

30V(D-S) N-Channel Enhancement Mode Power MOS FET

General Features

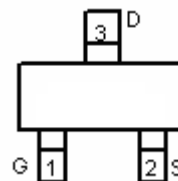
- $V_{DS} = 30V, I_D = 3.6A$
 $R_{DS(ON)} < 73m\Omega @ V_{GS}=4.5V$
 $R_{DS(ON)} < 58m\Omega @ V_{GS}=10V$
- High power and current handing capability
- Lead free product is acquired
- Surface mount package



Lead Free

Application

- Battery protection
- Load switch
- Power management

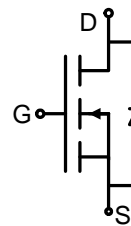


Marking and pin assignment

PIN Configuration



SOT-23 top view



Schematic diagram

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
	MSN2304	SOT-23	Ø180mm	8 mm	3000 units

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

Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V_{DS}	30	V
Gate-Source Voltage	V_{GS}	± 20	V
Drain Current-Continuous	I_D	3.6	A
Drain Current-Pulsed (Note 1)	I_{DM}	15	A
Maximum Power Dissipation	P_D	1.7	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	$^\circ\text{C}$

Thermal Characteristic

Thermal Resistance, Junction-to-Ambient (Note 2)	$R_{\theta JA}$	73.5	$^\circ\text{C/W}$
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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 _{GS} =0V, I _D =250μA	30	33	-	V
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} =30V, V _{GS} =0V	-	-	1	μA
Gate-Body Leakage Current	I _{GSS}	V _{GS} =±20V, V _{DS} =0V	-	-	±100	nA
On Characteristics (Note 3)						
Gate Threshold Voltage	V _{GS(th)}	V _{DS} =V _{GS} , I _D =250μA	1.2	1.5	2.2	V
Drain-Source On-State Resistance	R _{DS(ON)}	V _{GS} =4.5V, I _D =3.1A	-	58	73	mΩ
		V _{GS} =10V, I _D =3.6A	-	40	58	mΩ
Forward Transconductance	g _{FS}	V _{DS} =5V, I _D =3.6A	-	11	-	S
Dynamic Characteristics (Note4)						
Input Capacitance	C _{iss}	V _{DS} =15V, V _{GS} =0V, F=1.0MHz	-	230	-	PF
Output Capacitance	C _{oss}		-	40	-	PF
Reverse Transfer Capacitance	C _{rss}		-	17	-	PF
Switching Characteristics (Note 4)						
Turn-on Delay Time	t _{d(on)}	V _{DD} =10V, I _D =3.6A V _{GS} =4.5V, R _{GEN} =6Ω	-	10	-	nS
Turn-on Rise Time	t _r		-	50	-	nS
Turn-Off Delay Time	t _{d(off)}		-	10	-	nS
Turn-Off Fall Time	t _f		-	20	-	nS
Total Gate Charge	Q _g	V _{DS} =15V, I _D =3.6A, V _{GS} =10V	-	4.0	-	nC
Gate-Source Charge	Q _{gs}		-	0.75	-	nC
Gate-Drain Charge	Q _{gd}		-	0.65	-	nC
Drain-Source Diode Characteristics						
Diode Forward Voltage (Note 3)	V _{SD}	V _{GS} =0V, I _S =2.7A	-	0.8	1.2	V
Diode Forward Current (Note 2)	I _S		-	-	1.6	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 $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics

