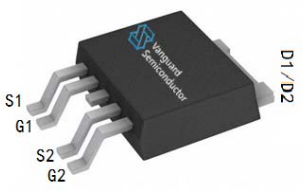
Features

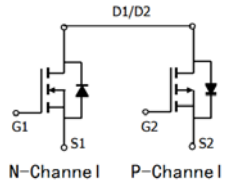
- N+P Channel
- Enhancement mode
- Very low on-resistance
- Fast Switching and High efficiency
- 100% Avalanche Tested
- Pb-free lead plating; RoHS compliant

Pb-Free RoHS HF Halogen-Free

V_{DS}	40	-40	V
$R_{DS(on),TYP}$@ V_{GS}=±10 V	12	30	mΩ
$R_{DS(on),TYP}$@ V_{GS}=±4.5V	18	50	mΩ
I_D	40	-25	A

TO-252-4L





Part ID	Package Type	Marking	Tape and reel information
VSD020C04MC	TO-252-4L	020C04MC	2500pcs/Reel

Symbol	Parameter		Rating		Unit
			NMOS	PMOS	
$V_{(BR)DSS}$	Drain-Source breakdown voltage		40	-40	V
VGS	Gate-Source voltage		±20	±20	V
I_S	Diode continuous forward current	T_C=25°C	40	-25	A
I_D	Continuous drain current @VGS=±10V	T_C=25°C	40	-25	A
		T_C=100°C	28	-18	A
I_{DM}	Pulse drain current tested ①	T_C=25°C	160	-100	A
I_{DSM}	Continuous drain current @VGS=±10V	T_A=25°C	7	-5	A
		T_A=70°C	6	-4	A
EAS	Avalanche energy, single pulsed ②		16	20	mJ
P_D	Maximum power dissipation	T_C=25°C	38	38	W
P_{DSM}	Maximum power dissipation ③	T_A=25°C	1.3	1.3	W
T_{STG}, T_J	Storage and junction temperature range		-55 to 175	-55 to 175	°C

Thermal Characteristics

Symbol	Parameter	Typical	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3.9	°C/W
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient	100	°C/W

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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_C =25℃)	V_{DS}=40V,V_{GS}=0V	--	--	1	μA
	Zero Gate Voltage Drain Current(T_C =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	1.3	1.8	2.5	V
$R_{DS(ON)}$	Drain-Source On-State Resistance ④	V_{GS}=10V, I_D=20A	--	12	17	mΩ
		T_C =100℃	--	15	--	mΩ
		V_{GS}=4.5V, I_D=10A	--	18	25	mΩ
Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise stated)						
C_{iss}	Input Capacitance	V_{DS}=20V,V_{GS}=0V, f=1MHz	1120	1320	1520	pF
C_{oss}	Output Capacitance		85	100	115	pF
C_{rss}	Reverse Transfer Capacitance		70	80	90	pF
R_g	Gate Resistance	f=1MHz	--	1.9	--	Ω
Q_g (10V)	Total Gate Charge	V_{DS}=20V,I_D=20A, V_{GS}=10V	--	22	--	nC
Q_g (4.5V)	Total Gate Charge		--	10	--	nC
Q_{gs}	Gate Source Charge		--	5.3	--	nC
Q_{gd}	Gate Drain Charge		--	3.7	--	nC
Switching Characteristics						
$t_{d(on)}$	Turn on Delay Time	V_{DD}=20V, I_D=20A, R_G=3Ω, V_{GS}=10V	--	8.2	--	ns
t_r	Turn on Rise Time		--	56	--	ns
$t_{d(off)}$	Turn Off Delay Time		-	19	--	ns
t_f	Turn Off Fall Time		--	40	--	ns
Source Drain Diode Characteristics						
V_{SD}	Forward on voltage	I_{SD}=20A,V_{GS}=0V	--	0.9	1.2	V
t_{rr}	Reverse Recovery Time	T_j=25℃,I_{sd}=20A, V_{GS}=0V di/dt=-100A/μs	--	12	--	ns
Q_{rr}	Reverse Recovery Charge		--	5.3	--	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} = 8A, V_{GS} =10V. Part not recommended for use above this value

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

④ Pulse width ≤ 380μs; duty cycle≤ 2%.

