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## Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(ON)}$                    | $I_D$<br>$T_A = +25^\circ C$ |
|--------|---------------|---------------------------------|------------------------------|
| Q1     | 40V           | 15m $\Omega$ @ $V_{GS} = 10V$   | 12.2A                        |
|        |               | 20m $\Omega$ @ $V_{GS} = 4.5V$  | 10.6A                        |
| Q2     | -40V          | 29m $\Omega$ @ $V_{GS} = -10V$  | -8.8A                        |
|        |               | 45m $\Omega$ @ $V_{GS} = -4.5V$ | -7.1A                        |

## Description

This new generation 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

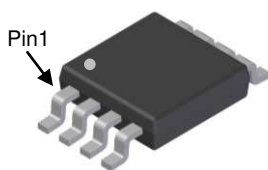
- DC-DC Converters
- Power Management Functions
- Backlighting

## Features and Benefits

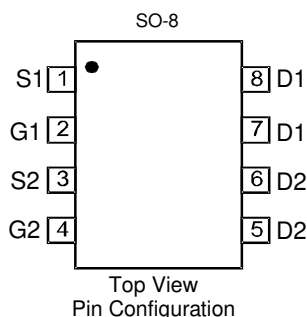
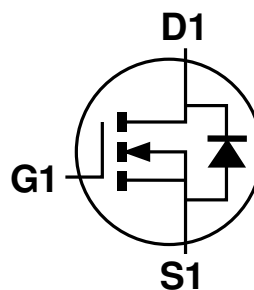
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

## Mechanical Data

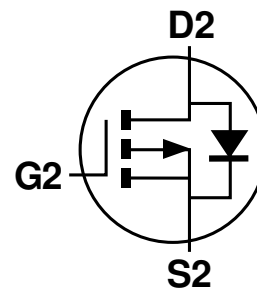
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Matte Tin Annealed over Copper Leadframe Solderable per MIL-STD-202, Method 208(3)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

**NEW PRODUCT**


Top View


 Top View  
Pin Configuration


Q N-Channel MOSFET



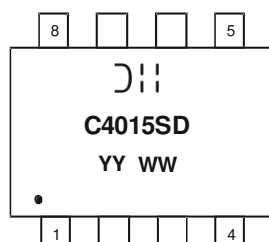
Q2 P-Channel MOSFET

## Ordering Information (Note 4)

| Part Number   | Case | Packaging         |
|---------------|------|-------------------|
| DMC4015SSD-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](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



$\text{D}||$  = Manufacturer's Marking  
 C4015SD = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY or YY = Year (ex: 14 = 2014)  
 WW = Week (01 - 53)

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic  |              |  | Symbol           | Value_Q1    | Value_Q2     | Units |
|---|--------------|--|------------------|-------------|--------------|-------|
| Drain-Source Voltage                                    |              |  | V <sub>DSS</sub> | 40          | -40          | V     |
| Gate-Source Voltage                                     |              |  | V <sub>GSS</sub> | ±20         | ±20          | V     |
| Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V | Steady State | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 8.6<br>6.8  | -6.2<br>-4.9 | A     |
|   | t < 10s      | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 12.2<br>9.8 | -8.8<br>-7.1 | A     |
| Maximum Body Diode Forward Current (Note 6)             |              |  | I <sub>S</sub>   | 2.5         | -2.2         | A     |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%)      |              |  | I <sub>DM</sub>  | 80          | -50          | A     |
| Avalanche Current (Note 7) L = 0.1mH                    |              |  | I <sub>AS</sub>  | 27          | -25          | A     |
| Avalanche Energy (Note 7) L = 0.1mH                     |              |  | E <sub>AS</sub>  | 37          | 32           | mJ    |

**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                                   |                        | Symbol                            | Value       | Units |
|--|------------------------|-----------------------------------|-------------|-------|
| Total Power Dissipation (Note 5)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 1.2         | W     |
|  | T <sub>A</sub> = +70°C |                                   | 0.9         |       |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady State           | R <sub>θJA</sub>                  | 106         | °C/W  |
|  | t < 10s                |                                   | 45          |       |
| Total Power Dissipation (Note 6)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 1.7         | W     |
|  | T <sub>A</sub> = +70°C |                                   | 1.1         |       |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady State           | R <sub>θJA</sub>                  | 76          | °C/W  |
|  | t < 10s                |                                   | 37          |       |
| Thermal Resistance, Junction to Case (Note 6)    |                        | R <sub>θJC</sub>                  | 12          |       |
| Operating and Storage Temperature Range          |                        | T <sub>J</sub> , T <sub>STG</sub> | -55 to +150 | °C    |

