

**DUAL N-CHANNEL ENHANCEMENT MODE MOSFET**

### Product Summary

BV <sub>DSS</sub>	R <sub>DS(ON)</sub>	Package	I <sub>D</sub> T <sub>A</sub> = +25°C
60V	8Ω @ V <sub>GS</sub> = 5V	SOT363	170mA
	6Ω @ V <sub>GS</sub> = 10V		200mA

### Description

This new generation MOSFET is designed to minimize the on-state resistance (R<sub>DS(ON)</sub>), yet maintain superior switching performance, making it ideal for high-efficiency power management applications.

### Applications

- DC-DC Converters
- Power Management Functions
- Battery Operated Systems and Solid-State Relays
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc.

### Features

- Dual N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- HBM Class 1C
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The 2N7002DWAQ is suitable for automotive applications requiring specific change control; it is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
- <https://www.diodes.com/quality/product-definitions/>

### Mechanical Data

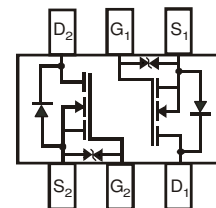
- Case: SOT363
- Case Material: Molded Plastic.  
UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish Annealed over Alloy 42 Leadframe  
Solderable per MIL-STD-202, Method 208 Ⓔ
- Terminal Connections: See Diagram
- Weight: 0.006 grams (Approximate)



HBM Class 1C



Top View



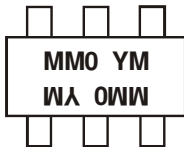
Top View  
Internal Schematic

### Ordering Information (Note 4)

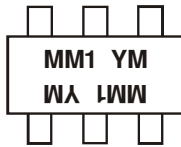
Part Number	Compliance	Case	Packaging
2N7002DWA-7	Standard	SOT363	3,000/Tape & Reel
2N7002DWA-13	Standard	SOT363	10,000/Tape & Reel
2N7002DWAQ-7	Automotive	SOT363	3,000/Tape & Reel
2N7002DWAQ-13	Automotive	SOT363	10,000/Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> 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 <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

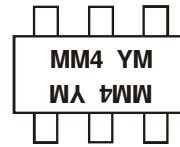
## Marking Information



MM0 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: E = 2017)  
M = Month (ex: 9 = September)



MM1 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: E = 2017)  
M = Month (ex: 9 = September)



MM4 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: E = 2017)  
M = Month (ex: 9 = September)

### Date Code Key

Year	2012	-	2017	2018	2019	2020	2021	2022	2023	2024
Code	Z	-	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	0	N	D

## Maximum Ratings (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic				Symbol	Value	Unit
Drain-Source Voltage				V <sub>DSS</sub>	60	V
Gate-Source Voltage				V <sub>GSS</sub>	±20	V
Continuous Drain Current (Note 5)	V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	180	mA
			T <sub>A</sub> = +70°C		140	
Continuous Drain Current (Note 5)	V <sub>GS</sub> = 5V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	150	mA
			T <sub>A</sub> = +70°C		120	
Continuous Drain Current (Note 6)	V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	200	mA
			T <sub>A</sub> = +70°C		160	
Continuous Drain Current (Note 6)	V <sub>GS</sub> = 5V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	170	mA
			T <sub>A</sub> = +70°C		140	
Pulsed Drain Current (10μs Pulse, Duty Cycle = 1%)				I <sub>DM</sub>	700	mA

## Thermal Characteristics

Characteristic	Symbol	Value	Unit
Total Power Dissipation (Note 5)	P <sub>D</sub>	300	mW
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	435	°C/W
Total Power Dissipation (Note 6)	P <sub>D</sub>	400	mW
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	330	°C/W
Thermal Resistance, Junction to Case (Note 6)	R <sub>θJC</sub>	139	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

- Notes:
5. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  6. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout.

**Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</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>	—	—	1.0	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Body Leakage	I <sub>GSS</sub>	—	—	±5	μA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	V <sub>GS(TH)</sub>	0.8	—	2.5	V	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	—	—	8	Ω	V <sub>GS</sub> = 5.0V, I <sub>D</sub> = 0.115A
		—	—	6	Ω	V <sub>GS</sub> = 10.0V, I <sub>D</sub> = 0.115A
Forward Transconductance	g <sub>FS</sub>	80	—	—	mS	V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.115A
Diode Forward Voltage	V <sub>SD</sub>	—	0.8	1.2	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 115mA
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	C <sub>iss</sub>	—	22.0	—	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	3.2	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	2.0	—	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 30V, I <sub>D</sub> = 150mA
Gate Resistance	R <sub>G</sub>	—	88	—		
Total Gate Charge V <sub>GS</sub> = 10V	Q <sub>g</sub>	—	0.87	—		
Total Gate Charge V <sub>GS</sub> = 4.5V	Q <sub>g</sub>	—	0.43	—		
Gate-Source Charge	Q <sub>gs</sub>	—	0.11	—	ns	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.115A, V <sub>GEN</sub> = 10V, R <sub>GEN</sub> = 25Ω
Gate-Drain Charge	Q <sub>gd</sub>	—	0.11	—		
Turn-On Delay Time	t <sub>D(ON)</sub>	—	3.3	—		
Turn-On Rise Time	t <sub>R</sub>	—	3.2	—		
Turn-Off Delay Time	t <sub>D(OFF)</sub>	—	12.0	—		
Turn-Off Fall Time	t <sub>F</sub>	—	6.3	—		

