

**N-Channel Enhancement Mode Field Effect Transistor**

**- 0.25Amp 60Volt**

**Application**

- Servomotor control
- Power MOSFET gate drivers
- Other switching applications

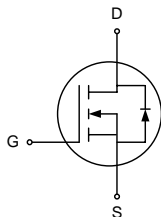
**Feature**

- Small surface mounting type
- High density cell design for low RDS(ON)
- Suitable for high packing density
- Rugged and reliable
- High saturation current capability
- Voltage controlled small signal switch

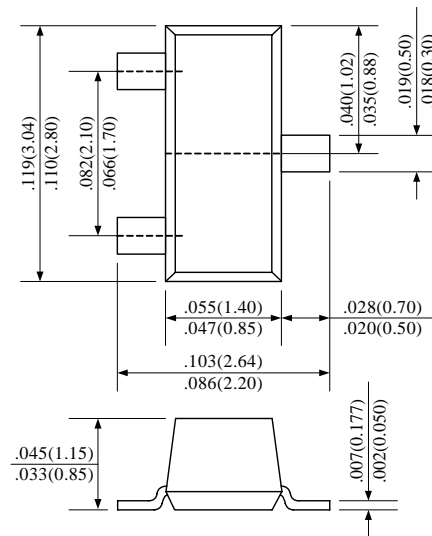
**Construction**

- N-Channel Enhancement

**Circuit**



**SOT-23**



**Absolute Maximum Ratings**

PARAMETER	SYMBOL	2N7002PT	UNIT
Drain-Source Voltage	V <sub>DSS</sub>	60	V
Drain-Gate Voltage (R <sub>GS</sub> ≤ 1MΩ)	V <sub>DGR</sub>	60	V
Gate-Source Voltage - Continuous	V <sub>GSS</sub>	± 20	V
- Non Repetitive (tp < 50μs)		± 40	
Maximum Drain Current - Continuous	I <sub>D</sub>	250	mA
- Pulsed		190	
Maximum Power Dissipation	P <sub>D</sub>	350	mW
		220	
Operating and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-55 to +150	mW
Maximum Lead Temperature for Soldering Purposes, 1/16" from Case for 10 Seconds	T <sub>L</sub>	300	°C
Thermal Resistance, Junction-to-Ambient	RθJA	357	°C/W

## □ Electrical Characteristics

PARAMETER	SYMBOL	CONDITIONS	MIN.	TYP.	MAX.	UNIT
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### OFF CHARACTERISTICS

Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> = 10μA	60	70		V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> = 60V, V <sub>GS</sub> = 0V			1	μA
Gate-Body Leakage, Forward	I <sub>GSSF</sub>	V <sub>GS</sub> = 15V, V <sub>DS</sub> = 0V			10	nA
Gate-Body Leakage, Reverse	I <sub>GSSR</sub>	V <sub>GS</sub> = -15V, V <sub>DS</sub> = 0V			-10	nA

### ON CHARACTERISTICS (Note 1)

Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250μA	1.0	2.0	2.5	V
Static Drain-Source On-Resistance	R <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 250mA		1.7	3.0	Ω
		V <sub>GS</sub> = 4V, I <sub>D</sub> = 100mA		2.5	4.0	
Drain-Source On-Voltage	V <sub>DS(ON)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> = 500mA		0.6	3.75	V
		V <sub>GS</sub> = 5V, I <sub>D</sub> = 50mA		0.09	1.5	
On-State Drain Current	I <sub>D(ON)</sub>	V <sub>GS</sub> = 10V, V <sub>DS</sub> = 7.5V <sub>DS(ON)</sub>	800	1800		mA
		V <sub>GS</sub> = 4.5V, V <sub>DS</sub> = 10V <sub>DS(ON)</sub>	500	700		
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> = 15V <sub>DS(ON)</sub> , I <sub>D</sub> = 200mA		250		mS