**Electrical Characteristics N-Channel Q1** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                             | Symbol              | Min | Typ  | Max  | Unit | Test Condition  |
|--|---------------------|-----|------|------|------|---|
| <b>OFF CHARACTERISTICS (Note 8)</b>        |                     |     |      |      |      |   |
| Drain-Source Breakdown Voltage             | BV <sub>DSS</sub>   | 40  | —    | —    | 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> = 40V, 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 (Note 8)</b>         |                     |     |      |      |      |   |
| Gate Threshold Voltage                     | V <sub>GS(th)</sub> | 1   | —    | 3    | V    | V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250µA                                |
| Static Drain-Source On-Resistance          | R <sub>DS(ON)</sub> | —   | —    | 15   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 3A  |
|  |                     | —   | —    | 20   |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 3A   |
| Diode Forward Voltage                      | V <sub>SD</sub>     | —   | 0.7  | 1.0  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A   |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b>    |                     |     |      |      |      |   |
| Input Capacitance                          | C <sub>ISS</sub>    | —   | 1810 | —    | pF   | V <sub>DS</sub> = 20V, V <sub>GS</sub> = 0V,<br>f = 1.0MHz                                |
| Output Capacitance                         | C <sub>OSS</sub>    | —   | 135  | —    |      |   |
| Reverse Transfer Capacitance               | C <sub>RSS</sub>    | —   | 112  | —    |      |   |
| Gate Resistance                            | R <sub>G</sub>      | —   | 1.7  | —    | 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>      | —   | 19   | —    | nC   | V <sub>DS</sub> = 20V, I <sub>D</sub> = 3A  |
| Total Gate Charge (V <sub>GS</sub> = 10V)  | Q <sub>g</sub>      | —   | 40   | —    |      |   |
| Gate-Source Charge                         | Q <sub>gs</sub>     | —   | 5.5  | —    |      |   |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | —   | 6.3  | —    |      |   |
| Turn-On Delay Time                         | t <sub>D(on)</sub>  | —   | 5.1  | —    | nS   | V <sub>DD</sub> = 20V, I <sub>D</sub> = 3A<br>V <sub>GS</sub> = 10V, R <sub>G</sub> = 3Ω, |
| Turn-On Rise Time                          | t <sub>r</sub>      | —   | 5.7  | —    |      |   |
| Turn-Off Delay Time                        | t <sub>D(off)</sub> | —   | 23   | —    |      |   |
| Turn-Off Fall Time                         | t <sub>f</sub>      | —   | 6.3  | —    |      |   |
| Body Diode Reverse Recovery Time           | t <sub>rr</sub>     | —   | 12.2 | —    | nS   | I <sub>S</sub> = 3A, dI/dt = 100A/µs  |
| Body Diode Reverse Recovery Charge         | Q <sub>rr</sub>     | —   | 5.4  | —    | nC   | I <sub>S</sub> = 3A, dI/dt = 100A/µs  |



