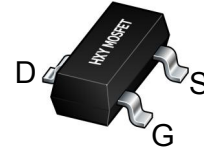




## Description

The 2N7002-HXY uses advanced trench technology to provide excellent  $R_{DS(ON)}$ , low gate charge and operation with gate voltages as low as 4.5V. This device is suitable for use as a Battery protection or in other Switching application.



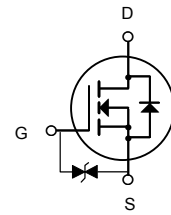
SOT-23

## General Features

$V_{DS} = 60V$   $I_D = 0.3A$

$R_{DS(ON)} < 2\Omega @ V_{GS}=10V$

ESD Rating: HBM  $\geq 2000V$



N-Channel MOSFET

## Application

Battery protection

Load switch

Uninterruptible power supply

## Package Marking and Ordering Information

Product ID	Pack	Marking	Qty(PCS)
2N7002-HXY	SOT-23	72K/7002	3000

## Absolute Maximum Ratings ( $T_C=25^\circ C$ unless otherwise noted)

Symbol	Parameter	Limit	Unit	
$V_{DS}$	Drain-Source Voltage	60	V	
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V	
$I_D$	Continuous Drain Current ( $T_J = 150^\circ C$ )	$T_A = 25^\circ C$	0.3	A
		$T_A = 100^\circ C$	0.19	
$I_{DM}$	Drain Current-Pulsed (Note 1)	0.8	A	
$P_D$	Maximum Power Dissipation	0.35	W	
$T_J, T_{STG}$	Operating Junction and Storage Temperature Range	-55 To 150	$^\circ C$	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 2)	350	$^\circ C/W$	



**Electrical Characteristics ( $T_A=25^{\circ}\text{C}$  unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=250\mu A$	60	68	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=60V, V_{GS}=0V$	-	-	1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 10V, V_{DS}=0V$	-	$\pm 100$	$\pm 500$	nA
		$V_{GS}=\pm 20V, V_{DS}=0V$	-	$\pm 4$	$\pm 10$	$\mu A$
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=250\mu A$	0.7	1.2	1.9	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=5V, I_D=0.1A$	-	1.3	3	$\Omega$
		$V_{GS}=10V, I_D=0.1A$	-	1	2	$\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=10V, I_D=0.2A$	0.1	-	-	S
Input Capacitance	$C_{iss}$	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0\text{MHz}$	-	21	50	PF
Output Capacitance	$C_{oss}$		-	11	25	PF
Reverse Transfer Capacitance	$C_{rss}$		-	4.2	5	PF
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=30V, I_D=0.2A$ $V_{GS}=10V, R_{GEN}=10\Omega$	-	10	-	nS
Turn-on Rise Time	$t_r$		-	50	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	17	-	nS
Turn-Off Fall Time	$t_f$		-	10	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=10V, I_D=0.3A,$ $V_{GS}=4.5V$	-	1.7	3	nC
Diode Forward Voltage <sup>(Note 3)</sup>	$V_{SD}$	$V_{GS}=0V, I_S=0.2A$	-	-	1.2	V
Diode Forward Current <sup>(Note 2)</sup>	$I_S$		-	-	0.3	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.
3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .
4. Guaranteed by design, not subject to production



