

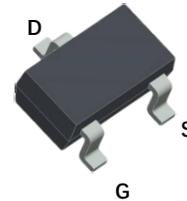
## FEATURES

- ◆ Low On-Resistance
- ◆ Low Input Capacitance
- ◆ Fast Switching Speed



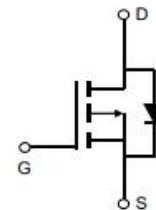
## APPLICATIONS

- ◆ Power Management Functions
- ◆ DC/DC Converters



## Description

The series advanced trench technology and design to provide excellent RDS(ON) with low gate charge. It can be used in a wide variety of applications.



Product summary		
$V_{DSS}$	-20	V
$I_D$	-2.3	A
$R_{DS(ON)TYP}$	89.5	m $\Omega$
Ordering Information		
Part Number	Package	
HX2301A	SOT-23	

Absolute maximum ratings (T<sub>c</sub>= 25°C unless otherwise specified)

Symbol	Parameter	Rating	Unit
		SOT-23	
$V_{DSS}$	Drain-to-Source Voltage	-20	V
$I_D$	Continuous Drain Current	-2.3	A
	Continuous Drain Current T <sub>c</sub> = 100 °C	-1	A
$I_{DM}^{a4}$	Pulsed Drain Current	-12	A
$V_{GS}$	Gate-to-Source Voltage	±12	V
$E_{AS}^{a2}$	Single Pulse Avalanche Energy	2.5	mJ
$dv/dt^{a3}$	Peak Diode Recovery dv/dt	-	V/ns
$P_D$	Power Dissipation	1.00	W
	Derating Factor above 25°C	3	
$T_J, T_{stg}$	Operating Junction and Storage Temperature Range	-55 to 150	°C

OFF Characteristics (T<sub>c</sub>= 25°C unless otherwise specified)

Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$V_{DSS}$	Drain to Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu A$	-20	--	--	V
$\Delta BV_{DSS}/\Delta T_J$	Bvdss Temperature Coefficient	$I_D=250\mu A, \text{Reference } 25^\circ C$	--	0.11	--	V/°C
$I_{DSS}$	Drain to Source Leakage Current	$V_{DS} = -15V, V_{GS} = 0V, T_J = 25^\circ C$	--	--	-1	$\mu A$
		$V_{DS} = -15V, V_{GS} = 0V, T_J = 125^\circ C$	--	--	--	$\mu A$
$I_{GSS(F)}$	Gate to Source Forward Leakage	$V_{GS} = +4.5V$	--	--	100	nA
$I_{GSS(R)}$	Gate to Source Reverse Leakage	$V_{GS} = -4.5V$	--	--	-100	nA

## P-Channel MOSFET

ON Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_{DS(ON)}$	Drain-to-Source On-Resistance	$V_{GS} = -4.5\text{V}, I_D = -2\text{A}$	--	89.5	120	m $\Omega$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 250\mu\text{A}$	-0.4	--	-1.2	V
Dynamic Characteristics Essentially independent of operating temperature						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$R_g$	Gate resistance	$f = 1.0\text{MHz}$	--	6	--	$\Omega$
$g_{fs}$	Forward Transconductance	$V_{DS} = -10\text{V}, I_D = 2\text{A}$	--	8.0	--	S
$C_{iss}$	Input Capacitance	$V_{GS} = 0\text{V}$	--	234	--	pF
$C_{oss}$	Output Capacitance	$V_{DS} = -10\text{V}$	--	34	--	
$C_{rss}$	Reverse Transfer Capacitance	$f = 1.0\text{MHz}$	--	24	--	
Resistive Switching Characteristics Essentially independent of operating temperature						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$t_{d(ON)}$	Turn-on Delay Time	$I_D = -1\text{A}$ $V_{DD} = -10\text{V}$ $R_G = 3\Omega$	--	0.6	--	ns
$t_r$	Rise Time		--	3.0	--	
$t_{d(OFF)}$	Turn-Off Delay Time		--	5.0	--	
$t_f$	Fall Time		--	2.0	--	
$Q_g$	Total Gate Charge	$I_D = -1\text{A}$ $V_{DD} = -10\text{V}$ $V_{GS} = -10\text{V}$	--	2.0	--	nC
$Q_{gs}$	Gate to Source Charge		--	0.3	--	
$Q_{gd}$	Gate to Drain ("Miller") Charge		--	0.6	--	
Source-Drain Diode Characteristics $T_J=25^\circ\text{C}$ unless otherwise specified						
Symbol	Parameter	Test Conditions	Rating			Units
			Min.	Typ.	Max.	
$I_S$	Continuous Source Current (Body Diode)		--	-1	--	A
$I_{SM}$	Maximum Pulsed Current (Body Diode)		--	--	--	A
$V_{SD}$	Diode Forward Voltage	$I_S = -1.5\text{A}, V_{GS} = 0\text{V}$	--	0.7	--	V
$t_{rr}$	Reverse Recovery Time	$I_S = -1\text{A}$ $T_J = 25^\circ\text{C}$ $dI_F/dt = 100\text{A}/\mu\text{s}$ $V_{GS} = 0\text{V}$	--	5.3	--	ns
$Q_{rr}$	Reverse Recovery Charge		--	0.5	--	$\mu\text{C}$
$I_{RRM}$	Reverse Recovery Current		--	--	--	A

