

## Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub> Max	I <sub>D</sub> Max T <sub>A</sub> = +25°C
-20V	700mΩ @ V <sub>GS</sub> = -4.5V	-460mA
	900mΩ @ V <sub>GS</sub> = -2.5V	-420mA
	1300mΩ @ V <sub>GS</sub> = -1.8V	-350mA

## 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

## 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)**

## Mechanical Data

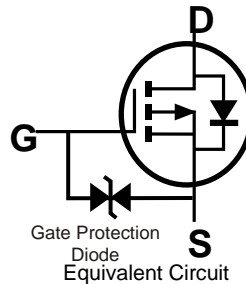
- Case: SOT523
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Annealed over Alloy 42 Leadframe. Solderable per MIL-STD-202, Method 208 ③
- Terminal Connections: See Diagram
- Weight: 0.002 grams (Approximate)



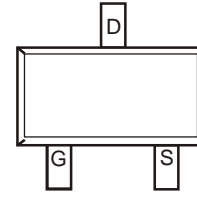
ESD PROTECTED TO 3kV



Top View



Gate Protection Diode Equivalent Circuit



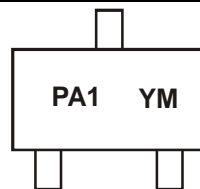
Top View

## 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.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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to [http://www.diodes.com/product\\_compliance\\_definitions.html](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** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic			Symbol	Value	Unit
Drain-Source Voltage			$V_{DSS}$	-20	V
Gate-Source Voltage			$V_{GSS}$	$\pm 6$	V
Drain Current (Note 6)	Steady State	$T_A = +25^\circ\text{C}$	$I_D$	-0.46	A
		$T_A = +85^\circ\text{C}$		-0.33	
Pulsed Drain Current (Note 7)			$I_{DM}$	-6	A

**Thermal Characteristics** (@ $T_A = +25^\circ\text{C}$ , 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	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	-20	-	-	V	$V_{GS} = 0V, I_D = -250\mu\text{A}$
Zero Gate Voltage Drain Current $T_J = +25^\circ\text{C}$	$I_{DSS}$	-	-	-100	nA	$V_{DS} = -20V, V_{GS} = 0V$
Gate-Source Leakage	$I_{GSS}$	-	-	$\pm 2.0$	$\mu\text{A}$	$V_{GS} = \pm 4.5V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 8)</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	-0.5	-	-1.0	V	$V_{DS} = V_{GS}, I_D = -250\mu\text{A}$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	-	0.5	0.7	$\Omega$	$V_{GS} = -4.5V, I_D = -350\text{mA}$
			0.7	0.9		$V_{GS} = -2.5V, I_D = -300\text{mA}$
			1.0	1.3		$V_{GS} = -1.8V, I_D = -150\text{mA}$
Forward Transfer Admittance	$ Y_{fs} $	-	0.9	-	S	$V_{DS} = -10V, I_D = -250\text{mA}$
Diode Forward Voltage	$V_{SD}$	-	-0.8	-1.2	V	$V_{GS} = 0V, I_S = -150\text{mA}$
<b>DYNAMIC CHARACTERISTICS (Note 9)</b>						
Input Capacitance	$C_{iss}$	-	59.76	-	pF	$V_{DS} = -16V, V_{GS} = 0V, f = 1.0\text{MHz}$
Output Capacitance	$C_{oss}$	-	12.07	-	pF	
Reverse Transfer Capacitance	$C_{rss}$	-	6.36	-	pF	
Total Gate Charge	$Q_g$	-	580	-	pC	$V_{GS} = -4.5V, V_{DS} = -10V, I_D = -250\text{mA}$
Gate-Source Charge	$Q_{gs}$	-	104	-	pC	
Gate-Drain Charge	$Q_{gd}$	-	125	-	pC	
Turn-On Delay Time	$t_{D(ON)}$	-	5.1	-	ns	$V_{DD} = -10V, V_{GS} = -4.5V, R_L = 47\Omega, R_g = 10\Omega, I_D = -200\text{mA}$
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 10 $\mu\text{s}$ .
  8. Measured under pulsed conditions to minimize self-heating effect. Pulse width  $\leq 300\mu\text{s}$ ; duty cycle  $\leq 2\%$ .
  9. For design aid only, not subject to production testing.

