



CHENMKO ENTERPRISE CO.,LTD

SURFACE MOUNT

N-Channel Enhancement Mode Field Effect Transistor

VOLTAGE 60 Volts CURRENT 0.300 Ampere

2N7002ESPT

Lead free devices

APPLICATION

- * Relay driver
- * High speed line driver
- * Logic level transistor

FEATURE

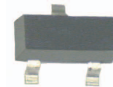
- * Small surface mounting type. (SOT-23)
- * High density cell design for low $R_{DS(ON)}$.
- * Suitable for high packing density.
- * Rugged and reliable.
- * High saturation current capability.
- * ESD protect in input gate 1.5KV

CONSTRUCTION

- * N-Channel Enhancement with ESD protection in input

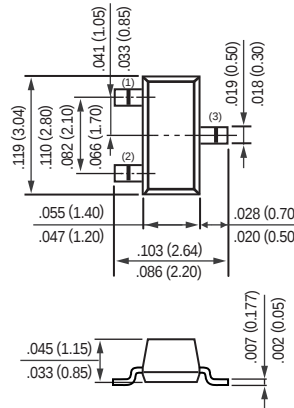
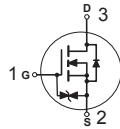
MARKING

- * PK1



SOT-23

CIRCUIT



Dimensions in inches and (millimeters)

SOT-23

Absolute Maximum Ratings $T_A = 25^\circ\text{C}$ unless otherwise noted

Symbol	Parameter	2N7002ESPT	Units
V_{DSS}	Drain-Source Voltage	60	V
V_{DGR}	Drain-Gate Voltage ($R_{GS} \leq 1 \text{ M}\Omega$)	60	V
V_{GSS}	Gate-Source Voltage - Continuous	± 20	V
	- Non Repetitive ($t_p < 50\mu\text{s}$)	± 40	
I_D	Maximum Drain Current - Continuous	300	mA
	- Pulsed	190	
P_D	Maximum Power Dissipation	830	mW
		500	mW
T_J, T_{STG}	Operating and Storage Temperature Range	-65 to 150	$^\circ\text{C}$
T_L	Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	300	$^\circ\text{C}$

Thermal characteristics

$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	350	$^\circ\text{C/W}$
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2003-10

RATING CHARACTERISTIC CURVES (2N7002ESPT)

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

Symbol	Parameter	Conditions	Min	Typ	Max	Units
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OFF CHARACTERISTICS

BV_{DSS}	Drain-Source Breakdown Voltage	$V_{GS} = 0\text{ V}, I_D = 10\text{ }\mu\text{A}$	60	75		V
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1.0	μA
		$T_J = 150^\circ\text{C}$			10	μA
I_{GSSF}	Gate - Body Leakage, Forward	$V_{GS} = 15\text{ V}, V_{DS} = 0\text{ V}$			500	nA
I_{GSSR}	Gate - Body Leakage, Reverse	$V_{GS} = -15\text{ V}, V_{DS} = 0\text{ V}$			-500	nA

ON CHARACTERISTICS (Note 1)

$V_{GS(th)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 1.0\text{ mA}$	1	2.0	2.5	V
$R_{DS(on)}$	Static Drain-Source On-Resistance	$V_{GS} = 10\text{ V}, I_D = 500\text{ mA}$		2.8	5.0	Ω
		$V_{GS} = 4.5\text{ V}, I_D = 75\text{ mA}$		3.8	5.3	
g_{FS}	Forward Transconductance	$V_{DS} = 10\text{ V}_{DS(on)}, I_D = 200\text{ mA}$	100	300		mS

DYNAMIC CHARACTERISTICS

C_{iss}	Input Capacitance	$V_{DS} = 10\text{ V}, V_{GS} = 0\text{ V},$ $f = 1.0\text{ MHz}$		13	40	pF
C_{oss}	Output Capacitance			8	30	
C_{rss}	Reverse Transfer Capacitance			4	10	
t_{on}	Turn-On Time	$V_{DD} = 50\text{ V}, R_L = 250\text{ }\Omega,$ $V_{GS} = 10\text{ V}, R_{GEN} = 50\text{ }\Omega$		3	10	nS
t_{off}	Turn-Off Time	$V_{DD} = 50\text{ V}, R_L = 250\text{ }\Omega,$ $V_{GS} = 10\text{ V}, R_{GEN} = 50\text{ }\Omega$		9	15	nS

DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

I _S	Maximum Continuous Drain-Source Diode Forward Current				300	mA
I _{SM}	Maximum Pulsed Drain-Source Diode Forward Current				1.2	A
V _{SD}	Drain-Source Diode Forward Voltage	V _{GS} = 0 V, I _S = 200 mA (Note 1)		0.85	1.5	V
t _{rr}	Reverse Recovery Time	I _S = 300 mA, dI _S /dt=-100 A/uS		30		nS
Q _r	Recovery Charge	V _{GS} = 0 V, V _{DS} = 25 V		30		nC

Note:

1. Pulse Test: Pulse Width < 300 μs , Duty Cycle < 2.0%.

RATING CHARACTERISTIC CURVES (2N7002ESPT)

Typical Electrical Characteristics

Figure 1. On-Region Characteristics

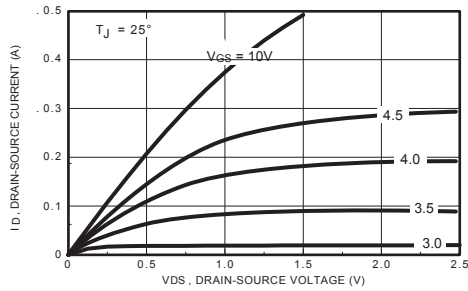


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

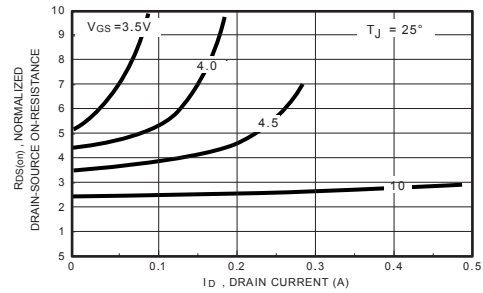


Figure 3. On-Resistance Variation with Temperature

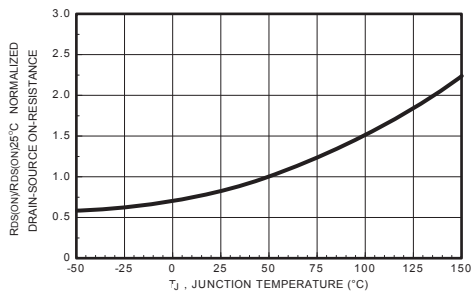


Figure 4. Sub-Threshold Drain Current with Gate - Source Voltage

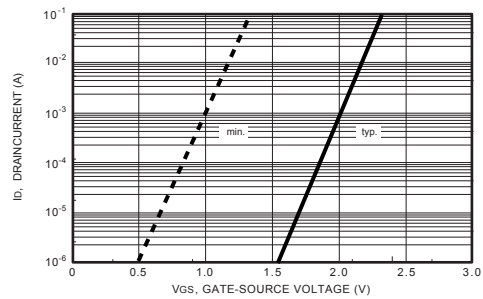


Figure 5. Transfer Characteristics

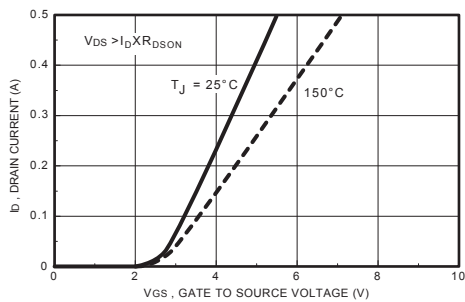
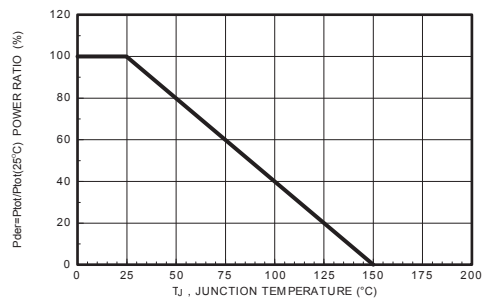


Figure 6. Power Derating Curve



RATING CHARACTERISTIC CURVES (2N7002ESPT)