Pulse width  $t_p \leq 300\mu\text{s}, \delta \leq 2\%$ 

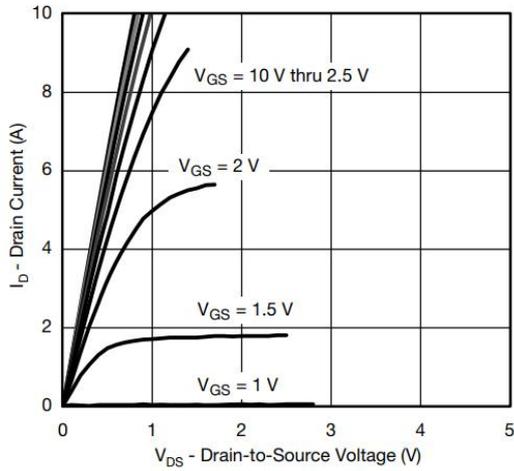
Parameter	Symbol	SOT-23	Units
Junction-to-Case	$R_{\theta JC}$	192.00	$^\circ\text{C}/\text{W}$
Junction-to-Ambient	$R_{\theta JA}$	115.00	$^\circ\text{C}/\text{W}$

## Notes:

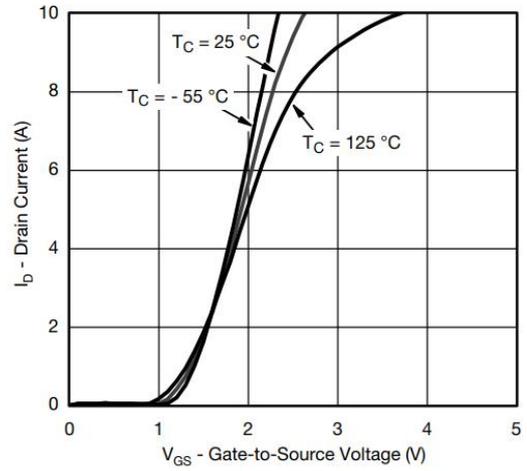
- \*1.  $T_J = +25^\circ\text{C}$  to  $+150^\circ\text{C}$
- \*2. Repetitive rating; pulse width limited by maximum junction temperature.
- \*3.  $I_S = -2\text{A}, di/dt < 100\text{A}/\mu\text{s}, V_{DD} < BVDSS, T_J = +150^\circ\text{C}$ .
- \*4. Pulse width  $< 300\mu\text{s}$ ; duty cycle  $< 2\%$ .

