

**SuperMOS – SOT-23 60V  $BV_{DSS}$ ,  $1.85\Omega R_{DS(on)}$ , N-channel MOSFET**

**1. Description**

The 2N7002 is N-Channel enhancement MOS Field Effect Transistor. Uses advanced technology and design to provide excellent  $R_{DS(ON)}$  with low gate charge. Device is suitable for use in DC-DC conversion, power switch and charging circuit. Standard Product 2N7002 is Pb-free.

**2. Features**

- 60V,  $R_{DS(ON)}=1.85\Omega(TYP.) @V_{GS}=10V$   
 $R_{DS(ON)}=2.05\Omega(TYP.) @V_{GS}=4.5V$
- Use trench MOSFET technology
- High density cell design for low  $R_{DS(on)}$
- ESD Protection - HBM : 2kV
- Material: Halogen free
- Reliable and rugged
- Avalanche Rated
- Low leakage current

**3. Applications**

- PWM applications
- Load switch
- Power management in portable/desktop PCs
- DC/DC conversion

**4. Ordering Information**

Part Number	Package	Marking	Material	Packing	Quantity per reel	Flammability Rating	Reel Size
2N7002	SOT-23	72K	Halogen free	Tape & Reel	3,000 PCS	UL 94V-0	7 inches

Table-1 Ordering information

**5. Pin Configuration and Functions**

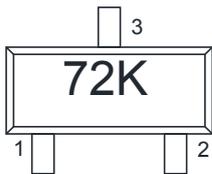
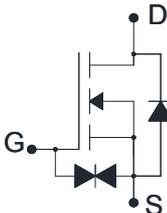
Pin	Function	Outline	Circuit Diagram
1	Gate		
2	Source		
3	Drain		

Table-2 Pin configuration

## 6. Specification

### Absolute Maximum Rating & Thermal Characteristics

Ratings at 25 °C ambient temperature unless otherwise specified.

Parameter		Symbol	Limit	Unit
Drain-Source Voltage		$BV_{DSS}$	60	V
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current	$T_A=25^\circ\text{C}$	$I_D$	0.3	A
	$T_A=100^\circ\text{C}$		0.2	
Maximum Power Dissipation		$P_D$	350	mW
Pulsed Drain Current		$I_{DM}$	1.2	A
Operating Junction Temperature		$T_J$	150	$^\circ\text{C}$
Lead Temperature		$T_L$	260	$^\circ\text{C}$
Storage Temperature Range		$T_{stg}$	-55 to 150	$^\circ\text{C}$

#### Thermal resistance ratings

Single Operation			
Parameter	Symbol	Typical	Unit
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	357	$^\circ\text{C}/\text{W}$

