

COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET
Product Summary

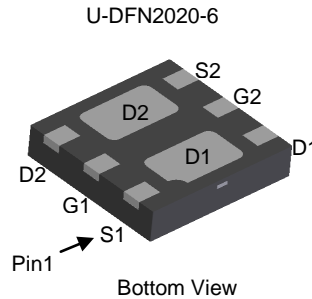
| Device | V _{(BR)DSS} | R _{DS(ON)} max | I _D MAX T _A = +25°C |
|-----------------|----------------------|---------------------------------|--|
| Q1 N-Channel | 20V | 40mΩ @ V _{GS} = 4.5V | 4.7A |
| | | 65mΩ @ V _{GS} = 2.5V | 3.7A |
| Q2 P-Channel | -20V | 90mΩ @ V _{GS} = -4.5V | -3.2A |
| | | 137mΩ @ V _{GS} = -2.5V | -2.6A |

Description

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

Applications

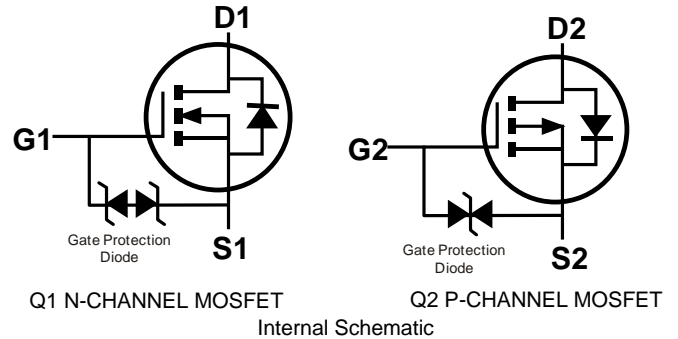
- Load Switch
- Power Management Functions
- Portable Power Adaptors


Features

- Low On-Resistance
- Low Input Capacitance
- Low Profile, 0.6mm Max Height
- **ESD protected Gate**
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

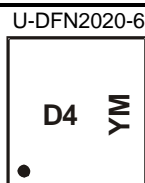
Mechanical Data

- 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 (e4)
- Terminal Connections: See Diagram Below
- Weight: 0.0065 grams (Approximate)


Ordering Information (Note 4)

| Part Number | Case | Packaging |
|-----------------|-------------|--------------------|
| DMC2041UFDB -7 | U-DFN2020-6 | 3,000/Tape & Reel |
| DMC2041UFDB -13 | U-DFN2020-6 | 10,000/Tape & Reel |

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
 2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
 3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
 4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

Marking Information


D4 = Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: B = 2014)
 M = Month (ex: 9 = September)

Date Code Key

| Year | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 |
|------|------|------|------|------|------|------|------|
| Code | B | C | D | E | F | G | H |

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Code | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | O | N | D |

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

| Characteristic | | Symbol | Q1 N-CHANNEL | Q2 P-CHANNEL | Units |
|--|--------------|--|-----------------|-----------------|-------|
| Drain-Source Voltage | | V _{DS} | 20 | -20 | V |
| Gate-Source Voltage | | V _{GS} | ±12 | ±12 | V |
| Continuous Drain Current (Note 5) V _{GS} = 4.5V | Steady State | T _A = +25°C T _A = +70°C | 4.7 3.8 | -3.2 -2.5 | A |
| | t < 5s | T _A = +25°C T _A = +70°C | 6.1 4.9 | -4.1 -3.2 | A |
| Maximum Continuous Body Diode Forward Current (Note 5) | | I _S | 2 | -1.5 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | I _{DM} | 30 | -18 | A |

Thermal Characteristics

| Characteristic | | Symbol | Value | Units |
|--|--------------|-----------------------------------|------------|-------|
| Total Power Dissipation (Note 5) | Steady State | P _D | 1.4 | W |
| | t < 5s | | 2.2 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State | R _{θJA} | 92 | °C/W |
| | t < 5s | | 55 | |
| Thermal Resistance, Junction to Case (Note 5) | | R _{θJC} | 30 | |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -55 to 150 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------|------|------|-----|------|--|
| OFF CHARACTERISTICS (Note 6) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | 20 | — | — | V | V _{GS} = 0V, I _D = 250µA |
| Zero Gate Voltage Drain Current T _J = +25°C | I _{DSS} | — | — | 1.0 | µA | V _{DS} = 20V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±10 | µA | V _{GS} = ±8V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 6) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | 0.35 | — | 1.4 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(on)} | — | 23 | 40 | mΩ | V _{GS} = 4.5V, I _D = 4.2A |
| | | — | 26 | 65 | | V _{GS} = 2.5V, I _D = 3.3A |
| Diode Forward Voltage | V _{SD} | — | 0.7 | 1.2 | V | V _{GS} = 0V, I _S = 4.4A |
| DYNAMIC CHARACTERISTICS (Note 7) | | | | | | |
| Input Capacitance | C _{iss} | — | 713 | — | pF | V _{DS} = 10V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 80 | — | pF | |
| Reverse Transfer Capacitance | C _{rss} | — | 68 | — | pF | |
| Gate Resistance | R _g | — | 15 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1MHz |
| Total Gate Charge (V _{GS} = 4.5V) | Q _g | — | 8 | — | nC | V _{DS} = 10V, I _D = 5.5A |
| Total Gate Charge (V _{GS} = 8V) | | — | 15 | — | nC | |
| Gate-Source Charge | Q _{gs} | — | 1.0 | — | nC | |
| Gate-Drain Charge | Q _{gd} | — | 1.1 | — | nC | |
| Turn-On Delay Time | t _{D(on)} | — | 3.6 | — | ns | V _{DD} = 10V, V _{GS} = 4.5V, R _L = 2.3Ω, R _G = 1Ω |
| Turn-On Rise Time | t _r | — | 15.9 | — | ns | |
| Turn-Off Delay Time | t _{D(off)} | — | 16.0 | — | ns | |
| Turn-Off Fall Time | t _f | — | 2.6 | — | ns | |
| Body Diode Reverse Recovery Time | t _{rr} | — | 6.6 | — | nS | I _S = 4.4A, dI/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | Q _{rr} | — | 1.2 | — | nC | I _S = 4.4A, dI/dt = 100A/µs |

