## Product Summary

| $V_{(BR)DSS}$ | $R_{DS(on)}$ | $I_D$ $T_A = 25°C$ |
|---|---|---|
| -20V | 700mΩ @ $V_{GS}$ = -4.5V | -460mA |
| | 900mΩ @ $V_{GS}$ = -2.5V | -420mA |
| | 1300mΩ @ $V_{GS}$ = -1.8V | -350mA |

## Features and Benefits

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Low Input/Output Leakage
- **ESD Protected Up To 3kV**
- **Lead Free By Design/RoHS Compliant (Note 1)**
- **"Green" Device (Note 2)**
- **Qualified to AEC-Q101 standards for High Reliability**

## 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
- Load switch
- Power management functions

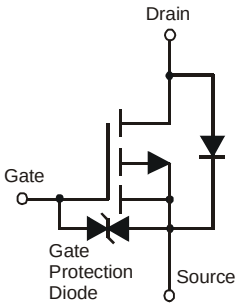
## Mechanical Data

- Case: SOT523
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin annealed over Alloy 42 leadframe. Solderable per MIL-STD-202, Method 208
- Terminal Connections: See Diagram
- Weight: 0.002 grams (approximate)

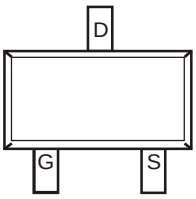
ESD PROTECTED TO 3kV

SOT523

Top View




Equivalent Circuit



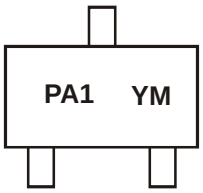

Top View

## Ordering Information (Note 3)

| Part Number | Case | Packaging |
|---|---|---|
| DMG1013T-7 | SOT523 | 3000/Tape & Reel |

Notes: 1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. No purposely added lead. Halogen and Antimony free.
2. Diodes Inc's "Green" policy can be found on our website at http://www.diodes.com.
3. For packaging details, go to our website at http://www.diodes.com.

## Marking Information




PA1 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: W = 2009)
M = Month (ex: 9 = September)

Date Code Key

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

| 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 |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## Maximum Ratings @$T_A$ = 25°C unless otherwise specified

| Characteristic | | | Symbol | Value | Units |
|---|---|---|---|---|---|
| Drain-Source Voltage | | | $V_{DSS}$ | -20 | V |
| Gate-Source Voltage | | | $V_{GSS}$ | ±6 | V |
| Drain Current (Note 4) | Steady State | $T_A$ = 25°C<br>$T_A$ = 85°C | $I_D$ | -0.46<br>-0.33 | A |
| Pulsed Drain Current (Note 5) | | | $I_{DM}$ | -6 | A |

## Thermal Characteristics @$T_A$ = 25°C unless otherwise specified

| Characteristic | Symbol | Value | Units |
|---|---|---|---|
| Total Power Dissipation (Note 4) | $P_D$ | 0.27 | W |
| Thermal Resistance, Junction to Ambient (Note 4) | $R_{\theta JA}$ | 461 | °C/W |
| Operating and Storage Temperature Range | $T_J$, $T_{STG}$ | -55 to +150 | °C |

## Electrical Characteristics @$T_A$ = 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 | $I_{DSS}$ | - | - | -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 | 0.7 | Ω | $V_{GS}$ = -4.5V, $I_D$ = -350mA |
| | | | 0.7 | 0.9 | | $V_{GS}$ = -2.5V, $I_D$ = -300mA |
| | | | 1.0 | 1.3 | | $V_{GS}$ = -1.8V, $I_D$ = -150mA |
| Forward Transfer Admittance | $\|Y_{fs}\|$ | - | 0.9 | - | S | $V_{DS}$ = -10V, $I_D$ = -250mA |
| Diode Forward Voltage | $V_{SD}$ | | -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 | $Q_g$ | - | 580 | - | pC | $V_{GS}$ = -4.5V, $V_{DS}$ = -10V, $I_D$ = -250mA |
| Gate-Source Charge | $Q_{gs}$ | - | 104 | - | pC | |
| Gate-Drain Charge | $Q_{gd}$ | - | 125 | - | pC | |
| Turn-On Delay Time | $t_{D(on)}$ | - | 5.1 | - | ns | $V_{DD}$ = -10V, $V_{GS}$ = -4.5V, $R_L$ = 47Ω, $R_G$ = 10Ω, $I_D$ = -200mA |
| Turn-On Rise Time | $t_r$ | - | 8.1 | - | ns | |
| Turn-Off Delay Time | $t_{D(off)}$ | - | 28.4 | - | ns | |
| Turn-Off Fall Time | $t_f$ | - | 20.7 | - | ns | |

