

N-Channel Enhancement Mode Power MOSFET

General Features

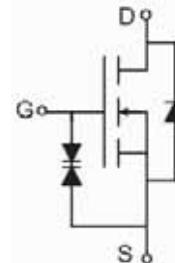
- $V_{DS} = 60V, I_D = 0.3A$
- $R_{DS(ON)} < 3\Omega @ V_{GS}=5V$
- $R_{DS(ON)} < 2\Omega @ V_{GS}=10V$

ESD Rating: HBM 2300V

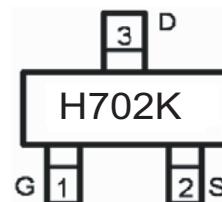
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

Application

- Direct logic-level interface: TTL/CMOS
- Drivers: relays, solenoids, lamps, hammers, display, memories, transistors, etc.
- Battery operated systems
- Solid-state relays
- P/N suffix V means AEC-Q101 qualified, e.g.:2N7002KV
- Halogen-free



Schematic diagram



Marking and pin assignment



SOT-23 top view

Package Marking And Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
H702K	2N7002K	SOT-23	Ø180mm	8 mm	3000 units

Absolute Maximum Ratings ($T_A=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ($T_J = 150^\circ C$)	I_D	0.3	A
		0.19	
Drain Current-Pulsed ^(Note 1)	I_{DM}	0.8	A
Maximum Power Dissipation	P_D	0.35	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	°C

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient ^(Note 2)	$R_{\theta JA}$	350	°C/W
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Electrical Characteristics ($T_A=25^\circ\text{C}$ unless otherwise noted)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics						
Drain-Source Breakdown Voltage	BV_{DSS}	$V_{\text{GS}}=0\text{V}, I_{\text{D}}=250\mu\text{A}$	60	68	-	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{\text{DS}}=60\text{V}, V_{\text{GS}}=0\text{V}$	-	-	1	μA
Gate-Body Leakage Current	I_{GSS}	$V_{\text{GS}}=\pm 10\text{V}, V_{\text{DS}}=0\text{V}$	-	± 100	± 500	nA
		$V_{\text{GS}}=\pm 20\text{V}, V_{\text{DS}}=0\text{V}$	-	± 4	± 10	μA
On Characteristics ^(Note 3)						
Gate Threshold Voltage	$V_{\text{GS}(\text{th})}$	$V_{\text{DS}}=V_{\text{GS}}, I_{\text{D}}=250\mu\text{A}$	1	1.7	1.9	V
Drain-Source On-State Resistance	$R_{\text{DS}(\text{ON})}$	$V_{\text{GS}}=5\text{V}, I_{\text{D}}=0.4\text{A}$	-	1.3	3	Ω
		$V_{\text{GS}}=10\text{V}, I_{\text{D}}=0.5\text{A}$	-	1	2	Ω
Forward Transconductance	g_{FS}	$V_{\text{DS}}=10\text{V}, I_{\text{D}}=0.2\text{A}$	0.1	-	-	S
Dynamic Characteristics ^(Note 4)						
Input Capacitance	C_{iss}	$V_{\text{DS}}=25\text{V}, V_{\text{GS}}=0\text{V}, F=1.0\text{MHz}$	-	21	50	PF
Output Capacitance	C_{oss}		-	11	25	PF
Reverse Transfer Capacitance	C_{rss}		-	4.2	5	PF
Switching Characteristics ^(Note 4)						
Turn-on Delay Time	$t_{\text{d}(\text{on})}$	$V_{\text{DD}}=30\text{V}, I_{\text{D}}=0.2\text{A}$ $V_{\text{GS}}=10\text{V}, R_{\text{GEN}}=10\Omega$	-	10	-	nS
Turn-on Rise Time	t_r		-	50	-	nS
Turn-Off Delay Time	$t_{\text{d}(\text{off})}$		-	17	-	nS
Turn-Off Fall Time	t_f		-	10	-	nS
Total Gate Charge	Q_g	$V_{\text{DS}}=10\text{V}, I_{\text{D}}=0.3\text{A}, V_{\text{GS}}=4.5\text{V}$	-	1.7	3	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage ^(Note 3)	V_{SD}	$V_{\text{GS}}=0\text{V}, I_{\text{s}}=0.2\text{A}$	-	-	1.3	V
Diode Forward Current ^(Note 2)	I_{s}		-	-	0.2	A

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, $t \leq 10$ sec.
3. Pulse Test: Pulse Width $\leq 300\mu\text{s}$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

RATING AND CHARACTERISTICS CURVES (2N7002K)

