

## Product Summary

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

## Description

This 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

- Motor Control
- Power Management Functions

## Features and Benefits

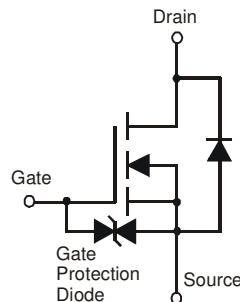
- N-Channel MOSFET
- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- ESD Protected Gate, 1.2kV HBM
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e.: parts qualified to AEC-Q101, PPAP capable, and manufactured in IATF 16949 certified facilities), please refer to the related automotive grade (Q-suffix) part. A listing can be found at <https://www.diodes.com/products/automotive/automotive-products/>.**
- **This part is qualified to JEDEC standards (as references in AEC-Q101) for High Reliability.**
- <https://www.diodes.com/quality/product-definitions/>

## Mechanical Data

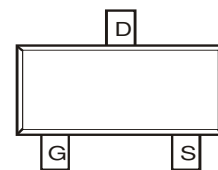
- Case: SOT23
- Case Material: Molded Plastic. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin annealed over Alloy 42 leadframe. Solderable per MIL-STD-202, Method 208 **e3**
- Terminal Connections: See Diagram
- Weight: 0.008 grams (approximate)



Top View



Equivalent Circuit



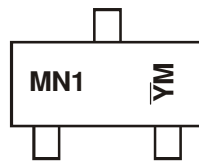
Top View  
Pin-Out

## Ordering Information (Note 4)

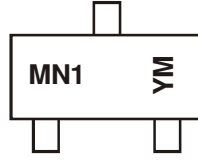
Part Number	Case	Packaging
2N7002A-7	SOT23	3,000/Tape & Reel
2N7002A-13	SOT23	10,000/Tape & Reel

- 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



Chengdu A/T Site



Shanghai A/T Site

MN1 = Product Type Marking Code  
 YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)  
 $\bar{Y}M$  = Date Code Marking for CAT (Chengdu Assembly/ Test site)  
 Y or  $\bar{Y}$  = Year (ex: A = 2013)  
 M = Month (ex: 9 = September)

### Date Code Key

Year Code	2008	2009	2010	2011	2012	2013	2014	2015
	V	W	X	Y	Z	A	B	C

Month Code	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	Units
Drain-Source Voltage	$V_{DSS}$	60	V
Gate-Source Voltage	$V_{GSS}$	$\pm 20$	V
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	180
		$T_A = +85^\circ\text{C}$	130
		$T_A = +100^\circ\text{C}$	115
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	220
		$T_A = +85^\circ\text{C}$	160
		$T_A = +100^\circ\text{C}$	140
Maximum Continuous Body Diode Forward Current (Note 6)	$I_S$	0.5	A
Pulsed Drain Current (10 $\mu\text{s}$ pulse, duty cycle = 1%)	$I_{DM}$	800	mA

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

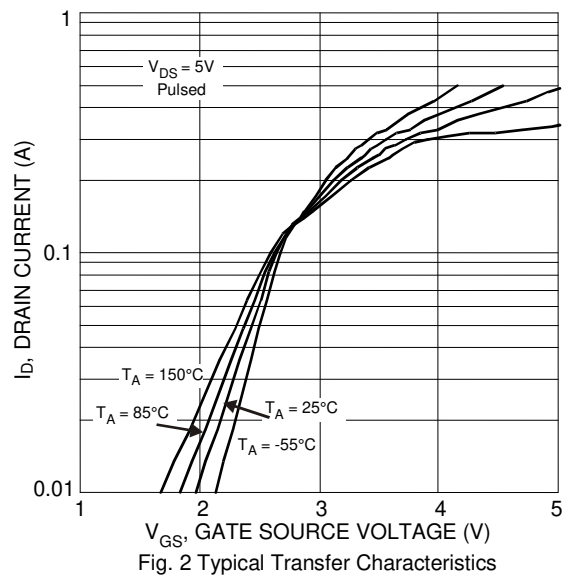
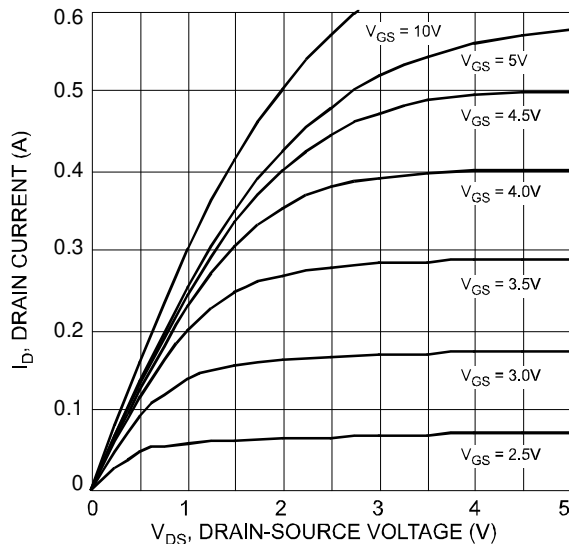
Characteristic	Symbol	Value	Units
Total Power Dissipation	$P_D$	(Note 5)	370
		(Note 6)	540
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	(Note 5)	348
		(Note 6)	241
Thermal Resistance, Junction to Case	$R_{\theta JC}$	91	$^\circ\text{C/W}$
Operating and Storage Temperature Range	$T_J, T_{STG}$	-55 to +150	$^\circ\text{C}$

Notes: 5. Device mounted on FR-4 PCB, with minimum recommended pad layout  
 6. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.

