Description

The Power MOSFET is fabricated using the advanced planar VDMOS technology. The resulting device has low conduction resistance, superior switching performance and high avalanche energy.

Features

- Low $R_{DS(on)}$
- Low gate charge (typ. Q_g = 50.5 nC)
- 100% UIS tested
- RoHS compliant

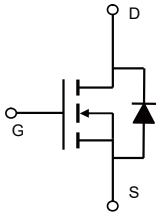
Applications

- Power factor correction.
- Switched mode power supplies.

Product Summary

V_{DSS}	500V
I_D	20A
$R_{DS(on),max}$	0.29Ω
$Q_{g,typ}$	50.5 nC

TO-220F



Schematic

Absolute Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	500	V
Continuous drain current (T_C = 25°C)	I_D	20	A
(T_C = 100°C)		12.5	A
Pulsed drain current [1]	I_{DM}	80	A
Gate-Source voltage	V_{GSS}	±30	V
Avalanche energy, single pulse [2]	E_{AS}	1200	mJ
Power Dissipation (T_C = 25°C)	P_D	37.8	W
Operating junction and storage temperature range	T_J, T_{STG}	-55 to +150	°C
Continuous diode forward current	I_S	20	A
Diode pulse current	$I_{S,pulse}$	80	A

Thermal Characteristics

Parameter	Symbol	Value	Unit
Thermal resistance, Junction-to-case	$R_{\theta JC}$	3.3	°C/W
Thermal resistance, Junction-to-ambient [3]	$R_{\theta JA}$	60	°C/W

Package Marking and Ordering Information

Device	Device Package	Marking	Units/Tube
VSM20N50-TF	TO-220F	VSM20N50-TF	50

Electrical Characteristics

T_c = 25°C unless otherwise noted

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Static characteristics						
Drain-source breakdown voltage	BV_{DSS}	V_{GS}=0 V, I_D=0.25 mA	500	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=0.25 mA	2	-	4	V
Drain cut-off current	I_{DSS}	V_{DS}=500 V, V_{GS}=0 V, T_j = 25°C T_j = 125°C	 - -	 -	 1 100	μA
Gate leakage current, Forward	I_{GSSF}	V_{GS}=20 V, V_{DS}=0 V	-	-	100	nA
Gate leakage current, Reverse	I_{GSSR}	V_{GS}=-20 V, V_{DS}=0 V	-	-	-100	nA
Drain-source on-state resistance	$R_{DS(on)}$	V_{GS}=10 V, I_D=10A	-	0.23	0.29	Ω
Dynamic characteristics						
Input capacitance	C_{iss}	V_{DS} = 25 V, V_{GS} = 0 V,	-	3078	-	pF
Output capacitance	C_{oss}	f = 250kHz	-	263	-	
Reverse transfer capacitance	C_{rss}		-	19	-	
Turn-on delay time	$t_{d(on)}$	V_{DD} = 250 V, I_D = 10 A	-	22.7	-	ns
Rise time	t_r	R_G = 5Ω, V_{GS}=15 V	-	16.4	-	
Turn-off delay time	$t_{d(off)}$		-	127	-	
Fall time	t_f		-	15.2	-	
Gate charge characteristics						
Gate to source charge	Q_{gs}	V_{DD}=400 V, I_D=20 A,	-	12.7	-	nC
Gate to drain charge	Q_{gd}	V_{GS}=0 to 10 V	-	15.8	-	
Gate charge total	Q_g		-	50.5	-	
Gate plateau voltage	$V_{plateau}$		-	5	-	V
Reverse diode characteristics						
Diode forward voltage	V_{SD}	V_{GS}=0 V, I_F=10 A	-	-	1.3	V
Reverse recovery time	t_{rr}	V_R=250 V, I_F=20 A,	-	313.2	-	ns
Reverse recovery charge	Q_{rr}	dI_F/dt=100 A/μs	-	3.3	-	μC
Peak reverse recovery current	I_{rrm}		-	20.8	-	A

Notes:

1. Pulse width limited by maximum junction temperature.
2. L=10mH, I_{AS} = 15.5A, Starting T_j= 25°C.
3. The value of R_{thJA} is measured by placing the device in a still air box which is one cubic foot.

