

## Product Summary

$V_{(BR)DSS}$	$R_{DS(ON)} \text{ max}$	$I_D \text{ max}$ $T_A = +25^\circ\text{C}$
60V	$7.5\Omega @ V_{GS} = 5V$	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

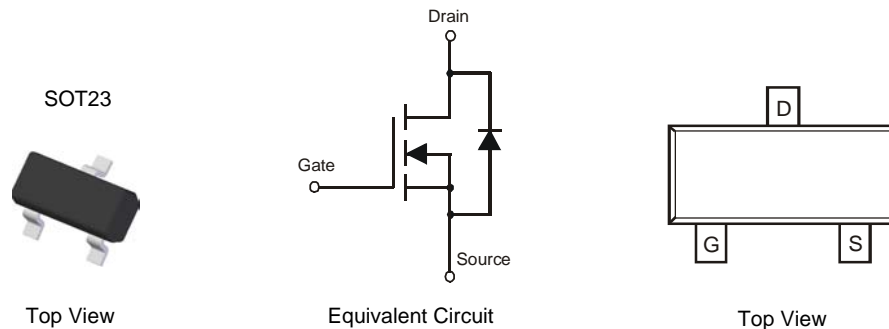
- Motor Control
- Power Management Functions

## 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 
- Terminal Connections: See Diagram
- Weight: 0.008 grams (approximate)

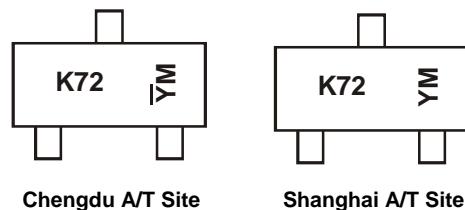


## Ordering Information (Note 5)

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:
- No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  - 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.
  - Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  - 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.
  - For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



K72 = Product Type Marking Code  
 YM = Date Code Marking for SAT (Shanghai Assembly/ Test site)  
 YM = Date Code Marking for CAT (Chengdu Assembly/ Test site)  
 Y or 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

**Maximum Ratings** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic			Symbol	Value	Units
Drain-Source Voltage			V <sub>DSS</sub>	60	V
Drain-Gate Voltage R <sub>GS</sub> ≤ 1.0MΩ			V <sub>DGR</sub>	60	V
Gate-Source Voltage		Continuous Pulsed	V <sub>GSS</sub>	±20 ±40	V
Continuous Drain Current (Note 6) V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	170	mA
		T <sub>A</sub> = +85°C		120	
		T <sub>A</sub> = +100°C		105	
Continuous Drain Current (Note 7) V <sub>GS</sub> = 10V	Steady State	T <sub>A</sub> = +25°C	I <sub>D</sub>	210	mA
		T <sub>A</sub> = +85°C		150	
		T <sub>A</sub> = +100°C		135	
Maximum Body Diode Forward Current (Note 7)	Pulsed		I <sub>S</sub>	0.5	A
	Continuous			2	
Pulsed Drain Current (10μs pulse, duty cycle = 1%)			I <sub>DM</sub>	800	mA

