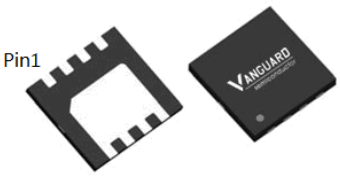
V_{DS}	40	V
$R_{DS(on),TYP}$@ V_{GS}=10 V	9	mΩ
$R_{DS(on),TYP}$@ V_{GS}=4.5V	11	mΩ
I_D	40	A

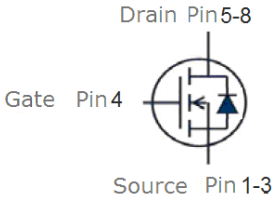
Features

- N-Channel
- Enhancement mode
- Very low on-resistance $R_{DS(on)}$ @ V_{GS}=4.5 V
- Fast Switching
- 100% Avalanche Tested
- Pb-free lead plating; RoHS compliant

Pb-Free RoHS HF Halogen-Free

TDFN3.3x3.3





Part ID	Package Type	Marking	Tape and reel information
VSB013N04MS	TDFN3.3x3.3	013N04M	5000pcs/Reel

Maximum ratings, at T_j=25 °C, unless otherwise specified

Symbol	Parameter		Rating	Unit
$V_{(BR)DSS}$	Drain-Source breakdown voltage		40	V
I_S	Diode continuous forward current	T_C=25°C	40	A
I_D	Continuous drain current@V_{GS}=10V	T_C=25°C	40	A
		T_A=100°C	26	A
I_{DM}	Pulse drain current tested ①	T_C=25°C	150	A
EAS	Avalanche energy, single pulsed ②	I_D=10A	25	mJ
P_D	Maximum power dissipation	T_A=25°C	50	W
V_{GS}	Gate-Source voltage		±20	V
T_{STG} T_J	Storage and operating temperature range		-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Thermal Resistance-Junction to Case	2.5	°C/W
$R_{\theta JA}$	Thermal Resistance Junction-Ambient	60	°C/W

Typical Characteristics

Symbol	Parameter	Condition	Min.	Typ.	Max.	Unit
Static Electrical Characteristics @ T_C = 25°C (unless otherwise stated)						
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	V_{GS}=0V I_D=250μA	40	--	--	V
I_{DSS}	Zero Gate Voltage Drain Current(Tc=25℃)	V_{DS}=40V,V_{GS}=0V	--	--	1	μA
	Zero Gate Voltage Drain Current(Tc=125℃)	V_{DS}=40V,V_{GS}=0V	--	--	100	μA
I_{GSS}	Gate-Body Leakage Current	V_{GS}=±20V,V_{DS}=0V	--	--	±100	nA
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS}=V_{GS},I_D=250μA	1.0	1.5	2.2	V
$R_{DS(ON)}$	Drain-Source On-State Resistance③	V_{GS}=10V, I_D=20A	--	9	13	mΩ
$R_{DS(ON)}$	Drain-Source On-State Resistance③	V_{GS}=4.5V, I_D=10A	--	11	15	mΩ
$R_{DS(ON)}$	Drain-Source On-State Resistance③	V_{GS}=4.2V, I_D=2A	--	13	17	mΩ
Dynamic Electrical Characteristics @ T_C= 25°C (unless otherwise stated)						
C_{iss}	Input Capacitance	V_{DS}=15V,V_{GS}=0V, f=1MHz	--	680	--	pF
C_{oss}	Output Capacitance		--	110	--	pF
C_{rss}	Reverse Transfer Capacitance		--	75	--	pF
Q_g	Total Gate Charge	V_{DS}=15V,I_D=10A, V_{GS}=10V	--	19	--	nC
Q_{gs}	Gate-Source Charge		--	5.5	--	nC
Q_{gd}	Gate-Drain Charge		--	4.5	--	nC
Switching Characteristics						
$t_{d(on)}$	Turn-on Delay Time	V_{DD}=15V, I_D=10A, R_G=6.8Ω, V_{GS}=10V	--	7	--	nS
t_r	Turn-on Rise Time		--	14	--	nS
$t_{d(off)}$	Turn-Off Delay Time		--	22	--	nS
t_f	Turn-Off Fall Time		--	8	--	nS
Source- Drain Diode Characteristics@ T_C = 25°C (unless otherwise stated)						
V_{SD}	Forward on voltage	I_{SD}=20A,V_{GS}=0V	--	0.84	1.2	V
t_{rr}	Reverse Recovery Time	T_j=25℃,I_{sd}=10A, V_{GS}=0V di/dt=100A/μs	--	28	--	nS
Q_{rr}	Reverse Recovery Charge			32		nC

