Features

- Ultra-low $R_{DS(ON)}$
- LowLowGateGateCChhaarrggee
- 100% UIS Tested, 100% R_g Tested
- PPb-freeb-freeLLeadeadPPlalatitningg
- Halogen-freeHalogen-freeandandRoHS-RoHS-ccoommpplilaiianntt

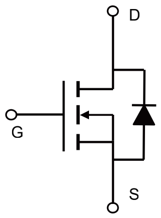
Product Summary

Parameter	Value	Unit
V_{DS}	100	V
$V_{GS(th)\_Typ}$	3.0	V
I_D (@ V_{GS} = 10V) (1)	113	A
$R_{DS(ON)\_Typ}$ (@ V_{GS} = 10V)	6.3	mΩ

Applications

- PowerMotorDManagementrivinginPoweinrComputing,Tool,E-vehicCE,le,RIEob4.0,oticCsommunications
- CurrentSwitchingSwitch/DC&DC-DC(SR)Sub-ssyysstteemmss
- LoadPowerSwitching,ManagementQuick/WirelessinTelecom.,Charging,IndustrialMotorAutomation,DrivingCE

TO-220



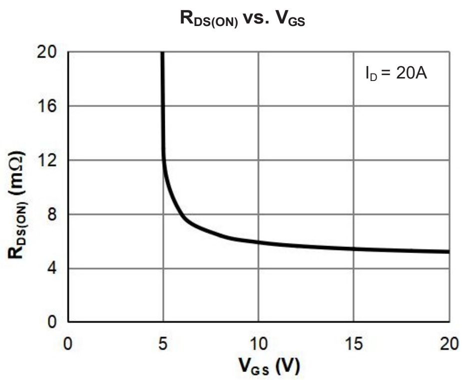
Schematic

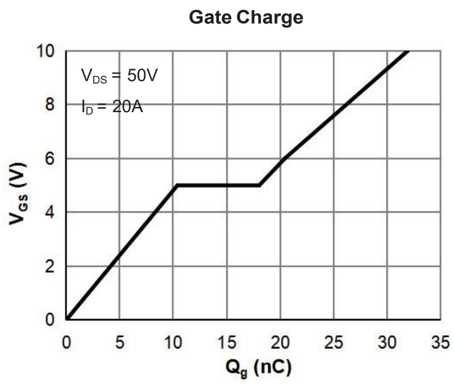
Ordering Information

Device	Package	# of Pins	Marking	MSL	T_J (°C)	Media	Quantity (pcs)
VSM113N10-TC	TO-220	3	VSM113N10	3	-55 to 150	13-inch Reel	800

Absolute Maximum Ratings (@ T_A = 25°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)	T_C = 25°C	I_D	113	A
	T_C = 100°C		71	
Pulsed Drain Current (2)		I_{DM}	452	A
Avalanche Energy (3)		E_{AS}	216	mJ
Power Dissipation (4)	T_C = 25°C	P_D	227	W
	T_C = 100°C		90	
Junction & Storage Temperature Range		T_J, T_{STG}	-55 to 150	°C





Electrical Characteristics (@ T_J = 25°C unless otherwise specified)

