Lead-free Green

# DMG1016UDW

## COMPLEMENTARY PAIR ENHANCEMENT MODE MOSFET

## Product Summary

| Device | $V_{(BR)DSS}$ | $R_{DS(ON)}$ | $I_D$ $T_A$ = +25°C |
|---|---|---|---|
| Q1 | 20V | 0.45Ω @ $V_{GS}$ = 4.5V | 1066mA |
| Q2 | | 0.75Ω @ $V_{GS}$ = -4.5V | -845mA |

## Description

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.

## Applications

- Battery Operated Systems and Solid-State Relays
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.
- Power Supply Converter Circuits

## Features and Benefits

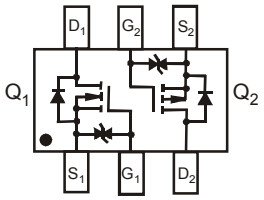
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- Complementary Pair MOSFET
- Ultra-Small Surface Mount Package
- ESD Protected Up to 2.5kV
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 standards for High Reliability**

## Mechanical Data

- Case: SOT363
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Alloy 42 leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208 e3
- Terminal Connections: See Diagram
- Weight: 0.006 grams (approximate)


ESD PROTECTED


Top View



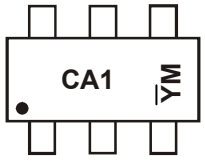
Top View
Internal Schematic

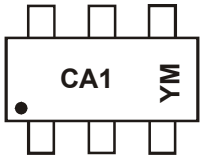
## Ordering Information (Note 4)

| Part Number | Compliance | Case | Packaging |
|---|---|---|---|
| DMG1016UDW-7 | Standard | SOT363 | 3000/Tape & Reel |
| DMG1016UDWQ-7 | Automotive | SOT363 | 3000/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




CA1 = Product Type Marking Code
YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)
$\overline{Y}$M = Date Code Marking for CAT (Chengdu Assembly/ Test site)
Y or $\overline{Y}$ = Year (ex: A = 2013)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|---|---|---|---|---|---|---|---|---|---|
| Code | V | W | X | Y | Z | A | B | C | D |

| 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 |

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

| Characteristic | Symbol | Value | Units |
|---|---|---|---|
| Total Power Dissipation (Note 5) | $P_D$ | 330 | mW |
| Thermal Resistance, Junction to Ambient (Note 5) | $R_{\theta JA}$ | 379 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Maximum Ratings N-CHANNEL – Q1 (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | 20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±6 | V |
| Continuous Drain Current (Note 5) | Steady State | $T_A$ = +25°C<br>$T_A$ = +85°C | $I_D$ | 1066<br>690 | mA |

## Maximum Ratings P-CHANNEL – Q2 (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±6 | V |
| Continuous Drain Current (Note 5) | Steady State | $T_A$ = +25°C<br>$T_A$ = +85°C | $I_D$ | -845<br>-548 | mA |

## Electrical Characteristics N-CHANNEL – Q1 (@$T_A$ = +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 @$T_C$ = +25°C | $I_{DSS}$ | — | — | 100 | nA | $V_{DS}$ =20V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±1.0 | µA | $V_{GS}$ = ±4.5V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 6)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | 0.5 | — | 1.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = 250µA |
| Static Drain-Source On-Resistance | $R_{DS(ON)}$ | — | 0.3 | 0.45 | Ω | $V_{GS}$ = 4.5V, $I_D$ = 600mA |
| | | | 0.4 | 0.6 | | $V_{GS}$ = 2.5V, $I_D$ = 500mA |
| | | | 0.5 | 0.75 | | $V_{GS}$ = 1.8V, $I_D$ = 350mA |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 1.4 | — | S | $V_{DS}$ = 10V, $I_D$ = 400mA |
| Diode Forward Voltage (Note 6) | $V_{SD}$ | — | 0.7 | 1.2 | V | $V_{GS}$ = 0V, $I_S$ = 150mA |
| **DYNAMIC CHARACTERISTICS (Note 7)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 60.67 | — | pF | $V_{DS}$ = 10V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 9.68 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 5.37 | — | pF | |
| Total Gate Charge (4.5V) | $Q_g$ | — | 736.6 | — | nC | $V_{GS}$ = 4.5V, $V_{DS}$ = 10V, $I_D$ = 250mA |
| Gate-Source Charge | $Q_{gs}$ | — | 93.6 | — | nC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 116.6 | — | nC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 5.1 | — | ns | $V_{DD}$ = 10V, $V_{GS}$ = 4.5V, $R_L$ = 47Ω, $R_G$ = 10Ω, |
| Turn-On Rise Time | $t_r$ | — | 7.4 | — | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 26.7 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 12.3 | — | ns | |

Notes: 5. Device mounted on FR-4 PCB with minimum recommended pad layout.
6. Short duration pulse test used to minimize self-heating effect.
7. Guaranteed by design. Not subject to production testing.