### Typical Electrical And Thermal Characteristics



Figure 1: Switching Test Circuit

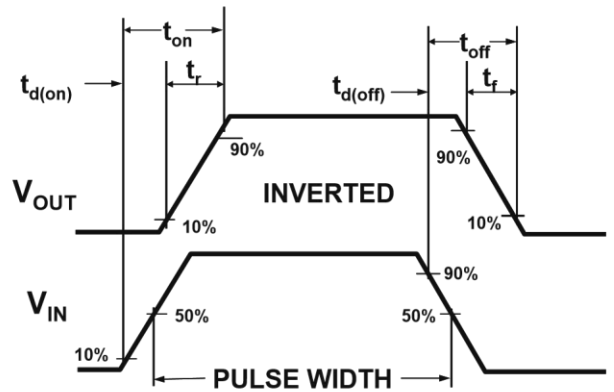


Figure 2: Switching Waveforms

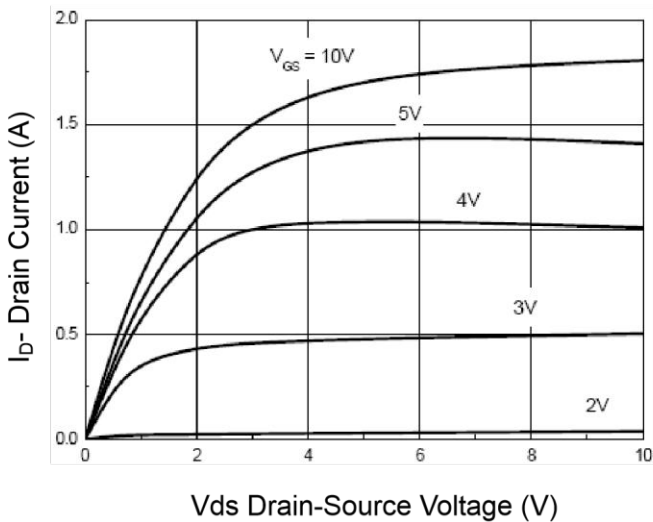


Figure 3 Output Characteristics

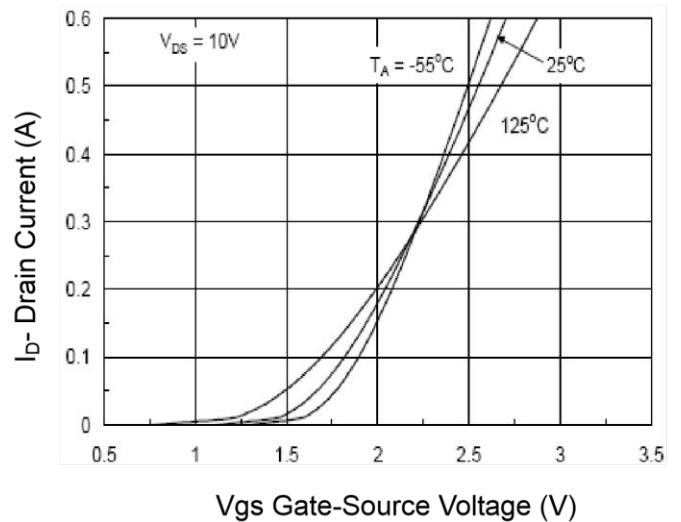


