



# 2N7002

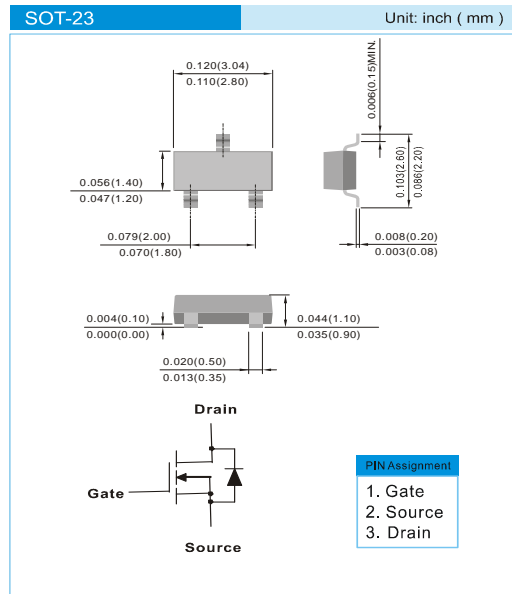
## 60V N-Channel Enhancement Mode MOSFET

### FEATURES

- $R_{DS(ON)}, V_{GS} @ 10V, I_{DS} @ 500mA = 5\Omega$
- $R_{DS(ON)}, V_{GS} @ 4.5V, I_{DS} @ 75mA = 7.5\Omega$
- Advanced Trench Process Technology
- High Density Cell Design For Ultra Low On-Resistance
- Specially Designed for Battery Operated Systems, Solid-State Relays Drivers : Relays, Displays, Lamps, Solenoids, Memories, etc.
- Lead free in comply with EU RoHS 2011/65/EU directives
- Green molding compound as per IEC61249 Std. . (Halogen Free)

### MECHANICAL DATA

- Case : SOT-23 Package
- Terminals : Solderable per MIL-STD-750, Method 2026
- Approx. Weight : 0.0003 ounces, 0.008 grams
- Marking : S72



### Maximum Ratings and Thermal Characteristics ( $T_A = 25^\circ\text{C}$ unless otherwise noted )

PARAMETER	Symbol	Limit	Units
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$I_D$	250	mA
Pulsed Drain Current <sup>1)</sup>	$I_{DM}$	1300	mA
Maximum Power Dissipation	$P_D$	$T_A = 25^\circ\text{C}$ 350 $T_A = 75^\circ\text{C}$ 210	mW
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to + 150	$^\circ\text{C}$
Junction-to Ambient Thermal Resistance(PCB mounted) <sup>2)</sup>	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$

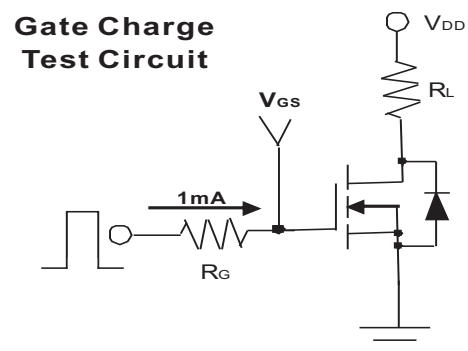
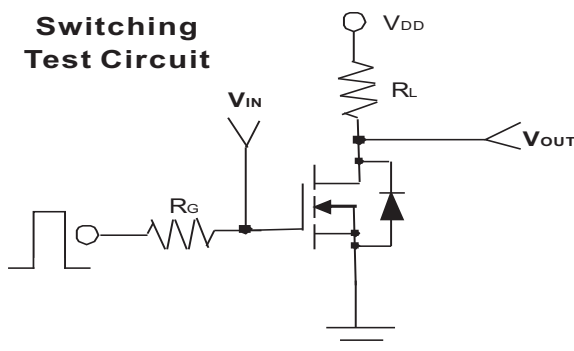
Note:1. Maximum DC current limited by the package  
2. Surface mounted on FR4 board,  $t \leq 10$  sec



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## ELECTRICAL CHARACTERISTICS

