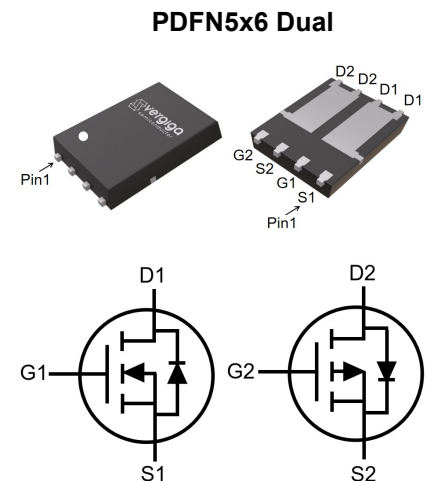


Features

- N+P Channel
- Enhancement mode
- Low on-resistance $R_{DS(on)}$ @ $V_{GS}=\pm 4.5V$
- Fast Switching and High efficiency
- Pb-free lead plating; RoHS compliant



Part ID	Package Type	Marking	Packing
VSP040C04MD	PDFN5x6 Dual	040C04MD	3000pcs/Reel



Maximum ratings, at $T_A=25^\circ\text{C}$, unless otherwise specified

Symbol	Parameter		Rating		Unit
			NMOS	PMOS	
V _{(BR)DSS}	Drain-Source breakdown voltage		40	-40	V
V _{GS}	Gate-Source voltage		±20	±20	V
I _S	Diode continuous forward current	T _C =25°C	20	-22	A
I _D	Continuous drain current @V _{GS} = ± 10V	T _C =25°C	20	-22	A
		T _C =100°C	12	-14	A
I _{DM}	Pulse drain current tested ①	T _C =25°C	80	-88	A
I _{DSM}	Continuous drain current @V _{GS} = ± 10V	T _A =25°C	7.5	-7	A
		T _A =70°C	6	-5.5	A
EAS	Avalanche energy, single pulsed ②		10	41	mJ
P _D	Maximum power dissipation	T _C =25°C	18	25	W
P _{DSM}	Maximum power dissipation ③	T _A =25°C	2.5	2.5	W
T _{STG} , T _J	Storage and junction temperature range		-55 to 150	-55 to 150	°C

Thermal Characteristics

Symbol	Parameter	Typical		Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	7	5	$^\circ\text{C/W}$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	50		$^\circ\text{C/W}$

N-Channel Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ T _J = 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(T _J =25°C)	V _{DS} =40V,V _{GS} =0V	--	--	1	μA
	Zero Gate Voltage Drain Current(T _J =125°C)	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	1.3	1.8	2.4	V
R _{DS(ON)}	Drain-Source On-State Resistance ④	V _{GS} =10V, I _D =12A	--	26	37	mΩ
		V _{GS} =4.5V, I _D =10A	--	40	56	mΩ
Dynamic Electrical Characteristics @ T _J = 25°C (unless otherwise stated)						
C _{iss}	Input Capacitance	V _{DS} =20V,V _{GS} =0V, f=1MHz	385	450	520	pF
C _{oss}	Output Capacitance		55	65	75	pF
C _{rss}	Reverse Transfer Capacitance		40	50	60	pF
R _g	Gate Resistance	f=1MHz	--	1.6	--	Ω
Q _g (10V)	Total Gate Charge	V _{DS} =20V,I _D =12A, V _{GS} =10V	--	9.5	--	nC
Q _g (4.5V)	Total Gate Charge		--	7.7	--	nC
Q _{gs}	Gate Source Charge		--	3.2	--	nC
Q _{gd}	Gate Drain Charge		--	3.9	--	nC
Switching Characteristics						
t _{d(on)}	Turn on Delay Time	V _{DD} =20V, I _D =12A, R _G =3Ω, V _{GS} =10V	--	6.2	--	ns
t _r	Turn on Rise Time		--	5.4	--	ns
t _{d(off)}	Turn Off Delay Time		-	18	--	ns
t _f	Turn Off Fall Time		--	4	--	ns
Source Drain Diode Characteristics						
V _{SD}	Forward on voltage	I _{SD} =12A,V _{GS} =0V	--	0.9	1.2	V
t _{rr}	Reverse Recovery Time	T _J =25°C,I _{sd} =12A, V _{GS} =0V	--	29	--	ns
Q _{rr}	Reverse Recovery Charge	di/dt=100A/μs	--	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} = 5A, V_{GS}=10V. Part not recommended for use above this value

③ The power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150°C.

④ Pulse width ≤ 300μs; duty cycles ≤ 2%.