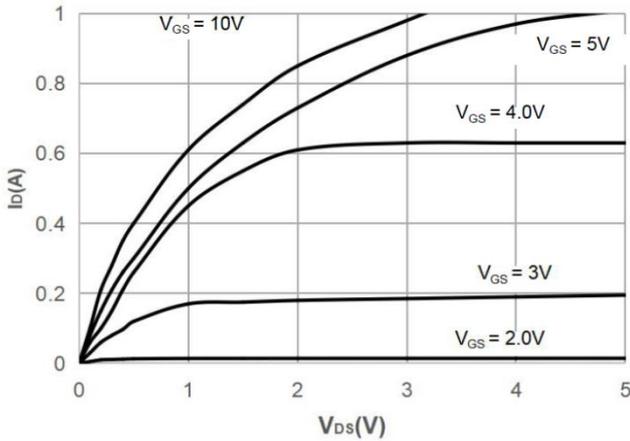
## Electrical Characteristics

At TA = 25°C unless otherwise specified

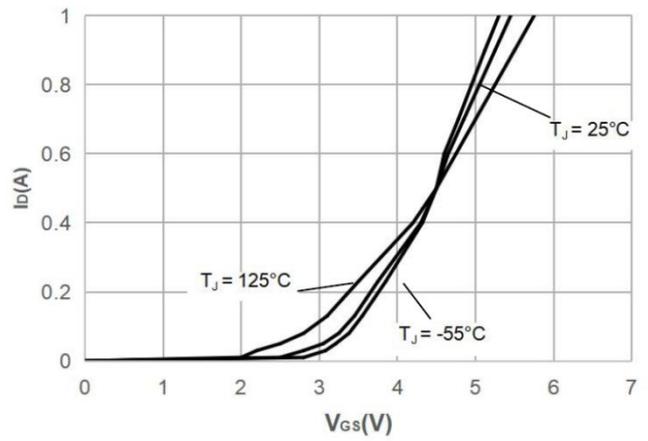
Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
<b>OFF CHARACTERISTICS</b>						
Drain-to-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60			V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$			1.0	$\mu A$
Gate-to-source Leakage Current	$I_{GSS}$	$V_{DS}=0V, V_{GS}=\pm 20V$			$\pm 10$	$\mu A$
<b>ON CHARACTERISTICS</b>						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250\mu A$	1.0	1.6	2.0	V
Drain-to-source On-resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=0.3A$		1.85	2.2	$\Omega$
		$V_{GS}=4.5V, I_D=0.2A$		2.05	3.0	
<b>CHARGES, CAPACITANCES AND GATE RESISTANCE</b>						
Input Capacitance	$C_{ISS}$	$V_{GS}=0V, f=1MHz, V_{DS}=25V$		28		pF
Output Capacitance	$C_{OSS}$			11		
Reverse Transfer Capacitance	$C_{RSS}$			4		
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=4.5V, V_{DS}=10V, I_D=0.3A$		1.8		nC
Gate-to-Source Charge	$Q_{GS}$			0.3		
Gate-to-Drain Charge	$Q_{GD}$			0.6		
<b>SWITCHING CHARACTERISTICS</b>						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS}=10V, V_{DS}=10V, I_D=0.2A, R_G=10\Omega$		2		ns
Rise Time	$t_r$			15		
Turn-Off Delay Time	$t_{d(OFF)}$			7		
Fall Time	$t_f$			20		
<b>BODY DIODE CHARACTERISTICS</b>						
Forward Voltage	$V_{SD}$	$V_{GS}=0V, I_S=0.3A$			1.5	V

