

20V(D-S) N-Channel Enhancement Mode Power MOS FET

**General Features**

- $V_{DS} = 20V, I_D = 2.5A$   
 $R_{DS(ON)} < 100m\Omega @ V_{GS}=2.5V$   
 $R_{DS(ON)} < 65m\Omega @ V_{GS}=4.5V$
- High power and current handing capability
- Lead free product is acquired
- Surface mount package

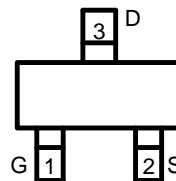


**Lead Free**

**Application**

- Battery protection
- Load switch
- Power management

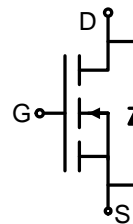
**PIN Configuration**



Marking and pin assignment



SOT-23 top view



Schematic diagram

**Package Marking and Ordering Information**

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
	MSN2302B	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	$V_{DS}$	20	V
Gate-Source Voltage	$V_{GS}$	$\pm 12$	V
Drain Current-Continuous	$I_D$	2.5	A
Drain Current-Pulsed (Note 1)	$I_{DM}$	9	A
Maximum Power Dissipation	$P_D$	0.9	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 To 150	$^{\circ}C$

**Thermal Characteristic**

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	125	$^{\circ}C/W$
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**Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)**

Parameter	Symbol	Condition	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	V <sub>GS</sub> =0V, I <sub>D</sub> =250μA	20	22	-	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =20V, V <sub>GS</sub> =0V	-	-	1	μA
Gate-Body Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> =±12V, V <sub>DS</sub> =0V	-	-	±100	nA
<b>On Characteristics (Note 3)</b>						
Gate Threshold Voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> =V <sub>GS</sub> , I <sub>D</sub> =250μA	0.5	0.75	1.2	V
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	V <sub>GS</sub> =2.5V, I <sub>D</sub> =2.5A	-	73	100	mΩ
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =2.9A	-	47	65	mΩ
Forward Transconductance	g <sub>FS</sub>	V <sub>DS</sub> =5V, I <sub>D</sub> =2.5A	-	9.5	-	S
<b>Dynamic Characteristics (Note4)</b>						
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =10V, V <sub>GS</sub> =0V, F=1.0MHz	-	280	-	PF
Output Capacitance	C <sub>oss</sub>		-	60	-	PF
Reverse Transfer Capacitance	C <sub>rss</sub>		-	40	-	PF
<b>Switching Characteristics (Note 4)</b>						
Turn-on Delay Time	t <sub>d(on)</sub>	V <sub>DD</sub> =10V, I <sub>D</sub> =2.5A V <sub>GS</sub> =4.5V, R <sub>GEN</sub> =2.8Ω	-	6		nS
Turn-on Rise Time	t <sub>r</sub>		-	5		nS
Turn-Off Delay Time	t <sub>d(off)</sub>		-	9		nS
Turn-Off Fall Time	t <sub>f</sub>		-	1.5		nS
Total Gate Charge	Q <sub>g</sub>	V <sub>DS</sub> =10V, I <sub>D</sub> =2.5A, V <sub>GS</sub> =4.5V	-	1.7		nC
Gate-Source Charge	Q <sub>gs</sub>		-	0.3	-	nC
Gate-Drain Charge	Q <sub>gd</sub>		-	0.8	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	V <sub>SD</sub>	V <sub>GS</sub> =0V, I <sub>S</sub> =2.5A	-	0.75	1.2	V
Diode Forward Current (Note 2)	I <sub>S</sub>		-	-	2.5	A

**Notes:**

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. Surface Mounted on FR4 Board, t ≤ 10 sec.
3. Pulse Test: Pulse Width ≤ 300μs, Duty Cycle ≤ 2%.
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics

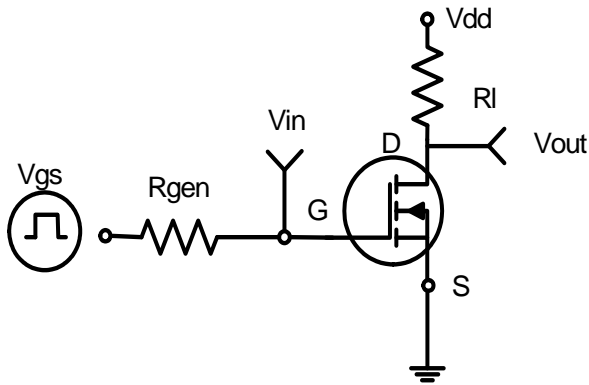


Figure 1: Switching Test Circuit

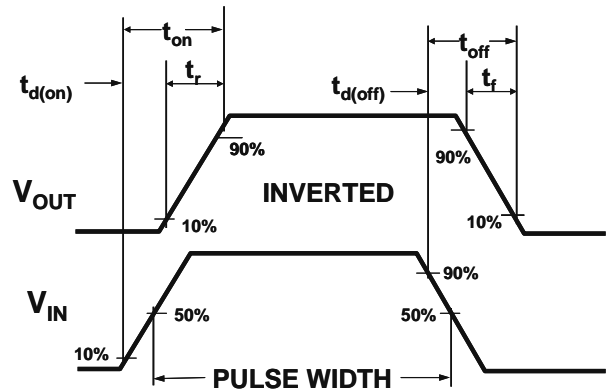


Figure 2: Switching Waveforms

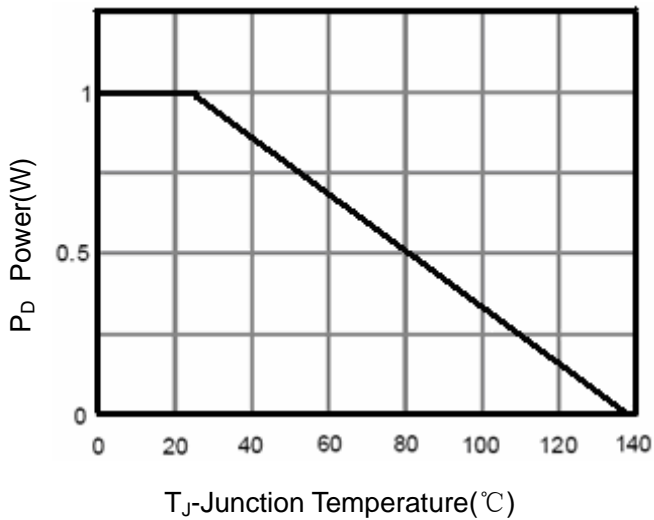


Figure 3 Power Dissipation

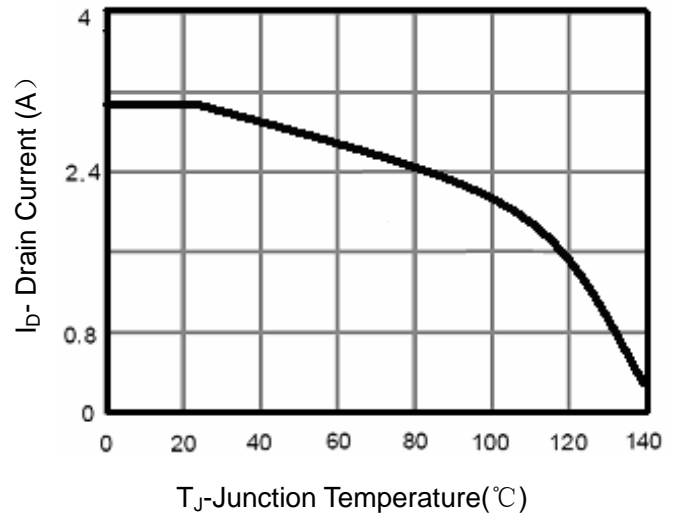