P-Channel Electrical Characteristics

Symbol	Parameter	Condition	Min	Typ	Max	Unit
Static Electrical Characteristics @ T _J = 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(T _J =25°C)	V _{DS} =-40V,V _{GS} =0V	--	--	-1	μA
	Zero Gate Voltage Drain Current(T _J =125°C)	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	-1.3	-1.7	-2.4	V
R _{DS(ON)}	Drain-Source On-State Resistance ④	V _{GS} =-10V, I _D =-12A	--	28	39	mΩ
		V _{GS} =-4.5V, I _D =-10A	--	43	60	mΩ
Dynamic Electrical Characteristics @ T _J = 25°C (unless otherwise stated)						
C _{iss}	Input Capacitance	V _{DS} =-20V,V _{GS} =0V, f=1MHz	1125	1325	1525	pF
C _{oss}	Output Capacitance		100	115	130	pF
C _{rss}	Reverse Transfer Capacitance		80	95	110	pF
R _g	Gate Resistance	f=1MHz	--	7.6	--	Ω
Q _g (-10V)	Total Gate Charge	V _{DS} =-20V,I _D =-12A, V _{GS} =-10V	--	30	--	nC
Q _g (-4.5V)	Total Gate Charge		--	15	--	nC
Q _{gs}	Gate Source Charge		--	4	--	nC
Q _{gd}	Gate Drain Charge		--	6	--	nC
Switching Characteristics						
t _{d(on)}	Turn on Delay Time	V _{DD} =-20V, I _D =-12A, R _G =3Ω, V _{GS} =-10V	--	9	--	ns
t _r	Turn on Rise Time		--	7	--	ns
t _{d(off)}	Turn Off Delay Time		-	192	--	ns
t _f	Turn Off Fall Time		--	64	--	ns
Source Drain Diode Characteristics						
V _{SD}	Forward on voltage	I _{SD} =-12A,V _{GS} =0V	--	-0.9	-1.2	V
t _{rr}	Reverse Recovery Time	T _J =25°C,I _{sd} =-12A, V _{GS} =0V	--	17	--	ns
Q _{rr}	Reverse Recovery Charge	di/dt=-100A/μs	--	7	--	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 The power dissipation P_{DSM} is based on R_{θJA} and the maximum allowed junction temperature of 150°C.

