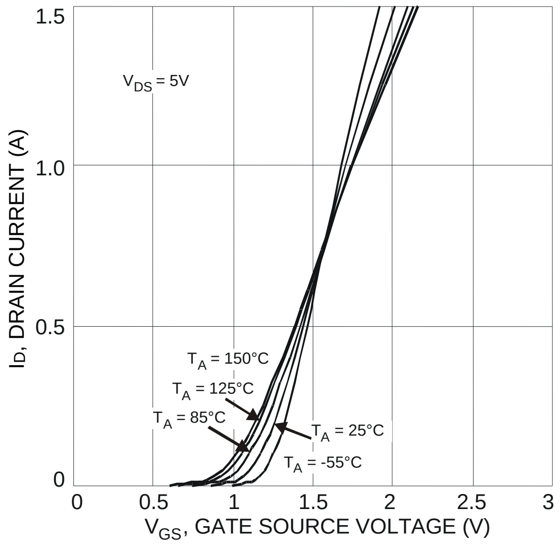


Fig. 2 Typical Transfer Characteristics

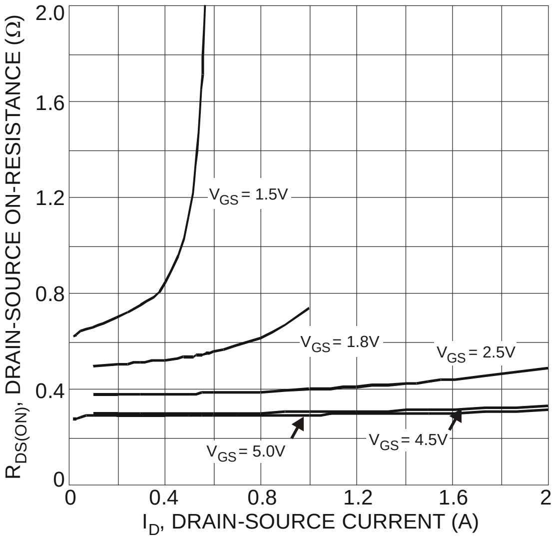


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

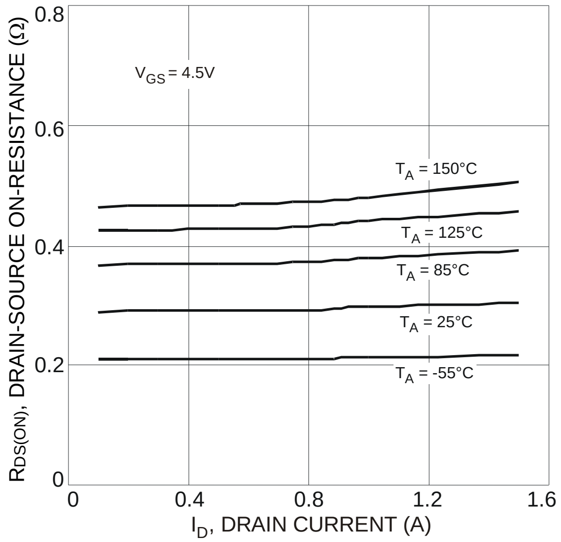


Fig. 4 Typical Drain-Source On-Resistance
vs. Drain Current and Temperature

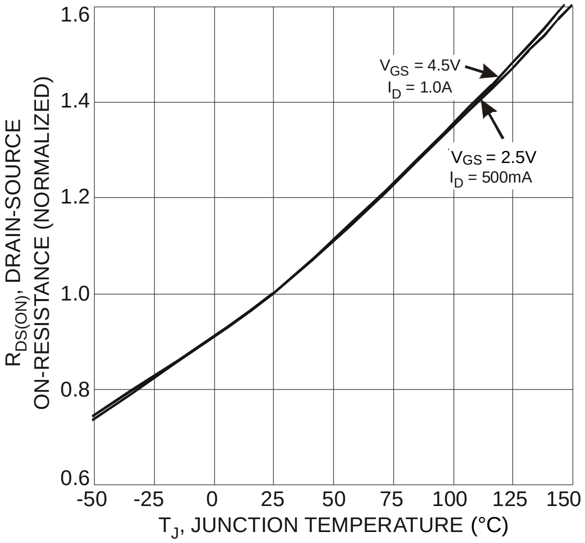


Fig. 5 On-Resistance Variation with Temperature

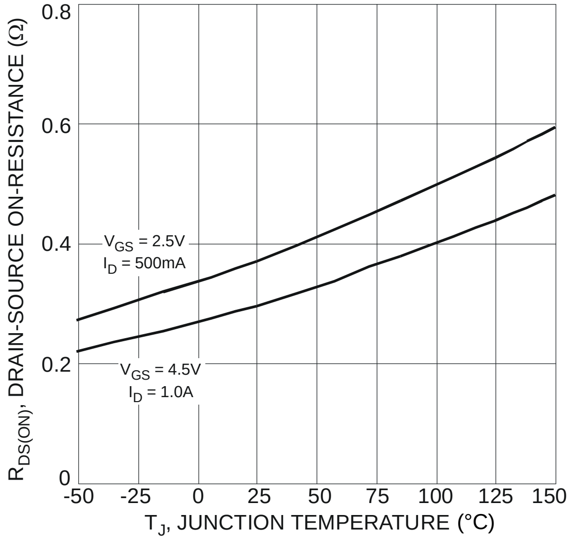


Fig. 6 On-Resistance Variation with Temperature

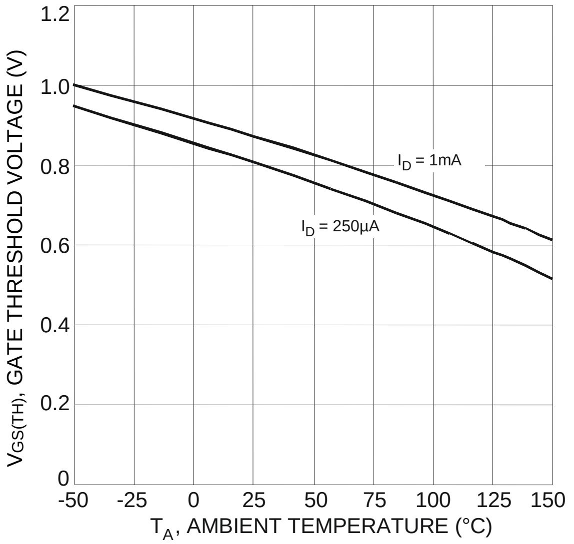


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

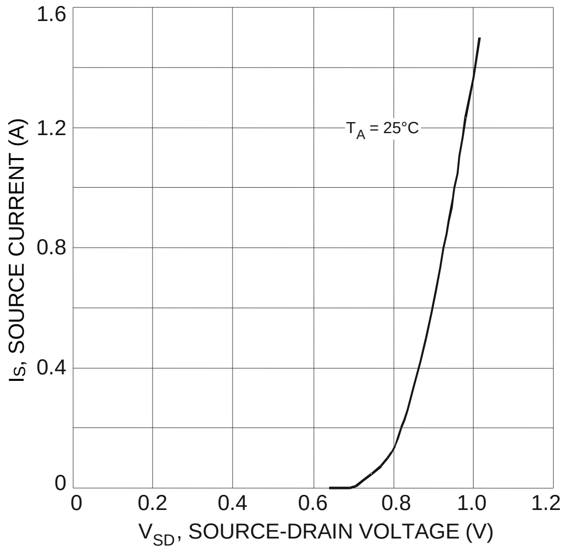


Fig. 8 Diode Forward Voltage vs. Current

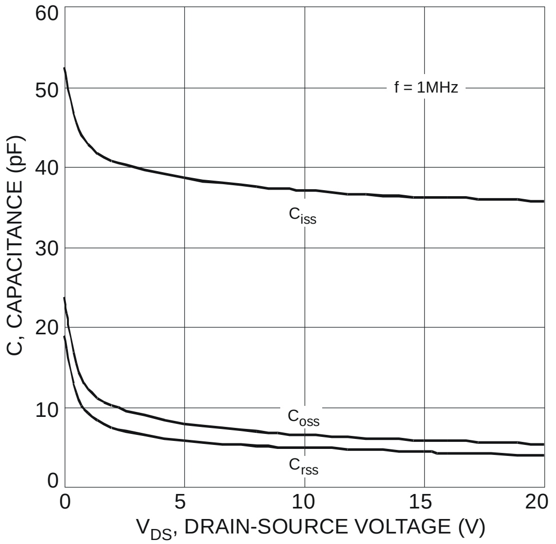


Fig. 9 Typical Capacitance