Figure 4 Drain Current

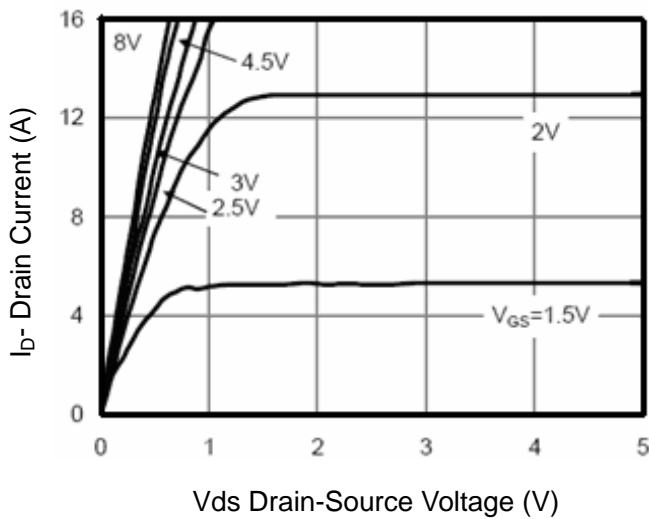


Figure 5 Output Characteristics

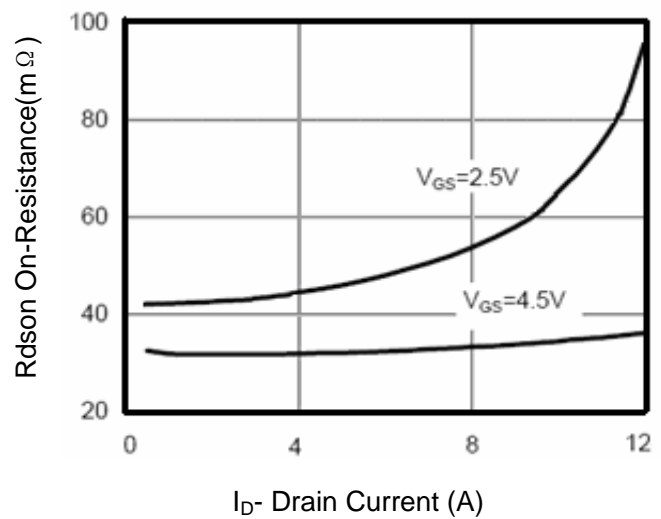


Figure 6 Drain-Source On-Resistance

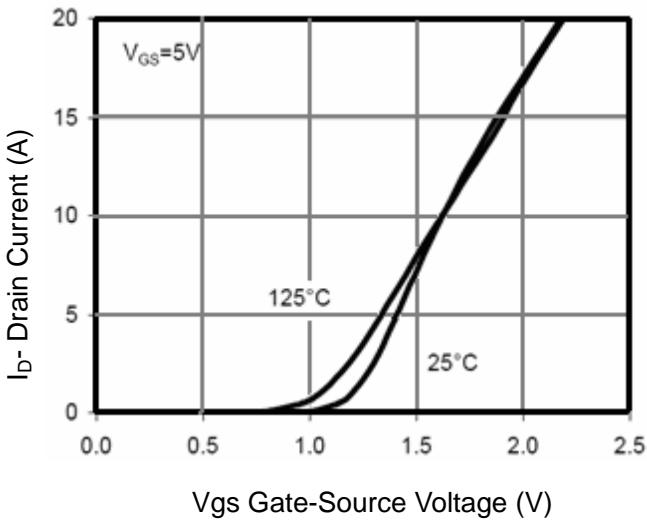