## N-CHANNEL – Q1

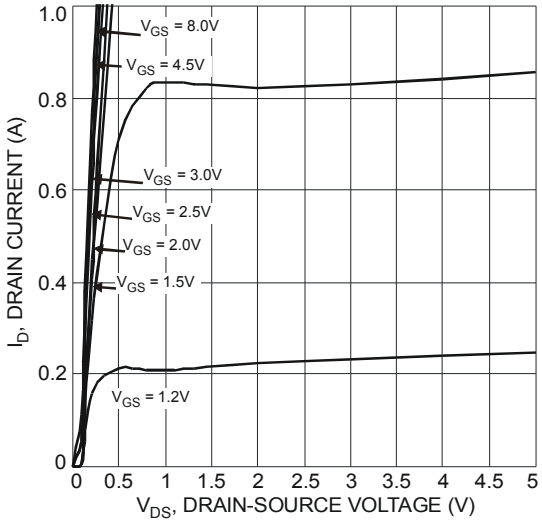



Fig. 1 Typical Output Characteristic

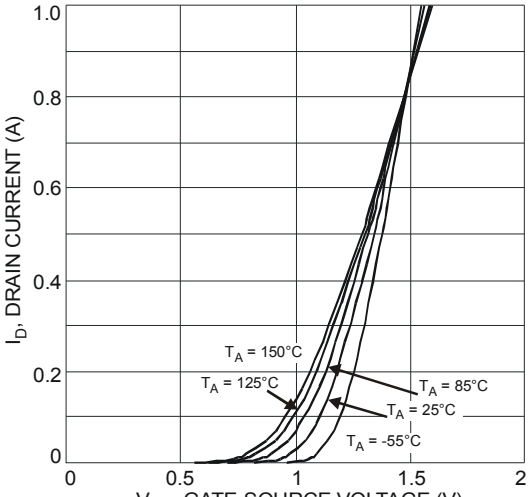



Fig. 2 Typical Transfer Characteristic

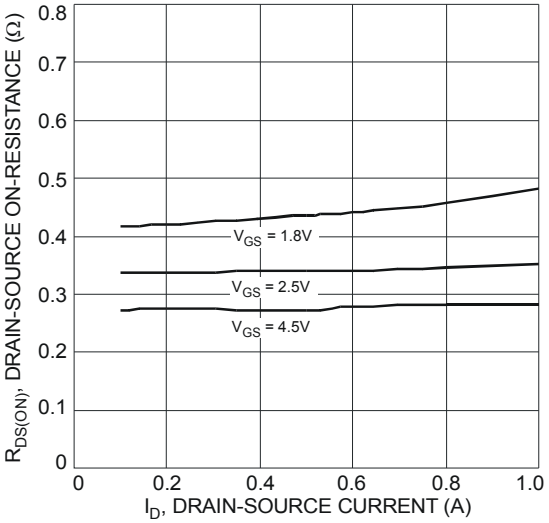



Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

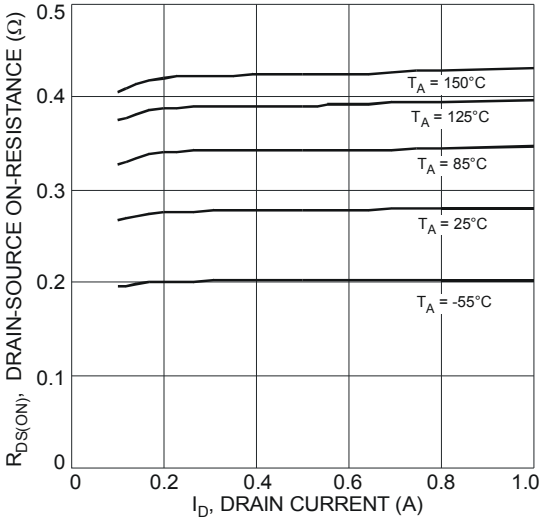



Fig. 4 Typical On-Resistance
vs. Drain Current and Temperature

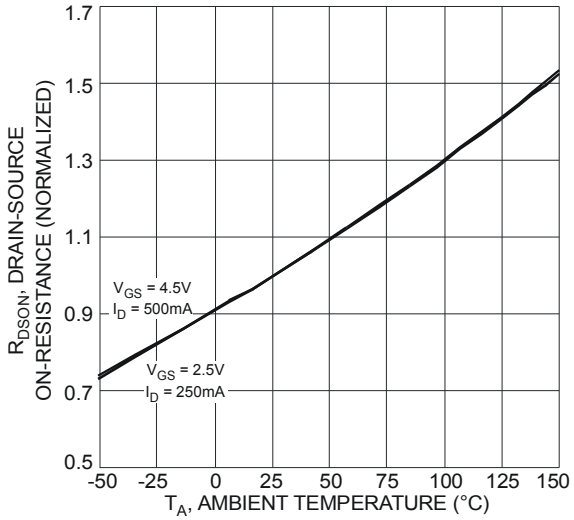



Fig. 5 On-Resistance Variation with Temperature

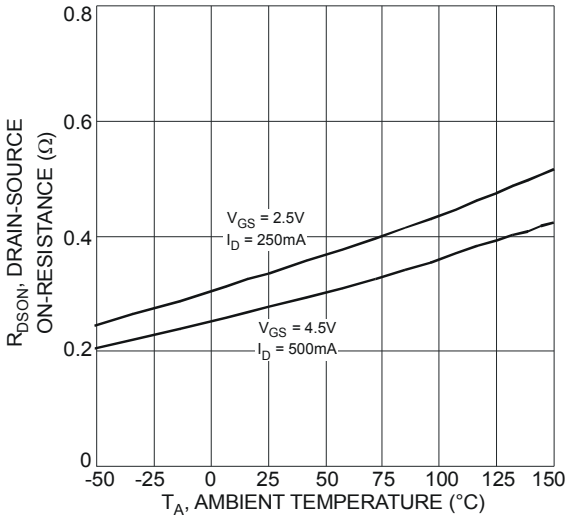



Fig. 6 On-Resistance Variation with Temperature

## N-CHANNEL – Q1 (cont.)

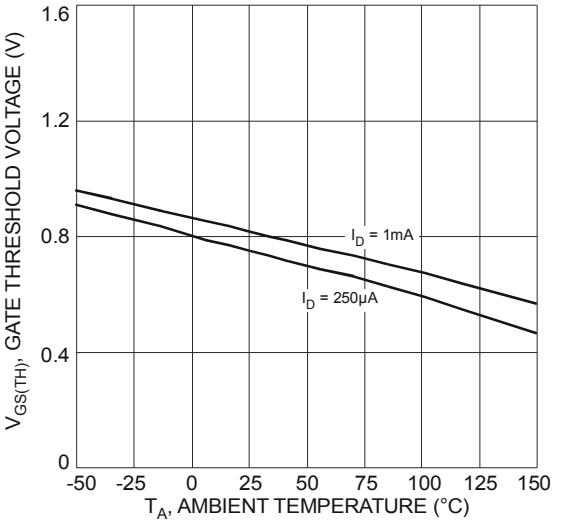



Fig. 7 Gate Threshold Variation vs. Ambient Temperature

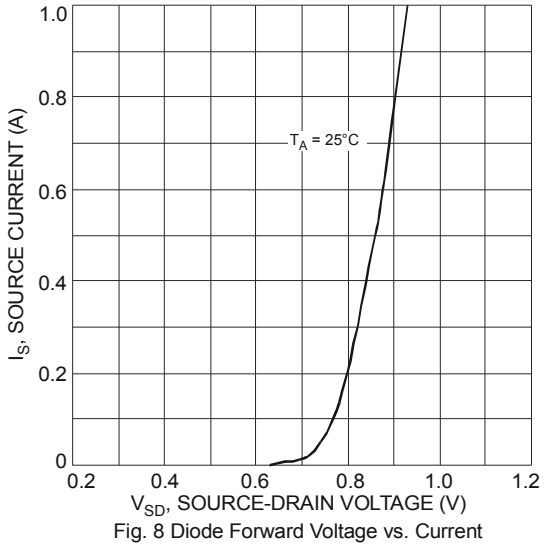



Fig. 8 Diode Forward Voltage vs. Current

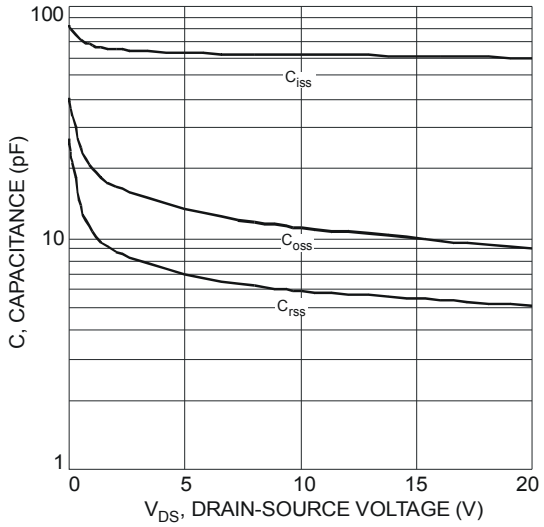



Fig. 9 Typical Total Capacitance

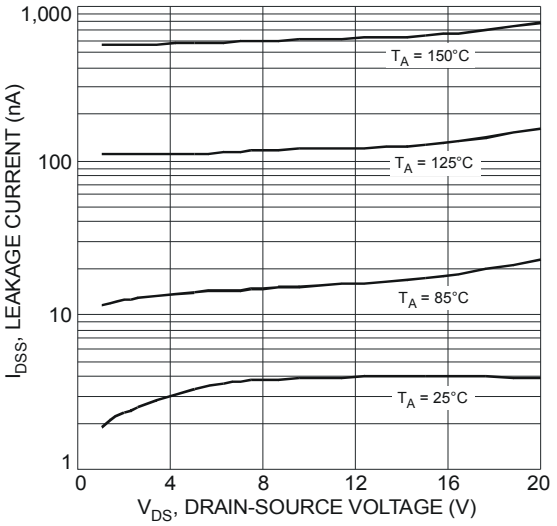