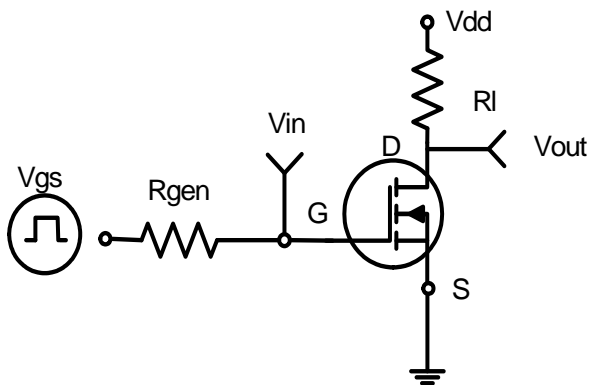


Figure 1: Switching Test Circuit

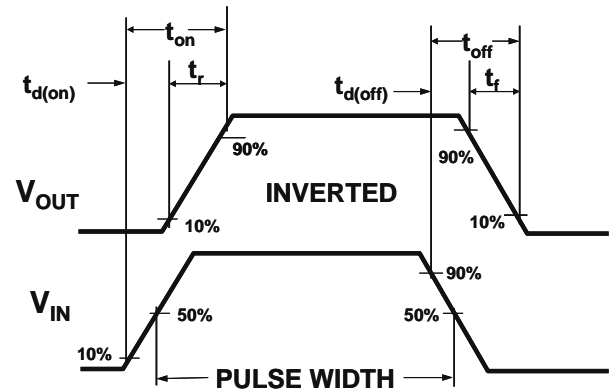


Figure 2: Switching Waveforms

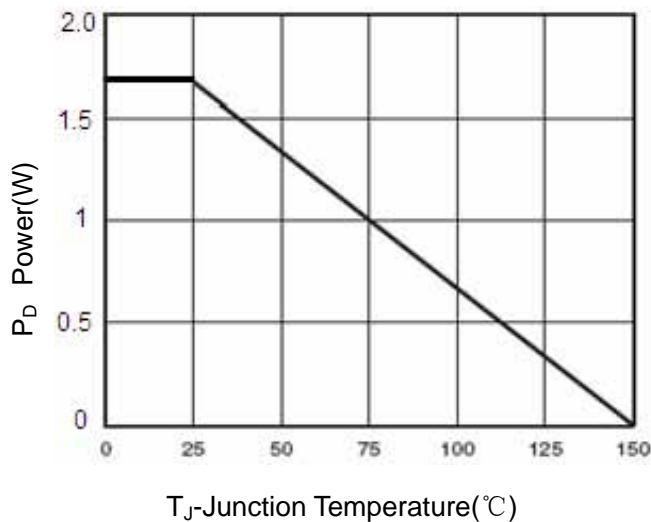


Figure 3 Power Dissipation

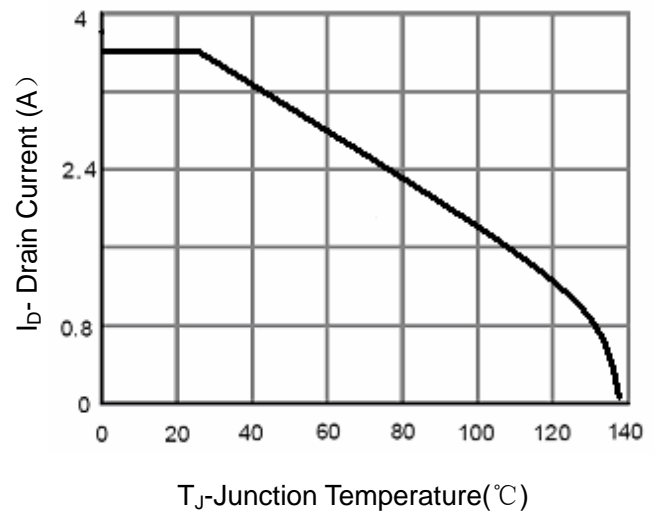


Figure 4 Drain Current

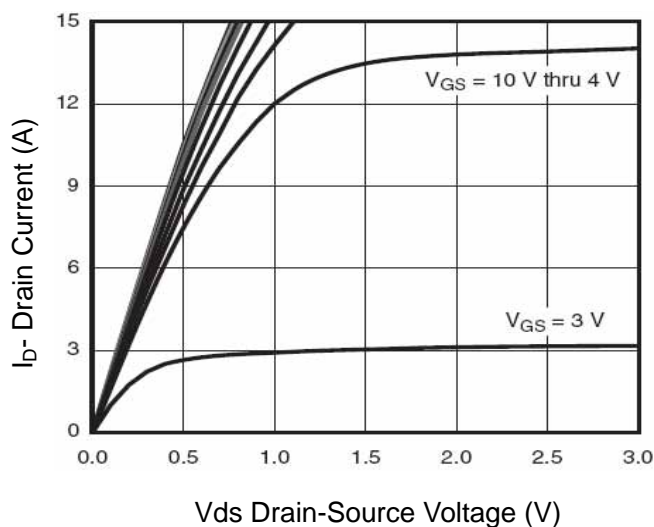


