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

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## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max<br>$T_A = +25°C$ |
|---|---|---|
| -250V | 14Ω @ $V_{GS}$ = -10V | -0.26A |
| | 18Ω @ $V_{GS}$ = -3.5V | -0.23A |

## Features and Benefits

- 0.6mm Profile – Ideal for Low-Profile Applications
- PCB Footprint of 4mm$^2$
- Low Gate Threshold Voltage
- Low On-Resistance

## Description and Applications

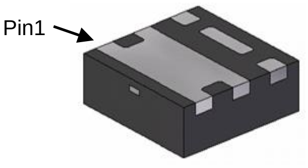
This new generation MOSFET is designed to minimize the on-state resistance ($R_{DS(ON)}$) yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

- General Purpose Interfacing Switch
- Load Switching
- Battery Management Application
- Power Management Functions

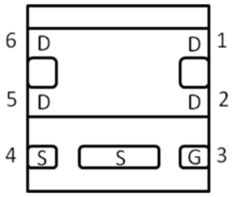
## Mechanical Data

- Case: U-DFN2020-6
- Case Material: Molded Plastic, “Green” Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish – NiPdAu over Copper Leadframe. Solderable per MIL-STD-202, Method 208 ⓔ4
- Weight: 0.0065 grams (Approximate)

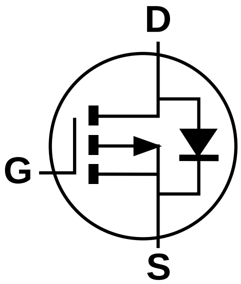
**U-DFN2020-6 (Type E)**



Bottom View



Pin Out
Bottom View



Equivalent Circuit

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

| Characteristic | | | Symbol | Value | Unit |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -250 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±40 | V |
| Continuous Drain Current (Note 6) $V_{GS}$ = -10V | Steady State | $T_A$ = +25°C<br>$T_A$ = +70°C | $I_D$ | -0.26<br>-0.21 | A |
| Pulsed Drain Current (10μs Pulse, Duty Cycle ≦1%) | | | $I_{DM}$ | -1.0 | A |
| Maximum Body Diode Continuous Current (Note 6) | | | $I_S$ | -0.26 | A |

## Thermal Characteristics

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Total Power Dissipation | (Note 5) | $P_D$ | 0.6 | W |
| | (Note 6) | | 1.4 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 191 | °C/W |
| | (Note 6) | | 86 | |
| Thermal Resistance, Junction to Case | (Note 6) | $R_{\theta JC}$ | 17 | |
| Operating and Storage Temperature Range | | $T_J$, $T_{STG}$ | -55 to +150 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| **OFF CHARACTERISTICS (Note 7)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -250 | — | — | V | $V_{GS}$ = 0V, $I_D$ = -1mA |
| Zero Gate Voltage Drain Current $T_J$ = +25°C | $I_{DSS}$ | — | — | -1 | μA | $V_{DS}$ = -250V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±100 | nA | $V_{GS}$ = ±40V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 7)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -0.5 | -1.7 | -2.5 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -1mA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 10 | 14 | Ω | $V_{GS}$ = -10V, $I_D$ = -200mA |
| | | | 13 | 18 | | $V_{GS}$ = -3.5V, $I_D$ = -100mA |
| Diode Forward Voltage | $V_{SD}$ | — | -0.8 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -200mA |
| **DYNAMIC CHARACTERISTICS (Note 8)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 81 | — | pF | $V_{DS}$ = -25V, $V_{GS}$ = 0V,<br>f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 14 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 4 | — | pF | |
| Gate Resistance | $R_g$ | — | 13 | — | Ω | $V_{DS}$ = 0V, $V_{GS}$ = 0V, f = 1MHz |
| Total Gate Charge ($V_{GS}$ = -10V) | $Q_g$ | — | 2.8 | — | nC | $V_{DS}$ = -25V, $I_D$ = -200mA |
| Gate-Source Charge | $Q_{gs}$ | — | 0.3 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 0.6 | — | nC | |
| Turn-On Delay Time | $t_{D(ON)}$ | — | 7.5 | — | ns | $V_{DS}$ = -30V, $I_D$ = -200mA<br>$V_{GS}$ = -10V, $R_G$ = 50Ω |
| Turn-On Rise Time | $t_R$ | — | 25 | — | ns | |
| Turn-Off Delay Time | $t_{D(OFF)}$ | — | 124 | — | ns | |
| Turn-Off Fall Time | $t_F$ | — | 95 | — | ns | |
| Reverse Recovery Time | $t_{RR}$ | — | 85 | — | ns | $I_F$ = -1.0A, di/dt = 100A/μs |
| Reverse Recovery Charge | $Q_{RR}$ | — | 294 | — | μC | |

Notes:
5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
6. Device mounted on FR-4 substrate PC board, 2oz copper, with thermal vias to bottom layer 1inch square copper plate.
7. Short duration pulse test used to minimize self-heating effect.
8. Guaranteed by design. Not subject to production testing.