Fig. 10 Typical Leakage Current vs. Drain-Source Voltage

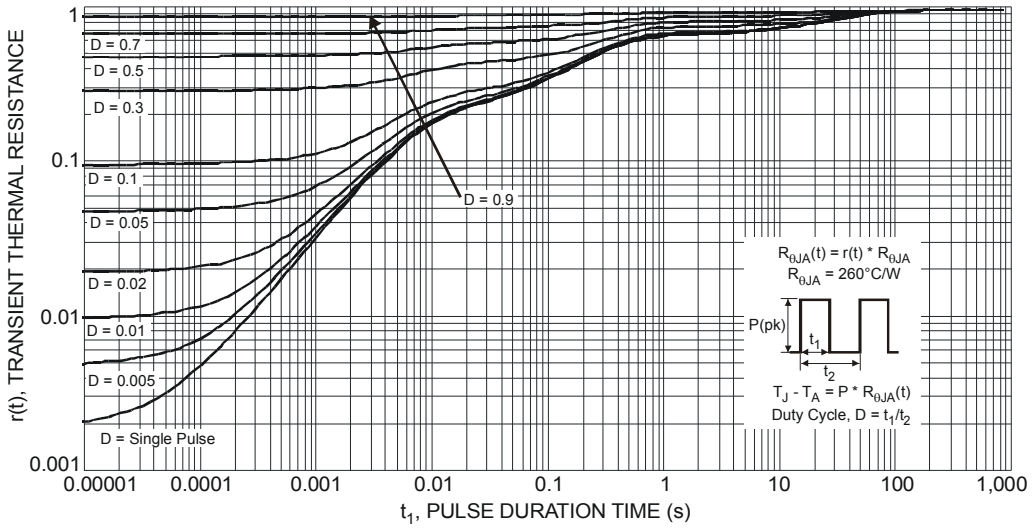



Fig. 11 Transient Thermal Response

## Electrical Characteristics P-CHANNEL – Q2 (@$T_A$ = +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 @$T_c$ = +25°C | $I_{DSS}$ | — | — | -100 | nA | $V_{DS}$ = -20V, $V_{GS}$ = 0V |
| Gate-Source Leakage | $I_{GSS}$ | — | — | ±2.0 | μA | $V_{GS}$ = ±4.5V, $V_{DS}$ = 0V |
| **ON CHARACTERISTICS (Note 6)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | -0.5 | — | -1.0 | V | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA |
| Static Drain-Source On-Resistance | $R_{DS\ (ON)}$ | — | 0.5 | 0.75 | Ω | $V_{GS}$ = -4.5V, $I_D$ = -430mA |
| | | | 0.7 | 1.05 | | $V_{GS}$ = -2.5V, $I_D$ = -300mA |
| | | | 1.0 | 1.5 | | $V_{GS}$ = -1.8V, $I_D$ = -150mA |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | — | 0.9 | — | S | $V_{DS}$ = -10V, $I_D$ = -250mA |
