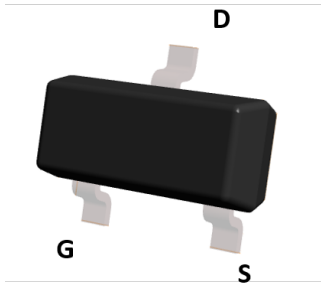
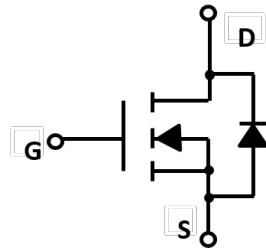
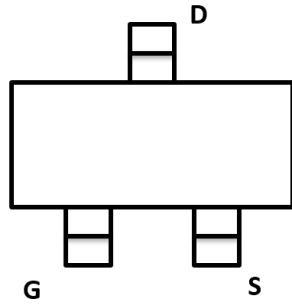


## N-Channel Enhancement Mode Field Effect Transistor



Top View

**SOT-23**



### Product Summary

- $V_{DS}$  60V
- $I_D$  340mA
- $R_{DS(ON)}$  (at  $V_{GS}=10V$ ) < 2.5ohm
- $R_{DS(ON)}$  (at  $V_{GS}=4.5V$ ) < 3.0ohm

### General Description

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

### Applications

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

### ■ 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	$V_{GS}$	$\pm 20$	V
Drain Current	$I_D$	$T_A=25^\circ C$ @ Steady State	340
		$T_A=70^\circ C$ @ Steady State	272
Pulsed Drain Current <sup>A</sup>	$I_{DM}$	1.5	A
Total Power Dissipation @ $T_A=25^\circ C$	$P_D$	350	mW
Thermal Resistance Junction-to-Ambient @ Steady State <sup>B</sup>	$R_{\theta JA}$	357	$^\circ C/W$
Junction and Storage Temperature Range	$T_J, T_{STG}$	-55~+150	$^\circ C$

### ■ Ordering Information (Example)

PREFERRED P/N	PACKING CODE	Marking	MINIMUM PACKAGE(pcs)	INNER BOX QUANTITY(pcs)	OUTER CARTON QUANTITY(pcs)	DELIVERY MODE
2N7002	F2	7002.	3000	30000	120000	7" reel

## ■ Electrical Characteristics (T<sub>J</sub>=25°C unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
<b>Static Parameter</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> = 0V, I <sub>D</sub> =250μA	60			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 Current	I <sub>GSS1</sub>	V <sub>GS</sub> = ±20V, V <sub>DS</sub> =0V			±100	nA
	I <sub>GSS2</sub>	V <sub>GS</sub> = ±10V, V <sub>DS</sub> =0V			±50	nA
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> =250μA	1	1.5	2.5	V
Static Drain-Source On-Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10V, I <sub>D</sub> =300mA		1.2	2.5	Ω
		V <sub>GS</sub> = 4.5V, I <sub>D</sub> =200mA		1.3	3.0	
Forward Transconductance	g <sub>fs</sub>	V <sub>DS</sub> =10 V, I <sub>D</sub> =200mA	80			ms
Diode Forward Voltage	V <sub>SD</sub>	I <sub>S</sub> =300mA, V <sub>GS</sub> =0V			1.2	V
Maximum Body-Diode Continuous Current	I <sub>S</sub>				340	mA
<b>Dynamic Parameters</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =30V, V <sub>GS</sub> =0V, f=1MHZ		27.5		pF
Output Capacitance	C <sub>oss</sub>			2.75		
Reverse Transfer Capacitance	C <sub>rss</sub>			1.9		
<b>Switching Parameters</b>						
Total Gate Charge	Q <sub>g</sub>	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V, I <sub>D</sub> =0.3A		1.6		nC
Gate-Source Charge	Q <sub>gs</sub>			0.47		
Gate-Drain Charge	Q <sub>gd</sub>			0.25		
Reverse Recovery Charge	Q <sub>rr</sub>	I <sub>F</sub> =0.3A, di/dt=-100A/us		2.5		
Reverse Recovery Time	t <sub>rr</sub>			11.5		
Turn-on Delay Time	t <sub>D(on)</sub>	V <sub>GS</sub> =10V, V <sub>DD</sub> =30V, I <sub>D</sub> =300mA, R <sub>GEN</sub> =6Ω		3.3		ns
Turn-on Rise Time	t <sub>r</sub>			19		
Turn-off Delay Time	t <sub>D(off)</sub>			9.6		
Turn-off fall Time	t <sub>f</sub>			49		

