2N7002DWA

DUAL N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

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

Description

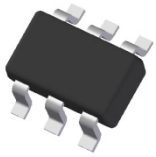
This new generation MOSFET has been designed to minimize the on-state resistance ($R_{DS(ON)}$) and yet maintain superior switching performance, making it ideal for high efficiency power management applications.

Applications

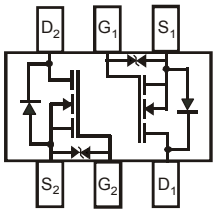
- DC-DC Converters
- Power Management Functions
- Battery Operated Systems and Solid-State Relays
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc

HBM Class 1C

SOT363



Top View



Top View
Internal Schematic

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

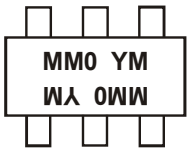
- Case: SOT363
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Matte Tin Finish annealed over Alloy 42 leadframe (Lead Free Plating). Solderable per MIL-STD-202, Method 208 e3
- Terminal Connections: See Diagram
- Weight: 0.006 grams (approximate)

Ordering Information (Note 4 & 5)

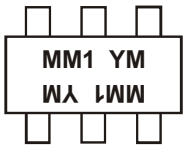
Part Number	Compliance	Case	Packaging
2N7002DWA-7	Standard	SOT363	3,000/Tape & Reel
2N7002DWA-13	Standard	SOT363	10,000/Tape & Reel
2N7002DWAQ-7	Automotive	SOT363	3,000/Tape & Reel
2N7002DWAQ-13	Automotive	SOT363	10,000/Tape & Reel

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 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/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

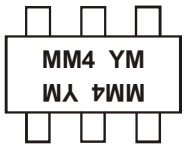
Marking Information



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

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

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

Characteristic				Symbol	Value	Units
Drain-Source Voltage				V_{DSS}	60	V
Gate-Source Voltage				V_{GSS}	±20	V
Continuous Drain Current (Note 6)	V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	180 140	mA
Continuous Drain Current (Note 6)	V_{GS} = 5V	Steady State	T_A = +25°C T_A = +70°C	I_D	150 120	mA
Continuous Drain Current (Note 7)	V_{GS} = 10V	Steady State	T_A = +25°C T_A = +70°C	I_D	200 160	mA
Continuous Drain Current (Note 7)	V_{GS} = 5V	Steady State	T_A = +25°C T_A = +70°C	I_D	170 140	mA
Pulsed Drain Current (10µs pulse, duty cycle = 1%)				I_{DM}	700	mA

Thermal Characteristics

Characteristic	Symbol	Value	Units
Total Power Dissipation (Note 6)	P_D	300	mW
Thermal Resistance, Junction to Ambient (Note 6)	$R_{\theta JA}$	435	°C/W
Total Power Dissipation (Note 7)	P_D	400	mW
Thermal Resistance, Junction to Ambient (Note 7)	$R_{\theta JA}$	330	°C/W
Thermal Resistance, Junction to Case (Note 7)	$R_{\theta JC}$	139	°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}	60	—	—	V	V_{GS} = 0V, I_D = 250µA
Zero Gate Voltage Drain Current	I_{DSS}	—	—	1.0	µA	V_{DS} = 60V, V_{GS} = 0V
Gate-Body Leakage	I_{GSS}	—	—	±5	µA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	$V_{GS(th)}$	0.8	—	2.5	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	—	8	Ω	V_{GS} = 5.0V, I_D = 0.115A
		—	—	6	Ω	V_{GS} = 10.0V, I_D = 0.115A
Forward Transconductance	g_{FS}	80	—	—	mS	V_{DS} = 10V, I_D = 0.115A
Diode Forward Voltage	V_{SD}	—	0.8	1.2	V	V_{GS} = 0V, I_S = 115mA
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C_{iss}	—	22.0	—	pF	V_{DS} = 25V, V_{GS} = 0V, f = 1.0MHz
Output Capacitance	C_{oss}	—	3.2	—		
Reverse Transfer Capacitance	C_{rss}	—	2.0	—		
Gate Resistance	R_G	—	88	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge V_{GS} = 10V	Q_g	—	0.87	—	nC	V_{GS} = 10V, V_{DS} = 30V, I_D = 150mA
Total Gate Charge V_{GS} = 4.5V	Q_g	—	0.43	—		
Gate-Source Charge	Q_{gs}	—	0.11	—		
Gate-Drain Charge	Q_{gd}	—	0.11	—		
Turn-On Delay Time	$t_{D(on)}$	—	3.3	—	nS	V_{DD} = 30V, I_D = 0.115A, V_{GEN} = 10V, R_{GEN} = 25Ω
Turn-On Rise Time	t_r	—	3.2	—		
Turn-Off Delay Time	$t_{D(off)}$	—	12.0	—		
Turn-Off Fall Time	t_f	—	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.

