

**DUAL N-CHANNEL ENHANCEMENT MODE MOSFET**

**Product Summary**

$V_{(BR)DSS}$	$R_{DS(ON)}$	Package	$I_D$ $T_A = +25^\circ C$
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**

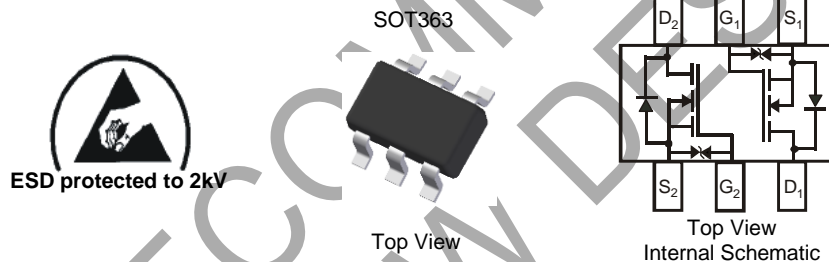
- DC-DC Converters
- Power Management Functions
- Battery Operated Systems and Solid-State Relays
- Drivers: Relays, Solenoids, Lamps, Hammers, Displays, Memories, Transistors, etc

**Features**

- Dual N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- ESD Protected up to 2kV
- **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)

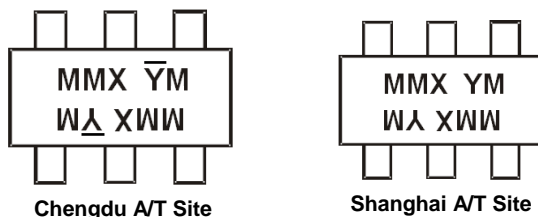


**Ordering Information** (Note 4)

Part Number	Case	Packaging
2N7002DWKX-7	SOT363	3,000/Tape & Reel
2N7002DWKX-13	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. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

**Marking Information**



MMX = Product Type Marking Code  
 YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)  
 ȲM = Date Code Marking for CAT (Chengdu Assembly/ Test site)  
 Y or Ȳ = Year (ex: A = 2013)  
 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

**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 5)	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 5)	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 6)	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 6)	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
Maximum Continuous Body Diode Forward Current (Note 6)				I <sub>S</sub>	0.5	A
Pulsed Drain Current (10μs pulse, duty cycle = 1%)				I <sub>DM</sub>	700	mA

**Thermal Characteristics**

Characteristic	Symbol	Value	Units
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>	316	°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

**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>	—	—	±10	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>	—	—	6	Ω	V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A
		—	—	8	Ω	V <sub>GS</sub> = 5V, I <sub>D</sub> = 0.05A
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>	—	56	—	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	4.4	—		
Reverse Transfer Capacitance	C <sub>rss</sub>	—	3.1	—		
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>	—	1.4	—	nC	V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V, I <sub>D</sub> = 250mA
Total Gate Charge V <sub>GS</sub> = 4.5V	Q <sub>g</sub>	—	0.6	—		
Gate-Source Charge	Q <sub>gs</sub>	—	0.2	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	0.1	—		
Turn-On Delay Time	t <sub>D(on)</sub>	—	3.0	—	nS	V <sub>DD</sub> = 30V, V <sub>GS</sub> = 10V, R <sub>G</sub> = 25Ω, I <sub>D</sub> = 200mA
Turn-On Rise Time	t <sub>r</sub>	—	2.8	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	17.4	—		
Turn-Off Fall Time	t <sub>f</sub>	—	8.1	—		

- Notes:
- Device mounted on FR-4 PC board, with minimum recommended pad layout, single sided.
  - Device mounted on FR-4 substrate PC board, 2oz copper, with 1inch square copper pad layout
  - Short duration pulse test used to minimize self-heating effect.
  - Guaranteed by design. Not subject to production testing.