- Notes: 5. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to product testing.

Electrical Characteristics Q2 P-CHANNEL (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|--------------|-------|-------|----------|------------|---|
| OFF CHARACTERISTICS (Note 6) | | | | | | |
| Drain-Source Breakdown Voltage | BV_{DSS} | -20 | — | — | V | $V_{GS} = 0V, I_D = -250\mu A$ |
| Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$ | I_{DSS} | — | — | -1.0 | μA | $V_{DS} = -20V, V_{GS} = 0V$ |
| Gate-Source Leakage | I_{GSS} | — | — | ± 10 | μA | $V_{GS} = \pm 8V, V_{DS} = 0V$ |
| ON CHARACTERISTICS (Note 6) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -0.35 | — | -1.4 | V | $V_{DS} = V_{GS}, I_D = -250\mu A$ |
| Static Drain-Source On-Resistance | $R_{DS(on)}$ | — | 59 | 90 | m Ω | $V_{GS} = -4.5V, I_D = -2.9A$ |
| | | — | 76 | 137 | | $V_{GS} = -2.5V, I_D = -2.3A$ |
| Diode Forward Voltage | V_{SD} | — | -0.65 | -1.2 | V | $V_{GS} = 0V, I_S = -3.0A$ |
| DYNAMIC CHARACTERISTICS (Note 7) | | | | | | |
| Input Capacitance | C_{iss} | — | 881 | — | pF | $V_{DS} = -10V, V_{GS} = 0V, f = 1.0MHz$ |
| Output Capacitance | C_{oss} | — | 84 | — | pF | |
| Reverse Transfer Capacitance | C_{rss} | — | 67 | — | pF | |
| Gate Resistance | R_g | — | 14.3 | — | Ω | $V_{DS} = 0V, V_{GS} = 0V, f = 1MHz$ |
| Total Gate Charge ($V_{GS} = -4.5V$) | Q_g | — | 11 | — | nC | $V_{DS} = -10V, I_D = -3.7A$ |
| Total Gate Charge ($V_{GS} = -8V$) | | — | 18 | — | nC | |
| Gate-Source Charge | Q_{gs} | — | 1.5 | — | nC | |
| Gate-Drain Charge | Q_{gd} | — | 2.3 | — | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 5.0 | — | ns | |
| Turn-On Rise Time | t_r | — | 9.5 | — | ns | $V_{DD} = -10V, V_{GS} = -4.5V, R_L = 3.3\Omega, R_G = 1\Omega$ |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 29.7 | — | ns | |
| Turn-Off Fall Time | t_f | — | 20.4 | — | ns | |
| Body Diode Reverse Recovery Time | t_{rr} | — | 23.6 | — | nS | $I_S = -3.0A, dI/dt = 100A/\mu s$ |
| Body Diode Reverse Recovery Charge | Q_{rr} | — | 11.4 | — | nC | $I_S = -3.0A, dI/dt = 100A/\mu s$ |

Notes: 6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to product testing.

