VFPB004R013NA

Datasheet

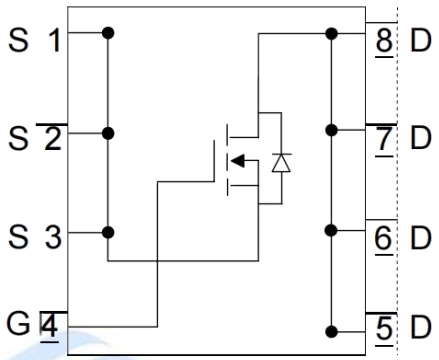
1.3mΩ, 40V, N-Channel MOSFET VFPB004R013NA

Description

- 40V N-channel SGT MOSFET
- It has been designed to ultra-lowon-state resistance (R_{DSON}) and yet maintain superior switching performance

$V_{(BR)DSS}$	$R_{DS(ON)\_max}$	I_D
40V	1.3mΩ@10V	176A

Symbol

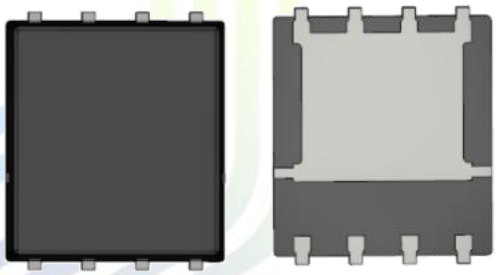


Symbol of VFPB004R013NA

Features

- N-channel, optimized for high-speed smooth switching
- Excellent gate charge ×R_{DSON} (FOM)
- Ultra-low on-resistance
- Rohs compliant [Note 1]
- Halogen-free [Note 1]

Package Type



Package Type of VFPB004R013NA

Application

- DC-DC Conversion
- Power tools

Ordering Information

Product Name	Package
VFPB004R013NA	PDFN5×6

Absolute Maximum Ratings (T_J= 25 ºC, unless otherwise specified)

Parameter	Symbol	Value	Units
Drain-Source Voltage	V_{DS}	40	V
Drain Current - Continuous (T_C= 25°C)	I_D	176	A
Drain Current - Continuous (T_C= 100°C)		110	A
Drain Current - Pulsed Note 1,2	I_{DM}	550	A
Gate-Source Voltage	V_{GS}	± 20	V
Single Pulsed Avalanche Energy Note 3	E_{AS}	306	mJ
Power Dissipation (TC = 25°C)	P_D	64	W
Operating and Storage Temperature Range	T_J,T_{STG}	-55 to +150	°C

Thermal Resistance

Parameter	Symbol	Value	Units
Thermal Resistance, Junction-to-Case, Steady-State	$R_{\theta JC}$	1.94	°C/W
Thermal Resistance, Junction-to-Ambient, Steady State Note 4	$R_{\theta JA}$	60	°C/W

Notes:

1. The max drain current rating is package limited
2. Repetitive Rating: Pulse width limited by maximum junction temperature
3. L = 0.5 mH, V_{DD} = 15 V, I_{AS}=35 A, R_G = 25 Ω, Starting T_J = 25 °C
4. Mount on 1 inch X 1 inch 2 oz FR-4 copper PCB
5. Pulse Test: Pulse width ≤ 300 us, Duty cycle ≤ 2%
6. Essentially independent of operating temperature

Electrical Characteristics(T_J= 25 ºC, unless otherwise specified)

