

Features

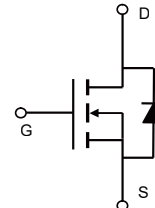
- Ultra-low $R_{DS(ON)}$
- Low Gate Charge
- 100% UIS Tested, 100% R_g Tested
- Pb-free Lead Plating
- Halogen-free and RoHS-compliant

Applications

- Power Management in Telecom., Industrial Automation, CE
- Current Switching in DC/DC & AC/DC Sub-systems
- Motor Driving in Power Tool, E-vehicle, Robotics

Product Summary

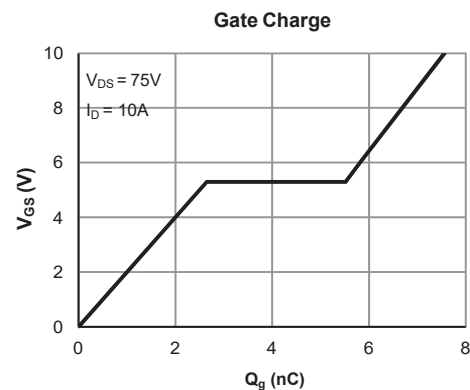
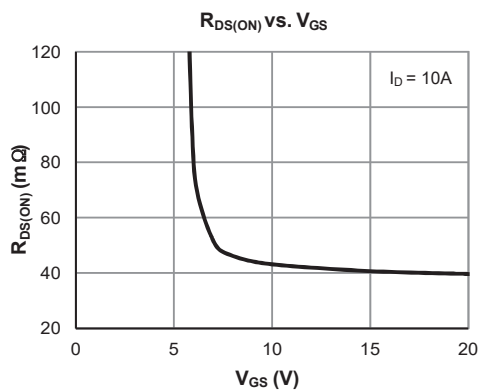
Parameter	Value	Unit
V_{DS}	150	V
$V_{GS(th_Typ)}$	3.2	V
I_D (@ $V_{GS} = 10V$) ⁽¹⁾	20	A
$R_{DS(ON_Typ)}$ (@ $V_{GS} = 10V$)	43	m Ω


DFN5x6

Schematic
Ordering Information

Device	Package	# of Pins	Marking	MSL	T_J (°C)	Media	Quantity (pcs)
VSM20N15-D56	DFN5x6	8	VSM20N15	1	-55 to 150	13-Inch Reel	5000

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

Parameter	Symbol	Value	Unit
Drain-to-Source Voltage	V_{DS}	150	V
Gate-to-Source Voltage	V_{GS}	± 20	V
Continuous Drain Current ⁽¹⁾	I_D	20	A
$T_C = 25^\circ\text{C}$		12	
$T_C = 100^\circ\text{C}$			
Pulsed Drain Current ⁽²⁾	I_{DM}	50	A
Avalanche Current ⁽³⁾	I_{AS}	16	A
Avalanche Energy ⁽³⁾	E_{AS}	13	mJ
Power Dissipation ⁽⁴⁾	P_D	50	W
$T_C = 25^\circ\text{C}$		20	
$T_C = 100^\circ\text{C}$			
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	$V_{(BR)DSS}$	$I_D = 250\ \mu\text{A}$, $V_{GS} = 0\text{V}$	150			V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 120\text{V}$, $V_{GS} = 0\text{V}$			1.0	μA
		$T_J = 55^\circ\text{C}$			5.0	
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	3.2	4.5	V
Static Drain-Source ON-Resistance	$R_{DS(on)}$	$V_{GS} = 10\text{V}$, $I_D = 10\text{A}$		43	52	$\text{m}\Omega$
Forward Transconductance	g_{FS}	$V_{DS} = 5\text{V}$, $I_D = 10\text{A}$		16		S
Diode Forward Voltage	V_{SD}	$I_S = 1\text{A}$, $V_{GS} = 0\text{V}$		0.73	1.0	V
Diode Continuous Current	I_S	$T_C = 25^\circ\text{C}$			50	A

DYNAMIC PARAMETERS ⁽⁵⁾

Input Capacitance	C_{iss}	$V_{GS} = 0\text{V}$, $V_{DS} = 75\text{V}$, $f = 1\text{MHz}$		540		pF
Output Capacitance	C_{oss}			69		pF
Reverse Transfer Capacitance	C_{rss}			4.1		pF
Gate Resistance	R_g	$V_{GS} = 0\text{V}$, $V_{DS} = 0\text{V}$, $f = 1\text{MHz}$		1.1		Ω