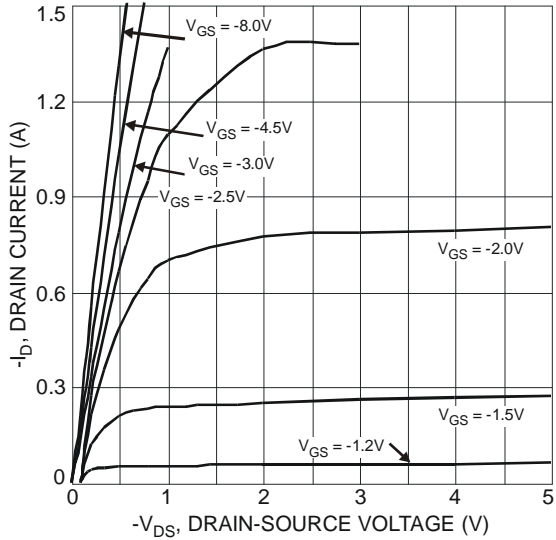


Fig. 1 Typical Output Characteristic

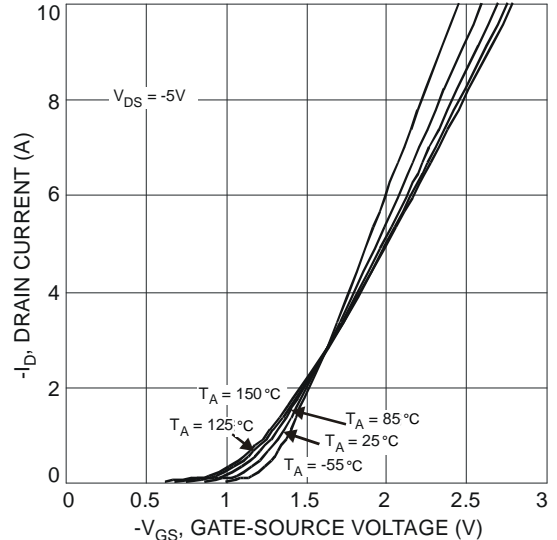


Fig. 2 Typical Transfer Characteristic

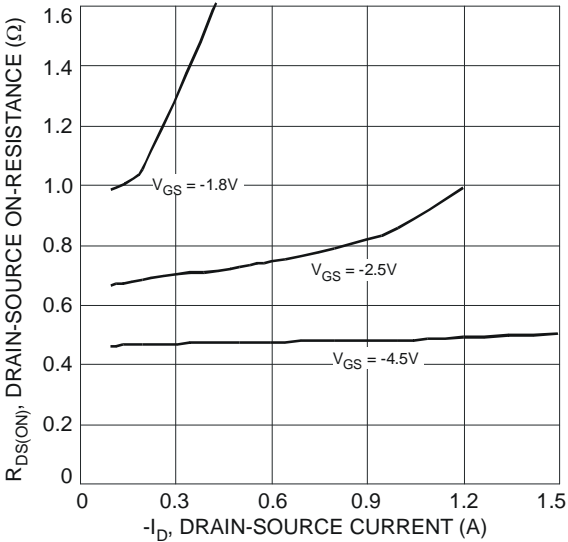


Fig. 3 Typical On-Resistance vs. Drain Current and Gate Voltage

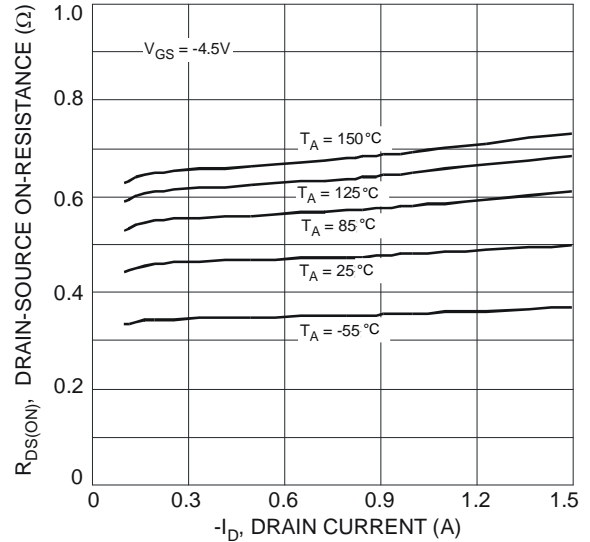


Fig. 4 Typical On-Resistance vs. Drain Current and Temperature

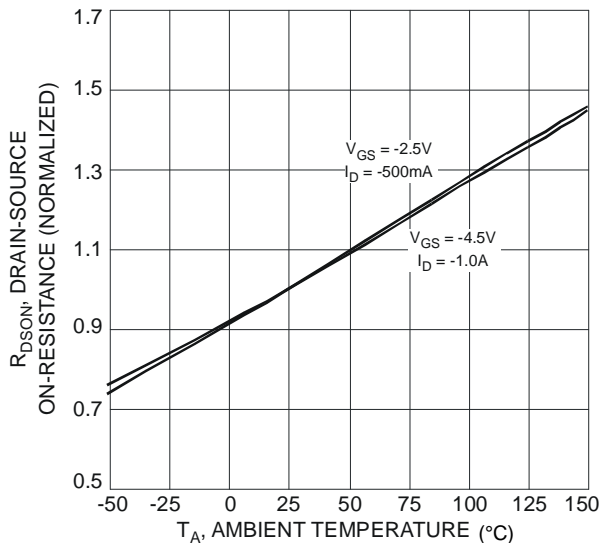


Fig. 5 On-Resistance Variation with Temperature

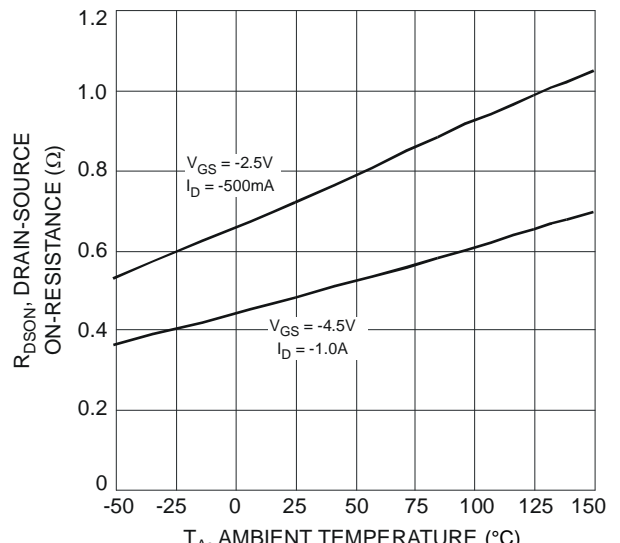


