

SuperMOS – SOT-23 60V BV_{DSS} 1.5 Ω $R_{DS(on)}$ 0.38A I_D , N-channel MOSFET

1. Description

The 2N7002E-T1-E3-ES is N-Channel enhancement MOS Field Effect Transistor. Uses advanced trench 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 2N7002E-T1-E3-ES is Pb-free.

2. Features

- 60V, $R_{DS(ON)}=1.5\Omega$ (Typ), $V_{GS}=10V$
 $R_{DS(ON)}=2.4\Omega$ (Typ), $V_{GS}=4.5V$
- Use trench MOSFET technology
- High density cell design for low $R_{DS(on)}$
- 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	Material	Packing	Quantity per reel	Flammability Rating	Reel Size
2N7002E-T1-E3-ES	SOT-23	Halogen free	Tape & Reel	3,000 PCS	UL 94V-0	7 inches

Table-1 Ordering information

5. Pin Configuration and Functions

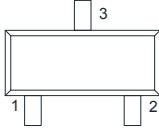
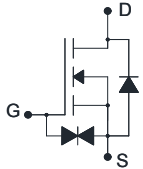
Pin	Function	Outline	Circuit Diagram
1	Gate		
2	Source		
3	Drain		

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}	± 20	V
Continuous Drain Current	$T_A=25^\circ\text{C}$	I_D	0.38	A
	$T_A=100^\circ\text{C}$		0.25	
Maximum Power Dissipation		P_D	350	mW
Pulsed Drain Current ^a		I_{DM}	1.5	A
Operating Junction Temperature		T_J	150	°C
Lead Temperature		T_L	260	°C
Storage Temperature Range		T_{stg}	-55 to 150	°C

Thermal resistance ratings

Single Operation			
Parameter	Symbol	Typical	Unit
Junction-to-Ambient Thermal Resistance	$R_{\theta JA}$	300	°C/W

Note:

a: Repetitive rating, pulse width limited by junction temperature, $t_p=10\mu\text{s}$, Duty Cycle=1%

Electrical Characteristics

At TA = 25°C unless otherwise specified

Parameter	Symbol	Test Conditions	Min.	Typ.	Max.	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0V, I_D=10mA$	60			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=60V, V_{GS}=0V, T_J=25^\circ C$			1.0	uA
		$V_{DS}=48V, V_{GS}=0V, T_J=125^\circ C$			100	
Gate-to-source Leakage Current	I_{GSS}	$V_{DS}=0V, V_{GS}=\pm 20V$			± 10	uA
Forward Trans conductance	g_{fs}	$V_{DS}=10V, I_D=0.1A$		0.24		S
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=250uA$	0.8	1.5	2.5	V
Drain-to-source On-resistance	$R_{DS(on)}$	$V_{GS}=10V, I_D=0.3A$		1.5	3	Ω
		$V_{GS}=4.5V, I_D=0.2A$		2.4	4	
CHARGES, CAPACITANCES AND GATE RESISTANCE						
Input Capacitance	C_{ISS}	$V_{GS}=0V, f=1MHz, V_{DS}=10V$		30.5	45	pF
Output Capacitance	C_{OSS}			5.5	10	
Reverse Transfer Capacitance	C_{RSS}			4.1	8	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS}=10V, V_{DS}=30V, I_D=0.2A$		1.12	2	nC
Gate-to-Source Charge	Q_{GS}			0.1	0.2	
Gate-to-Drain Charge	Q_{GD}			0.23	0.5	
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	$t_{d(ON)}$	$V_{GS}=10V, V_{DS}=30V, I_D=0.2A, R_G=6\Omega$		3	6	ns
Rise Time	t_r			5	10	
Turn-Off Delay Time	$t_{d(OFF)}$			14	27	
Fall Time	t_f			9	17	
BODY DIODE CHARACTERISTICS						
Forward Voltage	V_{SD}	$V_{GS}=0V, I_S=1A$			1	V

