

## Product Summary

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

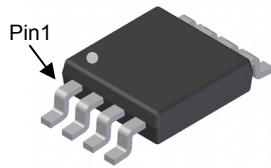
- DC-DC Converters
- Power Management Functions
- Backlighting

## Features and Benefits

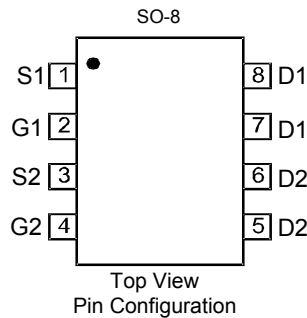
- Low Input Capacitance
- Low On-Resistance
- Fast Switching Speed
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Mechanical Data

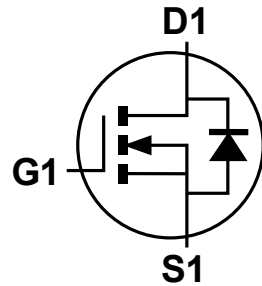
- Case: SO-8
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminal Connections: See Diagram
- Terminals: Finish – Tin Finish annealed over Copper leadframe. Solderable per MIL-STD-202, Method 208  $\text{e3}$
- Weight: 0.074 grams (approximate)



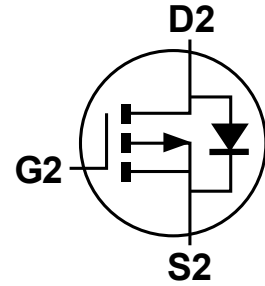
Top View



Top View  
Pin Configuration



Q1 N-Channel MOSFET



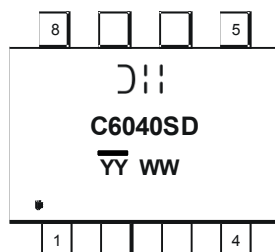
Q2 P-Channel MOSFET

## Ordering Information (Note 4)

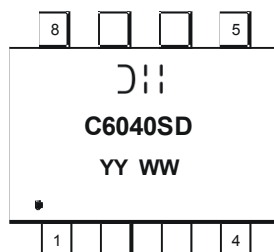
| Part Number   | Case | Packaging         |
|---------------|------|-------------------|
| DMC6040SSD-13 | SO-8 | 2,500/Tape & Reel |

- 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](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

- $\text{DII}$  = 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<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic   |              |  | Symbol           | Q1         | Q2           | Units |
|--|--------------|--|------------------|------------|--------------|-------|
| Drain-Source Voltage                                     |              |  | V <sub>DSS</sub> | 60         | -60          | 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>   | 5.1<br>4.1 | -3.1<br>-2.5 | A     |
|  | t < 10s      | T <sub>A</sub> = +25°C<br>T <sub>A</sub> = +70°C | I <sub>D</sub>   | 6.5<br>5.2 | -3.9<br>-3.1 | A     |
| Maximum Body Diode Forward Current (Note 6)              |              |  | I <sub>S</sub>   | 2.1        | -2.1         | A     |
| Pulsed Drain Current (10µs pulse, duty cycle = 1%)       |              |  | I <sub>DM</sub>  | 28         | -19          | A     |
| Avalanche Current (Note 7) L = 0.1mH                     |              |  | I <sub>AS</sub>  | 17.2       | -17.6        | A     |
| Avalanche Energy (Note 7) L = 0.1mH                      |              |  | E <sub>AS</sub>  | 14.7       | 15.4         | 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>                    | 1.24        | W     |
|  | T <sub>A</sub> = +70°C |                                   | 0.8         |       |
| Thermal Resistance, Junction to Ambient (Note 5) | Steady state           | R <sub>θJA</sub>                  | 101         | °C/W  |
|  | t < 10s                |                                   | 61          |       |
| Total Power Dissipation (Note 6)                 | T <sub>A</sub> = +25°C | P <sub>D</sub>                    | 1.56        | W     |
|  | T <sub>A</sub> = +70°C |                                   | 1.0         |       |
| Thermal Resistance, Junction to Ambient (Note 6) | Steady state           | R <sub>θJA</sub>                  | 80          | °C/W  |
|  | t < 10s                |                                   | 49          |       |
| Thermal Resistance, Junction to Case (Note 6)    |                        | R <sub>θJC</sub>                  | 14.7        | °C    |
| 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>   | 60  | —    | —    | 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> = 48V, 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> | —   | 33   | 40   | mΩ   | V <sub>GS</sub> = 10V, I <sub>D</sub> = 8A   |
|  |                     | —   | 37   | 55   |      | V <sub>GS</sub> = 4.5V, I <sub>D</sub> = 5A  |
| Diode Forward Voltage                      | V <sub>SD</sub>     | —   | 0.7  | 1.2  | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = 1A  |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b>    |                     |     |      |      |      |  |
| Input Capacitance                          | C <sub>iss</sub>    | —   | 1130 | —    | pF   | V <sub>DS</sub> = 15V, V <sub>GS</sub> = 0V f = 1.0MHz                                   |
| Output Capacitance                         | C <sub>oss</sub>    | —   | 69   | —    |      |  |
| Reverse Transfer Capacitance               | C <sub>rss</sub>    | —   | 42   | —    |      |  |
| 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> = 10V)  | Q <sub>g</sub>      | —   | 20.8 | —    | nC   | V <sub>DS</sub> = 30V, I <sub>D</sub> = 4.3A   |
| Total Gate Charge (V <sub>GS</sub> = 4.5V) | Q <sub>g</sub>      | —   | 9.4  | —    |      |  |
| Gate-Source Charge                         | Q <sub>gs</sub>     | —   | 3.3  | —    |      |  |
| Gate-Drain Charge                          | Q <sub>gd</sub>     | —   | 3.0  | —    |      |  |
| Turn-On Delay Time                         | t <sub>D(on)</sub>  | —   | 3.6  | —    | nS   | V <sub>GS</sub> = 10V, V <sub>DD</sub> = 30V, R <sub>G</sub> = 6Ω, I <sub>D</sub> = 4.3A |
| Turn-On Rise Time                          | t <sub>r</sub>      | —   | 1.8  | —    |      |  |
| Turn-Off Delay Time                        | t <sub>D(off)</sub> | —   | 20.1 | —    |      |  |
| Turn-Off Fall Time                         | t <sub>f</sub>      | —   | 4.3  | —    |      |  |
| Body Diode Reverse Recovery Time           | t <sub>rr</sub>     | —   | 14.2 | —    | nS   | I <sub>S</sub> = 4.3A, di/dt = 100A/µs   |
| Body Diode Reverse Recovery Charge         | Q <sub>rr</sub>     | —   | 7.5  | —    | nC   | I <sub>S</sub> = 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<sub>A</sub> = +25°C.
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to product testing.

