# DMG1013TQ

## 20V P-CHANNEL ENHANCEMENT MODE MOSFET

## Product Summary

| $BV_{DSS}$ | $R_{DS(ON)}$ Max | $I_D$ Max<br>$T_A$ = +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
- **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**
- **PPAP Capable (Note 4)**

## Description and Applications

This MOSFET is designed to meet the stringent requirements of Automotive applications. It is qualified to AEC-Q101, supported by a PPAP and is ideal for use in:

- DC-DC Converters
- Load Switch
- Power Management Functions

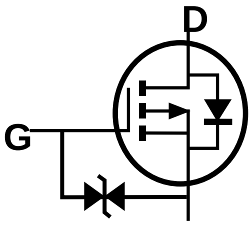
## Mechanical Data

- 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 ⓔ3
- Terminal Connections: See Diagram
- Weight: 0.002 grams (Approximate)

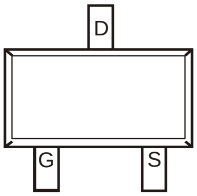
ESD PROTECTED TO 3kV

SOT523

Top View



Equivalent Circuit



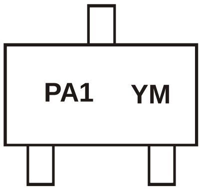
Top View

## Ordering Information (Note 5)

| Part Number | Case | Packaging |
|---|---|---|
| DMG1013TQ-7 | SOT523 | 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.htmlfor 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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to http://www.diodes.com/product_compliance_definitions.html.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

## Marking Information



PA1 = Product Type Marking Code
YM = Date Code Marking
Y = Year (ex: D = 2016)
M = Month (ex: 9 = September)

Date Code Key

| Year | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|
| Code | D | E | F | G | H | I | J | K | L |

| 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 |

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

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DSS}$ | -20 | V |
| Gate-Source Voltage | $V_{GSS}$ | ±6 | V |
| Drain Current (Note 6) Steady State $T_A = +25°C$<br>$T_A = +85°C$ | $I_D$ | -0.46<br>-0.33 | A |
| Pulsed Drain Current (Note 7) | $I_{DM}$ | -6 | A |

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

| Characteristic | Symbol | Value | Unit |
|---|---|---|---|
| Total Power Dissipation (Note 6) | $P_D$ | 0.27 | W |
| Thermal Resistance, Junction to Ambient (Note 6) | $R_{\theta JA}$ | 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 8)** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | -20 | - | - | V | $V_{GS} = 0V$, $I_D = -250\mu A$ |
| 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 | $V_{GS} = \pm 4.5V$, $V_{DS} = 0V$ |
| **ON CHARACTERISTICS (Note 8)** | | | | | | |
| Gate Threshold Voltage | $V_{GS(TH)}$ | -0.5 | - | -1.0 | V | $V_{DS} = V_{GS}$, $I_D = -250\mu A$ |
| 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 | $\lvert Y_{fs} \rvert$ | - | 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 9)** | | | | | | |
| 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 | $V_{DD} = -10V$, $V_{GS} = -4.5V$, $R_L = 47\Omega$, $R_g = 10\Omega$, $I_D = -200mA$ |
| 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:
6. For a device surface mounted on a minimum recommended pad layout of an FR-4 PCB, in still air conditions; the device is measured when operating in steady-state condition.
7. Same as note 5, except the device is pulsed at duty cycle of 1% for a pulse width of 10µs.
8. Measured under pulsed conditions to minimize self-heating effect. Pulse width ≤ 300µs; duty cycle ≤ 2%.
9. For design aid only, not subject to production testing.

