

Features

- Low Gate Charge
- 100% UIS Tested, 100% R_g Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant

Applications

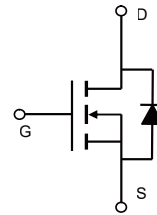
- Power Management in Computing, CE, IE 4.0, Communications
- Current Switching in DC/DC & AC/DC (SR) Sub-systems
- Load Switching, Quick/Wireless Charging, Motor Driving

Product Summary

Parameter	Value	Unit
V_{DS}	100	V
$V_{GS(th)}$ _Typ	2.0	V
I_D (@ $V_{GS} = 10V$) ⁽¹⁾	13	A
$R_{DS(ON)}$ _Typ (@ $V_{GS} = 10V$)	30	m Ω
$R_{DS(ON)}$ _Typ (@ $V_{GS} = 4.5V$)	38	m Ω



SOT-223



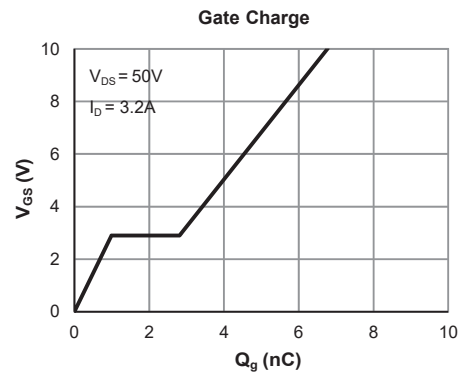
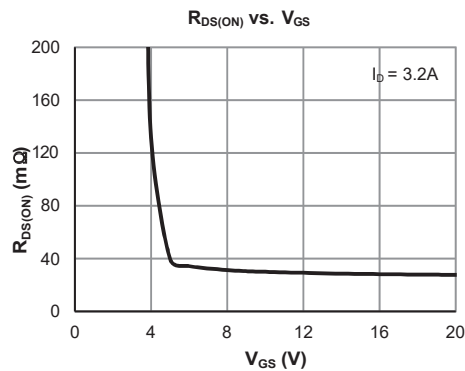
Schematic

Ordering Information

Device	Package	# of Pins	Marking	MSL	T_J (°C)	Media	Quantity (pcs)
VSM13N10-S23	SOT-223	3	VSM13N10	3	-55 to 150	13-inch Reel	4000

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	100	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ⁽¹⁾	I_D	13	A
		8.4	A
Pulsed Drain Current ⁽²⁾	I_{DM}	48	A
Avalanche Current ⁽³⁾	I_{AS}	6.5	A
Avalanche Energy ⁽³⁾	E_{AS}	21	mJ
Power Dissipation ⁽⁴⁾	P_D	13	W
		5.1	W
Junction & Storage Temperature Range	T_J, T_{STG}	-55 to 150	°C



Electrical Characteristics (@ $T_J = 25^\circ\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
STATIC PARAMETERS						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\text{V}$	100			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 80\text{V}$, $V_{GS} = 0\text{V}$ $T_J = 55^\circ\text{C}$			1.0 5.0	μA
Gate-Body Leakage Current	I_{GSS}	$V_{DS} = 0\text{V}$, $V_{GS} = \pm 20\text{V}$			± 100	nA
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	1.2	2.0	3.0	V
Static Drain-Source ON-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}$, $I_D = 3.2\text{A}$		30	39	$\text{m}\Omega$
		$V_{GS} = 4.5\text{V}$, $I_D = 2.7\text{A}$		38	50	$\text{m}\Omega$
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{V}$, $I_D = 3.2\text{A}$		11		S
Diode Forward Voltage	V_{SD}	$I_S = 1\text{A}$, $V_{GS} = 0\text{V}$		0.70	1.0	V
Diode Continuous Current	I_S	$T_C = 25^\circ\text{C}$			13	A

DYNAMIC PARAMETERS ⁽⁵⁾

Input Capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 50\text{V}$, $f = 1\text{MHz}$		363		pF
Output Capacitance	C_{oss}			85		pF
Reverse Transfer Capacitance	C_{rss}			3.0		pF
Gate Resistance	R_g	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V}$, $f = 1\text{MHz}$		2.6		Ω