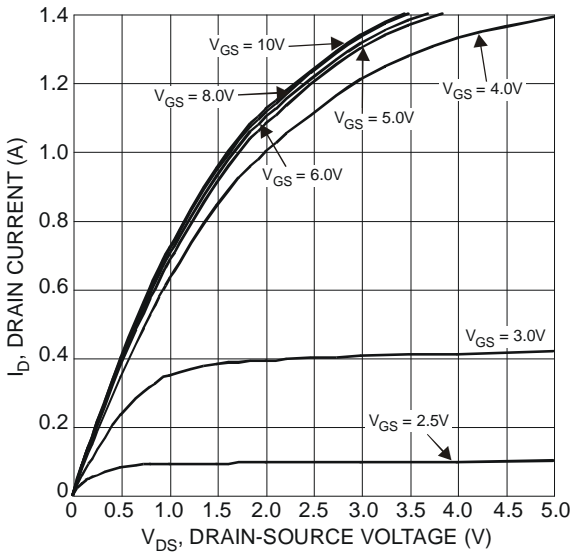


Figure 1 Typical Output Characteristics

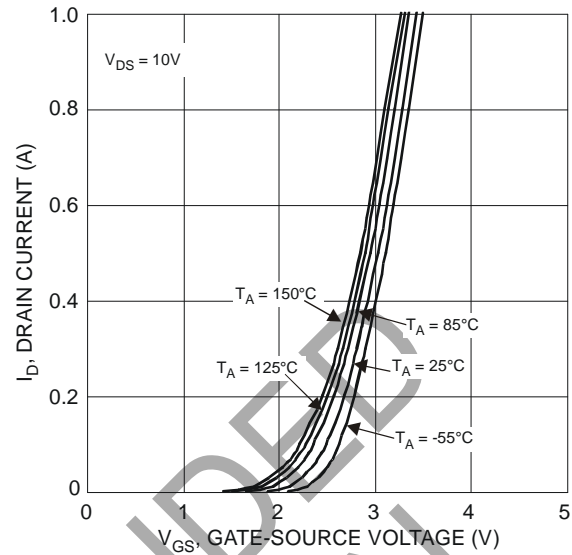


Figure 2 Typical Transfer Characteristics

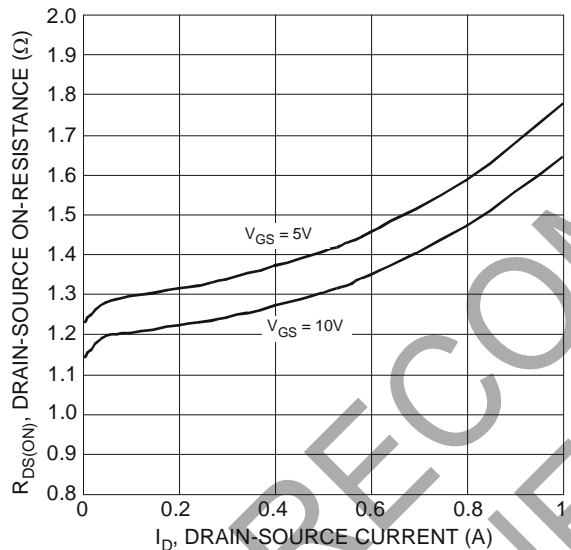


Figure 3 Typical On-Resistance vs. Drain Current and Gate Voltage

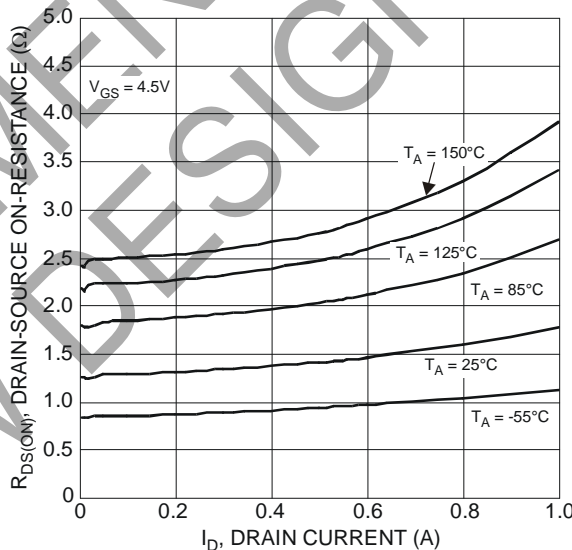


Figure 4 Typical On-Resistance vs. Drain Current and Temperature

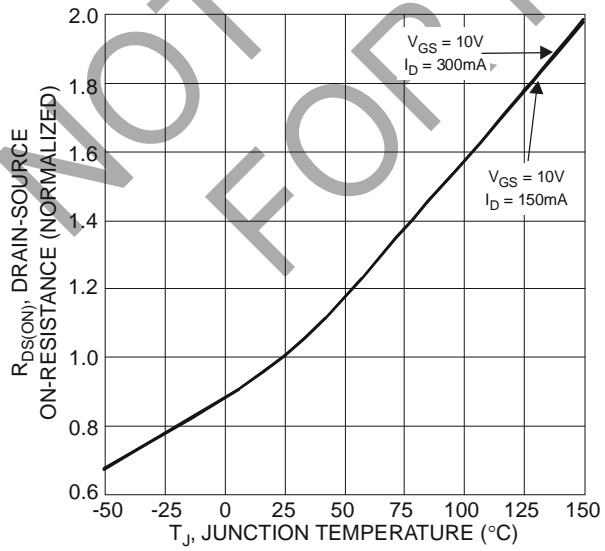


