N-CHANNEL ENHANCEMENT MODE MOSFET

Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)}$ max	I_D max T_A = +25°C
60V	7.5Ω @ V_{GS} = 5V	210mA

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

- Low On-Resistance
- Low Gate Threshold Voltage
- Low Input Capacitance
- Fast Switching Speed
- Small Surface Mount Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Notes 3 & 4)**
- **Qualified to AEC-Q101 standards for High Reliability**

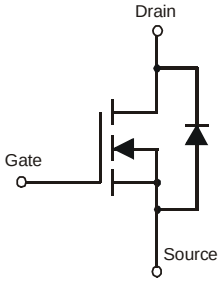
Mechanical Data

- Case: SOT23
- Case Material: Molded Plastic, "Green" Molding Compound. 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: 0.008 grams (approximate)

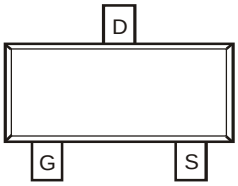
SOT23



Top View



Equivalent Circuit



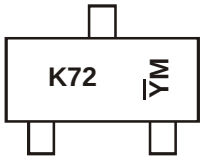
Top View

Ordering Information (Note 5)

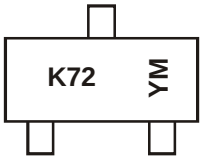
Part Number	Compliance	Case	Packaging
2N7002-7-F	Standard	SOT23	3,000/Tape & Reel
2N7002-13-F	Standard	SOT23	10,000/Tape & Reel
2N7002Q-7-F	Automotive	SOT23	3,000/Tape & Reel

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. Product manufactured with Date Code V12 (week 50, 2008) and newer are built with Green Molding Compound. Product manufactured prior to Date Code V12 are built with Non-Green Molding Compound and may contain Halogens or Sb_2O_3 Fire Retardants.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

Marking Information



Chengdu A/T Site



Shanghai A/T Site

K72 = Product Type Marking Code
YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)
$\overline{Y}\overline{M}$ = Date Code Marking for CAT (Chengdu Assembly/ Test site)
Y or $\overline{Y}$ = Year (ex: A = 2013)
M = Month (ex: 9 = September)

Date Code Key

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Code	N	P	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E

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

© Diodes Incorporated

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

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V_{DSS}	60	V
Drain-Gate Voltage $R_{GS} \leq 1.0M\Omega$			V_{DGR}	60	V
Gate-Source Voltage		Continuous Pulsed	V_{GSS}	±20 ±40	V
Continuous Drain Current (Note 6) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +85°C T_A = +100°C	I_D	170 120 105	mA
Continuous Drain Current (Note 7) V_{GS} = 10V	Steady State	T_A = +25°C T_A = +85°C T_A = +100°C	I_D	210 150 135	mA
Maximum Body Diode Forward Current (Note 7)	Pulsed Continuous		I_S	0.5 2	A
Pulsed Drain Current (10µs pulse, duty cycle = 1%)			I_{DM}	800	mA

Thermal Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Units
Total Power Dissipation	(Note 6)	P_D	370	mW
	(Note 7)		540	
Thermal Resistance, Junction to Ambient	(Note 6)	$R_{\theta JA}$	348	°C/W
	(Note 7)		241	
Thermal Resistance, Junction to Case	(Note 7)	$R_{\theta JC}$	91	
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	70	—	V	V_{GS} = 0V, I_D = 10µA
Zero Gate Voltage Drain Current	@ T_C = +25°C @ T_C = +125°C	I_{DSS}	—	—	1.0 500	µA	V_{DS} = 60V, V_{GS} = 0V
Gate-Body Leakage		I_{GSS}	—	—	±10	nA	V_{GS} = ±20V, V_{DS} = 0V
ON CHARACTERISTICS (Note 8)							
Gate Threshold Voltage		$V_{GS(th)}$	1.0	—	2.5	V	V_{DS} = V_{GS}, I_D = 250µA
Static Drain-Source On-Resistance	@ T_J = +25°C	$R_{DS(ON)}$	—	3.2	7.5	Ω	V_{GS} = 5.0V, I_D = 0.05A
	@ T_J = +25°C			—	5.0		V_{GS} = 10V, I_D = 0.5A
	@ T_J = +125°C			4.4	13.5		V_{GS} = 10V, I_D = 0.5A
On-State Drain Current		$I_{D(ON)}$	0.5	1.0	—	A	V_{GS} = 10V, V_{DS} = 7.5V
Forward Transconductance		g_{FS}	80	—	—	mS	V_{DS} =10V, I_D = 0.2A
Diode Forward Voltage		V_{SD}	—	0.78	1.5	V	V_{GS} = 0V, I_S = 115mA
DYNAMIC CHARACTERISTICS (Note 9)							
Input Capacitance		C_{iss}	—	22	50	pF	V_{DS} = 25V, V_{GS} = 0V f = 1.0MHz
Output Capacitance		C_{oss}	—	11	25	pF	
Reverse Transfer Capacitance		C_{rss}	—	2.0	5.0	pF	
Gate resistance		R_g	—	120	—	Ω	V_{DS} = 0V, V_{GS} = 0V, f = 1.0MHz
Total Gate Charge (V_{GS} = 4.5V)		Q_g	—	223	—	pC	V_{DS} = 10V, I_D = 250mA
Gate-Source Charge		Q_{gs}	—	82	—		
Gate-Drain Charge		Q_{gd}	—	178	—		
SWITCHING CHARACTERISTICS (Note 9)							
Turn-On Delay Time		$t_{D(on)}$	—	2.8	—	ns	V_{DD} = 30V, I_D = 0.2A, R_L = 150Ω, V_{GEN} = 10V, R_{GEN} = 25Ω
Turn-On Rise Time		t_r	—	3.0	—		
Turn-Off Delay Time		$t_{D(off)}$	—	7.6	—		
Turn-Off Fall Time		t_f	—	5.6	—		