Parameter	Symbol	Conditions		Min.	Typ.	Max.	Unit
STATIC PARAMETERS							
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	I_D = 250 μA, V_{GS} = 0V		100			V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 80V, V_{GS} = 0V				1.0	μA
			T_J = 55°C			5.0	
Gate-Body Leakage Current	I_{GSS}	V_{DS} = 0V, V_{GS} = ±20V				±100	nA
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 μA		2.0	3.0	4.0	V
Static Drain-Source ON-Resistance	$R_{DS(ON)}$	V_{GS} = 10V, I_D = 20A	TO-220-3L		6.3	8.0	mΩ
		V_{GS} = 10V, I_D = 20A	TO-263-3L		6.1	8.0	mΩ
Forward Transconductance	g_{FS}	V_{DS} = 5V, I_D = 20A			28		S
Diode Forward Voltage	V_{SD}	I_S = 1A, V_{GS} = 0V			0.70	1.0	V
Diode Continuous Current	I_S	T_C = 25°C				113	A
DYNAMIC PARAMETERS (5)							
Input Capacitance	C_{iss}	V_{GS} = 0V, V_{DS} = 50V, f = 1MHz			1998		pF
Output Capacitance	C_{oss}				777		pF
Reverse Transfer Capacitance	C_{rss}				20		pF
Gate Resistance	R_g	V_{GS} = 0V, V_{DS}= 0V, f = 1MHz			2.1		Ω
SWITCHING PARAMETERS (5)							
Total Gate Charge (@ V_{GS} = 10V)	Q_g	V_{GS} = 0 to 10V V_{DS} = 50V, I_D = 20A			32		nC
Total Gate Charge (@ V_{GS} = 6V)	Q_g				20		nC
Gate Source Charge	Q_{gs}				10		nC
Gate Drain Charge	Q_{gd}				8		nC
Turn-On DelayTime	$t_{D(on)}$	V_{GS} = 10V, V_{DS} = 50V R_L = 2.5Ω, R_{GEN} = 3Ω			13		ns
Turn-On Rise Time	t_r				21		ns
Turn-Off DelayTime	$t_{D(off)}$				54		ns
Turn-Off Fall Time	t_f				24		ns
Body Diode Reverse Recovery Time	t_{rr}	I_F = 15A, dI_F/dt = 100A/μS			47		ns
Body Diode Reverse Recovery Charge	Q_{rr}	I_F = 15A, dI_F/dt = 100A/μS			62		nC

Thermal Performance

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient	$R_{\theta JA}$	45	55	°C/W
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	0.48	0.55	°C/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°C.
3. E_{AS} of 216 mJ is based on starting T_J = 25°C, L = 3.0mH, I_{AS} = 12A, V_{GS} = 10V, V_{DD} = 50V; 100% test at L = 0.1mH, I_{AS} =42A.
4. The power dissipation P_D is based on T_{J_Max} = 150°C.
5. This value is guaranteed by design hence it is not included in the production test.