NOTE:

① Repetitive rating; pulse width limited by max. junction temperature.

② Limited by T_{Jmax}, starting T_J = 25°C, L = 0.5mH,R_G = 25Ω, I_{AS} = 10A, V_{GS} =10V. Part not recommended for use above this value

③ Pulse width ≤ 300μs; duty cycle≤ 2%.

Typical Characteristics

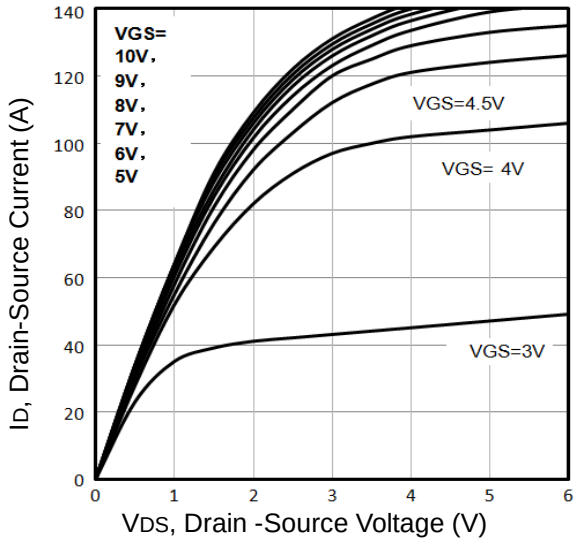


Fig1. Typical Output Characteristics

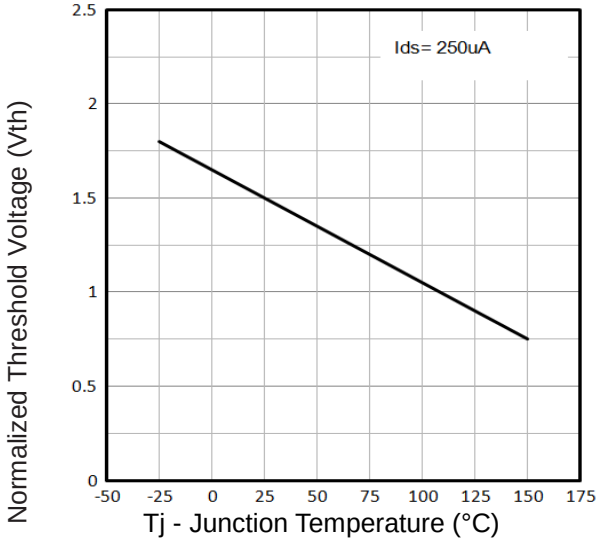


Fig2. Normalized Threshold Voltage Vs. Temperature

