

N-CHANNEL ENHANCEMENT MODE FIELD EFFECT TRANSISTOR
Product Summary

BV _{DSS}	R _{DS(ON)} Max	I _D Max T _A = +25°C
60V	5Ω @ V _{GS} = 10V	210mA
	7.5Ω @ V _{GS} = 5V	170mA

Features and Benefits

- 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 (Note 3)**
- **This part is qualified to JEDEC standards (as references in AEC-Q) for High Reliability.**
<https://www.diodes.com/quality/product-definitions/>
- **An automotive-compliant part is available under separate datasheet (2N7002Q)**

Description and Applications

This MOSFET has been designed to minimize the on-state resistance (R_{DS(ON)}) yet maintain superior switching performance, making it ideal for high-efficiency power-management applications.

- Motor controls
- Power-management functions

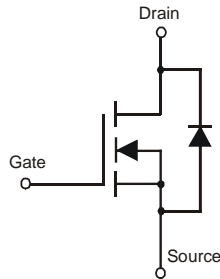
Mechanical Data

- Package: SOT23
- Package Material: Molded Plastic, "Green" Molding Compound. UL Flammability Classification Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish — Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (e3)
- Terminal Connections: See Diagram
- Weight: 0.009 grams (Approximate)

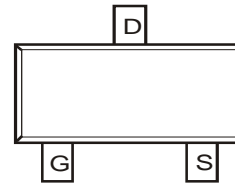
SOT23 (Standard)



Top View



Equivalent Circuit

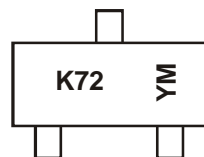


Top View

Ordering Information (Note 4)

Part Number	Package	Packing	
		Qty.	Carrier
2N7002-7-F	SOT23 (Standard)	3,000	Tape & Reel
2N7002-13-F	SOT23 (Standard)	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


K72 = Product Type Marking Code
 YM = Date Code Marking
 Y or \bar{Y} or \underline{Y} = Year (ex: L = 2024)
 M or \bar{M} = Month (ex: 9 = September)

Date Code Key

Year	2002	-	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Code	N	-	L	M	N	P	R	S	T	U	V	W
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 (@ $T_A = +25^\circ\text{C}$, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Drain-Source Voltage		V_{DSS}	60	V
Drain-Gate Voltage $R_{GS} \leq 1.0\text{M}\Omega$		V_{DGR}	60	V
Gate-Source Voltage		V_{GSS}	± 20 ± 40	V
Continuous Drain Current (Note 5) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	170	mA
		$T_A = +85^\circ\text{C}$	120	
		$T_A = +100^\circ\text{C}$	105	
Continuous Drain Current (Note 6) $V_{GS} = 10\text{V}$	Steady State	$T_A = +25^\circ\text{C}$	210	mA
		$T_A = +85^\circ\text{C}$	150	
		$T_A = +100^\circ\text{C}$	135	
Maximum Continuous Body Diode Forward Current (Note 6)		Continuous Pulsed (Note 8)	0.2	A
Pulsed Drain Current (10 μs Pulse, Duty Cycle = 1%)			0.5	
		I_{DM}	800	mA

