

Features

- Low $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested, 100% R_g Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant

Applications

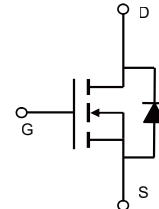
- Power Management in Computing, CE, IE 4.0, Communications
- Current Switching in DC/DC & AC/DC (SR) Sub-systems
- Load Switching, Quick/Wireless Charging, Motor Driving

Product Summary

Parameter	Value	Unit
V_{DS}	60	V
$V_{GS(th)}_{Typ}$	1.7	V
I_D (@ $V_{GS} = 10V$) ⁽¹⁾	13.6	A
$R_{DS(ON)}_{Typ}$ (@ $V_{GS} = 10V$)	7.5	m Ω
$R_{DS(ON)}_{Typ}$ (@ $V_{GS} = 4.5V$)	9.5	m Ω



SOP-8



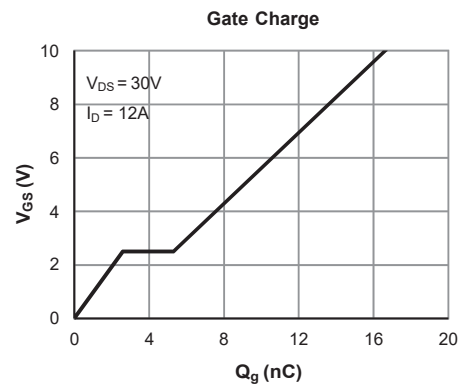
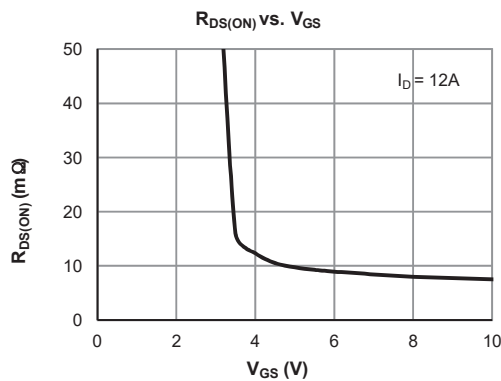
Schematic

Ordering Information

Device	Package	# of Pins	Marking	MSL	T_J (°C)	Media	Quantity (pcs)
VSM13N06-S8	SOP-8	8	VSM13N06	3	-55 to 150	13-inch Reel	2500

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	60	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ⁽¹⁾	I_D	13.6	A
		10.9	A
Pulsed Drain Current ⁽²⁾	I_{DM}	39	A
Avalanche Current ⁽³⁾	I_{AS}	26	A
Avalanche Energy ⁽³⁾	E_{AS}	34	mJ
Power Dissipation ⁽⁴⁾	P_D	3.1	W
		2.0	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	$V_{(BR)DSS}$	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\text{V}$	60			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 48\text{V}$, $V_{GS} = 0\text{V}$ $T_J = 55^\circ\text{C}$			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	1.7	2.5	V
Static Drain-Source ON-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}$, $I_D = 12\text{A}$		7.5	9.5	$\text{m}\Omega$
		$V_{GS} = 4.5\text{V}$, $I_D = 6\text{A}$		9.5	12.5	$\text{m}\Omega$
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{V}$, $I_D = 12\text{A}$		50		S
Diode Forward Voltage	V_{SD}	$I_S = 1\text{A}$, $V_{GS} = 0\text{V}$		0.72	1.0	V
Diode Continuous Current	I_S	$T_C = 25^\circ\text{C}$			3.1	A

DYNAMIC PARAMETERS ⁽⁵⁾

Input Capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 30\text{V}$, $f = 1\text{MHz}$		1083		pF
Output Capacitance	C_{oss}			349		pF
Reverse Transfer Capacitance	C_{rss}			8.5		pF
Gate Resistance	R_g	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V}$, $f = 1\text{MHz}$		1.6		Ω