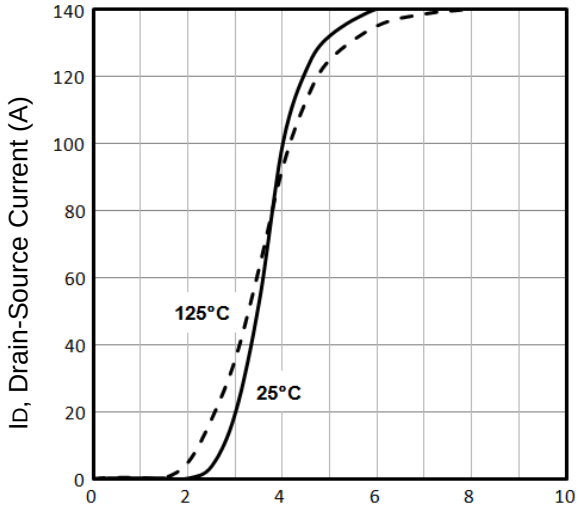


Fig3. Typical Transfer Characteristics

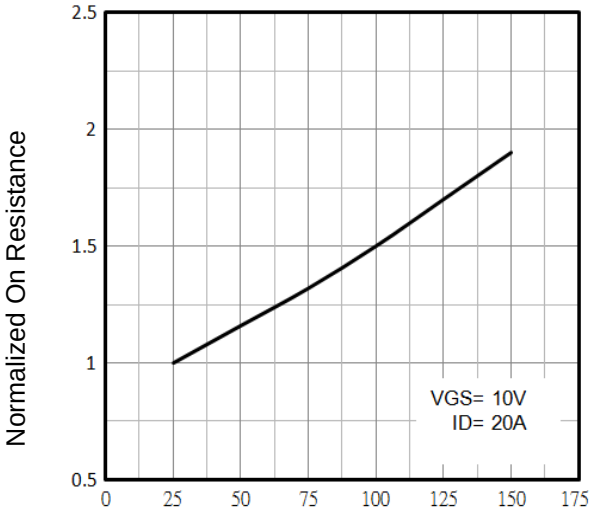


Fig4. Normalized On-Resistance Vs. Temperature

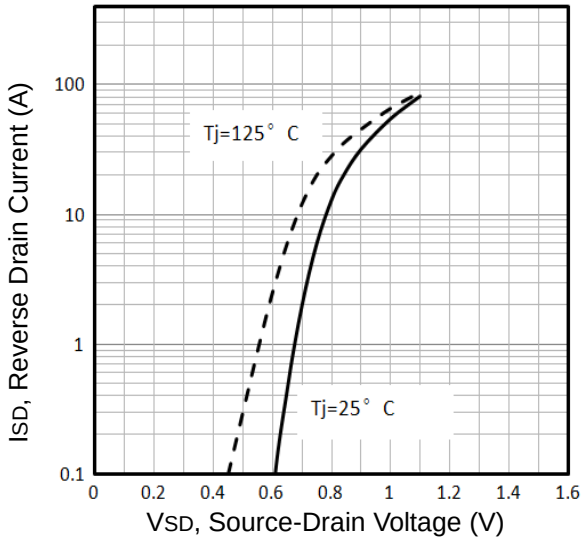


Fig5. Typical Source-Drain Diode Forward Voltage

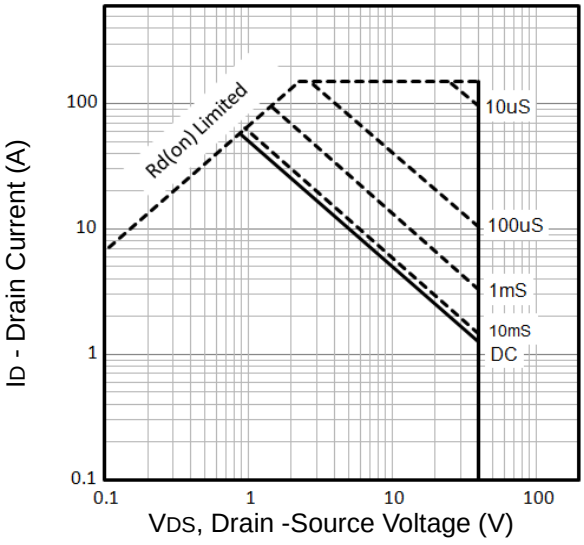


Fig6. Maximum Safe Operating Area

Typical Characteristics

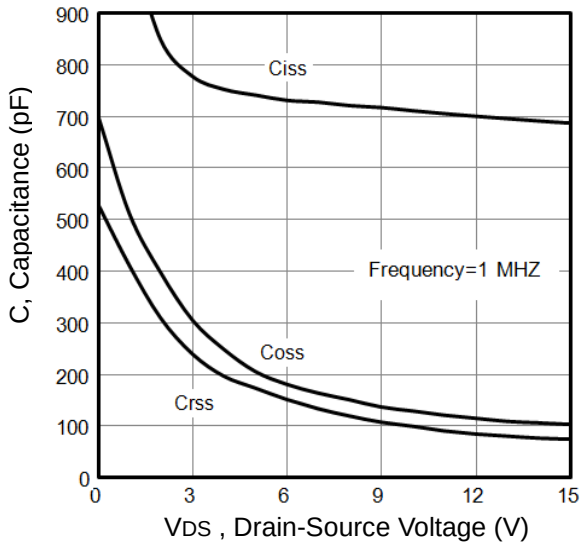


Fig7. Typical Capacitance Vs.Drain-Source Voltage

