

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

1. Description

The 2N7002E-T1-E3-ES 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 2N7002E-T1-E3-ES 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
2N7002E-T1-E3-ES	SOT-23	72K	Halogen free	Tape & Reel	3,000 PCS	UL 94V-0	7 inches

Table-1 Ordering information

5. Pin Configuration and Functions

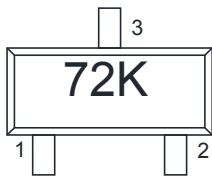
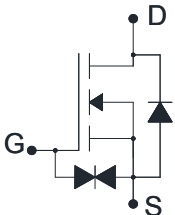
Pin	Function	Outline	Circuit Diagram
1	Gate		
2	Source		
3	Drain		

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}	± 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	$^\circ\text{C/W}$

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 =250uA	60			V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =60V, V _{GS} =0V			1.0	uA
Gate-to-source Leakage Current	I _{GSS}	V _{DS} =0V, V _{GS} =±20V			±10	uA
ON CHARACTERISTICS						
Gate Threshold Voltage	V _{GS(TH)}	V _{GS} =V _{DS} , I _D =250uA	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	Ω
		V _{GS} =4.5V, I _D =0.2A		2.05	3.0	
CHARGES, CAPACITANCES AND GATE RESISTANCE						
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		
SWITCHING CHARACTERISTICS						
Turn-On Delay Time	t _{d(ON)}	V _{GS} =10V, V _{DS} =10V, I _D =0.2A, R _G =10Ω		2		ns
Rise Time	t _r			15		
Turn-Off Delay Time	t _{d(OFF)}			7		
Fall Time	t _f			20		
BODY DIODE CHARACTERISTICS						
Forward Voltage	V _{SD}	V _{GS} =0V, I _S =0.3A			1.5	V