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

Characteristic		Symbol	Value	Unit
Total Power Dissipation	(Note 5)	P_D	370	mW
	(Note 6)		540	
	(Note 5)		348	
Thermal Resistance, Junction to Ambient	(Note 5)	$R_{\theta JA}$	348	$^\circ\text{C}/\text{W}$
	(Note 6)		241	
Thermal Resistance, Junction to Case	(Note 6)	$R_{\theta JC}$	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 7)							
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	@ $T_J = +25^\circ\text{C}$	I_{DSS}	—	—	1.0	μA	$V_{DS} = 60\text{V}, V_{GS} = 0\text{V}$
	@ $T_J = +125^\circ\text{C}$		—	—	500		
Gate-Body Leakage		I_{GSS}	—	—	± 10	nA	$V_{GS} = \pm 20\text{V}, V_{DS} = 0\text{V}$
ON CHARACTERISTICS (Note 7)							
Gate Threshold Voltage		$V_{GS(TH)}$	1.0	—	2.5	V	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$
Static Drain-Source On-Resistance	@ $T_J = +25^\circ\text{C}$	$R_{DS(ON)}$	—	3.2	7.5	Ω	$V_{GS} = 5.0\text{V}, I_D = 0.05\text{A}$
	@ $T_J = +25^\circ\text{C}$		—	2.4	5.0		$V_{GS} = 10\text{V}, I_D = 0.5\text{A}$
	@ $T_J = +125^\circ\text{C}$		—	4.4	13.5		$V_{GS} = 10\text{V}, I_D = 0.5\text{A}$
On-State Drain Current		$I_{D(ON)}$	0.5	1.0	—	A	$V_{GS} = 10\text{V}, V_{DS} = 7.5\text{V}$
Forward Transconductance		g_{FS}	80	—	—	mS	$V_{DS} = 10\text{V}, I_D = 0.2\text{A}$
Diode Forward Voltage		V_{SD}	—	0.78	1.5	V	$V_{GS} = 0\text{V}, I_S = 115\text{mA}$
DYNAMIC CHARACTERISTICS (Note 8)							
Input Capacitance		C_{iss}	—	22	50	pF	$V_{DS} = 25\text{V}, V_{GS} = 0\text{V}$ $f = 1.0\text{MHz}$
Output Capacitance		C_{oss}	—	11	25	pF	
Reverse Transfer Capacitance		C_{rss}	—	2.0	5.0	pF	
Gate Resistance		R_g	—	120	—	Ω	$V_{DS} = 0\text{V}, V_{GS} = 0\text{V}$ $f = 1.0\text{MHz}$
Total Gate Charge ($V_{GS} = 4.5\text{V}$)		Q_g	—	223	—	pC	$V_{DS} = 10\text{V}, I_D = 250\text{mA}$
Gate-Source Charge		Q_{gs}	—	82	—		
Gate-Drain Charge		Q_{gd}	—	178	—		
Turn-On Delay Time		$t_{D(ON)}$	—	2.8	—	ns	$V_{DD} = 30\text{V}, I_D = 0.2\text{A}$ $R_L = 150\Omega, V_{GEN} = 10\text{V}$ $R_{GEN} = 25\Omega$
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:
- 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.