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Units
Static						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=10\mu A$	60	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	1	-	2.5	V
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=4.5V, I_D=75mA$	-	-	7.5	$\Omega$
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=500mA$	-	-	5	
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
Gate Body Leakage	$I_{GSS}$	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	$\pm 100$	nA
Forward Transconductance	$g_{fs}$	$V_{DS}=15V, I_D=250mA$	200	-	-	mS
Dynamic						
Total Gate Charge	$Q_g$	$V_{DS}=15V, I_D=500mA$ $V_{DD}=4.5V$	-	0.6	0.7	nC
Gate-Source Charge	$Q_{gs}$		-	0.1	-	
Gate-Drain Charge	$Q_{gd}$		-	0.08	-	
Turn-On Time	$t_{on}$	$V_{DD}=10V, R_L=20\Omega$ $I_D=500mA, V_{GEN}=10V$ $R_G=10\Omega$	-	9	15	ns
Turn-Off Time	$t_{off}$		-	21	26	
Input Capacitance	$C_{iss}$	$V_{DS}=25V, V_{GS}=0V$ $f=1.0MHz$	-	-	50	pF
Output Capacitance	$C_{oss}$		-	-	25	
Reverse Transfer Capacitance	$C_{rss}$		-	-	5	
Source-Drain Diode						
Max. Diode Forward Current	$I_s$	-	-	-	250	mA
Diode Forward Voltage	$V_{SD}$	$I_s=250mA, V_{GS}=0V$	-	0.93	1.2	V





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Typical Characteristics Curves ( $T_A=25^\circ\text{C}$ , unless otherwise noted)