Figure 4 Transfer Characteristics

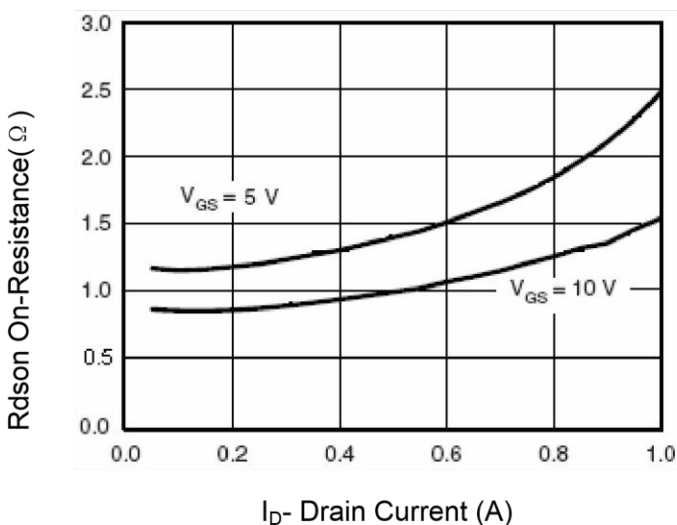


Figure 5 Drain-Source On-Resistance

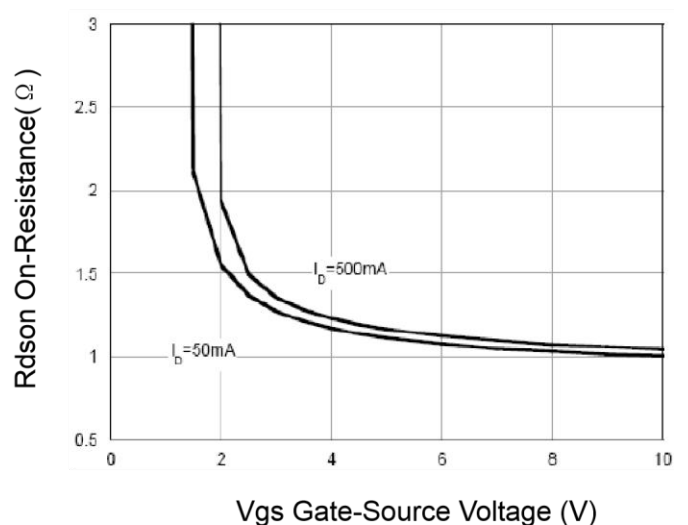
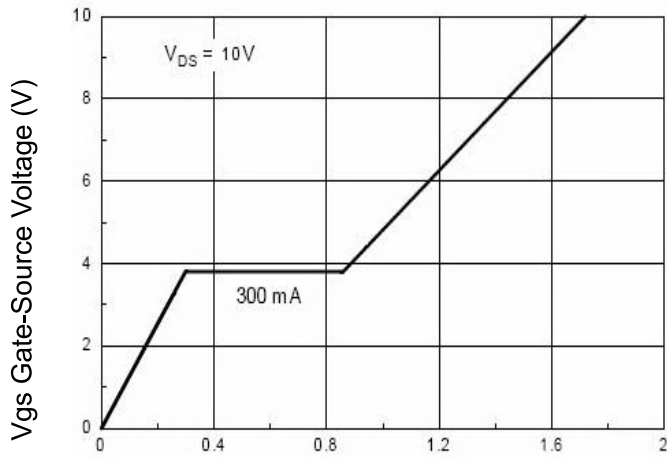
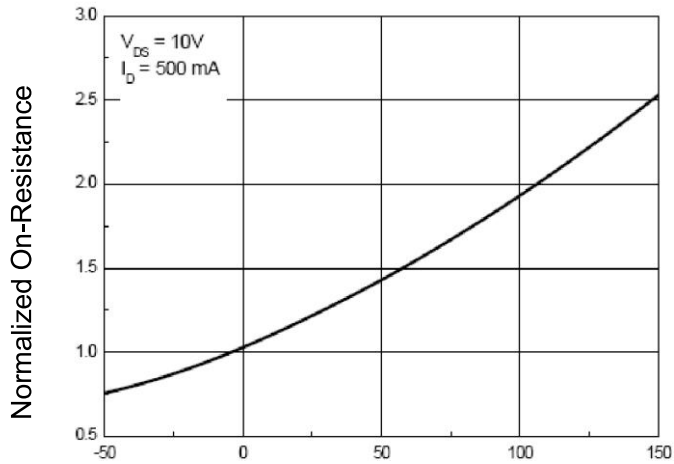


