

Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(on)}$ max | I_D $T_A = +25^\circ C$ |
|-----------------|---------------|----------------------------------|------------------------------|
| Q1 N-Channel | 60V | 40m Ω @ $V_{GS} = 10V$ | 6.5 A |
| | | 55m Ω @ $V_{GS} = 4.5V$ | 5.6 A |
| Q2 P-Channel | -60V | 110m Ω @ $V_{GS} = -10V$ | -3.9 A |
| | | 130m Ω @ $V_{GS} = -4.5V$ | -3.6 A |

Description and Applications

This new generation MOSFET has been 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.

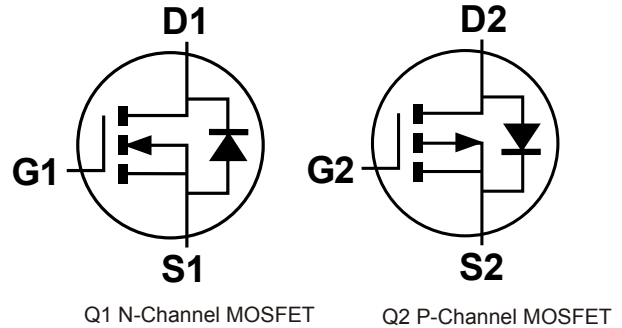
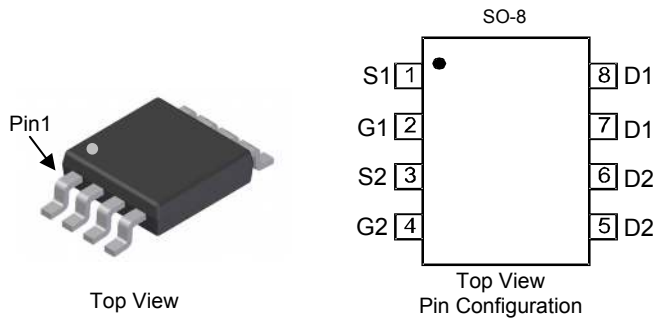
- DC-DC Converters
- Power Management Functions
- Backlighting

Features and Benefits

- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

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 – Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208 e3
- Weight: 0.074 grams (approximate)

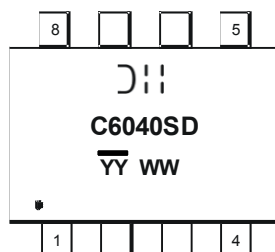
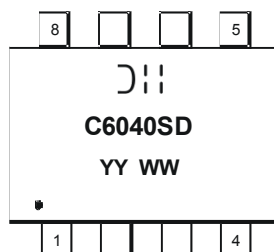


Ordering Information (Note 4)

| Part Number | Case | Packaging |
|---------------|------|-------------------|
| DMC6040SSD-13 | SO-8 | 2,500/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


Chengdu A/T Site

Shanghai A/T Site

- $\text{D}|||$ = Manufacturer's Marking
- C6040SD = Product Type Marking Code
- YYWW = Date Code Marking
- YY or YY = Year (ex: 14= 2014)
- WW = Week (01 - 53)
- YY = Date Code Marking for SAT (Shanghai Assembly/ Test site)
- YY = Date Code Marking for CAT (Chengdu Assembly/ Test site)

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

| Characteristic | | | Symbol | Q1 | Q2 | Units |
|--|--------------|--|------------------|------------|--------------|-------|
| Drain-Source Voltage | | | V _{DSS} | 60 | -60 | V |
| Gate-Source Voltage | | | V _{GSS} | ±20 | ±20 | V |
| Continuous Drain Current (Note 6) V _{GS} = -10V | Steady State | T _A = +25°C T _A = +70°C | I _D | 5.1 4.1 | -3.1 -2.5 | A |
| | t < 10s | T _A = +25°C T _A = +70°C | I _D | 6.5 5.2 | -3.9 -3.1 | A |
| Maximum Body Diode Forward Current (Note 6) | | | I _S | 2.1 | -2.1 | A |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%) | | | I _{DM} | 28 | -19 | A |
| Avalanche Current (Note 7) L = 0.1mH | | | I _{AS} | 17.2 | -17.6 | A |
| Avalanche Energy (Note 7) L = 0.1mH | | | E _{AS} | 14.7 | 15.4 | mJ |

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

| Characteristic | | Symbol | Value | Units |
|--|------------------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 5) | T _A = +25°C | P _D | 1.24 | W |
| | T _A = +70°C | | 0.8 | |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady state | R _{θJA} | 101 | °C/W |
| | t < 10s | | 61 | |
| Total Power Dissipation (Note 6) | T _A = +25°C | P _D | 1.56 | W |
| | T _A = +70°C | | 1.0 | |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state | R _{θJA} | 80 | °C/W |
| | t < 10s | | 49 | |
| Thermal Resistance, Junction to Case (Note 6) | | R _{θJC} | 14.7 | |
| Operating and Storage Temperature Range | | T _J , T _{STG} | -55 to +150 | °C |