7. Typical Characteristic

Figure 1: Output Characteristics

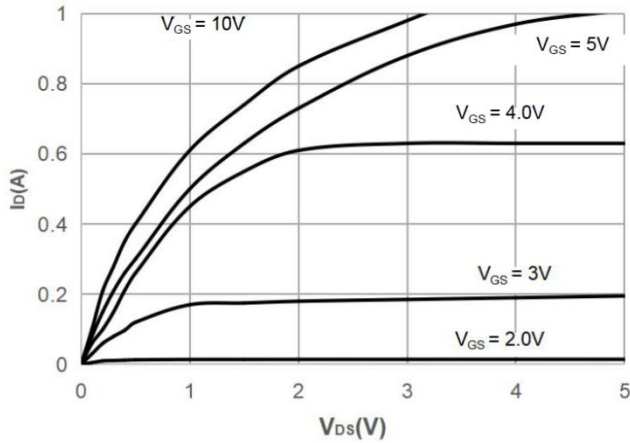


Figure 2: Typical Transfer Characteristics

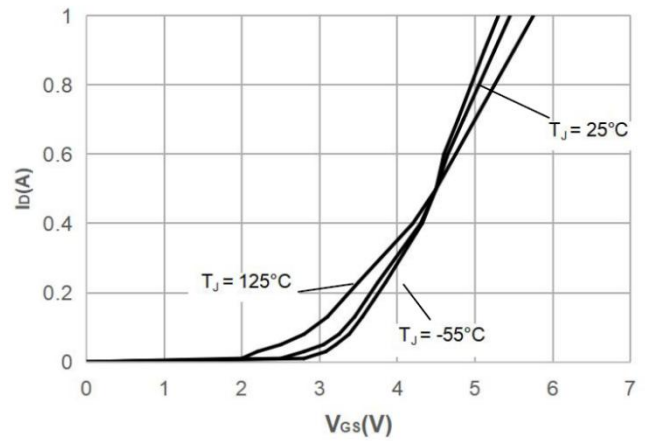


Figure 3: On-resistance vs. Drain Current

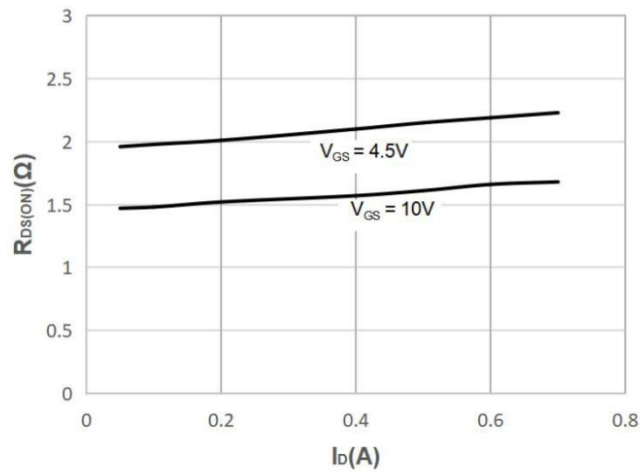


Figure 4: Body Diode Characteristics

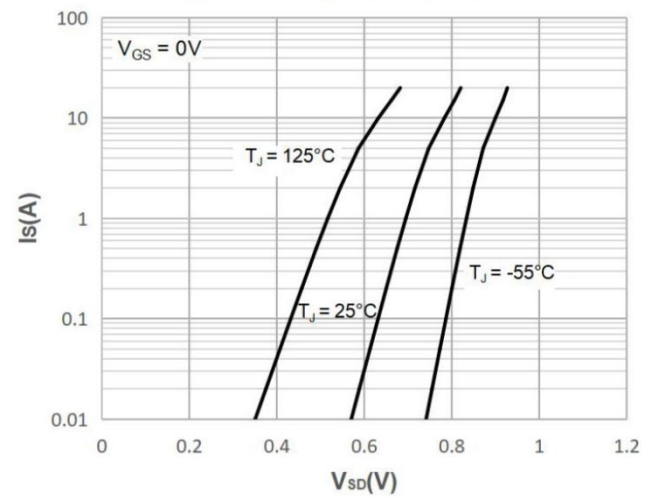


Figure 5: Gate Charge Characteristics

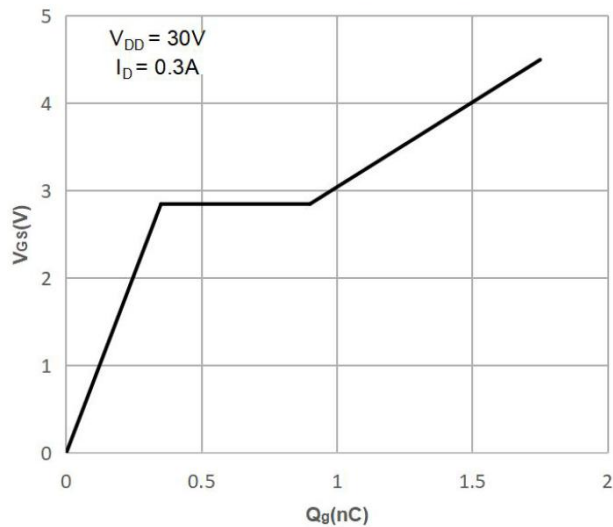


