



## P-Channel Enhancement Mode Power MOSFET **MX2301**

### DESCRIPTION

The MX2301 uses advanced trench technology to provide excellent  $R_{DS(ON)}$  and low gate charge. It can be used in a wide variety of applications.

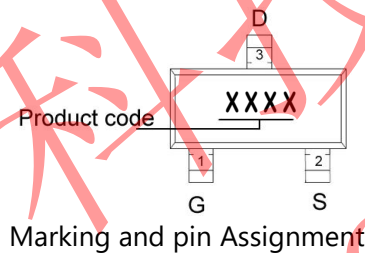
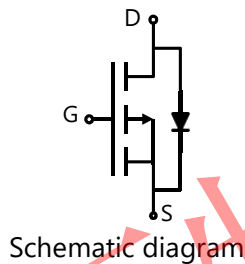
### GENERAL FEATURES

- $V_{DS}=-20V$ ,  $I_D=-3A$   
 $R_{DS(ON)}(Typ.)=110m\Omega$  @  $V_{GS}=-2.5V$   
 $R_{DS(ON)}(Typ.)=85m\Omega$  @  $V_{GS}=-4.5V$
- High Power and current handing capability
- Lead free product is acquired
- Surface Mount Package

### APPLICATION

- PWM applications
- Load switch
- Power management

### PINOUT



### ORDERING INFORMATION

Part Number	Storage Temperature	Package	Devices Per Reel
MX2301	-55°C to 150°C	SOT-23	3000

### 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	$I_D$	-3	A
Pulsed Drain Current <sup>(Note1)</sup>	$I_{DM}$	-10	A
Maximum Power Dissipation	$P_D$	1	W
Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-55 to 150	$^\circ C$

### THERMAL RESISTANCE

Thermal Resistance, Junction-to-Ambient <sup>(Note2)</sup>	$R_{\theta JA}$	125	$^\circ C/W$
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Note 1. Repetitive Rating: Pulse width limited by maximum junction temperature.

Note 2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.



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**ELECTRICAL CHARACTERISTICS** ( $T_A=25^\circ\text{C}$  unless otherwise noted)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
<b>Off Characteristics</b>						
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V, I_D=-250\mu A$	-20	-	-	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=-20V, V_{GS}=0V$	-	-	-1	$\mu A$
Gate-Body Leakage Current	$I_{GSS}$	$V_{GS}=\pm 12V, V_{DS}=0V$	-	-	$\pm 100$	nA
<b>On Characteristics</b> (Note 3)						
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}, I_D=-250\mu A$	-0.45	-0.7	-1	V
Drain-Source On-State Resistance	$R_{DS(ON)}$	$V_{GS}=-2.5V, I_D=-2A$	-	110	140	m $\Omega$
		$V_{GS}=-4.5V, I_D=-2.5A$	-	85	110	m $\Omega$
Forward Transconductance	$g_{FS}$	$V_{DS}=-5V, I_D=-2.8A$	-	9.5	-	S
<b>Dynamic Characteristics</b> (Note4)						
Input Capacitance	$C_{iss}$	$V_{DS}=-10V, V_{GS}=0V,$ $F=1.0MHz$	-	405	-	pF
Output Capacitance	$C_{oss}$		-	75	-	pF
Reverse Transfer Capacitance (Note4)	$C_{rss}$		-	55	-	pF
<b>Switching Characteristics</b>						
Turn-on Delay Time	$t_{d(on)}$	$V_{DD}=-10V, I_D=-1A,$ $R_L=1\Omega,$ $V_{GS}=-4.5V, R_G=3\Omega$	-	11	-	nS
Turn-on Rise Time	$t_r$		-	35	-	nS
Turn-Off Delay Time	$t_{d(off)}$		-	30	-	nS
Turn-Off Fall Time	$t_f$		-	10	-	nS
Total Gate Charge	$Q_g$	$V_{DS}=-10V, I_D=-3A,$ $V_{GS}=-4.5V$	-	3.3	-	nC
Gate-Source Charge	$Q_{gs}$		-	0.7	-	nC
Gate-Drain Charge	$Q_{gd}$		-	1.3	-	nC
<b>Drain-Source Diode Characteristics</b>						
Diode Forward Voltage (Note 3)	$V_{SD}$	$V_{GS}=0V, I_S=-1A$	-	-	-1.2	V
Diode Forward Current (Note 2)	$I_S$		-	-	-1.3	A

Note 2. Surface Mounted on FR4 Board,  $t \leq 10$  sec.