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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_C =25℃)	V_{DS}=-40V,V_{GS}=0V	--	--	-1	μA
	Zero Gate Voltage Drain Current(T_C =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	-1.3	-1.8	-2.5	V
$R_{DS(ON)}$	Drain-Source On-State Resistance ④	V_{GS}=-10V, I_D=-20A	--	30	40	mΩ
		T_C =100℃	--	35	--	mΩ
		V_{GS}=-4.5V, I_D=-15A	--	50	65	mΩ
Dynamic Electrical Characteristics @ T_J = 25°C (unless otherwise stated)						
C_{iss}	Input Capacitance	VDS=-20V,VGS=0V, f=1MHz	1100	1300	1500	pF
C_{oss}	Output Capacitance		90	110	130	pF
C_{rss}	Reverse Transfer Capacitance		70	85	100	pF
R_g	Gate Resistance	f=1MHz	--	7.1	--	Ω
Q_g (-10V)	Total Gate Charge	VDS=-20V,ID=-20A, VGS=-10V	--	21	--	nC
Q_g (-4.5V	Total Gate Charge		--	9.3	--	nC
Q_{gs}	Gate Source Charge		--	5.6	--	nC
Q_{gd}	Gate Drain Charge		--	3.5	--	nC
Switching Characteristics						
$t_{d(on)}$	Turn on Delay Time	VDD=-20V, ID=-20A, RG=2.7Ω, VGS=-10V	--	7.2	--	ns
t_r	Turn on Rise Time		--	44	--	ns
$t_{d(off)}$	Turn Off Delay Time		-	24	--	ns
t_f	Turn Off Fall Time		--	26	--	ns
Source Drain Diode Characteristics						
V_{SD}	Forward on voltage	I_{SD}=-20A,V_{GS}=0V	--	-1	-1.2	V
t_{rr}	Reverse Recovery Time	T_j=25℃,Isd=-20A, VGS=0V di/dt=-100A/μs	--	13	--	ns
Q_{rr}	Reverse Recovery Charge		--	6.3	--	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} = -9A, V_{GS} =-10V. Part not recommended for use above this value

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

④ Pulse width ≤ 380μs; duty cycle≤ 2%.

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N-Channel Typical Characteristics