④ -- = Not Specified

N-Channel Typical Characteristics

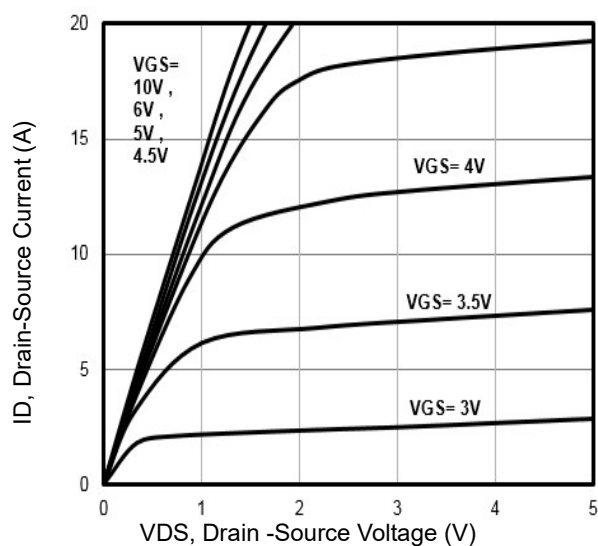


Fig1. Typical Output Characteristics

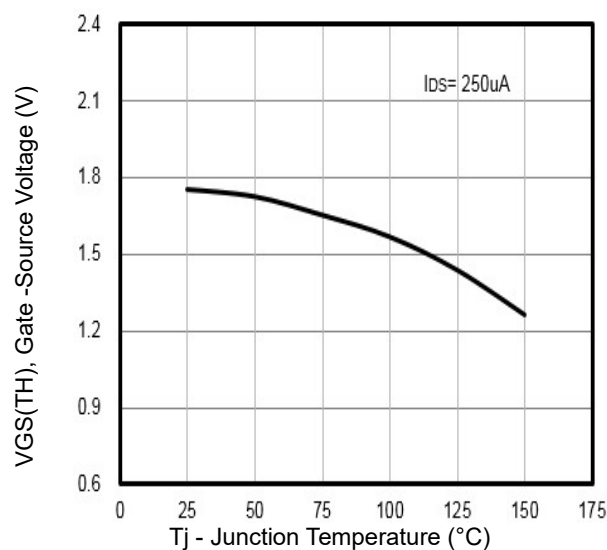


Fig2. $V_{GS(TH)}$ Gate-Source Voltage Vs. T_J

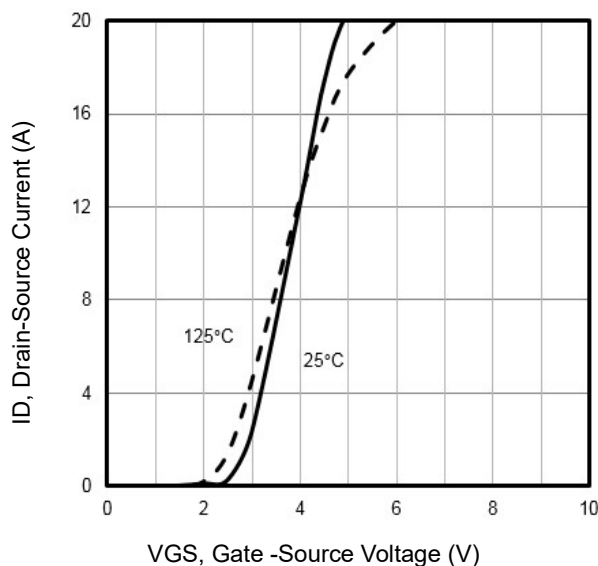


Fig3. Typical Transfer Characteristics

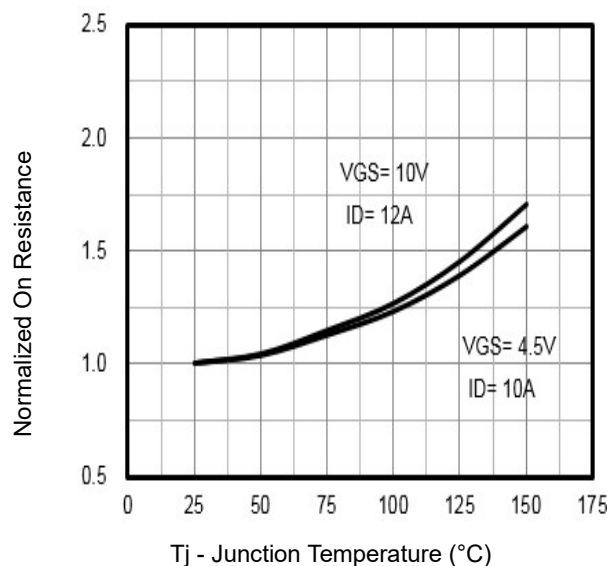