Note 3. Pulse Test: Pulse Width  $\leq 300\mu s$ , Duty Cycle  $\leq 2\%$ .

Note 4. Guaranteed by design, not subject to product.



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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

Figure 1. Switching Test Circuit

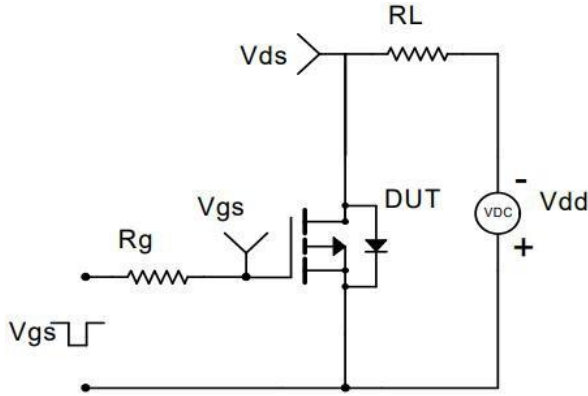


Figure 2. Switching Waveform

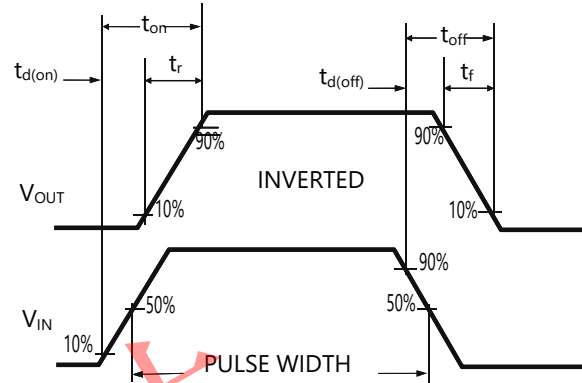


Figure 3. Power De-rating

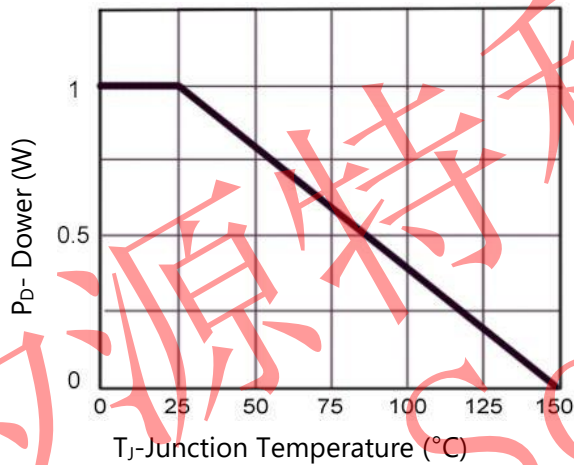


Figure 4. Drain Current

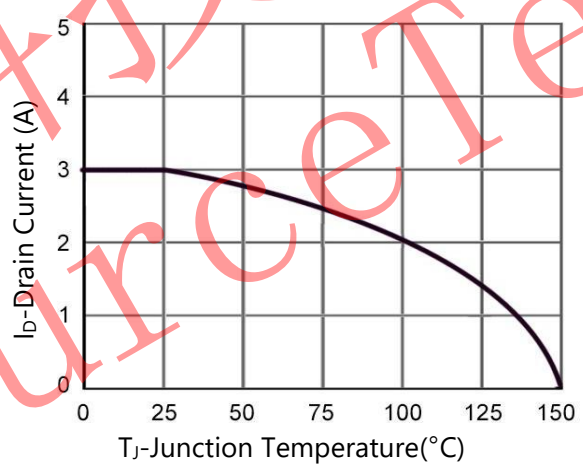