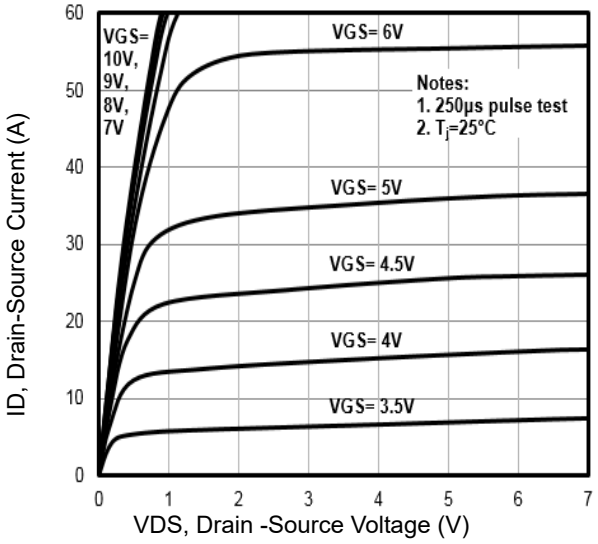

Fig1. Typical Output Characteristics

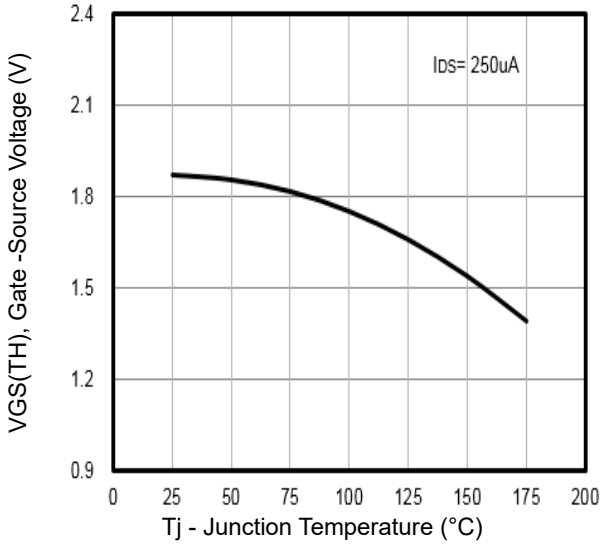

Fig2. $V_{GS(TH)}$ Gate -Source Voltage Vs. Tj

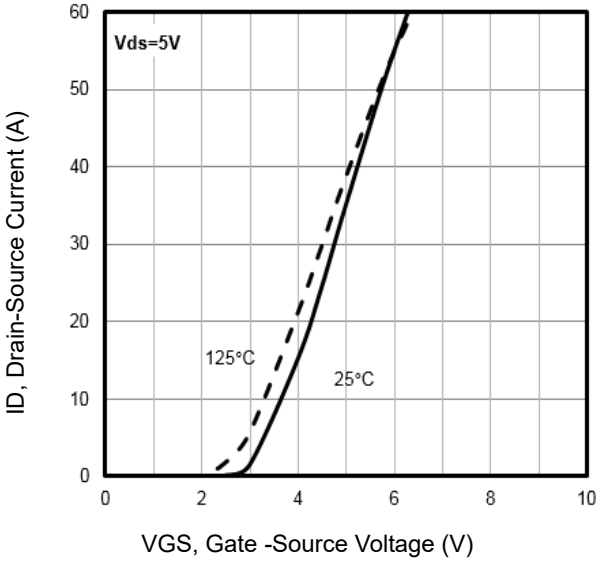

Fig3. Typical Transfer Characteristics

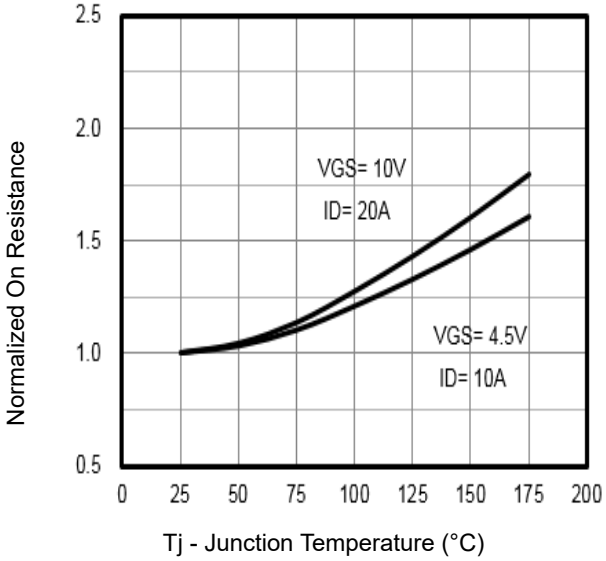

Fig4. Normalized On-Resistance Vs. Tj

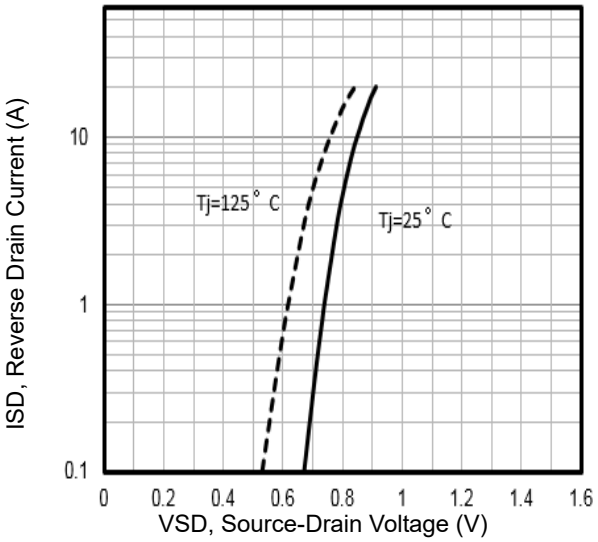

Fig5. Typical Source-Drain Diode Forward Voltage

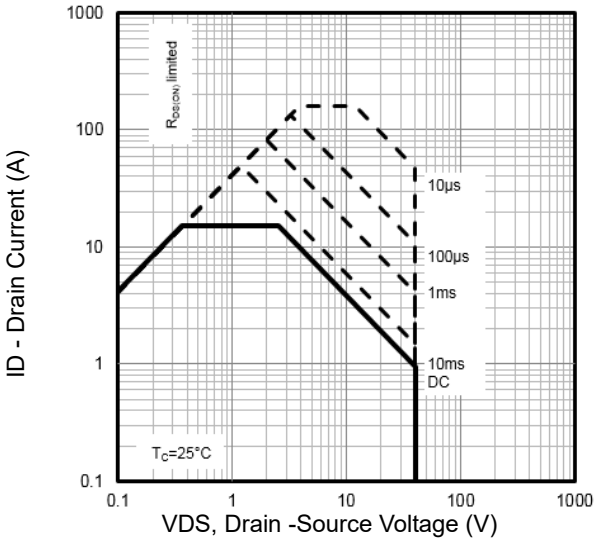

Fig6. Maximum Safe Operating Area

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N-Channel Typical Characteristics