Typical Characteristics

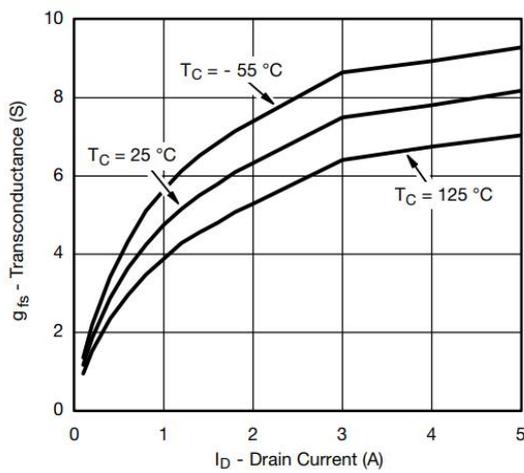
P-Channel MOSFET



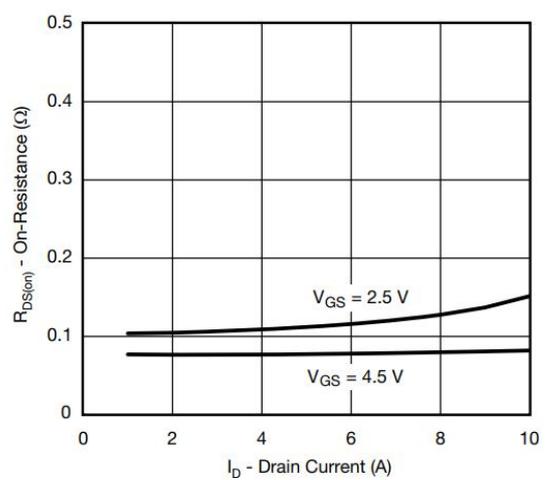
Output Characteristics



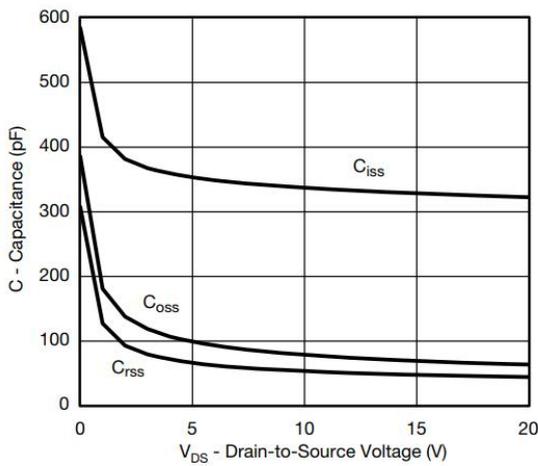
Transfer Characteristics



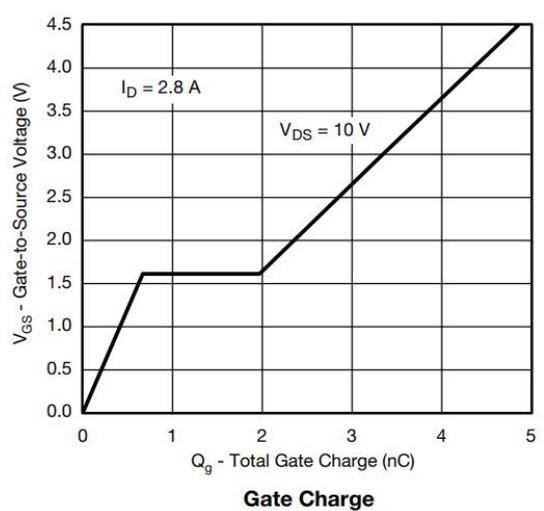
Transconductance



On-Resistance vs. Drain Current

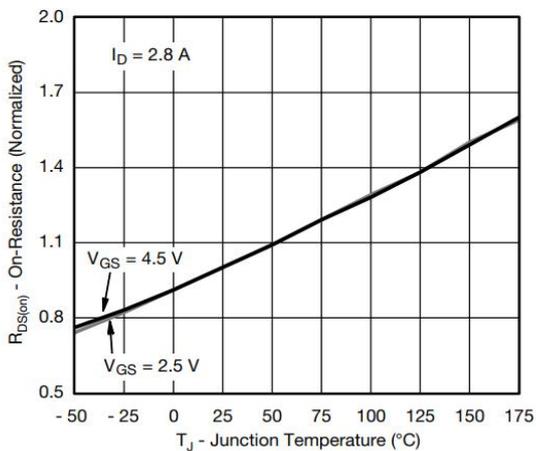