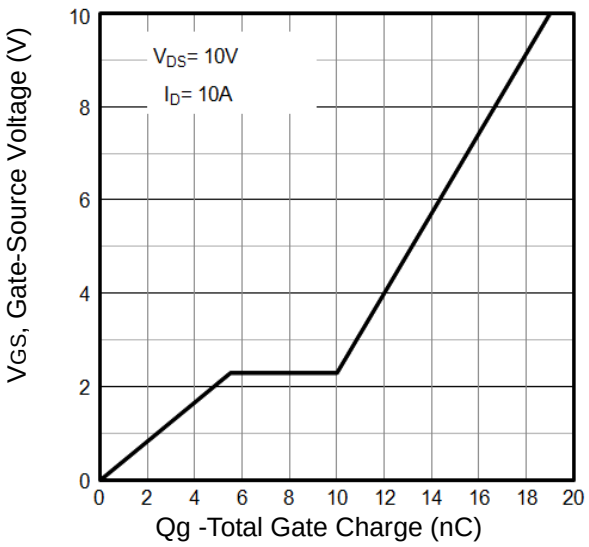


Fig8. Typical Gate Charge Vs.Gate-Source

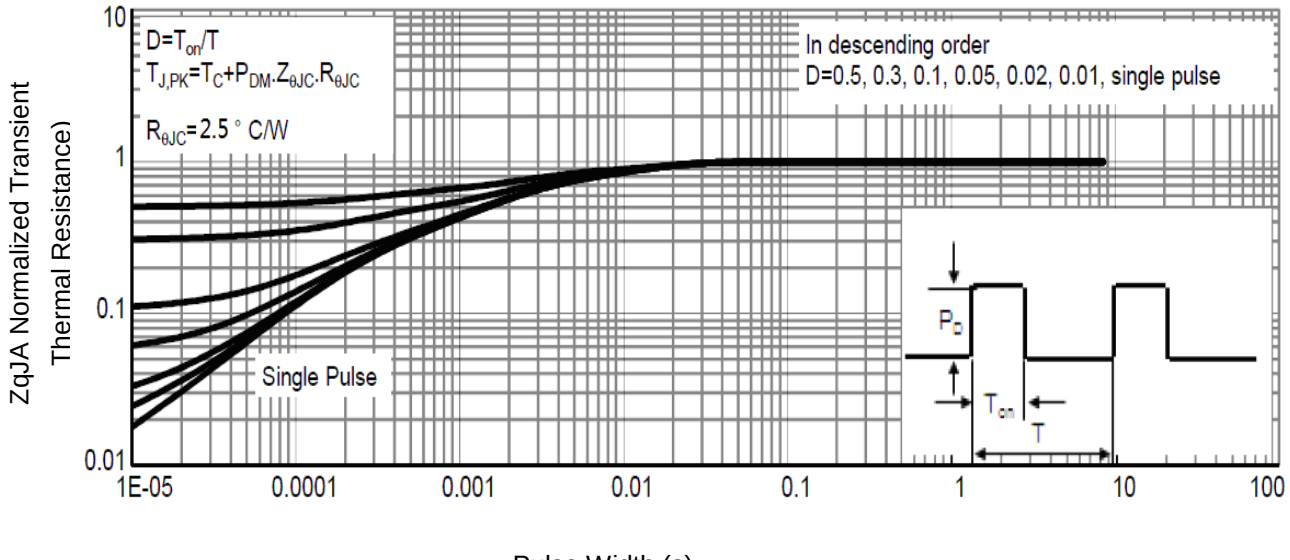


Fig 9 . Normalized Maximum Transient Thermal Impedance

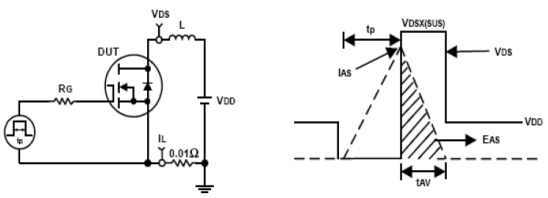


Fig10. Unclamped Inductive Test Circuit and waveforms

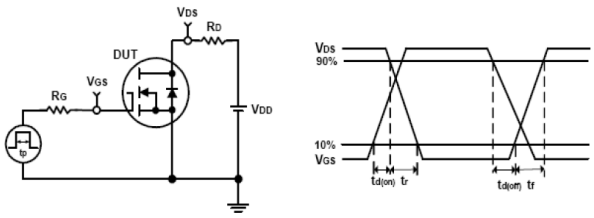
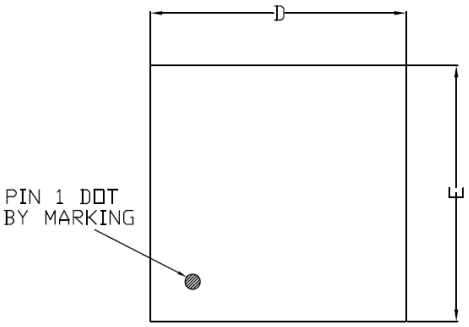
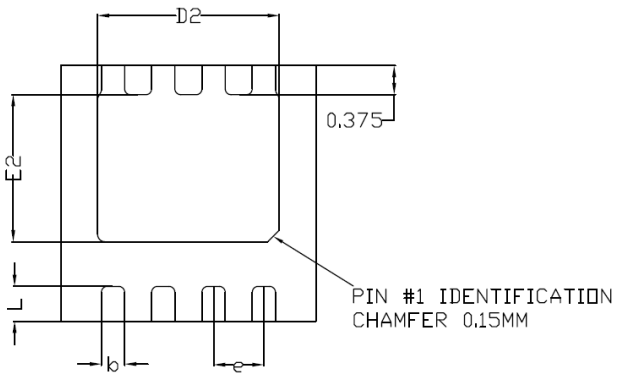


Fig11. Switching Time Test Circuit and waveforms

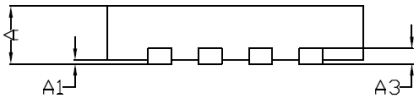
TDFN3.3x3.3 Package Outline Data



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Lead finish : NiPdAu

DIMENSIONS (unit : mm)

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	0.70	0.75	0.80	**A1**	0.00	--	0.05
A3	0.20 REF			**D**	3.25	3.30	3.35
E	3.25	3.30	3.35	**D2**	2.30	2.35	2.40
E2	1.85	1.90	1.95	**b**	0.25	0.30	0.35
L	0.35	0.45	0.55	**e**	0.65 BSC		

Customer Service

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