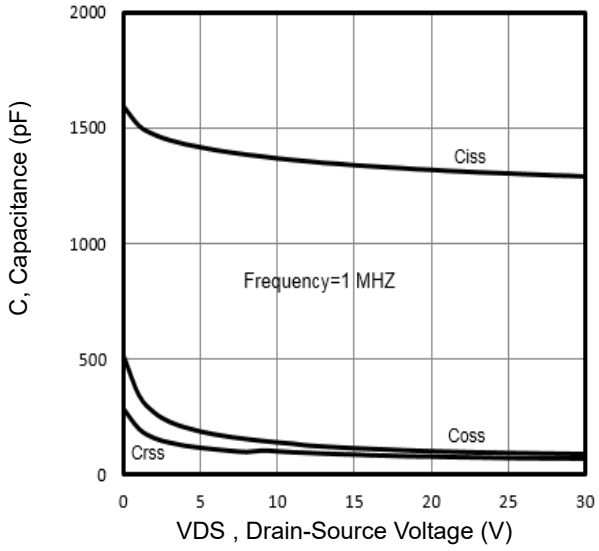

Fig7. Typical Capacitance Vs.Drain-Source Voltage

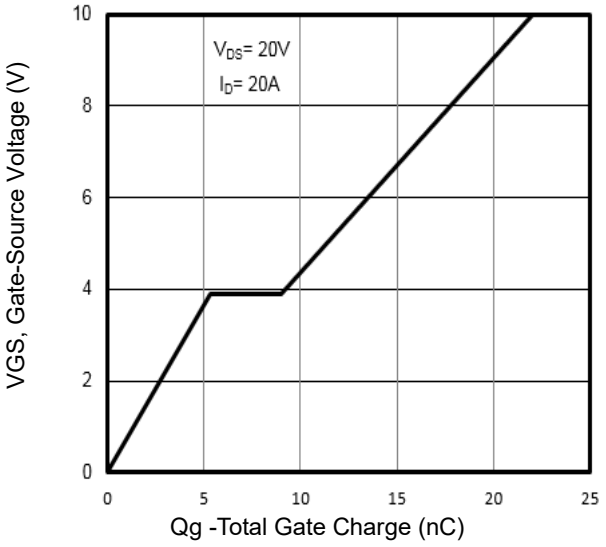

Fig8. Typical Gate Charge Vs.Gate-Source Voltage

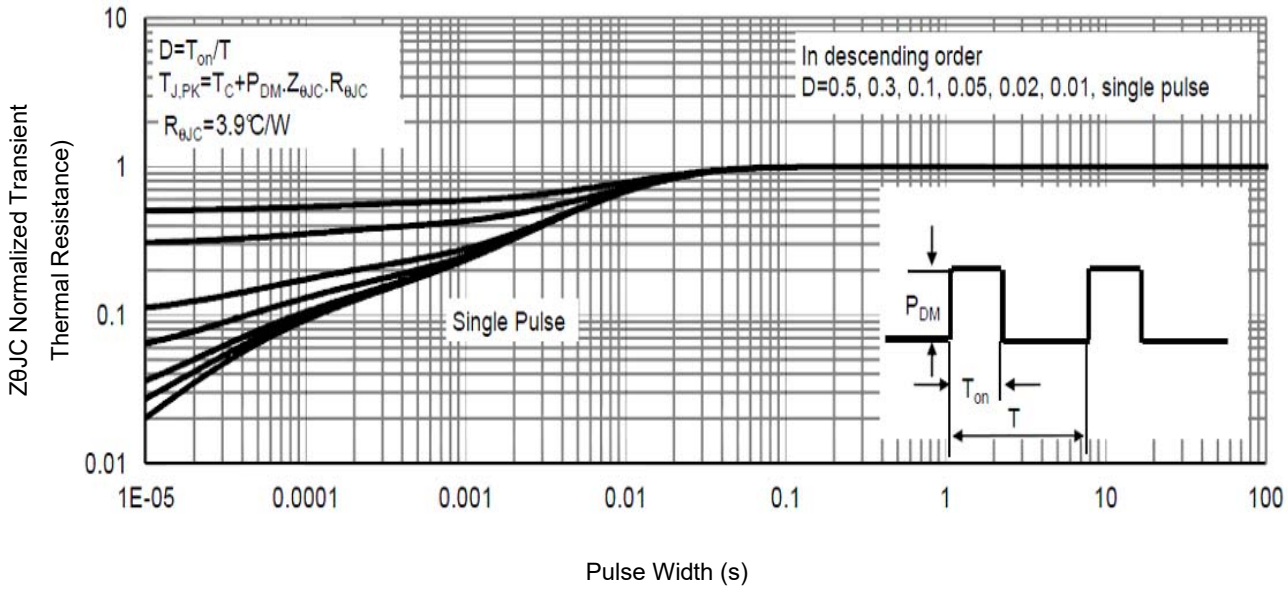

Fig 9 .Normalized Maximum Transient Thermal Impedance

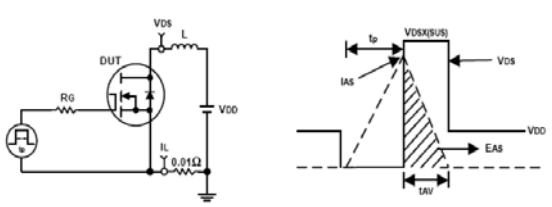

Fig10. Unclamped Inductive Test Circuit and waveforms

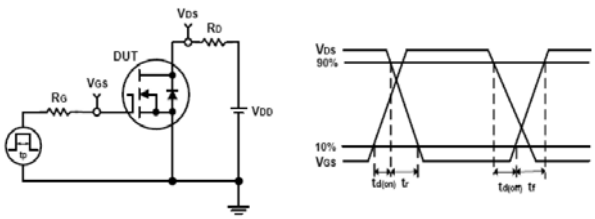

Fig11. Switching Time Test Circuit and waveforms

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P-Channel Typical Characteristics