## 7. Typical Characteristic

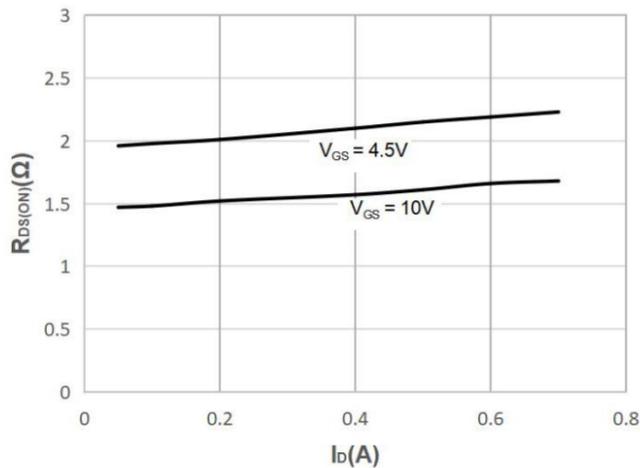
**Figure 1: Output Characteristics**



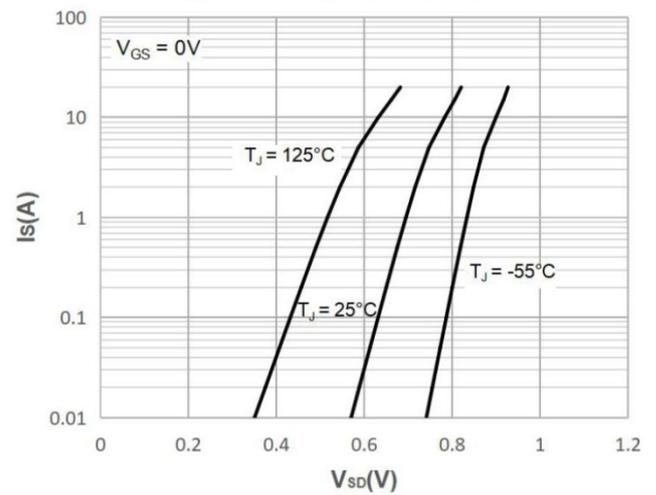
**Figure 2: Typical Transfer Characteristics**



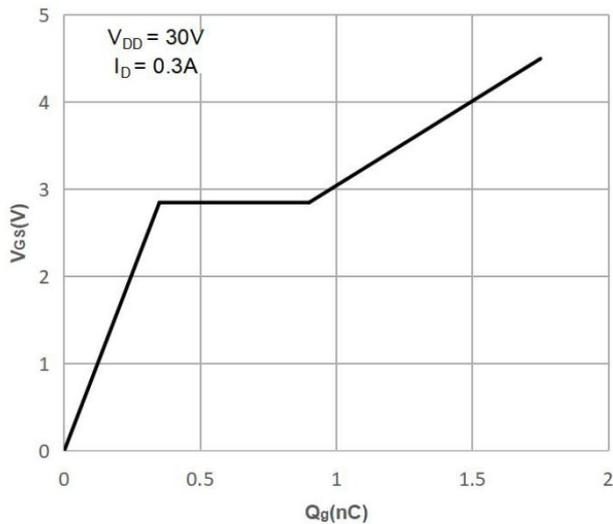
**Figure 3: On-resistance vs. Drain Current**



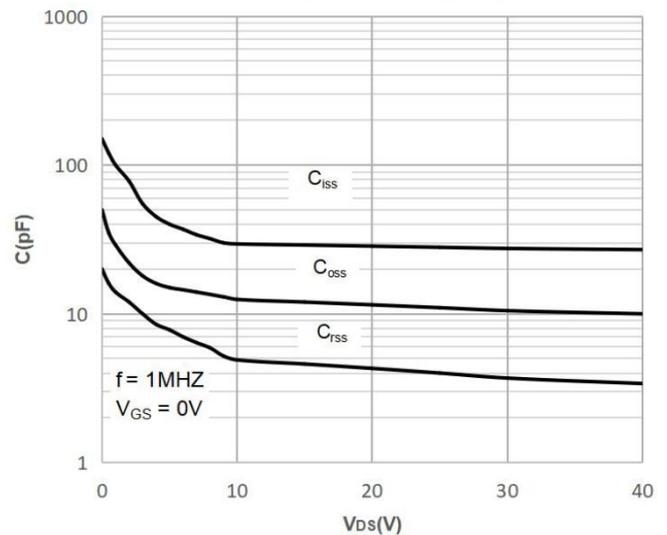
**Figure 4: Body Diode Characteristics**



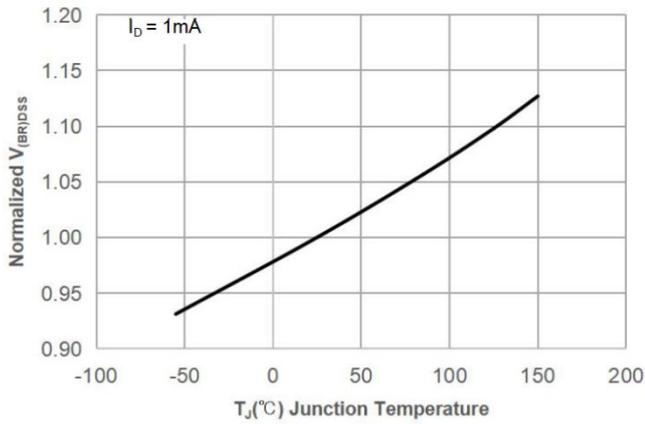
**Figure 5: Gate Charge Characteristics**