Figure 5 Output Characteristics

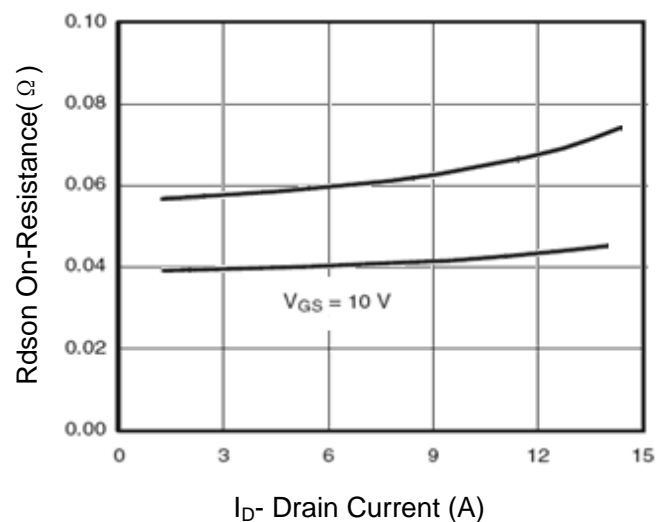


Figure 6 Drain-Source On-Resistance

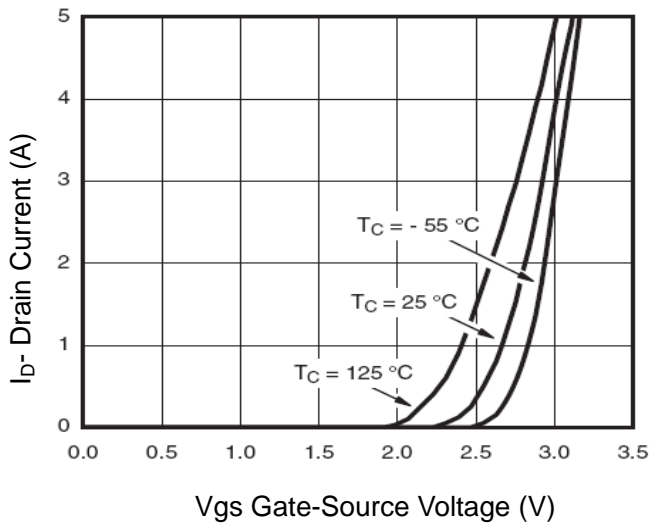


Figure 7 Transfer Characteristics

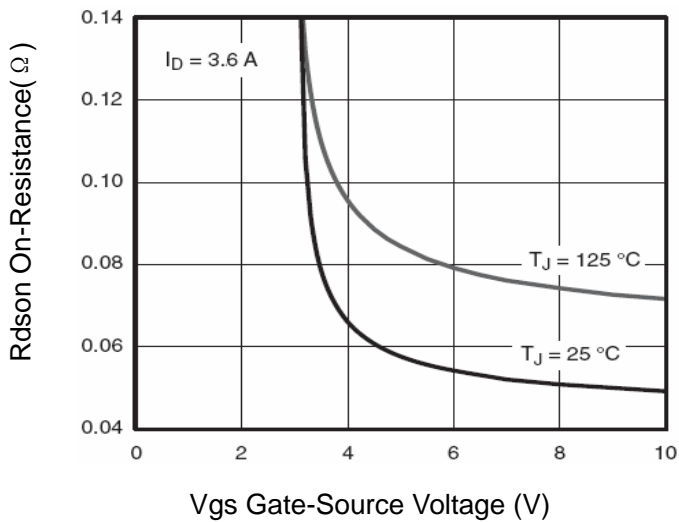


Figure 9 $R_{DS(on)}$ vs V_{GS}

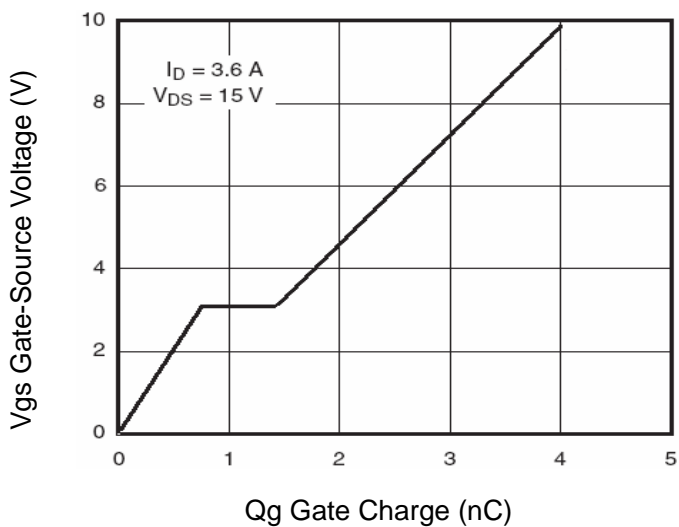


Figure 11 Gate Charge