| Diode Forward Voltage (Note 6) | $V_{SD}$ | — | -0.8 | -1.2 | V | $V_{GS}$ = 0V, $I_S$ = -150mA |
| **DYNAMIC CHARACTERISTICS (Note 7)** | | | | | | |
| Input Capacitance | $C_{iss}$ | — | 59.76 | — | pF | $V_{DS}$ = -16V, $V_{GS}$ = 0V, f = 1.0MHz |
| Output Capacitance | $C_{oss}$ | — | 12.07 | — | pF | |
| Reverse Transfer Capacitance | $C_{rss}$ | — | 6.36 | — | pF | |
| Total Gate Charge (4.5V) | $Q_g$ | — | 622.4 | — | pC | $V_{GS}$ = -4.5V, $V_{DS}$ = -10V, $I_D$ = -250mA |
| Gate-Source Charge | $Q_{gs}$ | — | 100.3 | — | pC | |
| Gate-Drain Charge | $Q_{gd}$ | — | 132.2 | — | pC | |
| Turn-On Delay Time | $t_{D(on)}$ | — | 5.1 | — | ns | $V_{DS}$ = -10V, $V_{GS}$ = -4.5V, $R_G$ = 10Ω, $R_L$ = 47Ω |
| Turn-On Rise Time | $t_r$ | — | 8.1 | — | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | — | 28.4 | — | ns | |
| Turn-Off Fall Time | $t_f$ | — | 20.72 | — | ns | |