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

NOT RECOMMENDED FOR NEW DESIGN

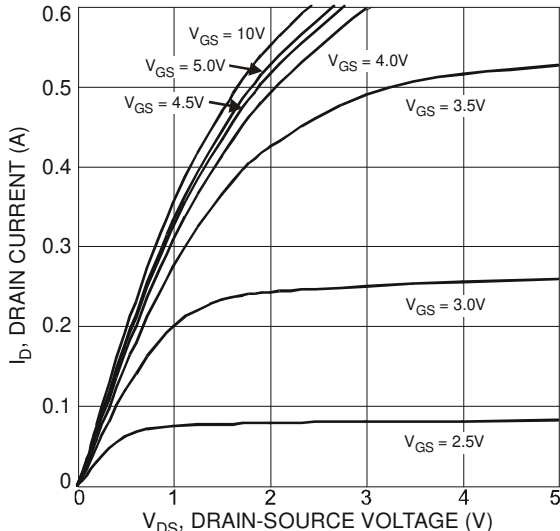


Figure 1 Typical Output Characteristic

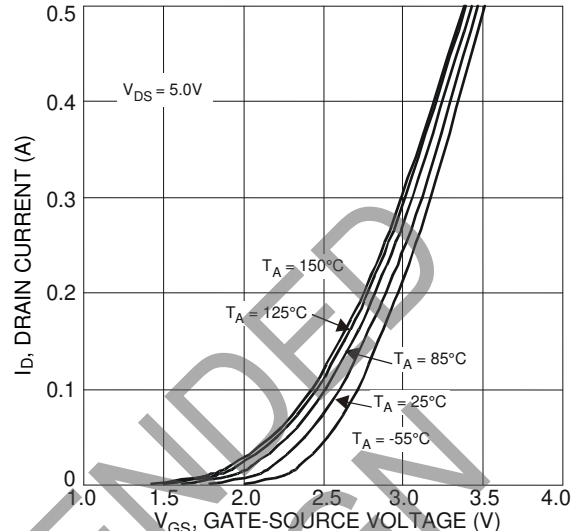


Figure 2 Typical Transfer Characteristics

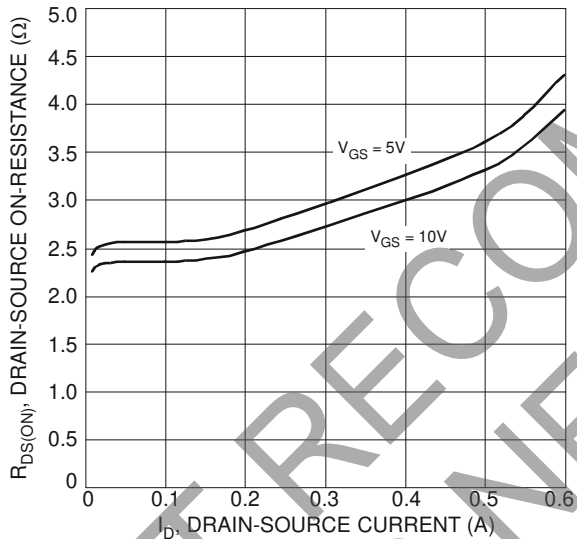


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

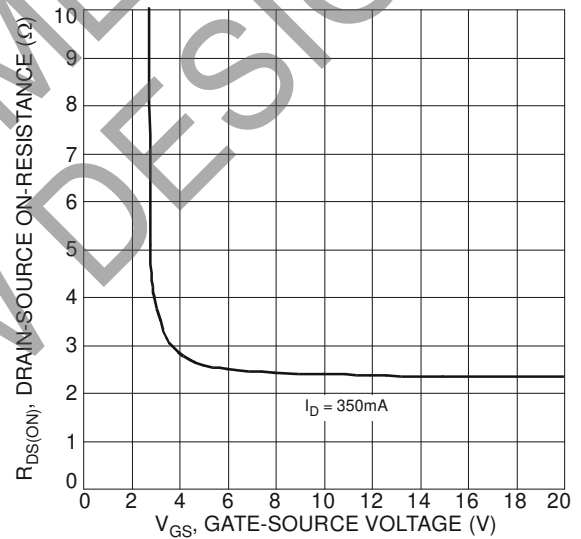


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

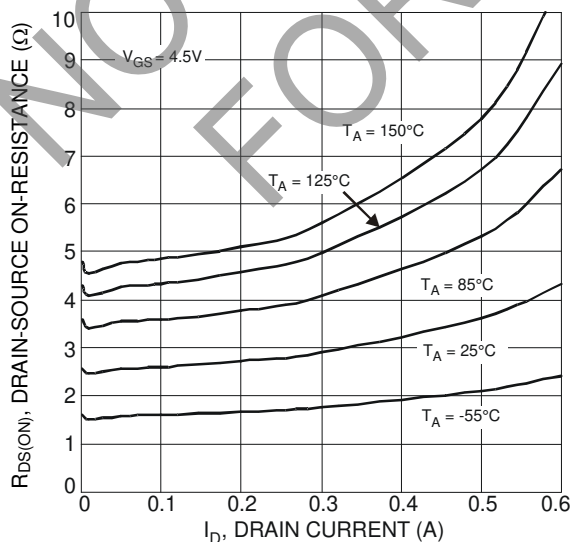


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