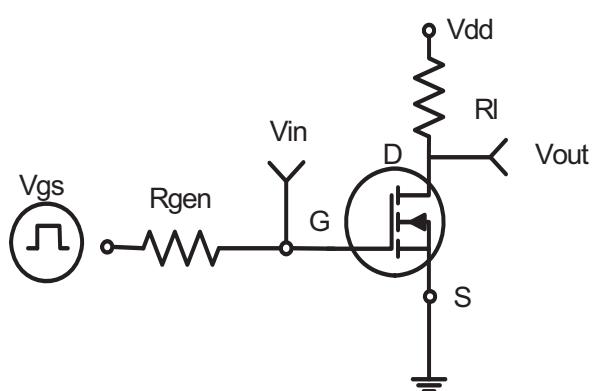


Figure 1:Switching Test Circuit

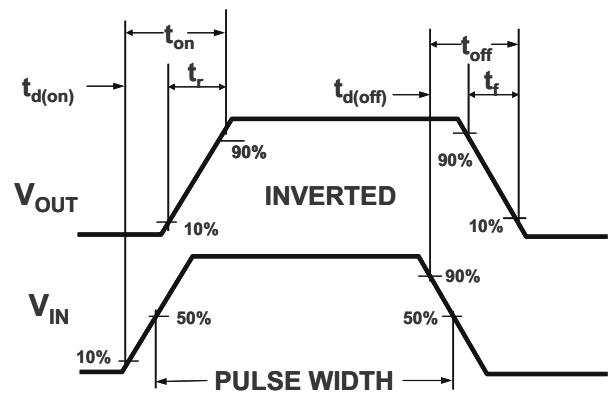


Figure 2:Switching Waveforms

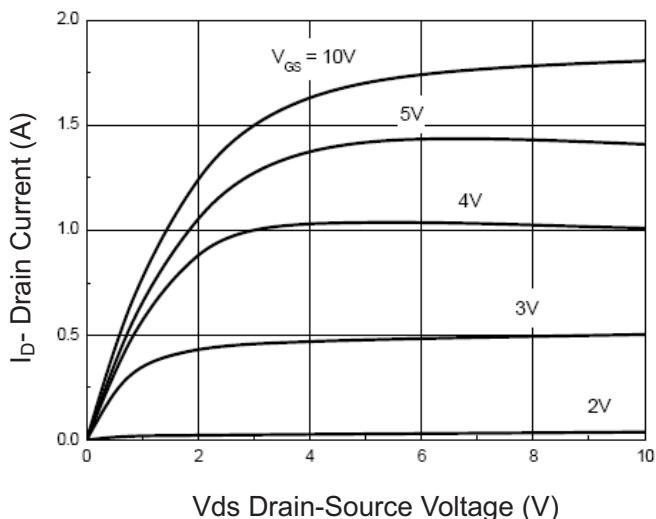


Figure 3 Output Characteristics

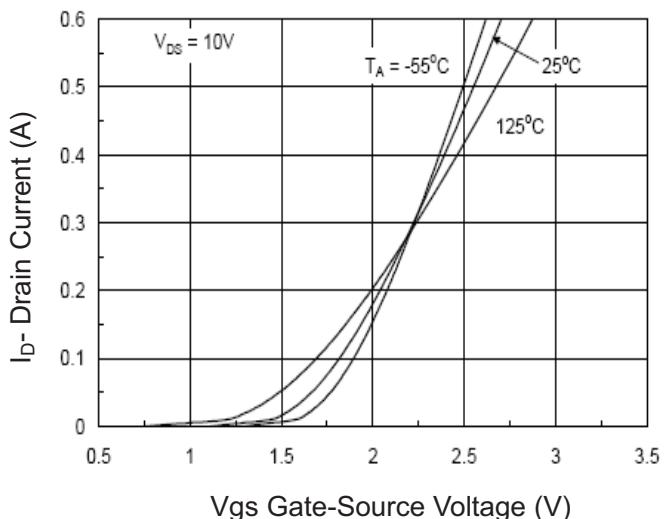