Fig4. Normalized On-Resistance Vs. T_J

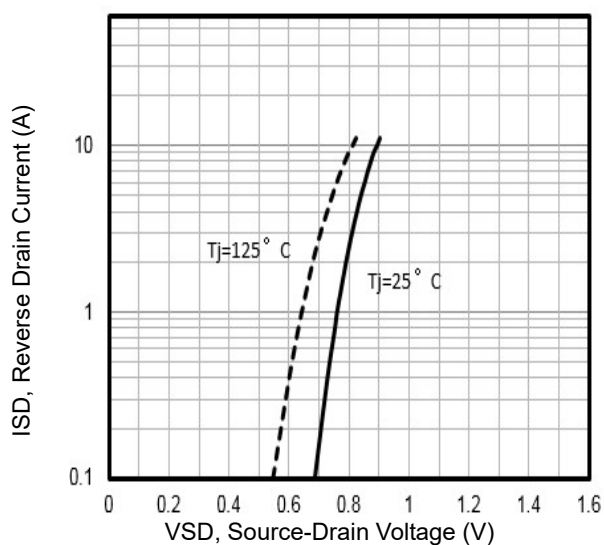


Fig5. Typical Source-Drain Diode Forward Voltage

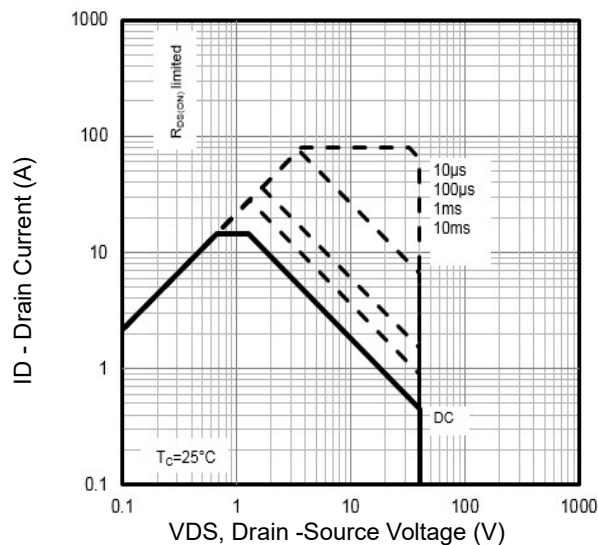


Fig6. Maximum Safe Operating Area

N-Channel Typical Characteristics

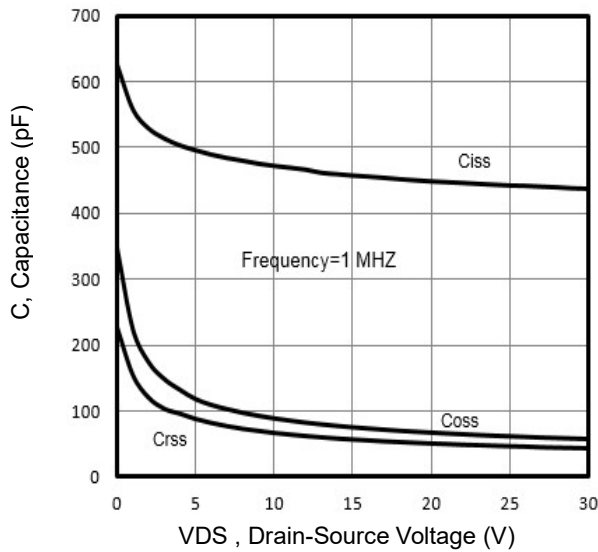


Fig7. Typical Capacitance Vs. Drain-Source Voltage

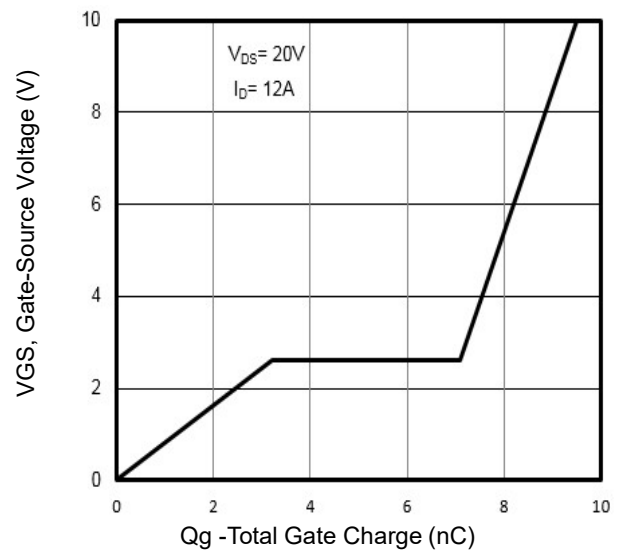