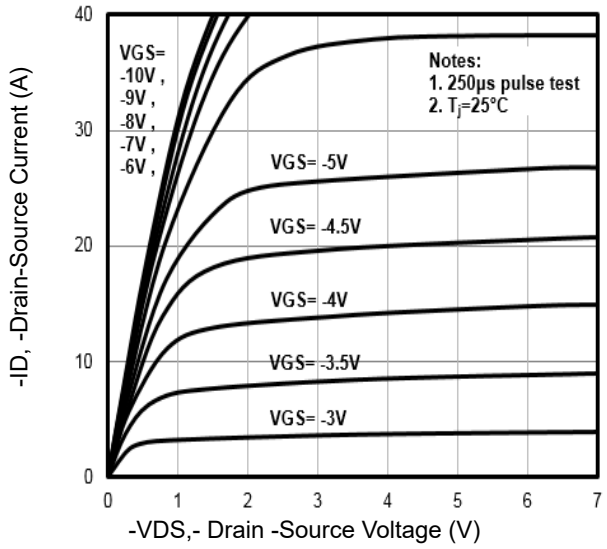

Fig1. Typical Output Characteristics

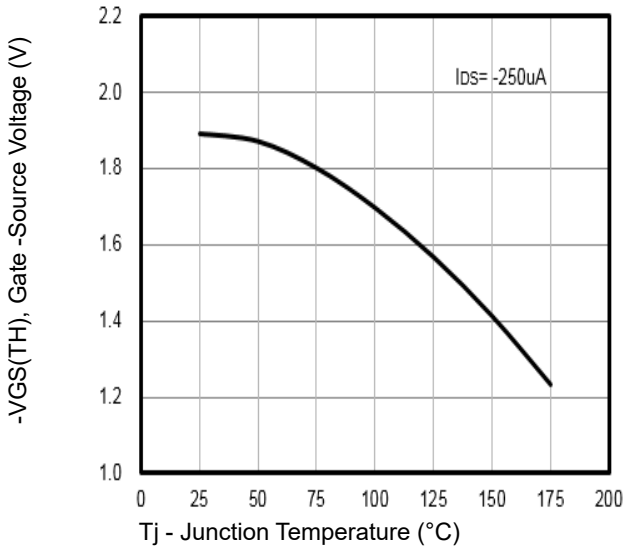

Fig2. $V_{GS(TH)}$ Gate -Source Voltage Vs. Tj

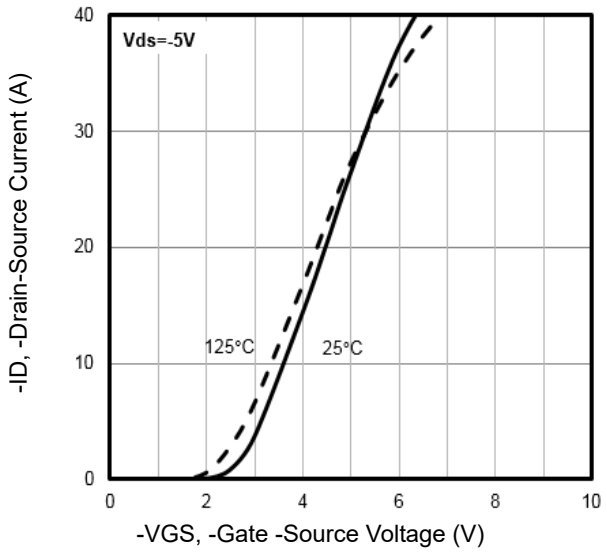

Fig3. Typical Transfer Characteristics

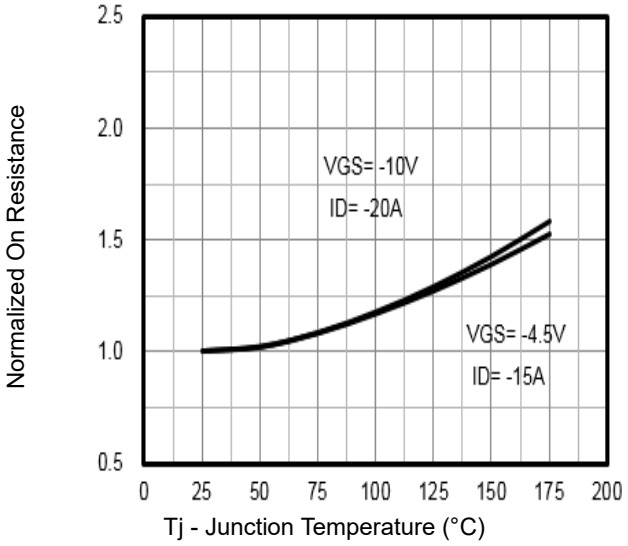