Figure 7 Transfer Characteristics

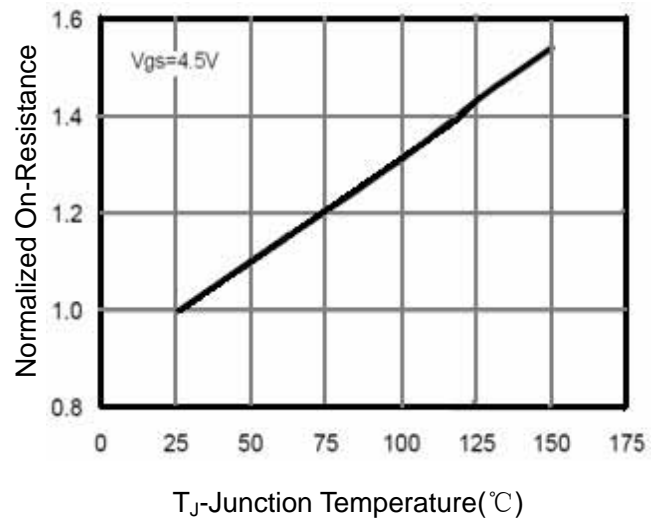


Figure 8 Drain-Source On-Resistance

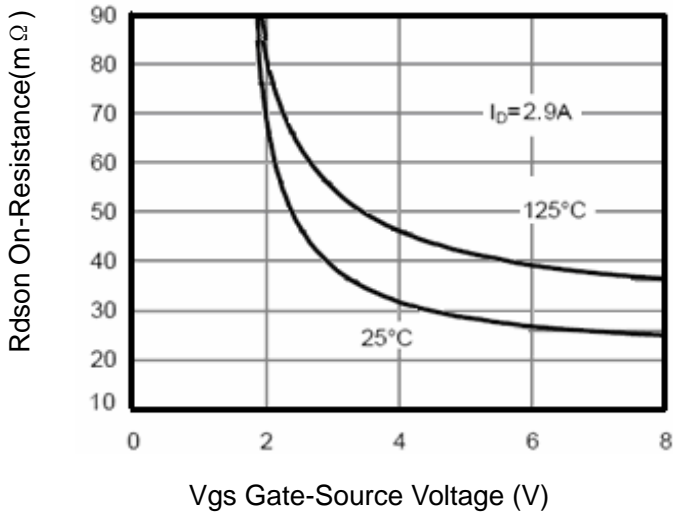


Figure 9 Rdson vs Vgs

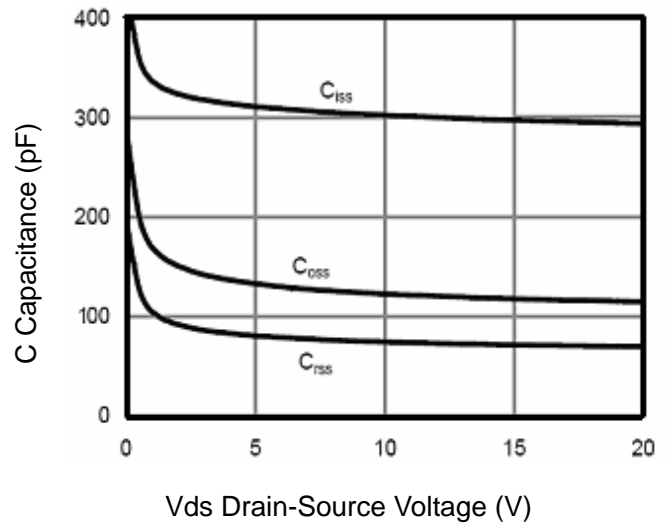


Figure 10 Capacitance vs Vds