Typical Electrical & Thermal Characteristics

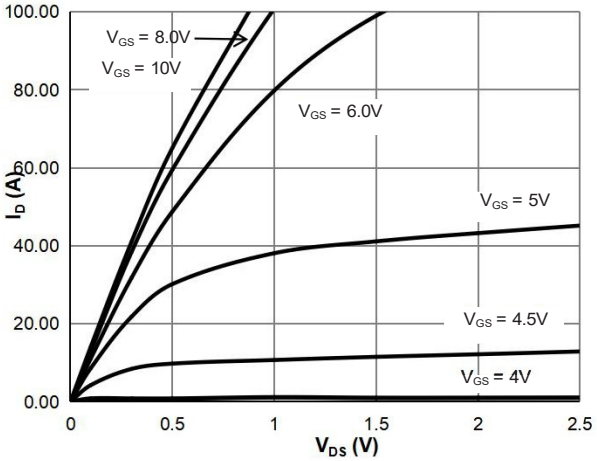


Figure 1: Saturation Characteristics

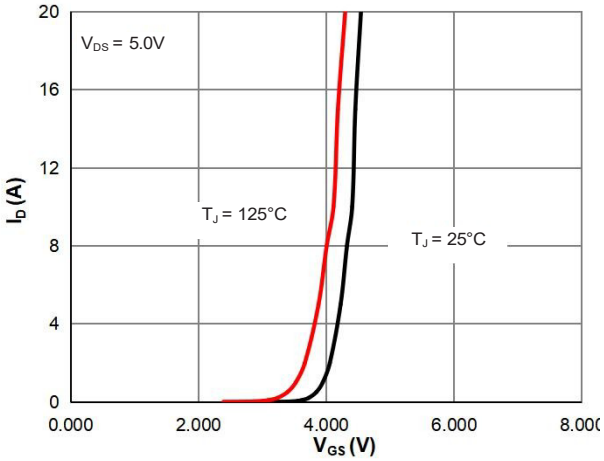


Figure 2: Transfer Characteristics

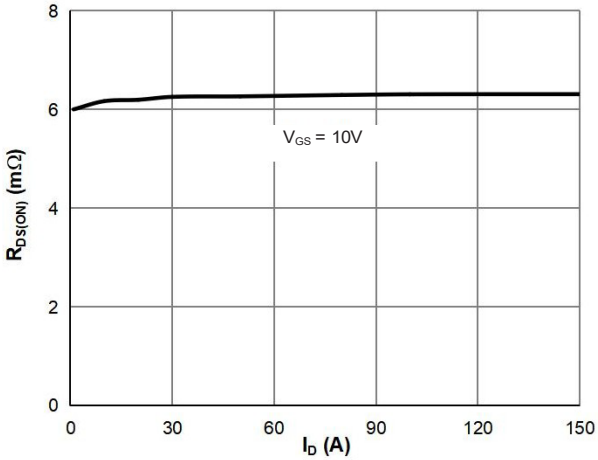


Figure 3: $R_{DS(ON)}$ vs. Drain Current

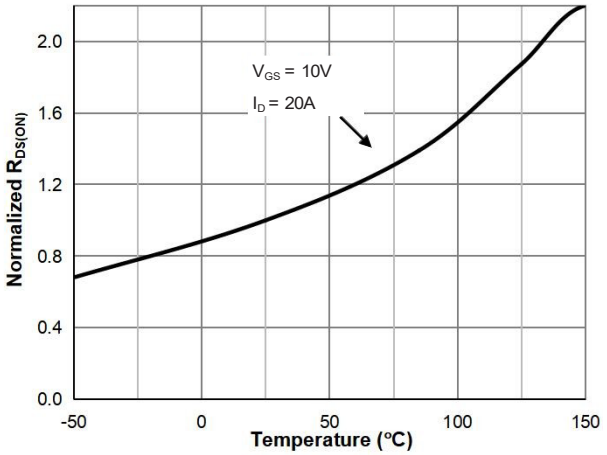


Figure 4: $R_{DS(ON)}$ vs. Junction Temperature

