

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

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
- **Lead, Halogen and Antimony Free, RoHS Compliant "Green" Device (Notes 1 and 2)**
- **Qualified to AEC-Q101 Standards for High Reliability**

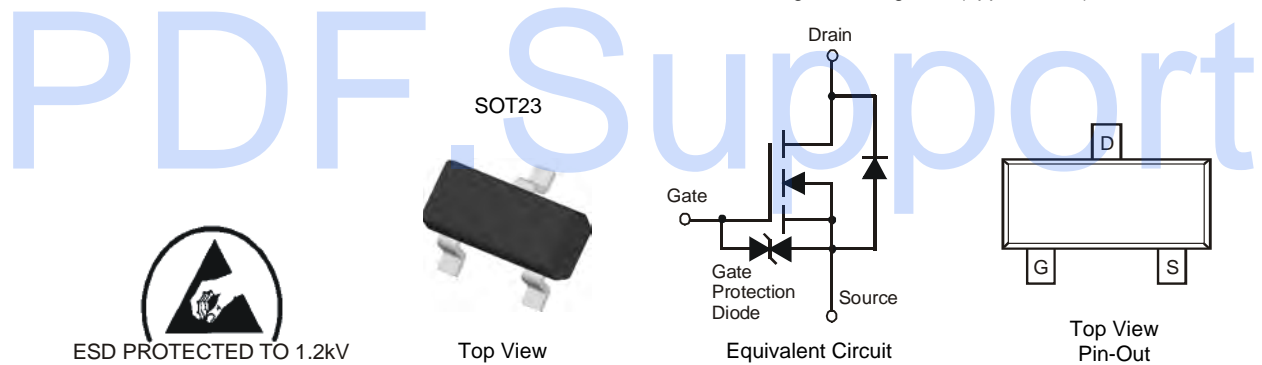
Description and Applications

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.

- Motor control
- Power Management Functions

Mechanical Data

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

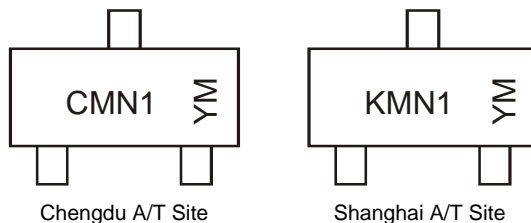


Ordering Information (Note 3)

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

- Notes:
1. EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant. No purposely added lead. Halogen and Antimony free.
 2. Product manufactured with Data Code V9 (week 33, 2008) and newer are built with Green Molding Compound. Product manufactured prior to Date Code V9 are built with Non-Green Molding Compound and may contain Halogens or Sb203 Fire Retardants.
 3. For packaging details, go to our website at <http://www.diodes.com>.

Marking Information



K = SAT (Shanghai Assembly/ Test site)
 C = CAT (Chengdu Assembly/ Test site)
 MN1= Product Type Marking Code
 YM = Date Code Marking
 Y = Year (ex: N = 2002)
 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}	± 20	V
Continuous Drain Current (Note 4) $V_{GS} = 10\text{V}$	Steady State	$T_A = 25^\circ\text{C}$	I_D	180	mA
		$T_A = 85^\circ\text{C}$		130	
		$T_A = 100^\circ\text{C}$		115	
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	Steady State	$T_A = 25^\circ\text{C}$	I_D	220	mA
		$T_A = 85^\circ\text{C}$		160	
		$T_A = 100^\circ\text{C}$		140	
Maximum Continuous Body Diode Forward Current (Note 5)			I_S	0.5	A
Pulsed Drain Current (10 μs 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	(Note 4)	P_D	370	mW
	(Note 5)		540	
Thermal Resistance, Junction to Ambient	(Note 4)	$R_{\theta JA}$	348	$^\circ\text{C/W}$
	(Note 5)		241	
Thermal Resistance, Junction to Case	(Note 5)	$R_{\theta JC}$	91	$^\circ\text{C}$
Operating and Storage Temperature Range		T_J, T_{STG}	-55 to 150	$^\circ\text{C}$

Electrical Characteristics @ $T_A = 25^\circ\text{C}$ unless otherwise specified

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

- Notes:
- Device mounted on FR-4 PCB, with minimum recommended pad layout
 - Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
 - Short duration pulse test used to minimize self-heating effect.
 - Guaranteed by design. Not subject to product testing.