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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|--|---------------------|-----|------|------|------|--|
| OFF CHARACTERISTICS (Note 8) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | 60 | — | — | V | V _{GS} = 0V, I _D = 250µA |
| Zero Gate Voltage Drain Current | I _{DSS} | — | — | 1 | µA | V _{DS} = 48V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | ±100 | nA | V _{GS} = ±20V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 8) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | 1 | — | 3 | V | V _{DS} = V _{GS} , I _D = 250µA |
| Static Drain-Source On-Resistance | R _{DS(on)} | — | 33 | 40 | mΩ | V _{GS} = 10V, I _D = 8A |
| | | — | 37 | 55 | | V _{GS} = 4.5V, I _D = 5A |
| Diode Forward Voltage | V _{SD} | — | 0.7 | 1.2 | V | V _{GS} = 0V, I _S = 1A |
| DYNAMIC CHARACTERISTICS (Note 9) | | | | | | |
| Input Capacitance | C _{iss} | — | 1130 | — | pF | V _{DS} = 15V, V _{GS} = 0V f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 69 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 42 | — | | |
| Gate Resistance | R _G | — | 1.7 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1.0MHz |
| Total Gate Charge (V _{GS} = 10V) | Q _g | — | 20.8 | — | nC | V _{DS} = 30V, I _D = 4.3A |
| Total Gate Charge (V _{GS} = 4.5V) | Q _g | — | 9.4 | — | | |
| Gate-Source Charge | Q _{gs} | — | 3.3 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 3.0 | — | | |
| Turn-On Delay Time | t _{D(on)} | — | 3.6 | — | nS | V _{GS} = 10V, V _{DD} = 30V, R _G = 6Ω, I _D = 4.3A |
| Turn-On Rise Time | t _r | — | 1.8 | — | | |
| Turn-Off Delay Time | t _{D(off)} | — | 20.1 | — | | |
| Turn-Off Fall Time | t _f | — | 4.3 | — | | |
| Body Diode Reverse Recovery Time | t _{rr} | — | 14.2 | — | nS | I _S = 4.3A, di/dt = 100A/µs |
| Body Diode Reverse Recovery Charge | Q _{rr} | — | 7.5 | — | nC | I _S = 4.3A, di/dt = 100A/µs |

- 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 1inch square copper plate.
 - UIS in production with L = 0.1mH, starting T_A = +25°C.
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to product testing.