Figure 6: Capacitance Characteristics

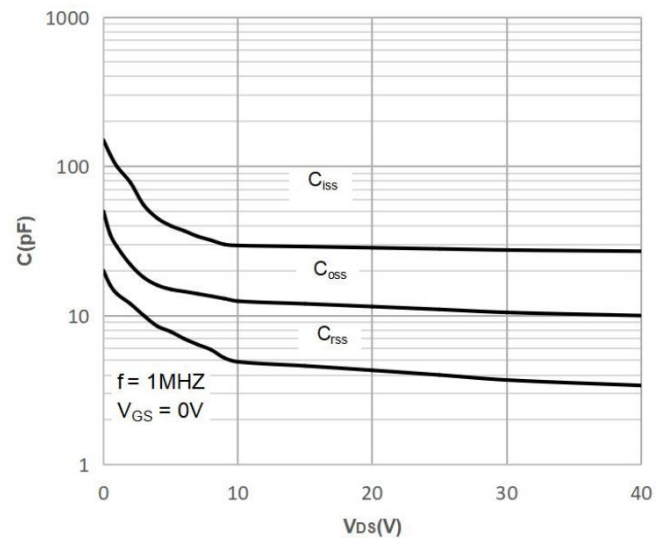


Figure 7: Normalized Breakdown voltage vs. Junction Temperature

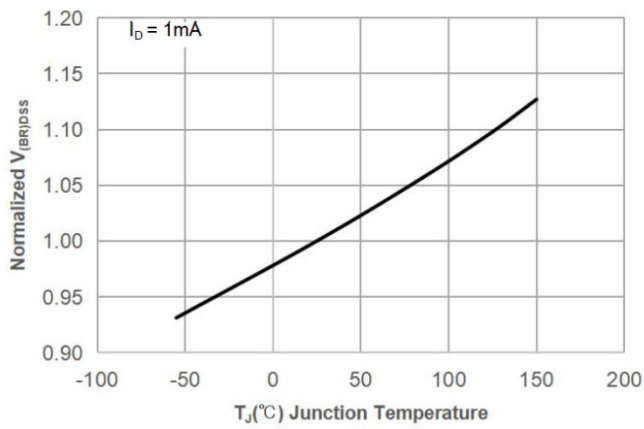


Figure 8: Normalized on Resistance vs. Junction Temperature

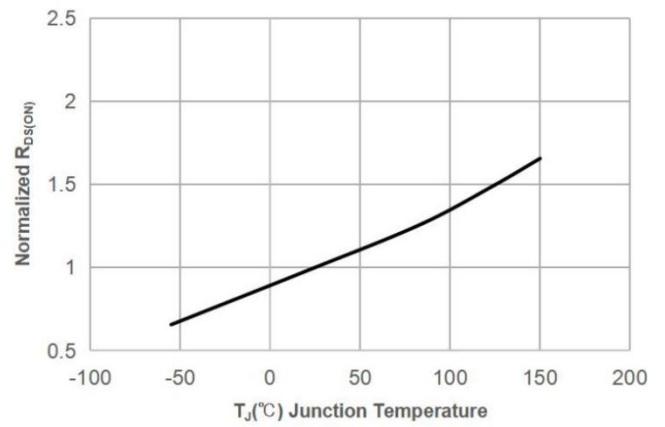


Figure 9: Maximum Safe Operating Area

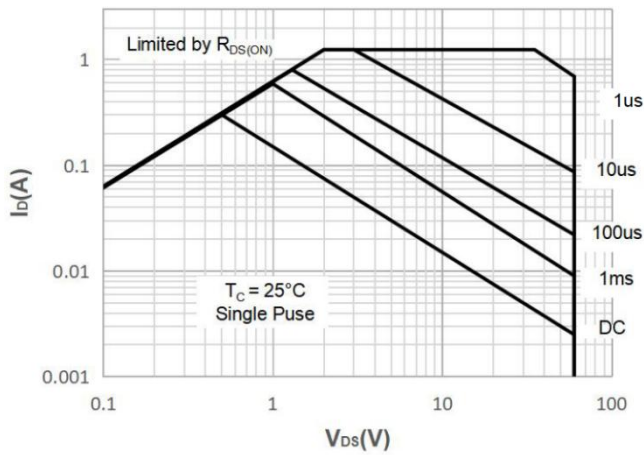