Electrical Characteristics Diagrams

Figure 1. Typical Output Characteristics

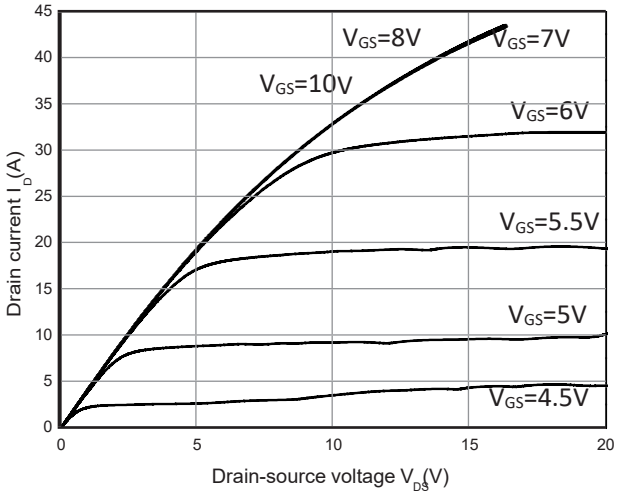


Figure 2. Transfer Characteristics

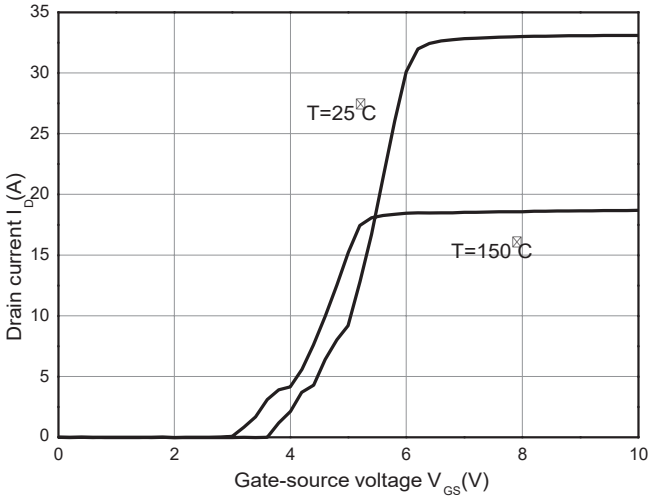


Figure 3. On-Resistance Variation vs. Drain Current

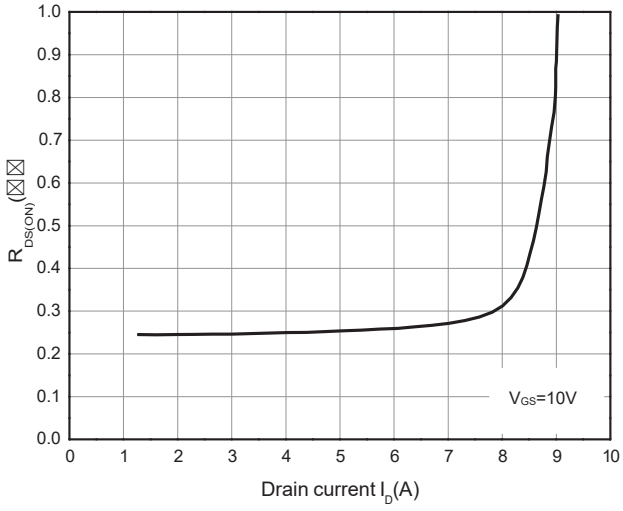