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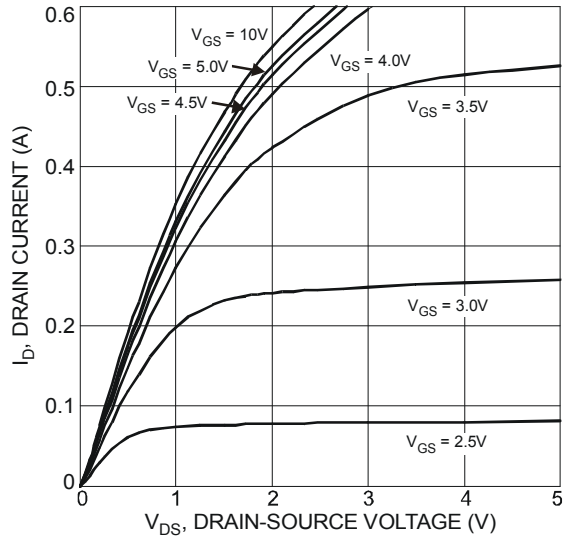

Figure 1 Typical Output Characteristic

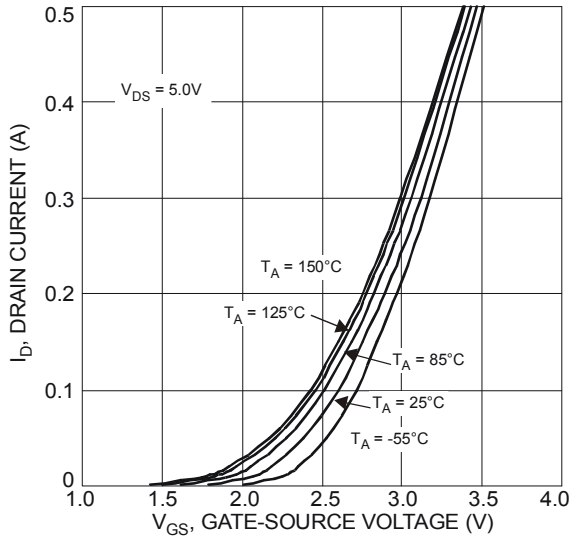

Figure 2 Typical Transfer Characteristics

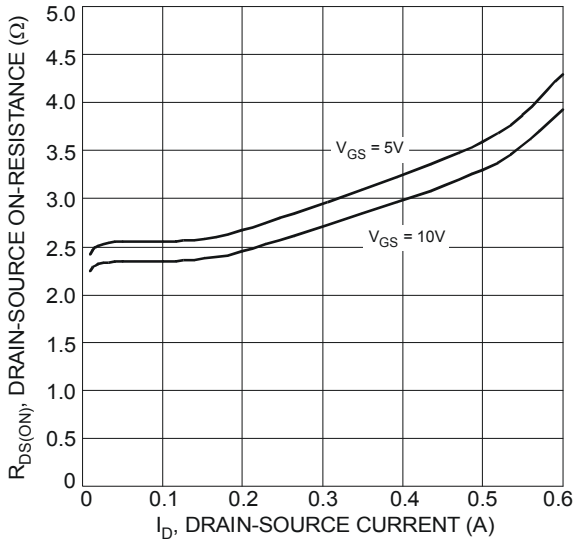

Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

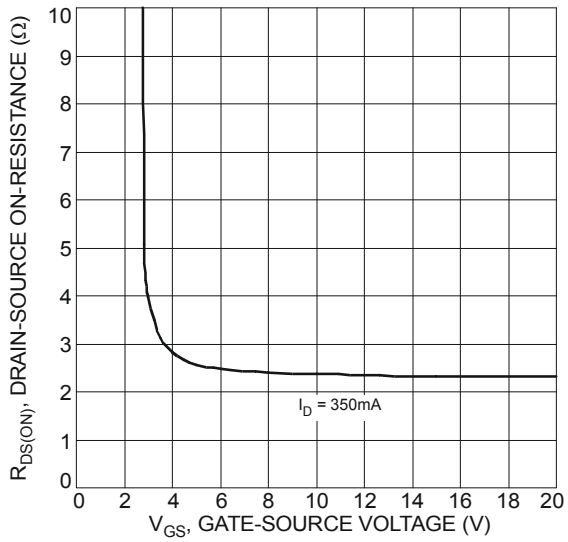