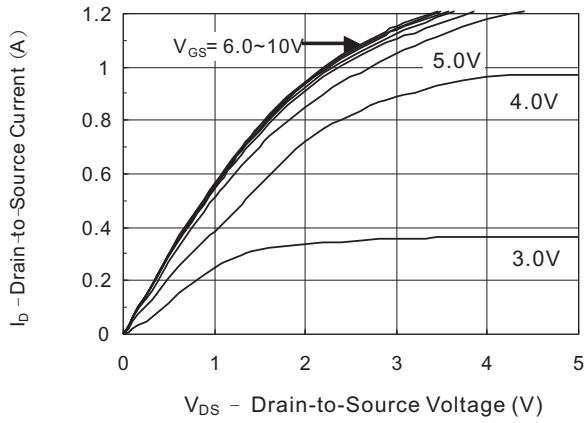


FIG.1- Output Characteristic

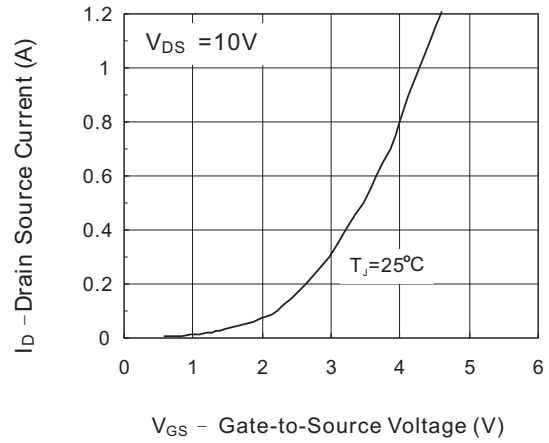


FIG.2- Transfer Characteristic

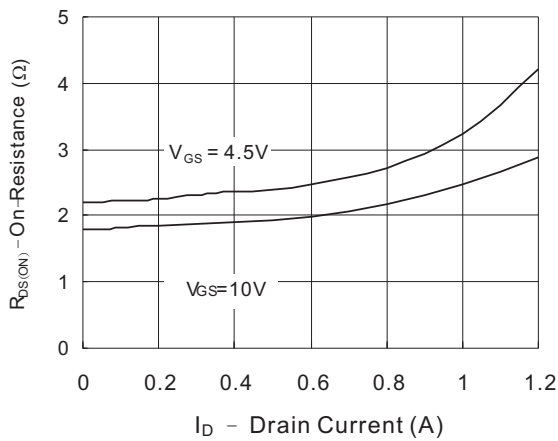


FIG.3- On Resistance vs Drain Current

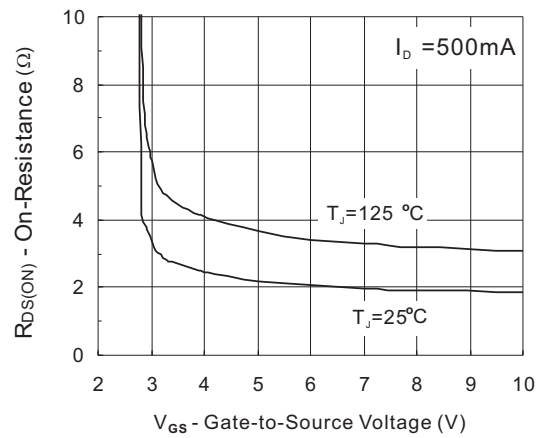


FIG.4- On Resistance vs Gate to Source Voltage

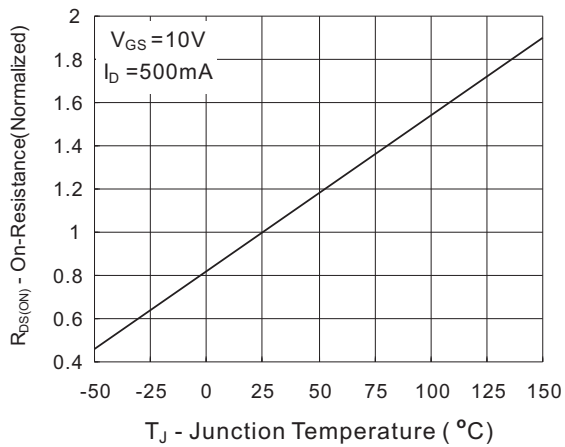


FIG.5- On Resistance vs Junction Temperature



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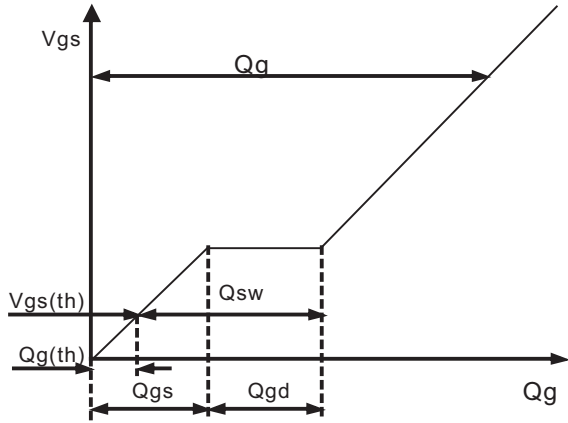