Figure 5 On-Resistance Variation with Temperature

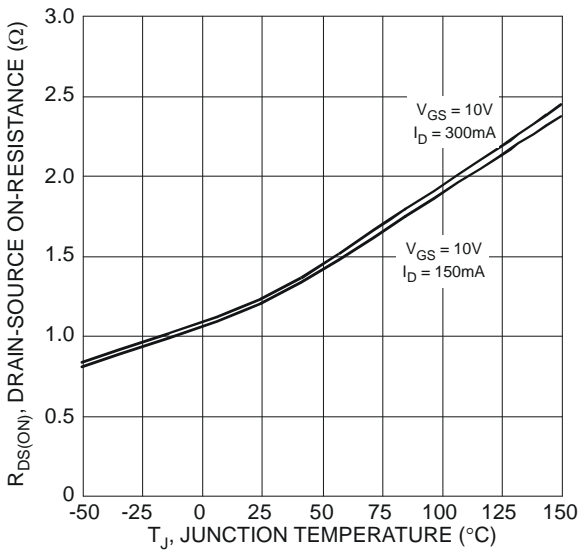


Figure 6 On-Resistance Variation with Temperature

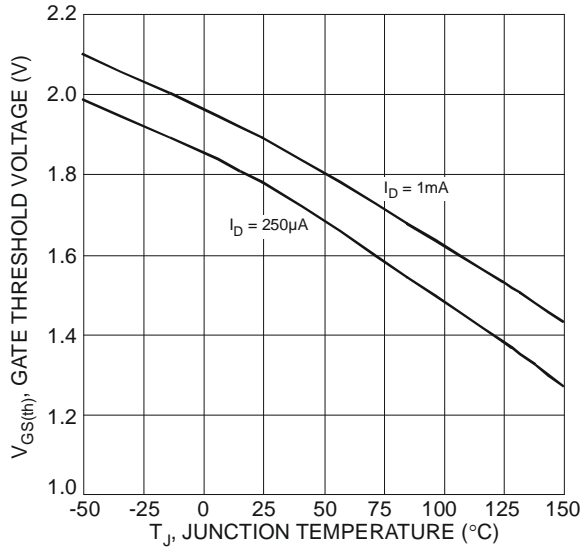


Figure 7 Gate Threshold Variation vs. Ambient Temperature

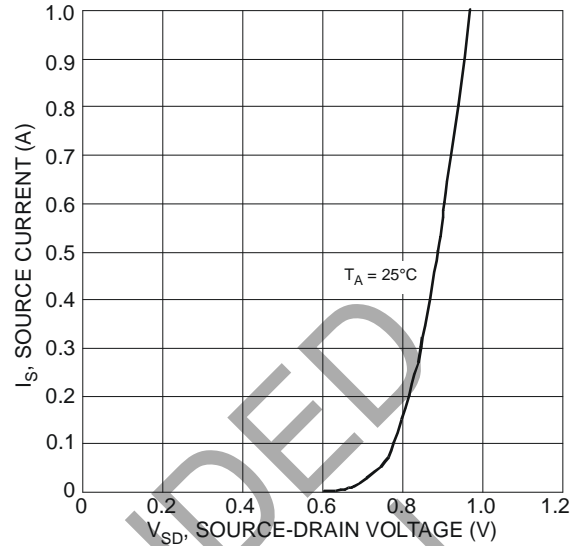


Figure 8 Diode Forward Voltage vs. Current

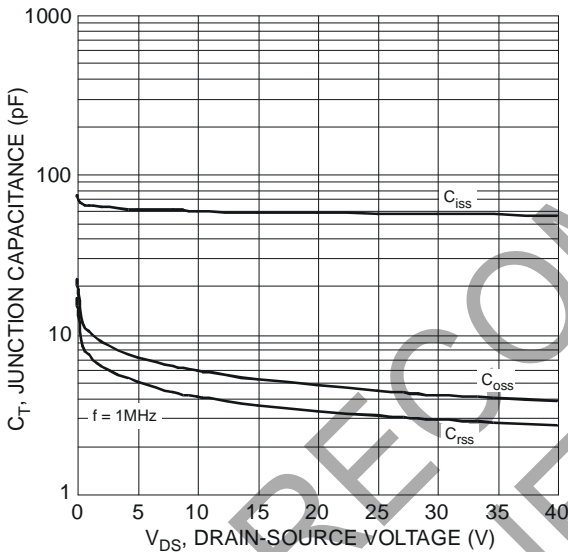


Figure 9 Typical Junction Capacitance

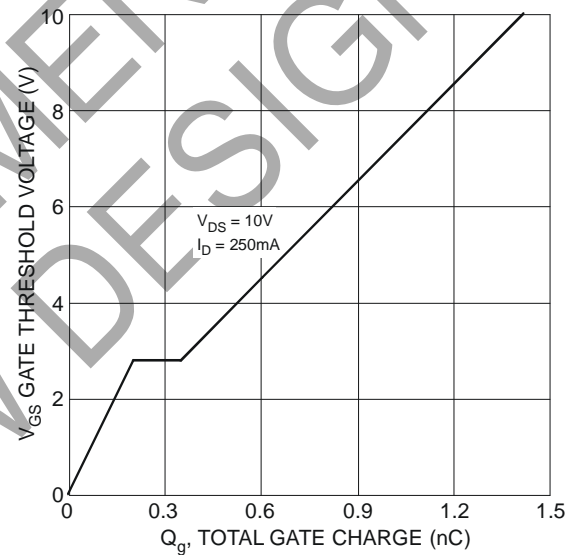