7. Typical Characteristic



Fig.1 Output Characteristics



Fig.2 Continuous Drain Current vs. T_c



Fig.3 Normalized R_{DSon} vs. T_J



Fig.4 Normalized V_{th} vs. T_J



Fig.5 Gate Charge Waveform

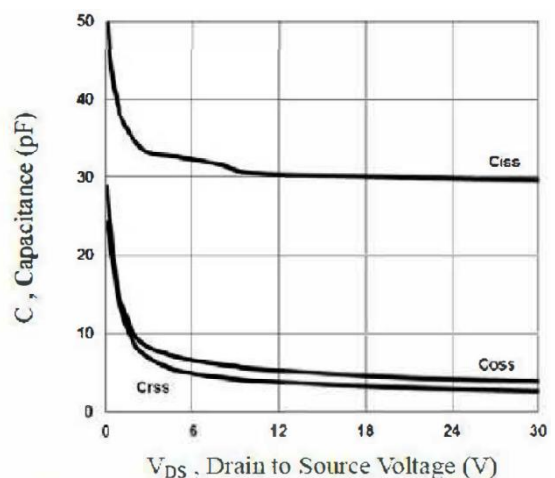


Fig.6 Capacitance Characteristics

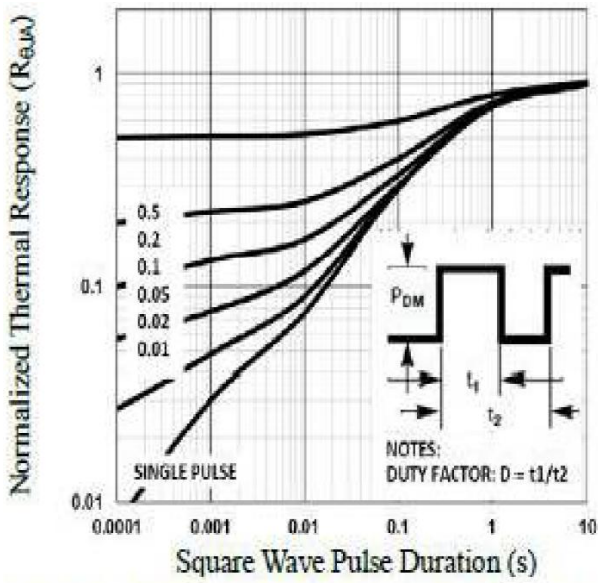


Fig.7 Normalized Transient Impedance



Fig.8 Maximum Safe Operation Area

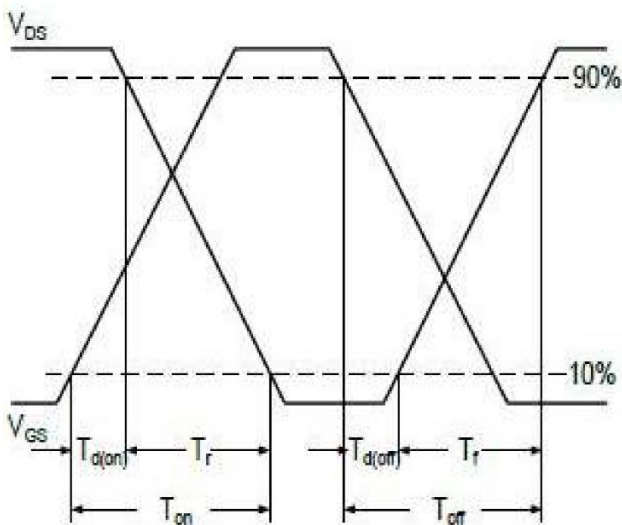


Fig.9 Switching Time Waveform

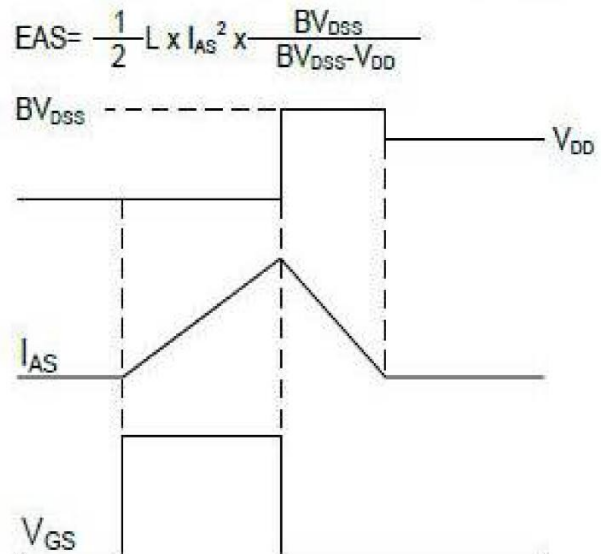