Capacitance

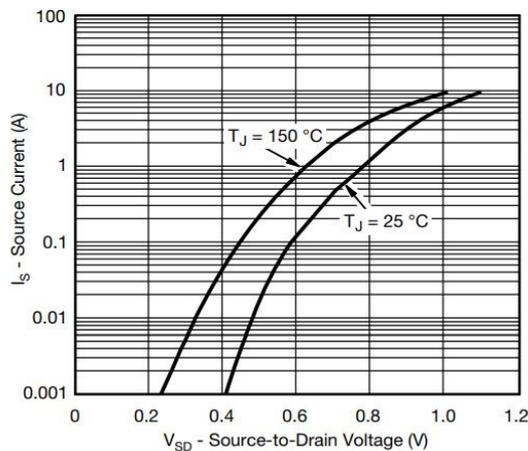


Gate Charge

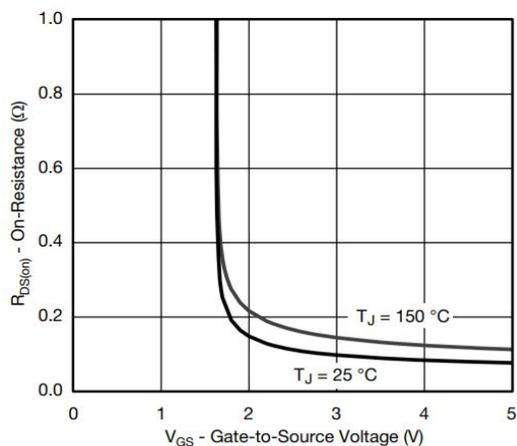
Typical Characteristics



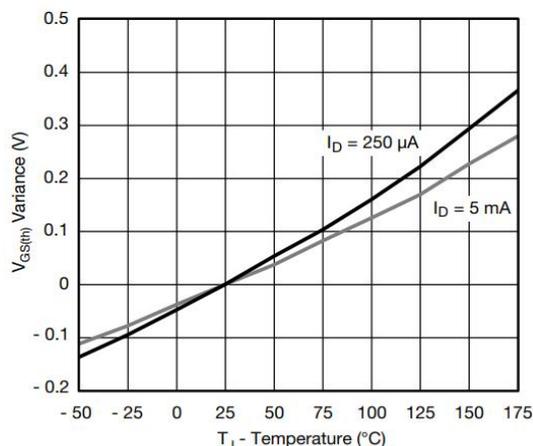
On-Resistance vs. Junction Temperature



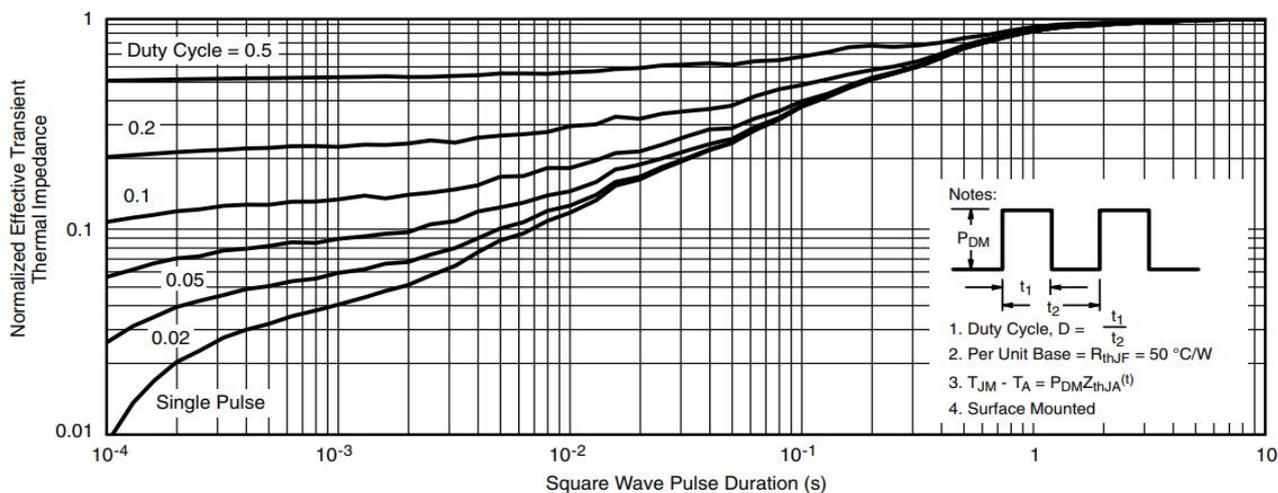
Source-Drain Diode Forward Voltage



On-Resistance vs. Gate-to-Source Voltage



