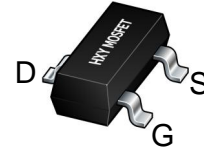




Description

The 2N7002E-T1-E3 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.



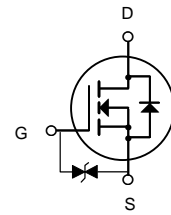
SOT-23

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	Brand	Qty(PCS)
2N7002E-T1-E3	SOT-23	HXY MOSFET	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	± 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	μA
Gate-Body Leakage Current	I_{GSS}	$V_{GS}=\pm 10V, V_{DS}=0V$	-	± 100	± 500	nA
		$V_{GS}=\pm 20V, V_{DS}=0V$	-	± 4	± 10	μA
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	Ω
		$V_{GS}=10V, I_D=0.1A$	-	1	2	Ω
Forward Transconductance	g_{FS}	$V_{DS}=10V, I_D=0.2A$	0.1	-	-	S
Input Capacitance	C_{iss}	$V_{DS}=25V, V_{GS}=0V,$ $F=1.0MHz$	-	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 ^(Note 3)	V_{SD}	$V_{GS}=0V, I_S=0.2A$	-	-	1.2	V
Diode Forward Current ^(Note 2)	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

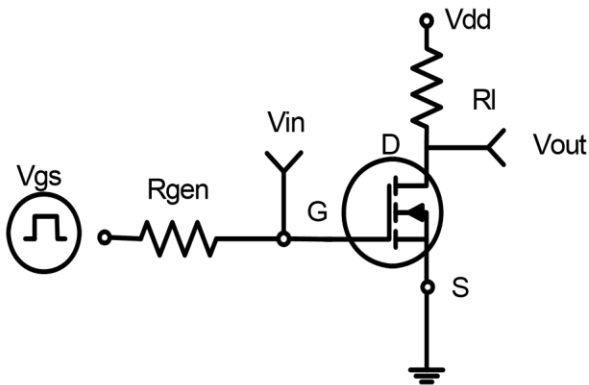


Figure 1: Switching Test Circuit

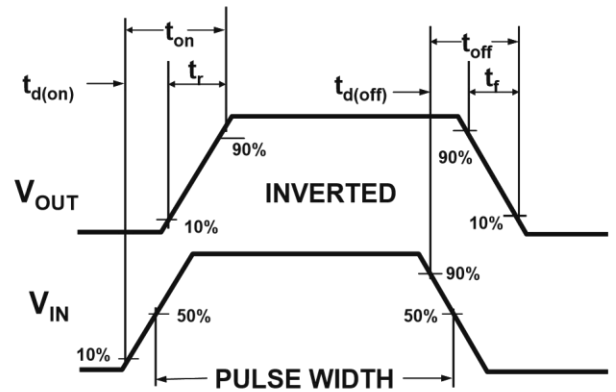


Figure 2: Switching Waveforms

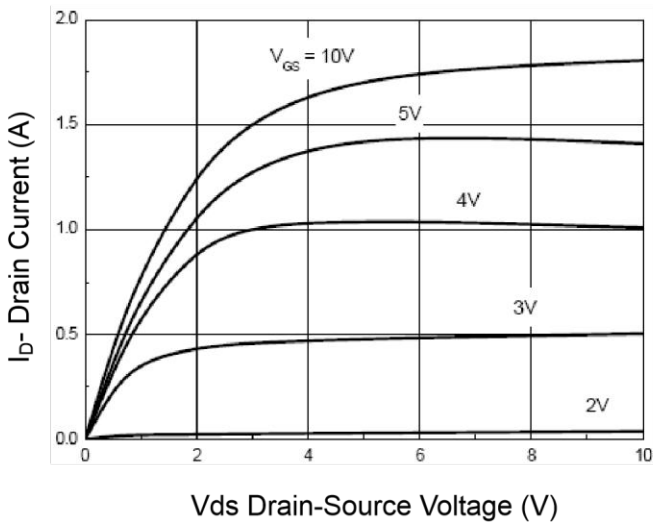


Figure 3 Output Characteristics

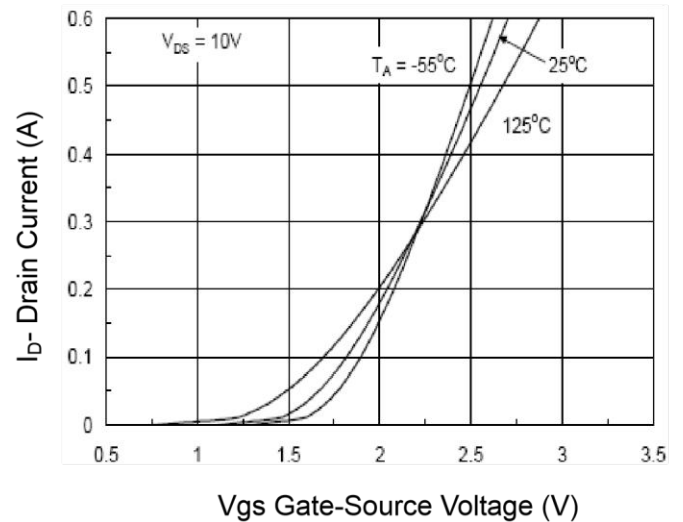


Figure 4 Transfer Characteristics

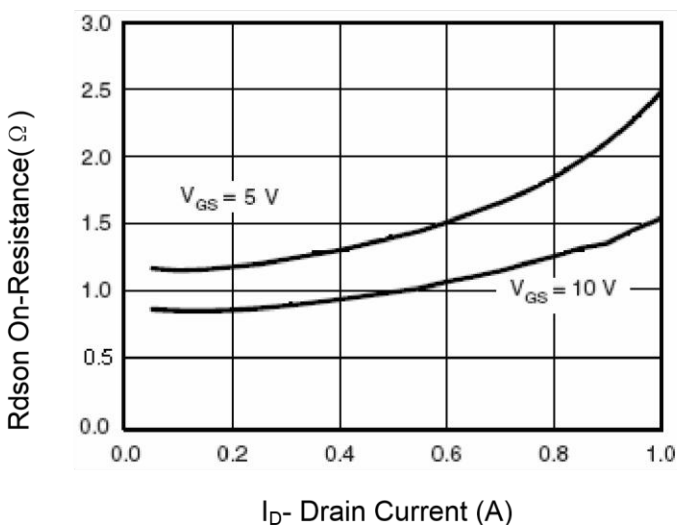


Figure 5 Drain-Source On-Resistance

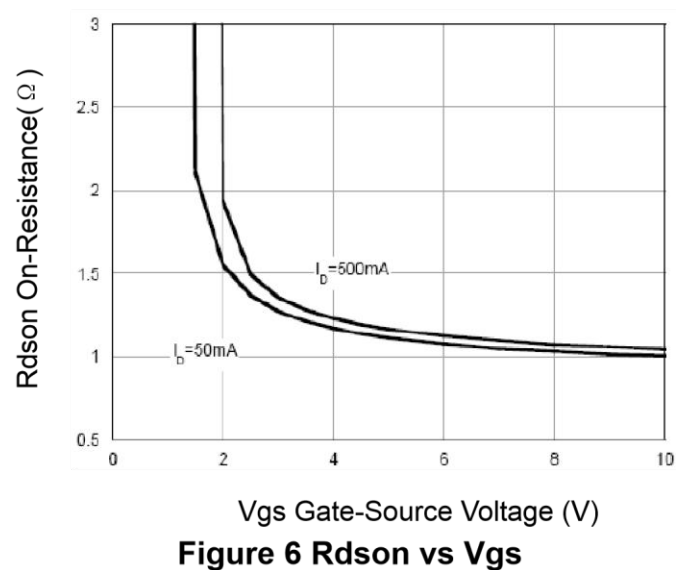
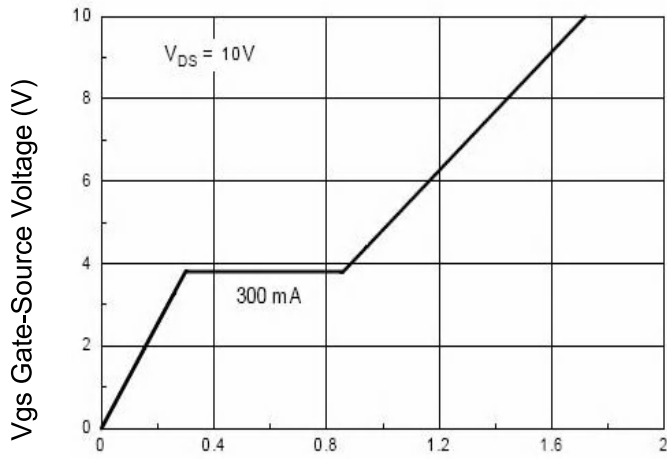
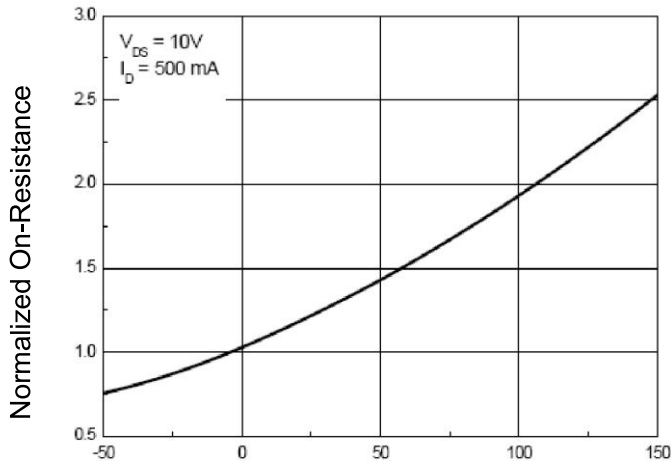