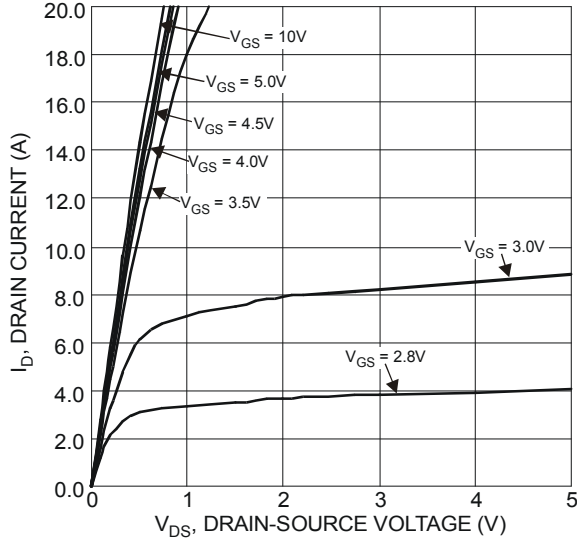


Figure 1 Typical Output Characteristics

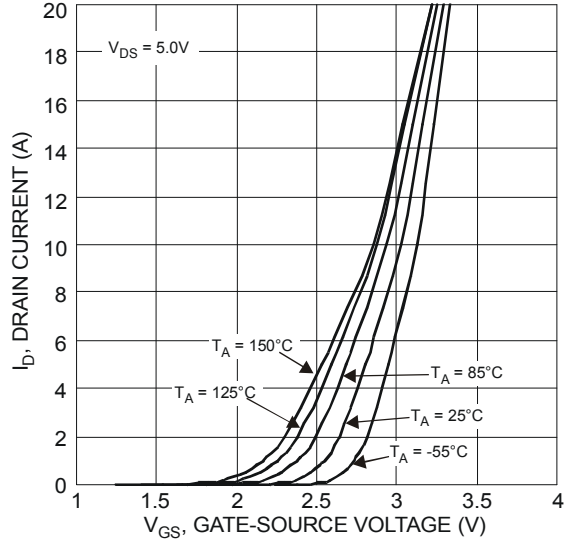


Figure 2 Typical Transfer Characteristics

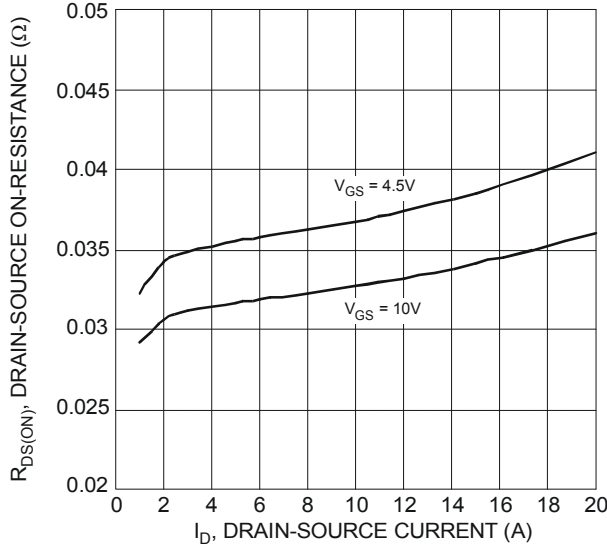


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

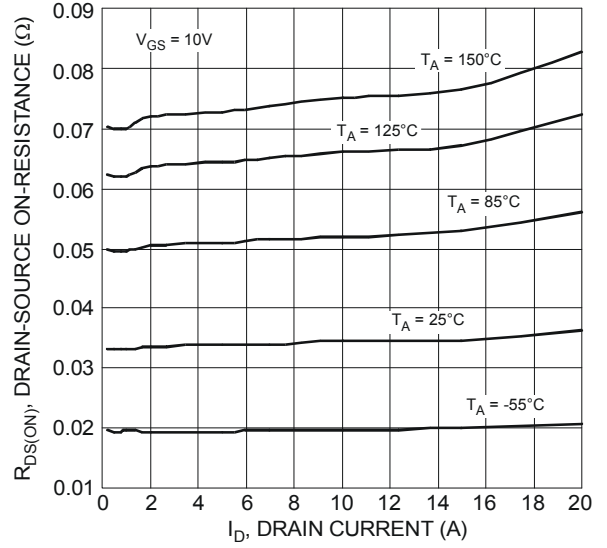


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

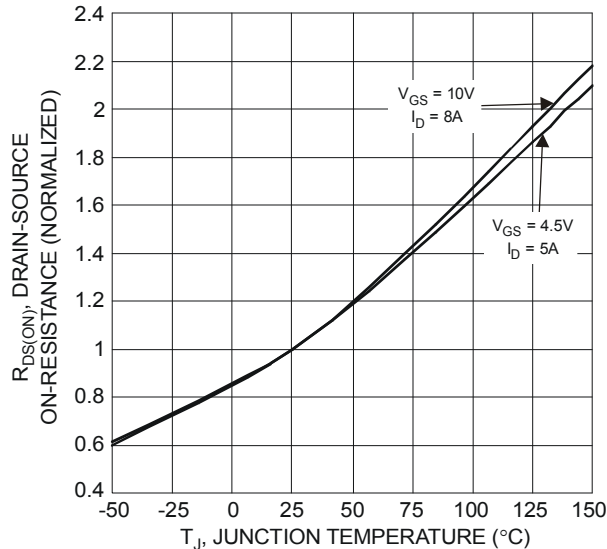


Figure 5 On-Resistance Variation with Temperature

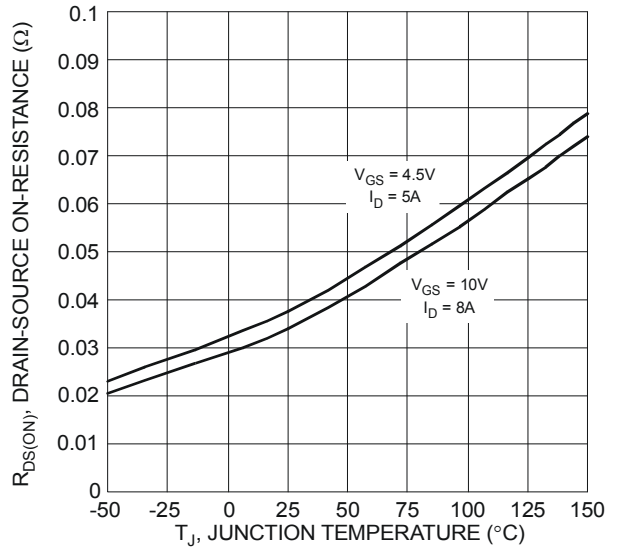


Figure 6 On-Resistance Variation with Temperature

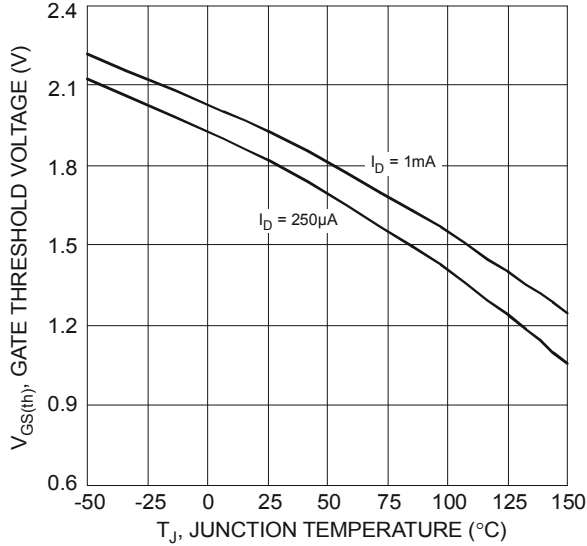


Figure 7 Gate Threshold Variation vs. Ambient Temperature

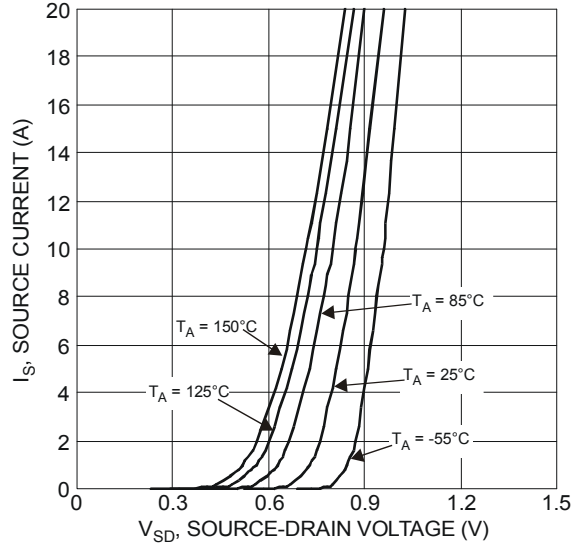


Figure 8 Diode Forward Voltage vs. Current

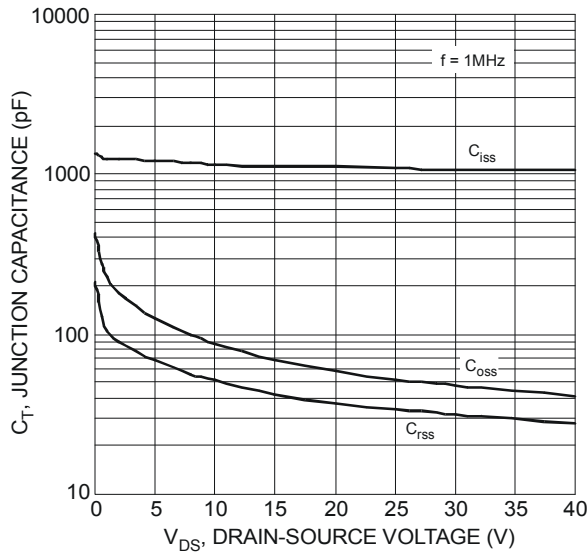


Figure 9 Typical Junction Capacitance

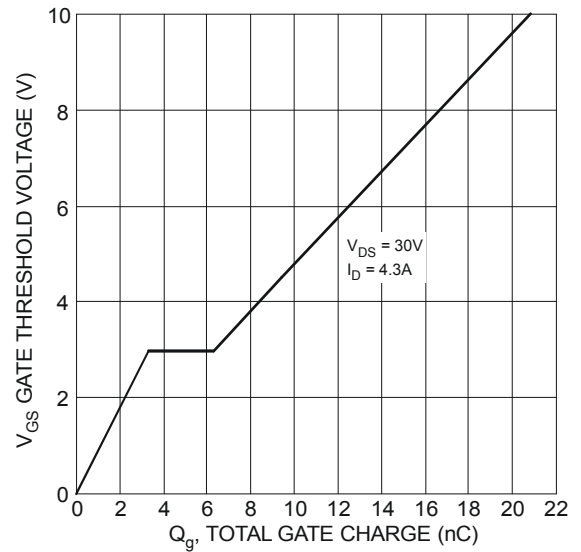


Figure 10 Gate Charge

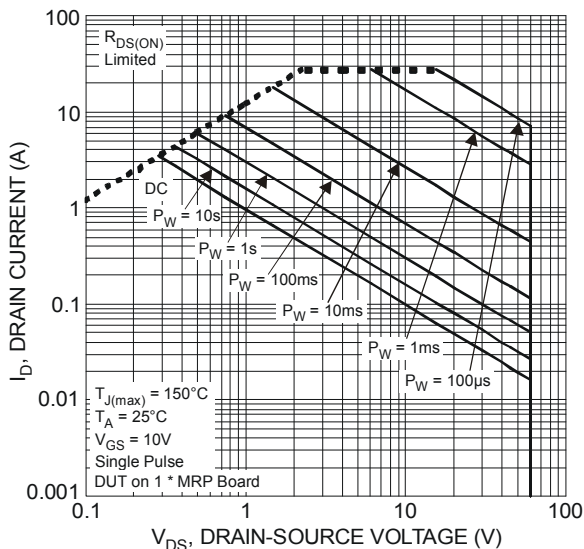