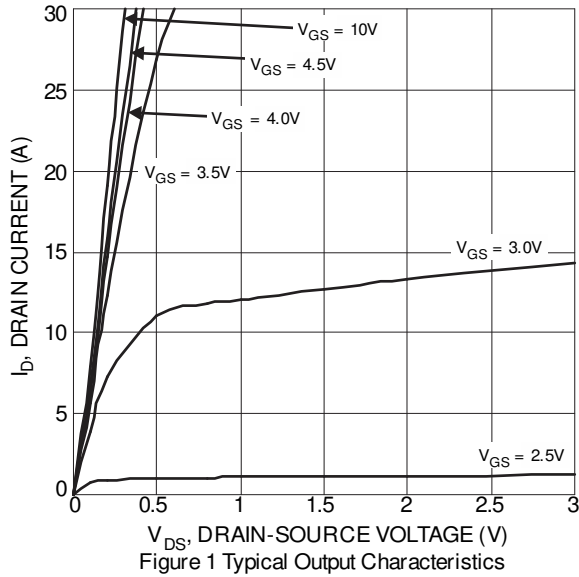


Figure 1 Typical Output Characteristics

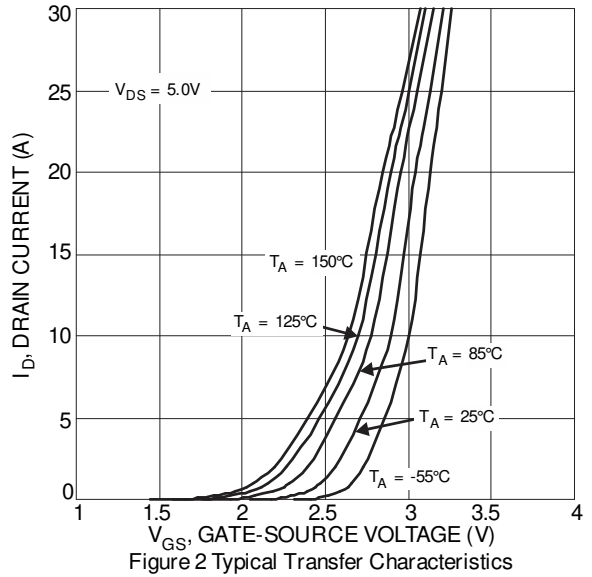


Figure 2 Typical Transfer Characteristics

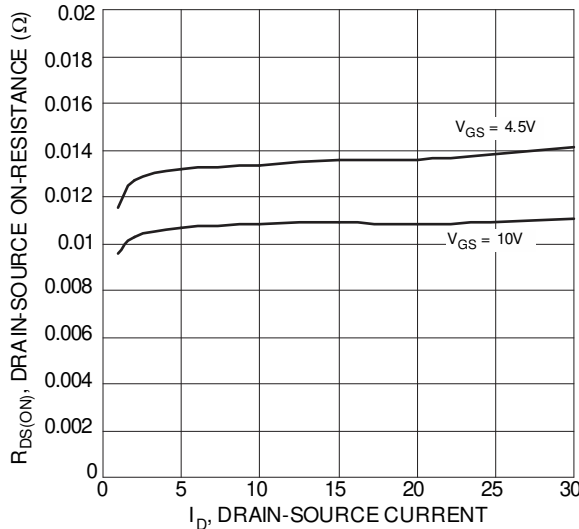


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

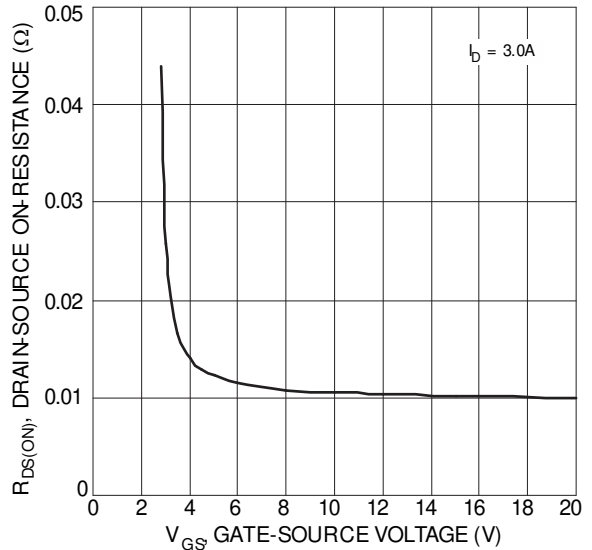


Figure 4 Typical Transfer Characteristic