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

## P-CHANNEL – Q2

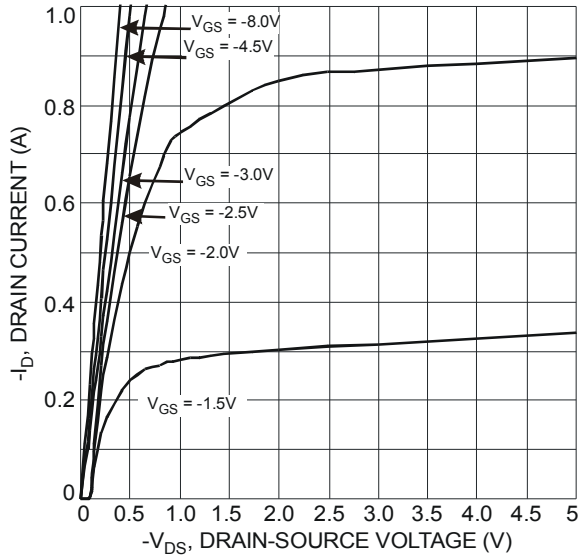



Fig. 12 Typical Output Characteristic

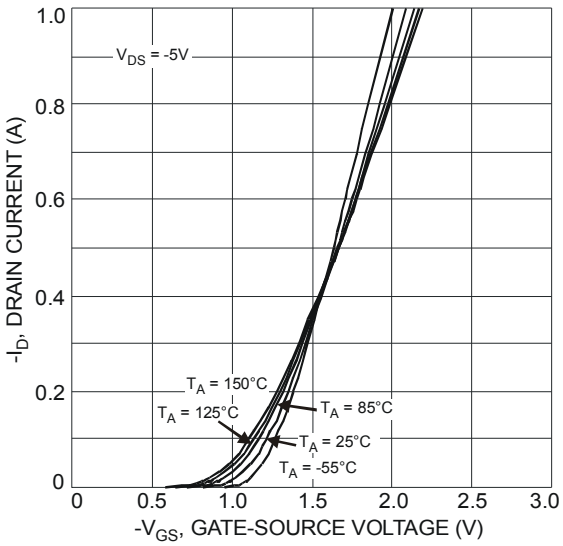



Fig. 13 Typical Transfer Characteristic

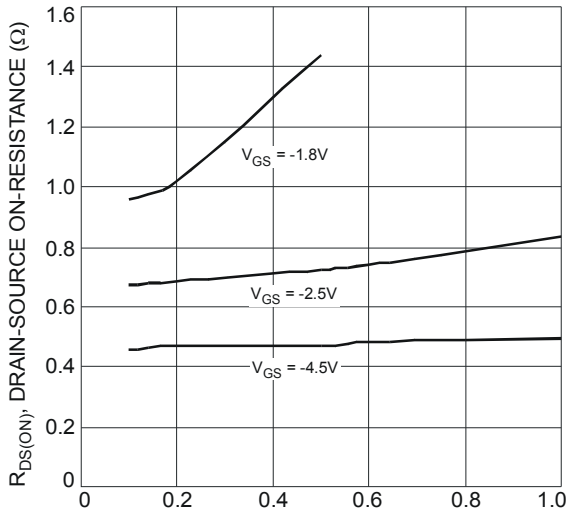



Fig. 14 Typical On-Resistance
vs. Drain Current and Gate Voltage

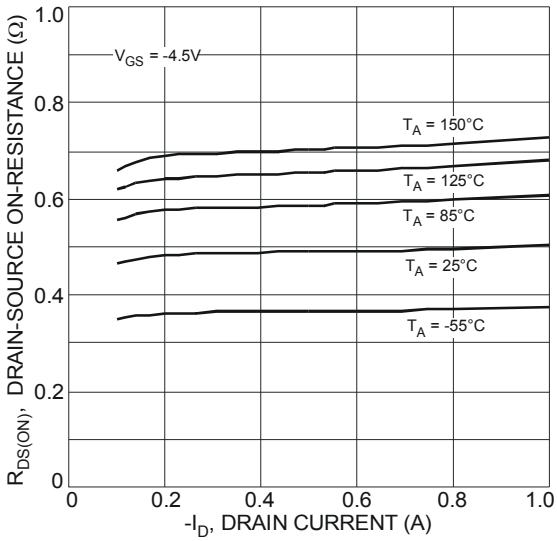



Fig. 15 Typical On-Resistance
vs. Drain Current and Temperature

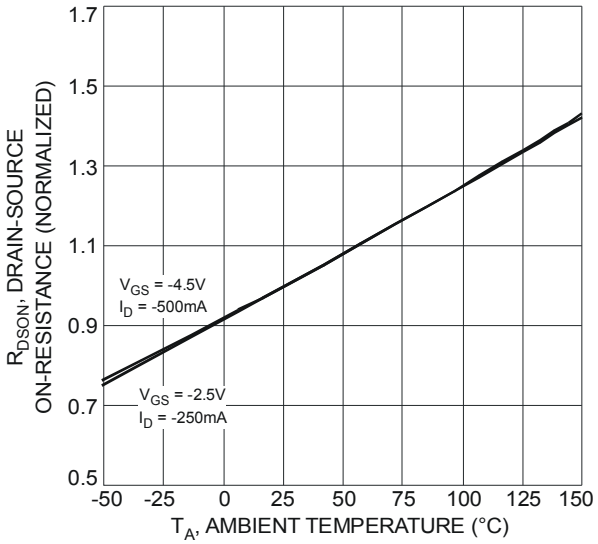