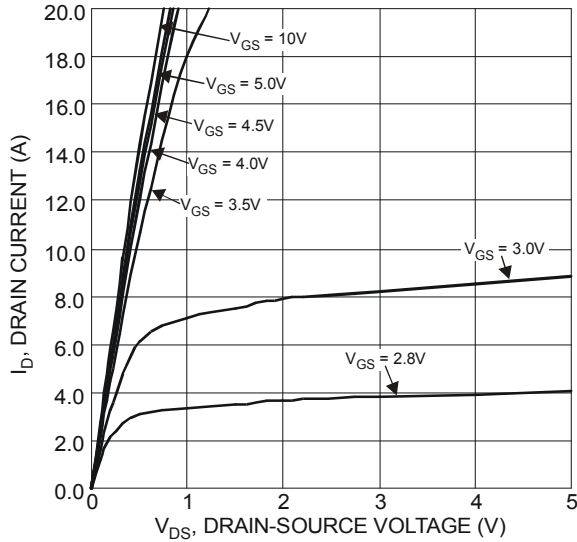


Figure 1 Typical Output Characteristics

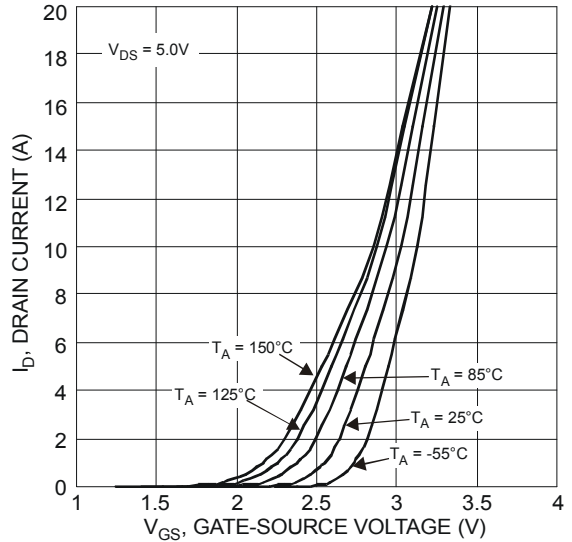


Figure 2 Typical Transfer Characteristics

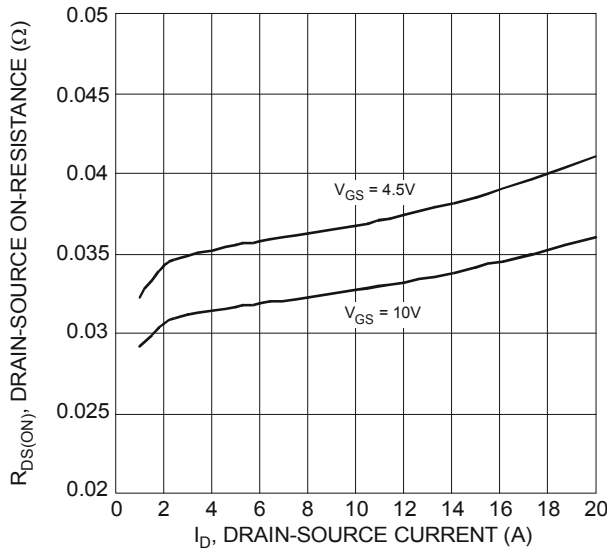


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

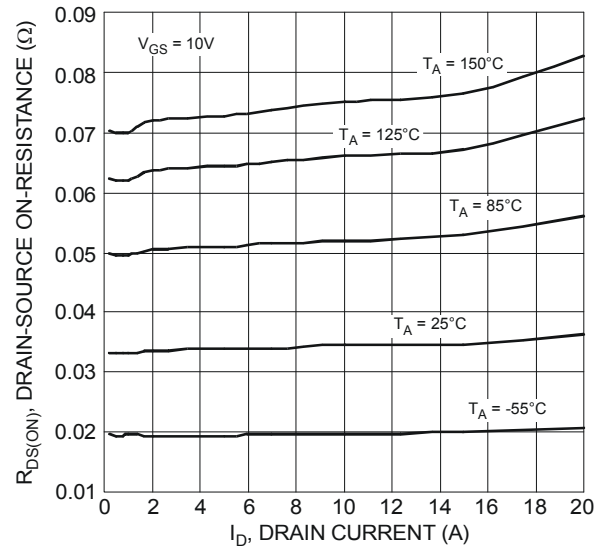


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

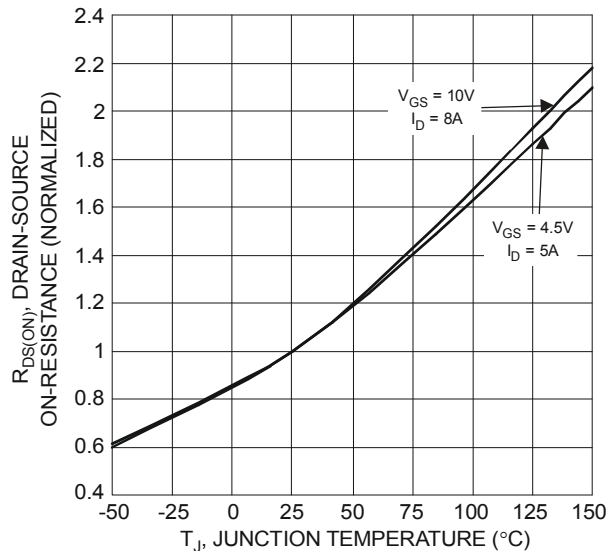


Figure 5 On-Resistance Variation with Temperature

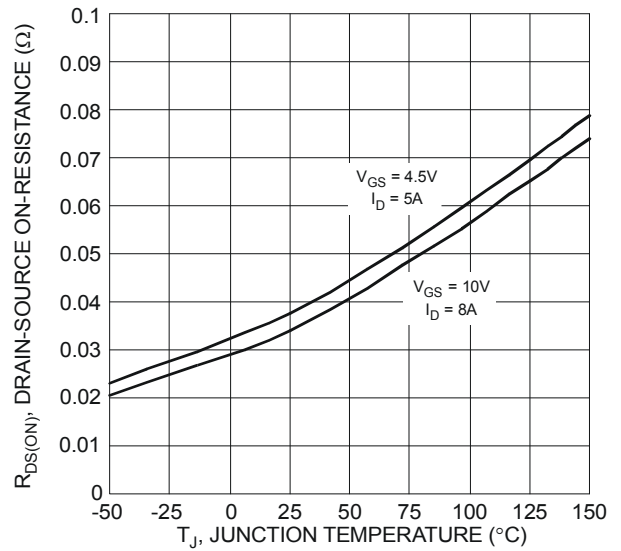


Figure 6 On-Resistance Variation with Temperature

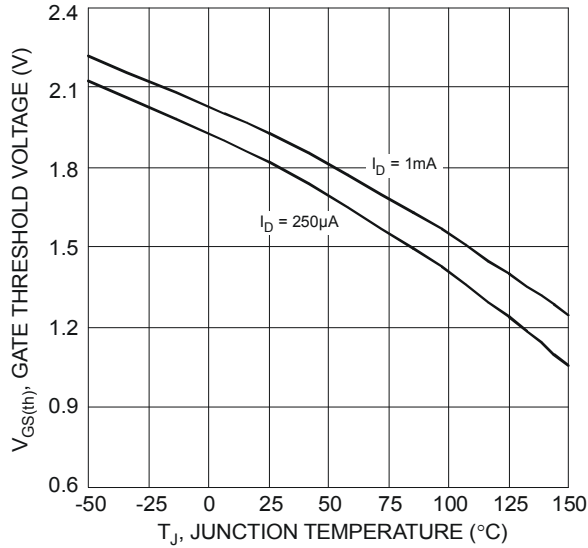


Figure 7 Gate Threshold Variation vs. Ambient Temperature

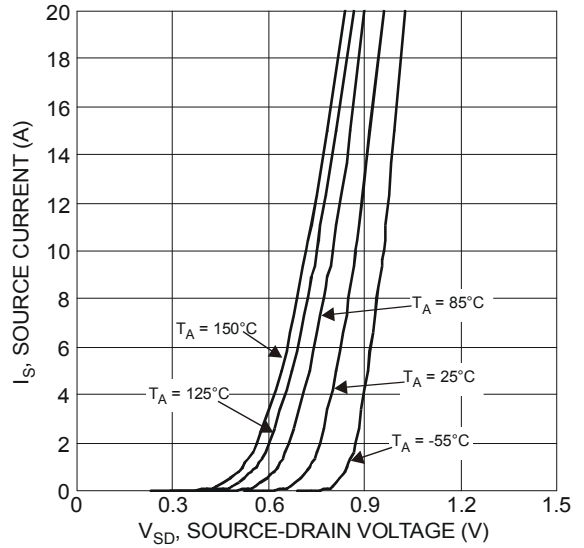


Figure 8 Diode Forward Voltage vs. Current

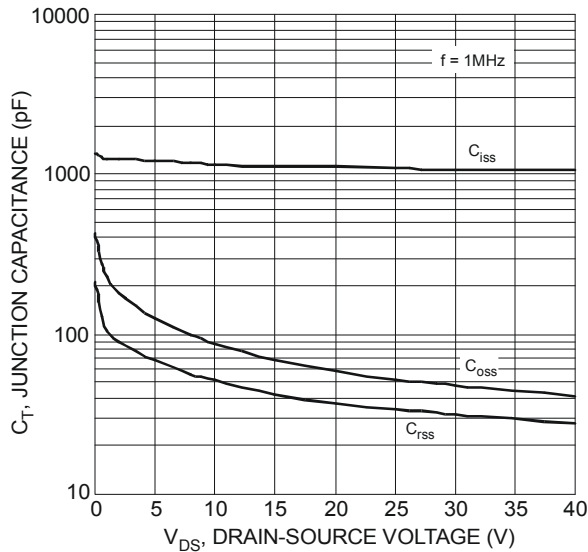


Figure 9 Typical Junction Capacitance

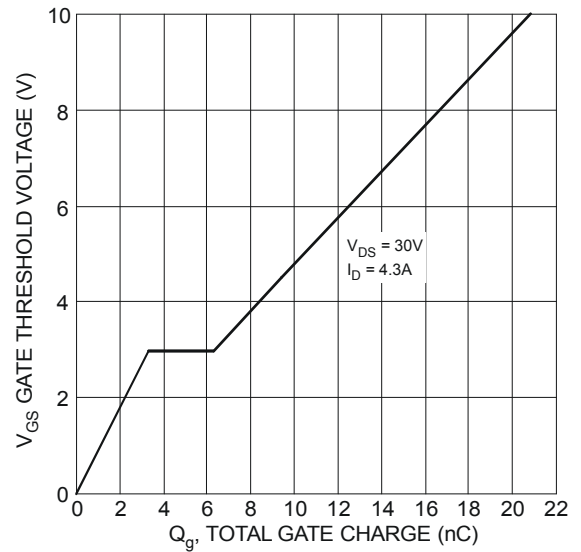


Figure 10 Gate Charge

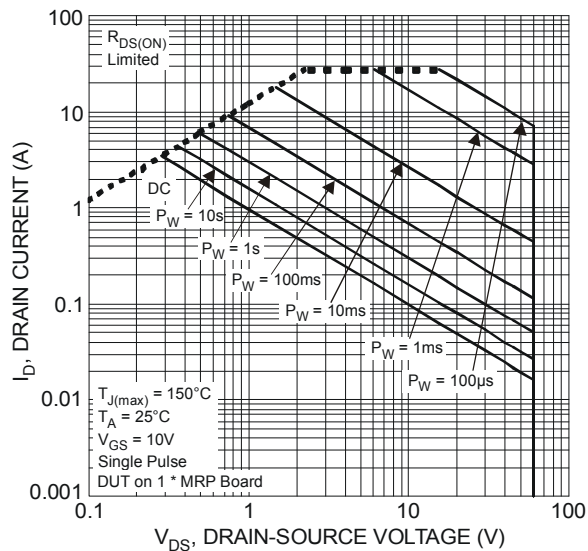
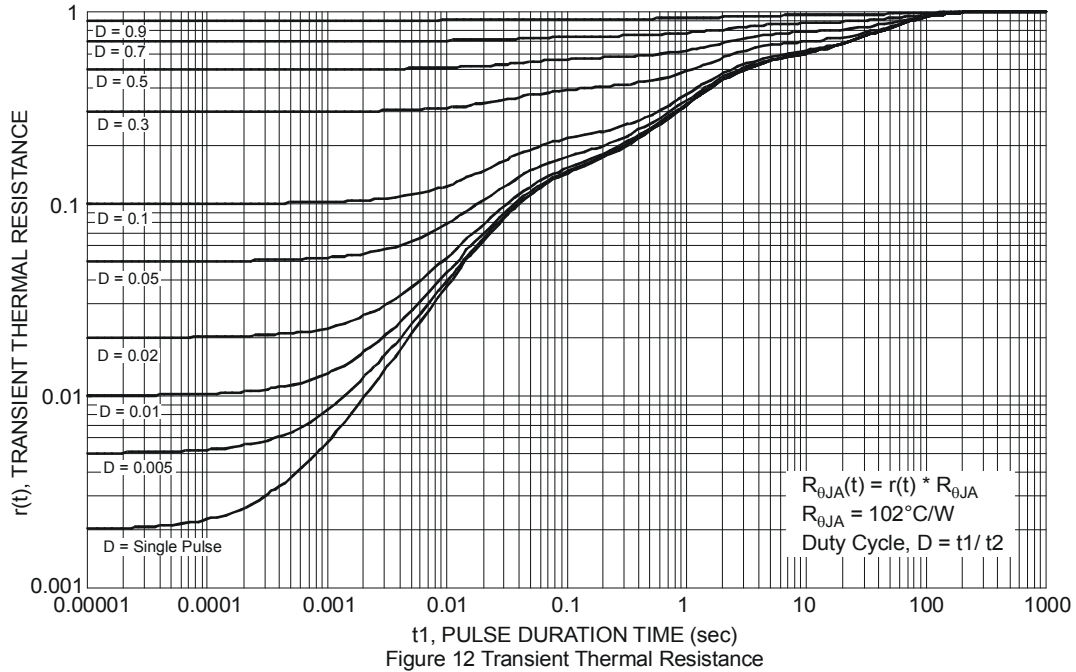