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
StaticCharacteristics						
Drain-Source Breakdown Voltage	$V_{(BR)DSS}$	V_{GS} = 0 V, I_D = 250 uA	40	-	-	V
Zero Gate Voltage Drain Current	I_{DSS}	V_{DS} = 40 V, V_{GS}=0V	-	-	1	uA
Gate Leakage Current	I_{GSS}	V_{GS} = ± 20 V, V_{DS} = 0 V	-	-	±100	nA
Gate Threshold voltage	$V_{GS(th)}$	V_{DS} = V_{GS}, I_D = 250 uA	1	1.5	2	V
Drain-Source on-state resistance	$R_{DS(ON)}$	V_{GS} = 10 V, I_D = 25 A	-	1.1	1.3	mΩ
		V_{GS} = 4.5 V, I_D = 25 A	-	1.6	2.0	mΩ
Forward Transconductance Note5	G_{FS}	V_{DS}=2V,I_D=25A	-	90	-	S
Dynamic Characteristics						
Input Capacitance	C_{iss}	V_{DS} = 20 V, V_{GS} = 0 V f = 1 MHz	-	3900	-	pF
Output Capacitance	C_{oss}		-	1460	-	pF
Reverse Transfer Capacitance	C_{rss}		-	32.9	-	pF
Gate Resistance	R_g	f = 1 MHz	-	4.5	-	Ω
Switching Characteristics						
Turn On Delay Time	$T_{D(on)}$	V_{DD} = 20V , I_D=25A V_{GS} = 10V, R_G = 4.7 Ω	-	11.8	-	ns
Rise Time	Tr		-	30.2	-	ns
Turn Off Delay Time	$T_{D(off)}$		-	78.7	-	ns
Fall Time	T_f		-	37.4	-	ns
Total Gate Charge	Q_g	V_{DS} = 20 V , I_D = 25 A V_{GS} = 10 V	-	63.1	-	nC
Gate-Source Charge	Q_{gs}		-	10.4	-	nC
Gate-Drain Charge	Q_{gd}		-	12	-	nC
Drain-Source Diode Characteristics and Maximum Ratings						
Maximum Continuous Body-Diode Forward Current	I_S		-	-	176	A
Maximum Pulsed Body-Diode Forward Current Note1	I_{SM}		-	-	550	A
Diode Forward Voltage	V_{SD}	V_{GS} = 0 V,I_S= 50A	-	0.84	-	V
Reverse recovery time	T_{rr}	I_S=50A,di/dt=100A/uS	-	49.5	-	ns
Reverse recovery charge	Q_{rr}		-	46.8	-	nC