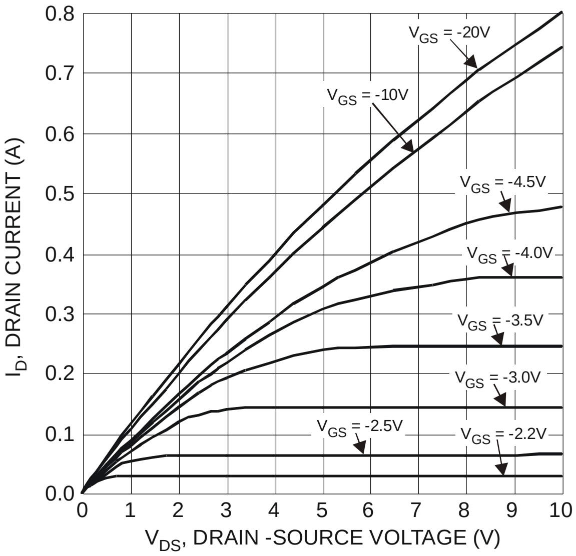


Figure 1 Typical Output Characteristics

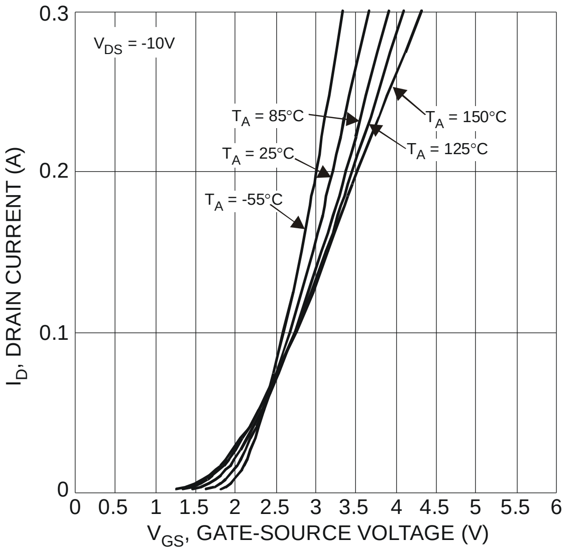


Figure 2 Typical Transfer Characteristics

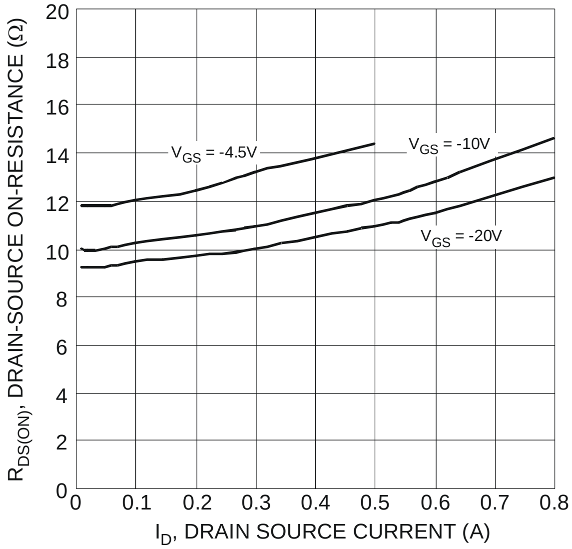


Figure 3 Typical On-Resistance vs.
Drain Current and Gate Voltage

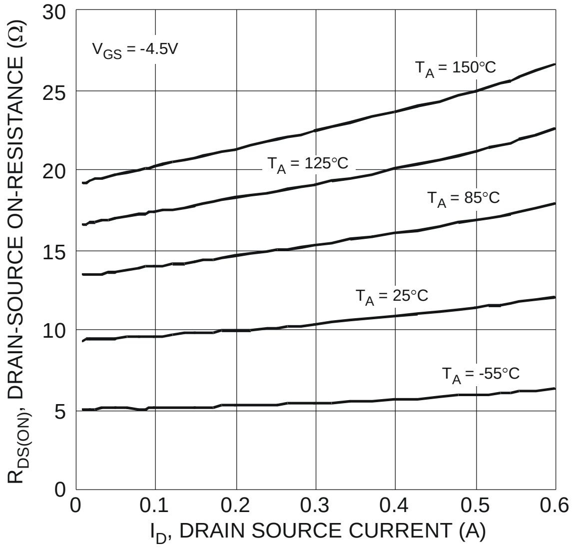


Figure 4 Typical On-Resistance vs.
Drain Current and Temperature

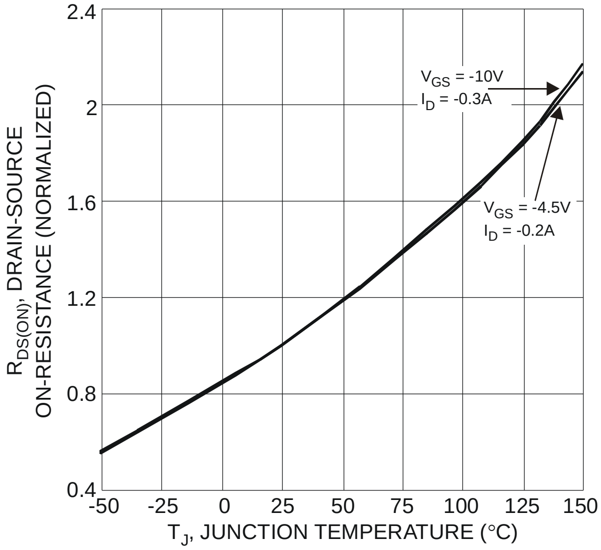


Figure 5 On-Resistance Variation with Temperature