SWITCHING PARAMETERS ⁽⁵⁾

Total Gate Charge (@ $V_{GS} = 10\text{V}$)	Q_g	$V_{GS} = 0$ to 10V $V_{DS} = 75\text{V}$, $I_D = 10\text{A}$		7.6		nC
Total Gate Charge (@ $V_{GS} = 6.0\text{V}$)	Q_g			5.8		nC
Gate Source Charge	Q_{gs}			2.7		nC
Gate Drain Charge	Q_{gd}			2.9		nC
Turn-On DelayTime	$t_{D(on)}$	$V_{GS} = 10\text{V}$, $V_{DS} = 75\text{V}$ $R_L = 7.5\ \Omega$, $R_{GEN} = 6\ \Omega$		11		ns
Turn-On Rise Time	t_r			18		ns
Turn-Off DelayTime	$t_{D(off)}$			20		ns
Turn-Off Fall Time	t_f			6.1		ns
Body Diode Reverse Recovery Time	t_{rr}	$I_F = 10\text{A}$, $di_F/dt = 100\text{A}/\mu\text{s}$		68		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F = 10\text{A}$, $di_F/dt = 100\text{A}/\mu\text{s}$		95		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}	2.0	2.5	$^\circ\text{C}/\text{W}$

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 [$L = 100\ \mu\text{H}$, $V_{GS} = 10\text{V}$, $V_{DS} = 75\text{V}$] 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