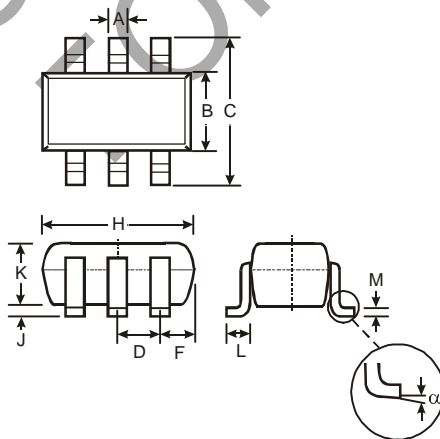


Figure 10 Gate Charge

**Package Outline Dimensions**

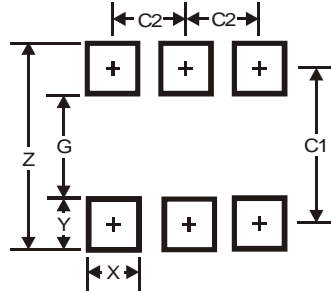
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



SOT363		
Dim	Min	Max
A	0.10	0.30
B	1.15	1.35
C	2.00	2.20
D	0.65 Typ	
F	0.40	0.45
H	1.80	2.20
J	0	0.10
K	0.90	1.00
L	0.25	0.40
M	0.10	0.22
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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