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

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
<b>OFF CHARACTERISTICS (Note 7)</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	60	70	—	V	$V_{GS} = 0V, I_D = 10\mu A$
Zero Gate Voltage Drain Current	$I_{DSS}$	—	—	1.0 500	$\mu A$	@ $T_C = +25^\circ\text{C}$ @ $T_C = +125^\circ\text{C}$ $V_{DS} = 60V, V_{GS} = 0V$
Gate-Body Leakage	$I_{GSS}$	—	—	$\pm 10$	$\mu A$	$V_{GS} = \pm 20V, V_{DS} = 0V$
<b>ON CHARACTERISTICS (Note 7)</b>						
Gate Threshold Voltage	$V_{GS(th)}$	1.2	—	2.0	V	$V_{DS} = V_{GS}, I_D = 250\mu A$
Static Drain-Source On-Resistance	$R_{DS(ON)}$	—	3.5 3.0	6 5	$\Omega$	@ $T_J = +25^\circ\text{C}$ @ $T_J = +125^\circ\text{C}$ $V_{GS} = 5.0V, I_D = 0.115A$ $V_{GS} = 10V, I_D = 0.115A$
Forward Transconductance	$g_{FS}$	80	—	—	mS	$V_{DS} = 10V, I_D = 0.115A$
<b>DYNAMIC CHARACTERISTICS (Note 8)</b>						
Input Capacitance	$C_{iss}$	—	23	—	pF	$V_{DS} = 25V, V_{GS} = 0V, f = 1.0\text{MHz}$
Output Capacitance	$C_{oss}$	—	3.4	—	pF	
Reverse Transfer Capacitance	$C_{rss}$	—	1.4	—	pF	
Gate Resistance	$R_G$	—	260	400	$\Omega$	$V_{DS} = 0V, V_{GS} = 0V, f = 1.0\text{MHz}$
<b>SWITCHING CHARACTERISTICS (Note 8)</b>						
Turn-On Delay Time	$t_{D(ON)}$	—	10	—	ns	$V_{DD} = 30V, I_D = 0.115A, R_L = 150\Omega,$ $V_{GEN} = 10V, R_{GEN} = 25\Omega$
Turn-Off Delay Time	$t_{D(OFF)}$	—	33	—	ns	