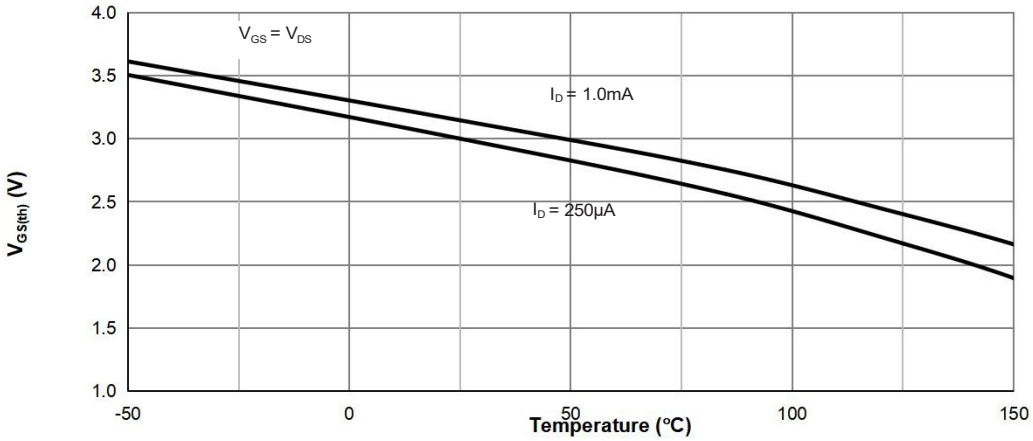


Figure 5: $V_{GS(th)}$ vs. Junction Temperature

Typical Electrical & Thermal Characteristics

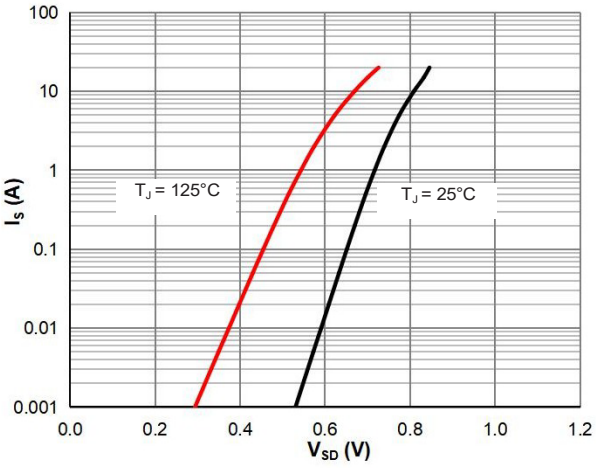


Figure 7: Body-Diode Characteristics

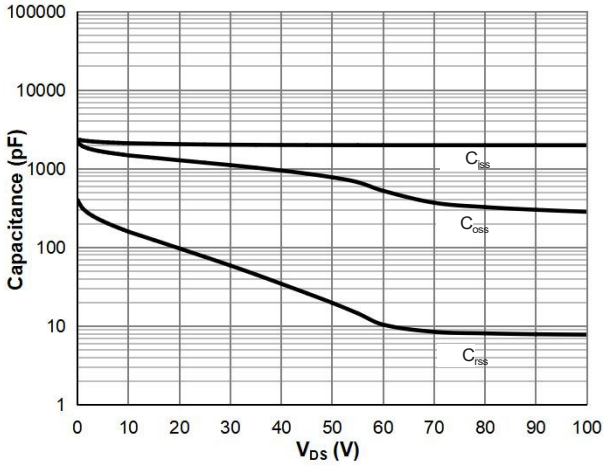


Figure 8: Capacitance Characteristics

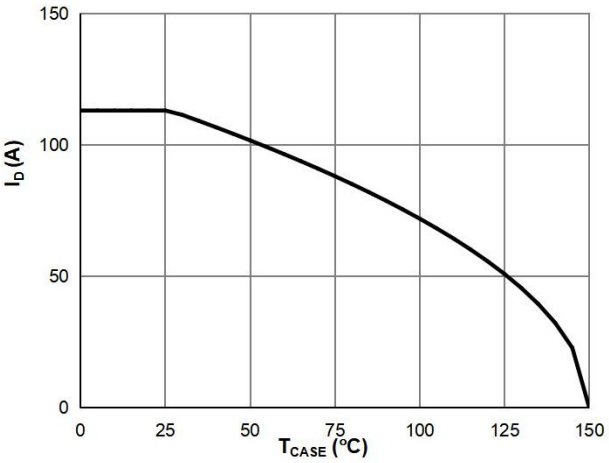


Figure 9: Current De-rating