Figure 4 Transfer Characteristics

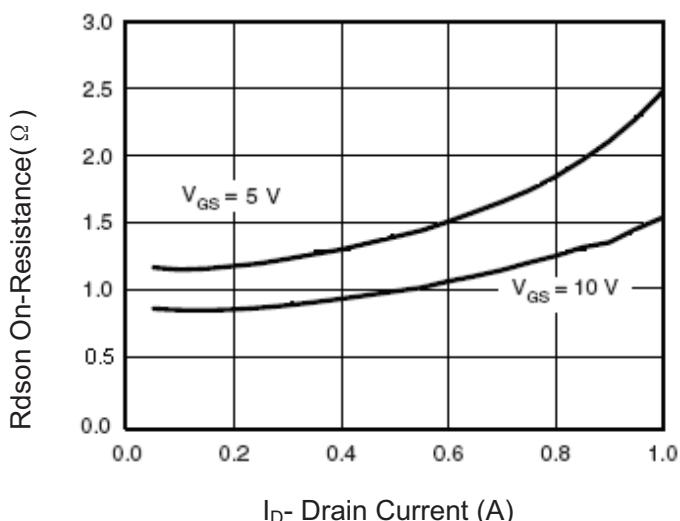


Figure 5 Drain-Source On-Resistance

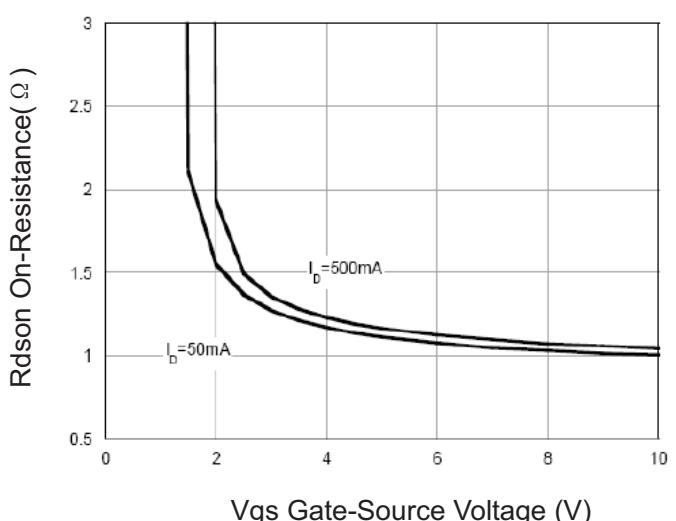


Figure 6 Rdson vs Vgs

RATING AND CHARACTERISTICS CURVES (2N7002K)