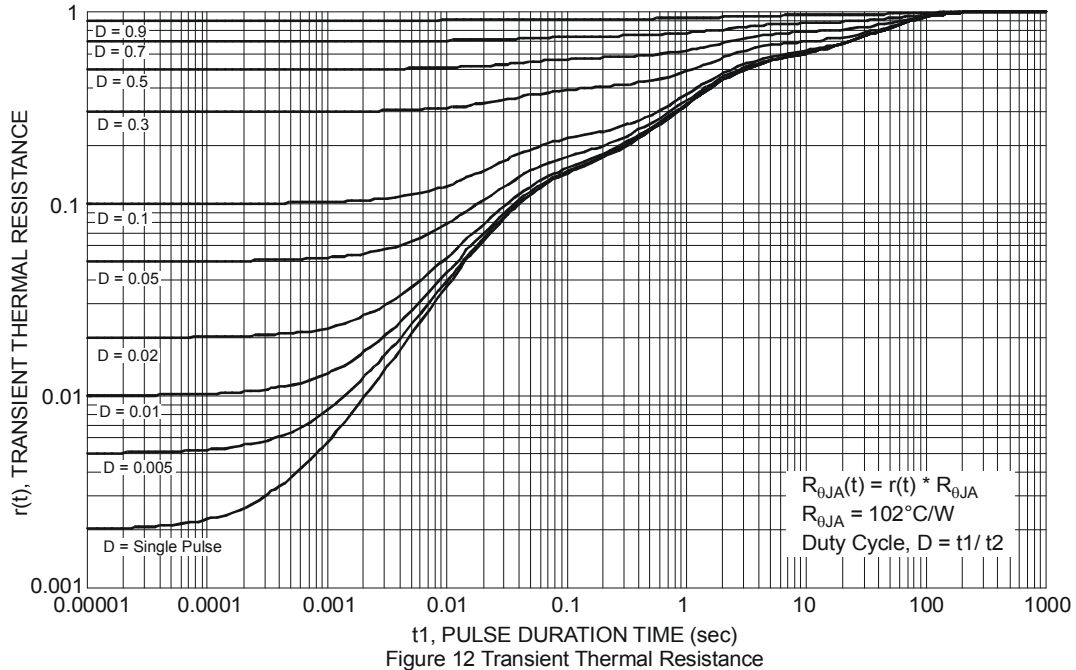


Figure 11 SOA, Safe Operation Area



**Electrical Characteristics P-Channel Q2 (@T<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>   | -60 | —     | —    | 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> = -48V, V <sub>GS</sub> = 0V  |
| Gate-Source Leakage                         | I <sub>GSS</sub>    | —   | —     | 100  | nA   | V <sub>GS</sub> = ±16V, 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> | —   | 86    | 110  | mΩ   | V <sub>GS</sub> = -10V, I <sub>D</sub> = -4.5A  |
|   |                     | —   | 98    | 130  |      | V <sub>GS</sub> = -4.5V, I <sub>D</sub> = -3.5A   |
| Diode Forward Voltage                       | V <sub>SD</sub>     | —   | -0.7  | -1.2 | V    | V <sub>GS</sub> = 0V, I <sub>S</sub> = -1A  |
| <b>DYNAMIC CHARACTERISTICS (Note 9)</b>     |                     |     |       |      |      |   |