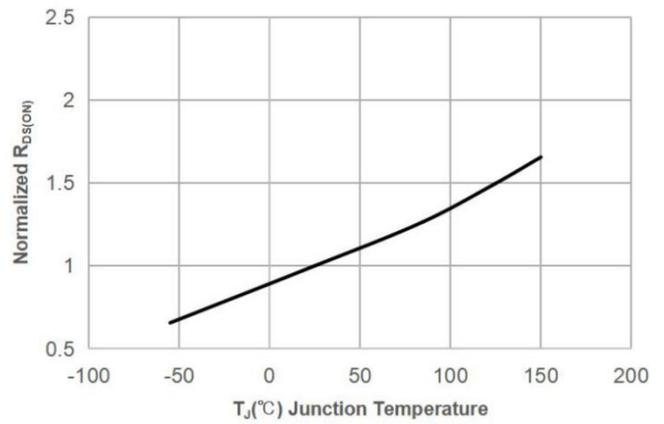
**Figure 6: Capacitance Characteristics**



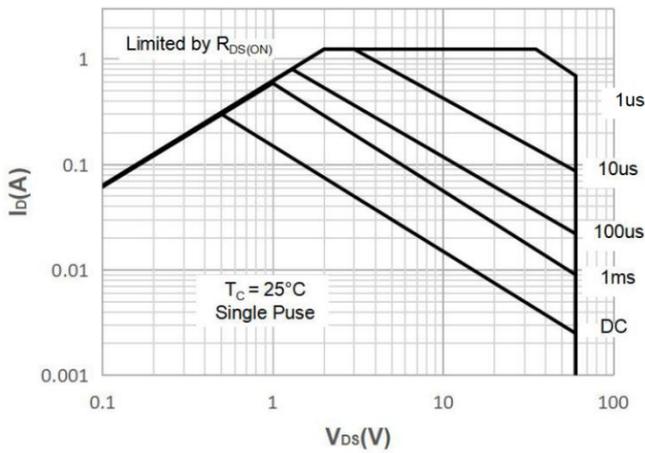
**Figure 7: Normalized Breakdown voltage vs. Junction Temperature**



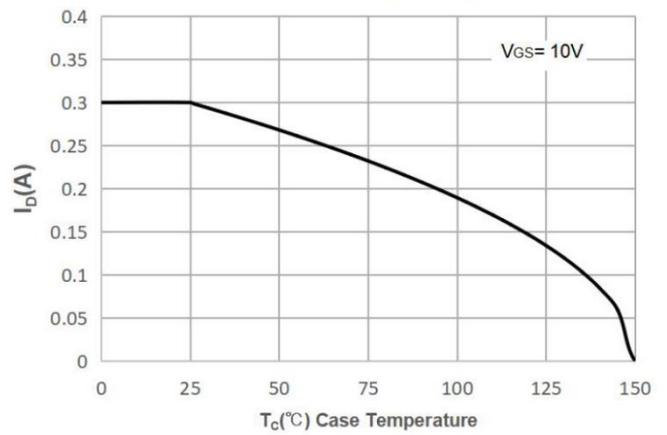
**Figure 8: Normalized on Resistance vs. Junction Temperature**