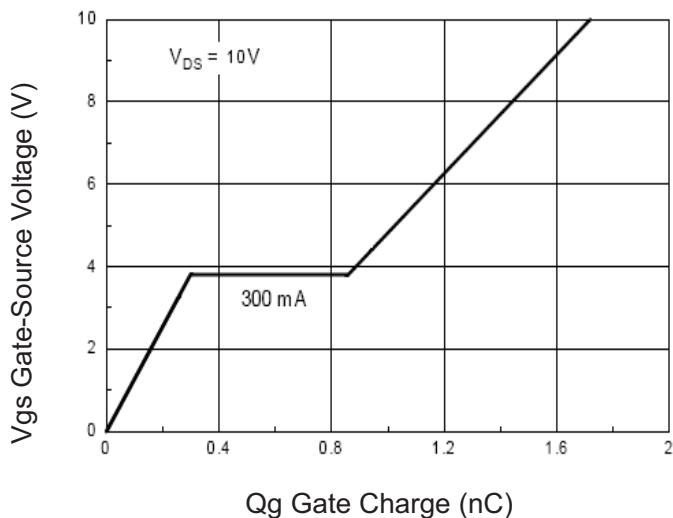


Figure 7 Gate Charge

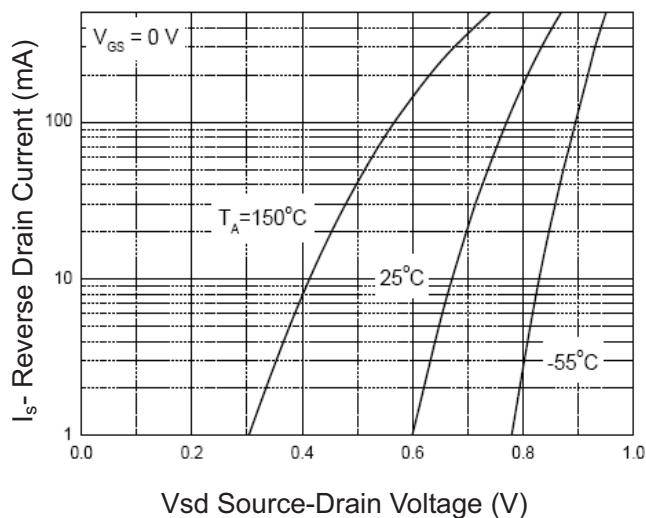


Figure 8 Source-DrainDiode Forward

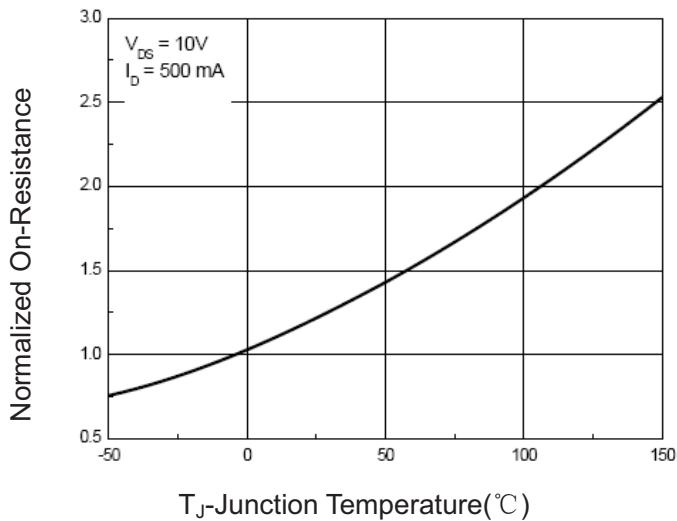


Figure 9 Drain-Source On-Resistance

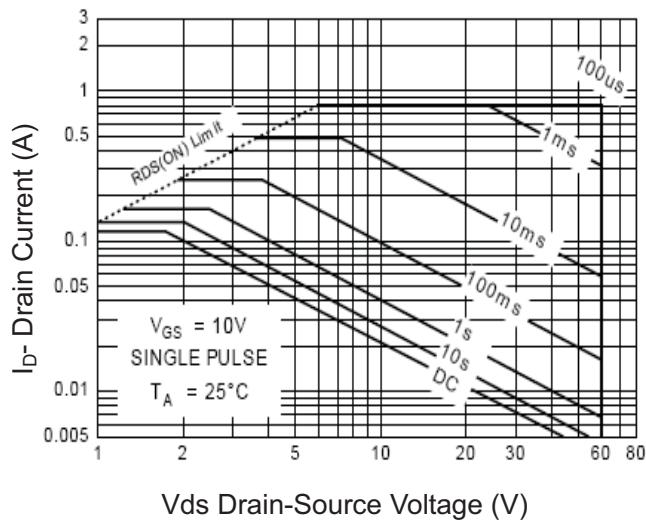


Figure 10 Safe Operation Area

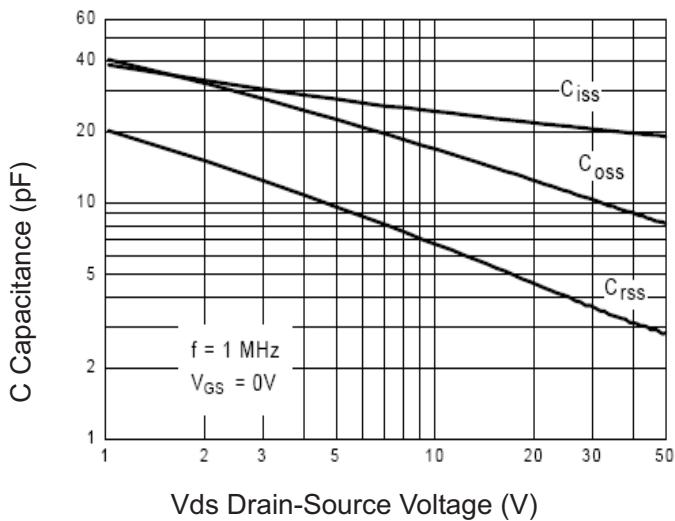


Figure 11 Capacitance vs Vds

RATING AND CHARACTERISTICS CURVES (2N7002K)