Figure 4 Typical Drain-Source On-Resistance vs. Gate-Source Voltage

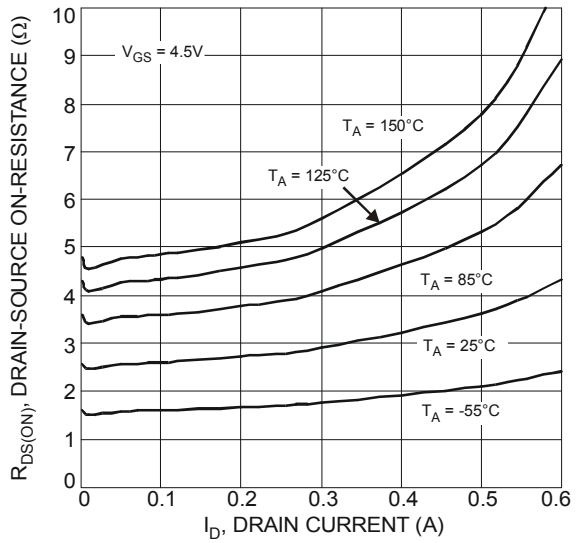

Figure 5 Typical On-Resistance vs. Drain Current and Temperature

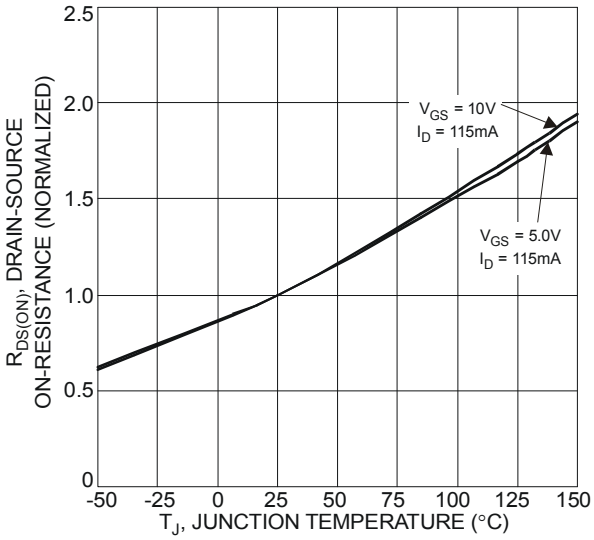

Figure 6 On-Resistance Variation with Temperature

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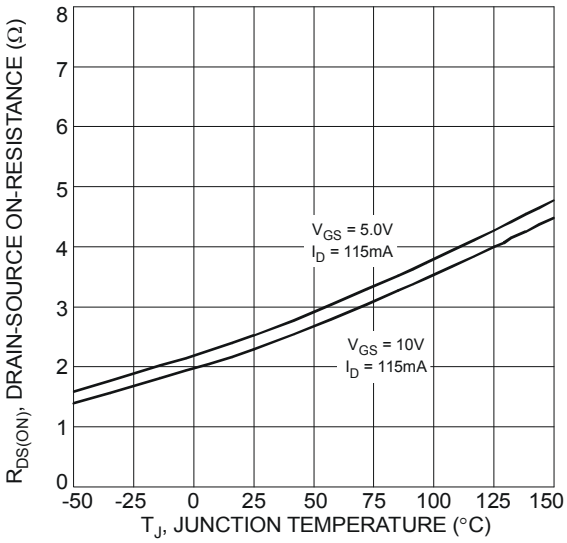