SWITCHING PARAMETERS ⁽⁵⁾

Total Gate Charge (@ $V_{GS} = 10\text{V}$)	Q_g	$V_{GS} = 0$ to 10V $V_{DS} = 30\text{V}$, $I_D = 12\text{A}$		17.2		nC
Total Gate Charge (@ $V_{GS} = 4.5\text{V}$)	Q_g			8.5		nC
Gate Source Charge	Q_{gs}			2.1		nC
Gate Drain Charge	Q_{gd}			2.6		nC
Turn-On Delay Time	$t_{D(on)}$	$V_{GS} = 10\text{V}$, $V_{DS} = 30\text{V}$ $R_L = 2.5\ \Omega$, $R_{GEN} = 6\ \Omega$		4.8		ns
Turn-On Rise Time	t_r			7.0		ns
Turn-Off Delay Time	$t_{D(off)}$			21.5		ns
Turn-Off Fall Time	t_f			9.0		ns
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 12\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		26		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F = 12\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		13.5		nC

Thermal Performance

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient ($t \leq 10\text{s}$)	R_{JA}	30	40	$^\circ\text{C}/\text{W}$
Thermal Resistance, Junction-to-Ambient (steady state)	R_{JA}	60	70	$^\circ\text{C}/\text{W}$

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 [$L = 100\ \mu\text{H}$, $V_{GS} = 10\text{V}$, $V_{DS} = 30\text{V}$] 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