Fig4. Normalized On-Resistance Vs. Tj

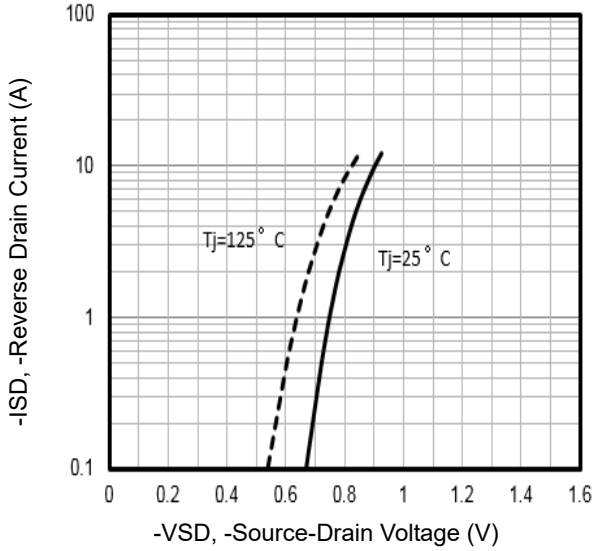

Fig5. Typical Source-Drain Diode Forward Voltage

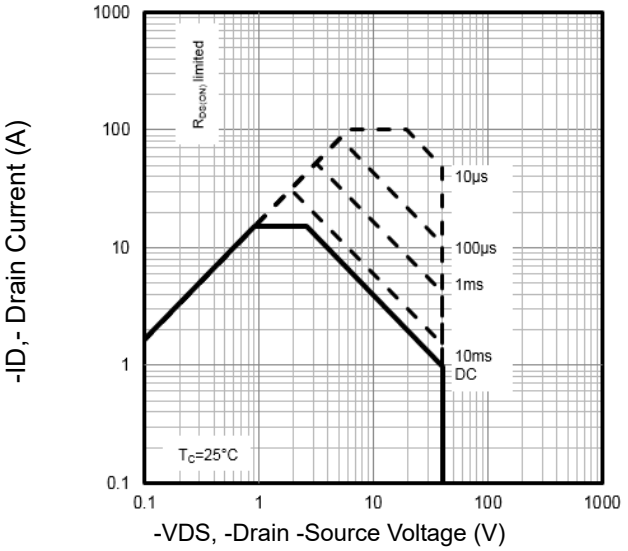

Fig6. Maximum Safe Operating Area

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P-Channel Typical Characteristics