Notes:
4. For a device surface mounted on a minimum recommended pad layout of an FR4 PCB, in still air conditions; the device is measured when operating in steady-state condition.
5. Same as note 4, except the device is pulsed at duty cycle of 1% for a pulse width of 10μs.
6. Measured under pulsed conditions to minimize self-heating effect. Pulse width ≤ 300μs; duty cycle ≤ 2%
7. For design aid only, not subject to production testing.


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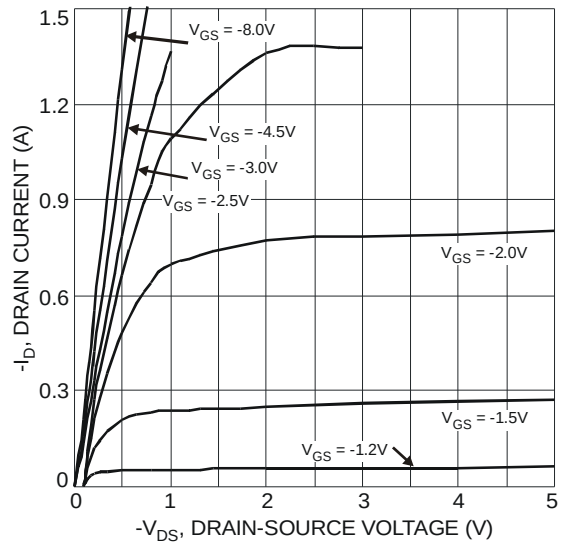