Fig. 6 On-Resistance Variation with Temperature

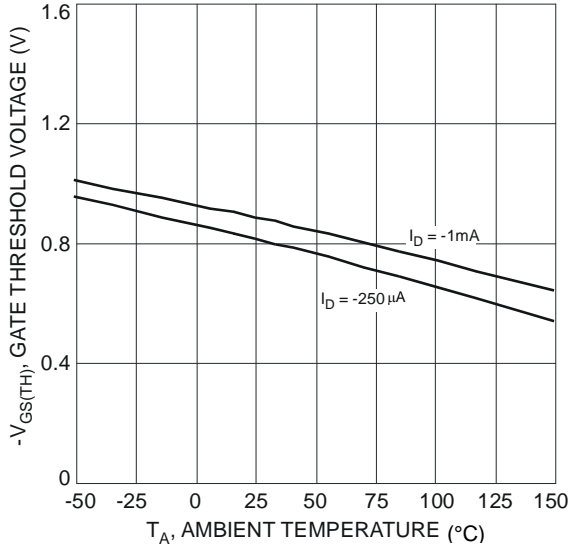


Fig. 7 Gate Threshold Variation vs. Ambient Temperature

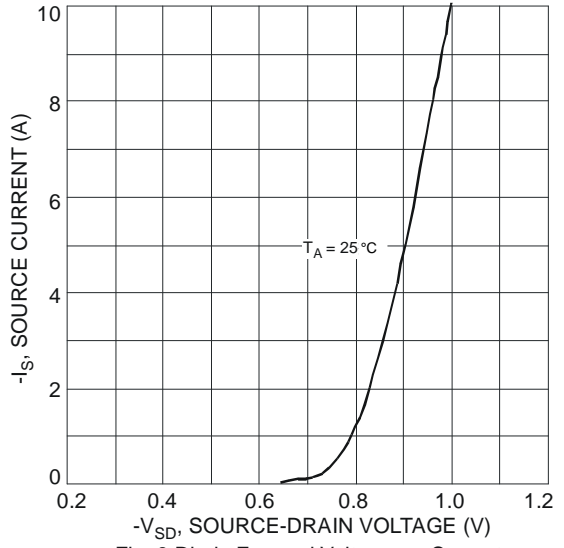


Fig. 8 Diode Forward Voltage vs. Current

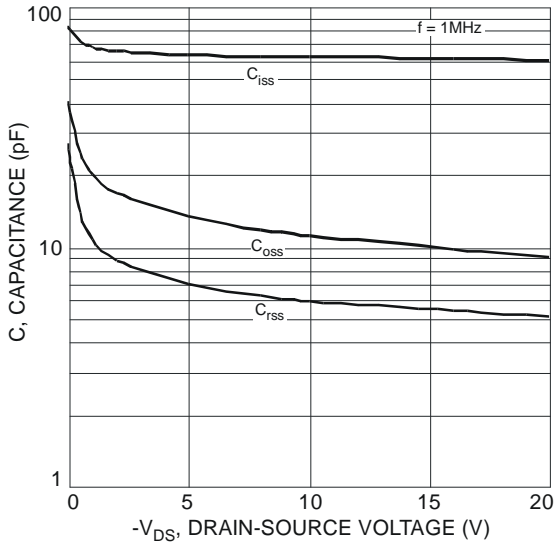


Fig. 9 Typical Total Capacitance

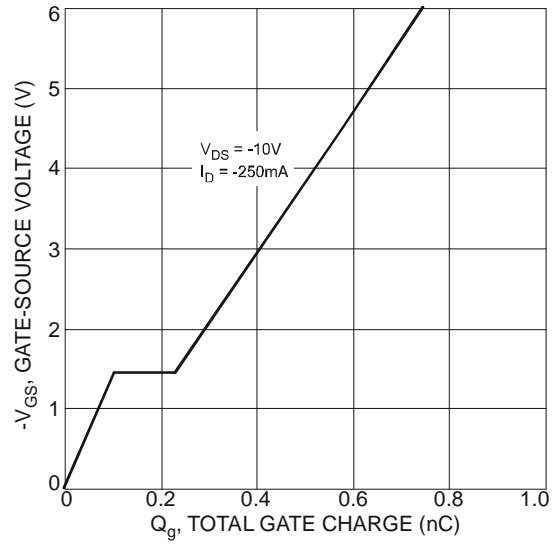


Fig. 10 Gate-Charge Characteristics

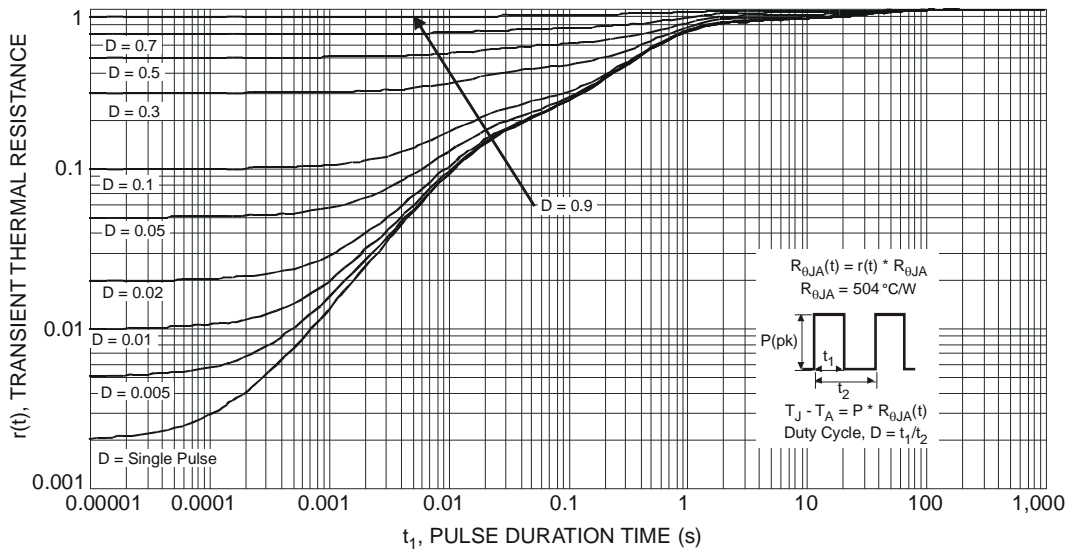
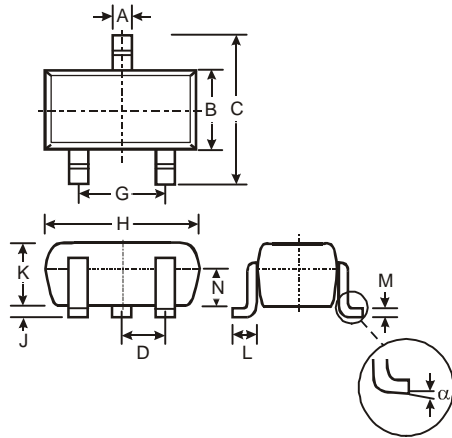


Fig. 11 Transient Thermal Response

**Package Outline Dimensions**

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

**SOT523**

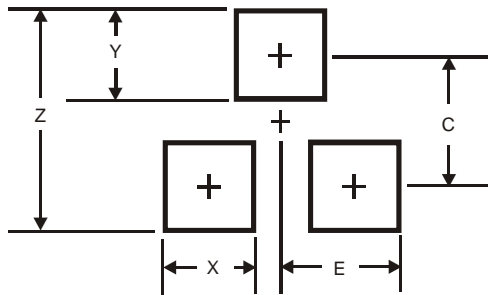


SOT523			
Dim	Min	Max	Typ
A	0.15	0.30	0.22
B	0.75	0.85	0.80
C	1.45	1.75	1.60
D	—	—	0.50
G	0.90	1.10	1.00
H	1.50	1.70	1.60
J	0.00	0.10	0.05
K	0.60	0.80	0.75
L	0.10	0.30	0.22
M	0.10	0.20	0.12
N	0.45	0.65	0.50
α	0°	8°	—
All Dimensions in mm			

**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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