| Input Capacitance                           | C <sub>iss</sub>    | —   | 1030  | —    | pF   | V <sub>DS</sub> = -30V, V <sub>GS</sub> = 0V, f = 1.0MHz                                    |
| Output Capacitance                          | C <sub>oss</sub>    | —   | 49.1  | —    |      |   |
| Reverse Transfer Capacitance                | C <sub>rss</sub>    | —   | 38.7  | —    |      |   |
| Gate Resistance                             | R <sub>G</sub>      | —   | 13.6  | —    | 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>      | —   | 9.5   | —    | nC   | V <sub>DS</sub> = -30V, I <sub>D</sub> = -5A  |
| Total Gate Charge (V <sub>GS</sub> = -10V)  | Q <sub>g</sub>      | —   | 19.4  | —    |      |   |
| Gate-Source Charge                          | Q <sub>gs</sub>     | —   | 2.3   | —    |      |   |
| Gate-Drain Charge                           | Q <sub>gd</sub>     | —   | 3.6   | —    |      |   |
| Turn-On Delay Time                          | t <sub>D(on)</sub>  | —   | 3.7   | —    | nS   | V <sub>GS</sub> = -10V, V <sub>DS</sub> = -30V, R <sub>GEN</sub> = 6Ω, I <sub>D</sub> = -5A |
| Turn-On Rise Time                           | t <sub>r</sub>      | —   | 6.3   | —    |      |   |
| Turn-Off Delay Time                         | t <sub>D(off)</sub> | —   | 58.7  | —    |      |   |
| Turn-Off Fall Time                          | t <sub>f</sub>      | —   | 26.1  | —    |      |   |
| Body Diode Reverse Recovery Time            | t <sub>rr</sub>     | —   | 14.85 | —    | nS   | I <sub>S</sub> = -5A, di/dt = 100A/μs   |
| Body Diode Reverse Recovery Charge          | Q <sub>rr</sub>     | —   | 8.8   | —    | nC   | I <sub>S</sub> = -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<sub>A</sub> = +25°C.  
 8. Short duration pulse test used to minimize self-heating effect.  
 9. Guaranteed by design. Not subject to product testing.