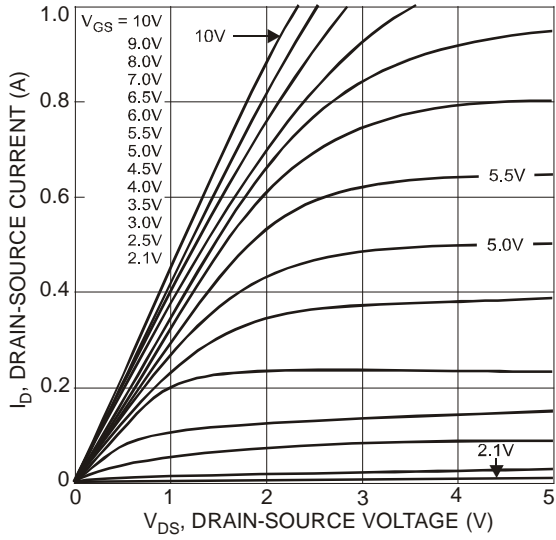


Fig. 1 On-Region Characteristics

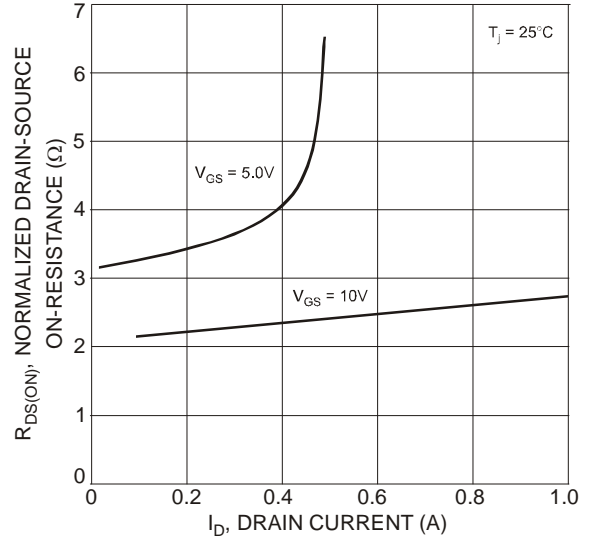


Fig. 2 On-Resistance vs. Drain Current

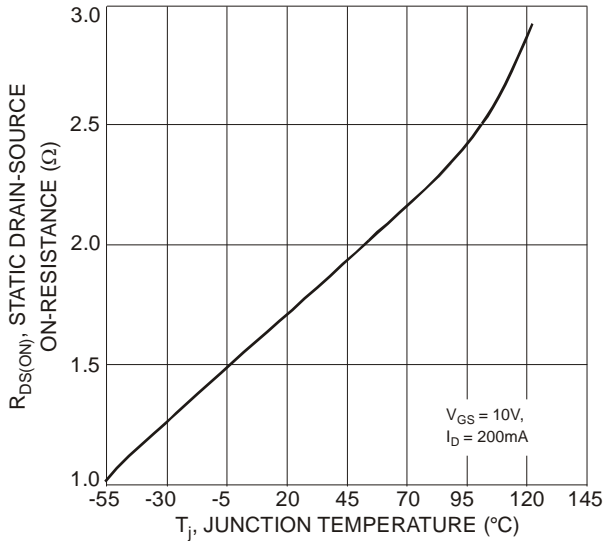


Fig. 3 On-Resistance vs. Junction Temperature

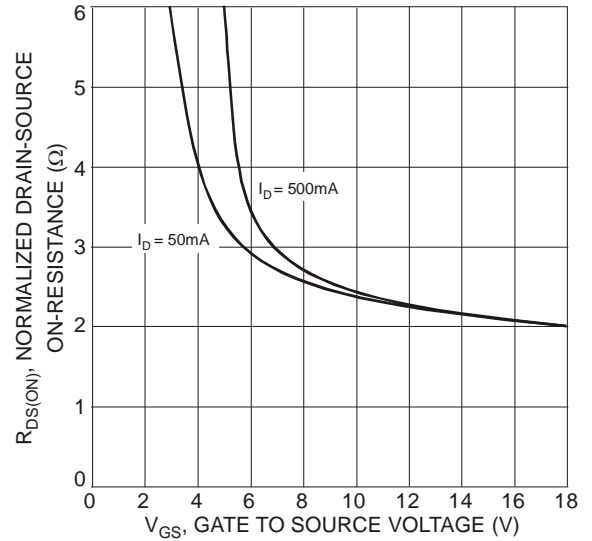


Fig. 4 On-Resistance vs. Gate-Source Voltage

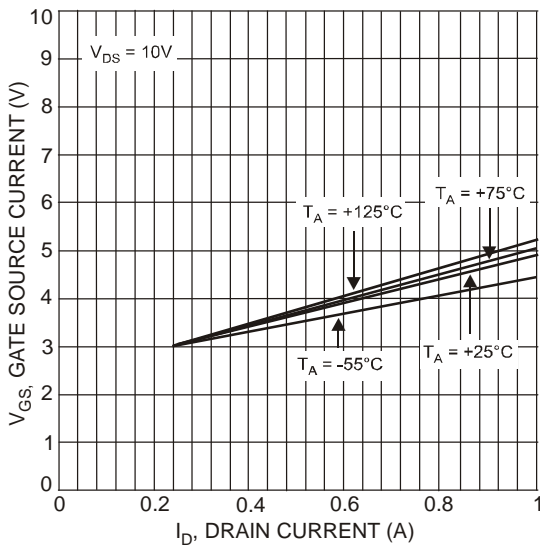


Fig. 5 Typical Transfer Characteristics

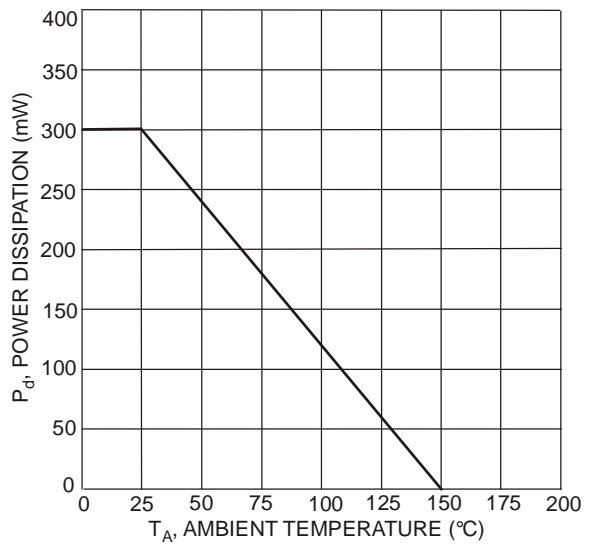
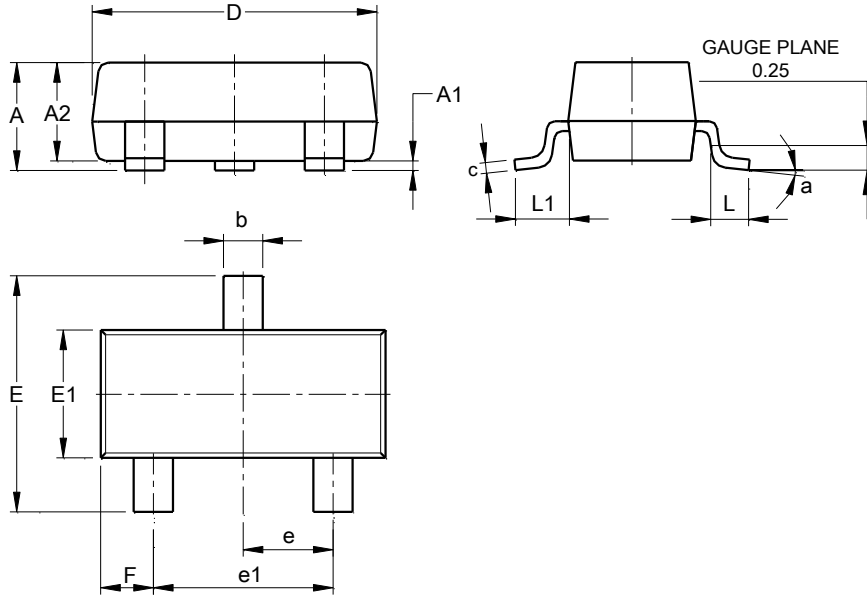


Fig. 6 Max Power Dissipation vs. Ambient Temperature

Package Outline Dimensions

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

SOT23 (Standard)

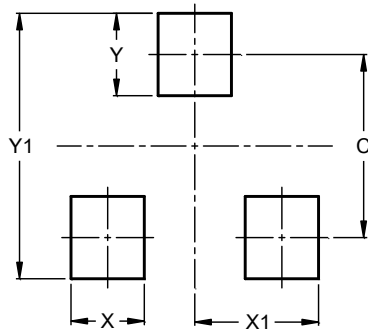


SOT23 (Standard)			
Dim	Min	Max	Typ
A	0.90	1.15	1.025
A1	0.00	0.10	0.05
A2	0.85	1.10	0.975
b	0.30	0.51	0.40
c	0.080	0.202	0.11
D	2.80	3.00	2.90
E	2.25	2.55	2.40
E1	1.20	1.40	1.30
e	0.89	1.03	0.915
e1	1.78	2.05	1.83
F	0.40	0.60	0.535
L1	0.45	0.61	0.55
L	0.25	0.55	0.40
a	0°	8°	--
All Dimensions in mm			

Suggested Pad Layout

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

SOT23 (Standard)



Dimensions	Value (in mm)
C	2.0
X	0.8
X1	1.35
Y	0.9
Y1	2.9

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