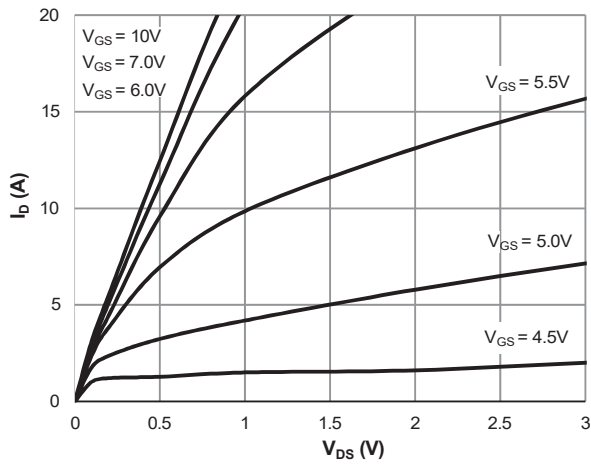


Figure 1: Saturation Characteristics

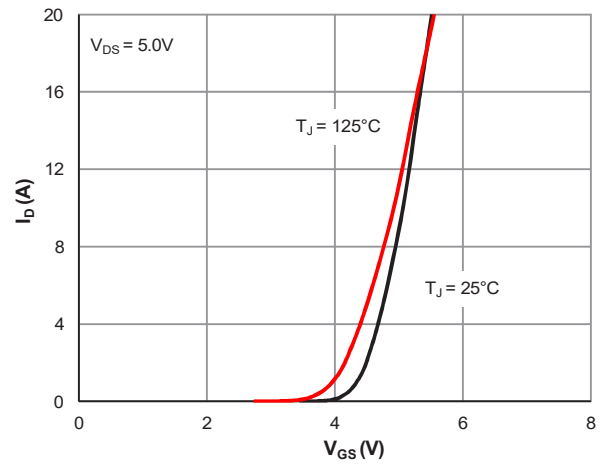


Figure 2: Transfer Characteristics

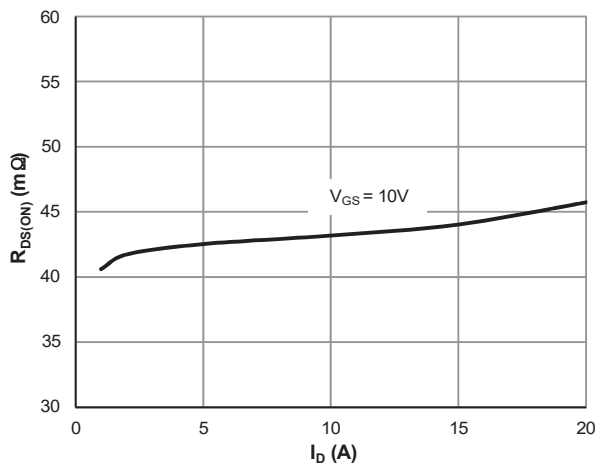


Figure 3: $R_{DS(ON)}$ vs. Drain Current

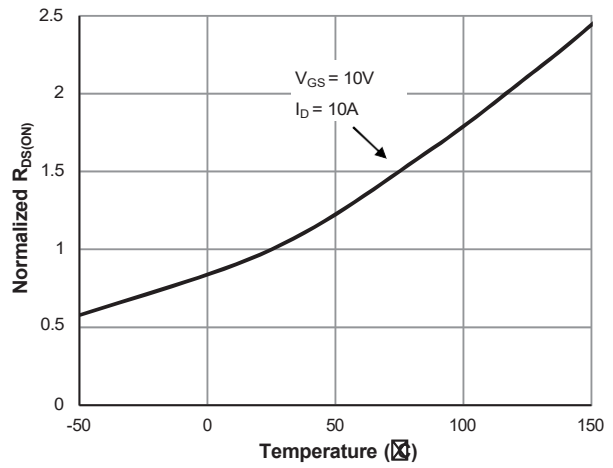


Figure 4: $R_{DS(ON)}$ vs. Junction Temperature

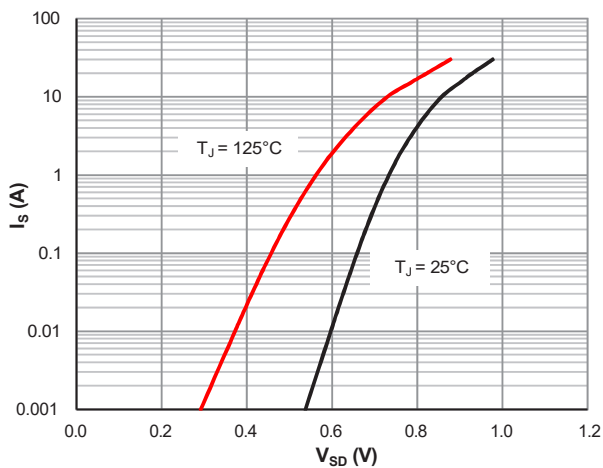


Figure 5: Body-Diode Characteristics

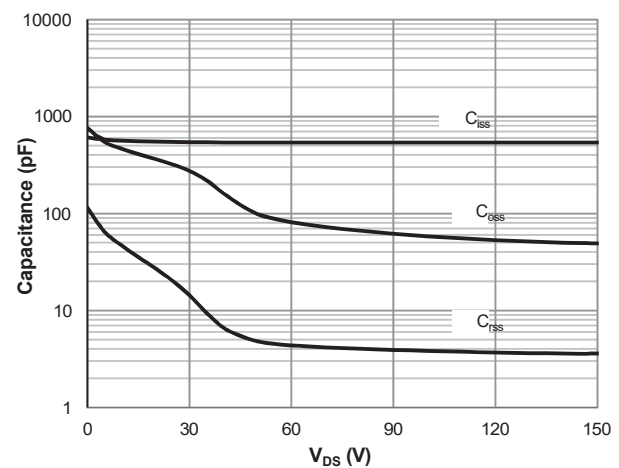


Figure 6: Capacitance Characteristics