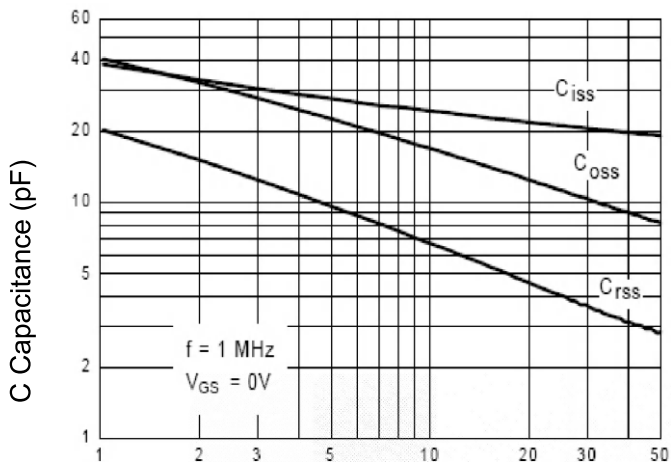
Figure 6 Rdson vs Vgs



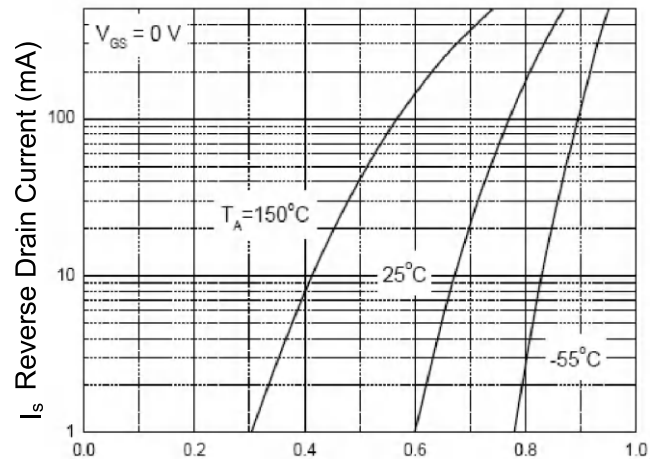
Qg Gate Charge (nC)
Figure 7 Gate Charge



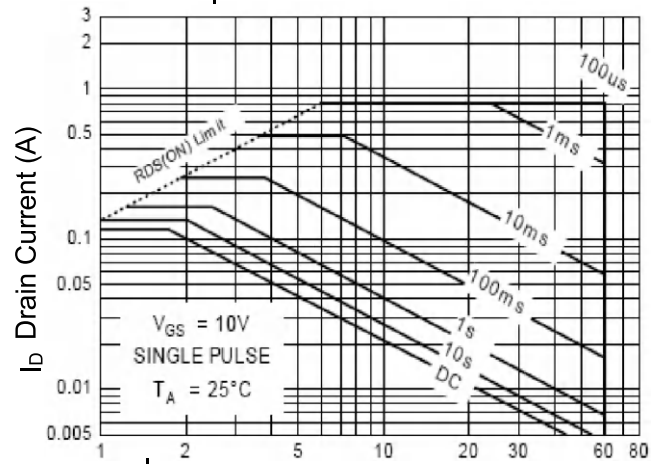
TJ-Junction Temperature(°C)
Figure 9 Drain-Source On-Resistance



