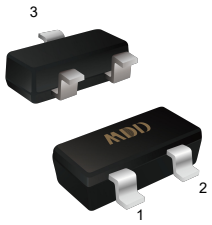
2N7002

60V N-Channel Enhancement Mode MOSFET

$V_{(BR)DSS}$	$R_{DS(on)}$MAX	I_D
60V	2.5Ω@10V	340mA
	3.0Ω@4.5V	

SOT-23



1. Gate
2. Source
3. Drain

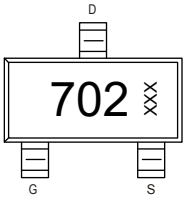
Features

- Trench Power MV MOSFET technology
- Voltage controlled small signal switch
- Low input Capacitance
- Fast Switching Speed
- Low Input / Output Leakage

Application

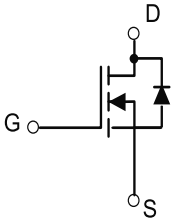
- Battery operated systems
- Solid-state relays
- Direct logic-level interface：TTL/CMOS

Marking



XXX:Date Code

Equivalent Circuit



Absolute Maximum Ratings (T_A=25℃unless otherwise noted)

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DS}	60	V
Gate-Source Voltage	V_{GS}	±20	V
Continuous Drain Current	I_D	340	mA
Pulsed Drain Current (Note 1)	I_{DM}	1.5	A
Power Dissipation(Note 2)	P_D	350	mW
Thermal Resistance from Junction to Ambient(Note 2)	$R_{\theta JA}$	357	℃/W
Junction Temperature and Storage Temperature	T_J,T_{stg}	-50 ~150	℃

Notes: Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Ta = 25℃ unless otherwise specified

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V, I_D=250μA	60	--	--	V
I_{DSS}	Drain-Source Leakage Current	V_{DS}=60V, V_{GS}=0V	--	--	1	uA
I_{GSS}	Gate-Source Leakage Current	V_{GS}=±20V, V_{DS}=0V	--	--	±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250μA	1	1.5	2.5	V
$R_{DS(ON)}$	Drain-Source On-State Resistance(Note 3)	V_{GS}=10V, I_D=300mA	--	1.2	2.5	Ω
		V_{GS}=4.5V, I_D=200mA	--	1.3	3.0	Ω

Dynamic Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
C_{iss}	Input Capacitance	V_{DS}=30V V_{GS}=0V f=1MHz	--	27.5	--	pF
C_{oss}	Output Capacitance		--	2.75	--	pF
C_{rss}	Reverse Transfer Capacitance		--	1.9	--	pF
Q_g	Total Gate Charge	V_{DS}=30V V_{GS}=10V I_D=0.3A	--	1.6	--	nC
Q_{gs}	Gate Source Charge		--	0.47	--	nC
Q_{gd}	Gate Drain Charge		--	0.25	--	nC

Switching Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
$t_{d(on)}$	Turn on Delay Time	V_{DS}=30V V_{GS} =10V I_D=300mA R_G=6Ω	--	3.3	--	ns
t_r	Turn on Rise Time		--	19	--	ns
$t_{d(off)}$	Turn Off Delay Time		--	9.6	--	ns
t_f	Turn Off Fall Time		--	49	--	ns

Source Drain Diode Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
I_{SD}	Source drain current(Body Diode)	T_A=25℃	--	--	340	mA
V_{SD}	Drain-Source Diode Forward Voltage	I_S=300mA, V_{GS}=0V	--	--	1.2	V

Notes: 1.Pulse width limited by maximum allowable junction temperature

2.The value of P_D&$R_{\theta JA}$ is measured with the device mounted on 1 in^2 FR-4 board with 2oz.Copper, double sided, in a still air environment with Ta=25℃.