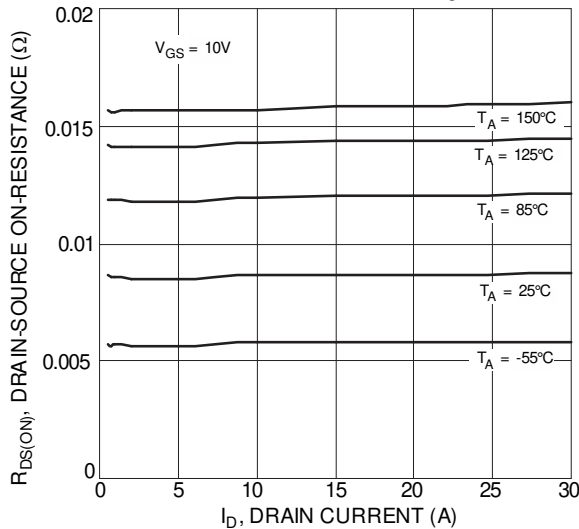


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

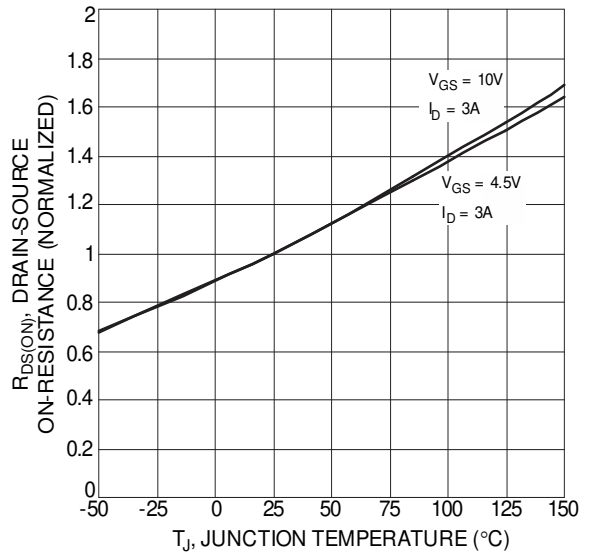
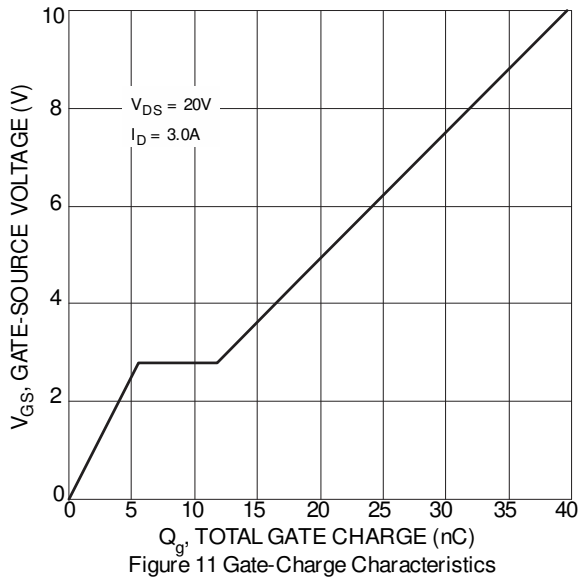
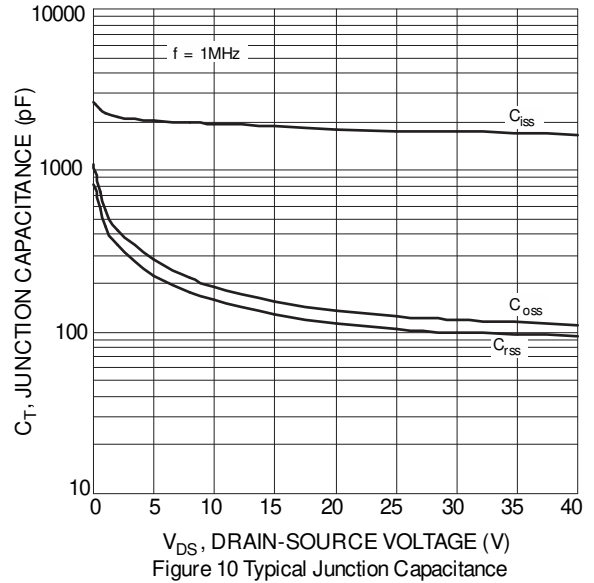
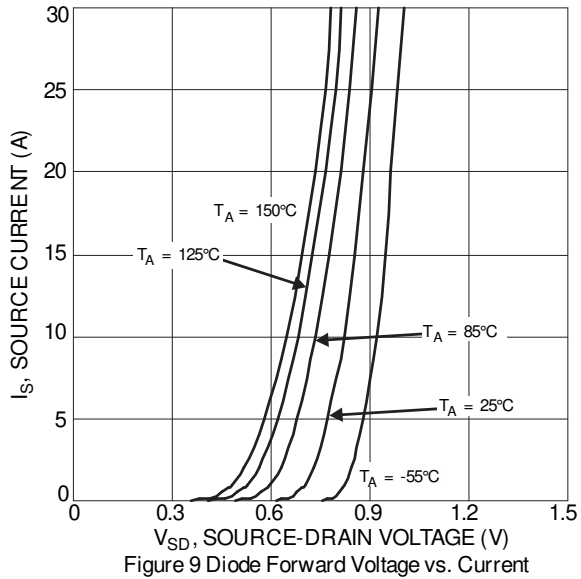
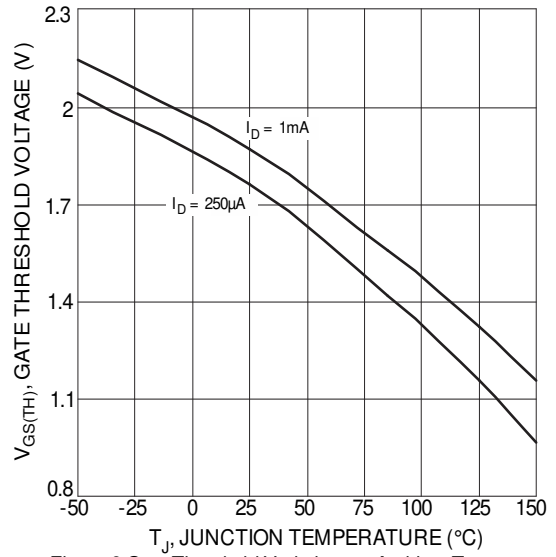
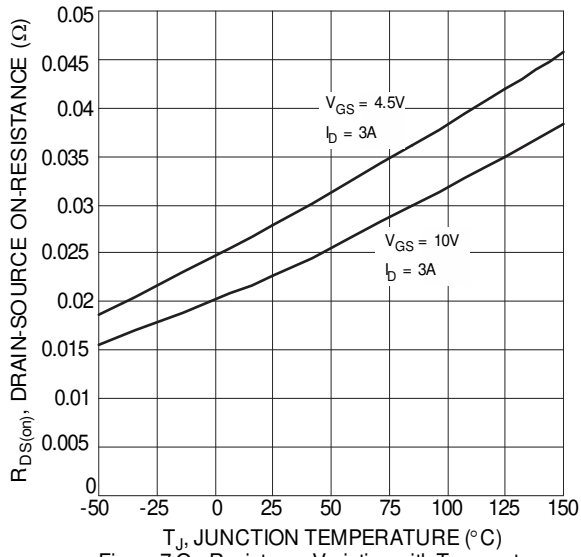