Figure 10: Maximum Continuous Drain Current vs. Case Temperature

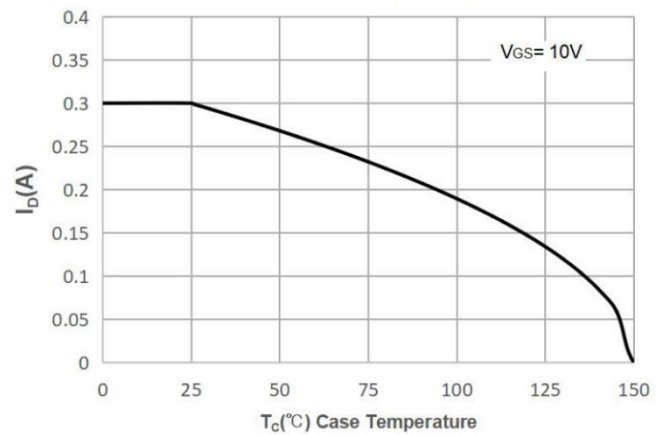


Figure 11: Normalized Maximum Transient Thermal Impedance

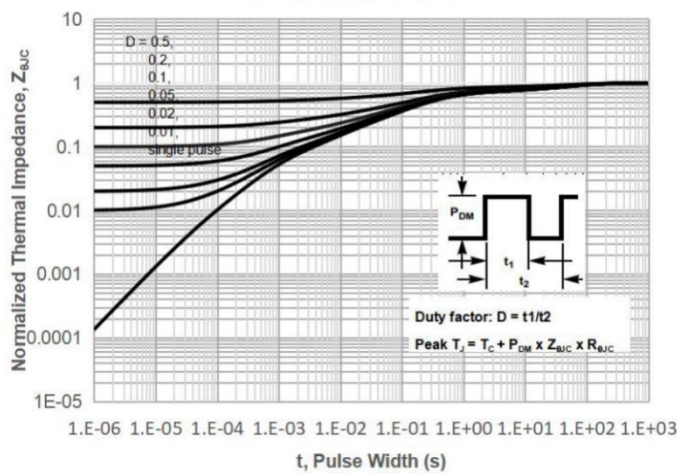
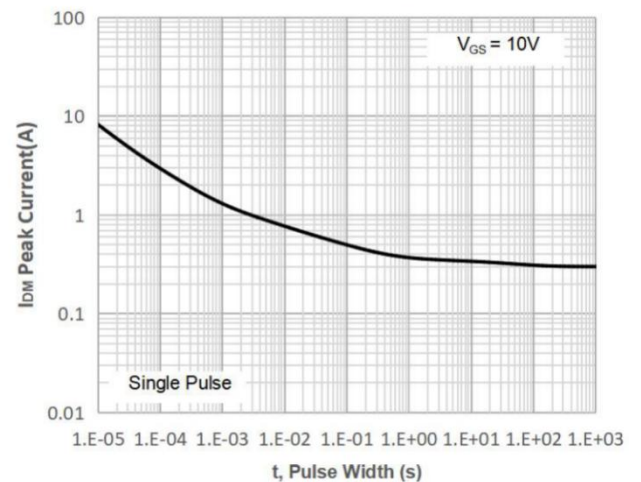
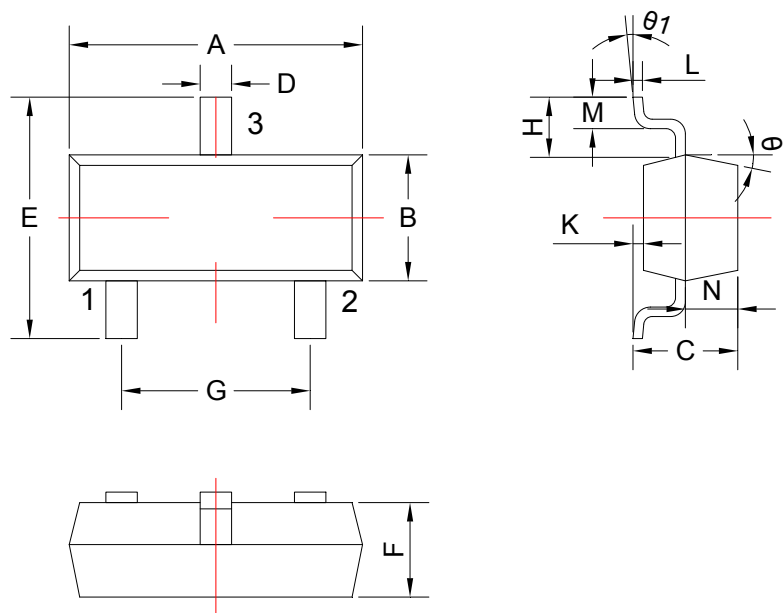


Figure 12: Peak Current Capacity



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	θ_1	0°	8°

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