Notes: 6. Device mounted on FR-4 PCB, with minimum recommended pad layout
7. Device mounted on 1" x 1" FR-4 PCB with high coverage 2oz. Copper, single sided.
8. Short duration pulse test used to minimize self-heating effect.
9. Guaranteed by design. Not subject to product testing.

© Diodes Incorporated

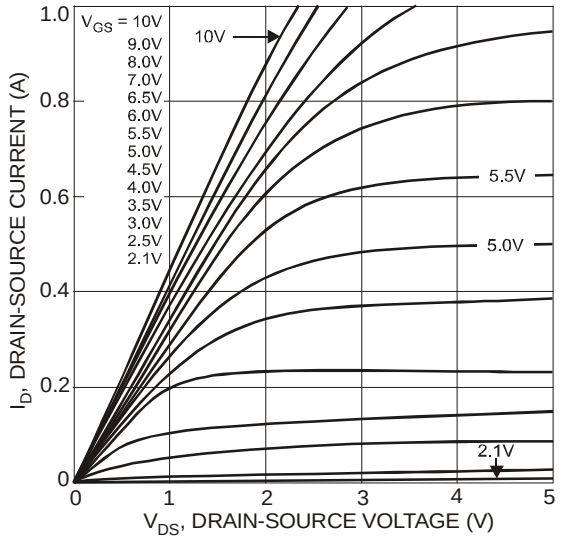


Fig. 1 On-Region Characteristics

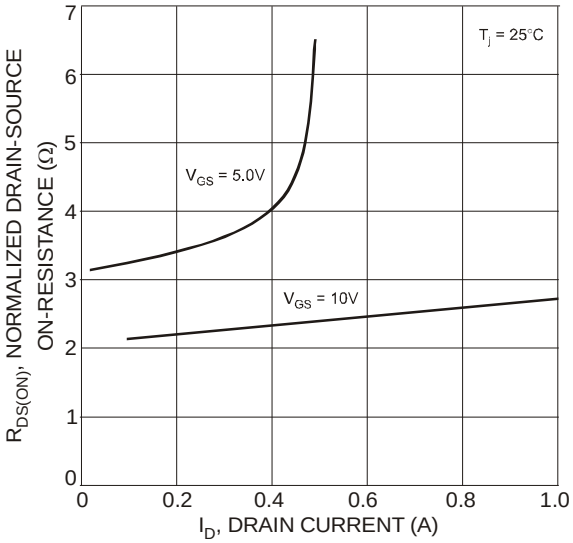


Fig. 2 On-Resistance vs. Drain Current

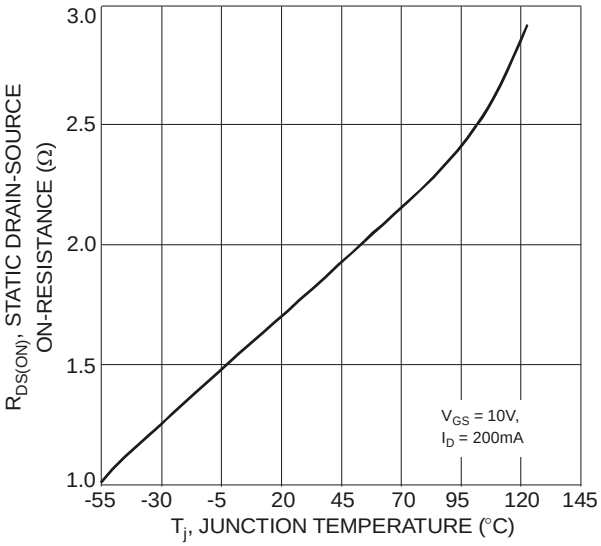


Fig. 3 On-Resistance vs. Junction Temperature

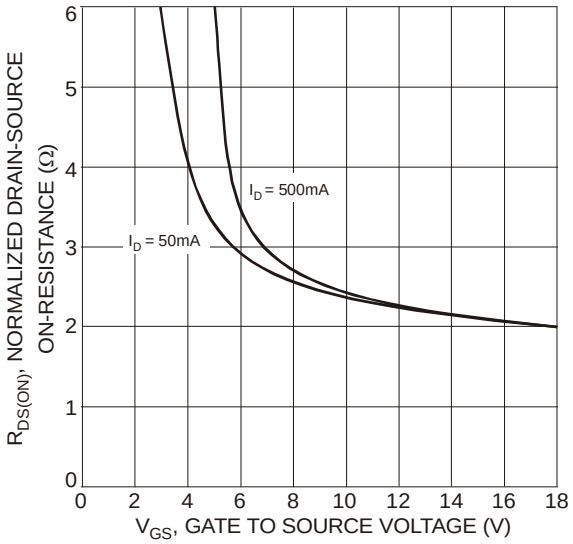


Fig. 4 On-Resistance vs. Gate-Source Voltage

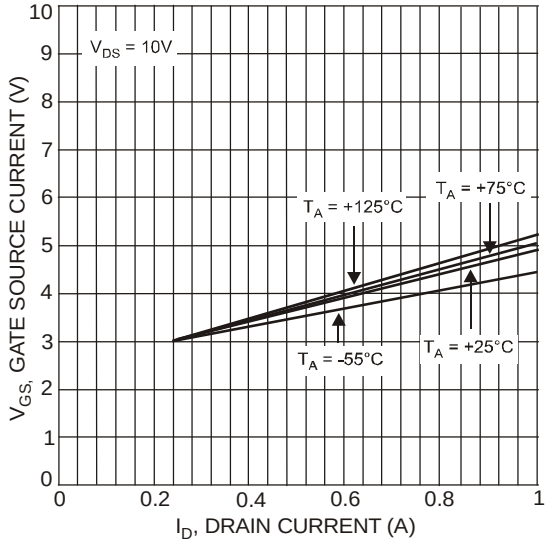


Fig. 5 Typical Transfer Characteristics