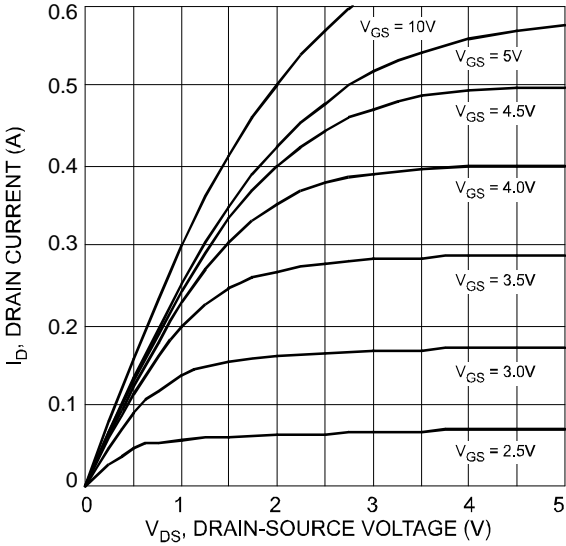


Fig. 1 Typical Output Characteristic

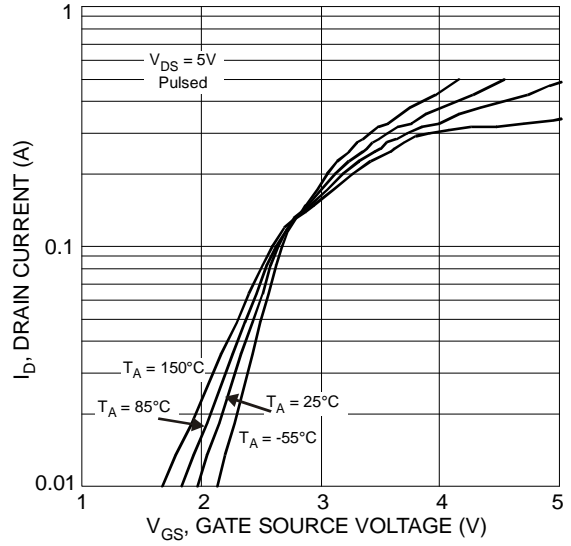


Fig. 2 Typical Transfer Characteristics

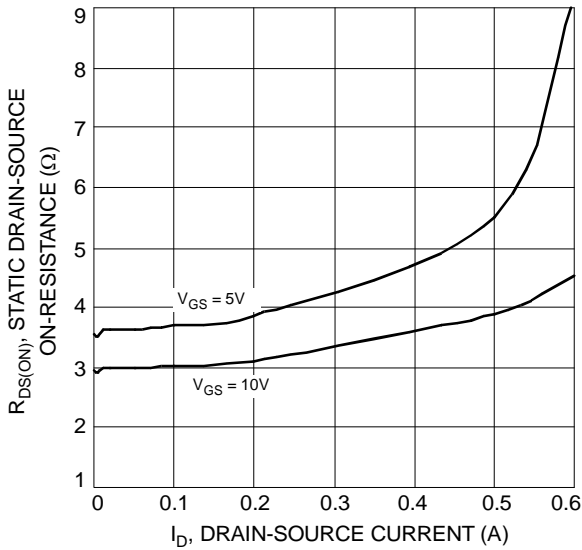


Fig. 3 On-Resistance vs. Drain Current & Gate Voltage

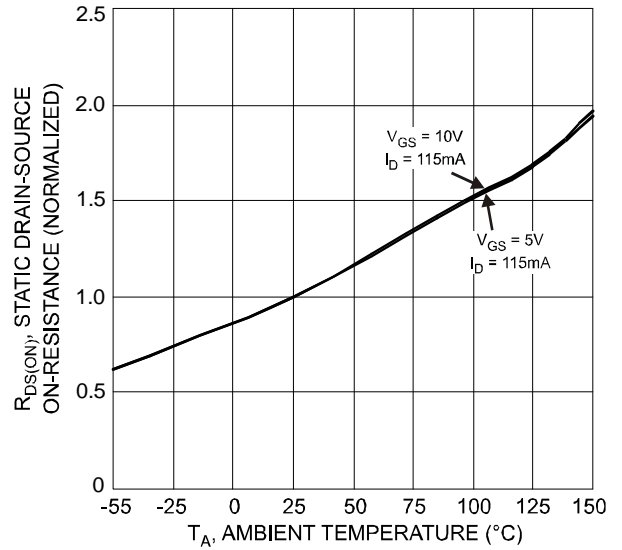


Fig. 4 Normalized Static Drain-Source On-Resistance vs. Ambient Temperature

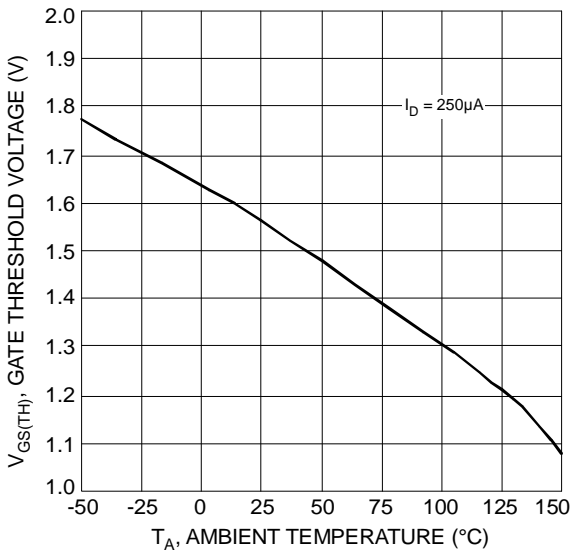


Fig. 5 Gate Threshold Variation vs. Ambient Temperature

