

Features

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

Applications

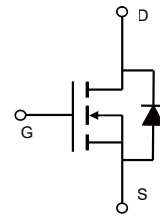
- Power Management in Computing, CE, IE 4.0, Communications
- Current Switching in DC/DC & AC/DC (SR) Sub-systems
- Load Switching, Quick/Wireless Charging, Motor Driving

Product Summary

Parameter	Value	Unit
V_{DS}	200	V
$V_{GS(th)}_{Typ}$	3.3	V
I_D (@ $V_{GS} = 10V$) ⁽¹⁾	129	A
$R_{DS(ON)}_{Typ}$ (@ $V_{GS} = 10V$)	9.1	mΩ



TO-220



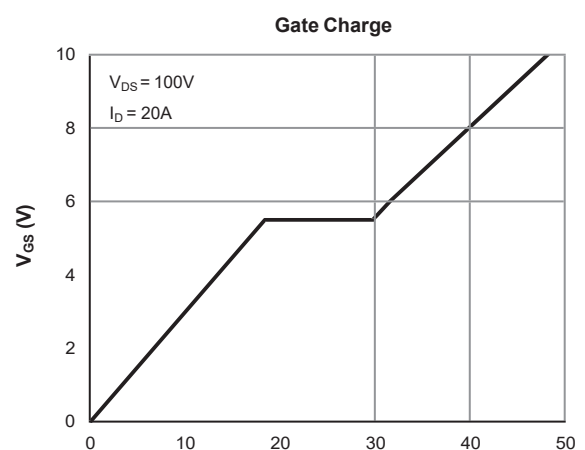
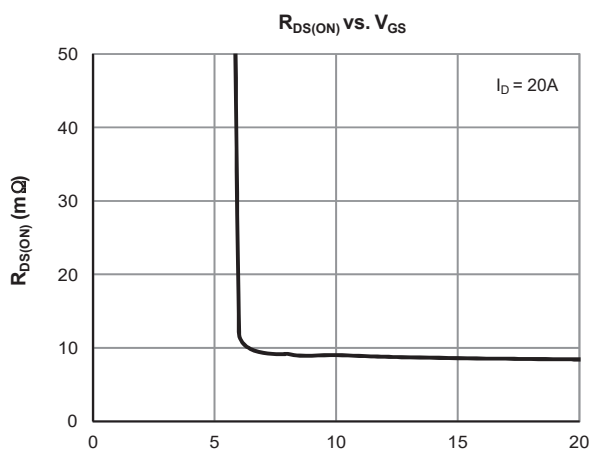
Schematic

Ordering Information

Device	Package	# of Pins	Marking	MSL	T_J (°C)	Media	Quantity (pcs)
VSM129N20-TC	TO-220	3	VSM129N20	NA	-55 to 175	Tube	50

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	200	V
Gate-to-Source Voltage	V_{GS}	±20	V
Continuous Drain Current ⁽¹⁾	I_D	129	A
		91	
Pulsed Drain Current ⁽²⁾	I_{DM}	517	A
Avalanche Current ⁽³⁾	I_{AS}	41	A
Avalanche Energy ⁽³⁾	E_{AS}	841	mJ
Power Dissipation ⁽⁴⁾	P_D	500	W
		250	
Junction & Storage Temperature Range	T_J, T_{STG}	-55 to 175	°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	$V_{(BR)DSS}$	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\text{V}$	200			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 160\text{V}$, $V_{GS} = 0\text{V}$ $T_J = 55^\circ\text{C}$			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	$V_{GS(th)}$	$V_{DS} = V_{GS}$, $I_D = 250\ \mu\text{A}$	2.5	3.3	4.5	V
Static Drain-Source ON-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}$, $I_D = 20\text{A}$ TO-263-3L TO-220-3L		9.1 9.4	10.7 10.9	m Ω m Ω
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{V}$, $I_D = 20\text{A}$		55		S
Diode Forward Voltage	V_{SD}	$I_S = 1\text{A}$, $V_{GS} = 0\text{V}$		0.67	1.0	V
Diode Continuous Current	I_S	$T_C = 25^\circ\text{C}$			129	A