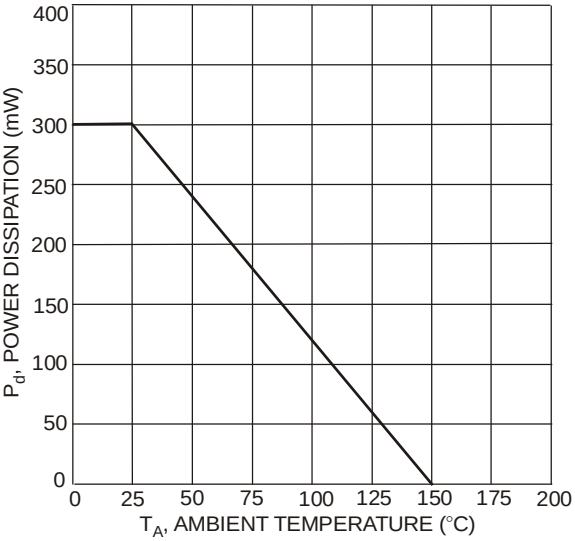
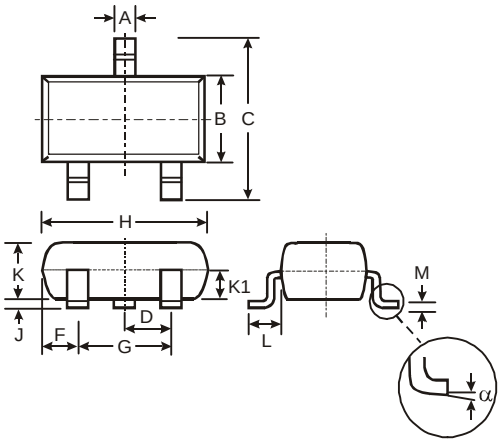


Fig. 6 Max Power Dissipation vs. Ambient Temperature

© Diodes Incorporated

Package Outline Dimensions

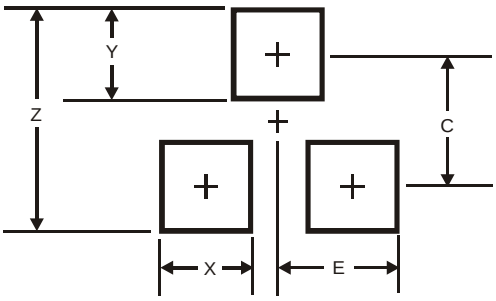
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.



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 AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.



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

© Diodes Incorporated

IMPORTANT NOTICE

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes Incorporated.

LIFE SUPPORT

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or

2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

Copyright © 2013, Diodes Incorporated

www.diodes.com