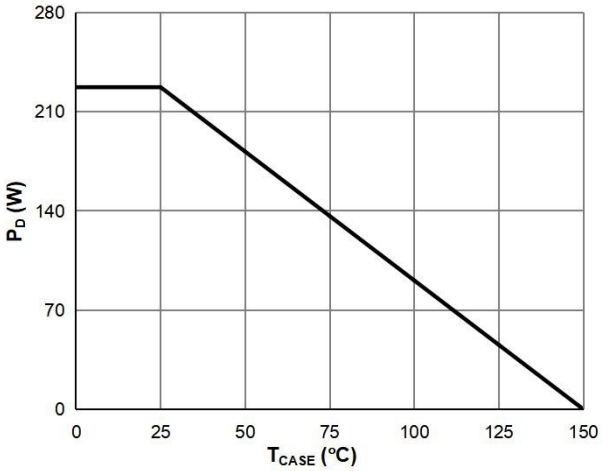


Figure 10: Power De-rating

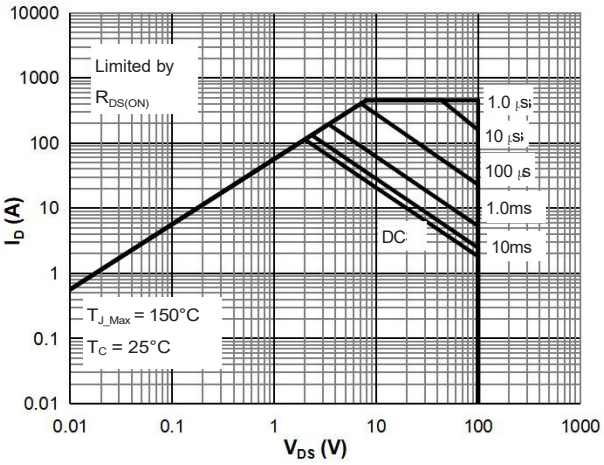


Figure 11: Maximum Safe Operating Area

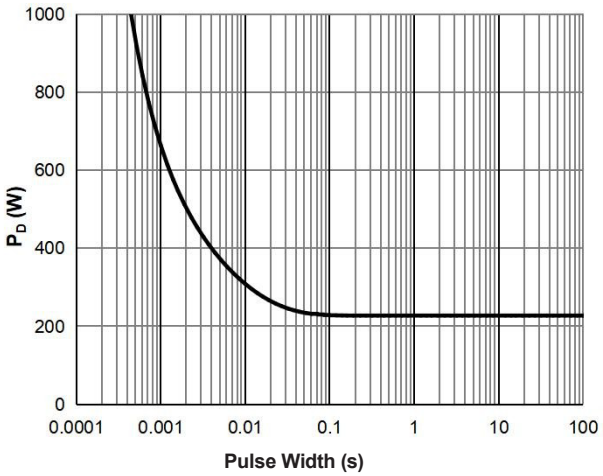


Figure 12: Single Pulse Power Rating, Junction-to-Case

Typical Electrical & Thermal Characteristics

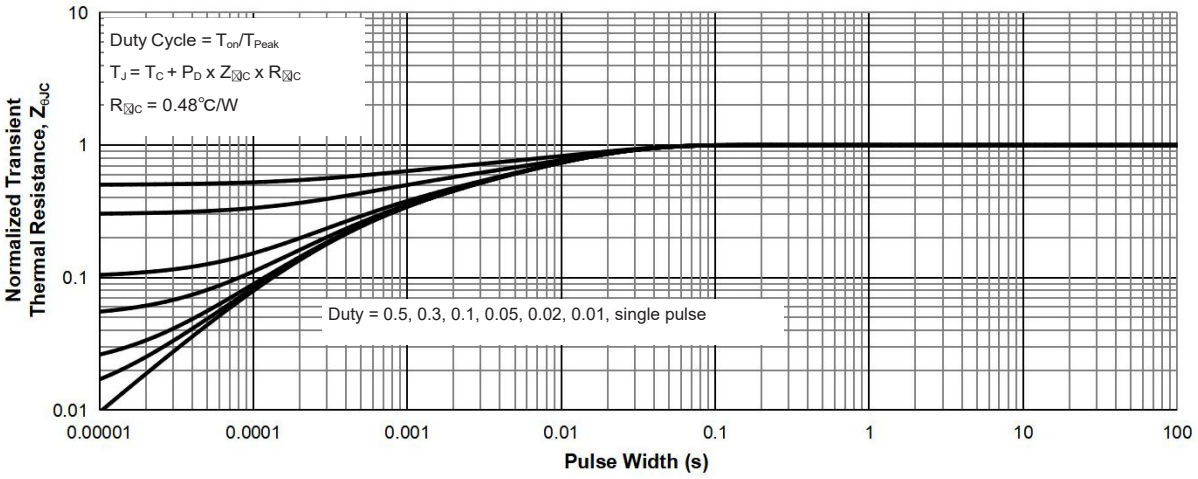


Figure 13: Normalized Maximum Transient Thermal Impedance