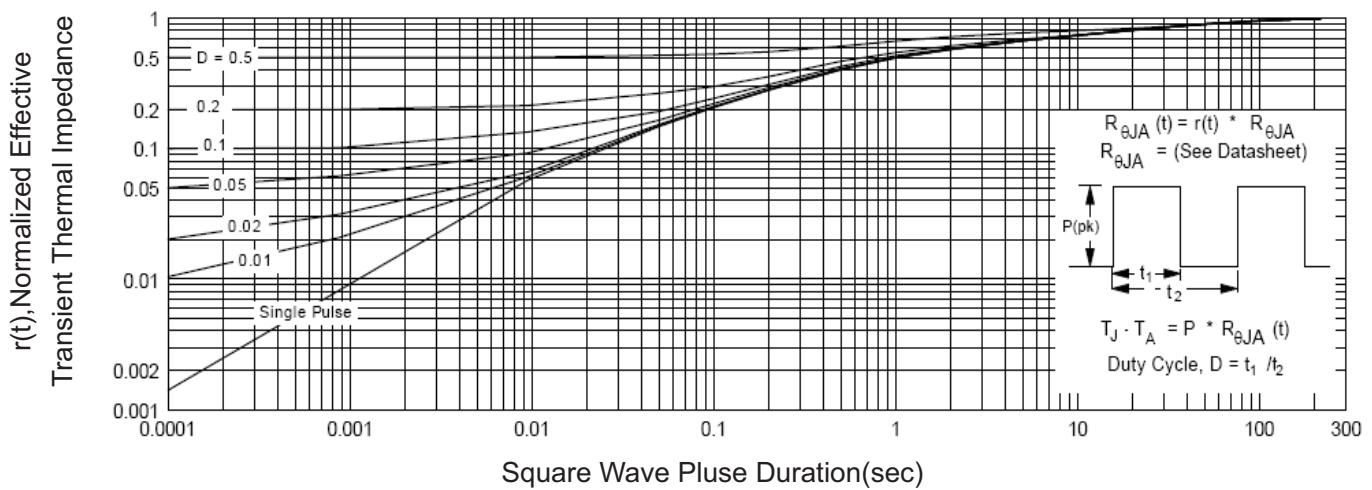
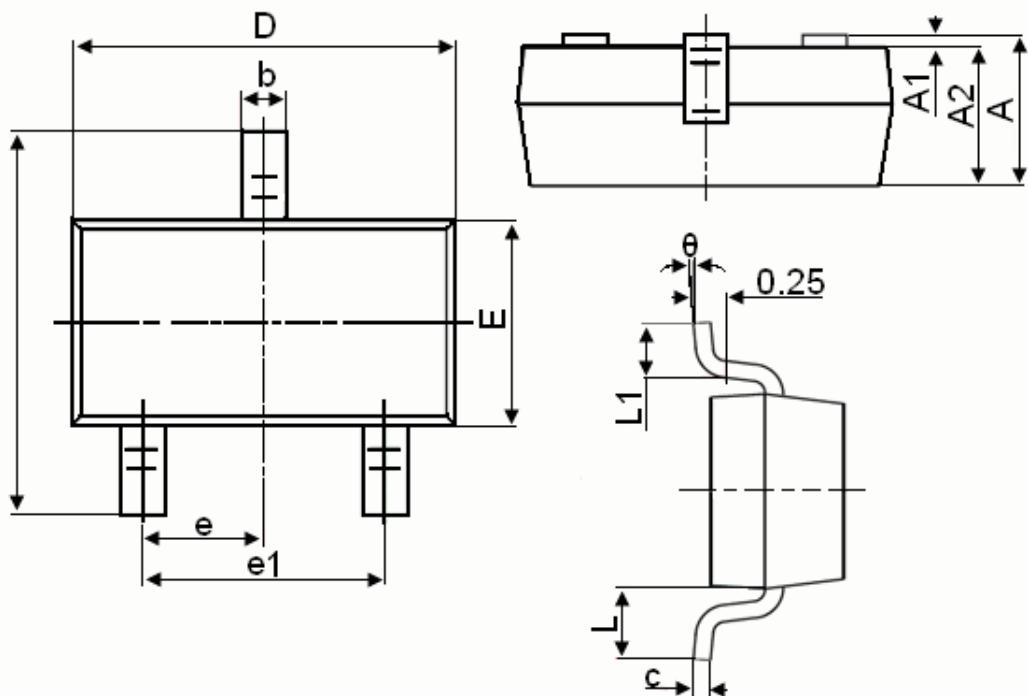


Figure 12 Normalized Maximum Transient Thermal Impedance

SOT-23 Package Information



Symbol	Dimensions in Millimeters	
	MIN.	MAX.
A	0.900	1.150
A1	0.000	0.100
A2	0.900	1.050
b	0.300	0.500
c	0.080	0.150
D	2.800	3.000
E	1.200	1.400
E1	2.250	2.550
e	0.950TYP	
e1	1.800	2.000
L	0.550REF	
L1	0.300	0.500
θ	0°	8°

Notes

1. All dimensions are in millimeters.
2. Tolerance $\pm 0.10\text{mm}$ (4 mil) unless otherwise specified
3. Package body sizes exclude mold flash and gate burrs. Mold flash at the non-lead sides should be less than 5 mils.
4. Dimension L is measured in gauge plane.
5. Controlling dimension is millimeter, converted inch dimensions are not necessarily exact.

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