Figure 4. Threshold Voltage vs. Temperature

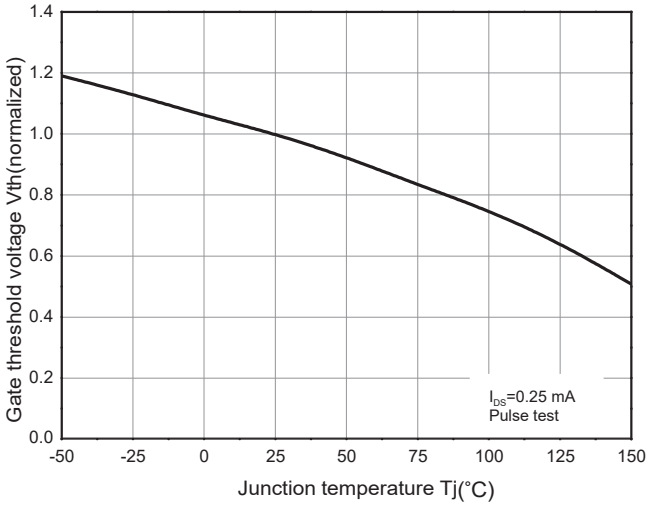


Figure 5. Breakdown Voltage vs. Temperature

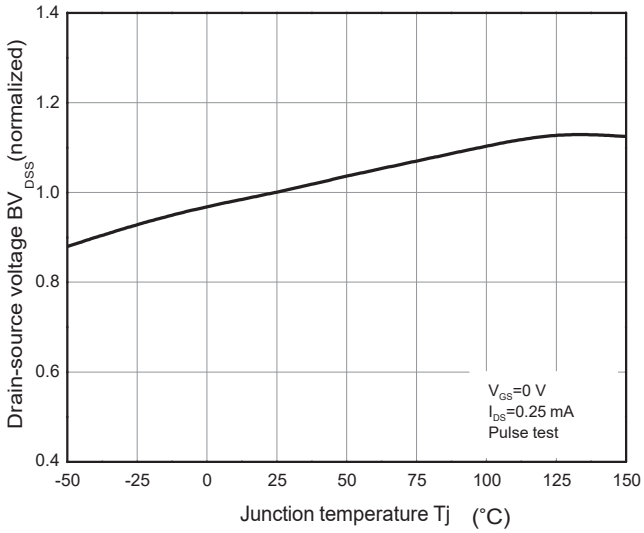


Figure 6. On-Resistance vs. Temperature

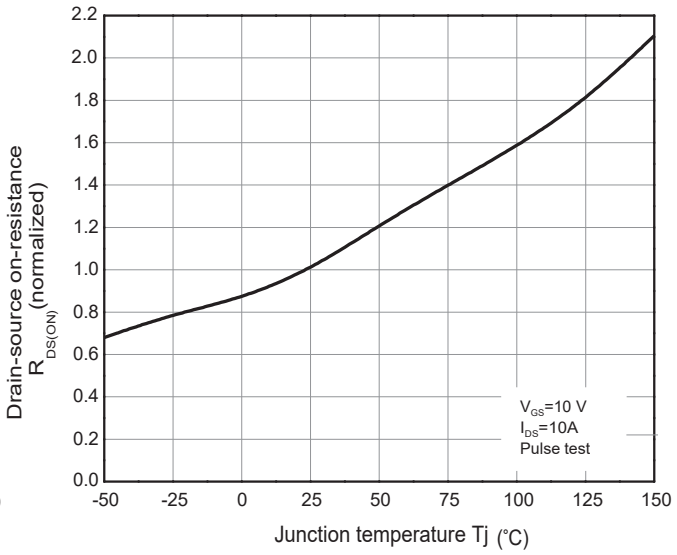