SWITCHING PARAMETERS ⁽⁵⁾

Total Gate Charge (@ $V_{GS} = 10\text{V}$)	Q_g	$V_{GS} = 0$ to 10V $V_{DS} = 50\text{V}$, $I_D = 3.2\text{A}$		6.8		nC
Total Gate Charge (@ $V_{GS} = 4.5\text{V}$)	Q_g			3.7		nC
Gate Source Charge	Q_{gs}			1.0		nC
Gate Drain Charge	Q_{gd}			1.8		nC
Turn-On DelayTime	$t_{D(on)}$	$V_{GS} = 10\text{V}$, $V_{DS} = 50\text{V}$ $R_L = 15.6\ \Omega$, $R_{GEN} = 6\ \Omega$		4.9		ns
Turn-On Rise Time	t_r			16.6		ns
Turn-Off DelayTime	$t_{D(off)}$			11.2		ns
Turn-Off Fall Time	t_f			4.9		ns
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 3.2\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		33		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F = 3.2\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		45		nC

Thermal Performance

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient	R_{JA}	50	60	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Case	R_{JC}	7.5	9.8	$^\circ\text{C}/\text{W}$

Notes:

1. Computed continuous current assumes the condition of T_{J_Max} while the actual continuous current depends on the thermal & electro-mechanical application board design.
2. This single-pulse measurement was taken under $T_{J_Max} = 150^\circ\text{C}$.
3. This single-pulse measurement was taken under the following condition [$L = 100\ \mu\text{H}$, $V_{GS} = 10\text{V}$, $V_{DS} = 50\text{V}$] while its value is limited by $T_{J_Max} = 150^\circ\text{C}$.
4. The power dissipation P_D is based on $T_{J_Max} = 150^\circ\text{C}$.
5. This value is guaranteed by design hence it is not included in the production test.