3.Pulse test ; Pulse width≤300us, duty cycle≤2%

■ Typical Performance Characteristics

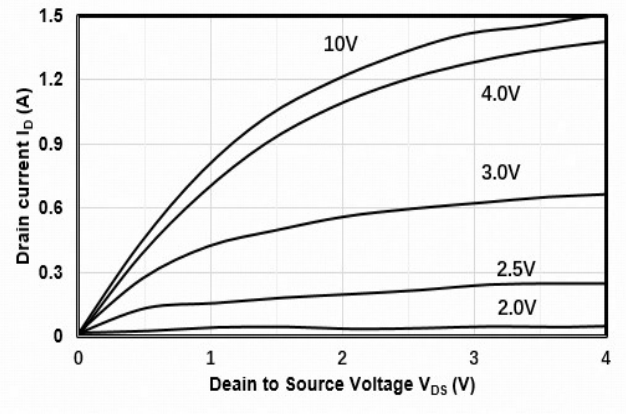


Figure1. Output Characteristics

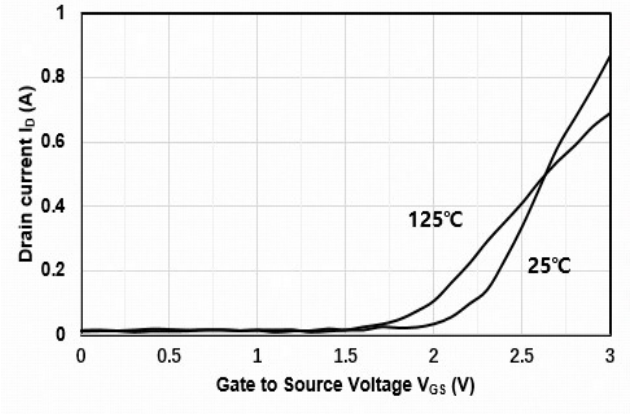


Figure2. Transfer Characteristics

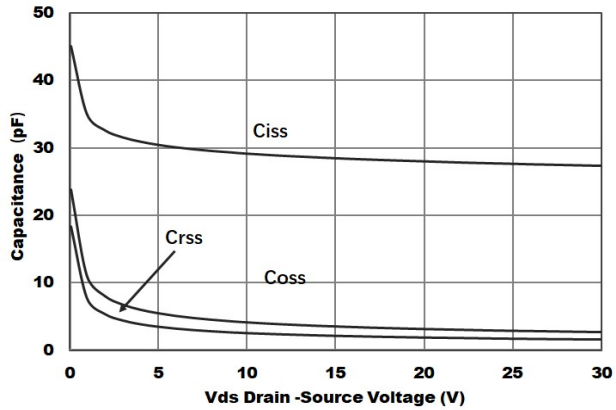


Figure3. Capacitance Characteristics

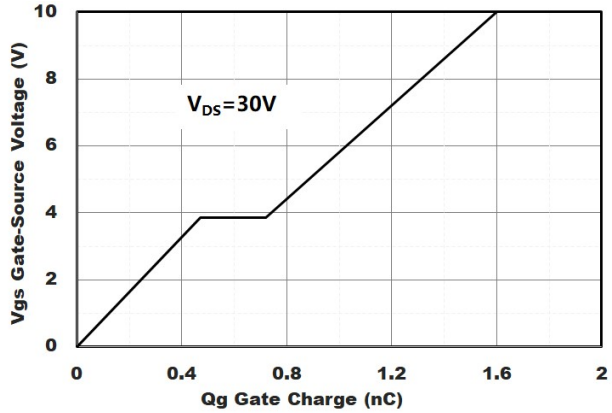


Figure4. Gate Charge

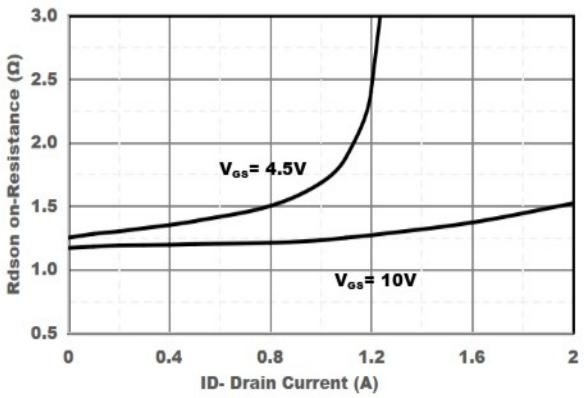


Figure5. Drain-Source on Resistance

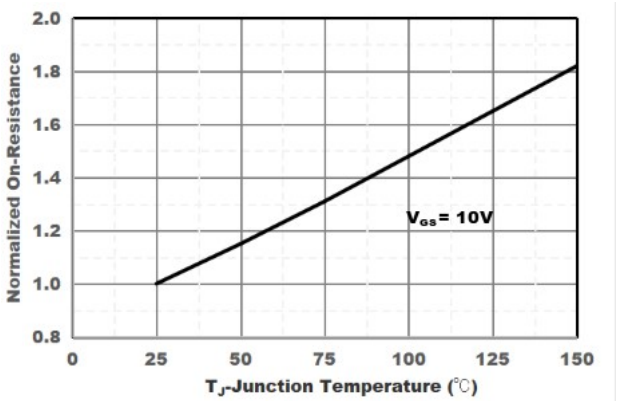


Figure6. Drain-Source on Resistance

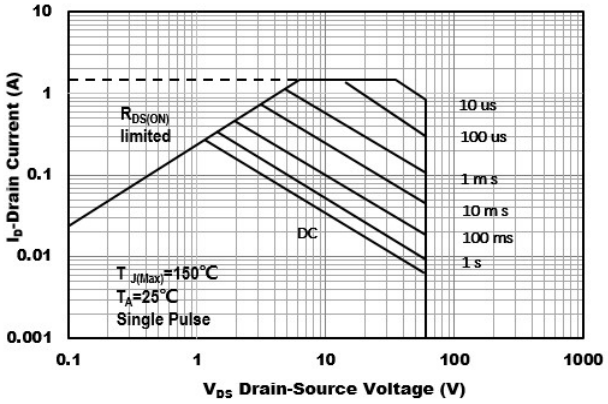


