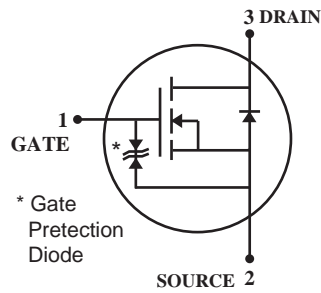


## N-Channel Enhancement Mode Power MOSFET

**(Pb)** Lead(Pb)-Free



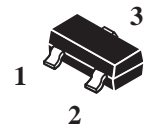
**DRAIN CURRENT**  
**640m AMPERES**  
**DRAIN SOURCE VOLTAGE**  
**60 VOLTAGE**

### Description:

The 2N7002K utilized advanced processing techniques to achieve the lowest possible on-resistance, extremely efficient and cost-effectiveness device. The 2N7002K is universally used for all commercial-industrial applications.

### Features:

- \*Simple Drive Requirement
- \*Small Package Outline



**SOT-23**

### Maximum Ratings ( $T_A=25^\circ\text{C}$ Unless Otherwise Specified)

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DS}$	60	V
Gate-Source Voltage	$V_{GS}$	$\pm 20$	
Continuous Drain Current <sup>3</sup> , $V_{GS}$ @10V ( $T_A=25^\circ\text{C}$ ) $V_{GS}$ @10V ( $T_A=70^\circ\text{C}$ )	$I_D$	640	mA
		500	
Pulsed Drain Current <sup>1,2</sup>	$I_{DM}$	950	
Total Power Dissipation ( $T_A=25^\circ\text{C}$ )	$P_D$	1.38	W
Maximum Junction-ambient <sup>3</sup>	$R_{\theta JA}$	90	$^\circ\text{C/W}$
Operating Junction Temperature Range	$T_J$	+150	$^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-55~+150	$^\circ\text{C}$
Gate-Source ESD Rating (HBM, Method 3015)	ESD	2500	V

### Device Marking

2N7002K = RK

**Electrical Characteristics** ( $T_A = 25^\circ\text{C}$  Unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
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**Static**

Drain-Source Breakdown Voltage $V_{GS}=0, I_D=250\mu\text{A}$	$V_{(BR)DSS}$	60	-	-	V
Gate-Source Threshold Voltage $V_{DS}=V_{GS}, I_D=250\mu\text{A}$	$V_{GS(Th)}$	1.0	-	3.0	
Gate-Source Leakage Current $V_{GS} = \pm 20\text{V}$	$I_{GSS}$	-	-	$\pm 10$	$\mu\text{A}$
Drain-Source Leakage Current( $T_j=25^\circ\text{C}$ ) $V_{DS}=60\text{V}, V_{GS}=0$	$I_{DSS}$	-	-	1	$\mu\text{A}$
Drain-Source Leakage Current( $T_j=70^\circ\text{C}$ ) $V_{DS}=48\text{V}, V_{GS}=0$		-	-	100	
Drain-Source On-Resistance $V_{GS}=10\text{V}, I_D=500\text{mA}$ $V_{GS}=4.5\text{V}, I_D=200\text{mA}$	$R_{DS(on)}$	-	-	2 4	$\Omega$
Forward Transconductance $V_{DS}=10\text{V}, I_D=600\text{mA}$	$g_{fs}$	-	600	-	mS

**Dynamic**

Input Capacitance $V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1.0\text{MHz}$	$C_{iss}$	-	32	50	pF
Output Capacitance $V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1.0\text{MHz}$	$C_{oss}$	-	8	-	
Reverse Transfer Capacitance $V_{GS}=0\text{V}, V_{DS}=25\text{V}, f=1.0\text{MHz}$	$C_{rss}$	-	6	-	

## Switching

Turn-on Delay Time <sup>2</sup> $V_{DS}=30V, V_{GS}=10V, I_D=600mA, R_D=52\Omega, R_G=3.3\Omega$	$t_{d(on)}$	-	12	-	ns
Rise Time $V_{DS}=30V, V_{GS}=10V, I_D=600mA, R_D=52\Omega, R_G=3.3\Omega$	$t_r$	-	10	-	
Turn-off Delay Time $V_{DS}=30V, V_{GS}=10V, I_D=600mA, R_D=52\Omega, R_G=3.3\Omega$	$t_{d(off)}$	-	59	-	
Fall Time $V_{DS}=30V, V_{GS}=10V, I_D=600mA, R_D=52\Omega, R_G=3.3\Omega$	$t_f$	-	29	-	
Total Gate Charge <sup>2</sup> $V_{DS}=50V, V_{GS}=4.5V, I_D=600mA$	$Q_g$	-	1	1.6	nC
Gate-Source Charge $V_{DS}=50V, V_{GS}=4.5V, I_D=600mA$	$Q_{gs}$	-	0.5	-	
Gate-Drain Charge $V_{DS}=50V, V_{GS}=4.5V, I_D=600mA$	$Q_{gd}$	-	0.5	-	