Fig. 1 Typical Output Characteristic

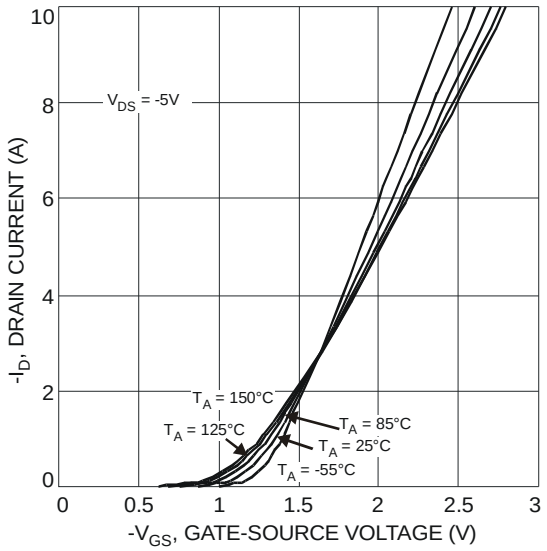


Fig. 2 Typical Transfer Characteristic

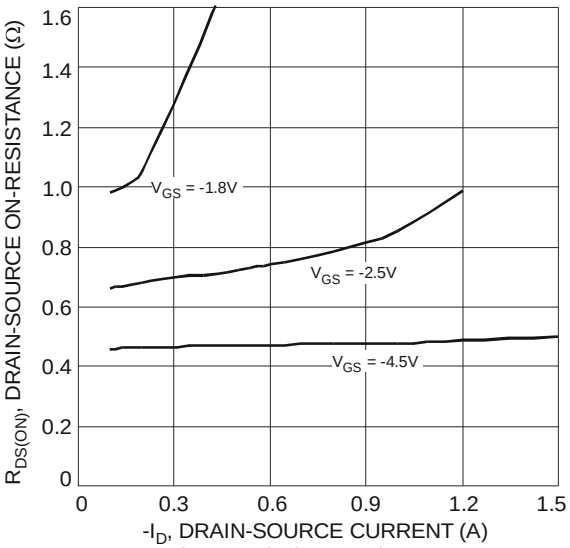


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

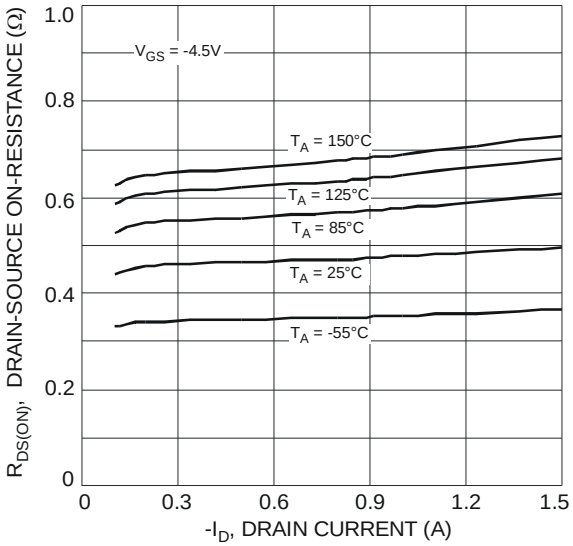


Fig. 4 Typical On-Resistance
vs. Drain Current and Temperature

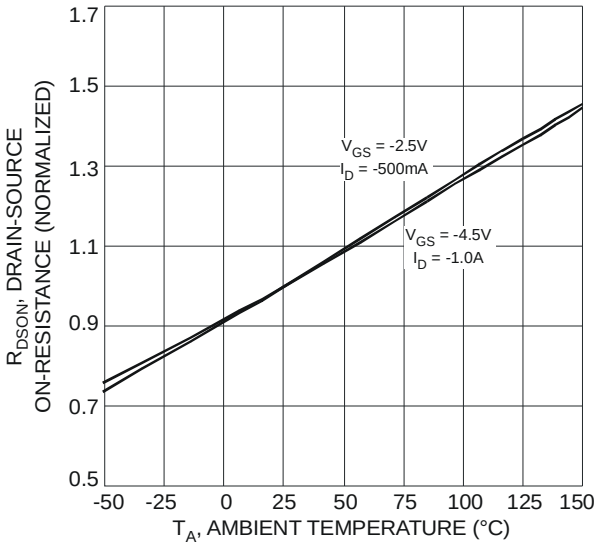


Fig. 5 On-Resistance Variation with Temperature

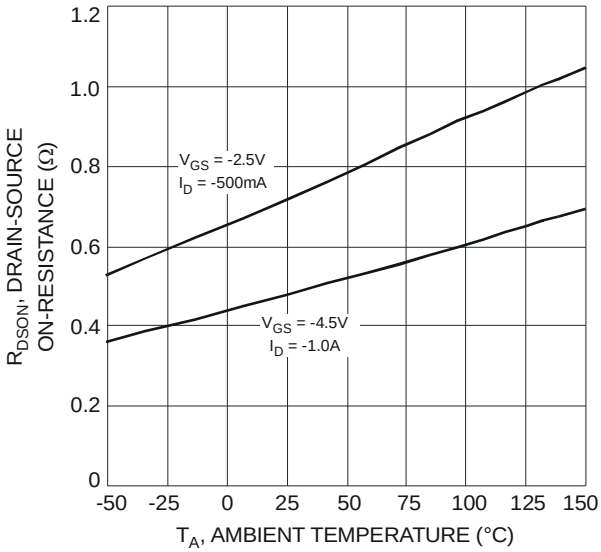


Fig. 6 On-Resistance Variation with Temperature


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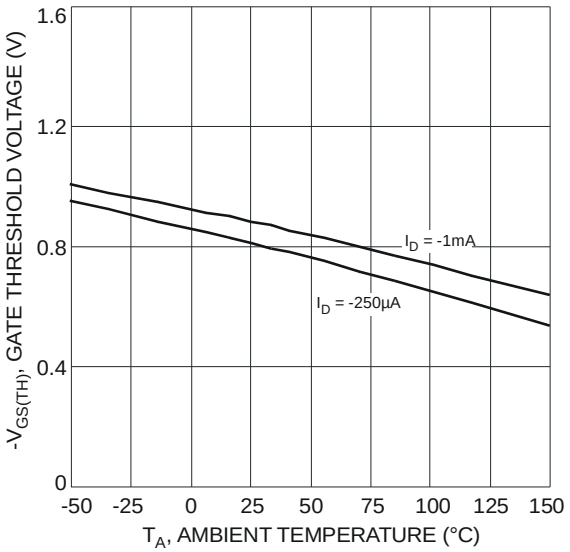