Electrical Characteristics Diagrams

Figure 1: On-Region Characteristics

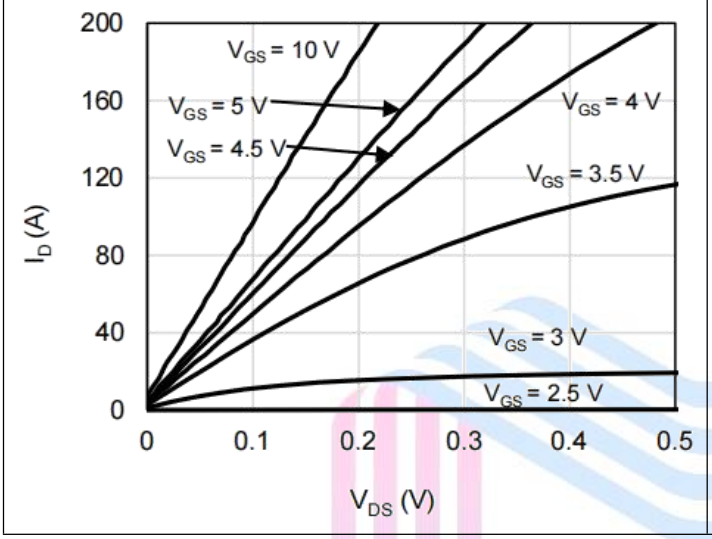


Figure 2: Transfer Characteristics

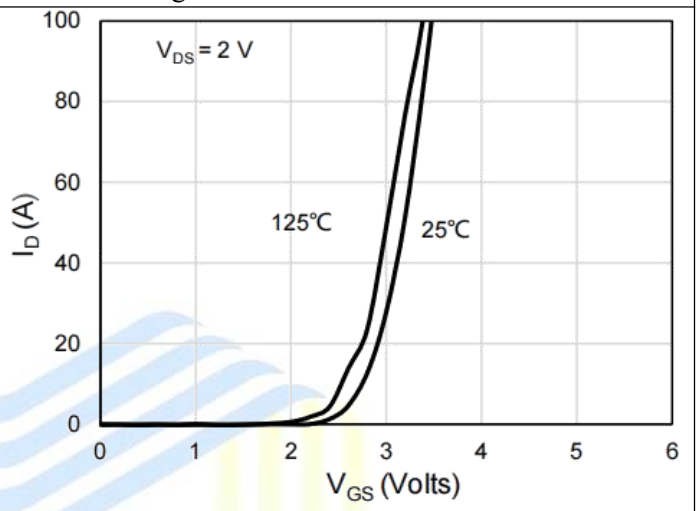


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

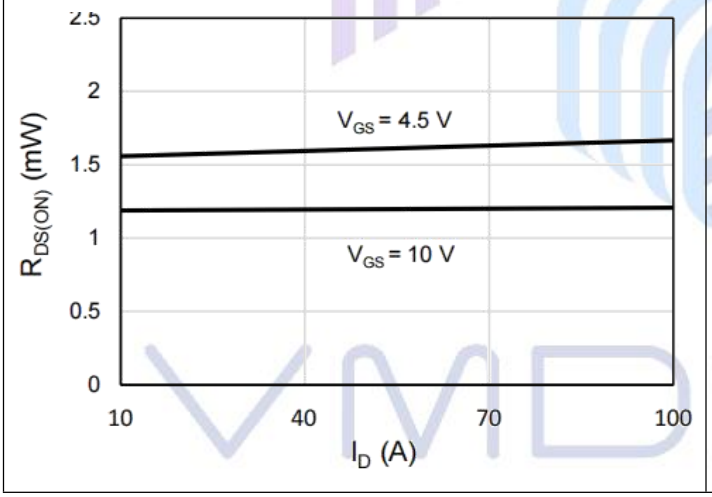


Figure 4:On-Resistance vs. Junction Temperature

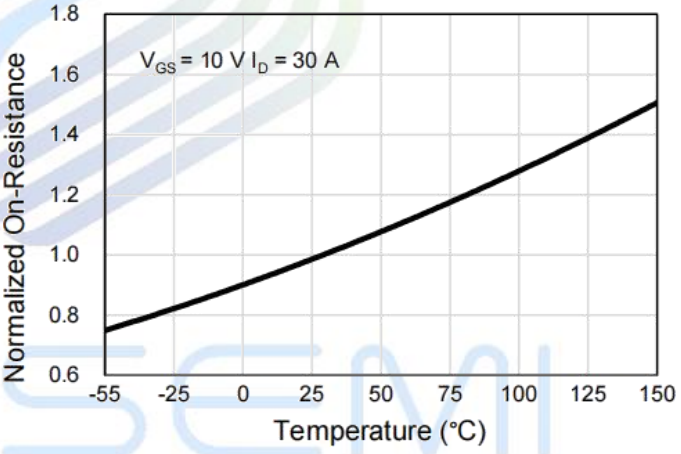


Figure 5: On-Resistance vs. Gate-Source Voltage