Typical Electrical & Thermal Characteristics

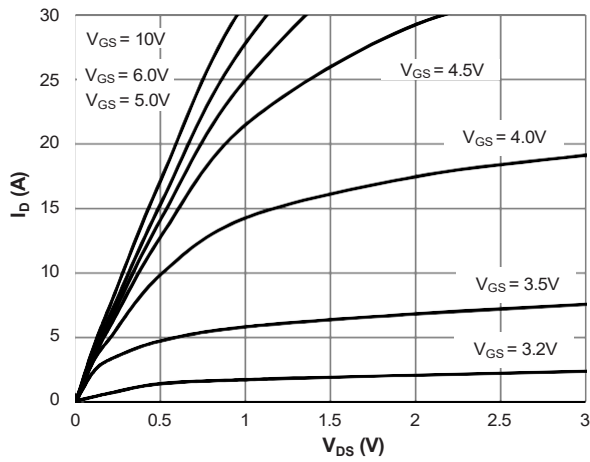


Figure 1: Saturation Characteristics

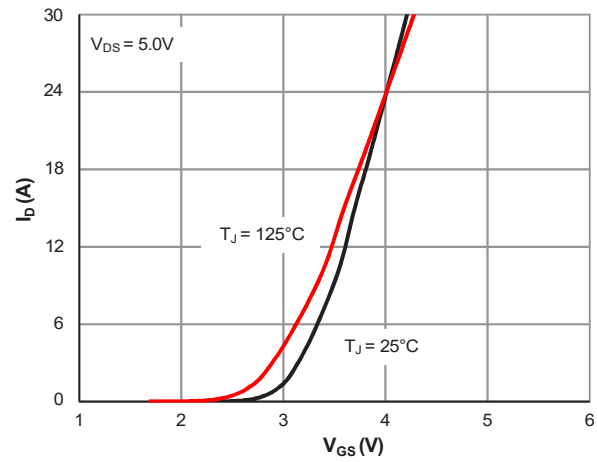


Figure 2: Transfer Characteristics

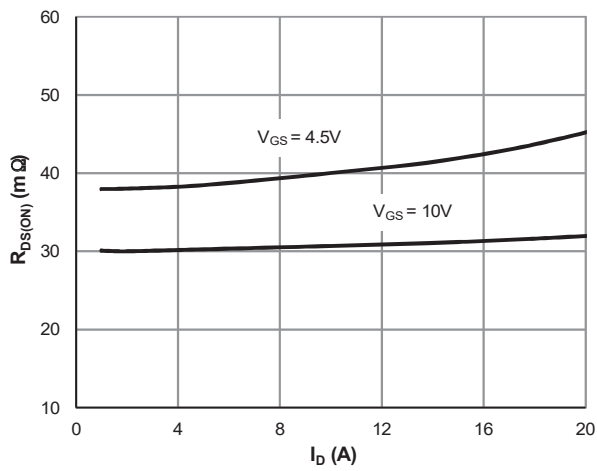


Figure 3: $R_{DS(ON)}$ vs. Drain Current

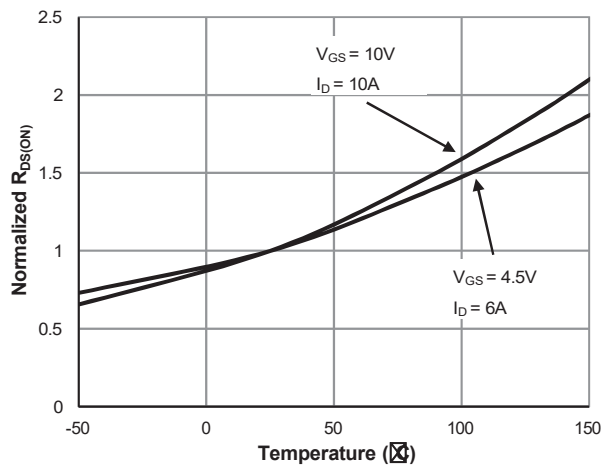


Figure 4: $R_{DS(ON)}$ vs. Junction Temperature

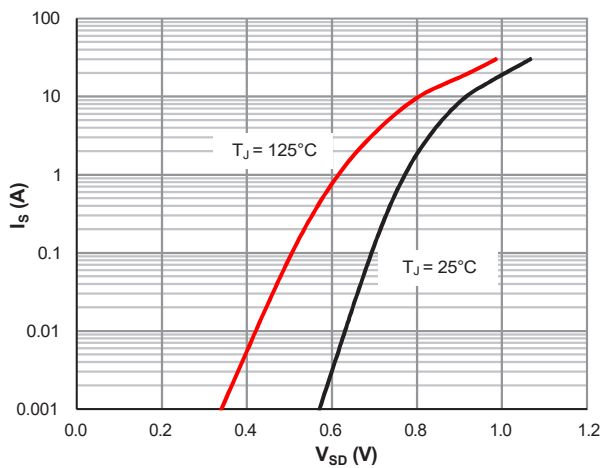


Figure 5: Body-Diode Characteristics

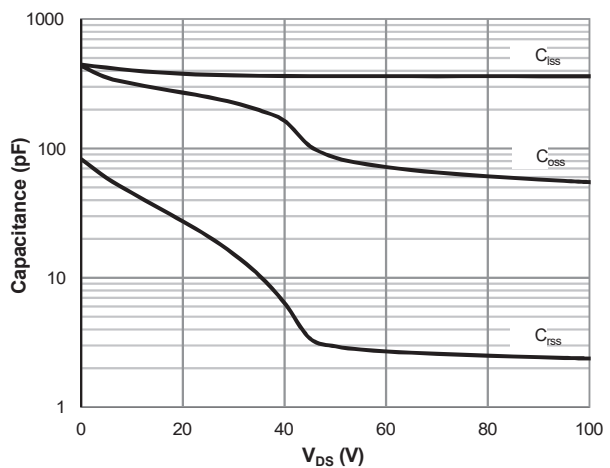