DYNAMIC PARAMETERS ⁽⁶⁾

Input Capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 100\text{V}$, $f = 1\text{MHz}$		3318		pF
Output Capacitance	C_{oss}			436		pF
Reverse Transfer Capacitance	C_{rss}			41		pF
Gate Resistance	R_g	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V}$, $f = 1\text{MHz}$		3.4		Ω

SWITCHING PARAMETERS ⁽⁶⁾

Total Gate Charge (@ $V_{GS} = 10\text{V}$)	Q_g	$V_{GS} = 0$ to 10V $V_{DS} = 100\text{V}$, $I_D = 20\text{A}$		48		nC
Total Gate Charge (@ $V_{GS} = 6.0\text{V}$)	Q_g			32		nC
Gate Source Charge	Q_{gs}			18.3		nC
Gate Drain Charge	Q_{gd}			11.3		nC
Turn-On DelayTime	$t_{D(on)}$	$V_{GS} = 10\text{V}$, $V_{DS} = 100\text{V}$ $R_L = 5.0\ \Omega$, $R_{GEN} = 6\ \Omega$		18.3		Quantity (pcs)
Turn-On Rise Time	t_r			27		ns
Turn-Off DelayTime	$t_{D(off)}$			38		800
Turn-Off Fall Time	t_f			19.4		ns
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 15\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		130		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F = 15\text{A}$, $dI_F/dt = 100\text{A}/\mu\text{s}$		667		nC

Thermal Performance

Parameter	Symbol	Typ.	Max.	Unit
Thermal Resistance, Junction-to-Ambient	R_{JA}	50	60	$^\circ\text{C/W}$
Thermal Resistance, Junction-to-Case	R_{JC}	0.30	0.36	$^\circ\text{C/W}$

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 $T_{J_Max} = 175^\circ\text{C}$.
3. This single-pulse measurement was taken under the following condition [$L = 1\text{mH}$, $V_{GS} = 10\text{V}$, $V_{DD} = 100\text{V}$] while its value is limited by $T_{J_Max} = 175^\circ\text{C}$.
4. The power dissipation P_D is based on $T_{J_Max} = 175^\circ\text{C}$.
5. This value is guaranteed by design hence it is not included in the production test.