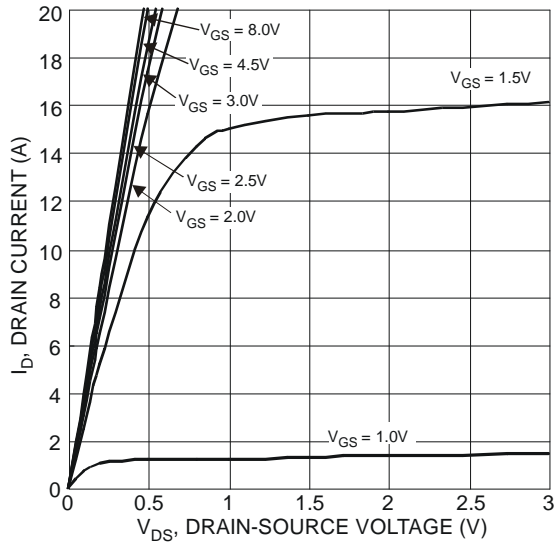


Figure 1 Typical Output Characteristics

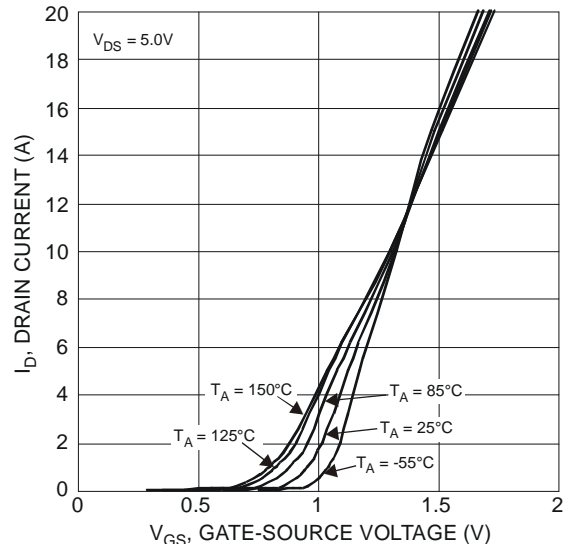


Figure 2 Typical Transfer Characteristics

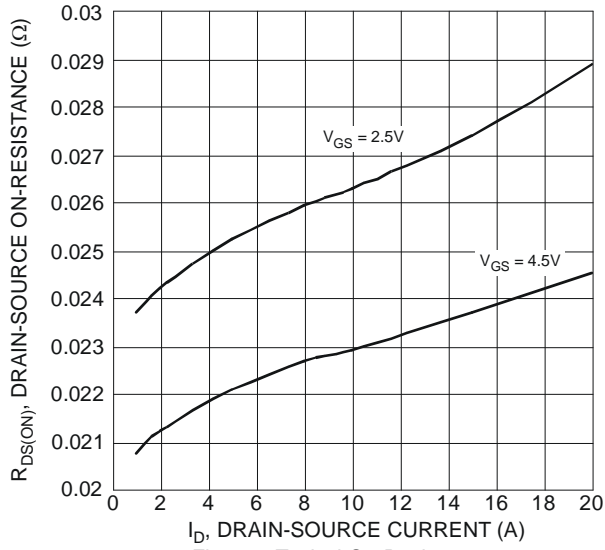


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

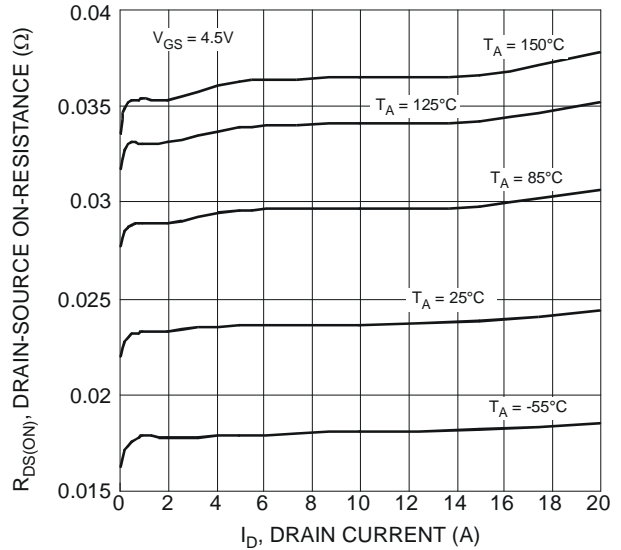


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

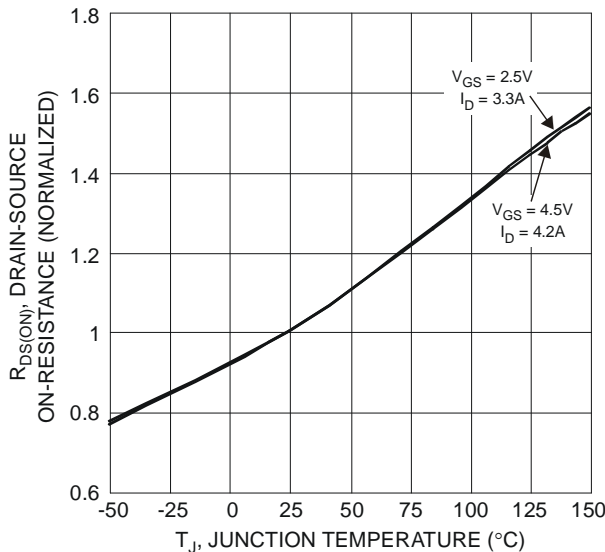


Figure 5 On-Resistance Variation with Temperature

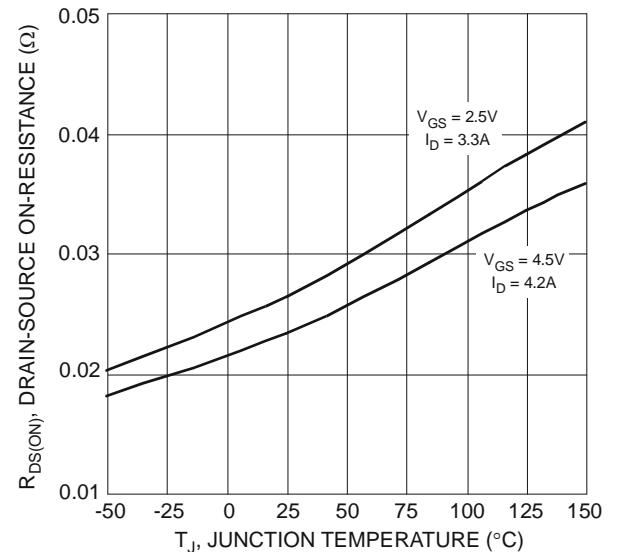