Figure 7 On-Resistance Variation with Temperature

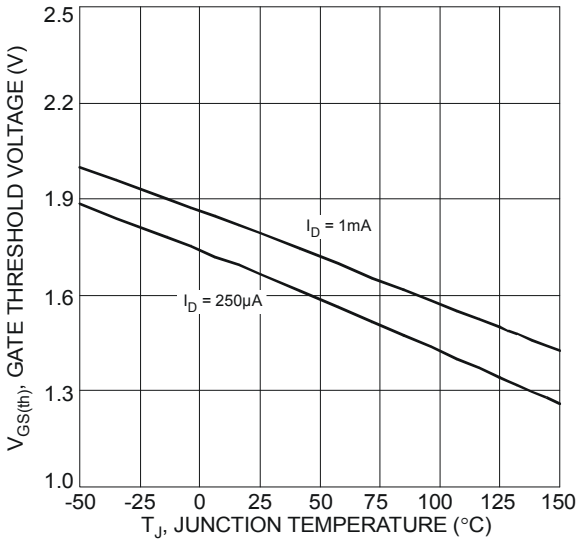


Figure 8 Gate Threshold Variation vs. Ambient Temperature

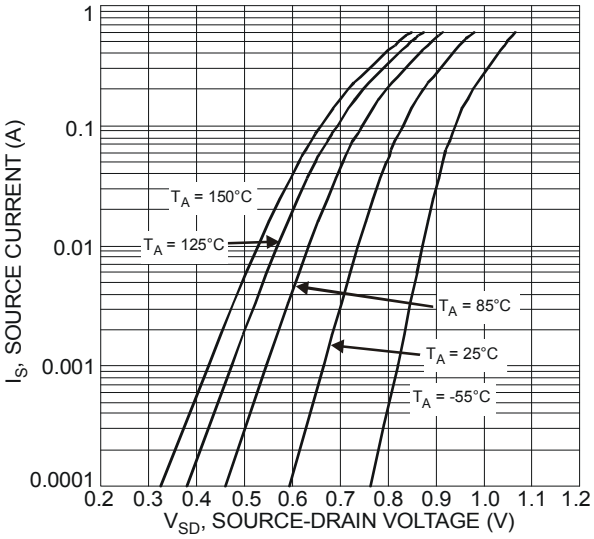


Figure 9 Diode Forward Voltage vs. Current

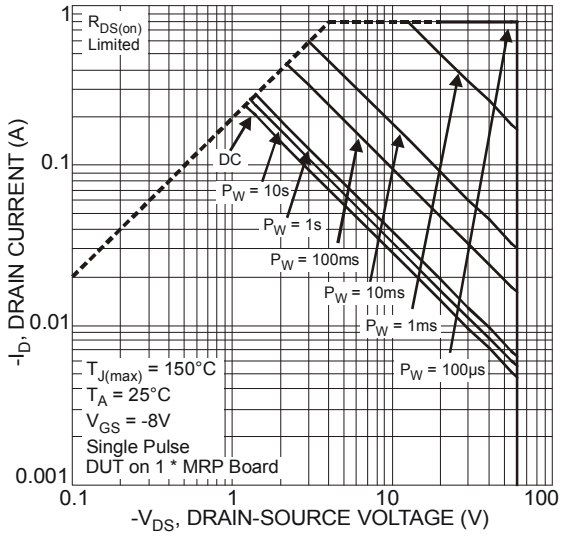
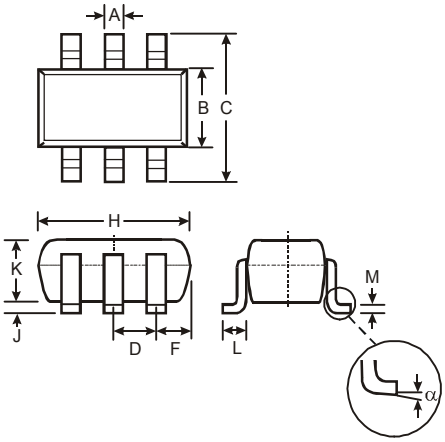


Figure 10 SOA, Safe Operation Area

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			

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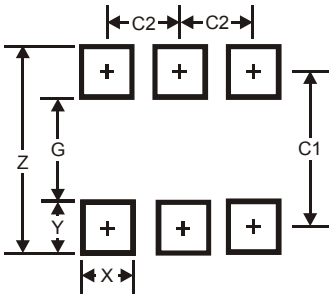
Suggested Pad Layout

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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