Figure 11 SOA, Safe Operation Area



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

| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---------------------|-----|-------|------|------|---|
| OFF CHARACTERISTICS (Note 8) | | | | | | |
| Drain-Source Breakdown Voltage | BV _{DSS} | -60 | — | — | V | V _{GS} = 0V, I _D = -250μA |
| Zero Gate Voltage Drain Current | I _{DSS} | — | — | -1 | μA | V _{DS} = -48V, V _{GS} = 0V |
| Gate-Source Leakage | I _{GSS} | — | — | 100 | nA | V _{GS} = ±16V, V _{DS} = 0V |
| ON CHARACTERISTICS (Note 8) | | | | | | |
| Gate Threshold Voltage | V _{GS(th)} | -1 | — | -3 | V | V _{DS} = V _{GS} , I _D = -250μA |
| Static Drain-Source On-Resistance | R _{DS(on)} | — | 86 | 110 | mΩ | V _{GS} = -10V, I _D = -4.5A |
| | | — | 98 | 130 | | V _{GS} = -4.5V, I _D = -3.5A |
| Diode Forward Voltage | V _{SD} | — | -0.7 | -1.2 | V | V _{GS} = 0V, I _S = -1A |
| DYNAMIC CHARACTERISTICS (Note 9) | | | | | | |