Figure 7. Drain current derating

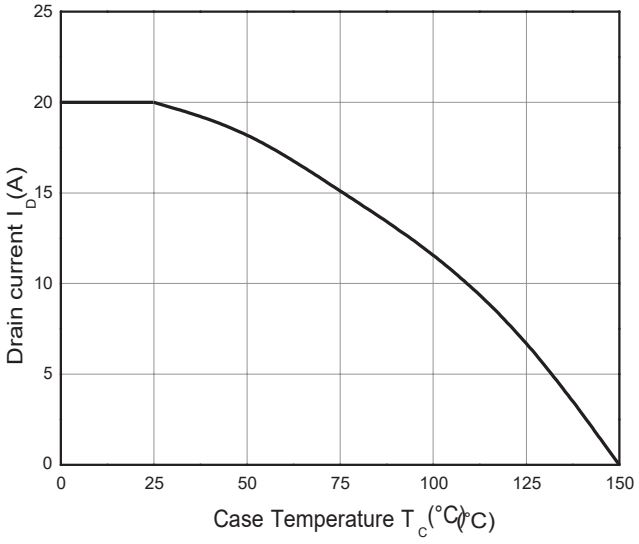


Figure 8. Capacitance Characteristics

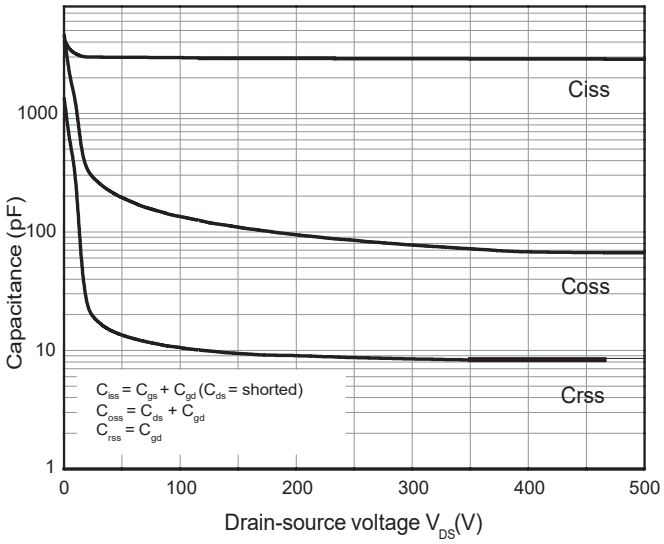


Figure 9. Gate Charge Characteristics

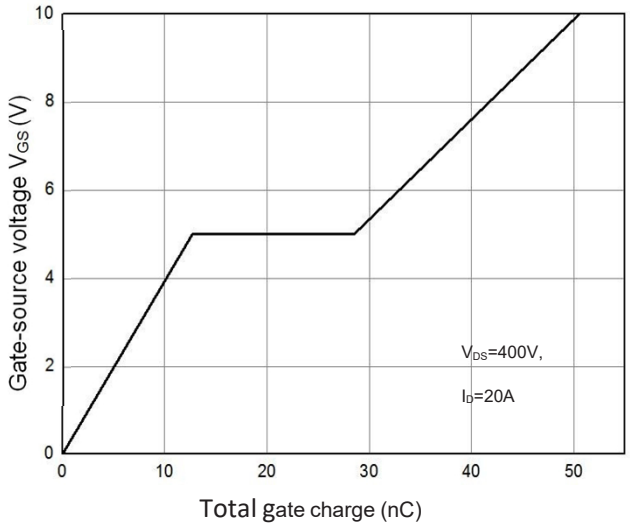


Figure 10. Body Diode Transfer Characteristics