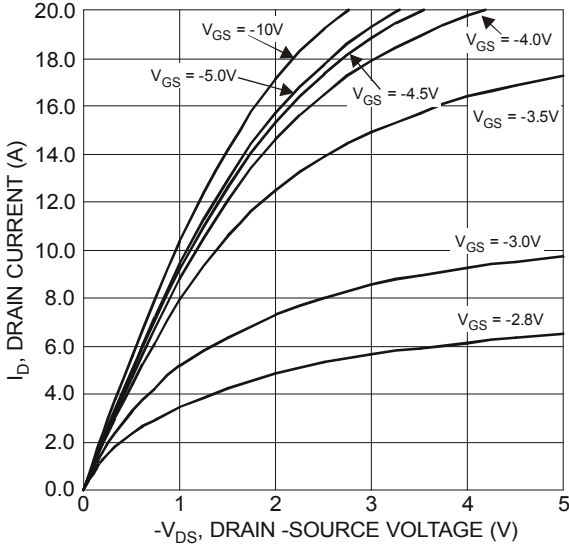


Figure 13 Typical Output Characteristics

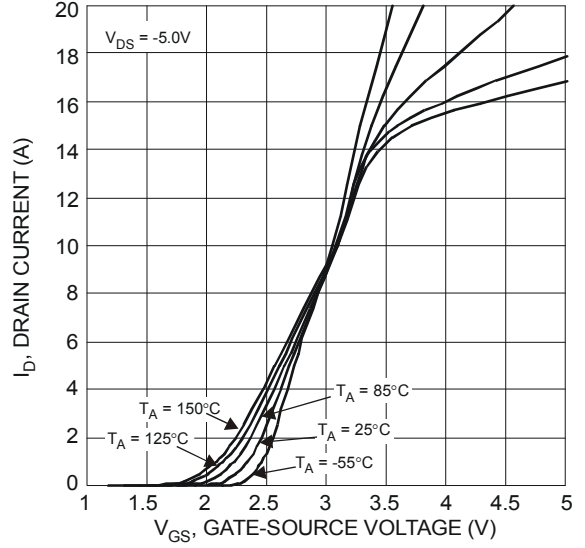


Figure 14 Typical Transfer Characteristics

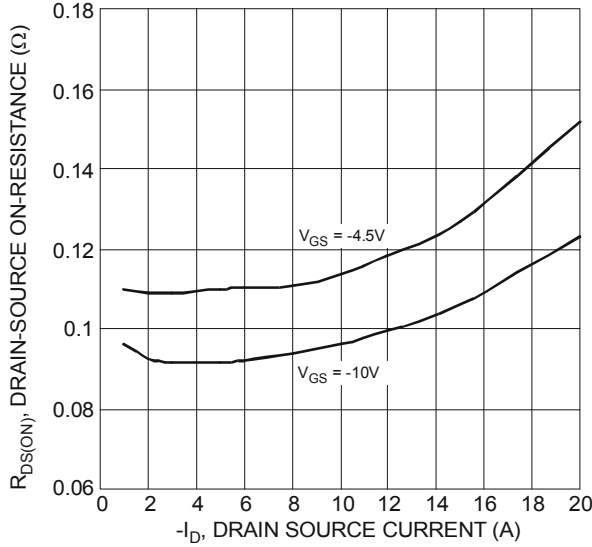


Figure 15 Typical On-Resistance vs. Drain Current and Gate Voltage

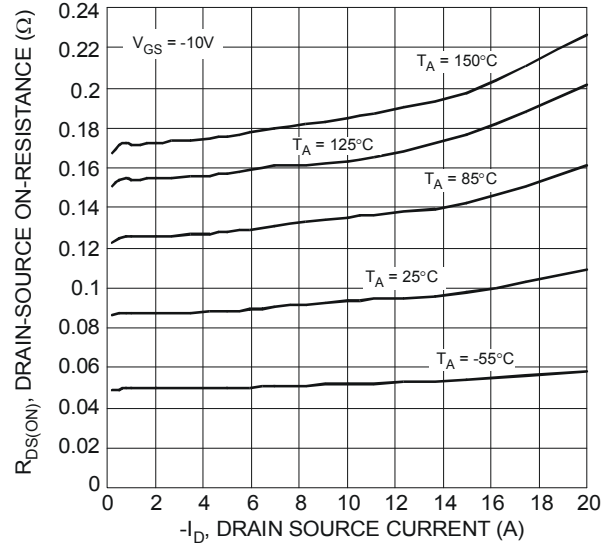


Figure 16 Typical On-Resistance vs. Drain Current and Temperature

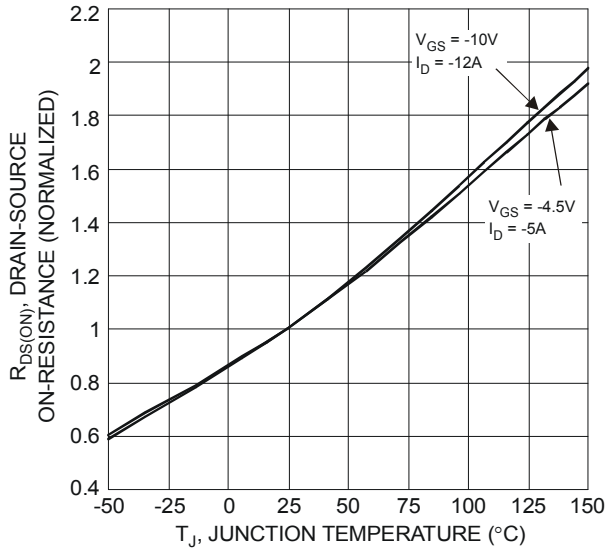


Fig. 17 On-Resistance Variation with Temperature

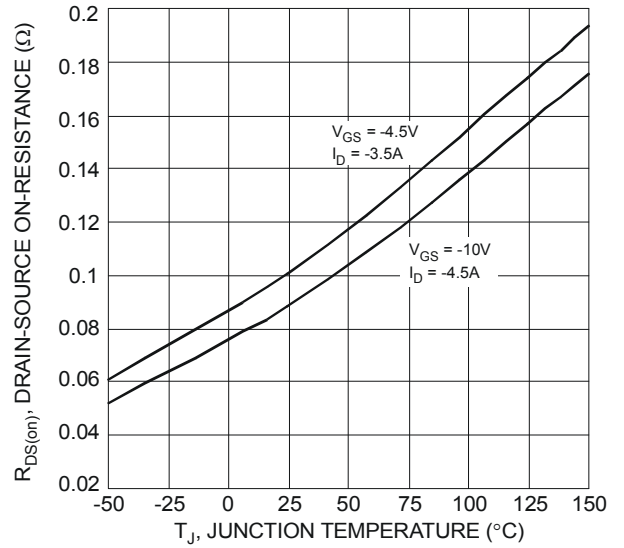