| Input Capacitance | C _{iss} | — | 1030 | — | pF | V _{DS} = -30V, V _{GS} = 0V, f = 1.0MHz |
| Output Capacitance | C _{oss} | — | 49.1 | — | | |
| Reverse Transfer Capacitance | C _{rss} | — | 38.7 | — | | |
| Gate Resistance | R _G | — | 13.6 | — | Ω | V _{DS} = 0V, V _{GS} = 0V, f = 1.0MHz |
| Total Gate Charge (V _{GS} = -4.5V) | Q _g | — | 9.5 | — | nC | V _{DS} = -30V, I _D = -5A |
| Total Gate Charge (V _{GS} = -10V) | Q _g | — | 19.4 | — | | |
| Gate-Source Charge | Q _{gs} | — | 2.3 | — | | |
| Gate-Drain Charge | Q _{gd} | — | 3.6 | — | | |
| Turn-On Delay Time | t _{D(on)} | — | 3.7 | — | nS | V _{GS} = -10V, V _{DS} = -30V, R _{GEN} = 6Ω, I _D = -5A |
| Turn-On Rise Time | t _r | — | 6.3 | — | | |
| Turn-Off Delay Time | t _{D(off)} | — | 58.7 | — | | |
| Turn-Off Fall Time | t _f | — | 26.1 | — | | |
| Body Diode Reverse Recovery Time | t _{rr} | — | 14.85 | — | nS | I _S = -5A, di/dt = 100A/μs |
| Body Diode Reverse Recovery Charge | Q _{rr} | — | 8.8 | — | nC | I _S = -5A, di/dt = 100A/μs |