Figure 6 On-Resistance Variation with Temperature

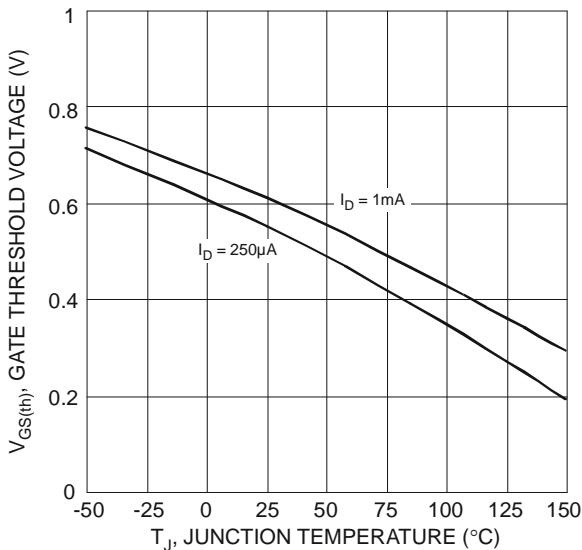


Figure 7 Gate Threshold Variation vs. Ambient Temperature

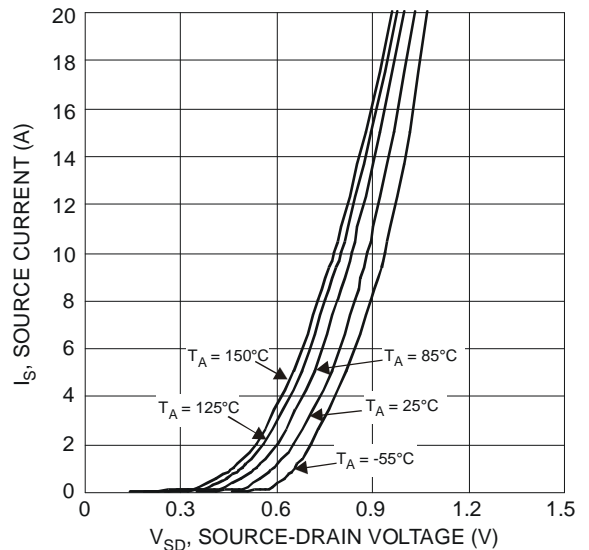


Figure 8 Diode Forward Voltage vs. Current

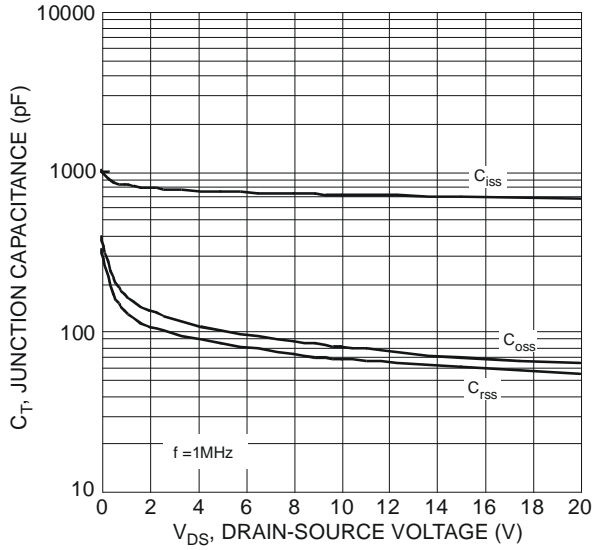


Figure 9 Typical Junction Capacitance

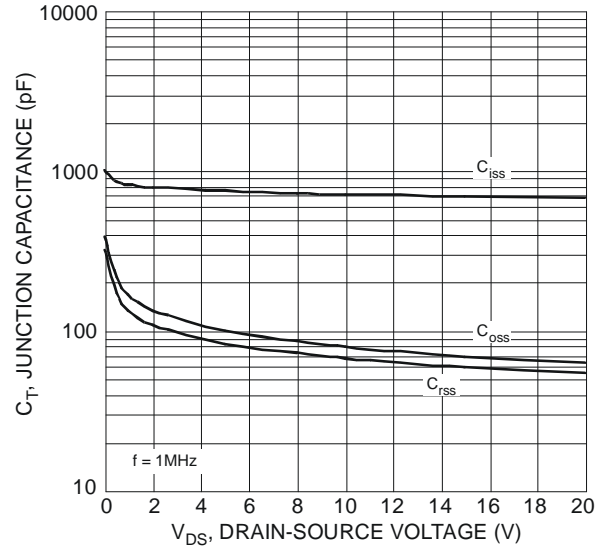


Figure 10 Typical Junction Capacitance

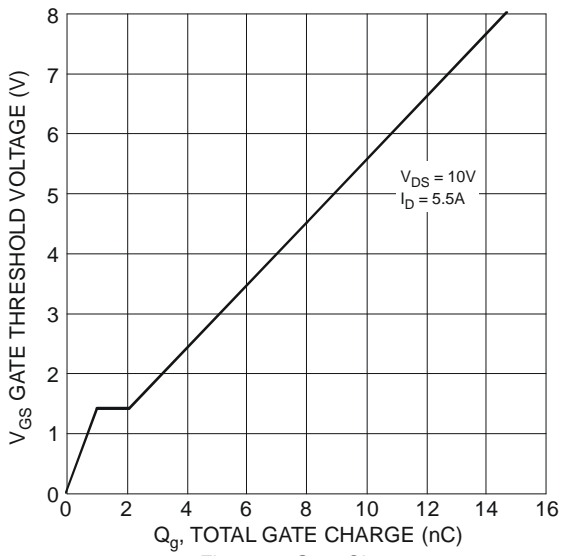


Figure 11 Gate Charge

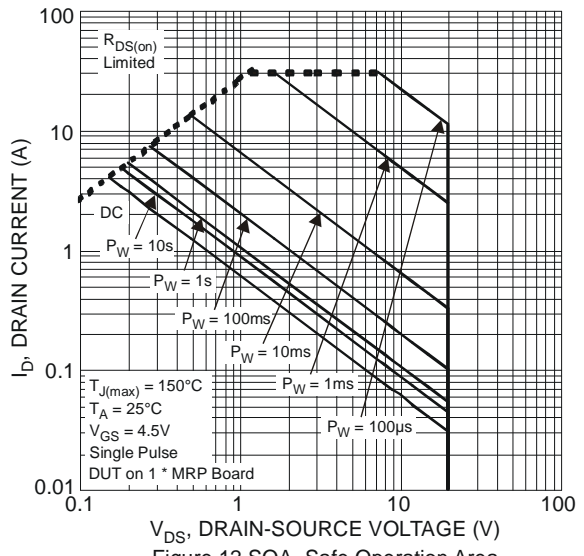