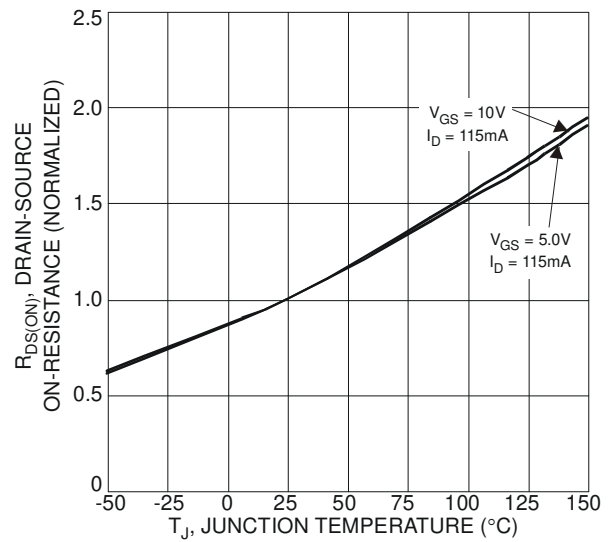


Figure 6 On-Resistance Variation with Temperature

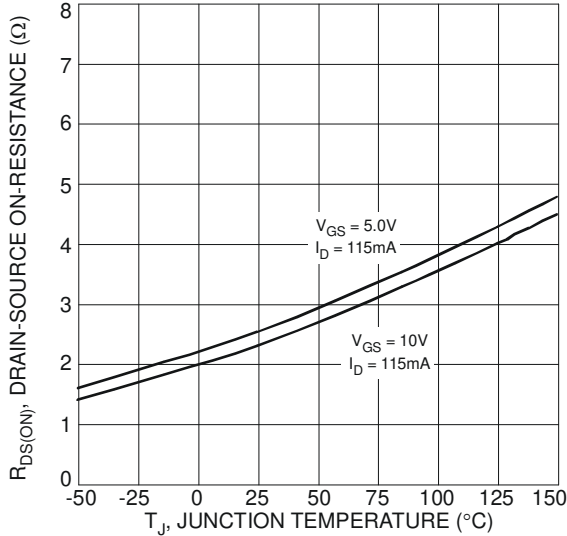


Figure 7 On-Resistance Variation with Temperature

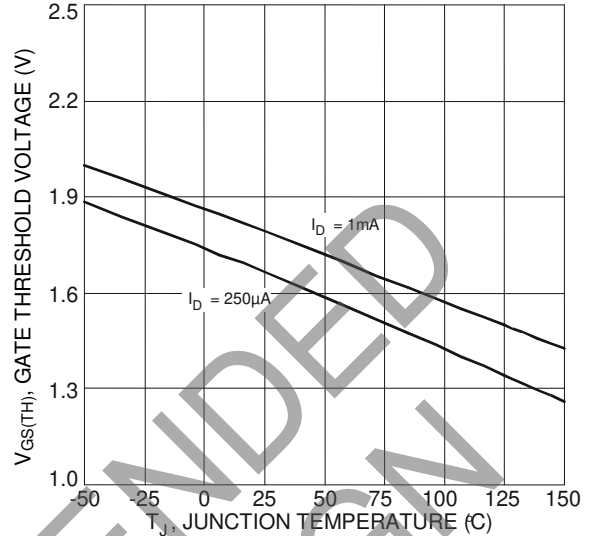


Figure 8 Gate Threshold Variation vs. Temperature

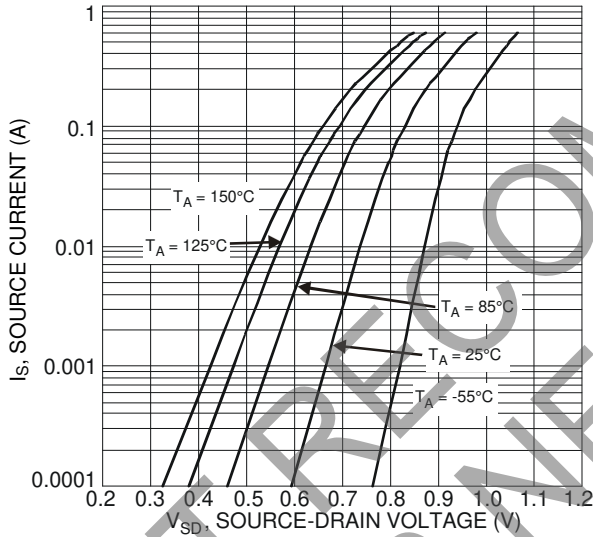


Figure 9 Diode Forward Voltage vs. Current

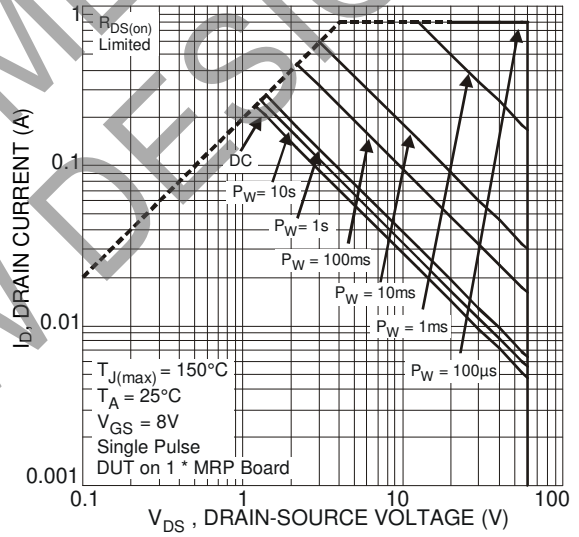
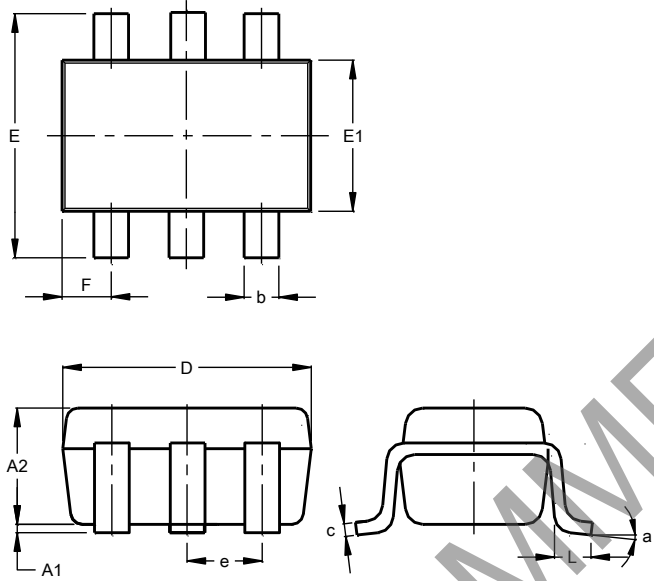


Figure 10 SOA, Safe Operation Area

**Package Outline Dimensions**

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

SOT363

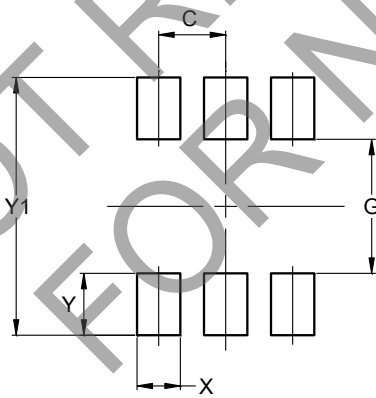


SOT363			
Dim	Min	Max	Typ
A1	0.00	0.10	0.05
A2	0.90	1.00	1.00
b	0.10	0.30	0.25
c	0.10	0.22	0.11
D	1.80	2.20	2.15
E	2.00	2.20	2.10
E1	1.15	1.35	1.30
e	0.650 BSC		
F	0.40	0.45	0.425
L	0.25	0.40	0.30
a	0°	8°	--
<b>All Dimensions in mm</b>			

**Suggested Pad Layout**

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

SOT363



Dimensions	Value (in mm)
C	0.650
G	1.300
X	0.420
Y	0.600
Y1	2.500

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