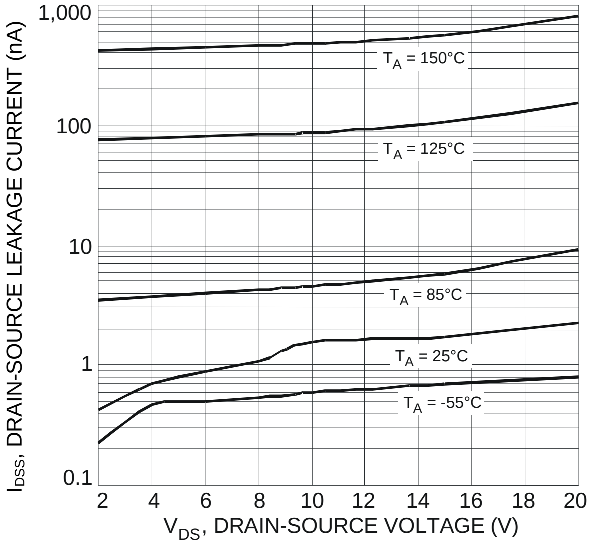


Fig. 10 Typical Drain-Source Leakage Current
vs. Drain-Source Voltage

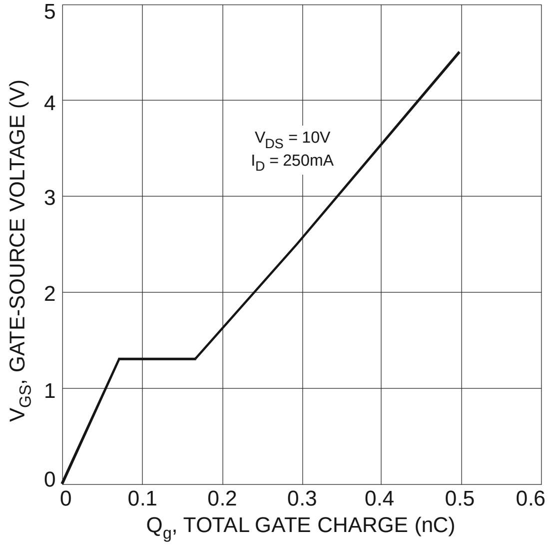


Fig. 11 Gate-Charge Characteristics

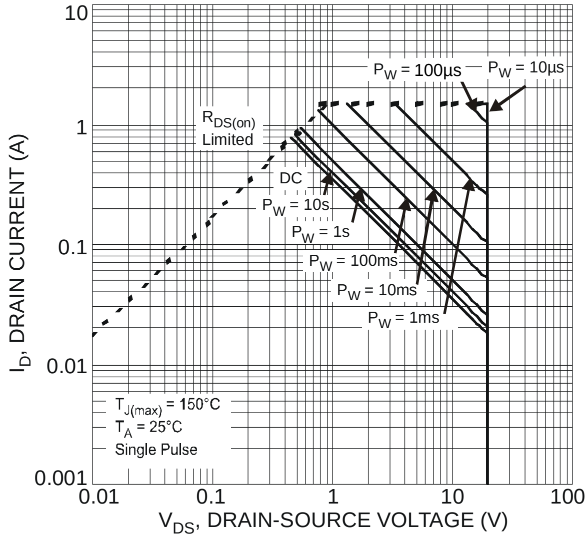


Fig. 12 SOA, Safe Operation Area

## Electrical Characteristics - Q2 P-CHANNEL (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -20 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -1mA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | -100 | nA | $V_{DS}$ = -20V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1.0 | µA | $V_{GS}$ = ±5V, $V_{DS}$ = 0V |
| | | — | — | ±5.0 | | $V_{GS}$ = ±8V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -0.5 | — | -1.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 0.67 | 0.97 | Ω | $V_{GS}$ = -5V, $I_D$ = -100mA |