Figure 6 On-Resistance Variation with Temperature



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

| Characteristic                          | Symbol       | Min | Typ  | Max       | Unit       | Test Condition  |
|---|--------------|-----|------|-----------|------------|---|
| <b>OFF CHARACTERISTICS (Note 8)</b>     |              |     |      |           |            |   |
| Drain-Source Breakdown Voltage          | $BV_{DSS}$   | -40 | —    | —         | V          | $V_{GS} = 0V, I_D = -250\mu A$  |
| Zero Gate Voltage Drain Current         | $I_{DSS}$    | —   | —    | -1        | $\mu A$    | $V_{DS} = -40V, V_{GS} = 0V$  |
| Gate-Source Leakage                     | $I_{GSS}$    | —   | —    | $\pm 100$ | nA         | $V_{GS} = \pm 20V, V_{DS} = 0V$   |
| <b>ON CHARACTERISTICS (Note 8)</b>      |              |     |      |           |            |   |
| Gate Threshold Voltage                  | $V_{GS(th)}$ | -1  | —    | -3        | V          | $V_{DS} = V_{GS}, I_D = -250\mu A$  |
| Static Drain-Source On-Resistance       | $R_{DS(ON)}$ | —   | —    | 29        | m $\Omega$ | $V_{GS} = -10V, I_D = -3A$  |
|   |              | —   | —    | 45        |            | $V_{GS} = -4.5V, I_D = -3A$   |
| Diode Forward Voltage                   | $V_{SD}$     | —   | -0.7 | -1.2      | V          | $V_{GS} = 0V, I_S = -1A$  |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b> |              |     |      |           |            |   |
| Input Capacitance                       | $C_{iss}$    | —   | 1626 | —         | pF         | $V_{DS} = -20V, V_{GS} = 0V, f = 1.0MHz$                                  |
| Output Capacitance                      | $C_{oss}$    | —   | 135  | —         |            |   |
| Reverse Transfer Capacitance            | $C_{rss}$    | —   | 107  | —         |            |   |
| Gate Resistance                         | $R_G$        | —   | 11   | —         | $\Omega$   | $V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz$                                    |
| Total Gate Charge ( $V_{GS} = -4.5V$ )  | $Q_g$        | —   | 17   | —         | nC         | $V_{DS} = -20V, I_D = -3A$  |
| Total Gate Charge ( $V_{GS} = -10V$ )   | $Q_g$        | —   | 34   | —         |            |   |
| Gate-Source Charge                      | $Q_{gs}$     | —   | 3.7  | —         |            |   |
| Gate-Drain Charge                       | $Q_{gd}$     | —   | 6.0  | —         |            |   |
| Turn-On Delay Time                      | $t_{D(on)}$  | —   | 3.9  | —         | nS         | $V_{DD} = -20V, R_L = 1.6\Omega, V_{GS} = -10V, R_G = 3\Omega, I_D = -3A$ |
| Turn-On Rise Time                       | $t_r$        | —   | 2.8  | —         |            |   |
| Turn-Off Delay Time                     | $t_{D(off)}$ | —   | 83   | —         |            |   |
| Turn-Off Fall Time                      | $t_f$        | —   | 30   | —         |            |   |
| Body Diode Reverse Recovery Time        | $t_{rr}$     | —   | 17.3 | —         | nS         | $I_S = -3A, di/dt = 100A/\mu s$   |
| Body Diode Reverse Recovery Charge      | $Q_{rr}$     | —   | 7.2  | —         | nC         | $I_S = -3A, di/dt = 100A/\mu s$   |

- 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 1 inch square copper plate.
  7.  $I_{AS}$  and  $E_{AS}$  rating are based on low frequency and duty cycles to keep  $T_J = +25^\circ\text{C}$ .
  8. Short duration pulse test used to minimize self-heating effect.
  9. Guaranteed by design. Not subject to product testing.