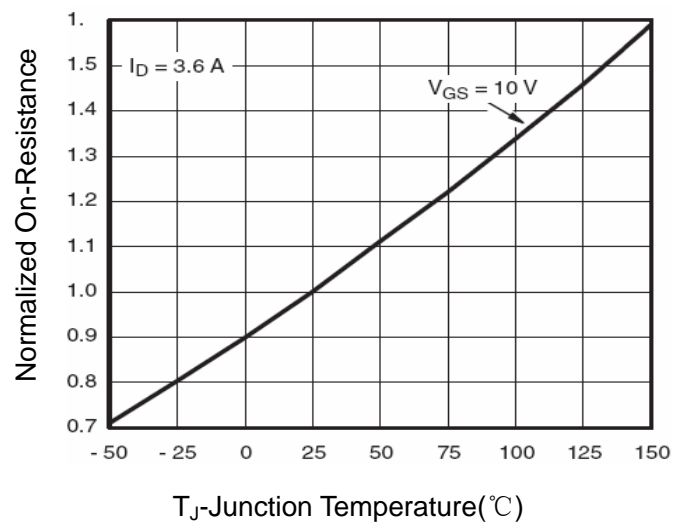


Figure 8 Drain-Source On-Resistance

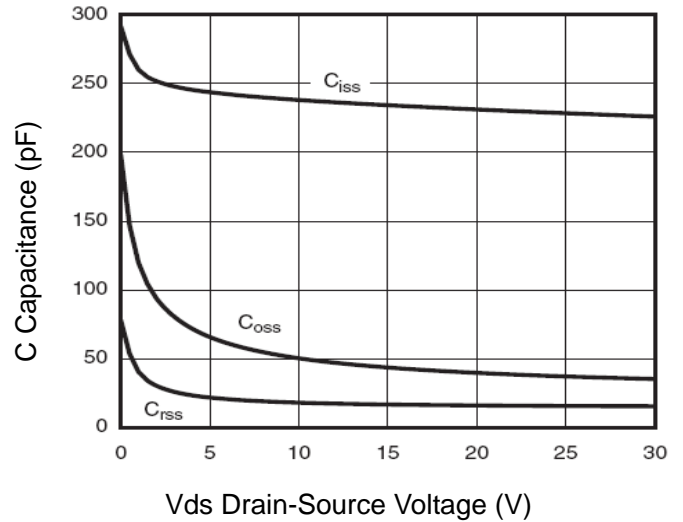


Figure 10 Capacitance vs V_{DS}

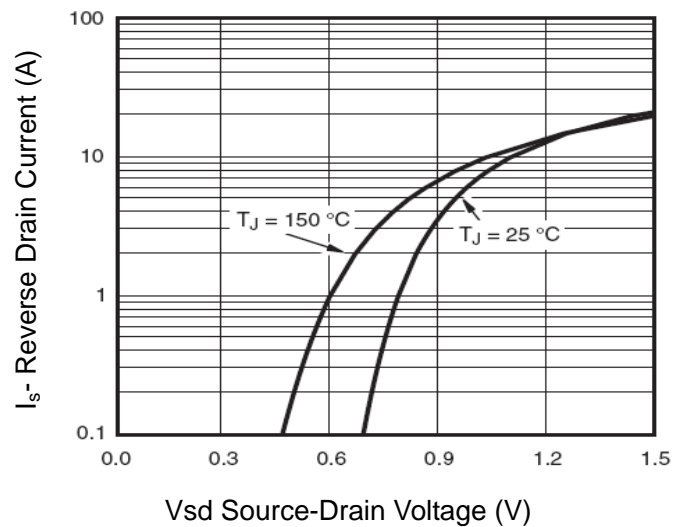


Figure 12 Source- Drain Diode Forward

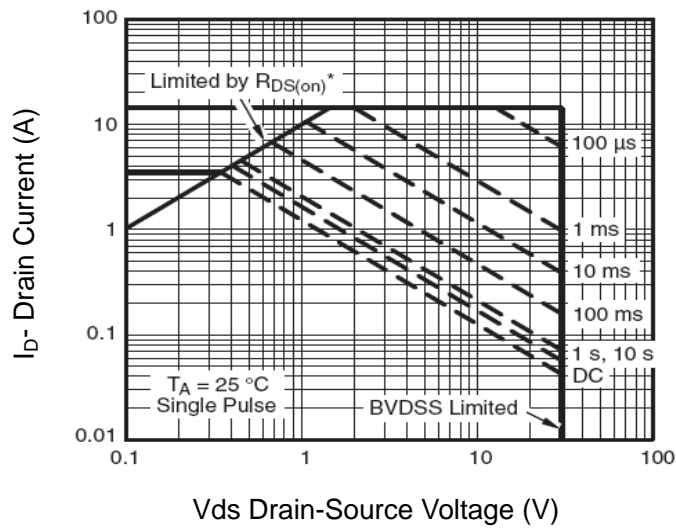


Figure 13 Safe Operation Area