| | | — | 0.7 | 1.0 | | $V_{GS}$ = -4.5V, $I_D$ = -100mA |
| | | — | 0.9 | 1.5 | | $V_{GS}$ = -2.5V, $I_D$ = -80mA |
| | | — | 1.2 | 2.0 | | $V_{GS}$ = -1.8V, $I_D$ = -40mA |
| | | — | 1.5 | 3.0 | | $V_{GS}$ = -1.5V, $I_D$ = -30mA |
| Diode Forward Voltage | $V_{SD}$ | — | -0.75 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -330mA |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 46.1 | — | pF | $V_{DS}$ = -10V, $V_{GS}$ = 0V,<br>f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 7.2 | — | | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 4.9 | — | | |
| Gate Resistance | $R_g$ | — | 14.3 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V |
| Total Gate Charge ($V_{GS}$ = -4.5V) | $Q_g$ | — | 0.5 | — | nC | $V_{DS}$ = -10V, $I_D$ = -250mA |
| Total Gate Charge ($V_{GS}$ = -10V) | $Q_g$ | — | 0.85 | — | | |
| Gate-Source Charge | $Q_{gs}$ | — | 0.09 | — | | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.09 | — | | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 8.5 | — | ns | $V_{DD}$ = -3V, $V_{GS}$ = -2.5V,<br>$R_L$ = 300Ω, $R_G$ = 25Ω,<br>$I_D$ = -100mA |
| Turn-On Rise Time | $t_R$ | — | 4.3 | — | | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 20.2 | — | | |
| Turn-Off Fall Time | $t_F$ | — | 19.2 | — | | |

Notes: 7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to product testing.