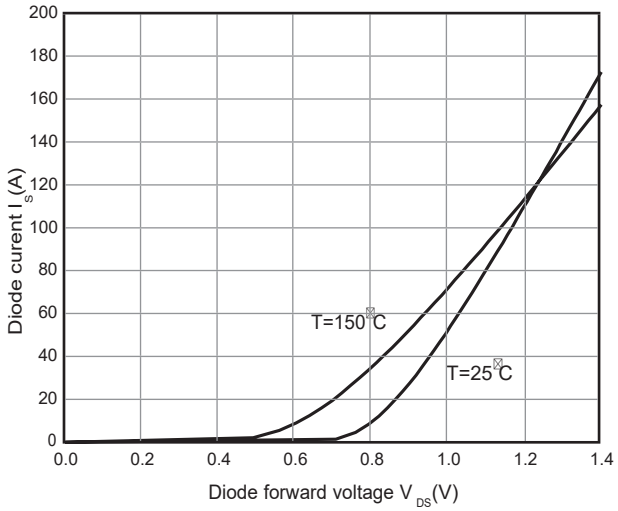


Figure 11. Power Dissipation vs. Temperature

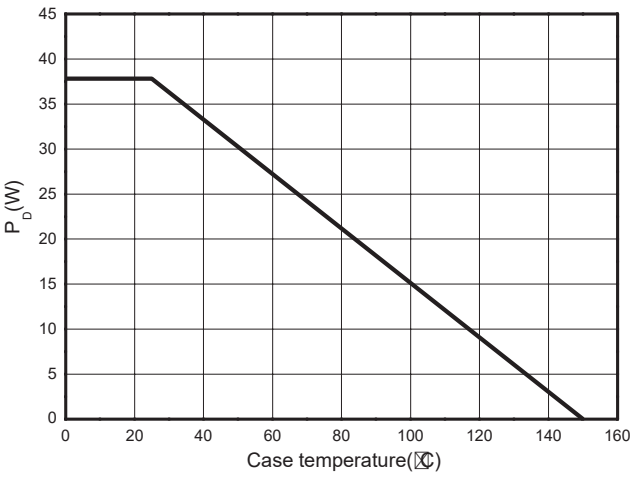


Figure 12: Safe Operating Area

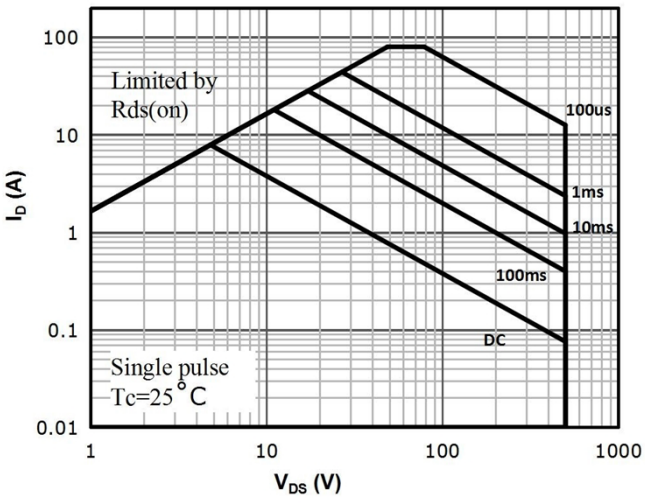
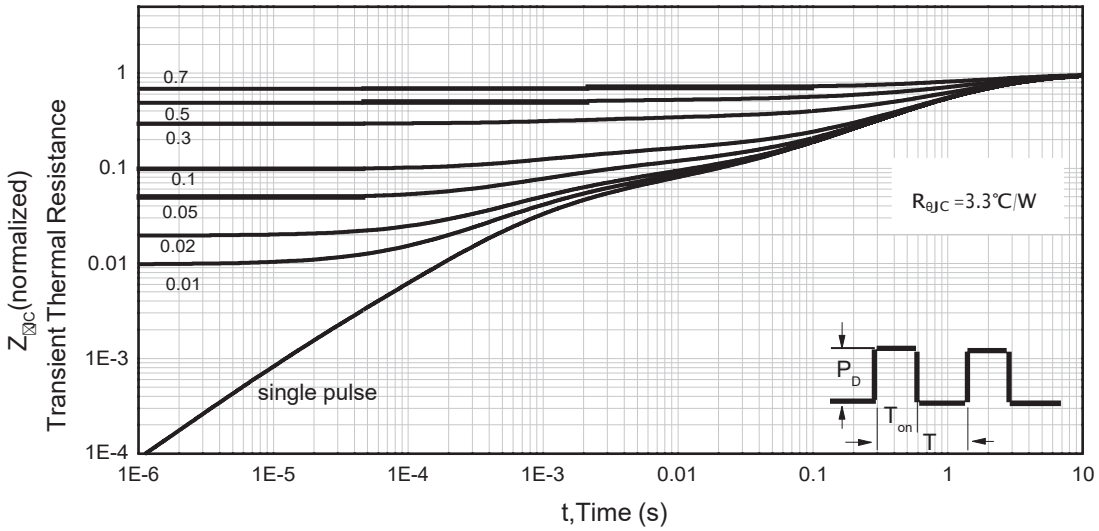
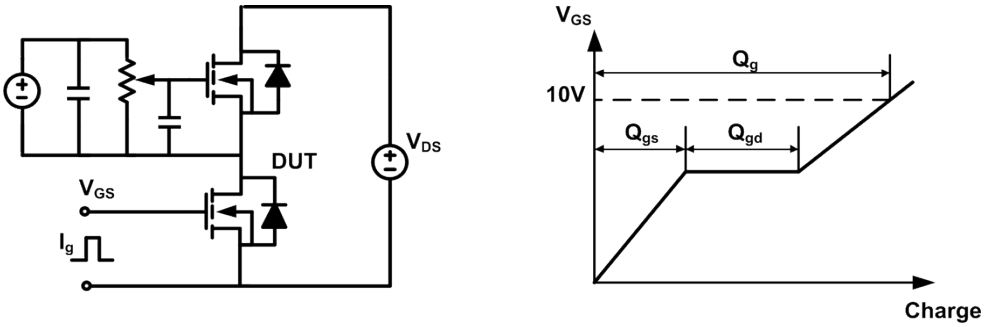