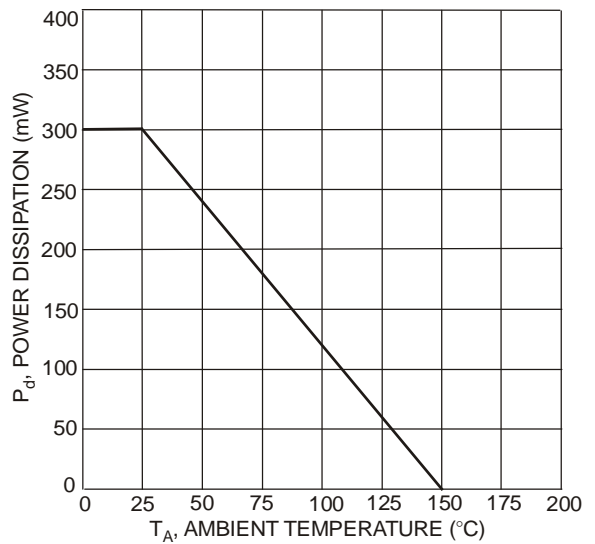
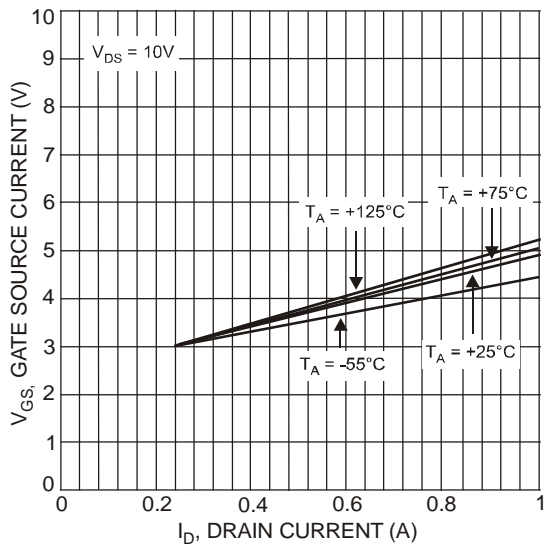
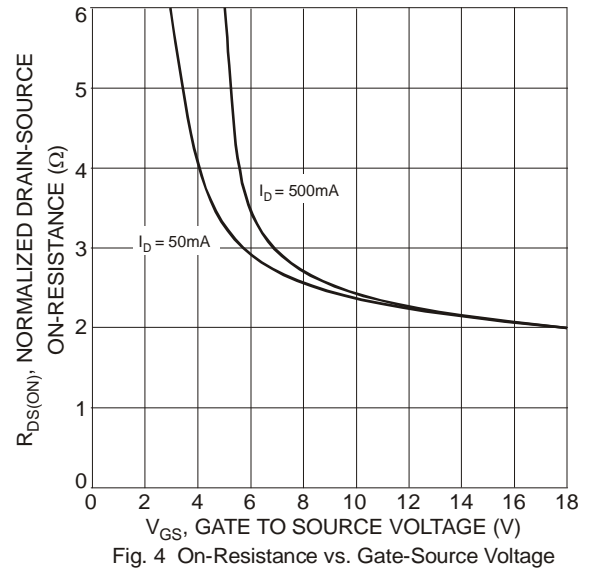
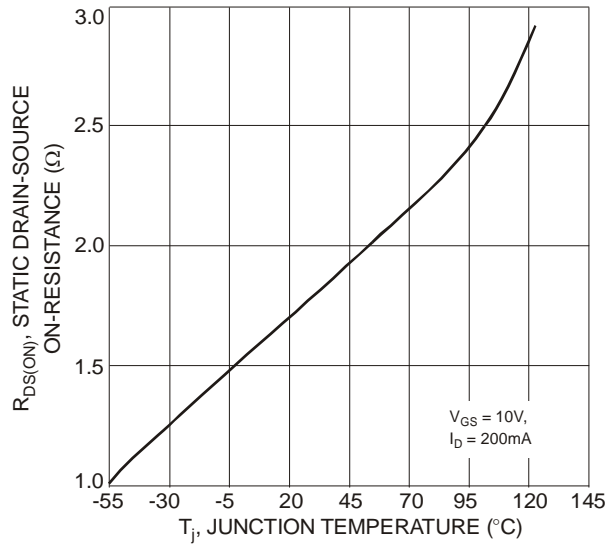
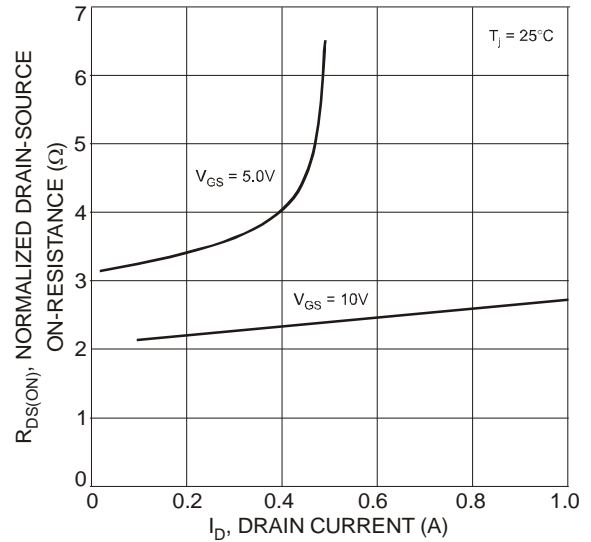
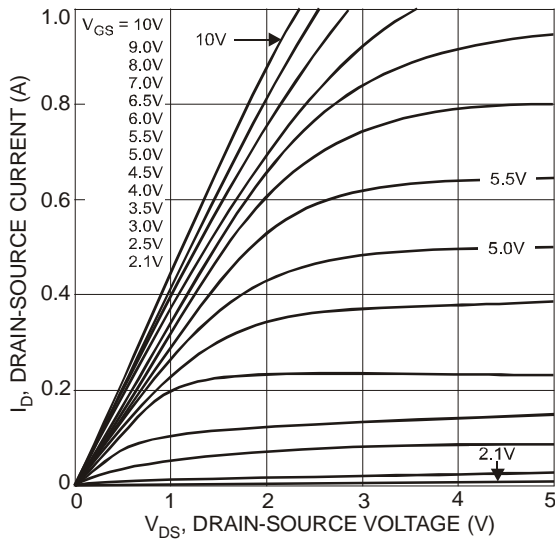
**Thermal Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Units
Total Power Dissipation	(Note 6)	P <sub>D</sub>	370	mW
	(Note 7)		540	
Thermal Resistance, Junction to Ambient	(Note 6)	R <sub>θJA</sub>	348	°C/W
	(Note 7)		241	
Thermal Resistance, Junction to Case	(Note 7)	R <sub>θJC</sub>	91	°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.)