Threshold Voltage

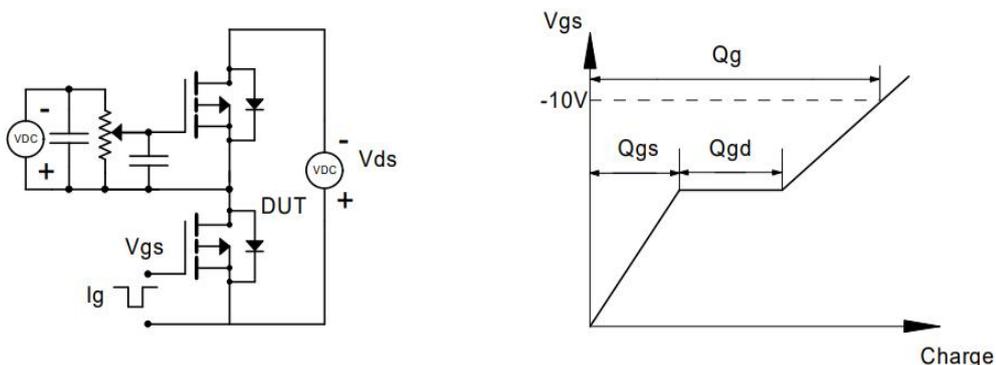


Normalized Thermal Transient Impedance, Junction-to-Foot

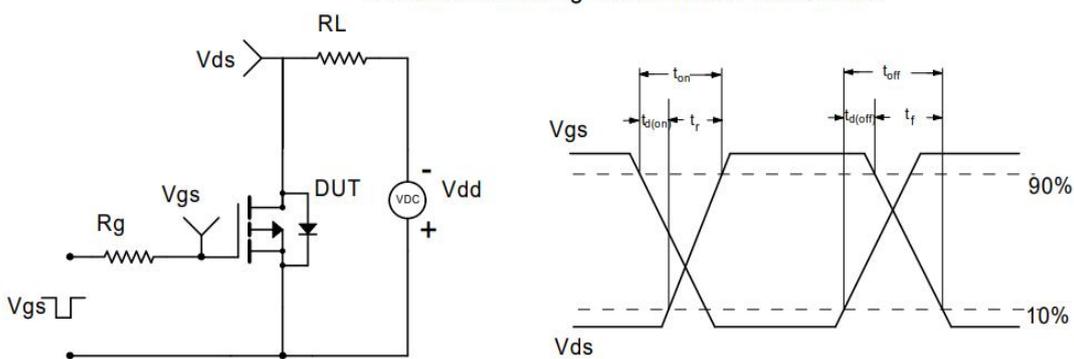
Test Circuit and Waveform

P-Channel MOSFET

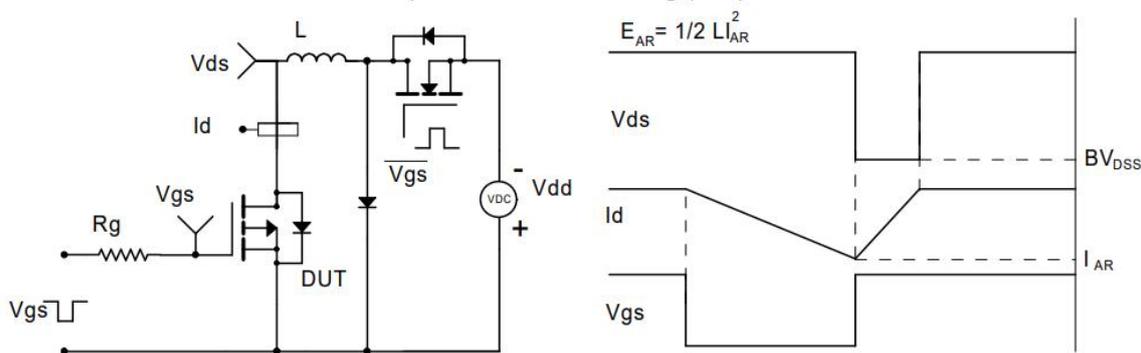
Gate Charge Test Circuit & Waveform



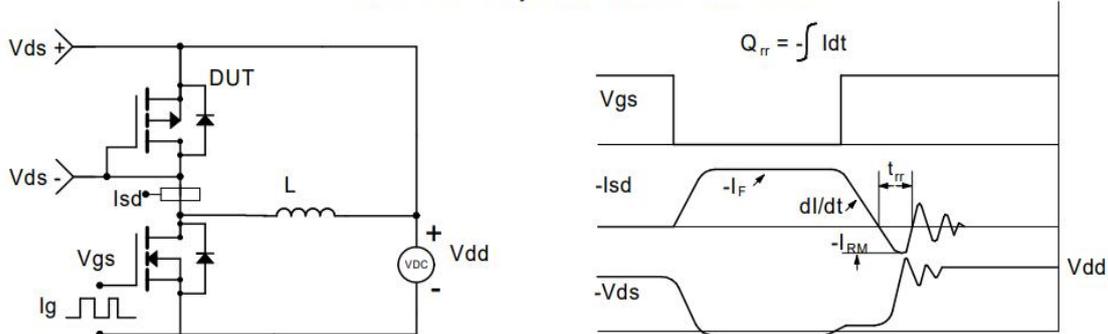