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



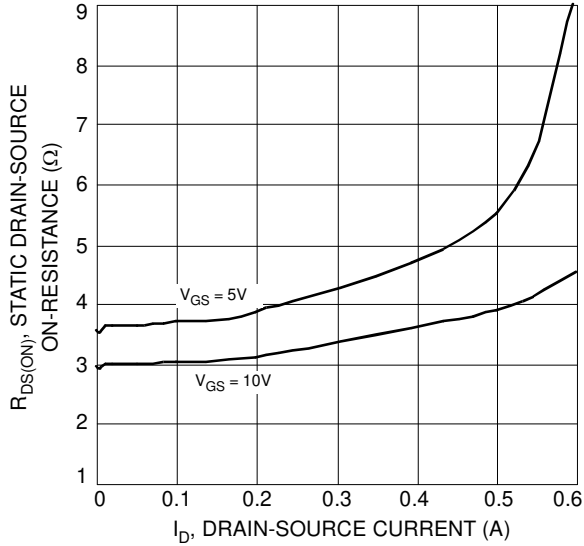


Fig. 3 On-Resistance vs. Drain Current & Gate Voltage

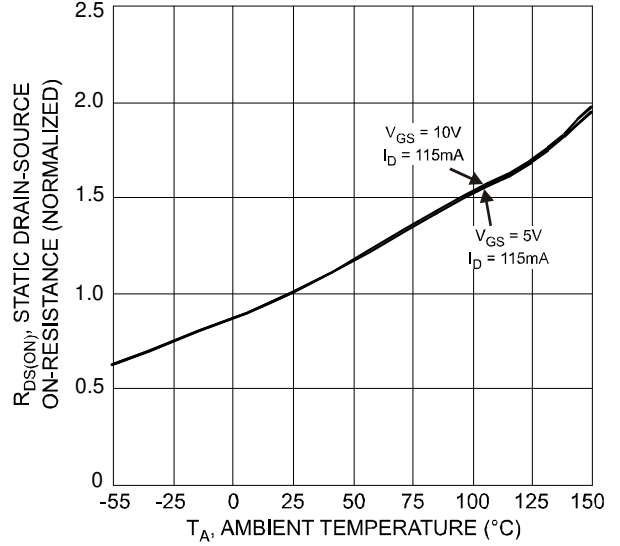


Fig. 4 Normalized Static Drain-Source On-Resistance vs. Ambient Temperature

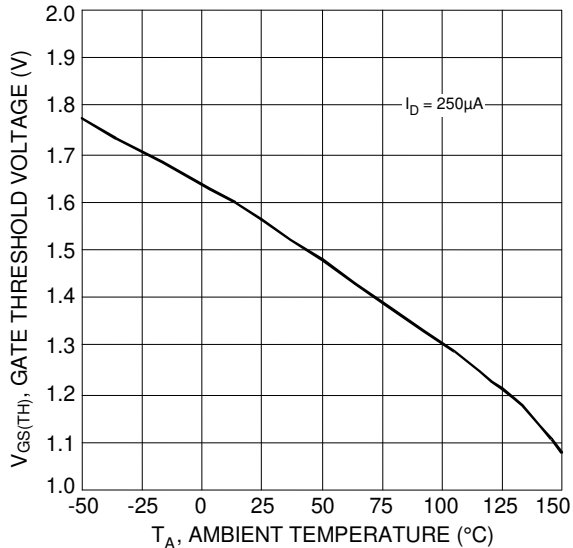


Fig. 5 Gate Threshold Variation vs. Ambient Temperature

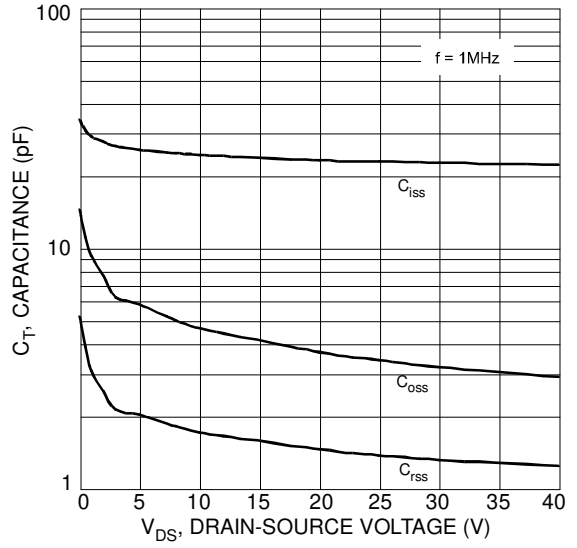


Fig. 6 Typical Total Capacitance

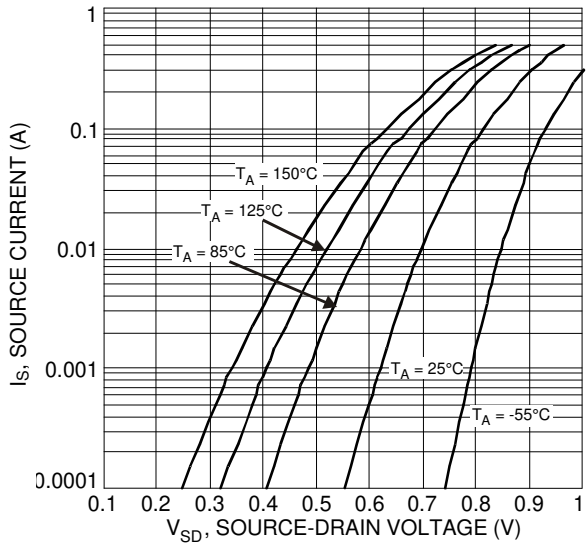
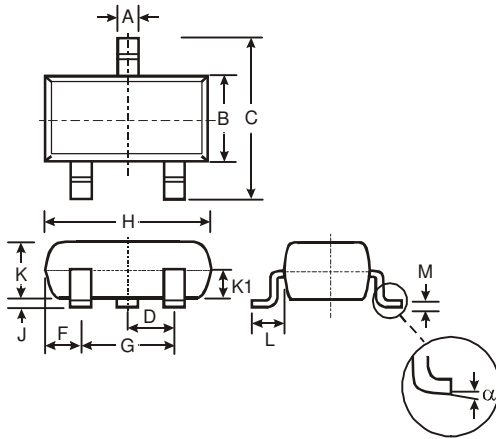


Fig. 7 Reverse Drain Current vs. Source-Drain Voltage

## Package Outline Dimensions

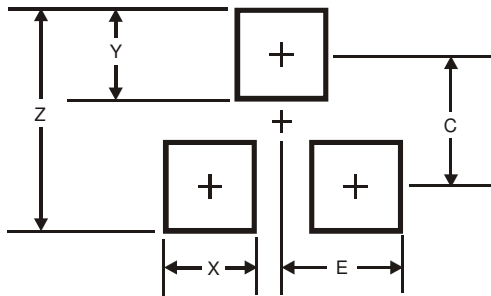
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.903	1.10	1.00
K1	-	-	0.400
L	0.45	0.61	0.55
M	0.085	0.18	0.11
α	0°	8°	-
All Dimensions in mm			

## Suggested Pad Layout

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



Dimensions	Value (in mm)
Z	2.9
X	0.8
Y	0.9
C	2.0
E	1.35

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