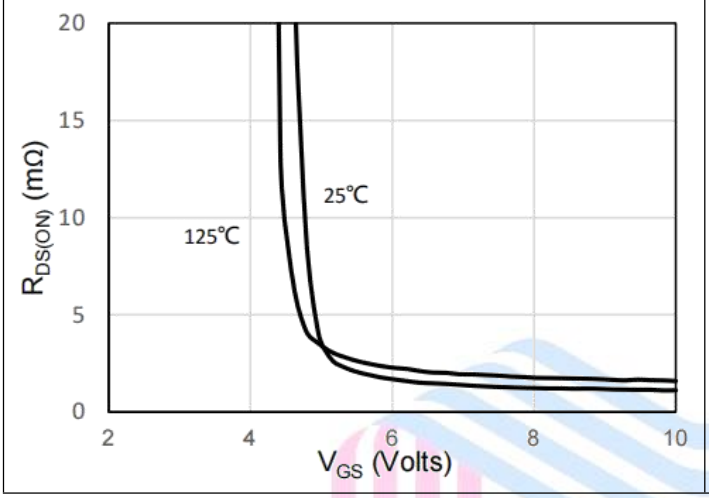


Figure 6: Body-Diode Characteristics

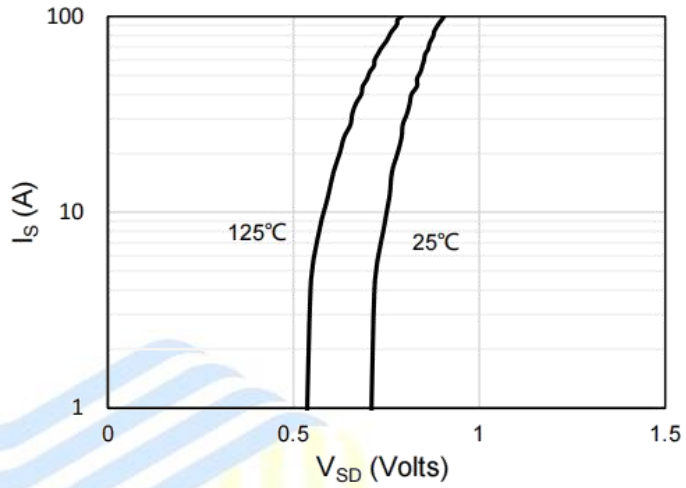


Figure 7: Gate-Charge Characteristics

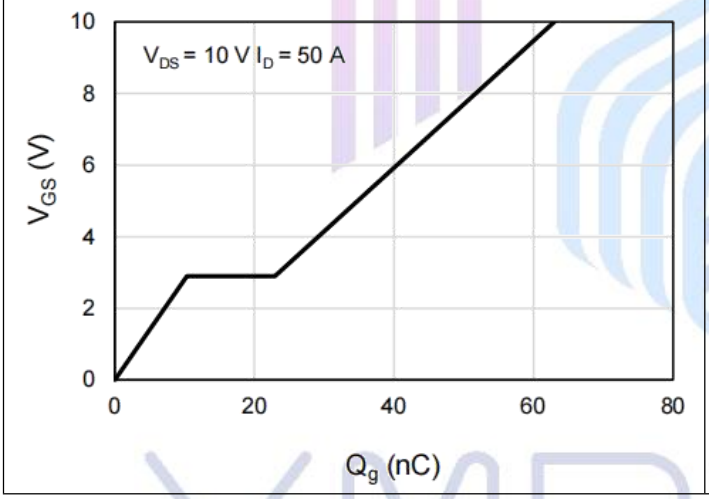


Figure 8: Capacitance Characteristics

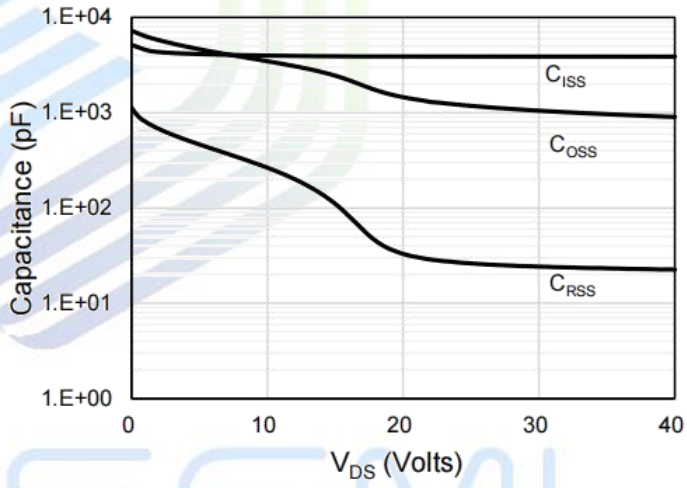


Figure 9: Maximum Forward Biased Safe Operating Area

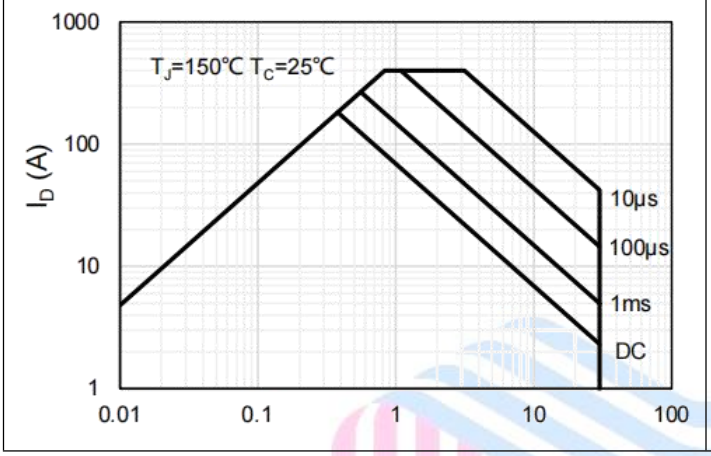