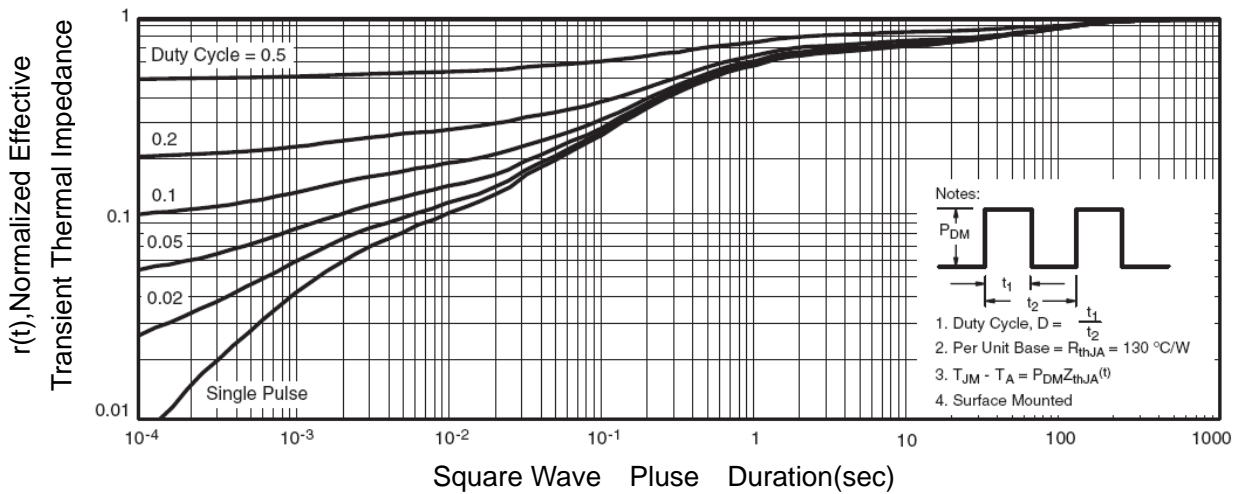
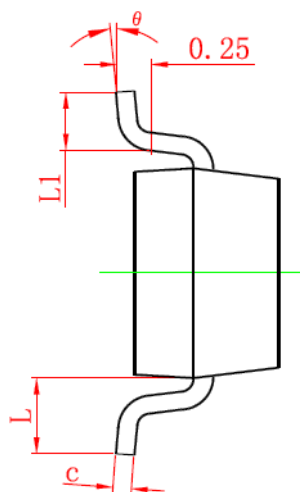
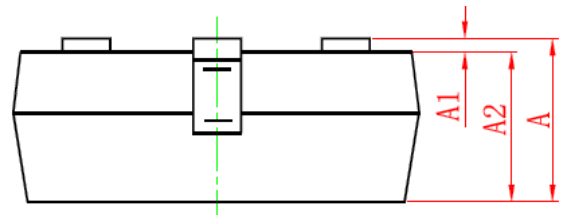
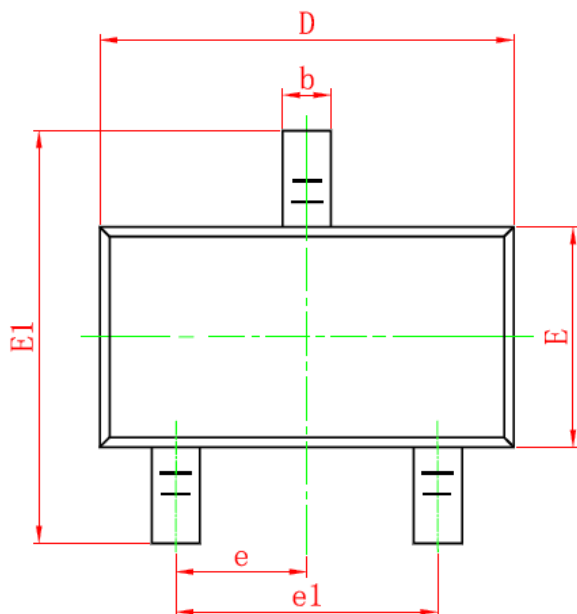


Figure 14 Normalized Maximum Transient Thermal Impedance

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
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.