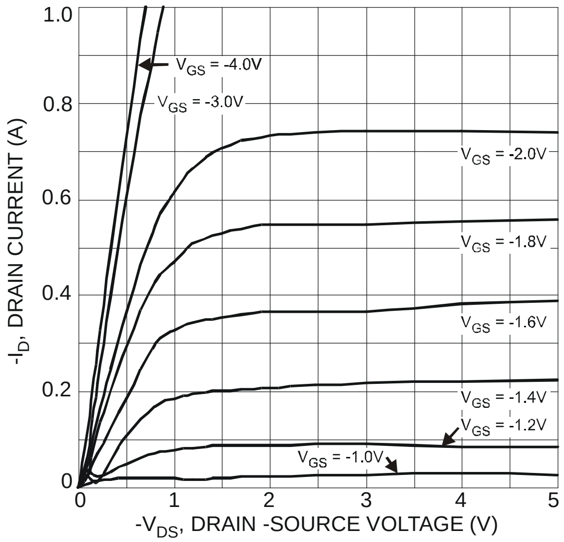


Fig. 13 Typical Output Characteristics

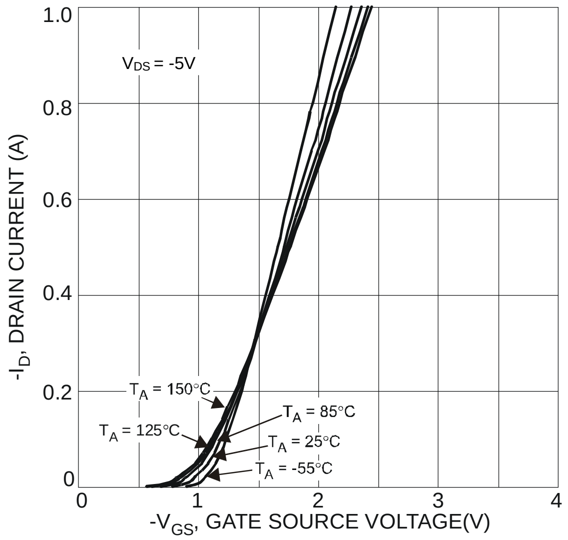


Fig. 14 Typical Transfer Characteristics

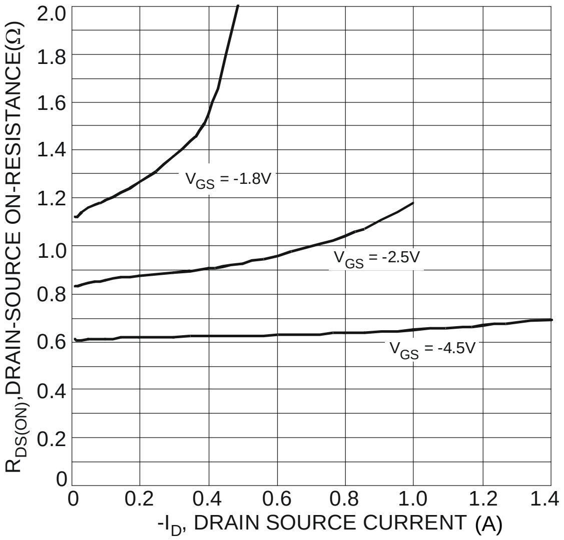


Fig. 15 Typical On-Resistance vs.
Drain Current and Gate Voltage

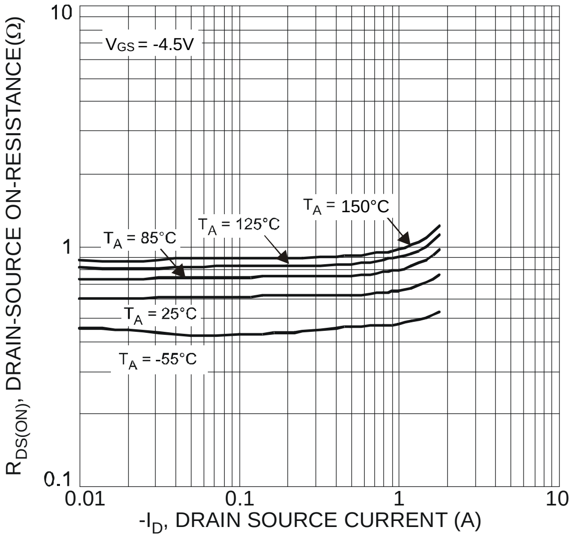


Fig. 16 Typical On-Resistance vs.
Drain Current and Temperature

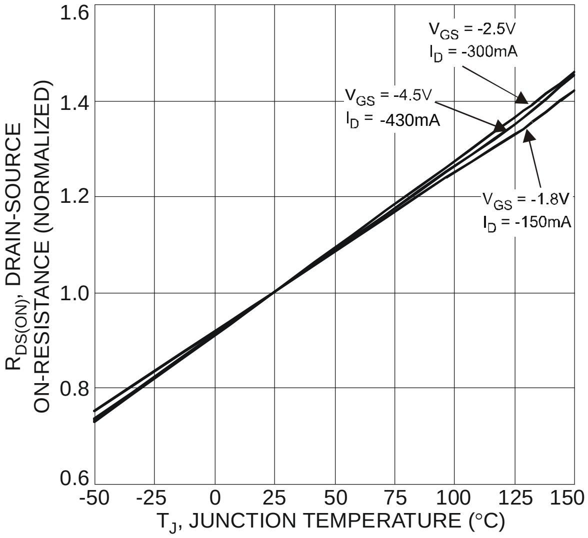


Fig. 17 On-Resistance Variation with Temperature