- 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.
 7. UIS in production with L = 0.1mH, starting T_A = +25°C.
 8. Short duration pulse test used to minimize self-heating effect.
 9. Guaranteed by design. Not subject to product testing.

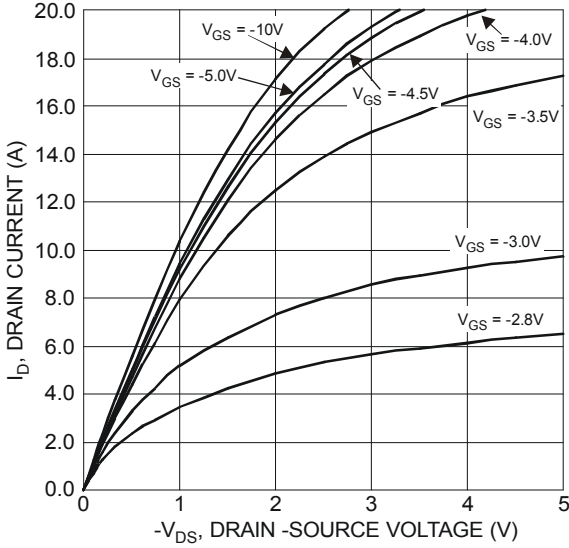


Figure 13 Typical Output Characteristics

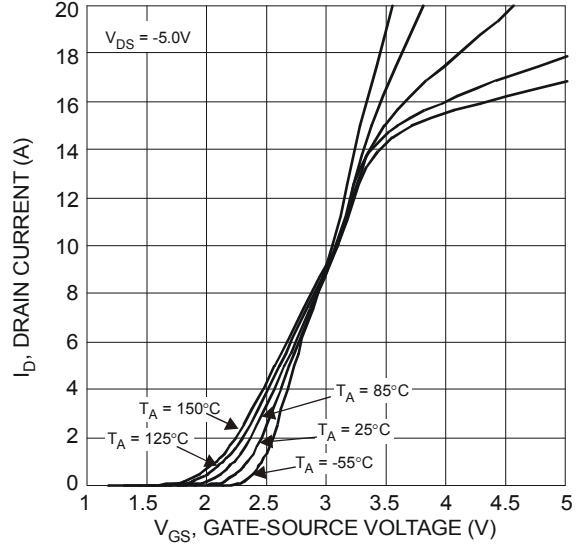


Figure 14 Typical Transfer Characteristics

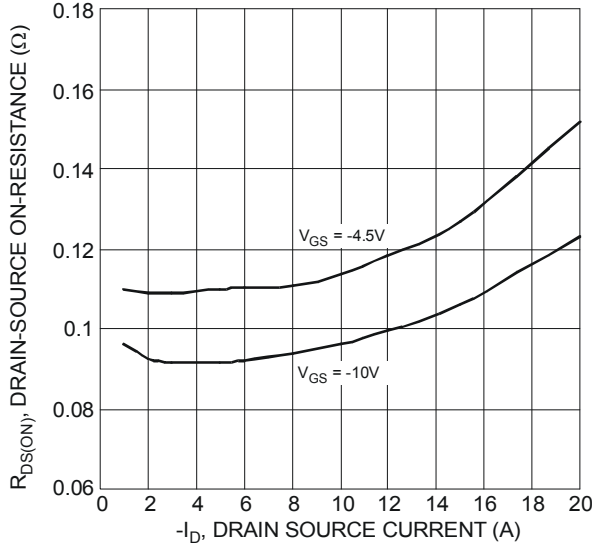


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

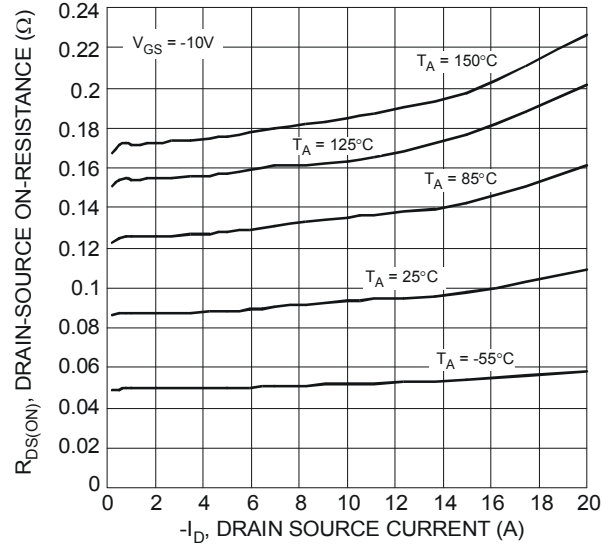