Fig8. Typical Gate Charge Vs. Gate-Source Voltage

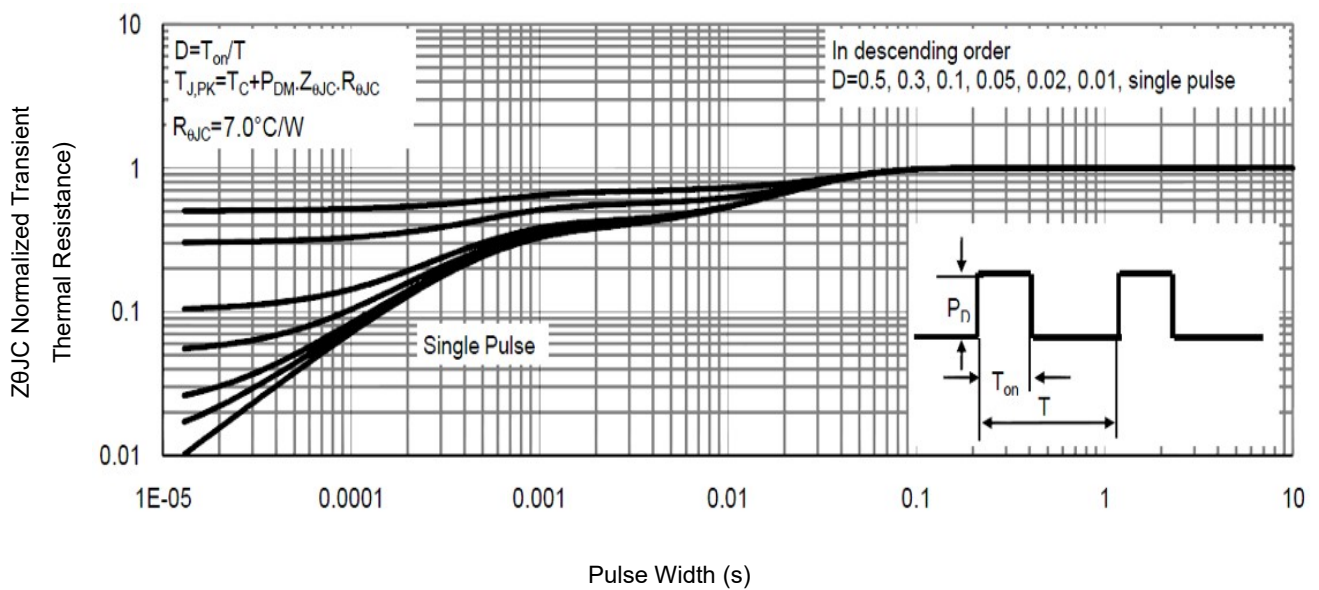


Fig 9 .Normalized Maximum Transient Thermal Impedance

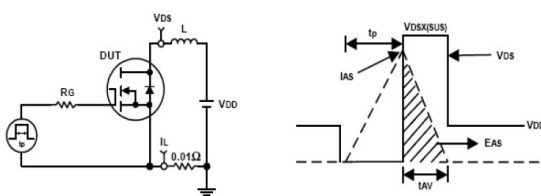


Fig10. Unclamped Inductive Test Circuit and waveforms

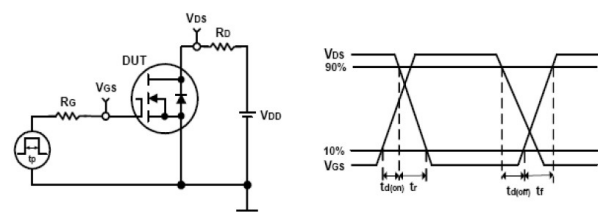
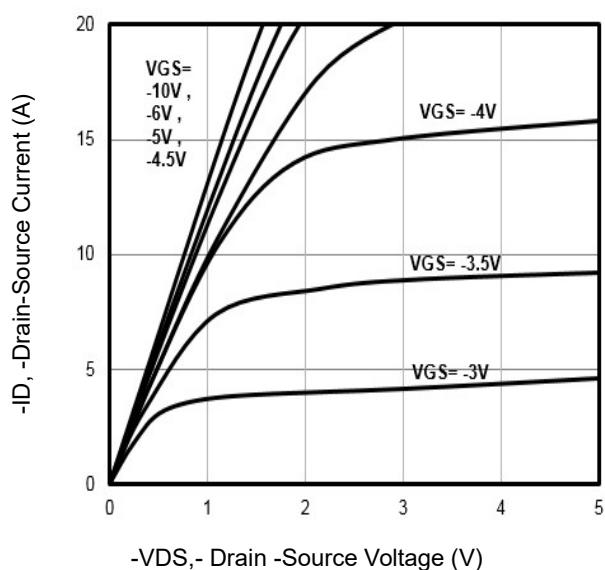
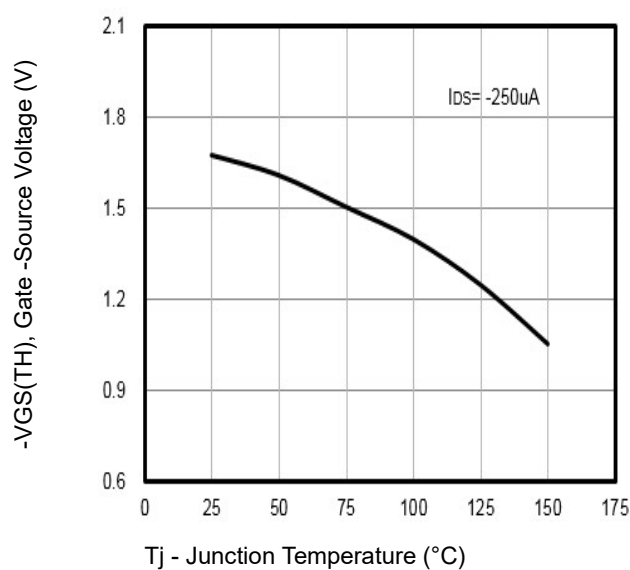