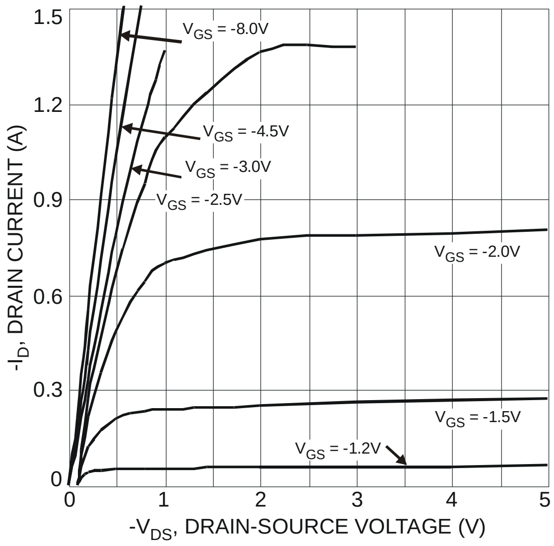


Fig. 1 Typical Output Characteristic

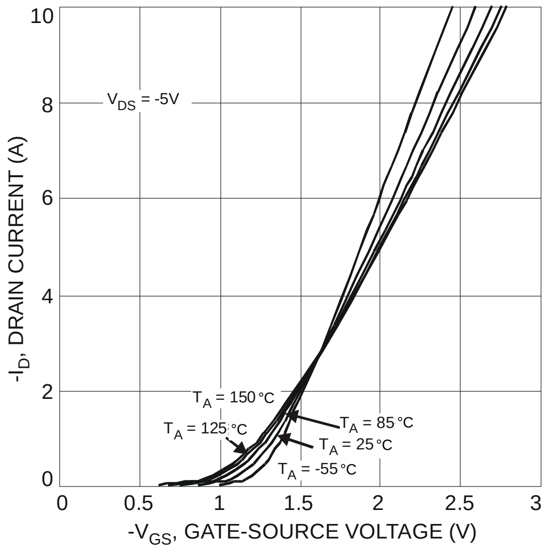


Fig. 2 Typical Transfer Characteristic

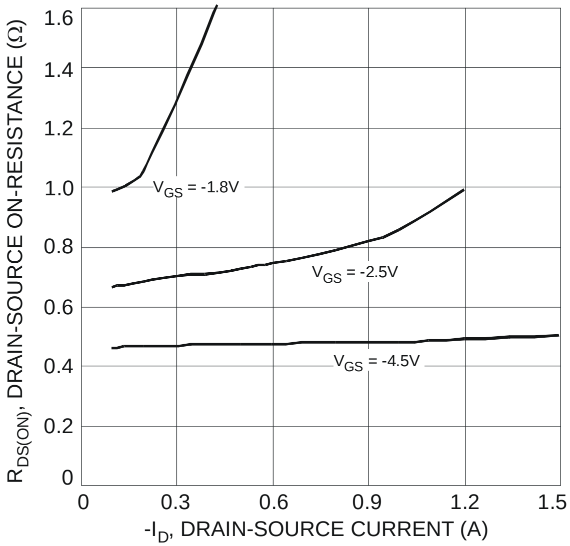


Fig. 3 Typical On-Resistance
vs. Drain Current and Gate Voltage

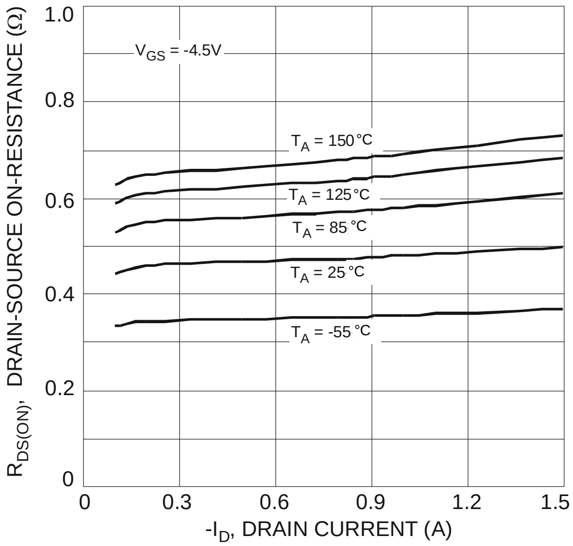


Fig. 4 Typical On-Resistance
vs. Drain Current and Temperature

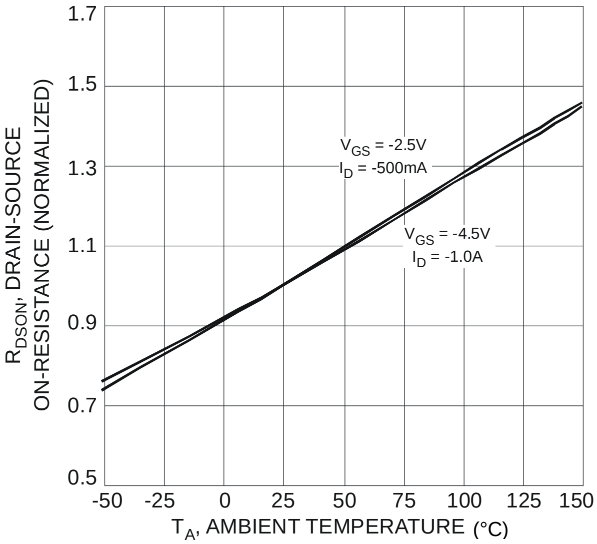


Fig. 5 On-Resistance Variation with Temperature

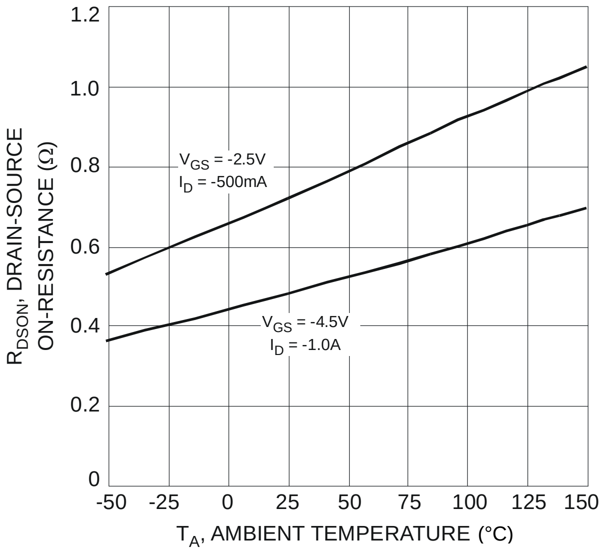


Fig. 6 On-Resistance Variation with Temperature

