

## Product Summary

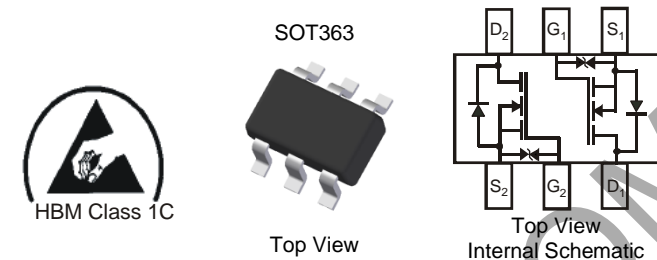
$V_{(BR)DSS}$	$R_{DS(ON)}$	Package	$I_D$ $T_A = +25^\circ\text{C}$
60V	$8\Omega @ V_{GS} = 5V$	SOT363	170mA
	$6\Omega @ V_{GS} = 10V$		200mA

## Description

This new generation MOSFET is 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

- 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)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## 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 (Lead Free Plating). Solderable per MIL-STD-202, Method 208 (63)
- Terminal Connections: See Diagram
- Weight: 0.006 grams (approximate)

## Ordering Information (Note 4 & 5)

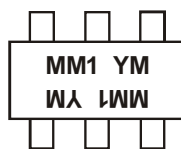
Part Number	Compliance	Case	Packaging
2N7002DWA-7	Standard	SOT363	3,000/Tape & Reel
2N7002DWA-13	Standard	SOT363	10,000/Tape & Reel
2N7002DWAQ-7	Automotive	SOT363	3,000/Tape & Reel
2N7002DWAQ-13	Automotive	SOT363	10,000/Tape & Reel

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) 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. Automotive, AEC-Q101 and standard products are electrically and thermally the same, except where specified. For more information, please refer to [http://www.diodes.com/quality/product\\_compliance\\_definitions/](http://www.diodes.com/quality/product_compliance_definitions/).
  5. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

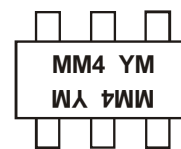
## Marking Information



MM0 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: Z = 2012)  
M = Month (ex: 9 = September)



MM1 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: Z = 2012)  
M = Month (ex: 9 = September)



MM4 = Product Type Marking Code  
YM = Date Code Marking  
Y = Year (ex: Z = 2012)  
M = Month (ex: 9 = September)

### Date Code Key

Date Code Key

Year	2012	2013	2014	2015	2016	2017	2018
Code	Z	A	B	C	D	E	F

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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic				Symbol	Value	Units
Drain-Source Voltage				V <sub>DSS</sub>	60	V
Gate-Source Voltage				V <sub>GSS</sub>	±20	V
Continuous Drain Current (Note 6)	V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	180 140	mA
Continuous Drain Current (Note 6)	V <sub>GS</sub> = 5V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	150 120	mA
Continuous Drain Current (Note 7)	V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	200 160	mA
Continuous Drain Current (Note 7)	V <sub>GS</sub> = 5V	Steady State	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	I <sub>D</sub>	170 140	mA
Pulsed Drain Current (10μs pulse, duty cycle = 1%)				I <sub>DM</sub>	700	mA

**Thermal Characteristics**

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 6)	P <sub>D</sub>	300	mW
Thermal Resistance, Junction to Ambient (Note 6)	R <sub>θJA</sub>	435	°C/W
Total Power Dissipation (Note 7)	P <sub>D</sub>	400	mW
Thermal Resistance, Junction to Ambient (Note 7)	R <sub>θJA</sub>	330	°C/W
Thermal Resistance, Junction to Case (Note 7)	R <sub>θJC</sub>	139	°C/W
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	°C

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 8)</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 8)</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 9)</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	—		
Gate Resistance	R <sub>G</sub>	—	88	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge V <sub>GS</sub> = 10V	Q <sub>g</sub>	—	0.87	—	nC	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 30V, I <sub>D</sub> = 150mA
Total Gate Charge V <sub>GS</sub> = 4.5V	Q <sub>g</sub>	—	0.43	—		
Gate-Source Charge	Q <sub>gs</sub>	—	0.11	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	0.11	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.3	—	nS	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.115A, V <sub>GEN</sub> = 10V, R <sub>GEN</sub> = 25Ω
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:
6. Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  7. Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout
  8. Short duration pulse test used to minimize self-heating effect.
  9. Guaranteed by design. Not subject to production testing.