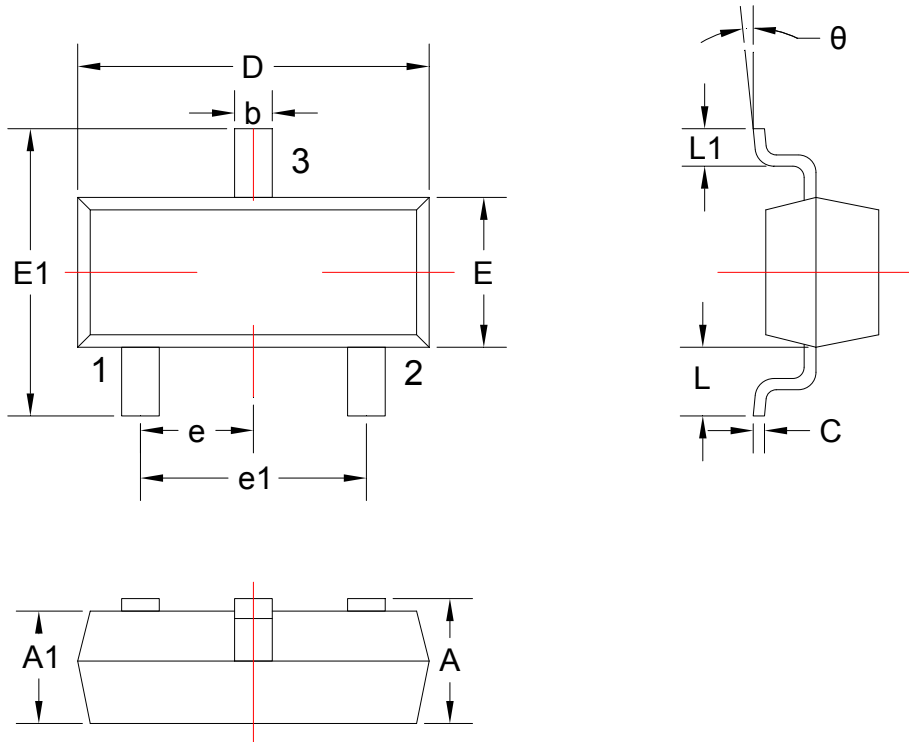


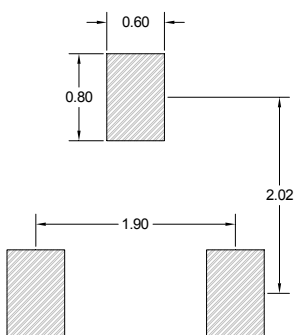
Fig.10 EAS Waveform

8. Dimension and Patterns (SOT-23)



Units: mm

Symbol	Dimensions		Symbol	Dimensions	
	Min.	Max.		Min.	Max.
A	0.900	1.150	E1	2.250	2.550
A1	0.900	1.050	e	0.950TYP	
b	0.300	0.500	e1	1.800	2.000
c	0.080	0.150	L	0.550REF	
D	2.800	3.000	L1	0.300	0.500
E	1.200	1.400	θ	0°	8°



Note:

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

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