Fig. 16 On-Resistance Variation with Temperature

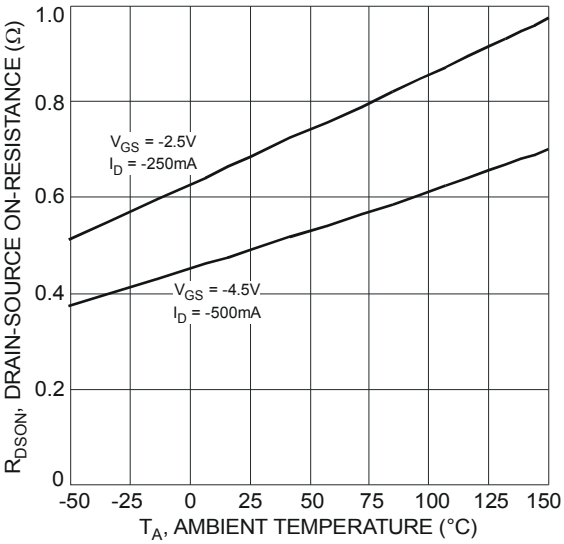



Fig. 17 On-Resistance Variation with Temperature

## P-CHANNEL – Q2 (cont.)

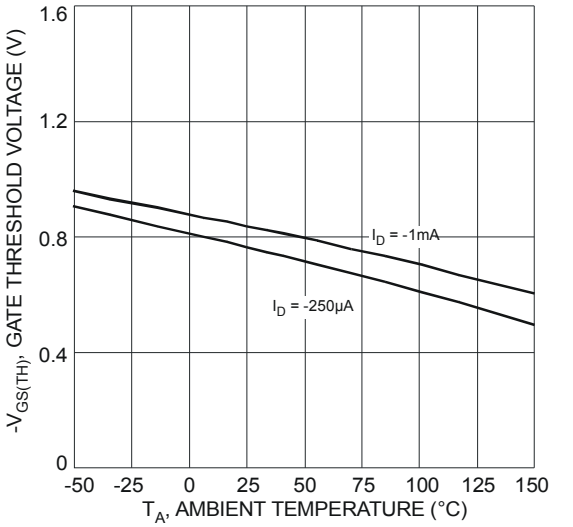



Fig. 18 Gate Threshold Variation vs. Ambient Temperature

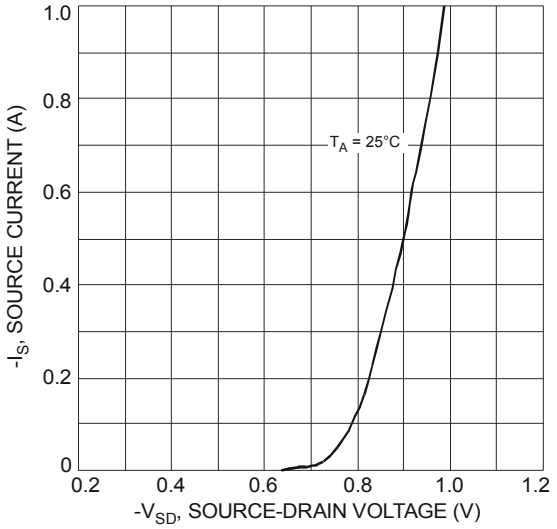



Fig. 19 Diode Forward Voltage vs. Current

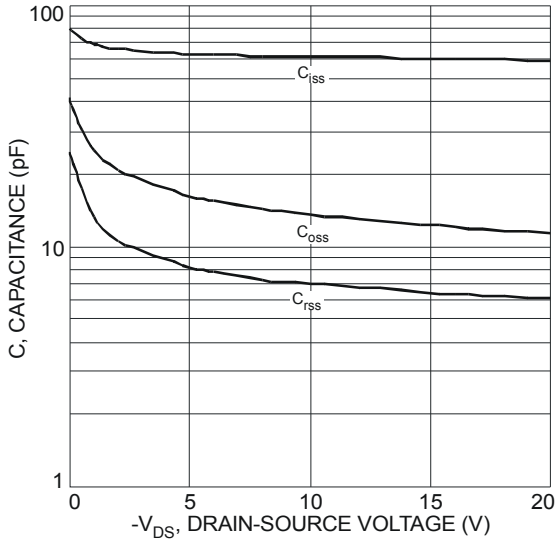



Fig. 20 Typical Total Capacitance

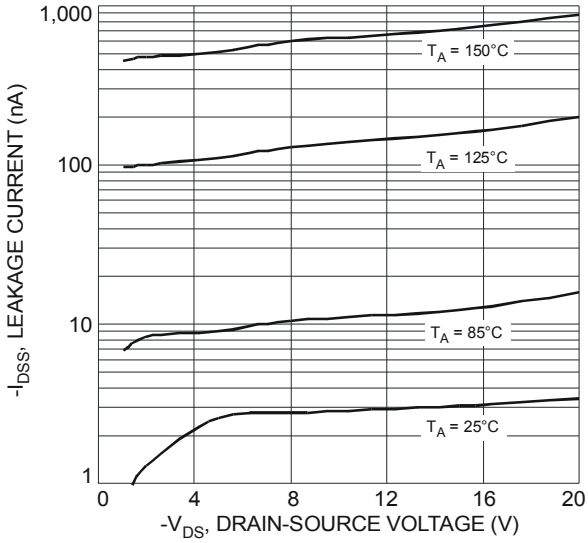