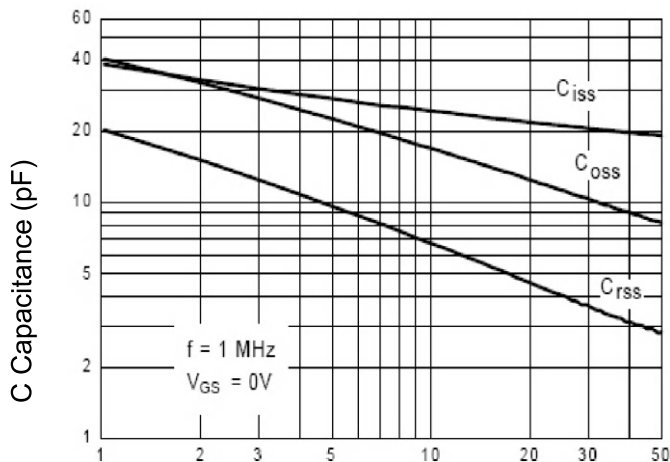
Figure 6 Rdson vs Vgs



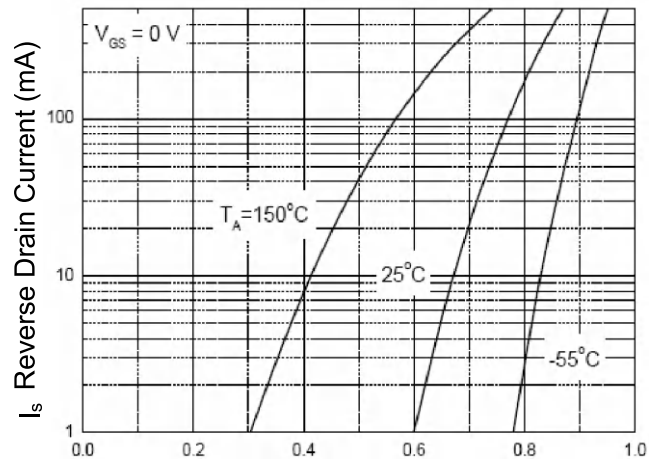
Qg Gate Charge (nC)  
**Figure 7 Gate Charge**



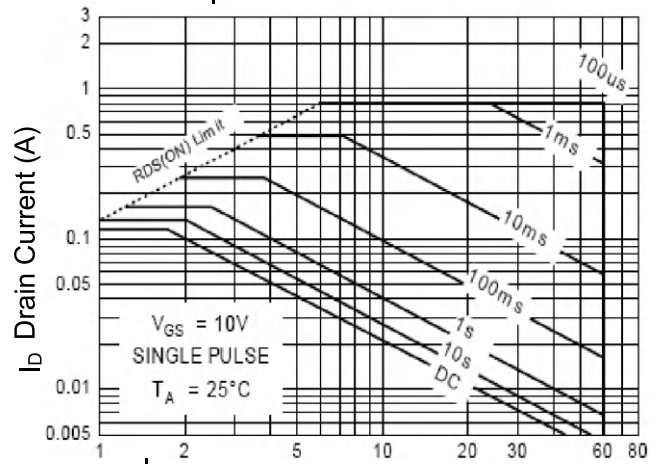
TJ-Junction Temperature(°C)  
**Figure 9 Drain-Source On-Resistance**



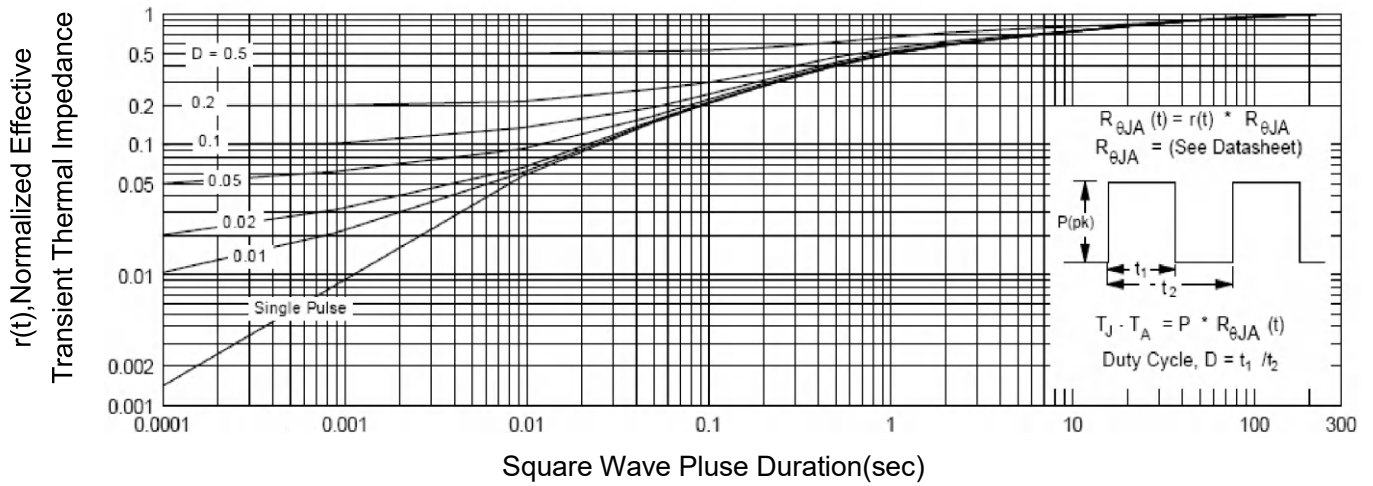
Vds Drain-Source Voltage (V)  
**Figure 11 Capacitance vs Vds**