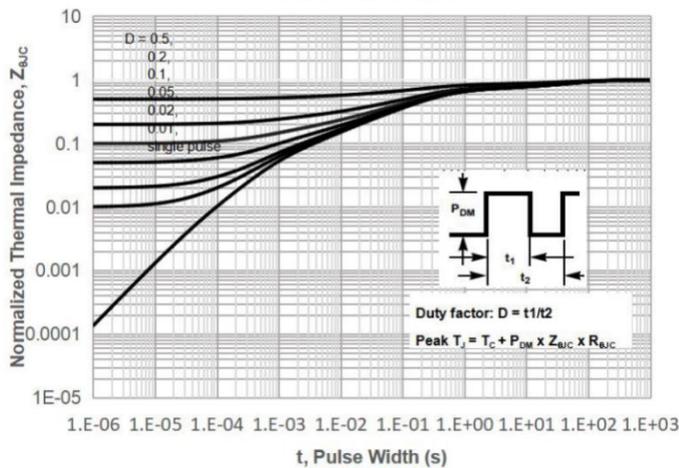
**Figure 9: Maximum Safe Operating Area**



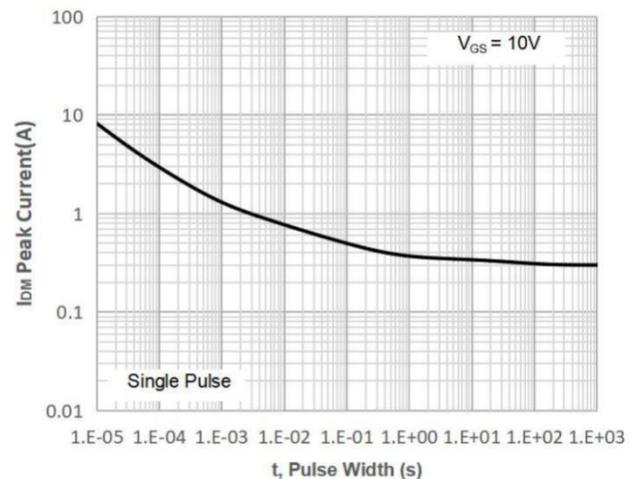
**Figure 10: Maximum Continuous Drianc Current vs. Case Temperature**



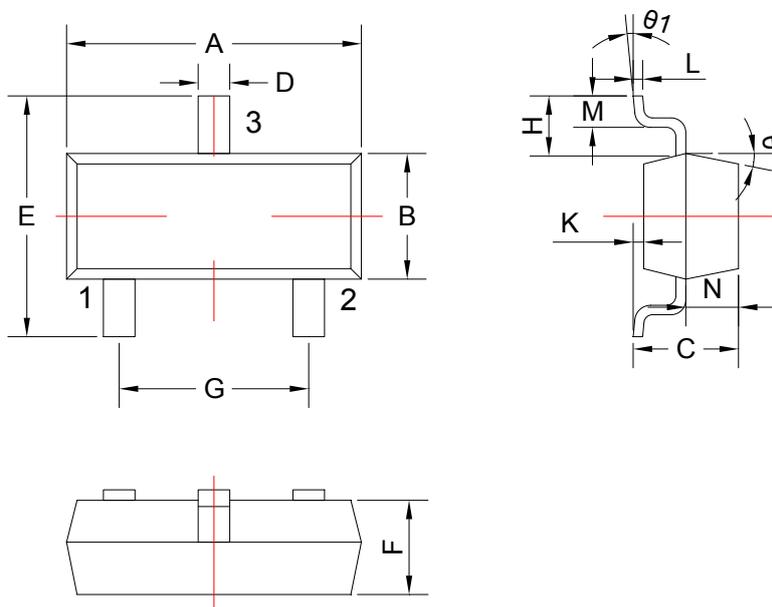
**Figure 11: Normalized Maximum Transient Thermal Impedance**



**Figure 12: Peak Current Capacity**



8. Dimension (SOT-23)



COMMON DIMENSIONS CUNITS MEASURE=MILLIMETER					
SYMBOL	MIN	MAX	SYMBOL	MIN	MAX
A	2.85	3.04	M	0.20	-
B	1.20	1.40	N	0.50	0.70
C	0.90	1.10	θ	5°	9°
D	0.40	0.50	F	0.95	1.05
E	2.25	2.55	H	0.50	0.60
G	1.80	2.00	L	0.095	0.115
K	0	0.10	θ1	0°	8°

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