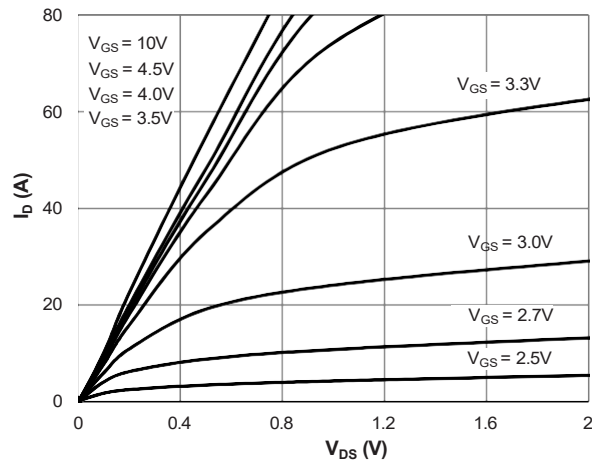


Figure 1: Saturation Characteristics

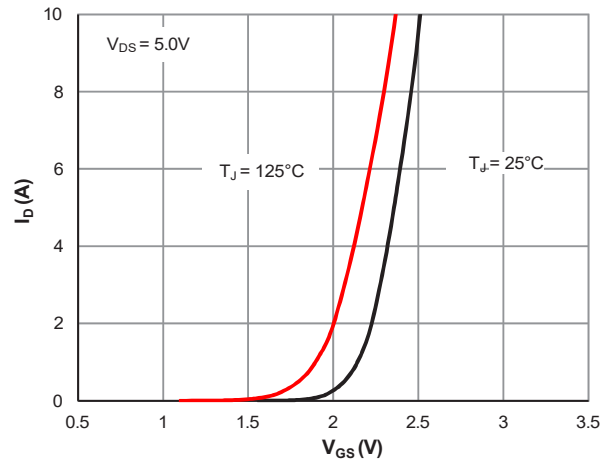


Figure 2: Transfer Characteristics

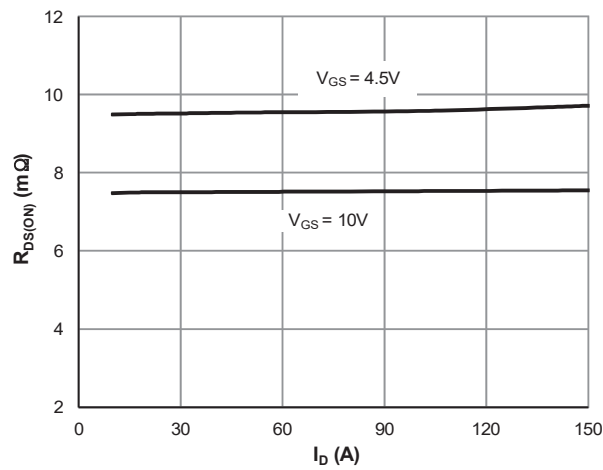


Figure 3: $R_{DS(ON)}$ vs. Drain Current

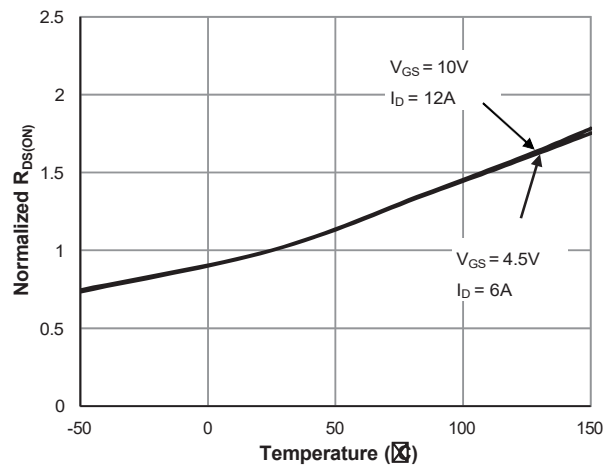


Figure 4: $R_{DS(ON)}$ vs. Junction Temperature

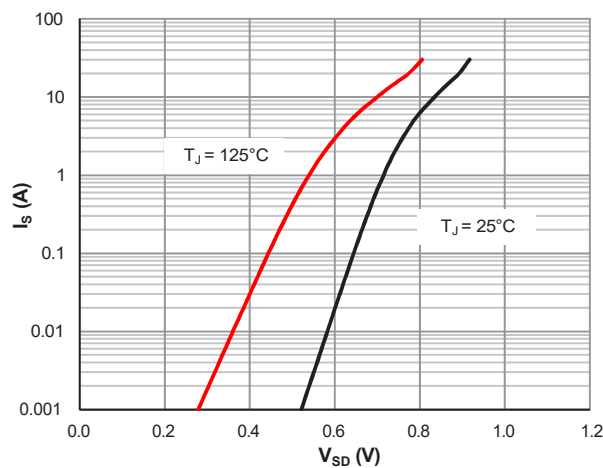


Figure 5: Body-Diode Characteristics

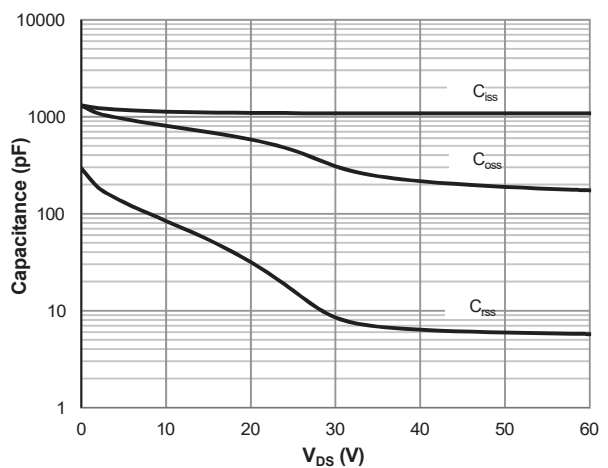


Figure 6: Capacitance Characteristics