Fig.6 - Gate Charge Waveform

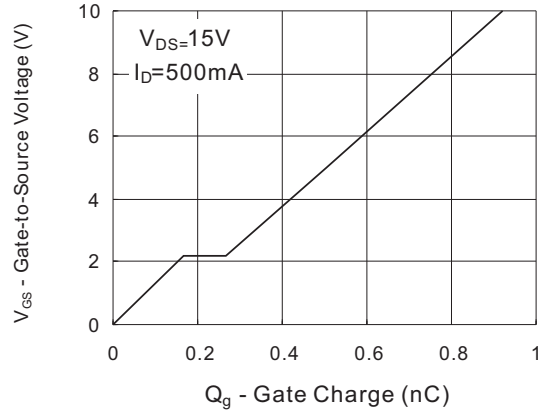


Fig.7 - Gate Charge

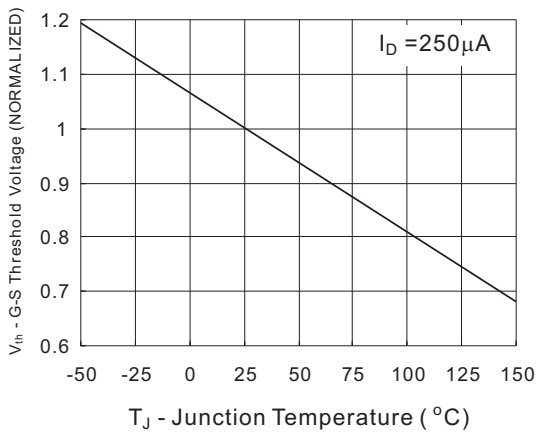


Fig.8 - Threshold Voltage vs Temperature

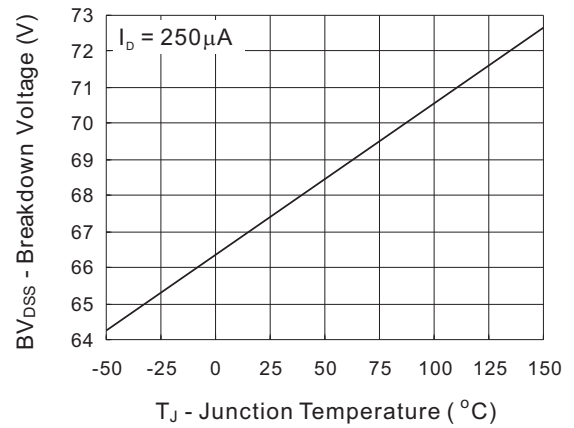


Fig.9 - Breakdown Voltage vs Junction Temperature

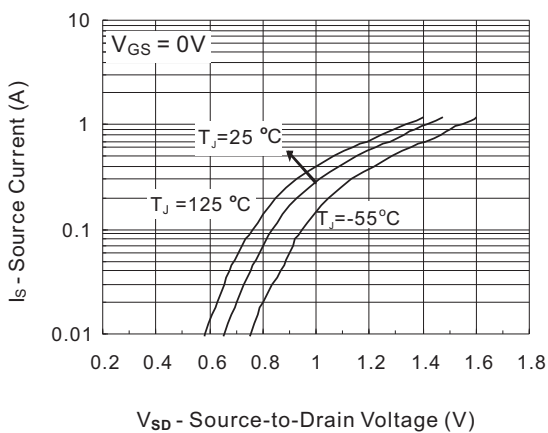


Fig.10 - Source-Drain Diode Forward Voltage

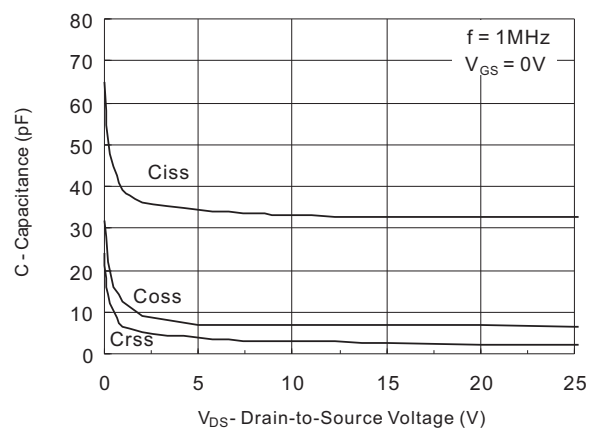


Fig.11 - Capacitance vs Drain to Source Voltage

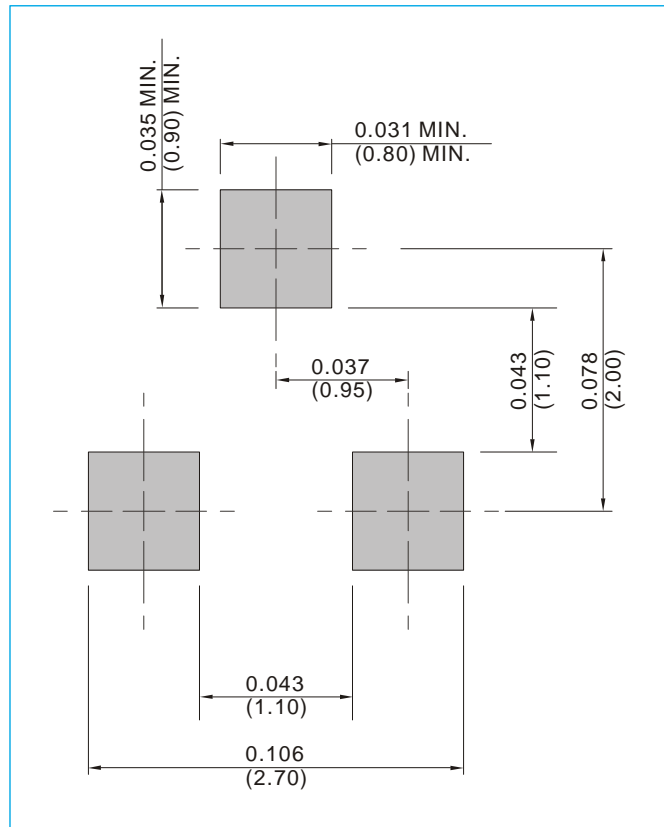


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## MOUNTING PAD LAYOUT

**SOT-23**

Unit : inch(mm)



## ORDER INFORMATION

- Packing information
  - T/R - 12K per 13" plastic Reel
  - T/R - 3K per 7" plastic Reel



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## Part No\_packing code\_Version

2N7002\_R1\_00001

2N7002\_R2\_00001

For example :

**RB500V-40\_R2\_00001**



Packing Code XX				Version Code XXXXX		
Packing type	1 <sup>st</sup> Code	Packing size code	2 <sup>nd</sup> Code	HF or RoHS	1 <sup>st</sup> Code	2 <sup>nd</sup> ~5 <sup>th</sup> Code
Tape and Ammunition Box (T/B)	A	N/A	0	HF	0	serial number
Tape and Reel (T/R)	R	7"	1	RoHS	1	serial number
Bulk Packing (B/P)	B	13"	2			
Tube Packing (T/P)	T	26mm	X			
Tape and Reel (Right Oriented) (TRR)	S	52mm	Y			
Tape and Reel (Left Oriented) (TRL)	L	PANASERT T/B CATHODE UP (PBCU)	U			
FORMING	F	PANASERT T/B CATHODE DOWN (PBCD)	D			



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