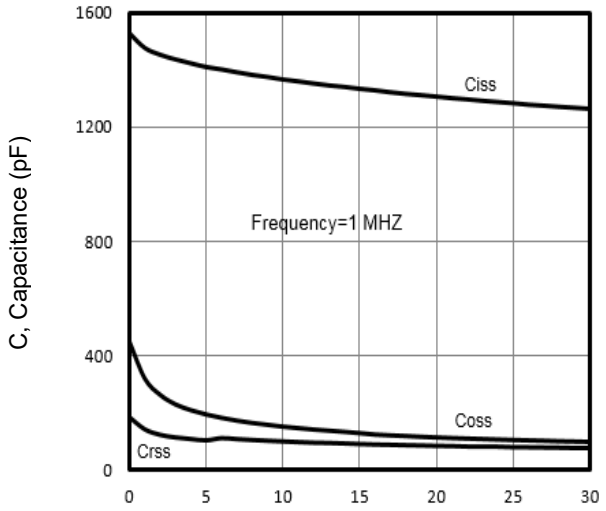

Fig7. Typical Capacitance Vs.Drain-Source Voltage

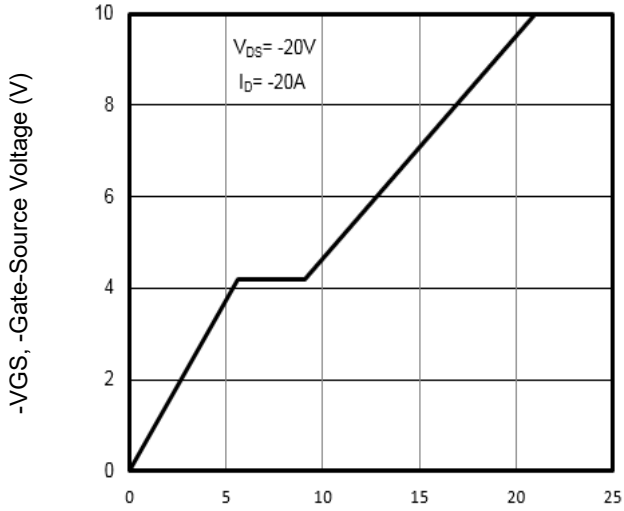

Fig8. Typical Gate Charge Vs.Gate-Source Voltage

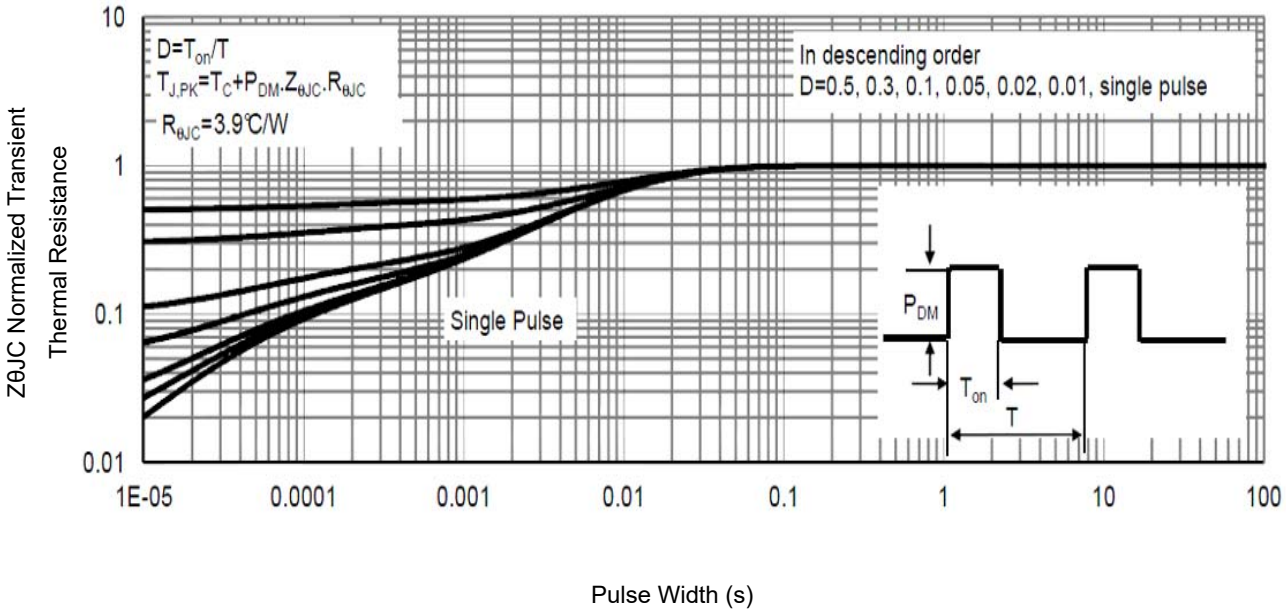

Fig9. Normalized Maximum Transient Thermal Impedance

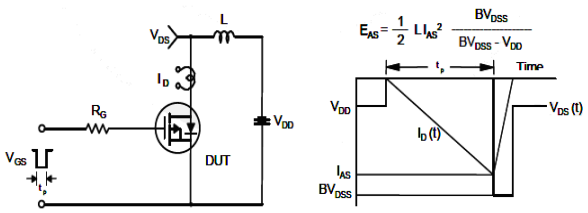

Fig10. Unclamped Inductive Test Circuit and Waveforms

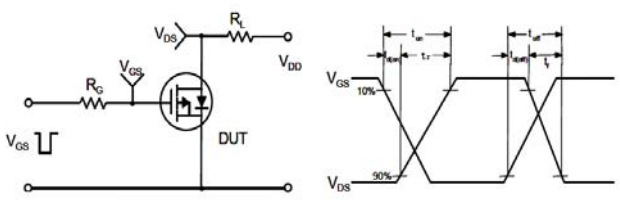

Fig11. Switching Time Test Circuit and waveforms

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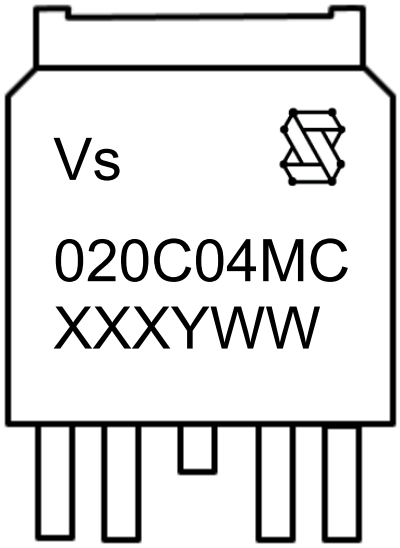
Marking Information