Typical Electrical & Thermal Characteristics

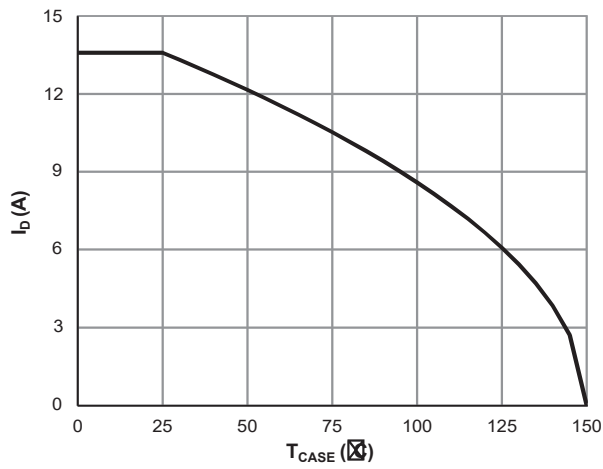


Figure 7: Current De-rating

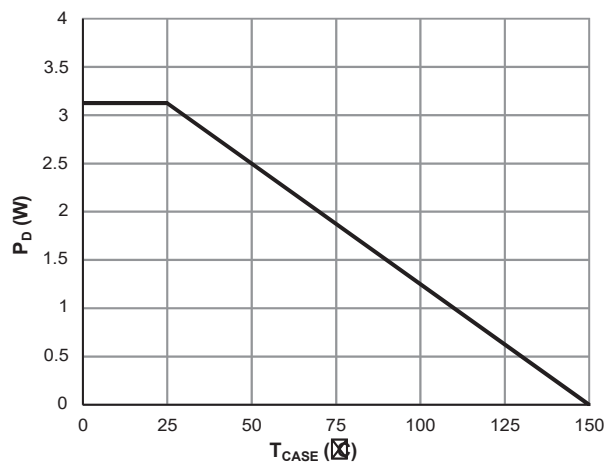


Figure 8: Power De-rating

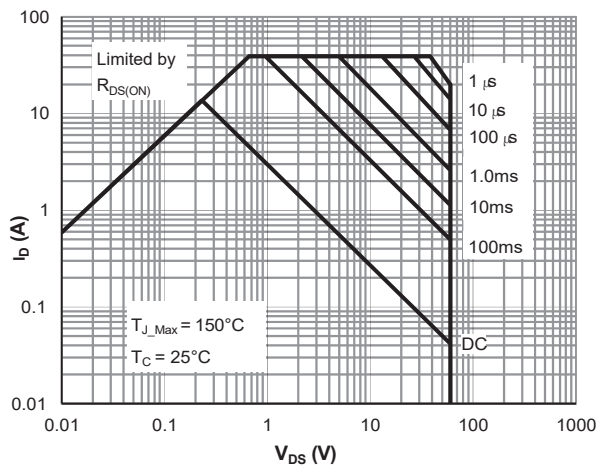


Figure 9: Maximum Safe Operating Area

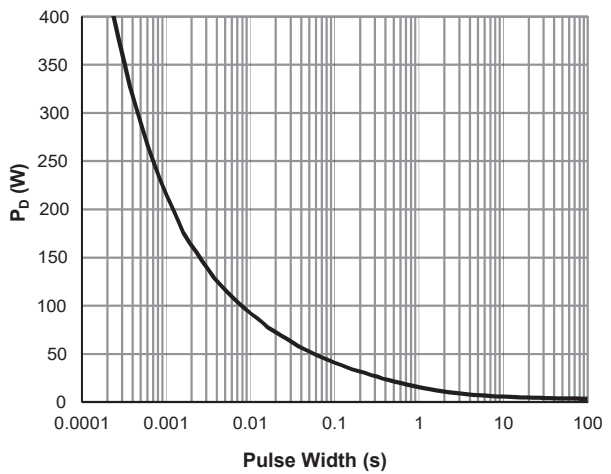


Figure 10: Single Pulse Power Rating, Junction-to-Case

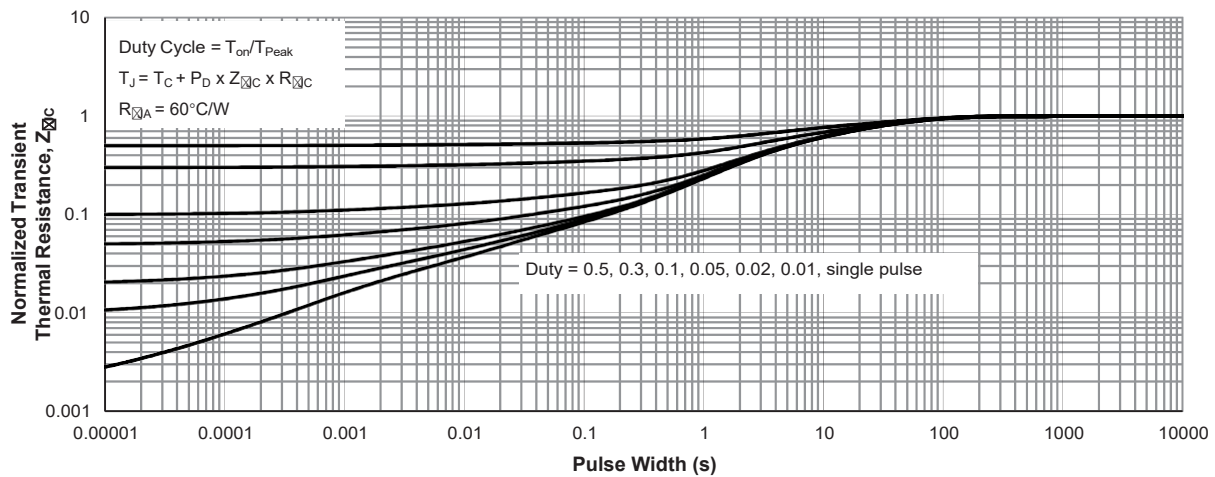


Figure 11: Normalized Maximum Transient Thermal Impedance