Typical Electrical & Thermal Characteristics

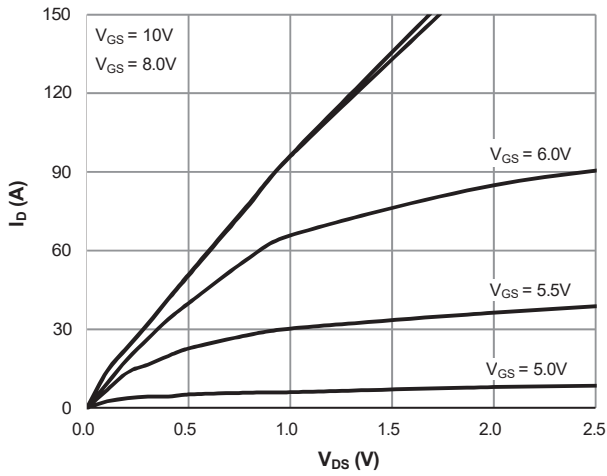


Figure 1: Saturation Characteristics

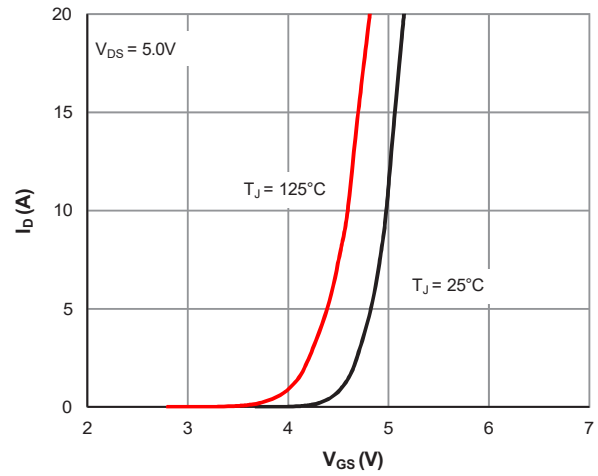


Figure 2: Transfer Characteristics

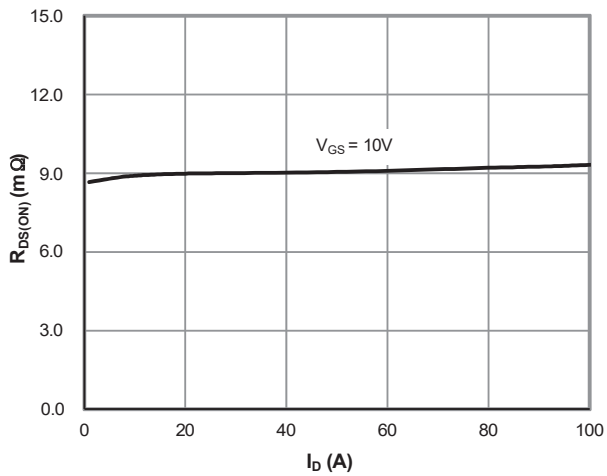


Figure 3: $R_{DS(ON)}$ vs. Drain Current

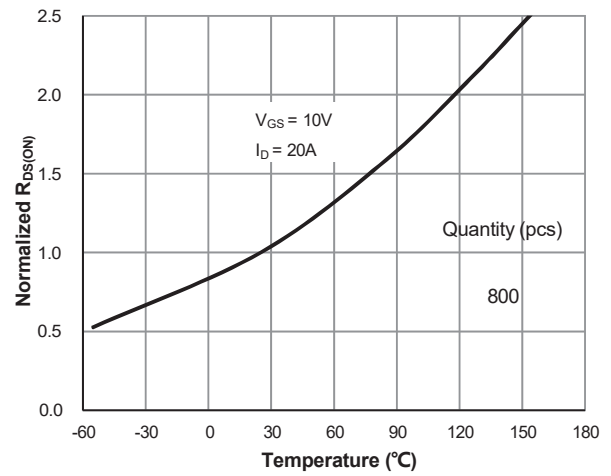


Figure 4: $R_{DS(ON)}$ vs. Junction Temperature

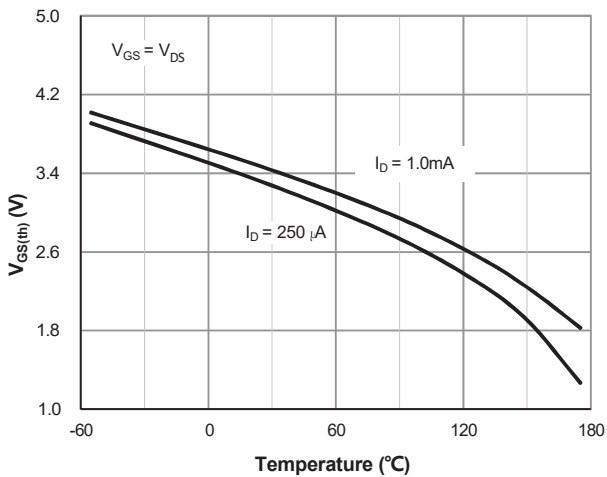