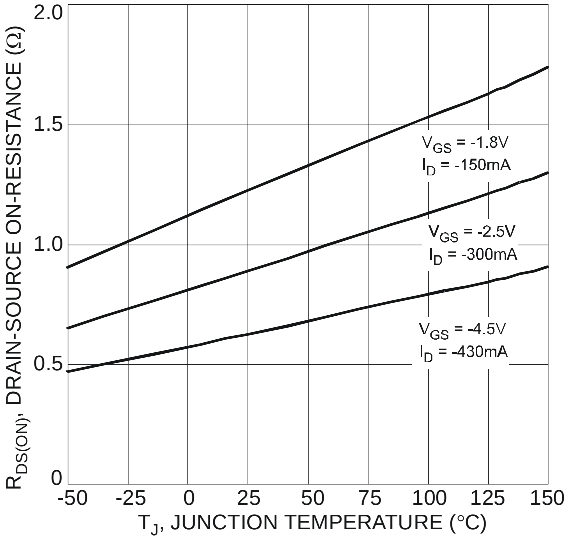


Fig. 18 On-Resistance vs.Temperature

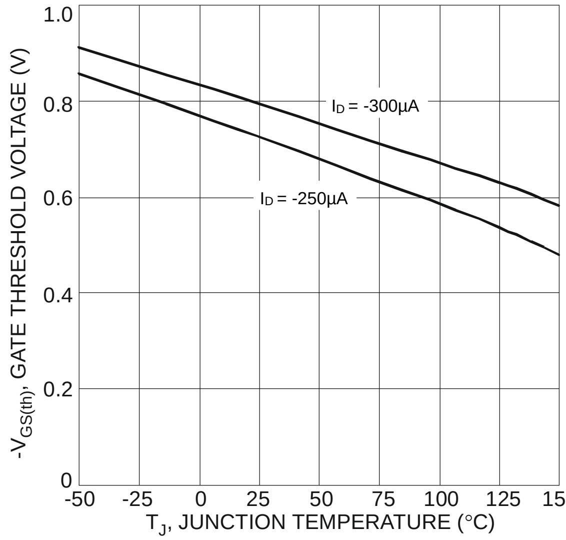


Fig. 19 Gate Threshold Voltage vs. Junction Temperature

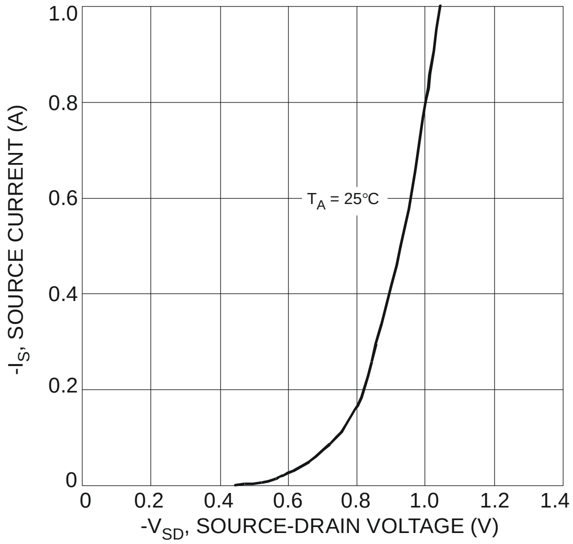


Fig. 20 Diode Forward Voltage vs. Current

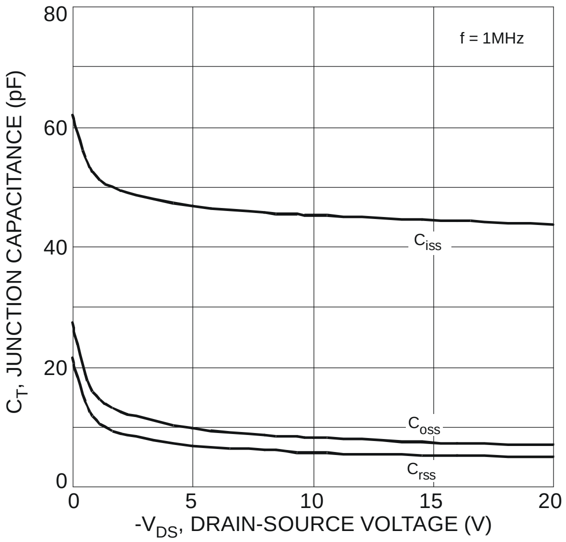


Fig. 21 Typical Junction Capacitance

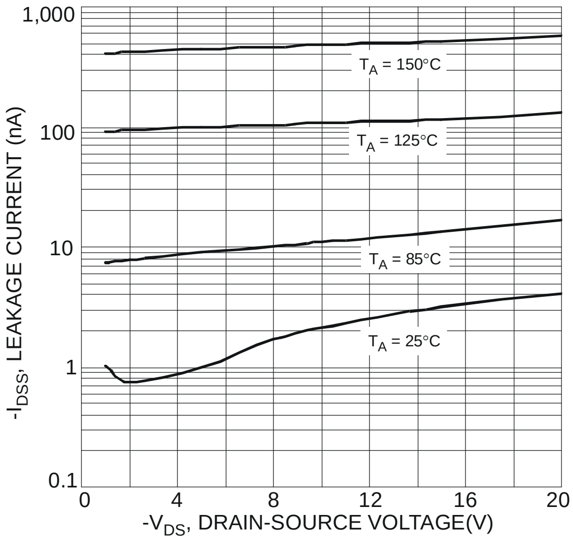


Fig. 22 Typical Drain-Source Leakage Current vs. Voltage