Figure 5. Output Characteristics

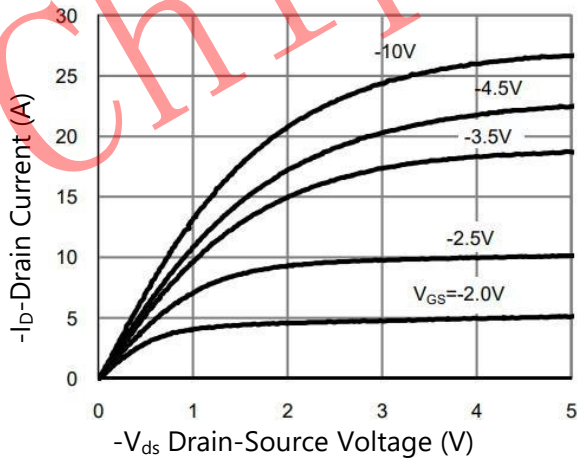
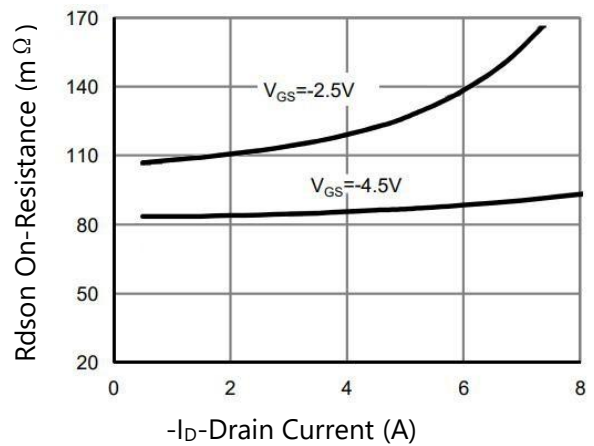


Figure 6. Rds(on) vs Drain Current

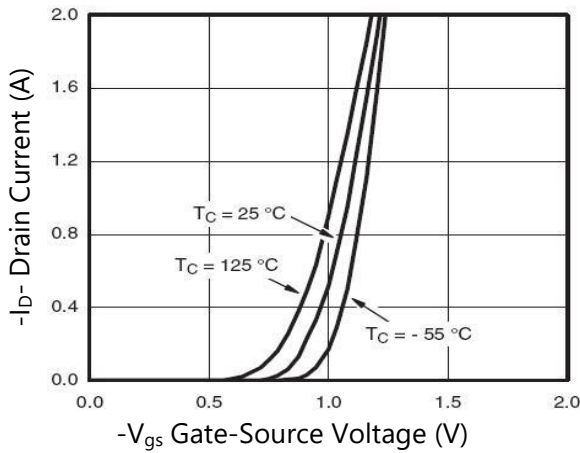




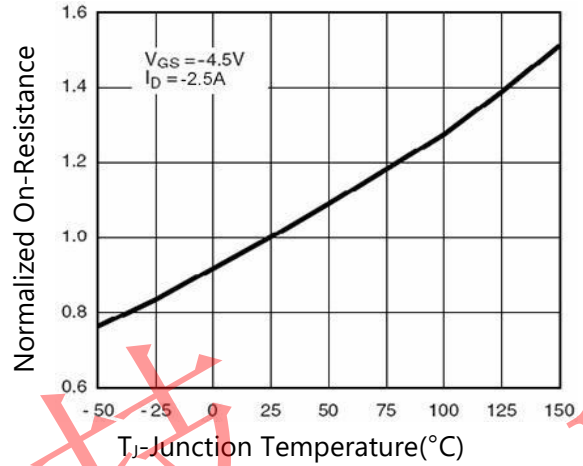
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**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

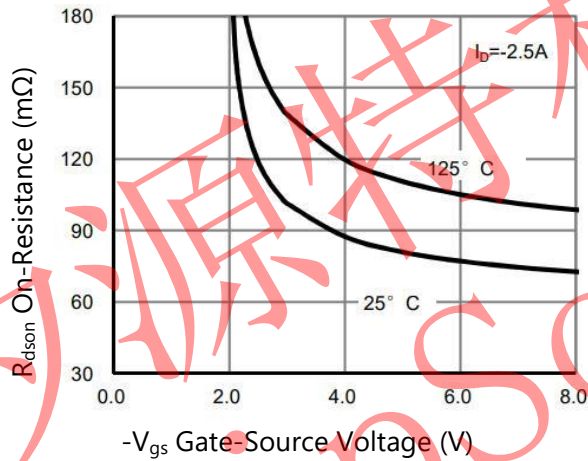
**Figure 7. Transfer Characteristics**



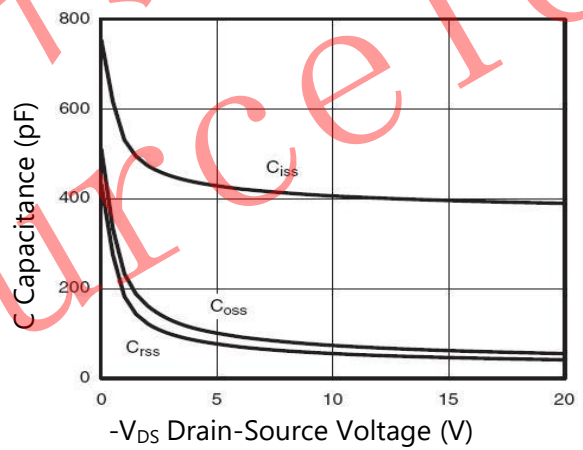
**Figure 8. Drain-Source On-Resistance**