Typical Electrical & Thermal Characteristics

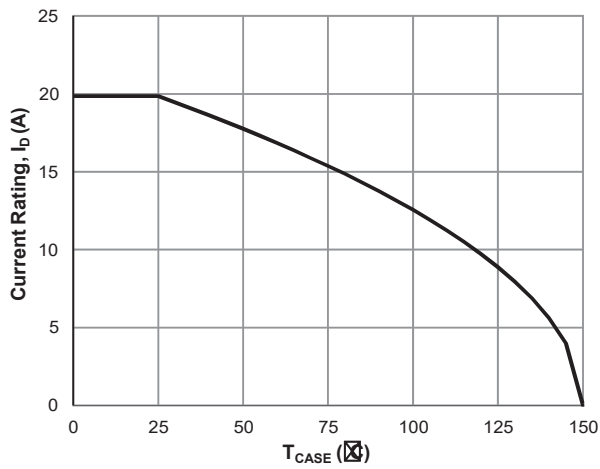


Figure 7: Current De-rating

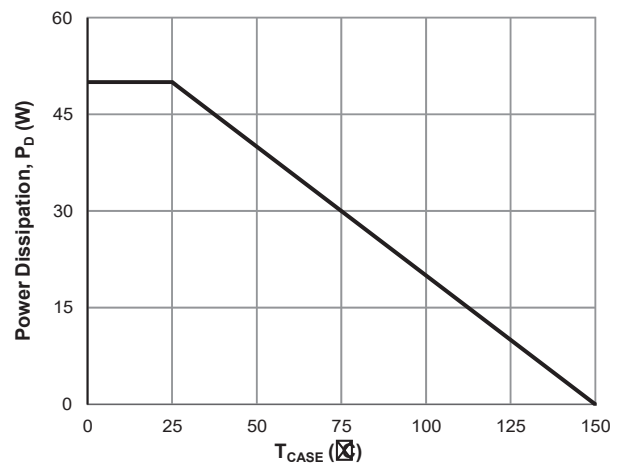


Figure 8: Power De-rating

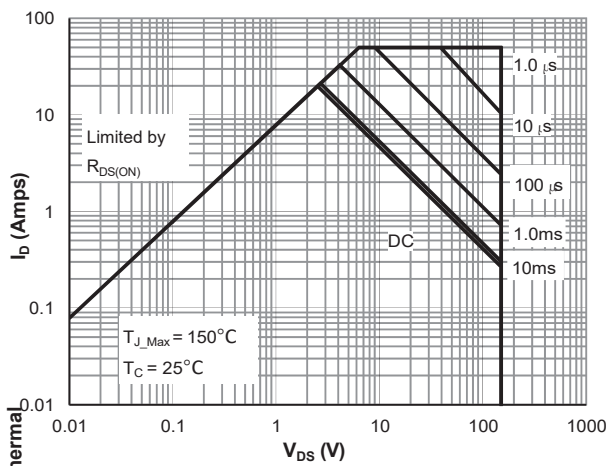


Figure 9: Maximum Safe Operating Area

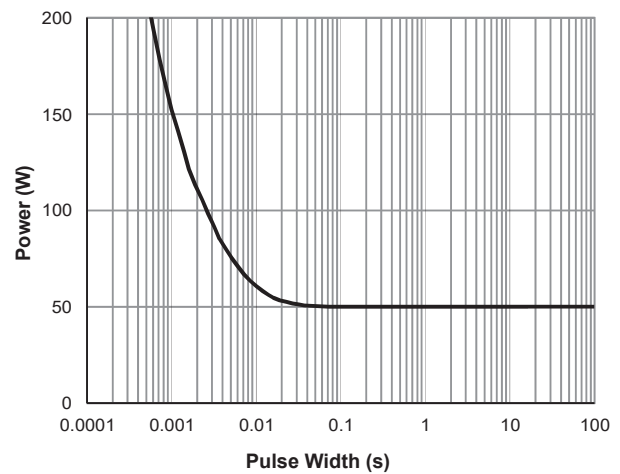


Figure 10: Single Pulse Power Rating, Junction-to-Case

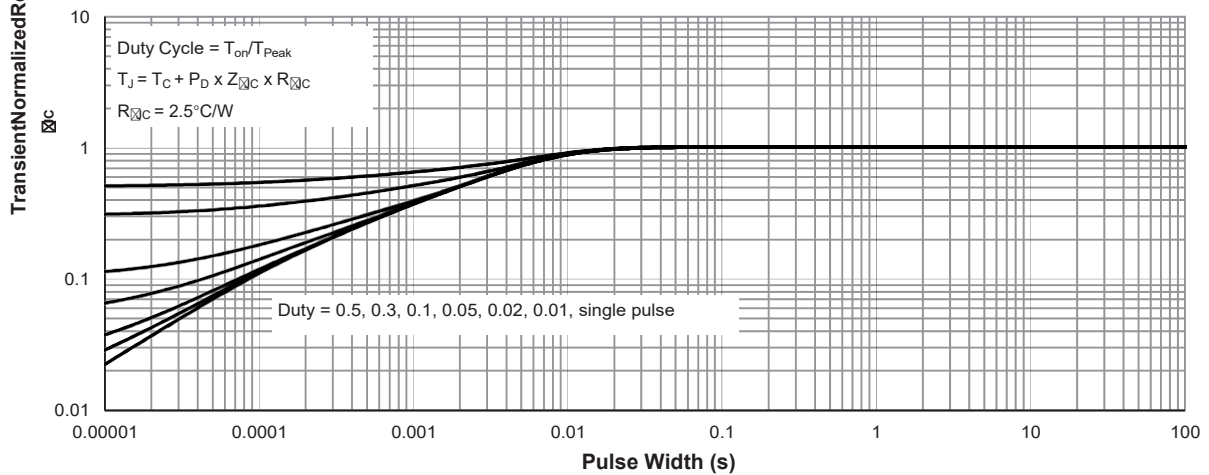


Figure 11: Normalized Maximum Transient Thermal Impedance