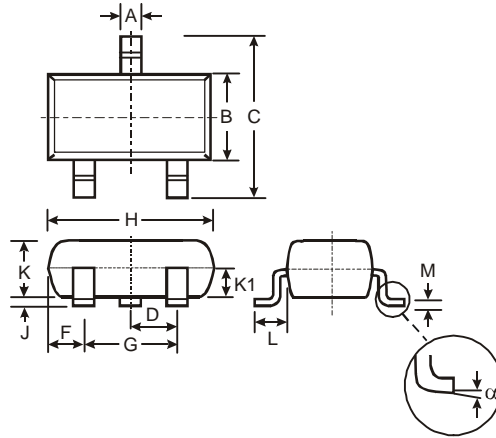
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
OFF CHARACTERISTICS (Note 8)						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	60	70	—	V	V <sub>GS</sub> = 0V, I <sub>D</sub> = 10μA
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	—	—	1.0 500	μA	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V
Gate-Body Leakage	I <sub>GSS</sub>	—	—	±10	nA	V <sub>GS</sub> = ±20V, V <sub>DS</sub> = 0V
ON CHARACTERISTICS (Note 8)						
Gate Threshold Voltage	V <sub>GS(th)</sub>	1.0	—	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>	—	3.2 — 4.4	7.5 5.0 13.5	Ω	V <sub>GS</sub> = 5.0V, I <sub>D</sub> = 0.05A V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A V <sub>GS</sub> = 10V, I <sub>D</sub> = 0.5A
On-State Drain Current	I <sub>D(ON)</sub>	0.5	1.0	—	A	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 7.5V
Forward Transconductance	g <sub>FS</sub>	80	—	—	mS	V <sub>DS</sub> = 10V, I <sub>D</sub> = 0.2A
Diode Forward Voltage	V <sub>SD</sub>	—	0.78	1.5	V	V <sub>GS</sub> = 0V, I <sub>S</sub> = 115mA
DYNAMIC CHARACTERISTICS (Note 9)						
Input Capacitance	C <sub>iss</sub>	—	22	50	pF	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V f = 1.0MHz
Output Capacitance	C <sub>oss</sub>	—	11	25	pF	
Reverse Transfer Capacitance	C <sub>rss</sub>	—	2.0	5.0	pF	
Gate resistance	R <sub>g</sub>	—	120	—	Ω	V <sub>DS</sub> = 0V, V <sub>GS</sub> = 0V, f = 1.0MHz
Total Gate Charge (V <sub>GS</sub> = 4.5V)	Q <sub>g</sub>	—	223	—	pC	V <sub>DS</sub> = 10V, I <sub>D</sub> = 250mA
Gate-Source Charge	Q <sub>gs</sub>	—	82	—		
Gate-Drain Charge	Q <sub>gd</sub>	—	178	—		
SWITCHING CHARACTERISTICS (Note 9)						
Turn-On Delay Time	t <sub>D(on)</sub>	—	2.8	—	ns	V <sub>DD</sub> = 30V, I <sub>D</sub> = 0.2A, R <sub>L</sub> = 150Ω, V <sub>GEN</sub> = 10V, R <sub>GEN</sub> = 25Ω
Turn-On Rise Time	t <sub>r</sub>	—	3.0	—		
Turn-Off Delay Time	t <sub>D(off)</sub>	—	7.6	—		
Turn-Off Fall Time	t <sub>f</sub>	—	5.6	—		

- 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.



## Package Outline Dimensions

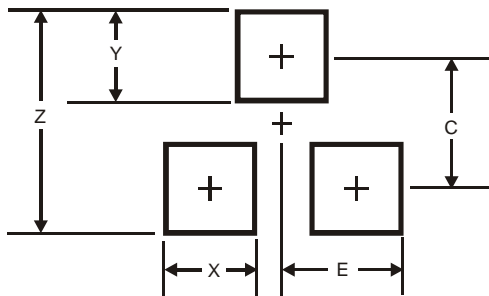
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



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

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