Figure 10: Single Pulse Power Rating Junction-to-Case

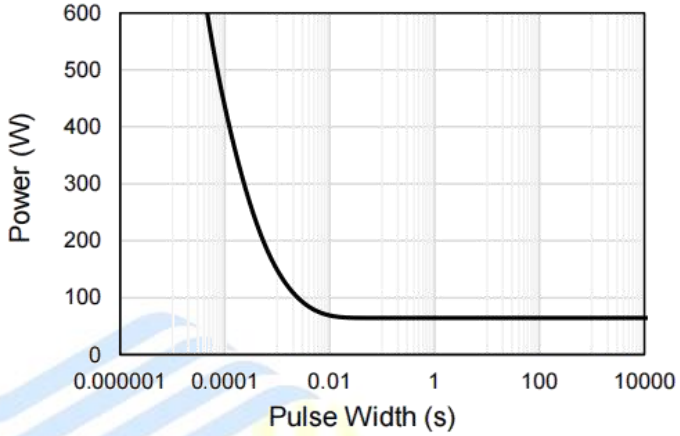


Figure 11: Current De-rating

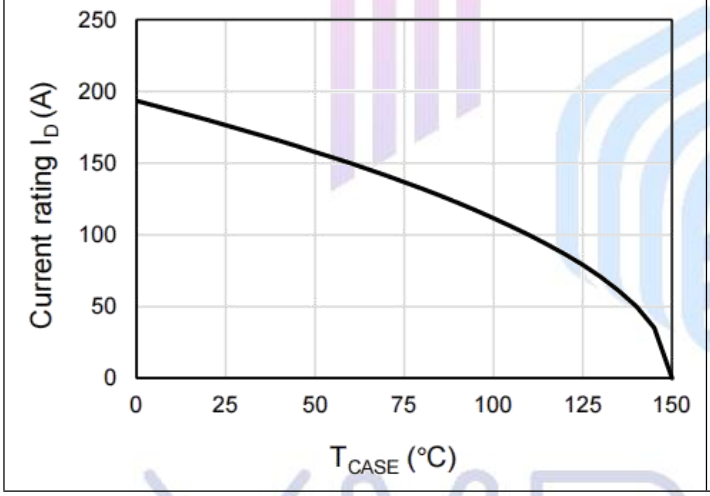


Figure 12: Power De-rating

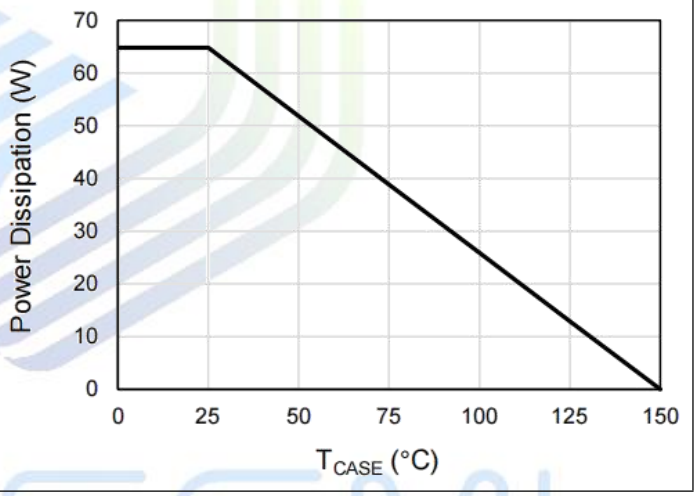
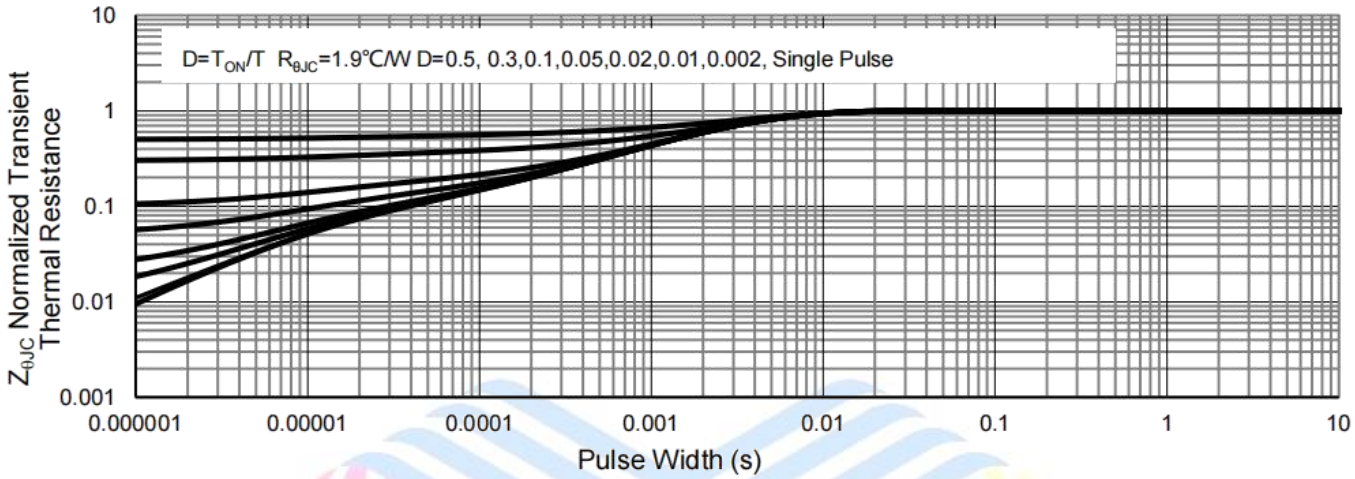
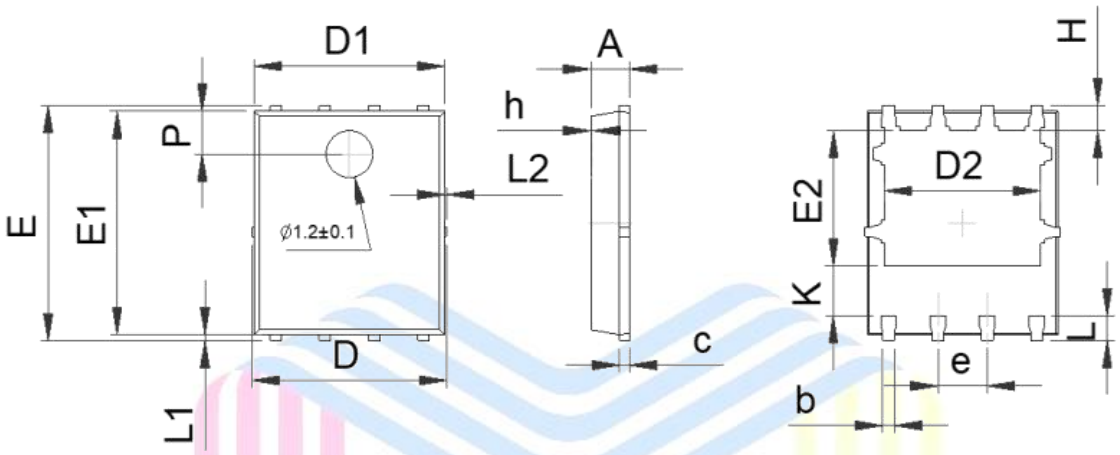


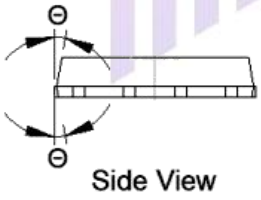
Figure 13: Normalized Maximum Transient Thermal Impedance



Mechanical Dimensions

PDFN5x6 Package Information





SYMBOL	MIN	NOM	MAX
A	0.90	1.00	1.10
b	0.20	0.30	0.40
c	0.21	0.25	0.34
D	–	–	5.10
D1	4.80	4.90	5.00
D2	3.91	4.01	4.11
e		1.27 BSC	
E	5.90	6.00	6.10
E1	5.65	5.75	5.85
E2	3.375	3.475	3.575
H	0.55	0.65	0.75
h	–	–	0.10
K	1.20	–	–
L	0.55	0.65	0.75
L1	0.05	0.15	0.25
L2	–	–	0.12
Θ	8°	10°	12°
P	1.00	1.10	1.20

Unit in mm

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