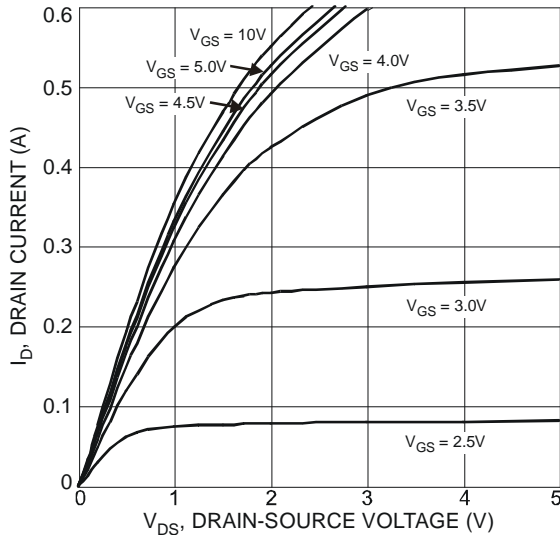


Figure 1 Typical Output Characteristic

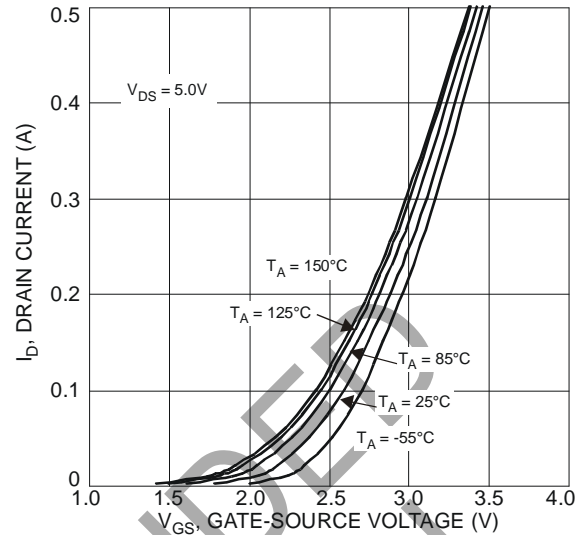


Figure 2 Typical Transfer Characteristics

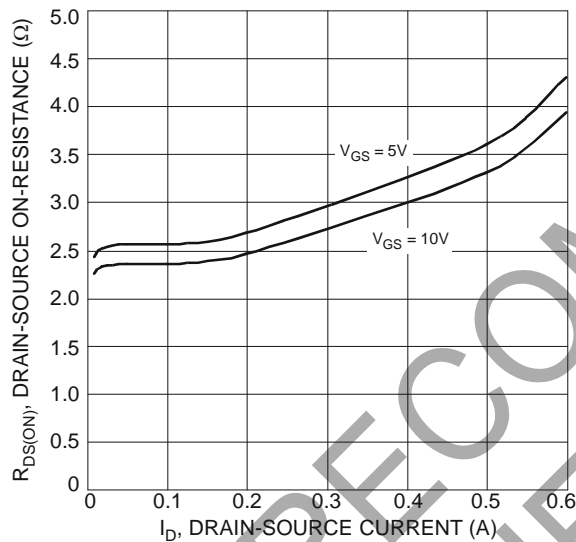


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

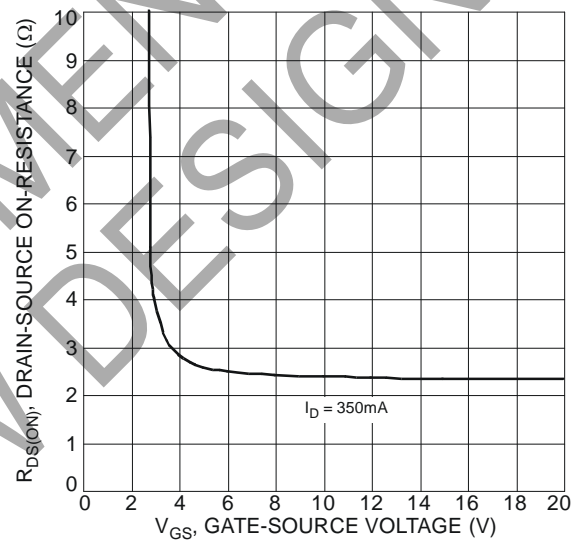


Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

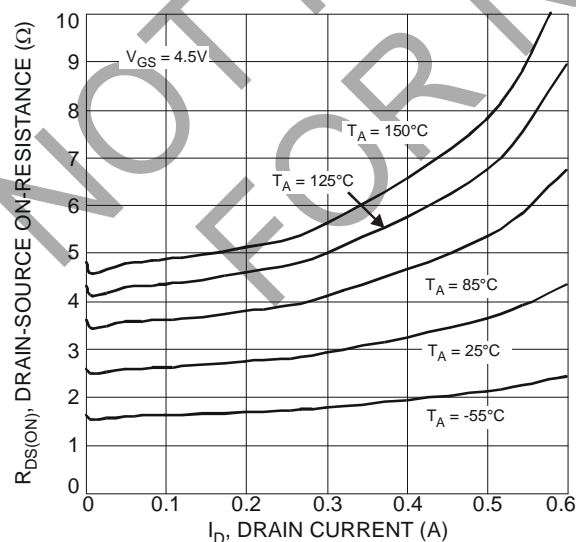


Figure 5 Typical On-Resistance vs. Drain Current and Temperature

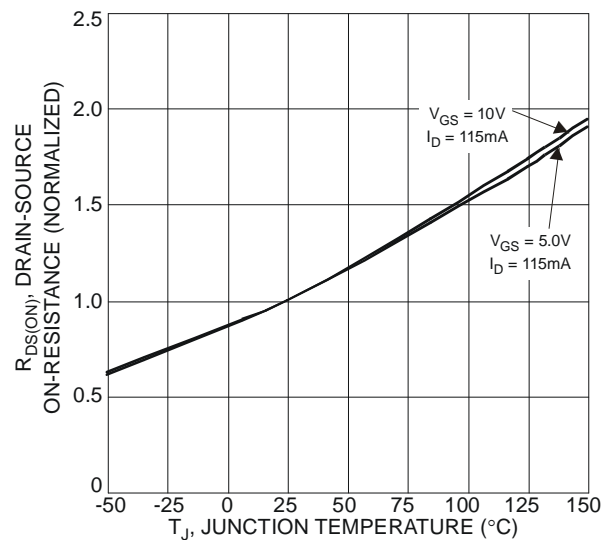