Figure 12 SOA, Safe Operation Area

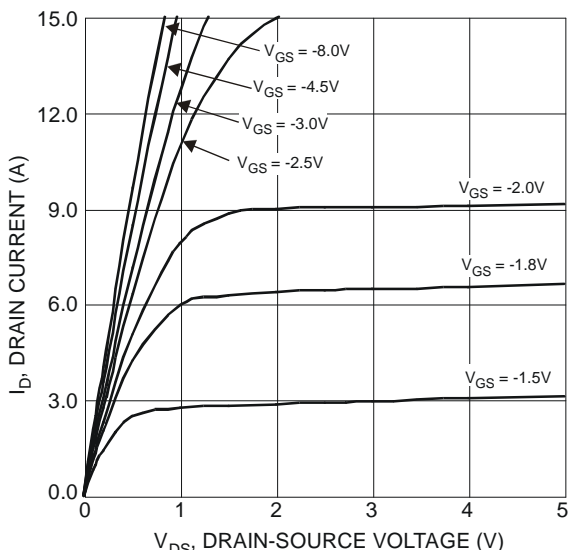


Figure 13 Typical Output Characteristics

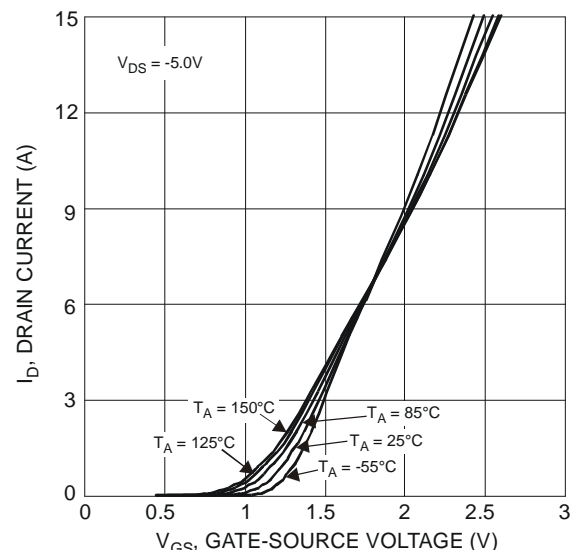


Figure 14 Typical Transfer Characteristics

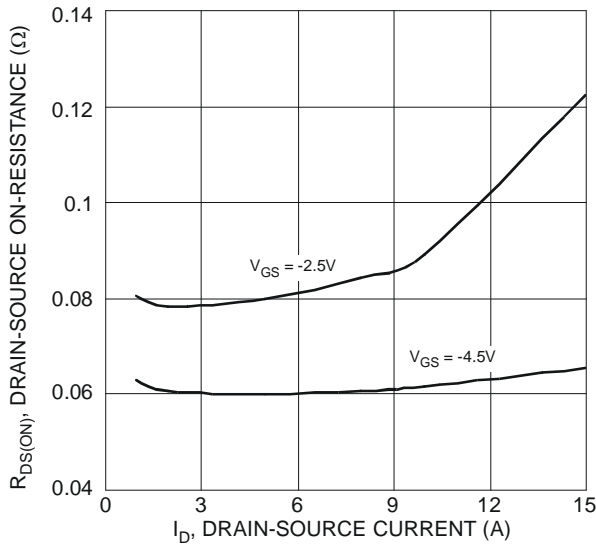


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

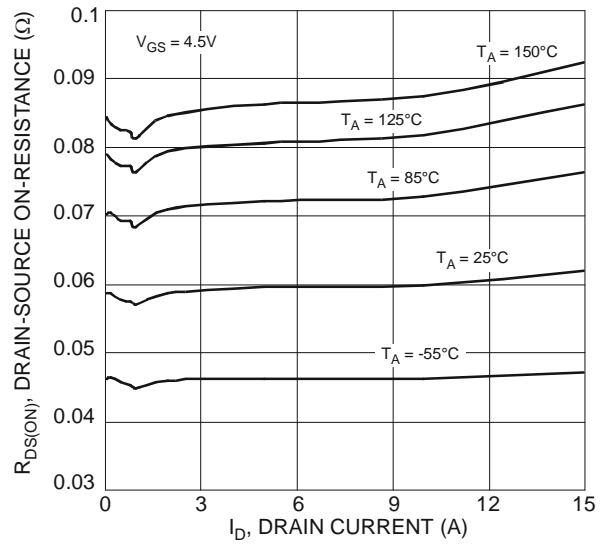


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

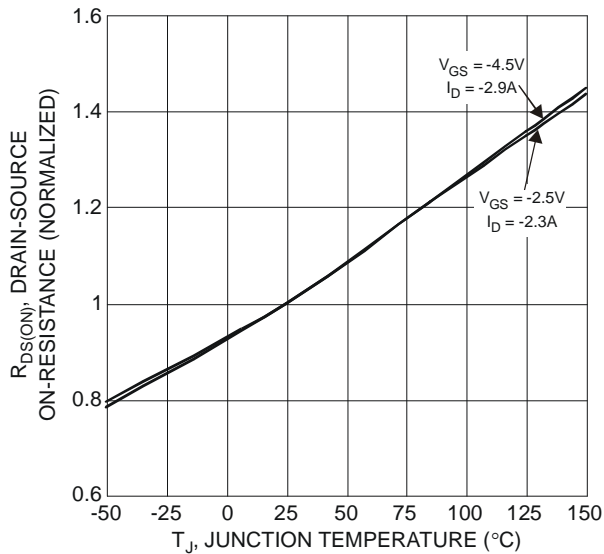


Figure 17 On-Resistance Variation with Temperature