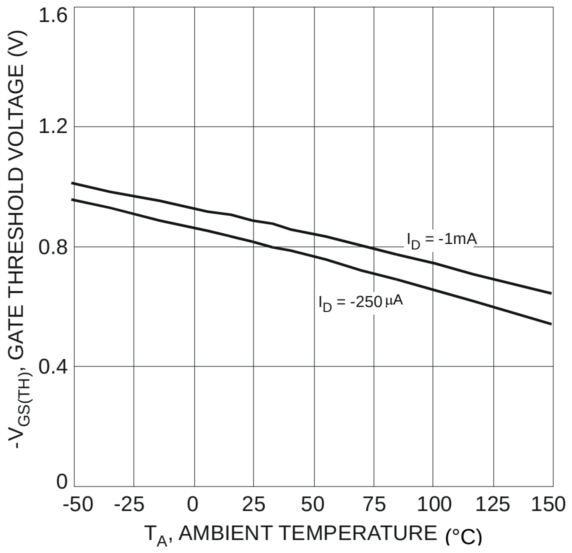


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

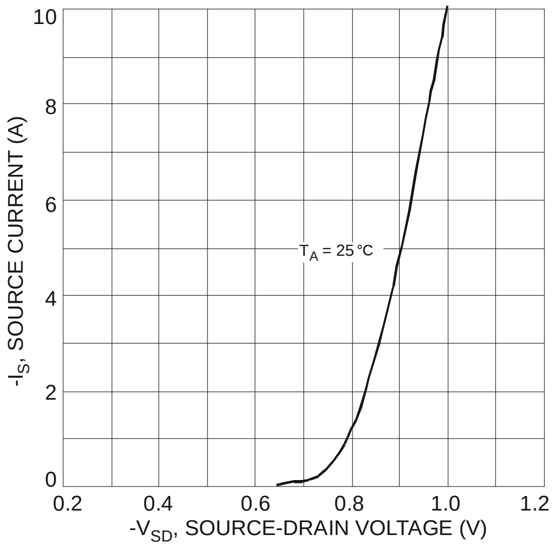


Fig. 8 Diode Forward Voltage vs. Current

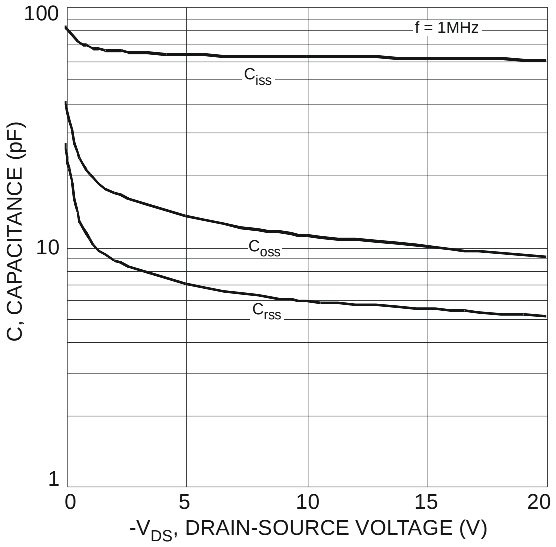


Fig. 9 Typical Total Capacitance

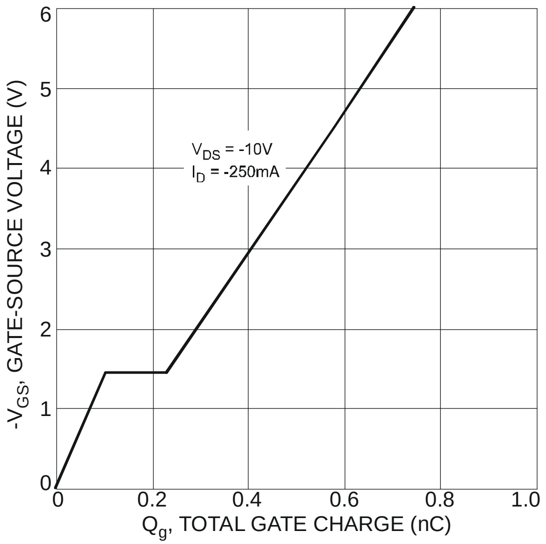


Fig. 10 Gate-Charge Characteristics

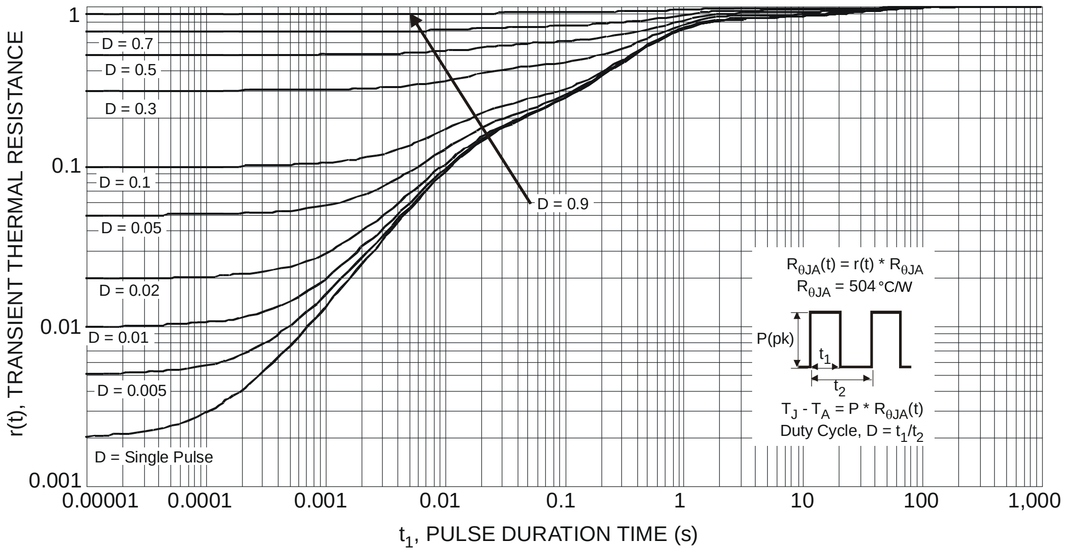
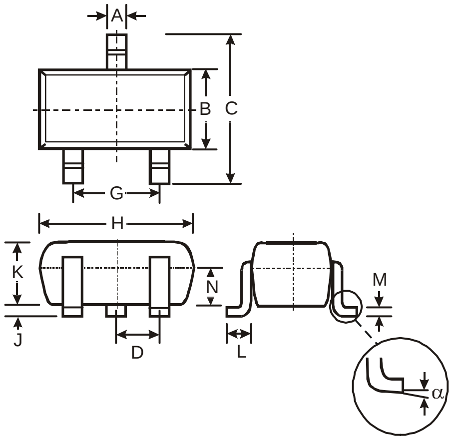


Fig. 11 Transient Thermal Response

## Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT523**

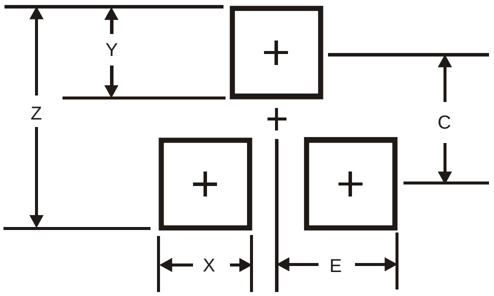


| SOT523 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.15 | 0.30 | 0.22 |
| **B** | 0.75 | 0.85 | 0.80 |
| **C** | 1.45 | 1.75 | 1.60 |
| **D** | — | — | 0.50 |
| **G** | 0.90 | 1.10 | 1.00 |
| **H** | 1.50 | 1.70 | 1.60 |
| **J** | 0.00 | 0.10 | 0.05 |
| **K** | 0.60 | 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

Please see http://www.diodes.com/package-outlines.html for the latest version.

**SOT523**



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

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