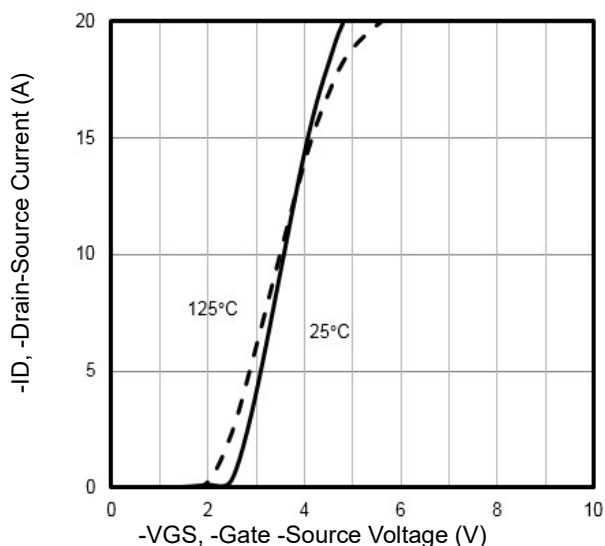
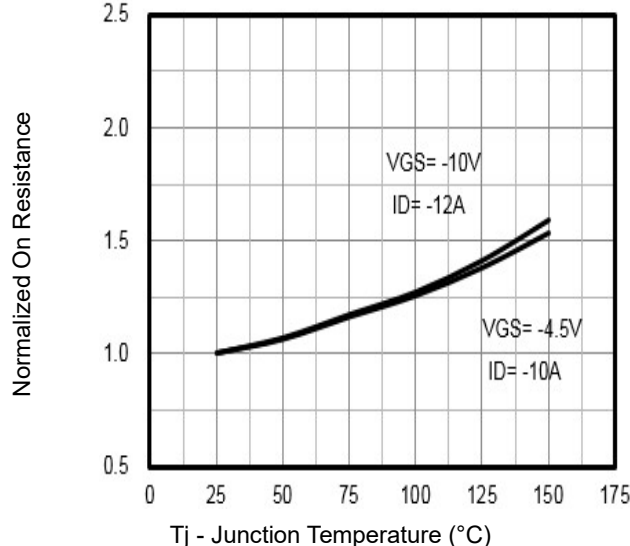
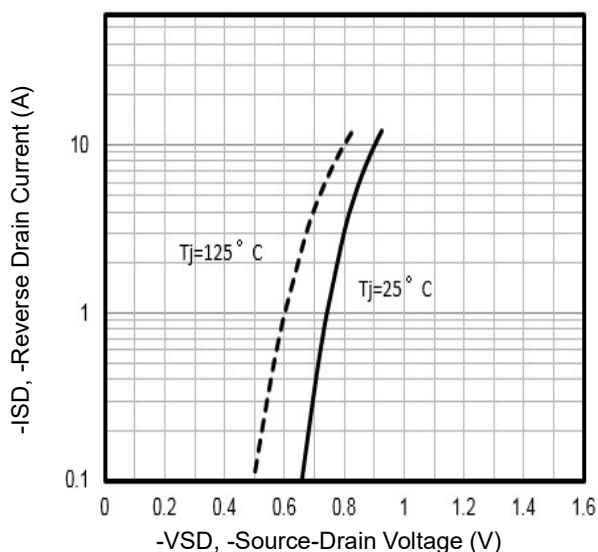
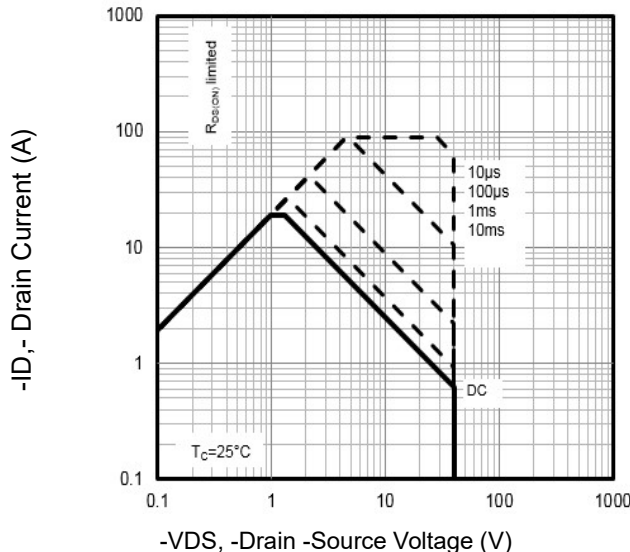
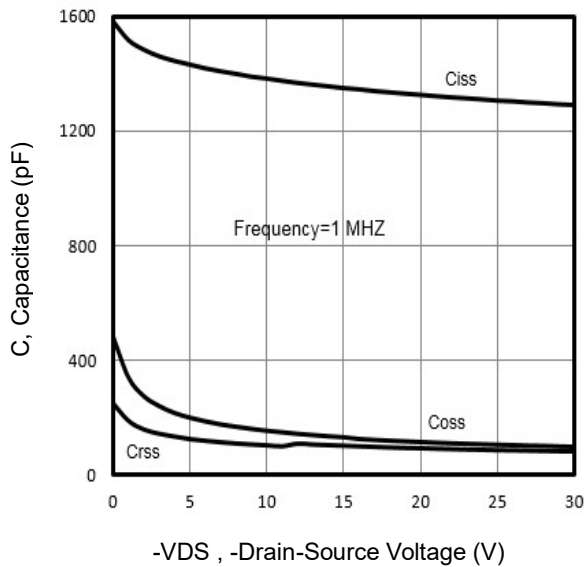
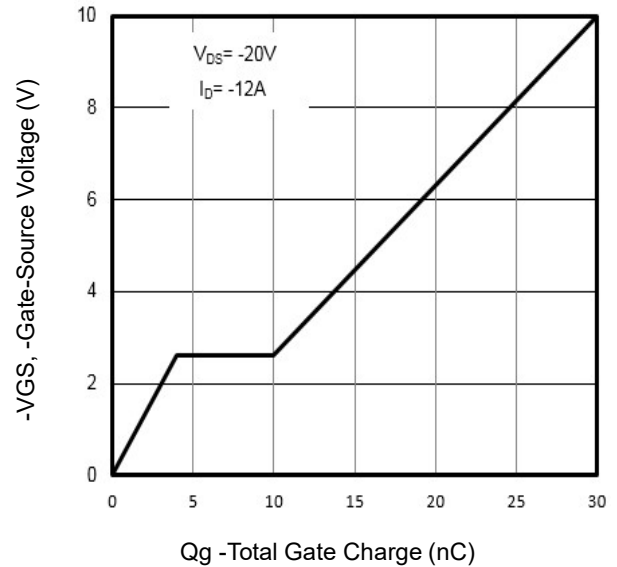
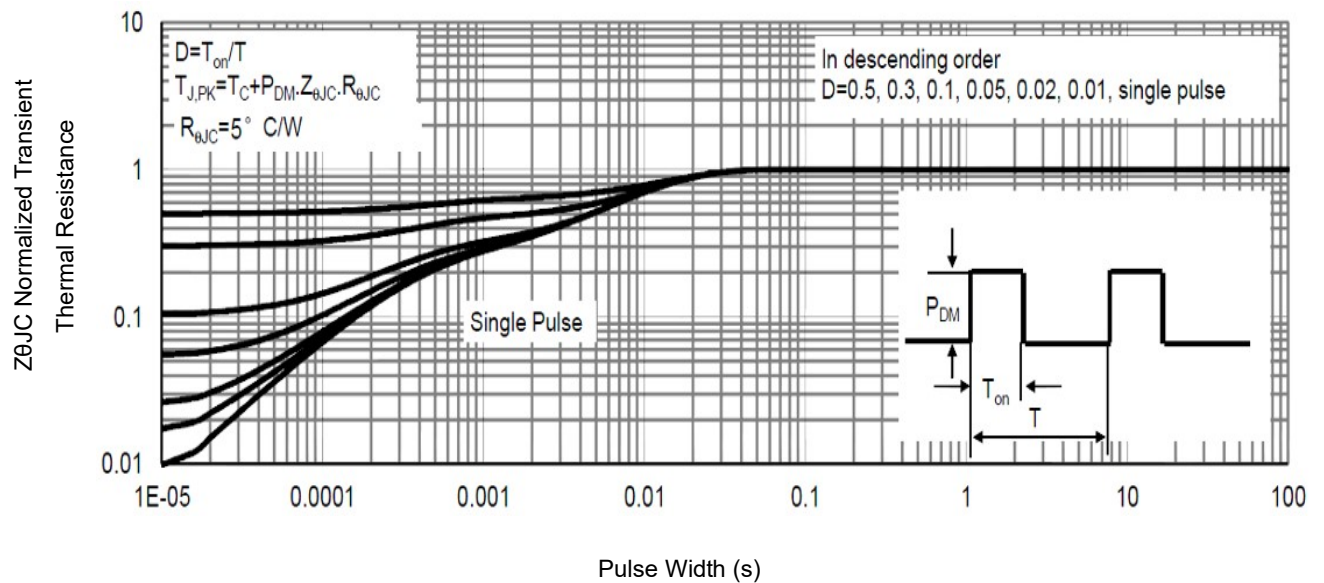
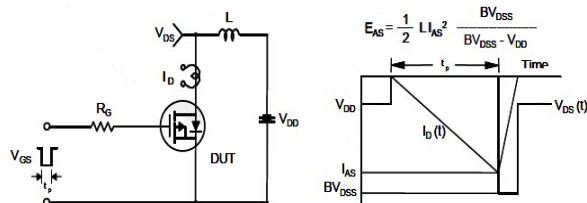
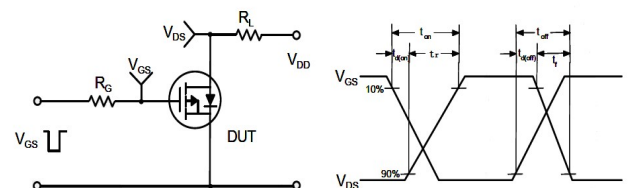