Figure 13. Transient Thermal Impedance, Junction to Case,

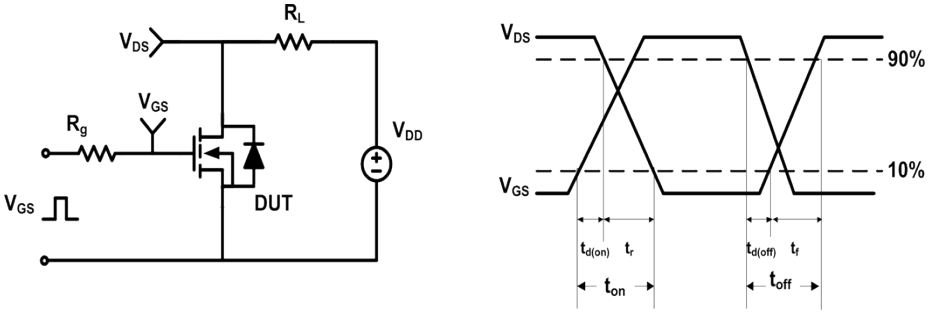


Test Circuit & Waveforms

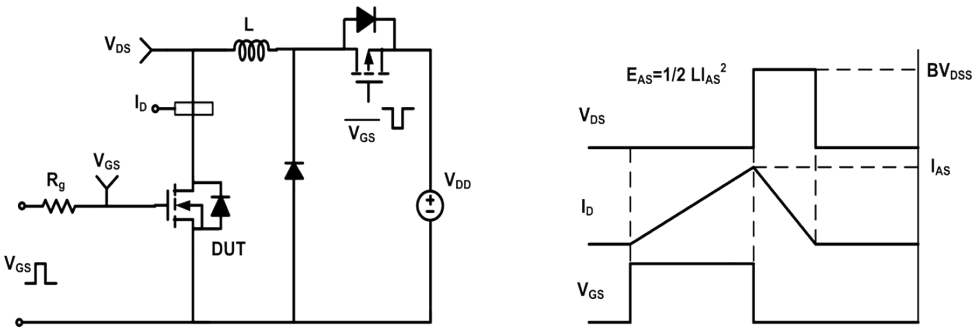
Gate Charge Test Circuit & Waveform



Resistive Switching Test Circuit & Waveform



Unclamped Inductive Switching (UIS) Test Circuit & Waveform



Diode Recovery Test Circuit & Waveform