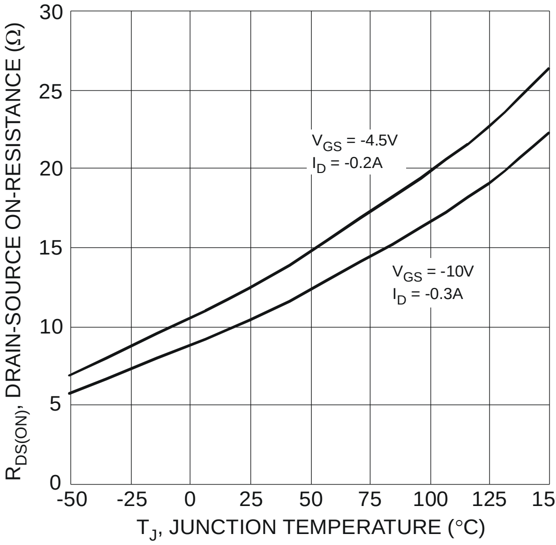


Figure 6 On-Resistance Variation with Temperature

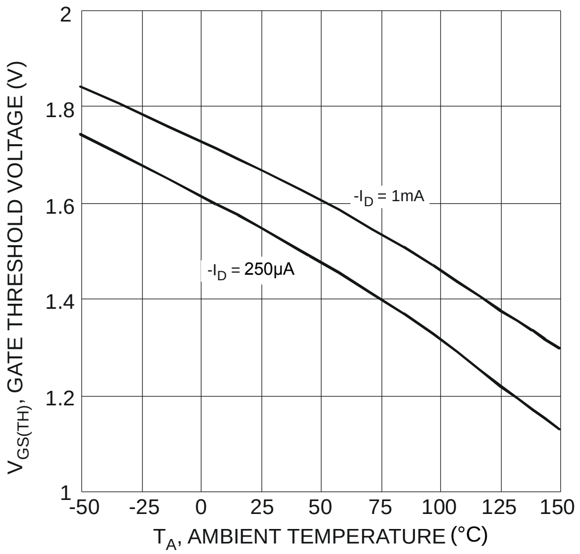


Figure 7 Gate Threshold Variation vs. Ambient Temperature

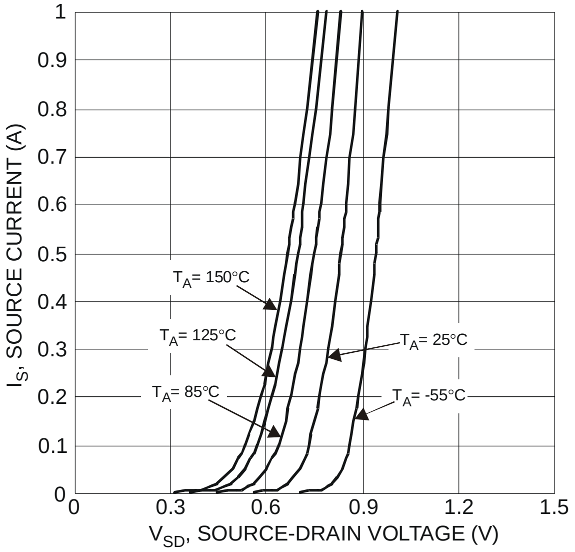


Figure 8 Diode Forward Voltage vs. Current

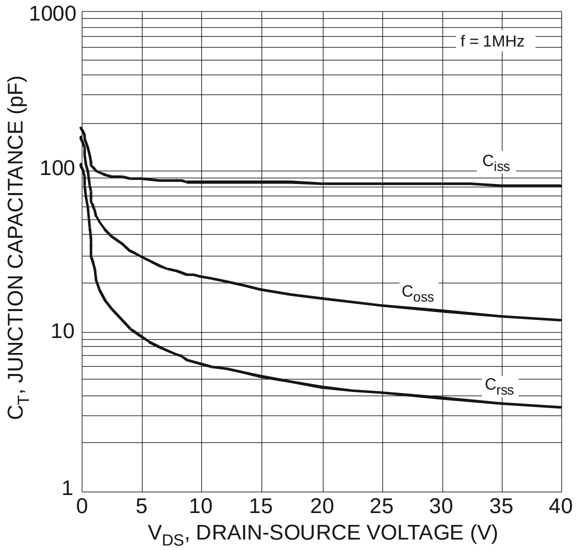


Figure 9 Typical Junction Capacitance

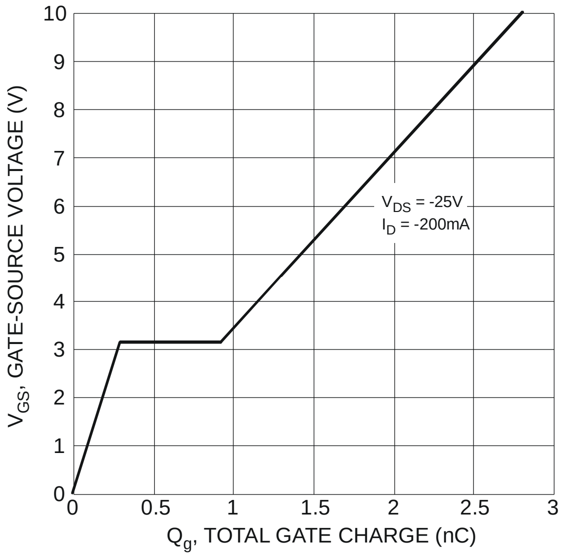


Figure 10 Gate-Charge Characteristics

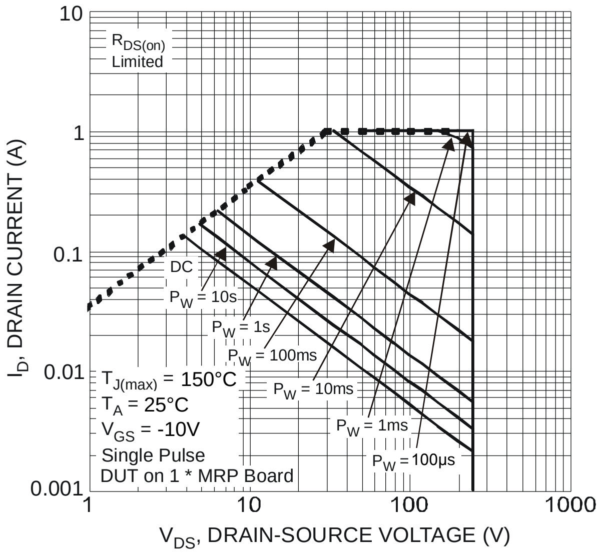


Figure 11 SOA, Safe Operation Area