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

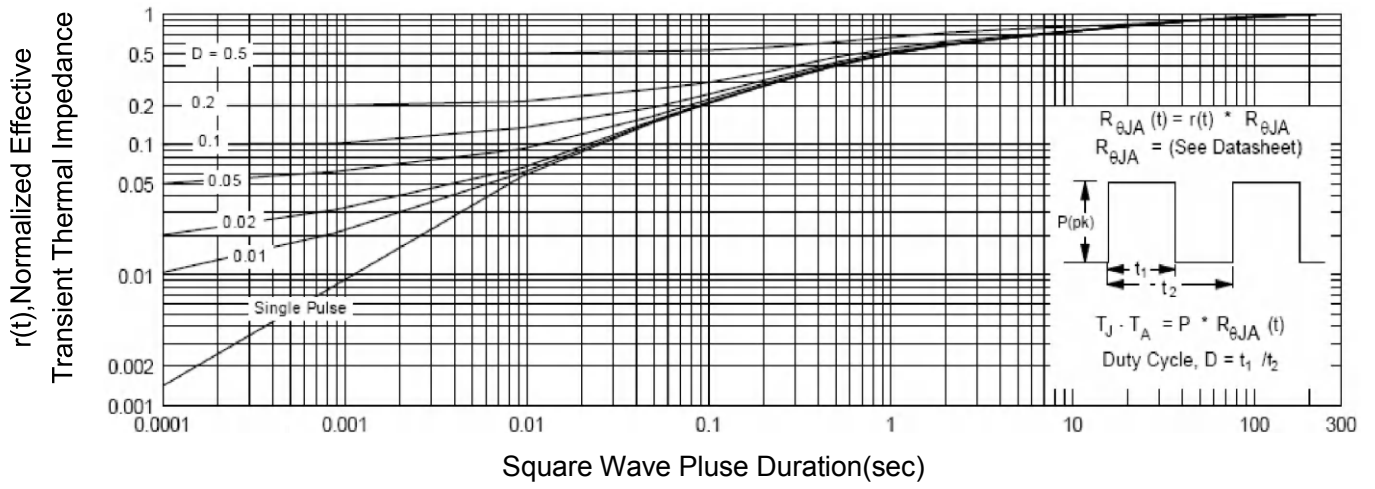
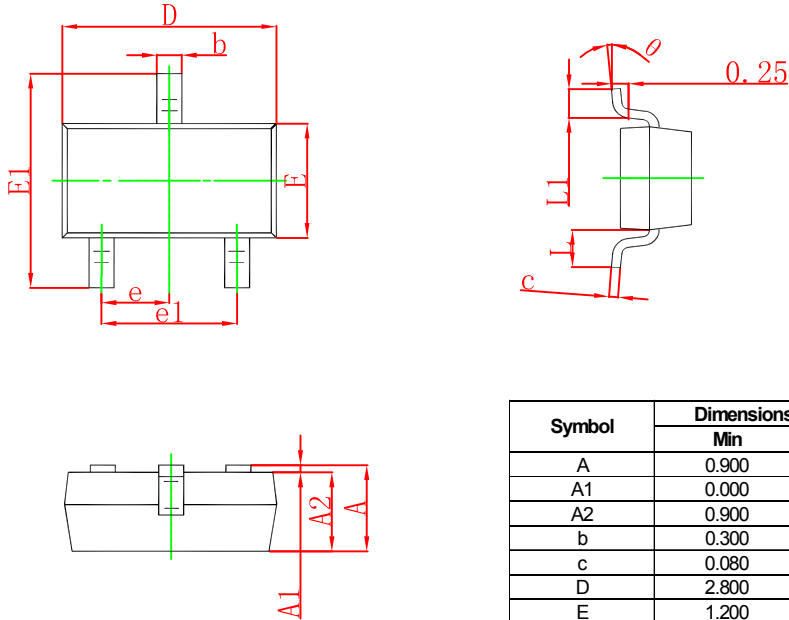


Figure 12 Normalized Maximum Transient Thermal Impedance

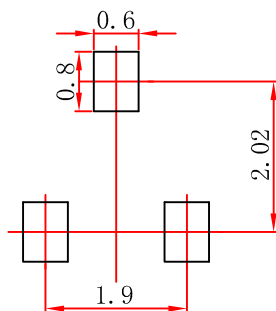


SOT-23 Package Outline Dimensions



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: ± 0.05 mm.
 3. The pad layout is for reference purposes only.



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