Figure 5: $V_{GS(th)}$ vs. Junction Temperature

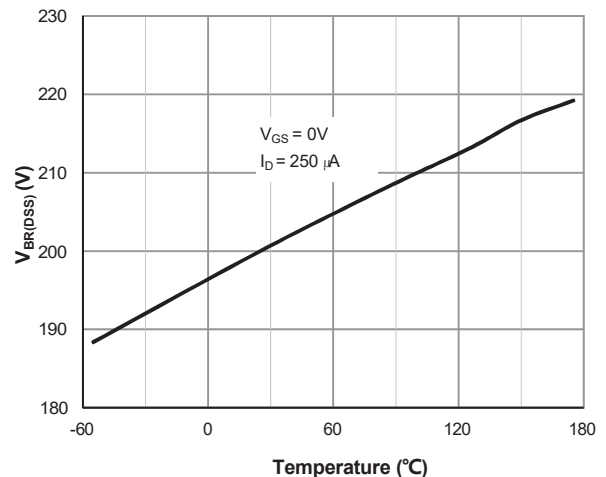


Figure 6: $V_{BR(DSS)}$ vs. Junction Temperature

Typical Electrical & Thermal Characteristics

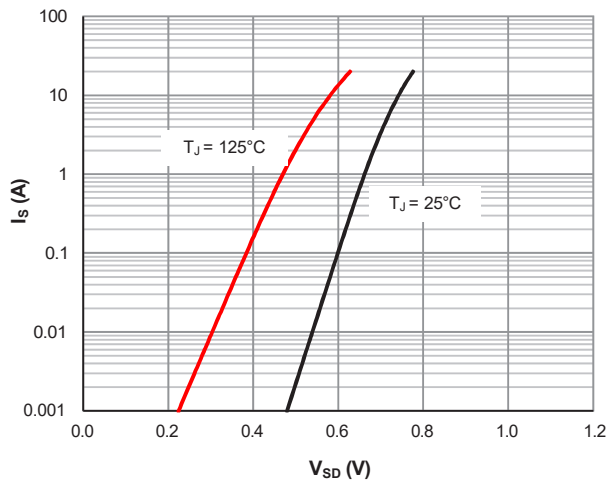


Figure 7: Body-Diode Characteristics

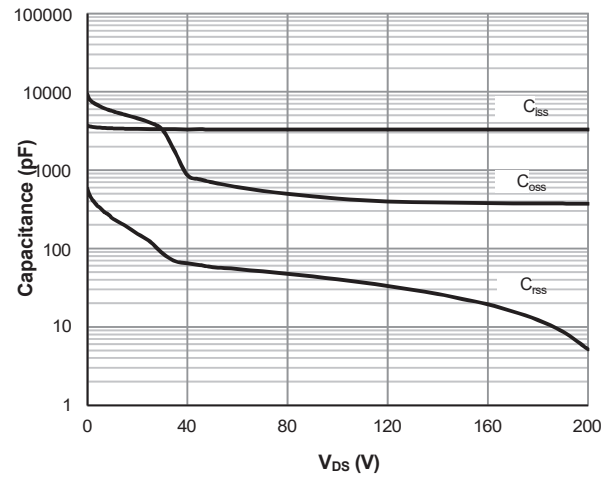


Figure 8: Capacitance Characteristics

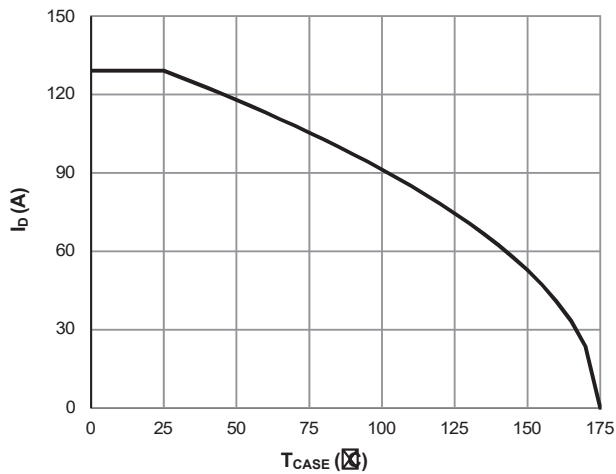


Figure 9: Current De-rating