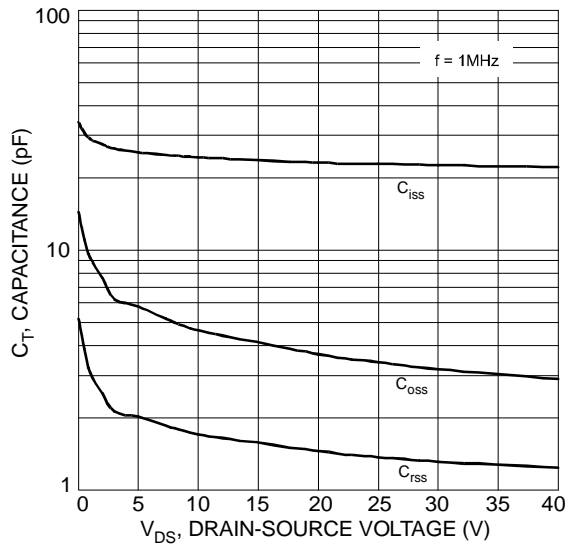


Fig. 6 Typical Total Capacitance

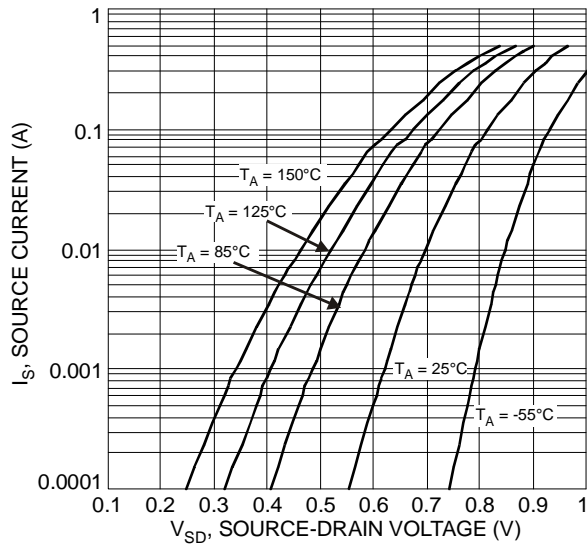
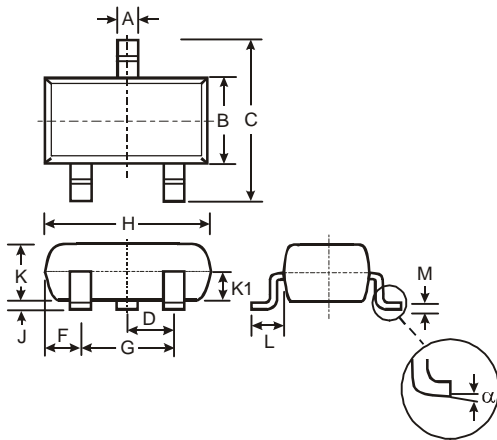


Fig. 7 Reverse Drain Current vs. Source-Drain Voltage

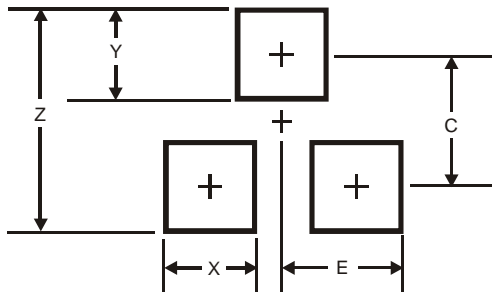
Package Outline Dimensions



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



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

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