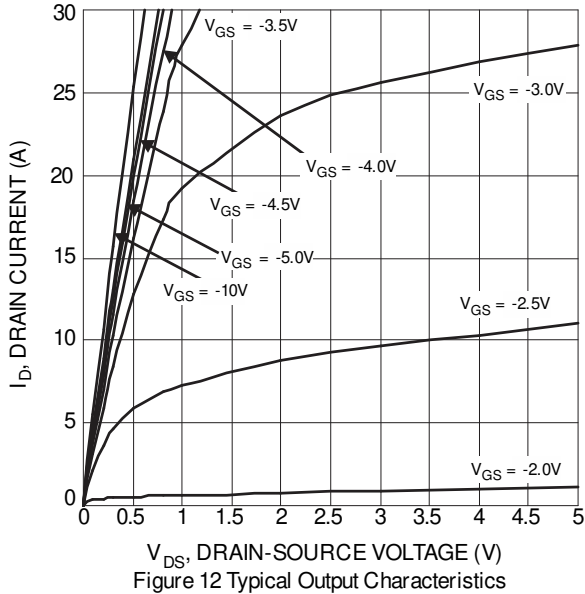


Figure 12 Typical Output Characteristics

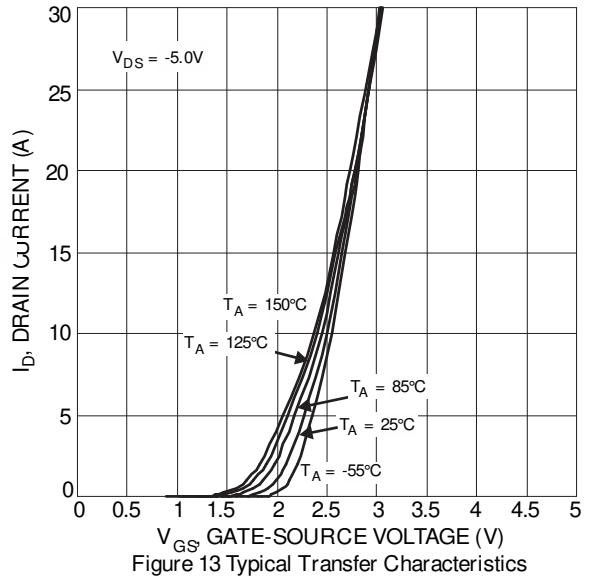


Figure 13 Typical Transfer Characteristics

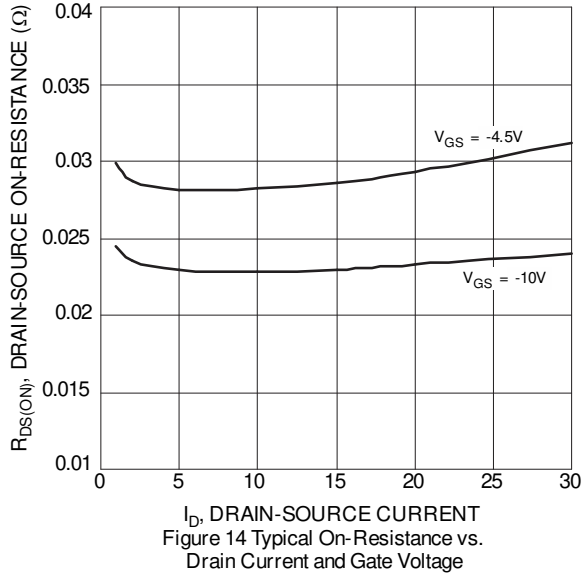


Figure 14 Typical On-Resistance vs. Drain Current and Gate Voltage

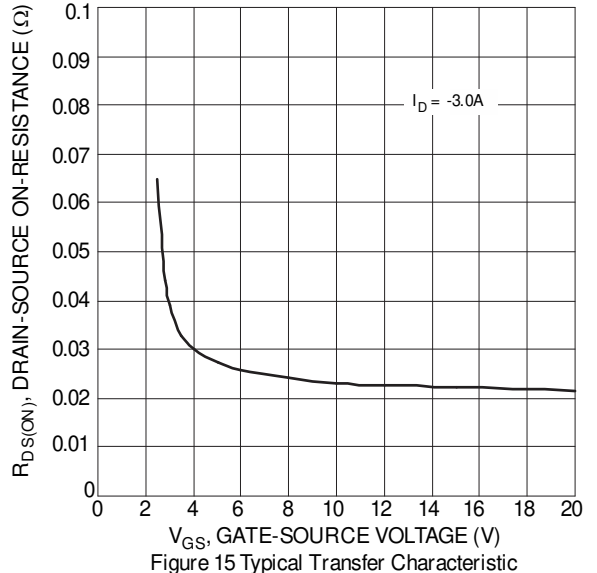


Figure 15 Typical Transfer Characteristic