Figure 18 On-Resistance Variation with Temperature

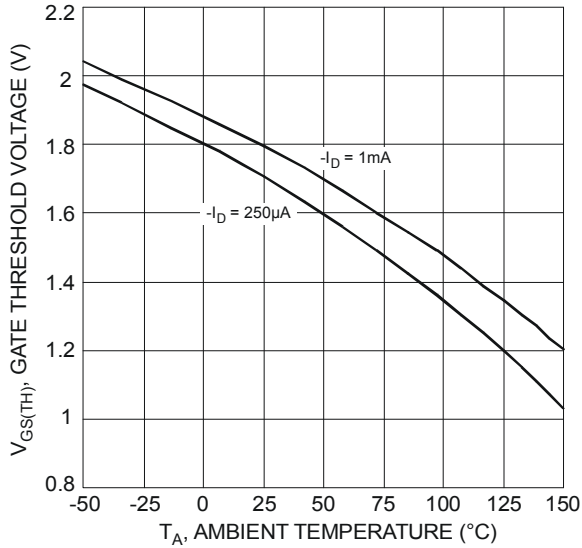


Figure 19 Gate Threshold Variation vs. Ambient Temperature

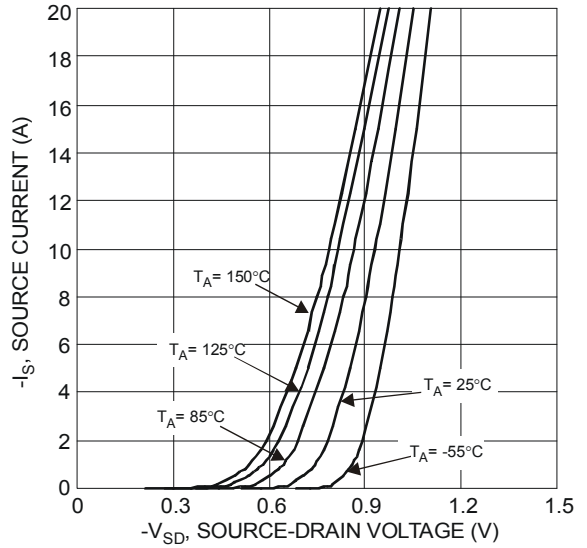


Figure 20 Diode Forward Voltage vs. Current

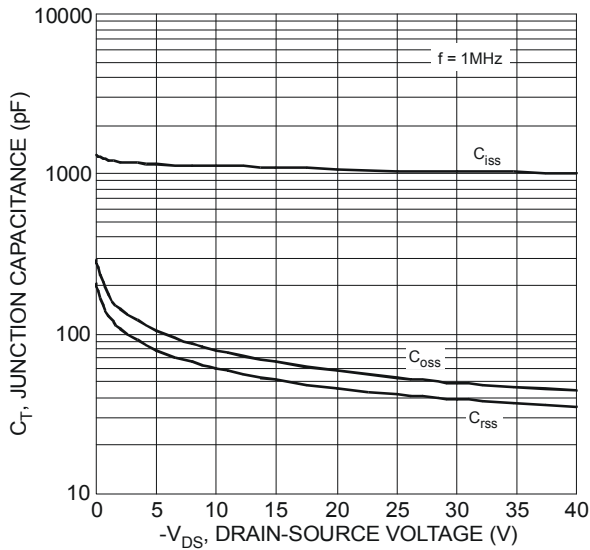


Figure 21 Typical Junction Capacitance

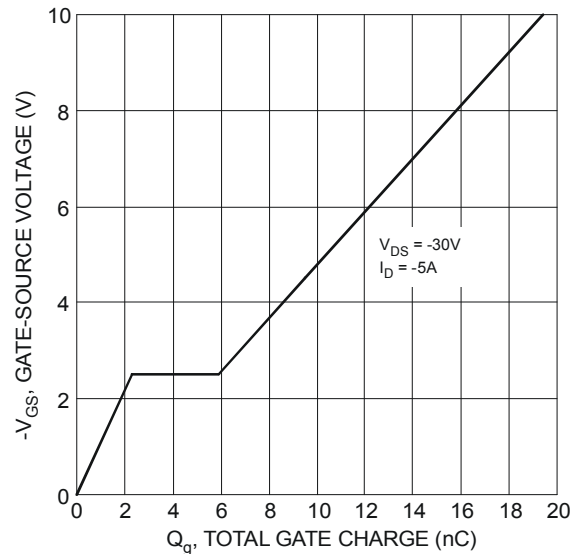


Figure 22 Gate-Charge Characteristics

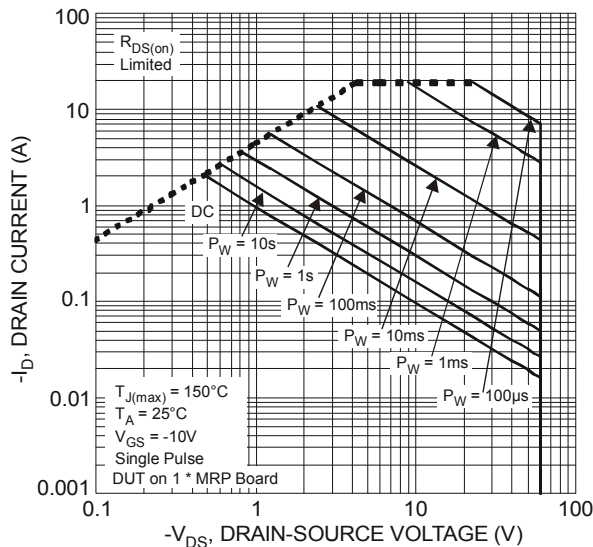
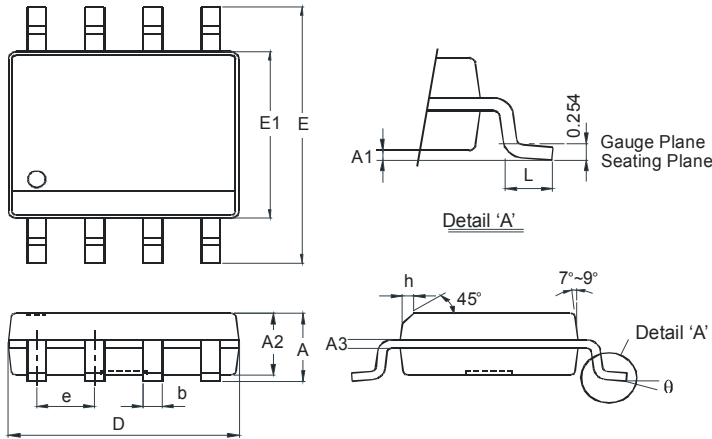


Figure 23 SOA, Safe Operation Area

**Package Outline Dimensions**

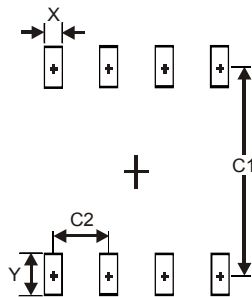
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for the latest version.



| 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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- При необходимости вся продукция военного и аэрокосмического назначения проходит испытания и сертификацию в лаборатории (по согласованию с заказчиком);
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## JONHON

«JONHON» (основан в 1970 г.)

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