Figure7. Safe Operation Area

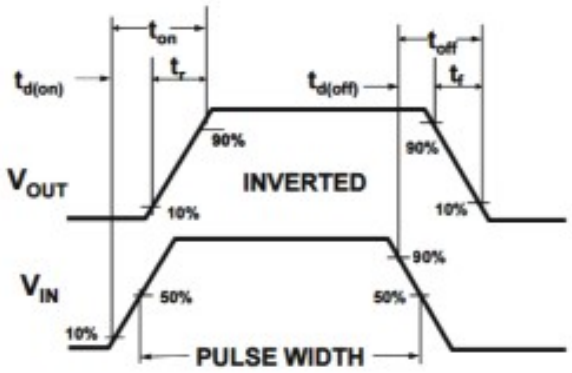
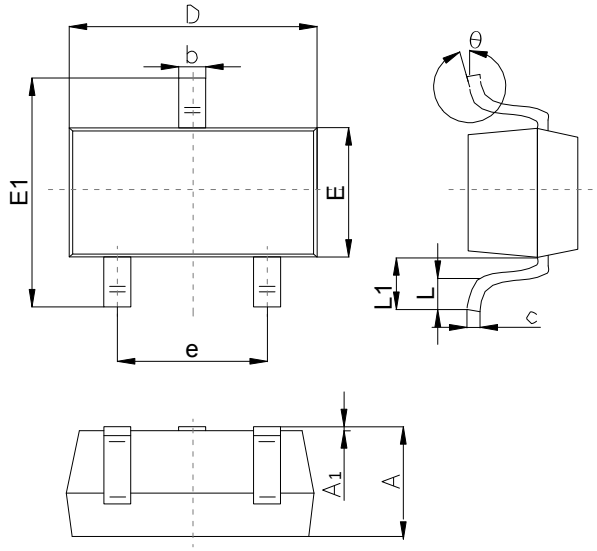


Figure8. Switching wave

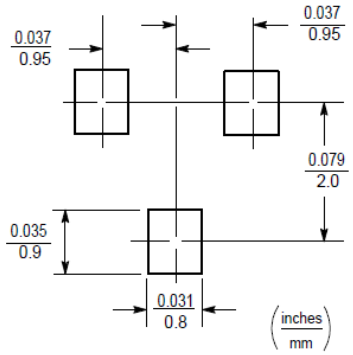
Outlitne Drawing

SOT-23 Package Outline Dimensions



Symbol	Dimensions In Millimeters		
	Min	Typ	Max
A	0.65		1.40
A1	0.00		0.20
b	0.30		0.55
c	0.08		0.20
D	2.70		3.10
E	1.15		1.65
E1	2.10		2.80
e	1.70		2.10
L	0.15		0.50
L1	0.35		0.70
θ	0°		12°

Suggested Pad Layout



Note:
1.Controlling dimension:in/millimeters.
2.General tolerance: ±0.05mm.
3.The pad layout is for reference purposes only.