Fig11. Switching Time Test Circuit and waveforms

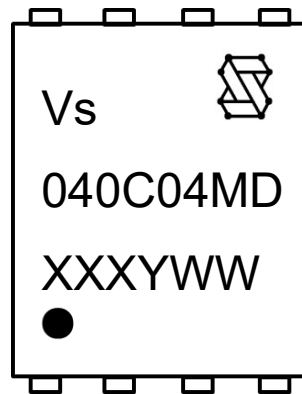
P-Channel Typical Characteristics


Fig1. Typical Output Characteristics

Fig2. $-V_{GS(TH)}$ Gate-Source Voltage Vs. T_j

Fig3. Typical Transfer Characteristics

Fig4. Normalized On-Resistance Vs. T_j

Fig5. Typical Source-Drain Diode Forward Voltage

Fig6. Maximum Safe Operating Area

P-Channel Typical Characteristics


Fig7. Typical Capacitance Vs. Drain-Source Voltage

Fig8. Typical Gate Charge Vs. Gate-Source Voltage

Fig9. Normalized Maximum Transient Thermal Impedance

Fig10. Unclamped Inductive Test Circuit and Waveforms

Fig11. Switching Time Test Circuit and waveforms

Marking Information



1st line: Vergiga Code (Vs), Vergiga Logo

2nd line: Part Number (040C04MD)