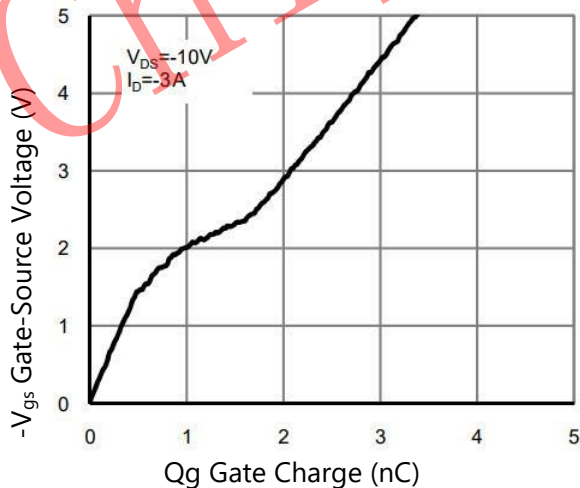
**Figure 9. Rdson vs Vgs**



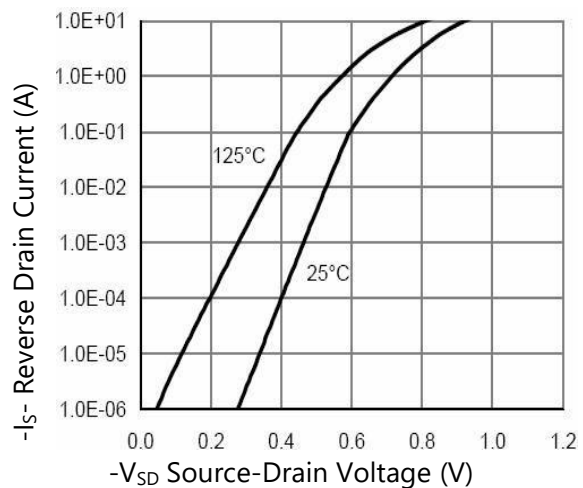
**Figure 10. Capacitance vs VDS**



**Figure 11. Gate Charge**



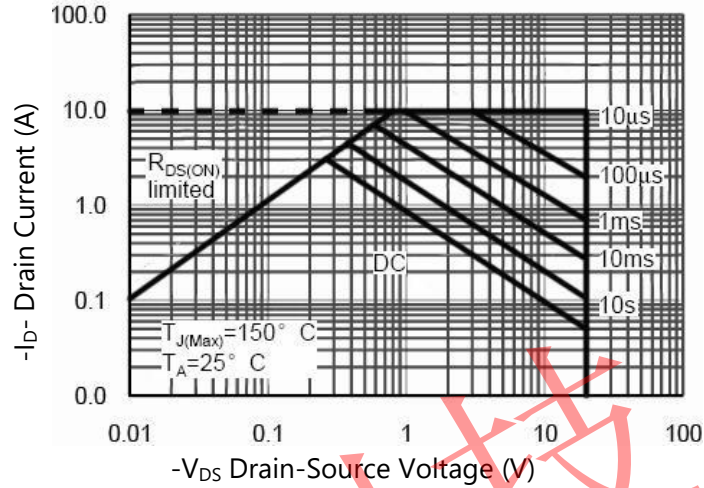
**Figure 12. Source- Drain Diode Forward**