## Source-Drain Diode Characteristics

Forward On Voltage <sup>2</sup> $V_{GS}=0V, I_S=200mA$	$V_{SD}$	-	-	1.2	v
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- Note: 1. Pulse width limited by Max, junction temperature.  
 2. pulse width  $\leq 300\mu s$ , duty cycle  $\leq 2\%$ .  
 3. Surface mounted on 1 in<sup>2</sup> copper pad of FR4 board; 270°C/W when mounted on min, copper pad.

### Characteristics Curve

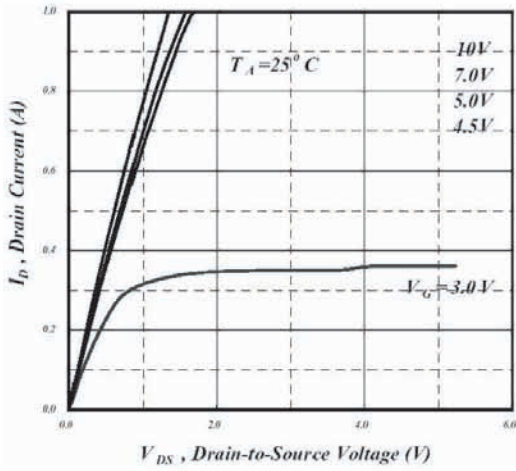


Fig 1. Typical Output Characteristics

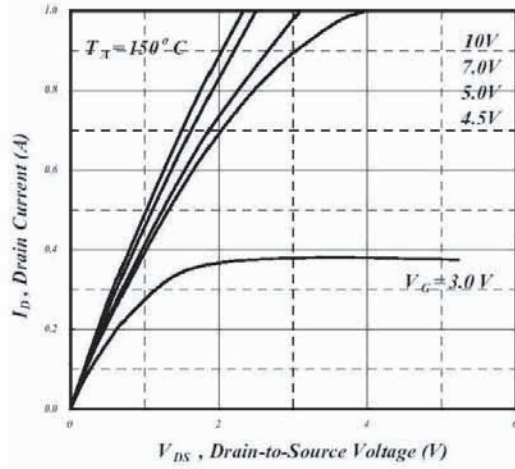