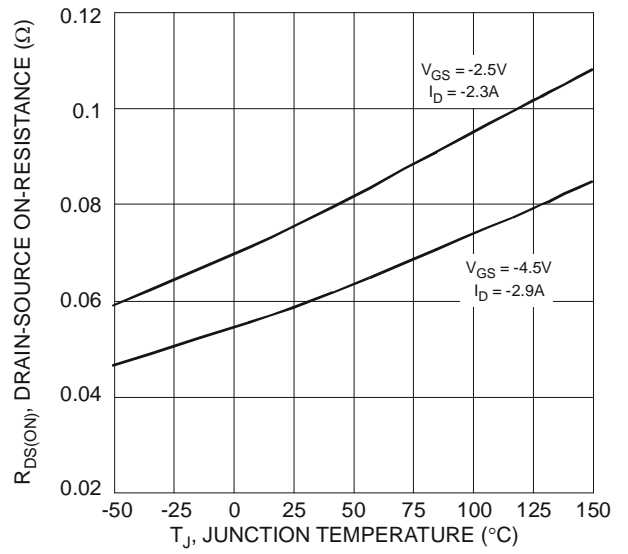


Figure 18 On-Resistance Variation with Temperature

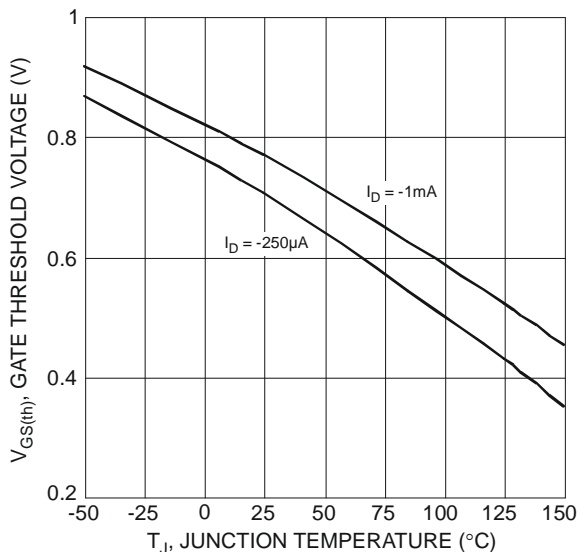


Figure 19 Gate Threshold Variation vs. Ambient Temperature

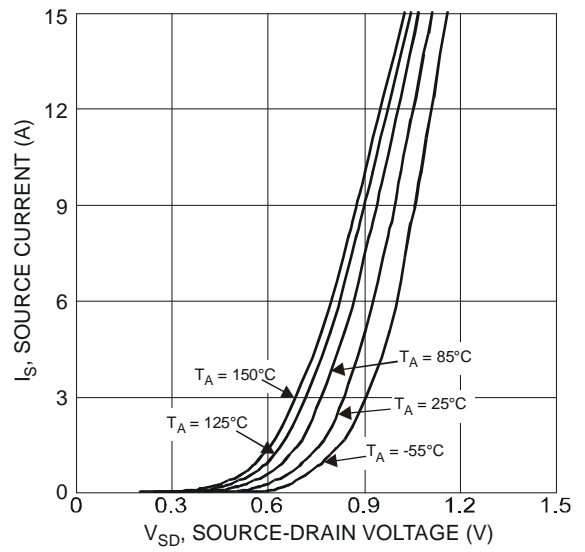


Figure 20 Diode Forward Voltage vs. Current

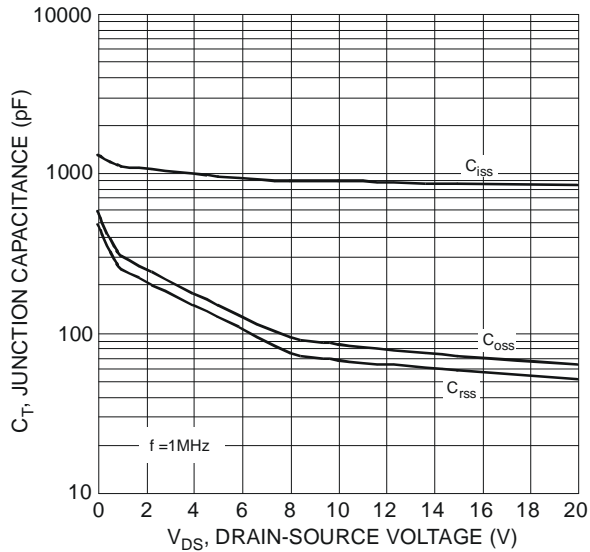


Figure 21 Typical Junction Capacitance

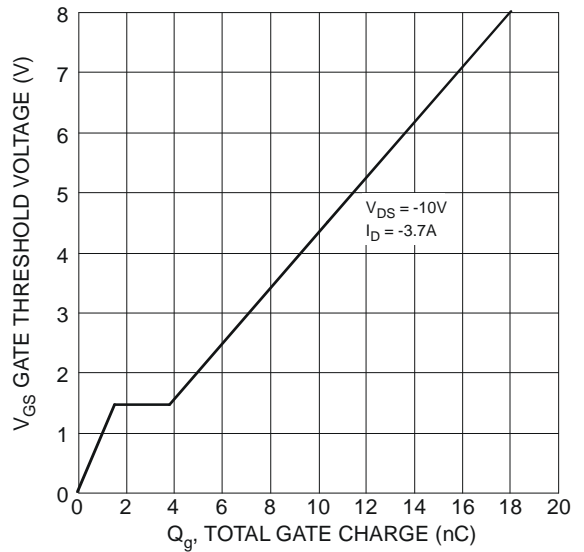


Figure 22 Gate Charge

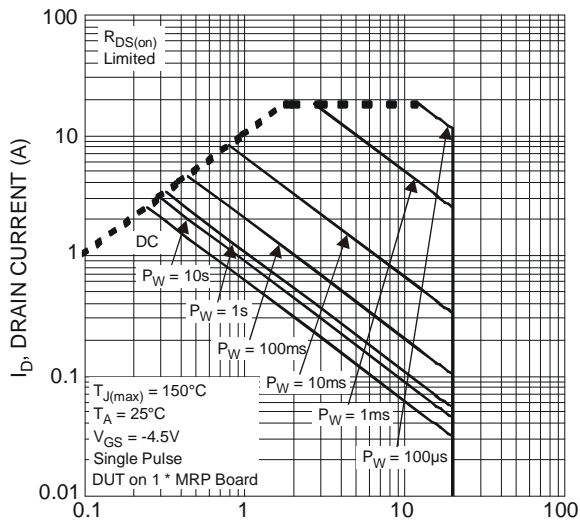


Figure 23 SOA, Safe Operation Area