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

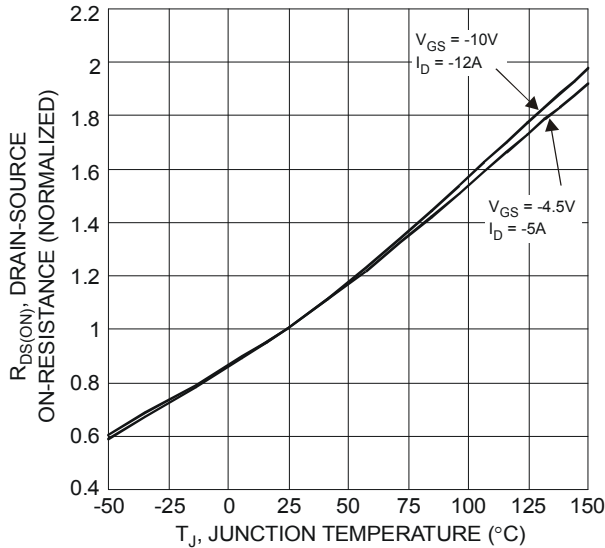


Fig. 17 On-Resistance Variation with Temperature

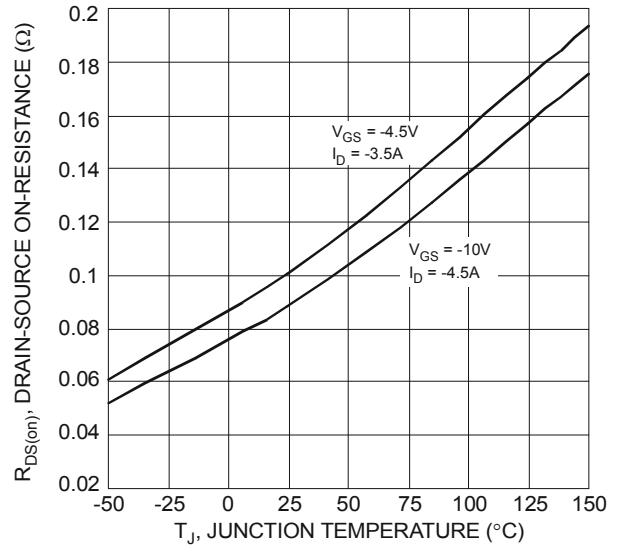


Figure 18 On-Resistance Variation with Temperature

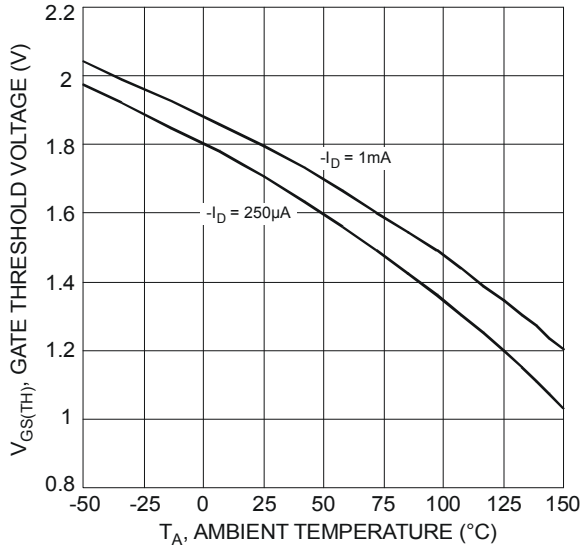


Figure 19 Gate Threshold Variation vs. Ambient Temperature

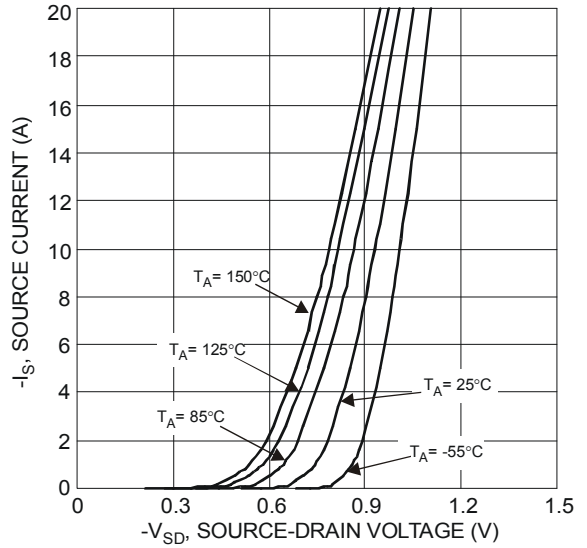


Figure 20 Diode Forward Voltage vs. Current

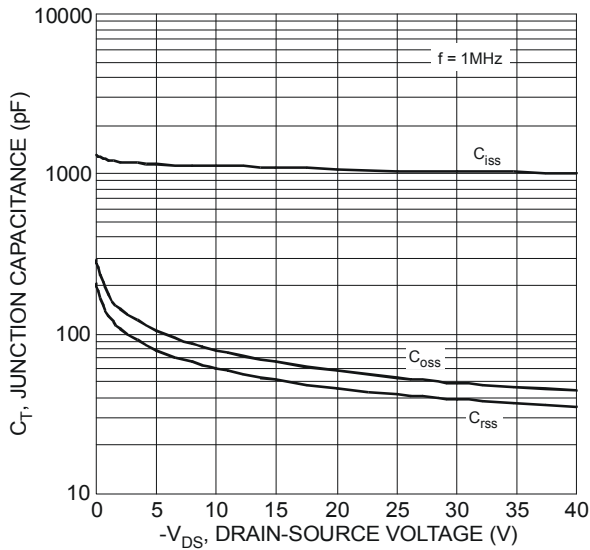


Figure 21 Typical Junction Capacitance