Vsd Source-Drain Voltage (V)  
**Figure 8 Source-Drain Diode Forward**



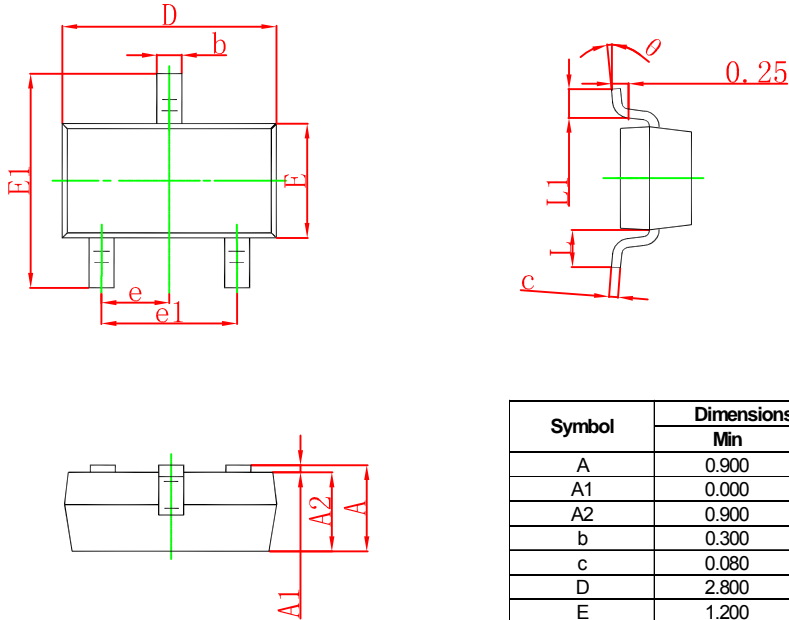
Vds Drain-Source Voltage (V)  
**Figure 10 Safe Operation Area**



**Figure 12 Normalized Maximum Transient Thermal Impedance**

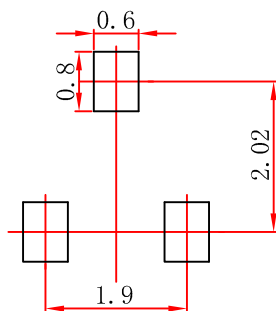


### SOT-23 Package Outline Dimensions



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	0.900	1.150	0.035	0.045
A1	0.000	0.100	0.000	0.004
A2	0.900	1.050	0.035	0.041
b	0.300	0.500	0.012	0.020
c	0.080	0.150	0.003	0.006
D	2.800	3.000	0.110	0.118
E	1.200	1.400	0.047	0.055
E1	2.250	2.550	0.089	0.100
e	0.950 TYP		0.037 TYP	
e1	1.800	2.000	0.071	0.079
L	0.550 REF		0.022 REF	
L1	0.300	0.500	0.012	0.020
θ	0°	8°	0°	8°

### SOT-23 Suggested Pad Layout



- Note:
1. Controlling dimension: in millimeters.
  2. General tolerance:  $\pm 0.05\text{mm}$ .
  3. The pad layout is for reference purposes only.



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