A. Pulse Test: Pulse Width ≤ 300us, Duty cycle ≤ 2%.

B. Device mounted on FR-4 PCB, 1 inch x 0.85 inch x 0.062 inch.

■ **Typical Performance Characteristics**

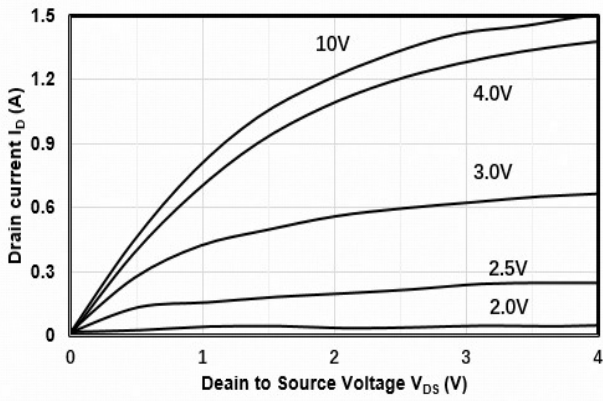


Figure1. Output Characteristics

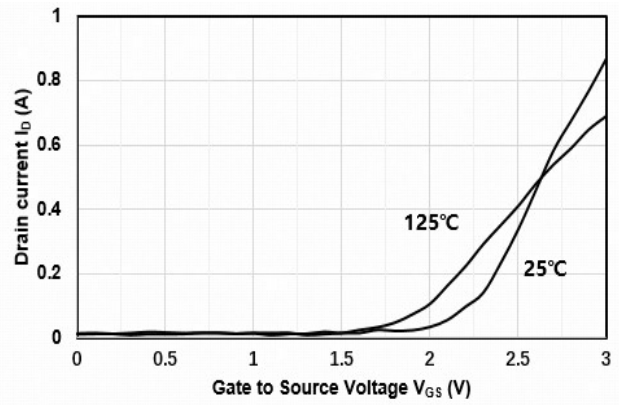


Figure2. Transfer Characteristics

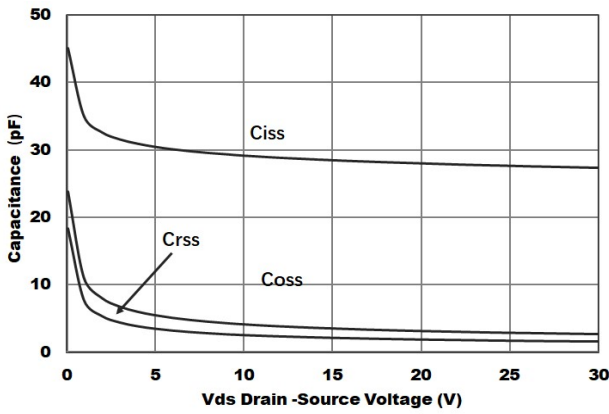


Figure3. Capacitance Characteristics

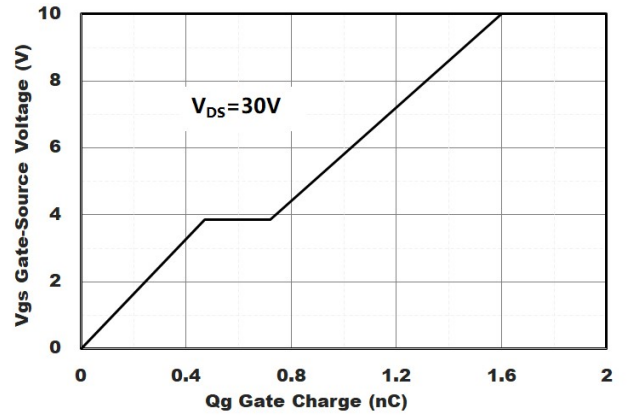


Figure4. Gate Charge

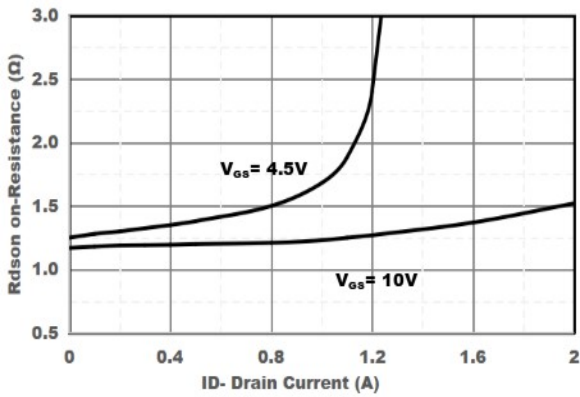


Figure5. Drain-Source on Resistance

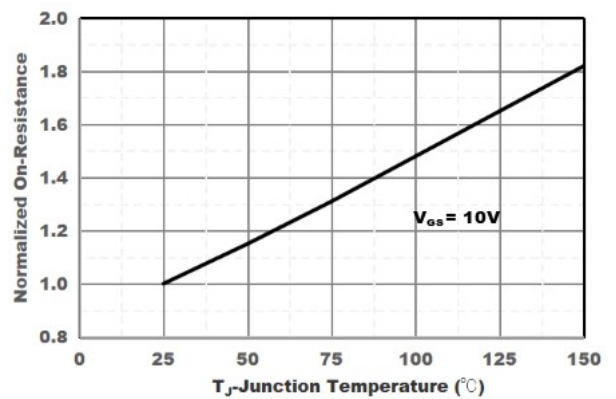


Figure6. Drain-Source on Resistance

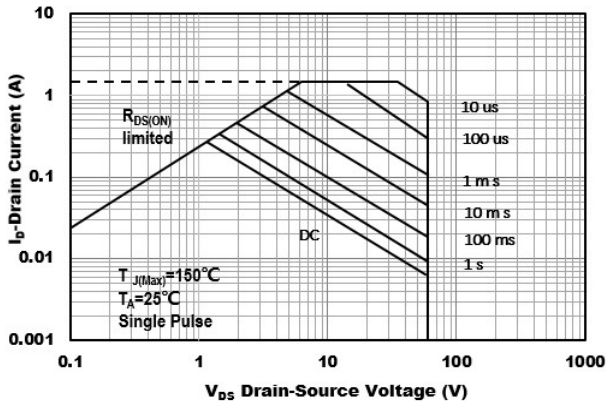


Figure7. Safe Operation Area

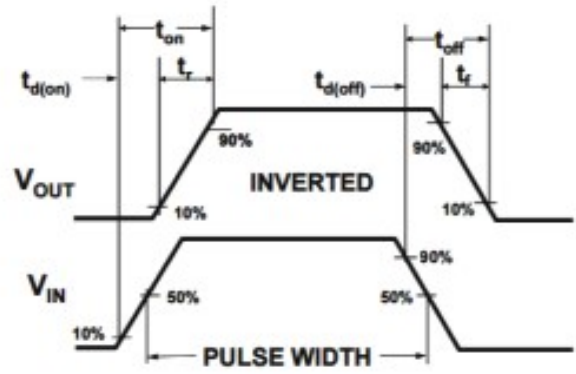
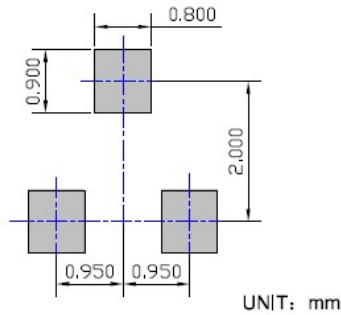
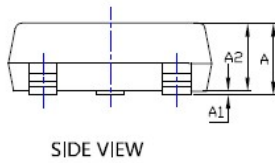
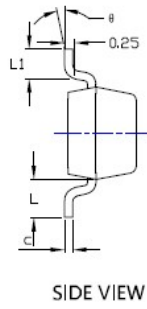