### DYNAMIC CHARACTERISTICS

Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> = 30V, V <sub>GS</sub> = 10V, I <sub>D</sub> = 200mA		0.6	1.0	nC
Gate-Source Charge	Q <sub>gs</sub>			0.06	25	
Gate-Drain Charge	Q <sub>gd</sub>			0.06	5	
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 25V, V <sub>GS</sub> = 0V, f = 1.0MHz		25	50	pF
Output Capacitance	C <sub>oss</sub>			6	25	
Reverse Transfer Capacitance	C <sub>rss</sub>			1.2	5	
Turn-On Time	t <sub>on</sub>	V <sub>DD</sub> = 30V, R <sub>L</sub> = 200Ω, I <sub>D</sub> = 100mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 10Ω		7.5	20	nS
	t <sub>r</sub>			6		
Turn-Off Times	t <sub>off</sub>	V <sub>DD</sub> = 30V, R <sub>L</sub> = 200Ω, I <sub>D</sub> = 100mA, V <sub>GS</sub> = 10V, R <sub>GEN</sub> = 10Ω		7.5	20	nS
	t <sub>f</sub>			3		

### DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS

Maximum Continuous Drain-Source Diode Forward Current	I <sub>S</sub>				115	mA
Maximum Pulsed Drain-Source Diode Forward Current	I <sub>SM</sub>				0.8	A
Drain-Source Diode Forward Voltage	V <sub>SD</sub>	V <sub>GS</sub> = 0V, I <sub>S</sub> = 200mA		0.85	1.2	V

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

# RATING CHARACTERISTIC CURVES ( 2N7002PT )

## Typical Electrical Characteristics

Figure 1. On-Region Characteristics

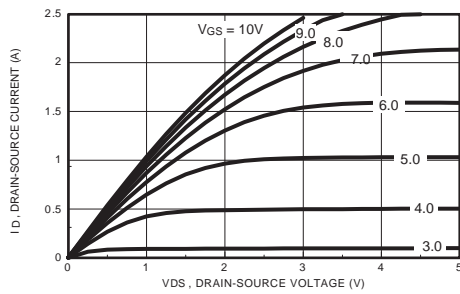


Figure 2. On-Resistance Variation with Gate Voltage and Drain Current

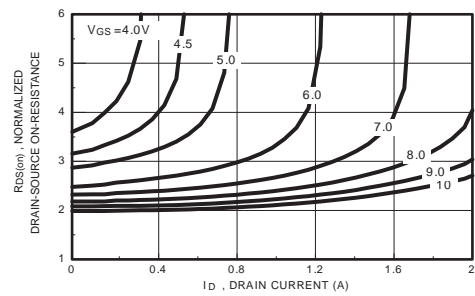


Figure 3. On-Resistance Variation with Temperature

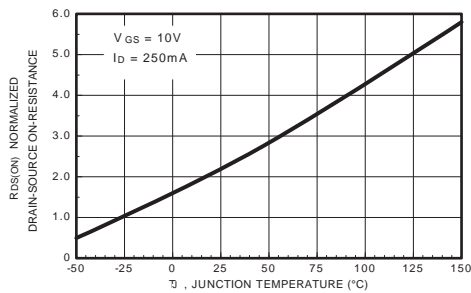


Figure 4. On-Resistance Variation with Drain Current and Temperature

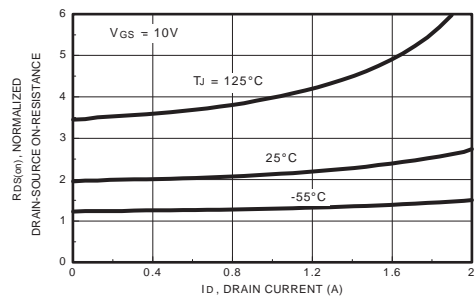


Figure 5. Transfer Characteristics

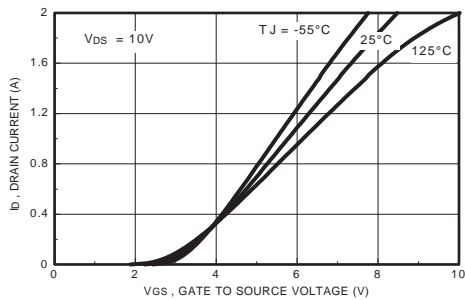
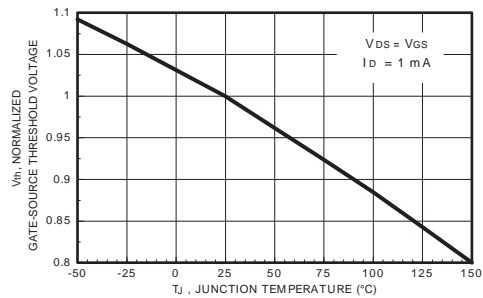