Typical Electrical Characteristics (continued)

Figure 7. Gate-Source Threshold Voltage with Temperature

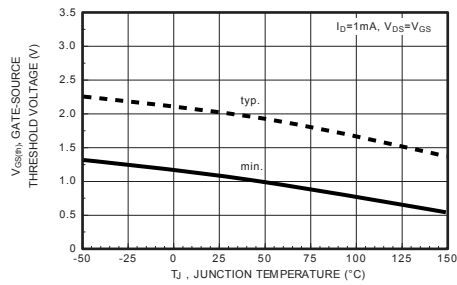


Figure 8. Body Diode Forward Voltage Variation with Drain Current

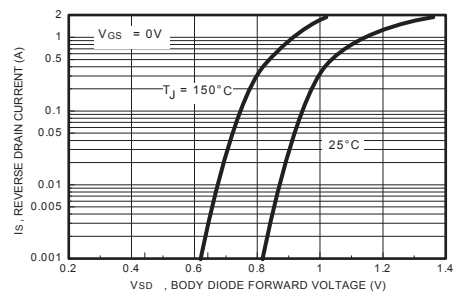


Figure 9. Capacitance Characteristics

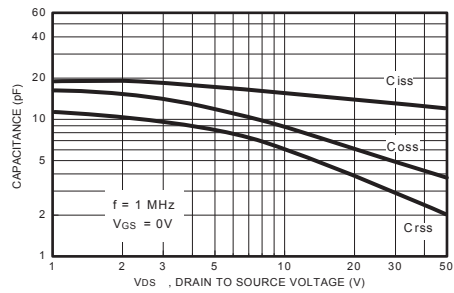


Figure 10. Forward Transconductance

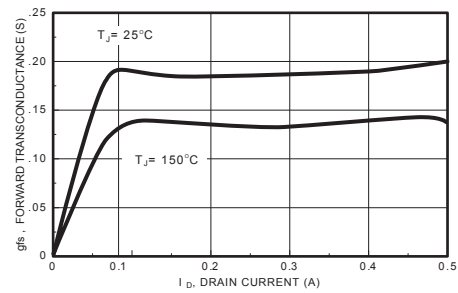


Figure 11.

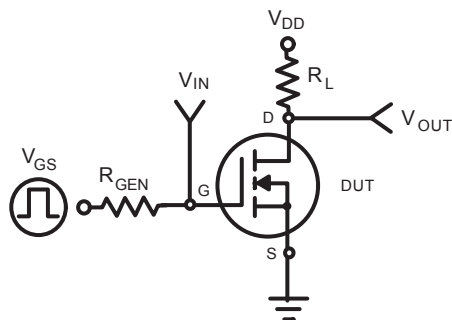
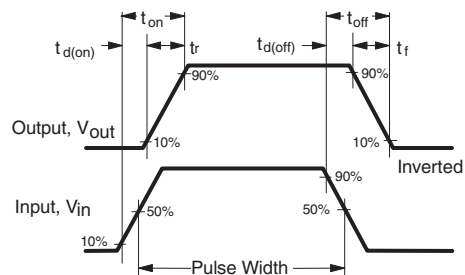


Figure 12. Switching Waveforms



RATING CHARACTERISTIC CURVES (2N7002ESPT)

Typical Electrical Characteristics (continued)

Figure 13. Maximum Safe Operating Area

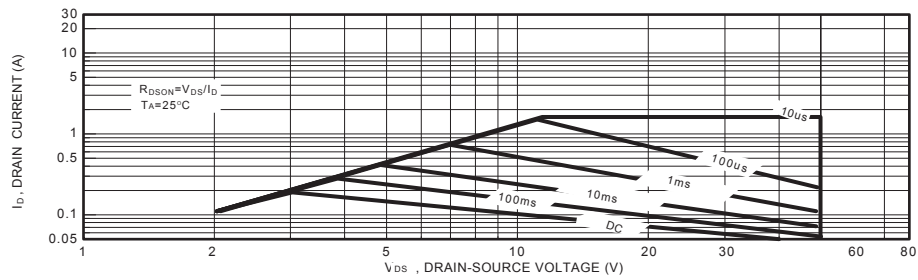


Figure 14. Transient Thermal Response Curve