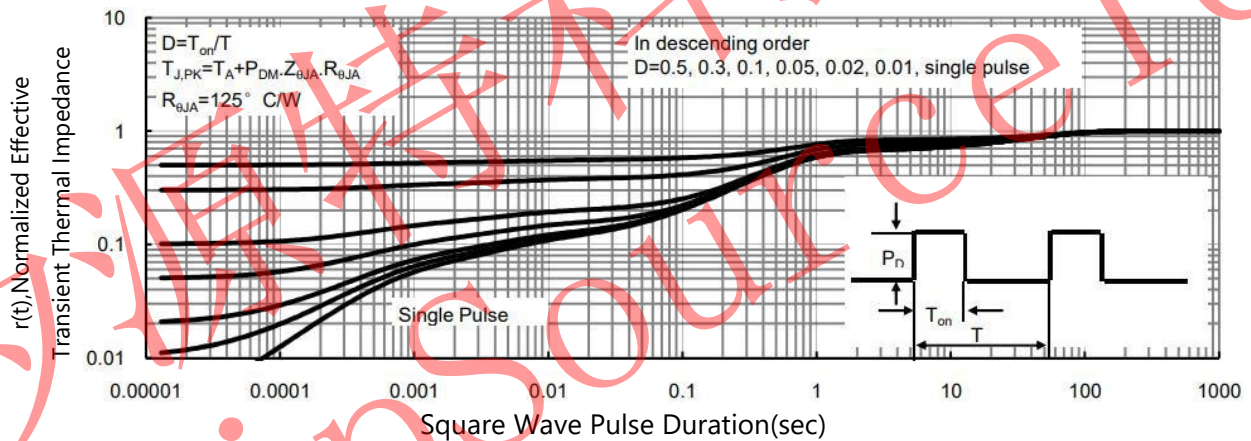


**TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS**

**Figure 13. Safe Operation Area**



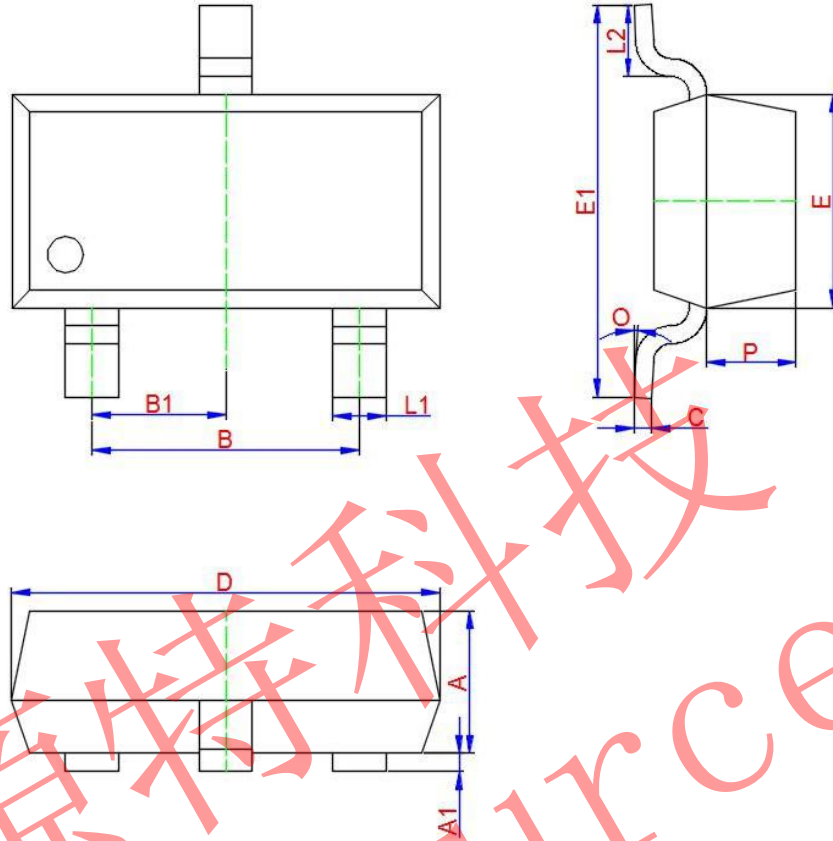
**Figure 14. Normalized Maximum Transient Thermal Impedance**





## PACKAGE INFORMATION

SOT-23



Symbol	Dimensions In Millimeters		
	Min.	Typ.	Max.
A	0.900	1.000	1.100
A1	0.000	0.050	0.100
L1	0.300	0.400	0.500
C	0.100	0.110	0.120
D	2.800	2.900	3.000
E	1.250	1.300	1.350
E1	2.250	2.400	2.550
B	1.800	1.900	2.000
B1	0.950 TYP.		
L2	0.200	0.350	0.450
P	0.550	0.575	0.600
O	0°	4°	8°