1st line： Vanguard Code（Vs）， Vanguard Logo
2nd line： Part Number（020C04MC）
3rd line： Date code （XXXYWW）
XXX： Wafer Lot Number Code , code changed with Lot Number
Y： Year Code，(e.g. E=2017, F=2018, G=2019, H=2020, etc)
WW： Week Code (01 to 53)

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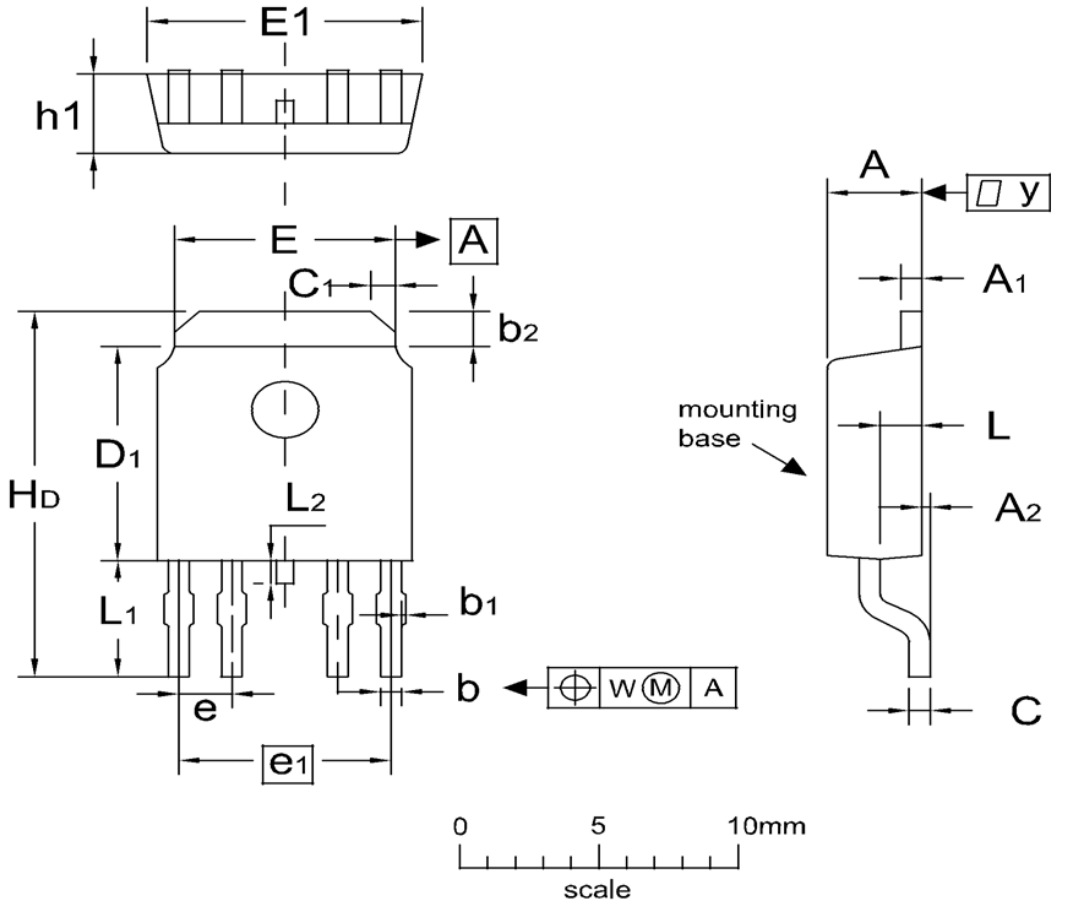
TO-252-4L Package Outline Data



DIMENSIONS (unit : mm)

Symbol	Min	Typ	Max	Symbol	Min	Typ	Max
A	2.1	2.3	2.5	**A_1**	0.4	0.5	0.6
A2	--	--	0.3	**b**	0.4	0.5	0.6
b_1	--	--	0.1	**b_2**	0.8	1.0	1.2
C	0.4	0.5	0.6	**C_1**	0.4	0.6	0.8
D_1	5.7	6.1	6.5	**E**	5.0	5.3	5.6
E_1	6.3	6.6	6.9	**e**	--	1.27	--
e_1	--	5.08	--	**H_D**	9.6	10.0	10.4
h_1	2.1	2.3	2.5	**L**	0.80	1.0	1.2
L_1	2.6	2.9	3.2	**L_2**	0.35	0.65	0.95

Customer Service

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