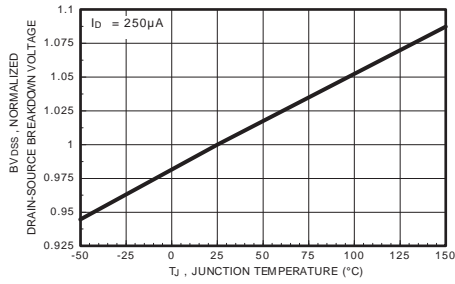
Figure 6. Gate Threshold Variation with Temperature



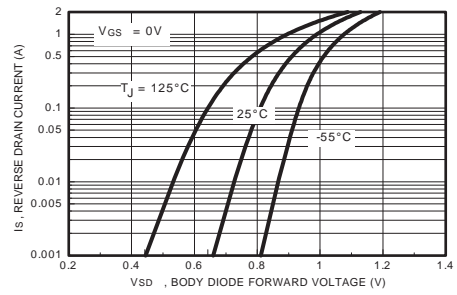
# RATING CHARACTERISTIC CURVES ( 2N7002PT )

## Typical Electrical Characteristics (continued)

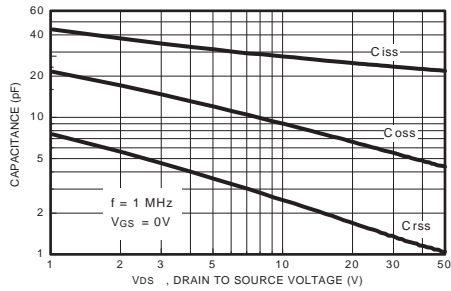
**Figure 7. Breakdown Voltage Variation with Temperature**



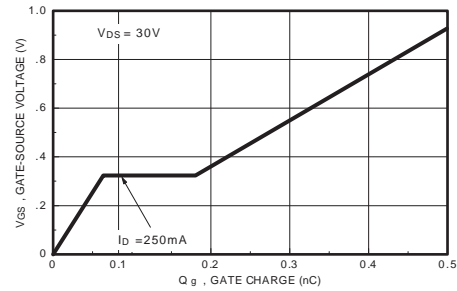
**Figure 8. Body Diode Forward Voltage Variation with Drain Current**



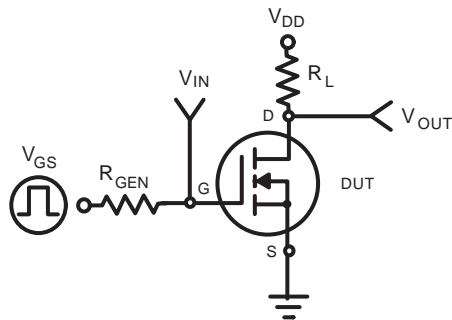
**Figure 9. Capacitance Characteristics**



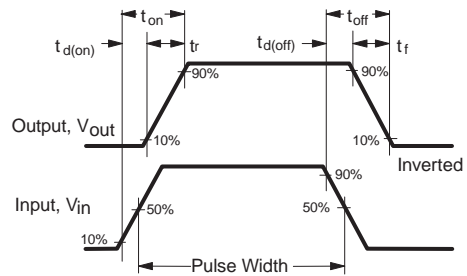
**Figure 10. Gate Charge Characteristics**



**Figure 11.**



**Figure 12. Switching Waveforms**



## RATING CHARACTERISTIC CURVES ( 2N7002PT )

### Typical Electrical Characteristics (continued)

Figure 13. 2N7002PT Maximum Safe Operating Area

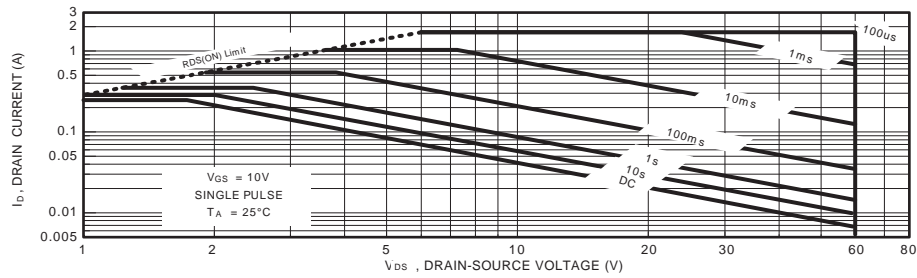


Figure 14. 2N7002PT Transient Thermal Response Curve