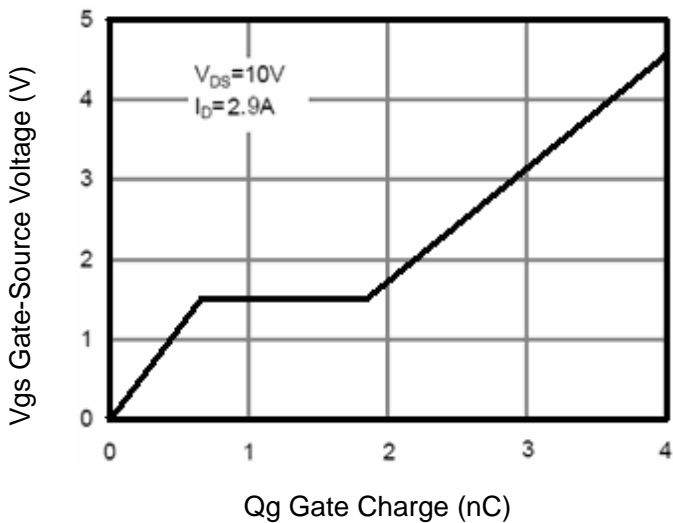


Figure 11 Gate Charge

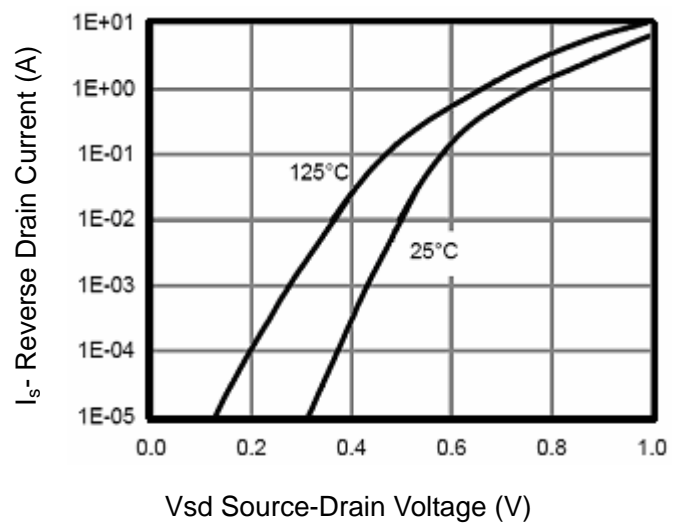


Figure 12 Source- Drain Diode Forward

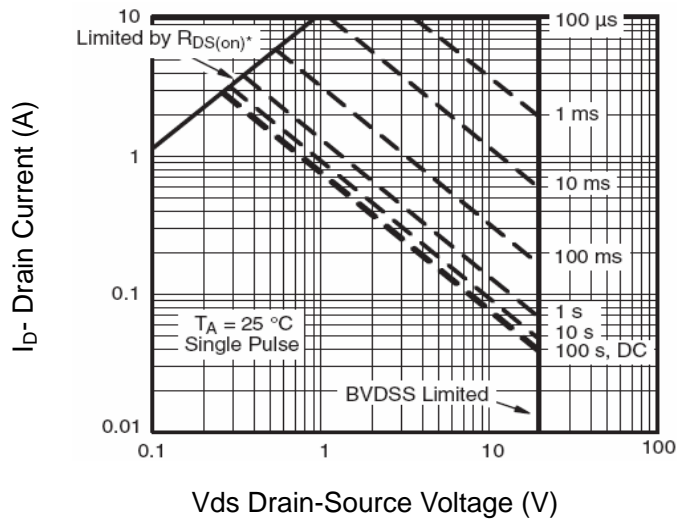


Figure 13 Safe Operation Area