Fig 2. Typical Output Characteristics

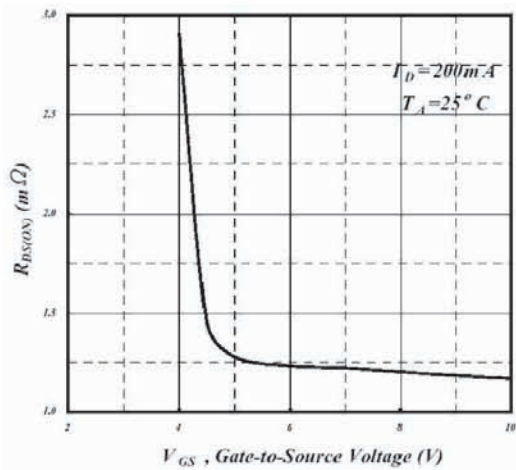


Fig 3. On-Resistance v.s. Gate Voltage

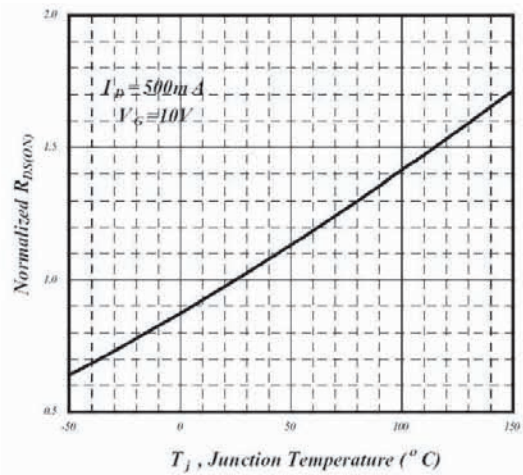


Fig 4. Normalized On-Resistance v.s. Junction Temperature

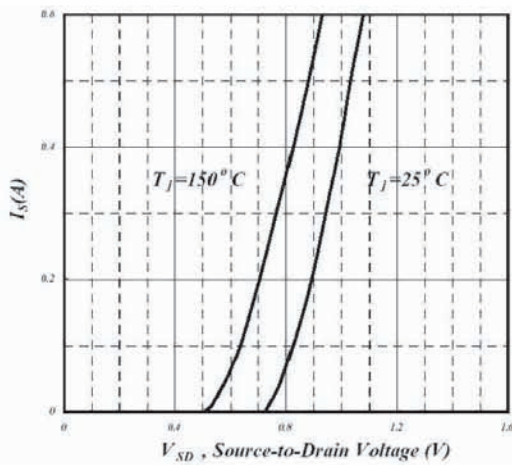


Fig 5. Forward Characteristics of Reverse Diode

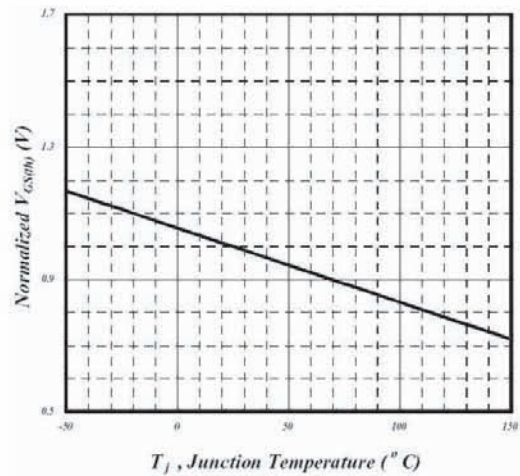
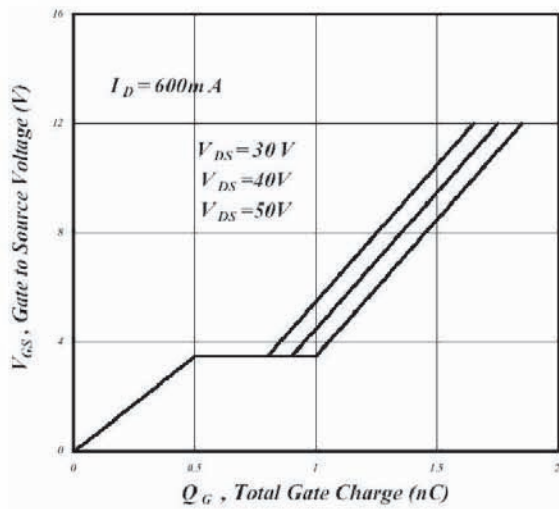
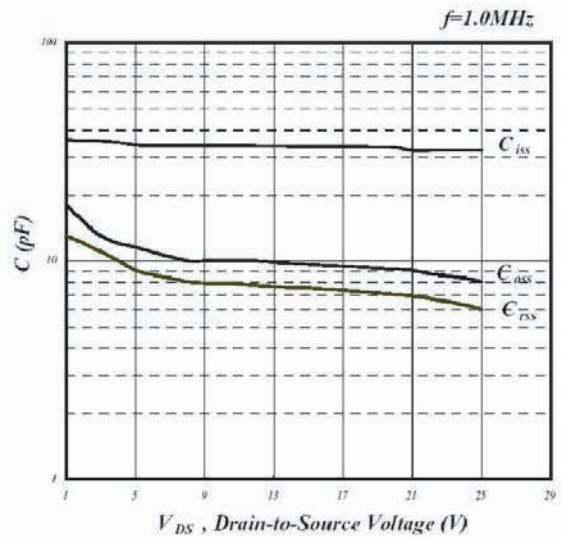


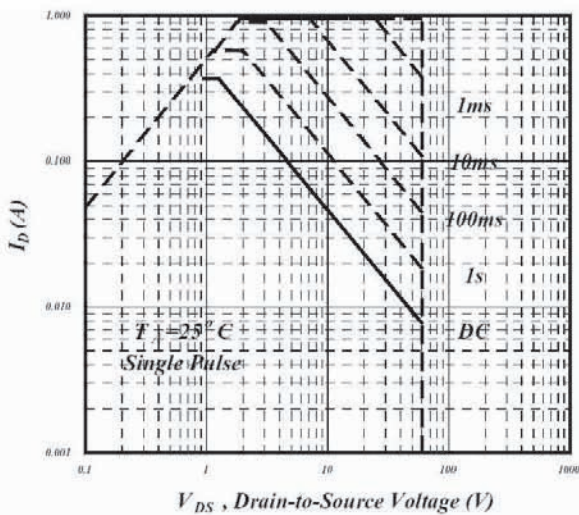
Fig 6. Gate Threshold Voltage v.s. Junction Temperature