Resistive Switching Test Circuit & Waveforms



Unclamped Inductive Switching (UIS) Test Circuit & Waveforms

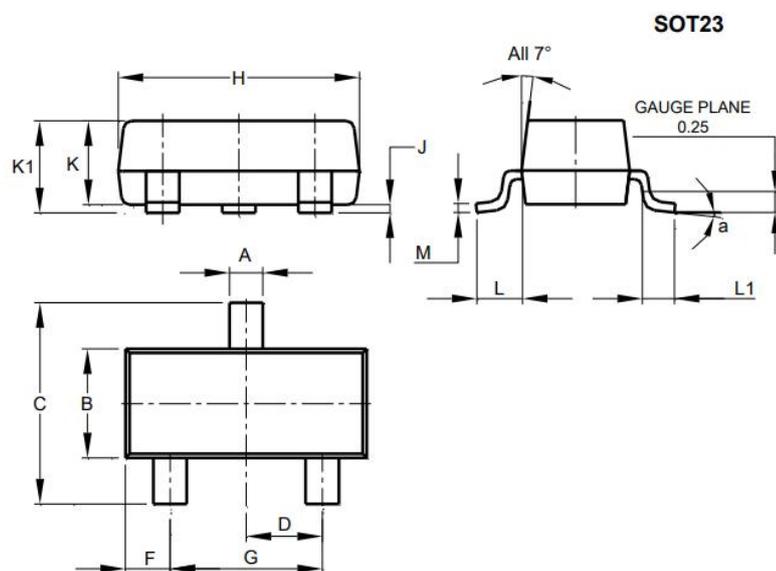


Diode Recovery Test Circuit & Waveforms



## Package Information

## P-Channel MOSFET



SOT23			
Dim	Min	Max	Typ
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	0°	8°	--
All Dimensions in mm			