Figure 6: Capacitance Characteristics

Typical Electrical & Thermal Characteristics

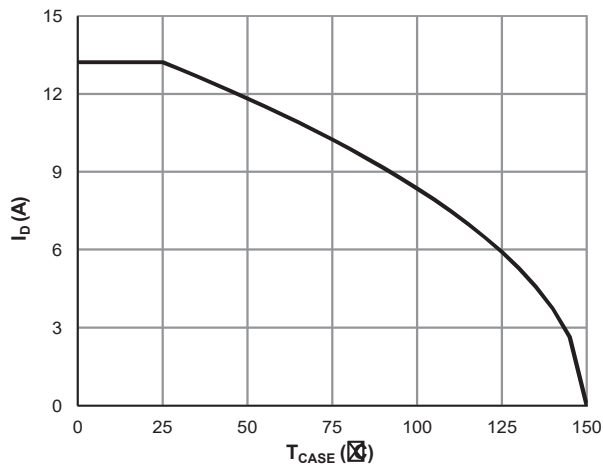


Figure 7: Current De-rating

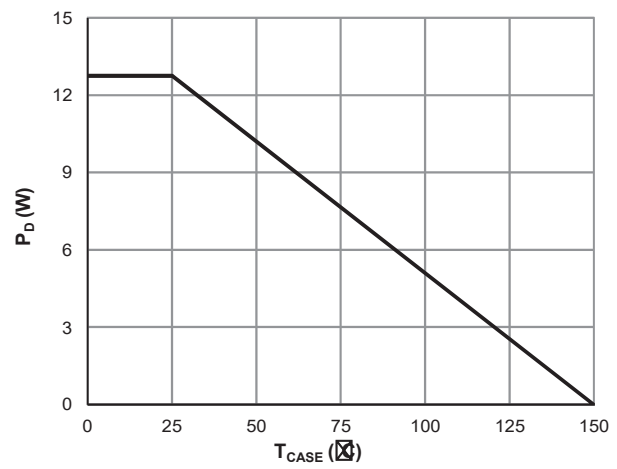


Figure 8: Power De-rating

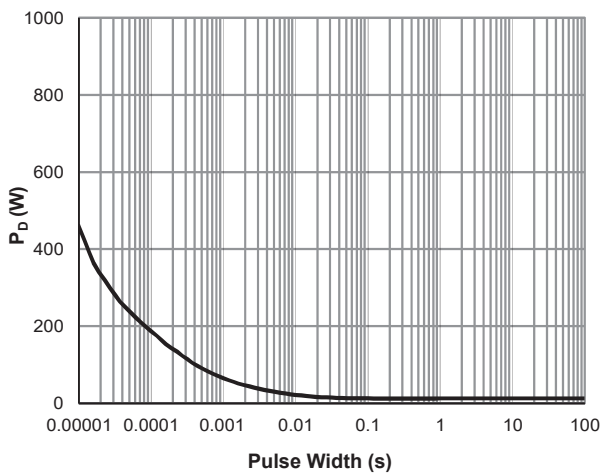
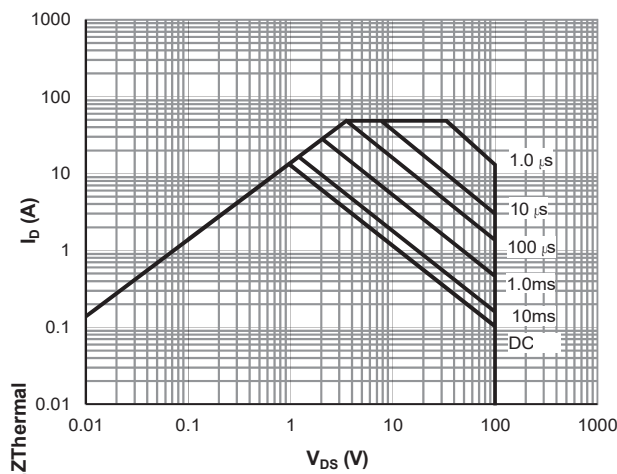


Figure 10: Single Pulse Power Rating, Junction-to-Case

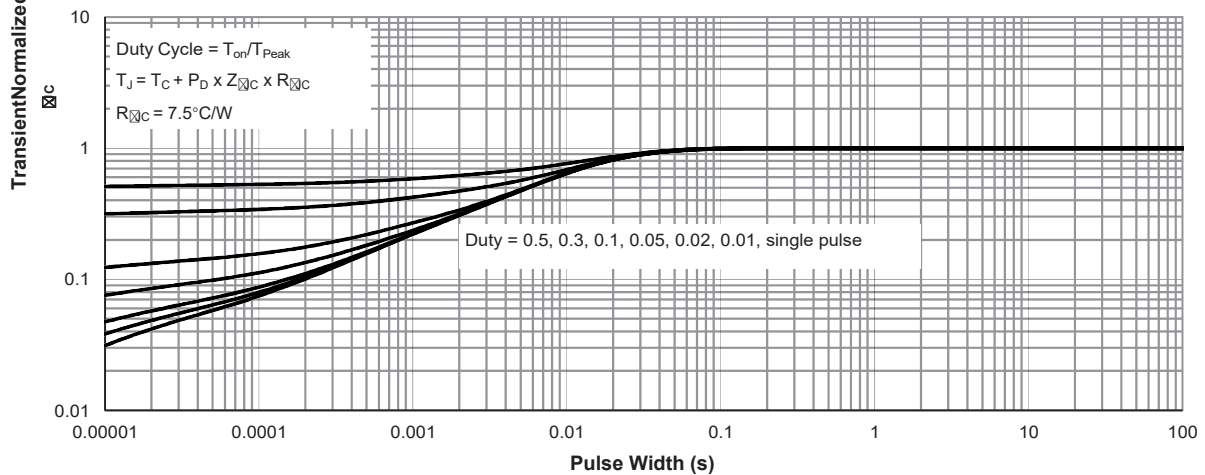


Figure 11: Normalized Maximum Transient Thermal Impedance