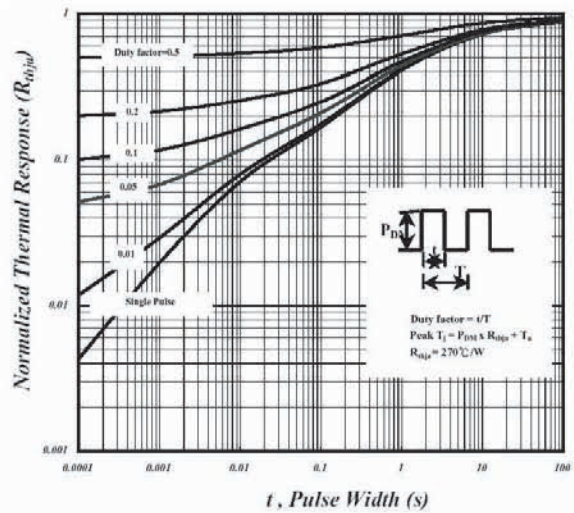
**Fig 7. Gate Charge Characteristics**



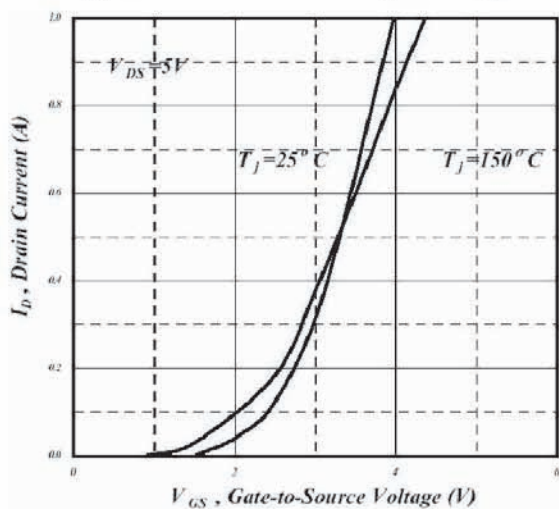
**Fig 8. Typical Capacitance Characteristics**



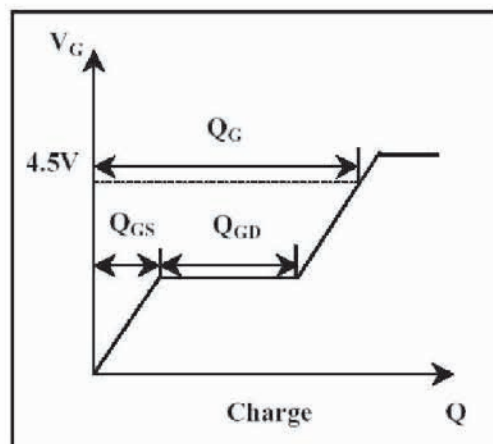
**Fig 9. Maximum Safe Operating Area**



**Fig 10. Effective Transient Thermal Impedance**

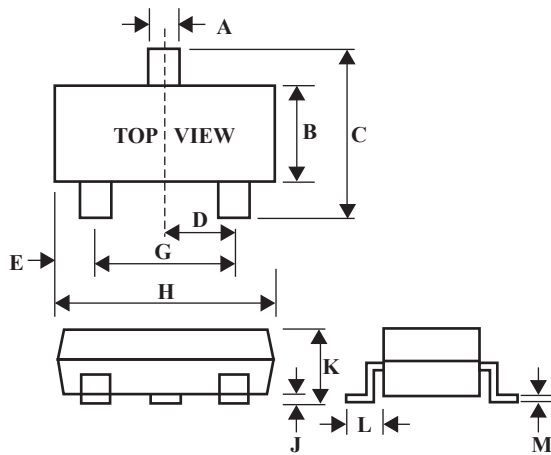


**Fig 11. Transfer Characteristics**



**Fig 12. Gate Charge Waveform**

### SOT-23 Outline Dimension



SOT-23		
Dim	Min	Max
A	0.35	0.51
B	1.19	1.40
C	2.10	3.00
D	0.85	1.05
E	0.46	1.00
G	1.70	2.10
H	2.70	3.10
J	0.01	0.13
K	0.89	1.10
L	0.30	0.61
M	0.076	0.25