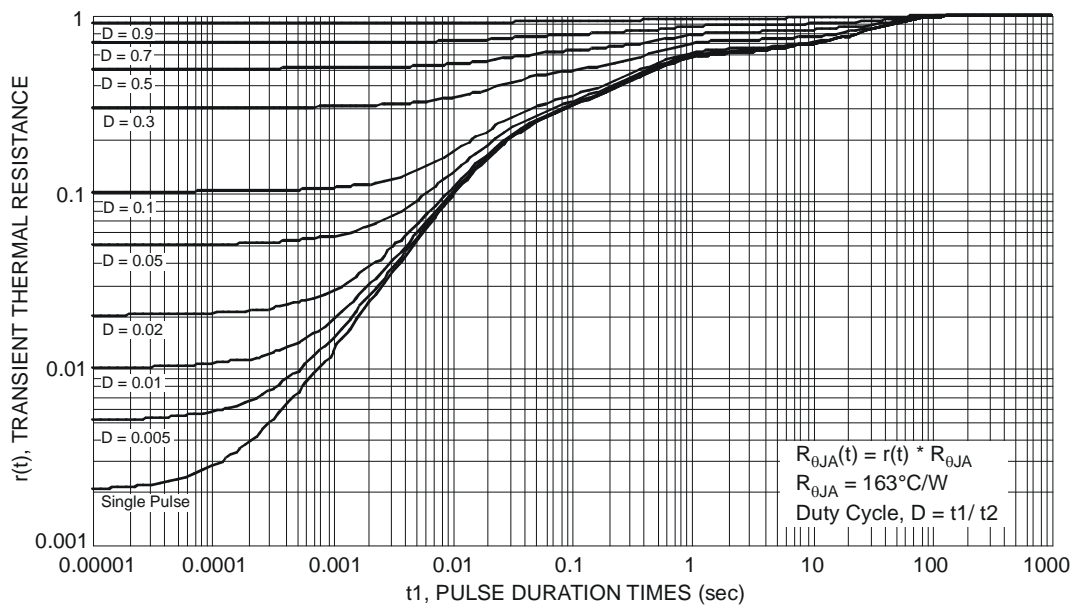
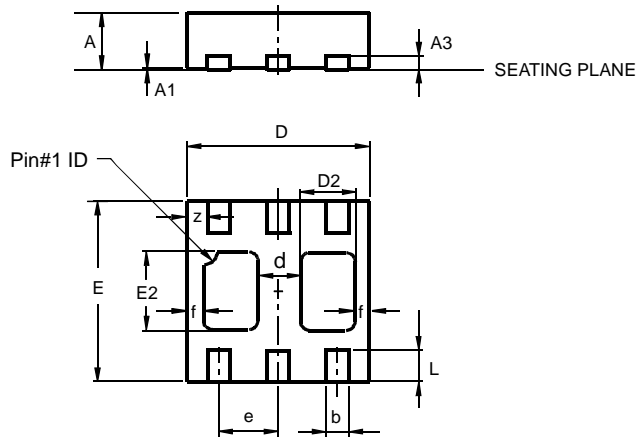


Figure 24 Transient Thermal Resistance

Package Outline Dimensions

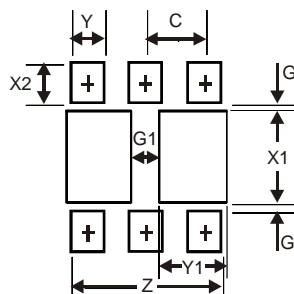
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the version.



| U-DFN2020-6 Type B | | | |
|-----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 0.545 | 0.605 | 0.575 |
| A1 | 0 | 0.05 | 0.02 |
| A3 | — | — | 0.13 |
| b | 0.20 | 0.30 | 0.25 |
| D | 1.95 | 2.075 | 2.00 |
| d | — | — | 0.45 |
| D2 | 0.50 | 0.70 | 0.60 |
| e | — | — | 0.65 |
| E | 1.95 | 2.075 | 2.00 |
| E2 | 0.90 | 1.10 | 1.00 |
| f | — | — | 0.15 |
| L | 0.25 | 0.35 | 0.30 |
| z | — | — | 0.225 |
| All Dimensions in mm | | | |

Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the latest version.



| Dimensions | Value (in mm) |
|------------|---------------|
| Z | 1.67 |
| G | 0.20 |
| G1 | 0.40 |
| X1 | 1.0 |
| X2 | 0.45 |
| Y | 0.37 |
| Y1 | 0.70 |
| C | 0.65 |

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