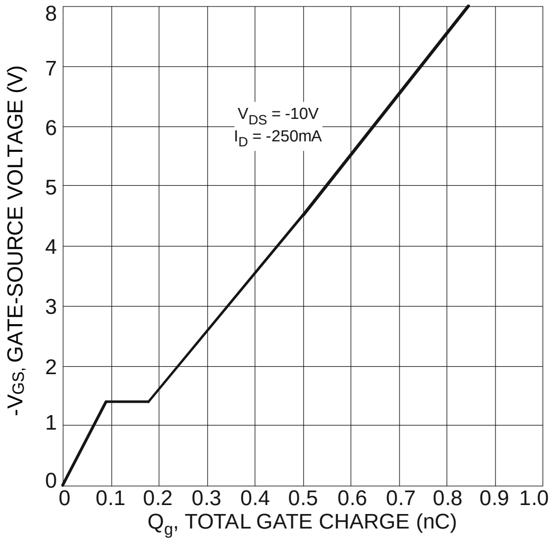


Fig. 23 Gate-Charge Characteristics

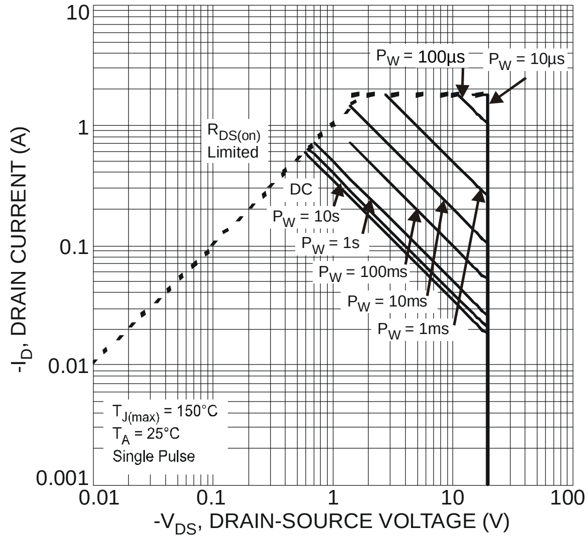


Fig. 24 SOA, Safe Operation Area

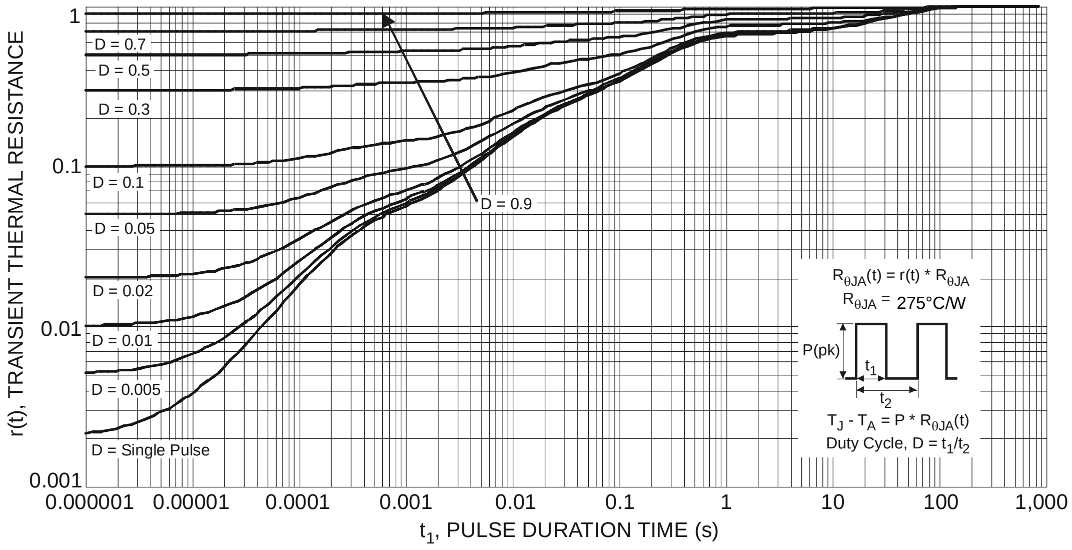
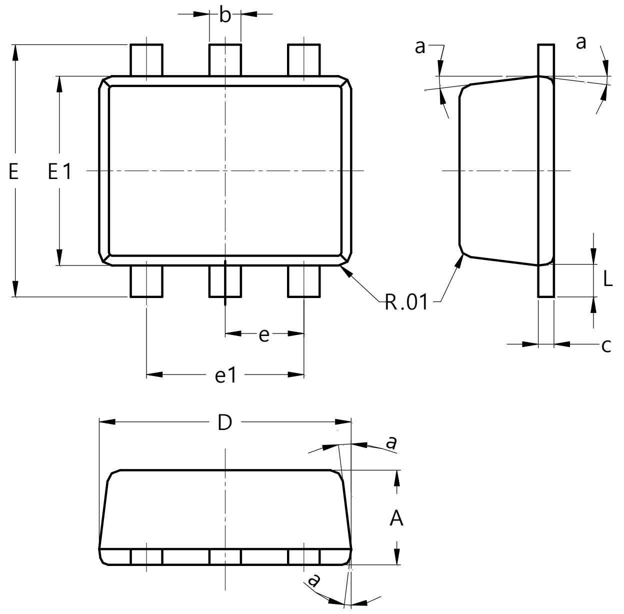


Fig. 25 Transient Thermal Response

## Package Outline Dimensions

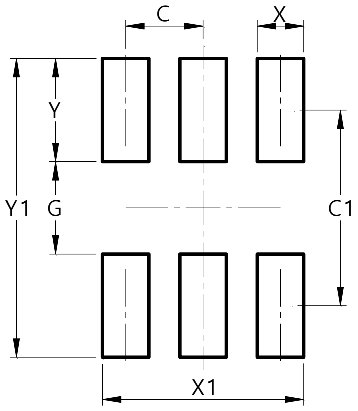
**SOT563**



| SOT563 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.55 | 0.60 | -- |
| **b** | 0.15 | 0.30 | 0.20 |
| **c** | 0.10 | 0.18 | 0.11 |
| **D** | 1.50 | 1.70 | 1.60 |
| **E** | 1.55 | 1.70 | 1.60 |
| **E1** | 1.10 | 1.25 | 1.20 |
| **e** | -- | -- | 0.50 |
| **e1** | 0.90 | 1.10 | 1.00 |
| **L** | 0.10 | 0.30 | 0.20 |
| **a** | 8° | 9° | 7° |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**SOT563**



| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.500 |
| **C1** | 1.270 |
| **G** | 0.600 |
| **X** | 0.300 |
| **X1** | 1.300 |
| **Y** | 0.670 |
| **Y1** | 1.940 |