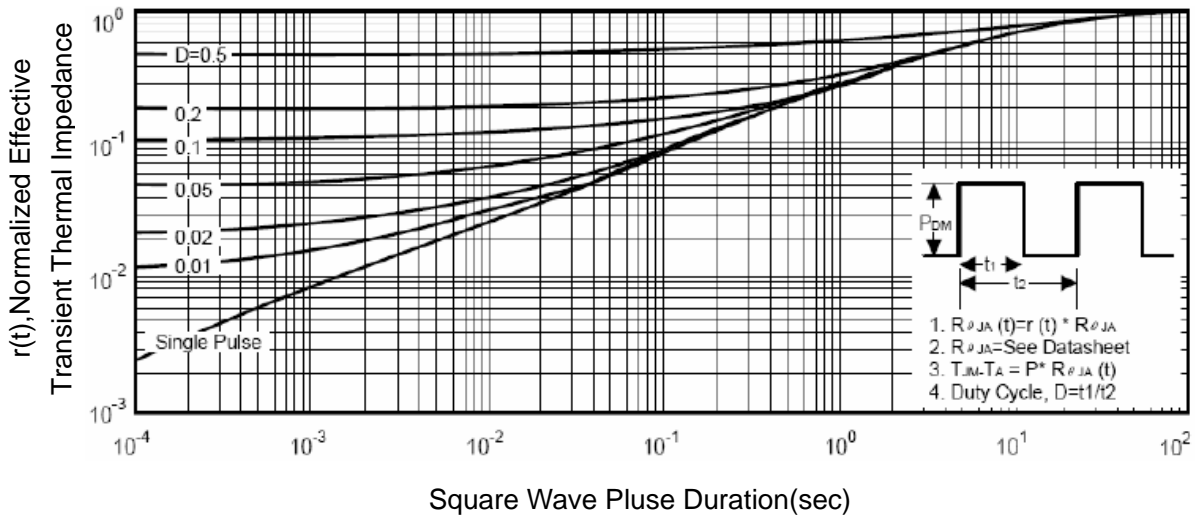
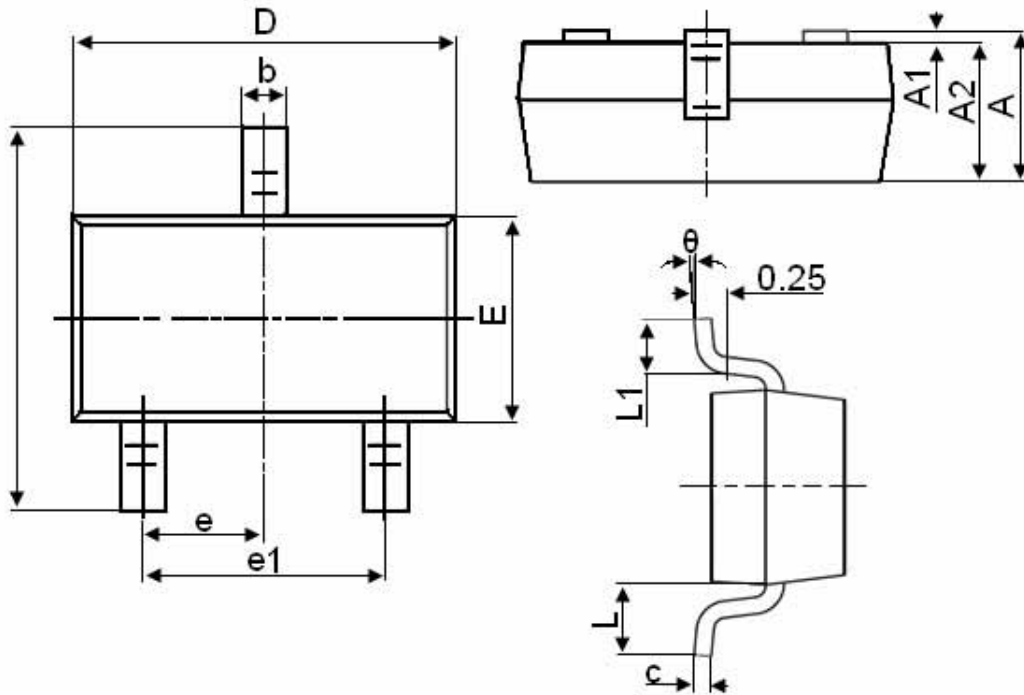


Figure 14 Normalized Maximum Transient Thermal Impedance

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
$\theta$	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.