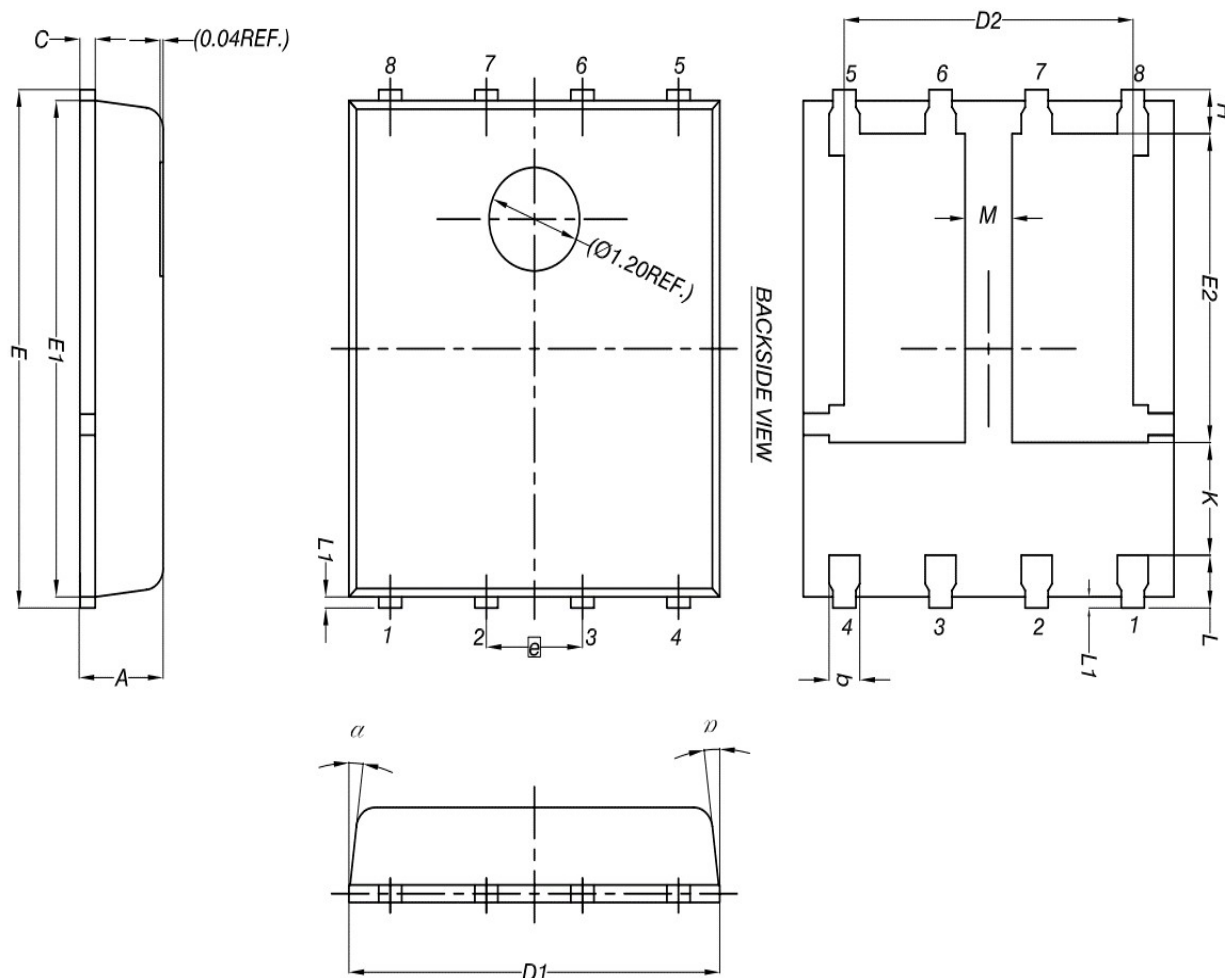
3rd line: Date code (XXXYWW)

XXX: Wafer Lot Number Code, code changed with Lot Number

Y: Year Code, refer to table below

WW: Week Code (01 to 53)

Code	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T
Year	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030

PDFN5x6 Dual Package Outline Data


Symbol	DIMENSIONS (unit : mm)		
	Min	Typ	Max
A	0.90	1.00	1.10
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	--	--
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
M	0.50	--	--
α	0°	--	12°

Notes:

1. Refer to JEDEC MO-240 variation AA.
2. Dimensions "D1" and "E1" do NOT include mold flash protrusions or gate burrs.
3. Dimensions "D1" and "E1" include interterminal flash or protrusion. Interterminal flash or protrusion shall not exceed 0.25mm per side.

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