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

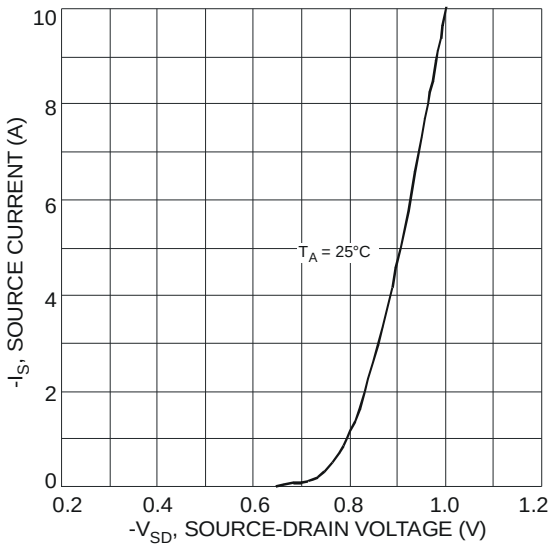


Fig. 8 Diode Forward Voltage vs. Current

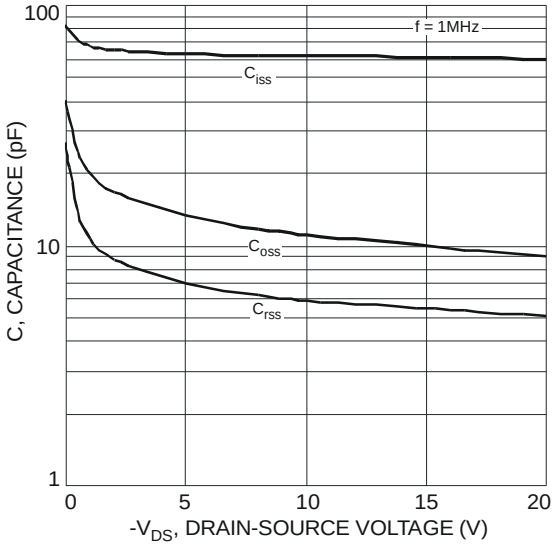


Fig. 9 Typical Total Capacitance

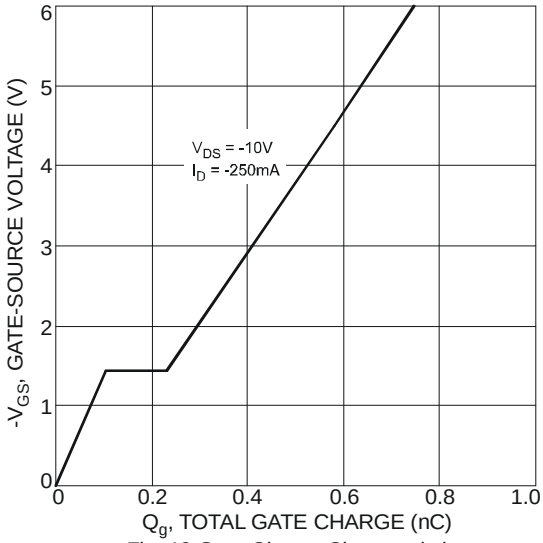


Fig. 10 Gate-Charge Characteristics

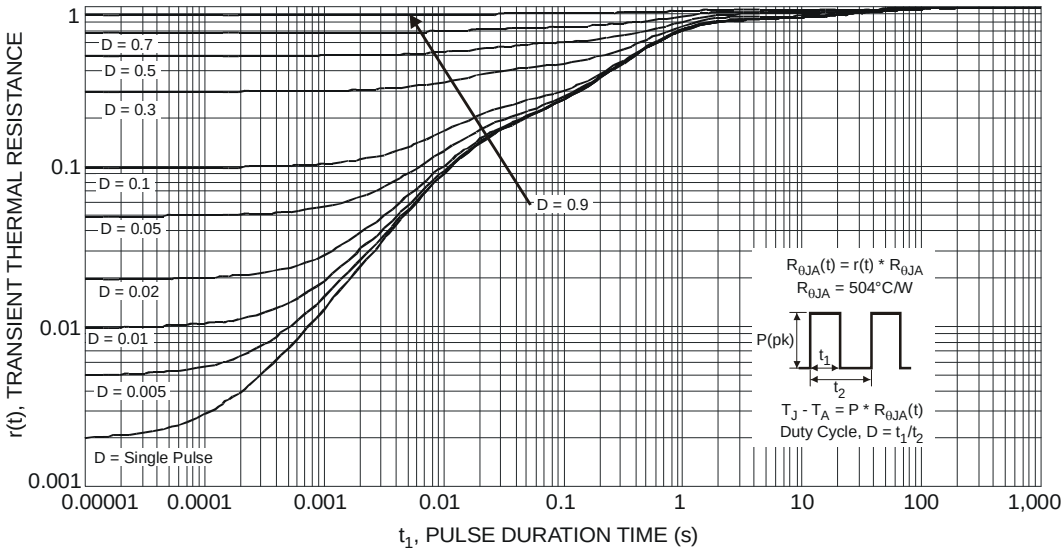


Fig. 11 Transient Thermal Response


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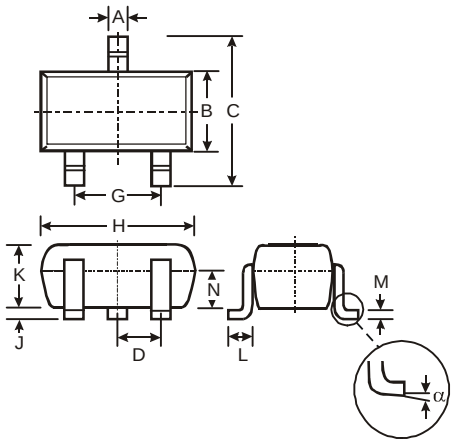
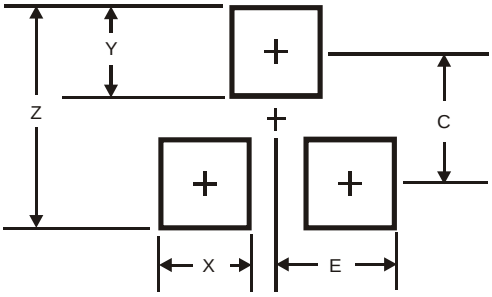
## Package Outline Dimensions




| SOT523 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.15 | 0.30 | 0.22 |
| **B** | 0.75 | 0.85 | 0.80 |
| **C** | 1.45 | 1.75 | 1.60 |
| **D** | — | — | 0.50 |
| **G** | 0.90 | 1.10 | 1.00 |
| **H** | 1.50 | 1.70 | 1.60 |
| **J** | 0.00 | 0.10 | 0.05 |
| **K** | 0.60 | 0.80 | 0.75 |
| **L** | 0.10 | 0.30 | 0.22 |
| **M** | 0.10 | 0.20 | 0.12 |
| **N** | 0.45 | 0.65 | 0.50 |
| **α** | 0° | 8° | — |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout




| Dimensions | Value (in mm) |
|---|---|
| **Z** | 1.8 |
| **X** | 0.4 |
| **Y** | 0.51 |
| **C** | 1.3 |
| **E** | 0.7 |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