Fig. 21 Typical Leakage Current vs. Drain-Source Voltage

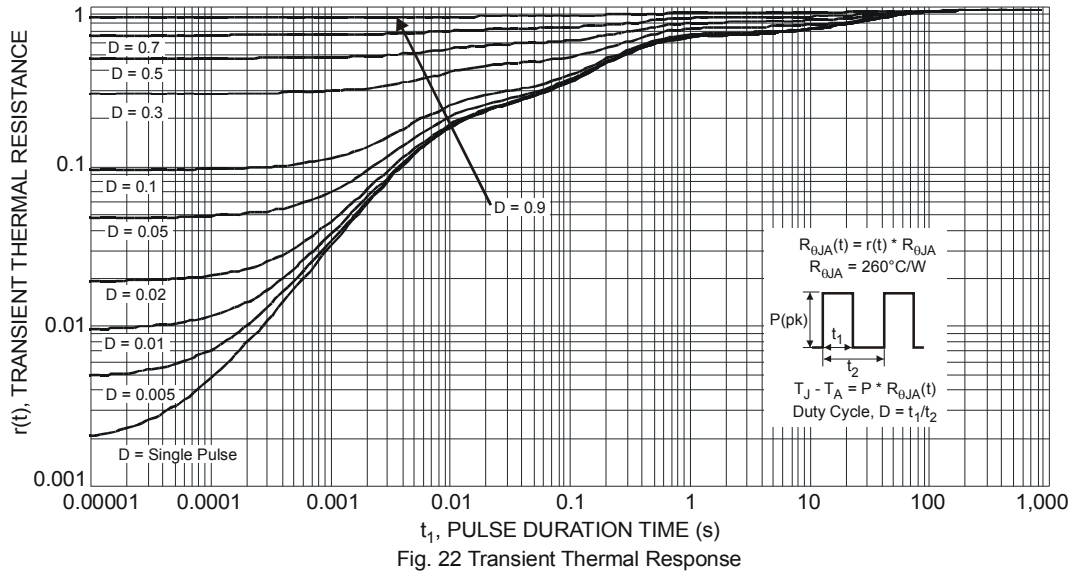
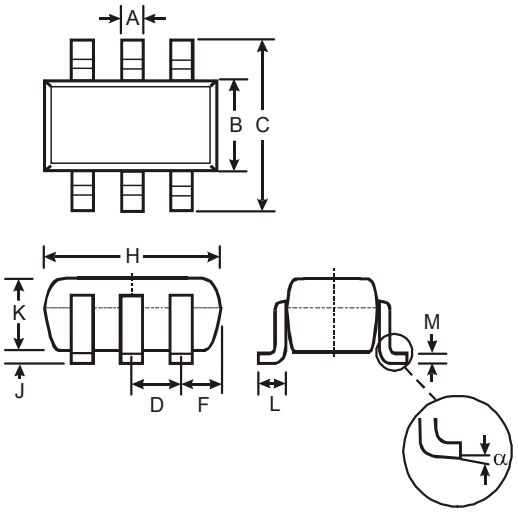



Fig. 22 Transient Thermal Response

## Package Outline Dimensions

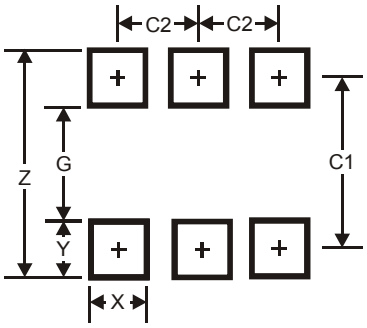
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.




| SOT363 | | |
|---|---|---|
| **Dim** | **Min** | **Max** |
| **A** | 0.10 | 0.30 |
| **B** | 1.15 | 1.35 |
| **C** | 2.00 | 2.20 |
| **D** | 0.65 Typ | |
| **F** | 0.40 | 0.45 |
| **H** | 1.80 | 2.20 |
| **J** | 0 | 0.10 |
| **K** | 0.90 | 1.00 |
| **L** | 0.25 | 0.40 |
| **M** | 0.10 | 0.22 |
| **α** | 0° | 8° |
| **All Dimensions in mm** | | |

## Suggested Pad Layout

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




| Dimensions | Value (in mm) |
|---|---|
| **Z** | 2.5 |
| **G** | 1.3 |
| **X** | 0.42 |
| **Y** | 0.6 |
| **C1** | 1.9 |
| **C2** | 0.65 |

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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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