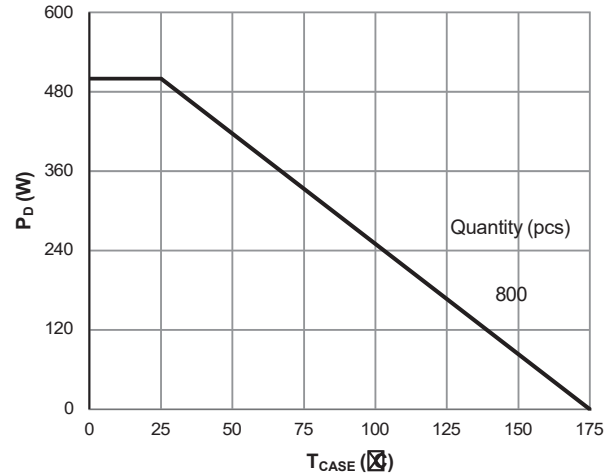


Figure 10: Power De-rating

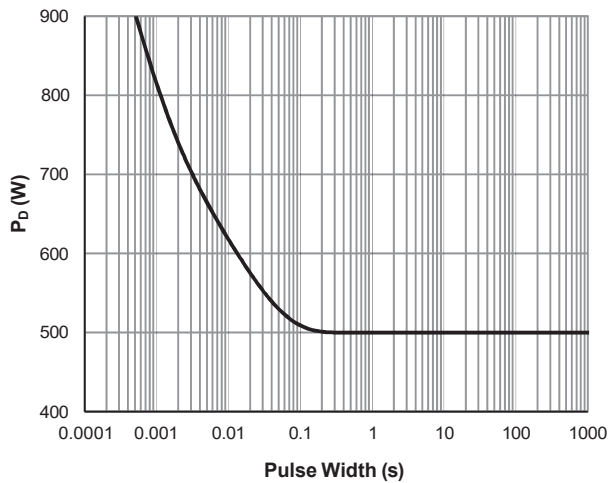


Figure 11: Single Pulse Power Rating, Junction-to-Case

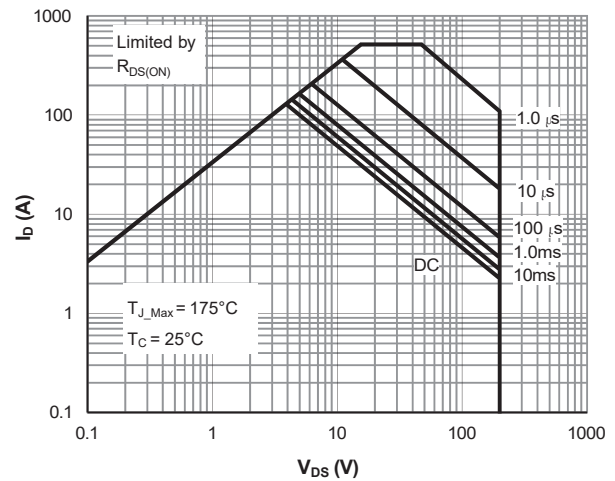


Figure 12: Maximum Safe Operating Area

Typical Electrical & Thermal Characteristics

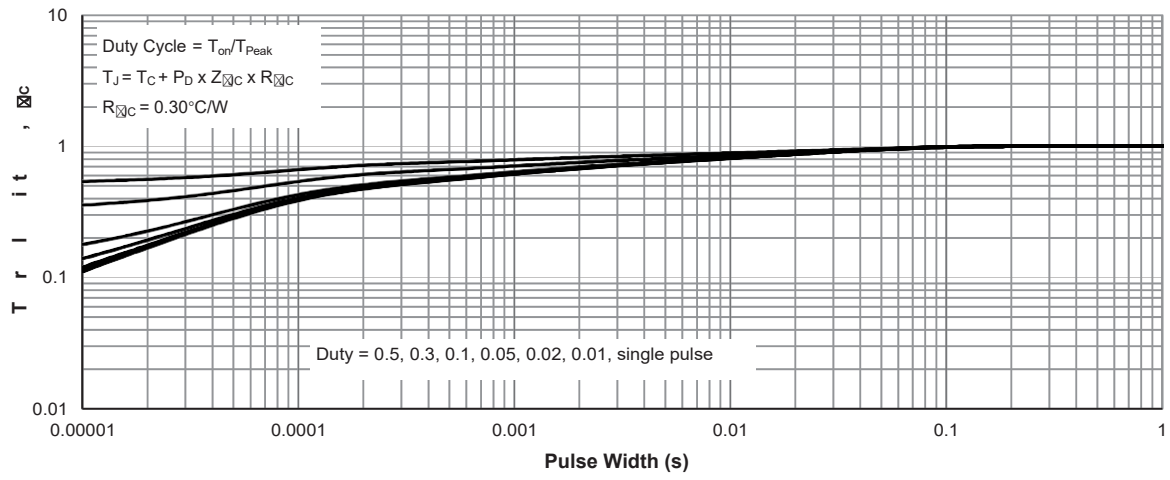


Figure 13: Normalized Maximum Transient Thermal Impedance

Quantity (pcs)

800