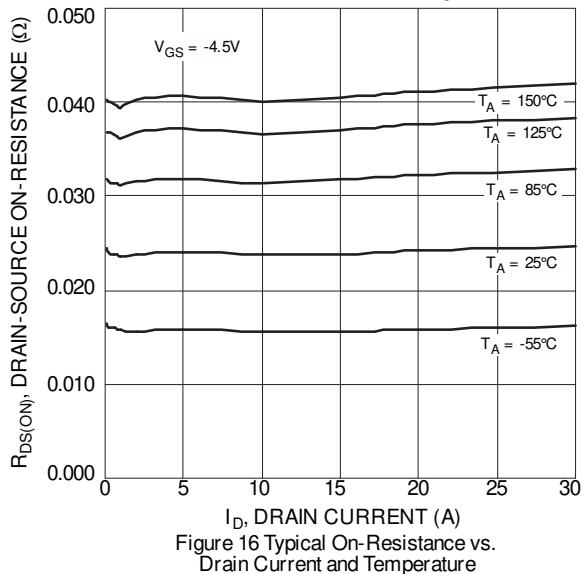


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

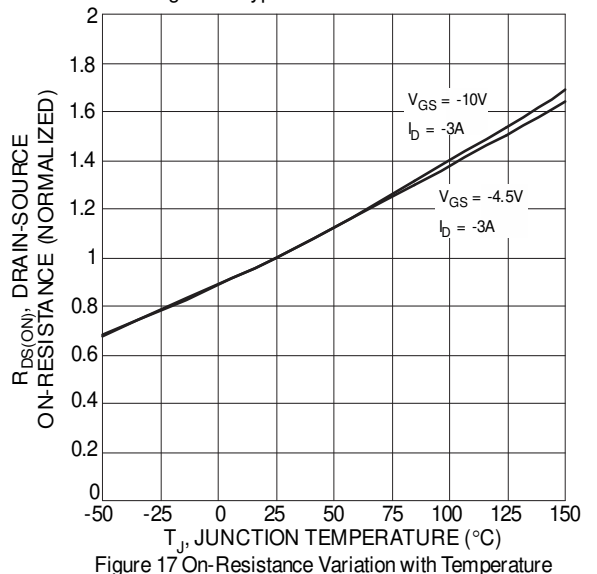
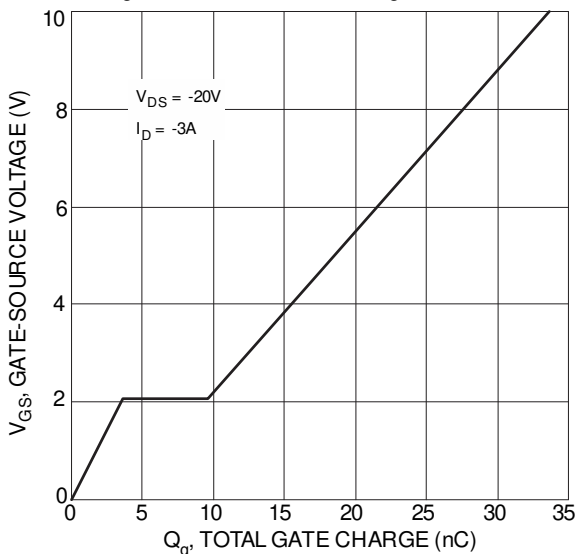
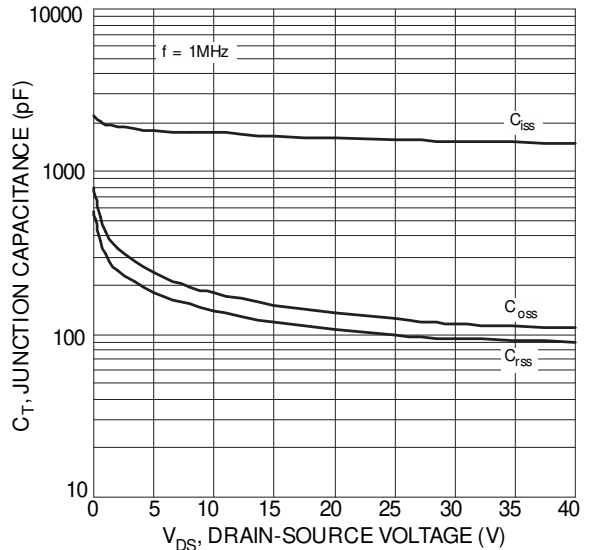
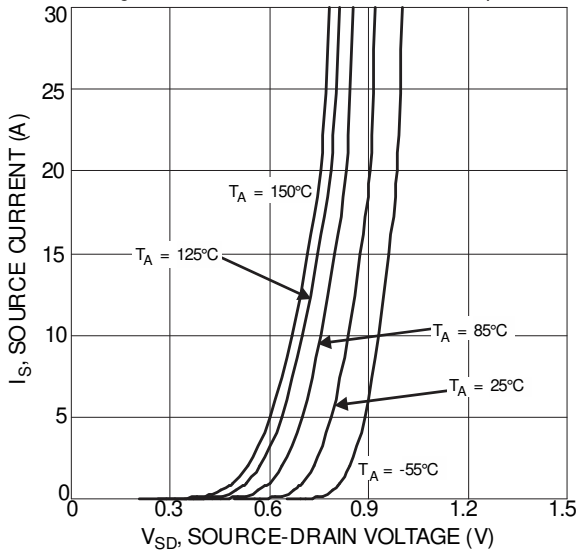
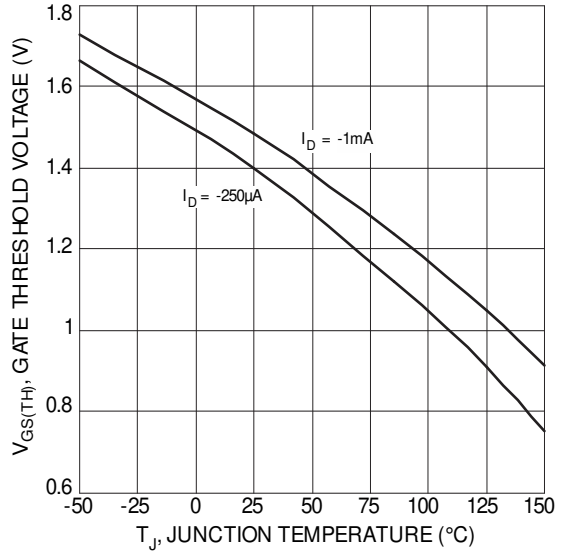
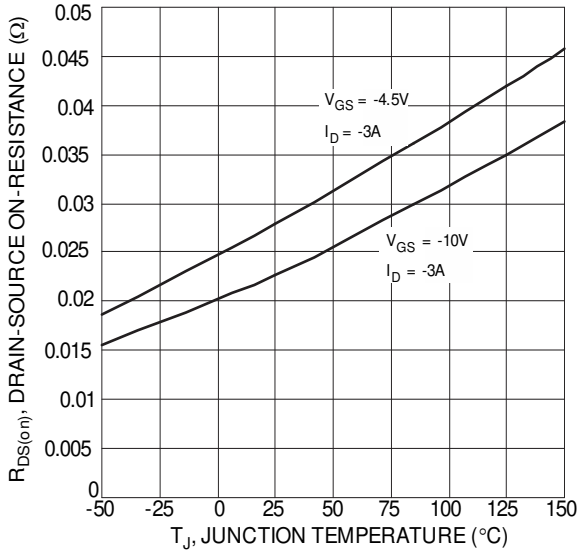