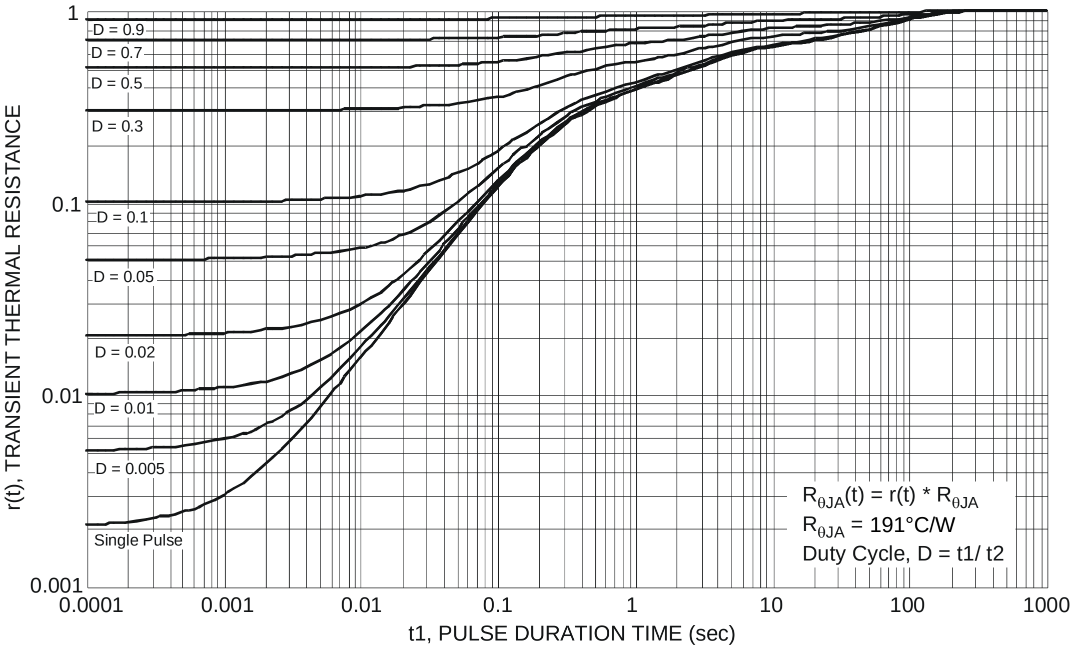
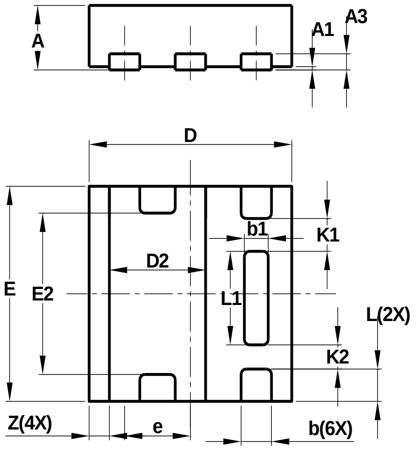


Figure 12 Transient Thermal Resistance

## Package Outline Dimensions

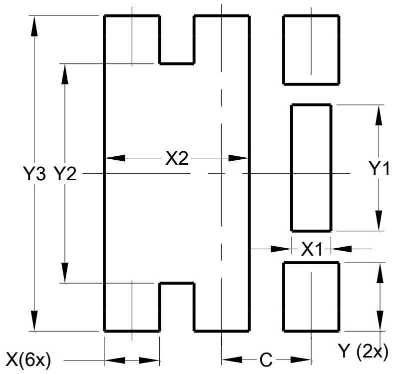
**U-DFN2020-6 (Type E)**



| U-DFN2020-6<br>Type E | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.57 | 0.63 | 0.60 |
| **A1** | 0 | 0.05 | 0.03 |
| **A3** | — | — | 0.15 |
| **b** | 0.25 | 0.35 | 0.30 |
| **b1** | 0.185 | 0.285 | 0.235 |
| **D** | 1.95 | 2.05 | 2.00 |
| **D2** | 0.85 | 1.05 | 0.95 |
| **E** | 1.95 | 2.05 | 2.00 |
| **E2** | 1.40 | 1.60 | 1.50 |
| **e** | — | — | 0.65 |
| **L** | 0.25 | 0.35 | 0.30 |
| **L1** | 0.82 | 0.92 | 0.87 |
| **K1** | — | — | 0.305 |
| **K2** | — | — | 0.225 |
| **Z** | — | — | 0.20 |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

**U-DFN2020-6 (Type E)**



| Dimensions | Value (in mm) |
|---|---|
| **C** | 0.650 |
| **X** | 0.400 |
| **X1** | 0.285 |
| **X2** | 1.050 |
| **Y** | 0.500 |
| **Y1** | 0.920 |
| **Y2** | 1.600 |
| **Y3** | 2.300 |