Figure 6 On-Resistance Variation with Temperature

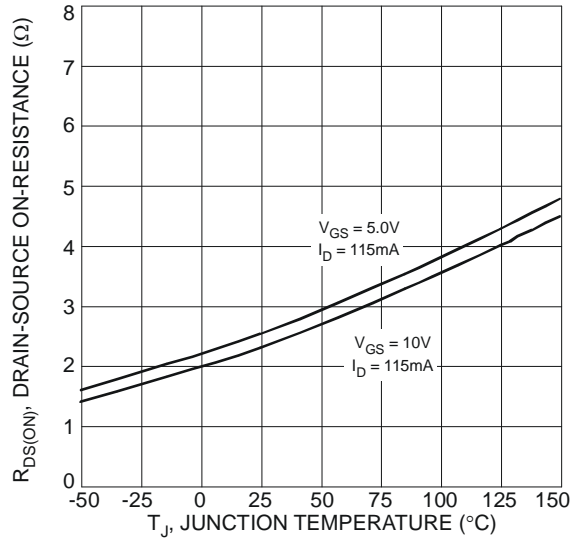


Figure 7 On-Resistance Variation with Temperature

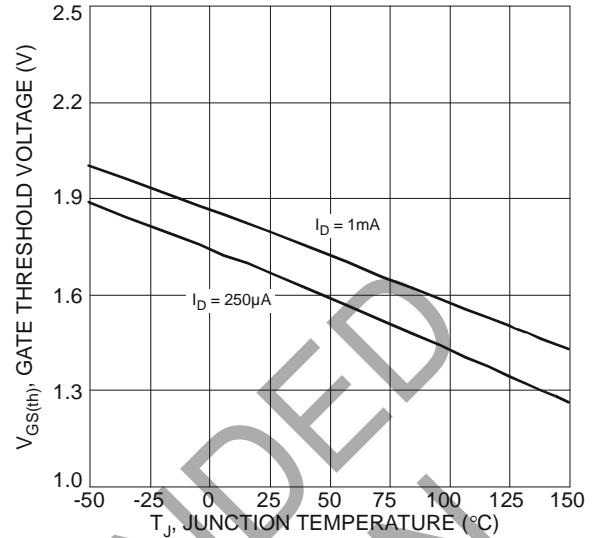


Figure 8 Gate Threshold Variation vs. Ambient Temperature

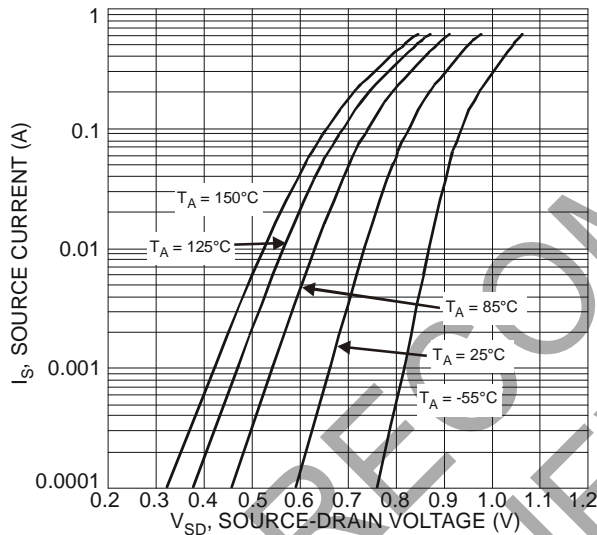


Figure 9 Diode Forward Voltage vs. Current

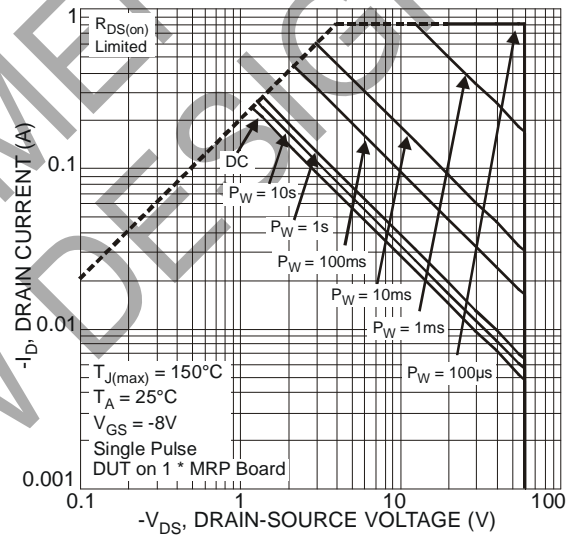
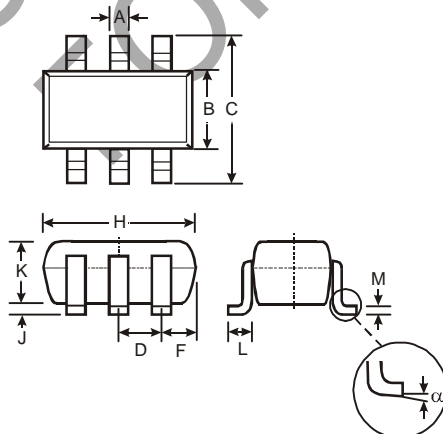


Figure 10 SOA, Safe Operation Area

## Package Outline Dimensions

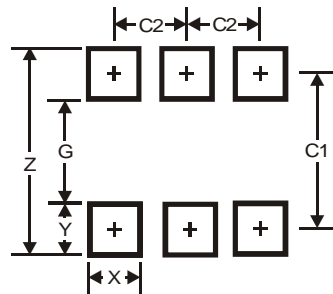
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



SOT363			
Dim	Min	Max	Typ
A	0.10	0.30	0.25
B	1.15	1.35	1.30
C	2.00	2.20	2.10
D	0.65 Typ		
F	0.40	0.45	0.425
H	1.80	2.20	2.15
J	0	0.10	0.05
K	0.90	1.00	1.00
L	0.25	0.40	0.30
M	0.10	0.22	0.11
α	0°	8°	-
All Dimensions in mm			

## Suggested Pad Layout

Please see AP02001 at <http://www.diodes.com/datasheets/ap02001.pdf> for the 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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