Figure 17 On-Resistance Variation with Temperature

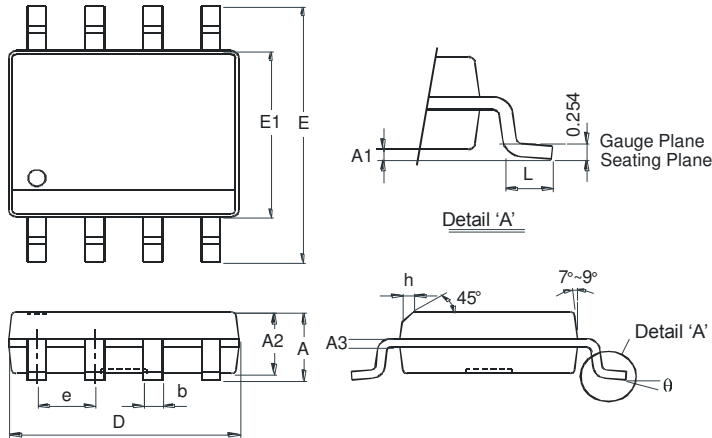
NEW PRODUCT





**Package Outline Dimensions**

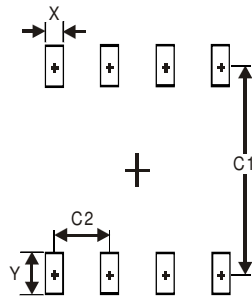
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



| 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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1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

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