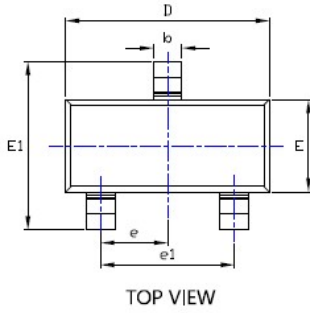


Figure8. Switching wave

### ■ SOT-23 Package information



SUGGESTED SOLDER PAD LAYOUT

SYMBOL	DIMENSIONS					
	INCHES			MILLimeter		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.035	---	0.045	0.900	---	1.150
A1	0.000	---	0.004	0.000	---	0.100
A2	0.035	0.038	0.041	0.900	0.975	1.050
b	0.012	0.016	0.020	0.300	0.400	0.500
c	0.004	---	0.008	0.100	---	0.200
D	0.110	0.114	0.118	2.800	2.900	3.000
E	0.047	0.051	0.055	1.200	1.300	1.400
E1	0.089	0.094	0.100	2.250	2.400	2.550
e	0.037 TYP			0.950 TYP		
e1	0.071	0.075	0.079	1.800	1.900	2.000
L	0.022 REF			0.550 REF		
L1	0.012	0.016	0.200	0.300	0.400	0.500
s	0*	---	8*	0*	---	8*

**NOTE:**

1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
2. TOLERANCE 0.1mm UNLESS OTHERWISE SPECIFIED.
3. THE PAD LAYOUT IS FOR REFERENCE PURPOSES ONLY.