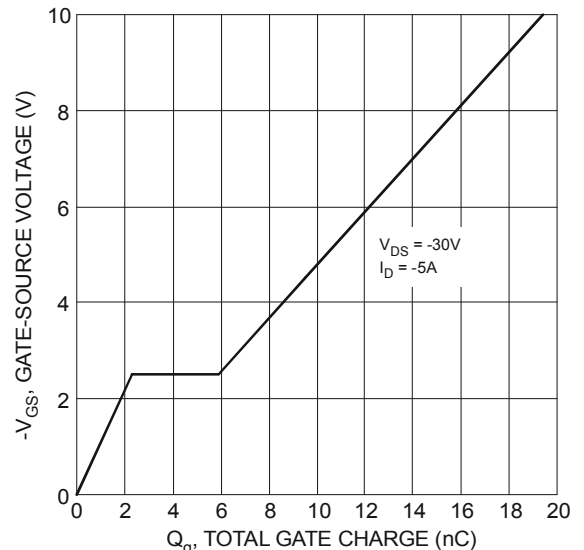


Figure 22 Gate-Charge Characteristics

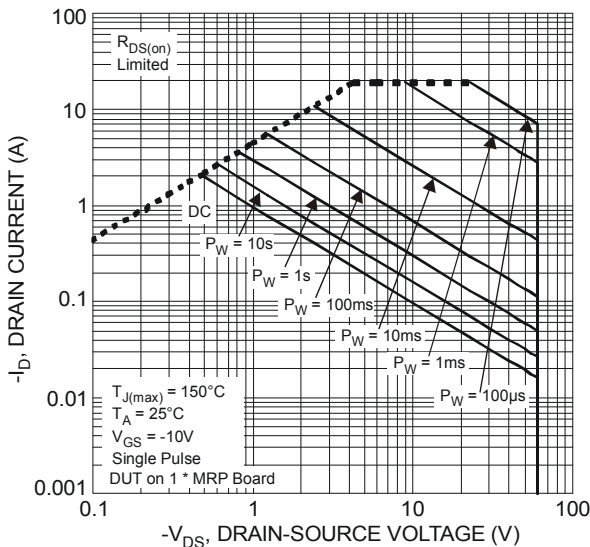
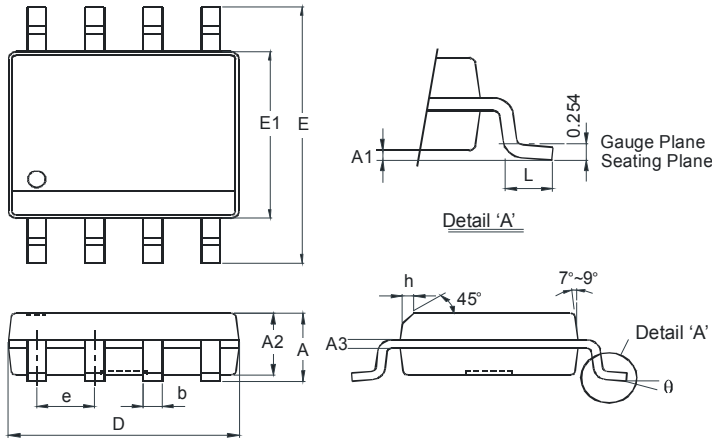


Figure 23 SOA, Safe Operation Area

Package Outline Dimensions

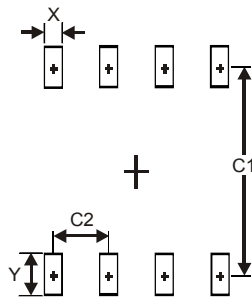
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



| 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

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



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

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