• General Description

It combines trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$. It combines one N channel MOSFET and one P channel MOSFET

• Features

■AEC-Q101 Qualified

■Low $R_{DS(ON)}$ to minimize conductive loss

■Dual DIE in one package

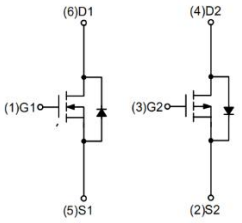
■Low Thermal resistance

•Application

■BLDC Motor driver

■Load switch

• Product Summary



V_{DS1}= 40V

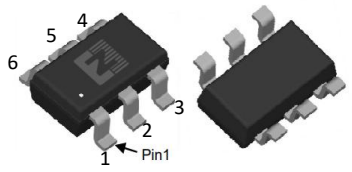
V_{DS2}= -40V

$R_{DS(ON)1}$ = 38mΩ

$R_{DS(ON)2}$ = 96mΩ

I_{D1}= 3.8A

I_{D2}= -2.4A



SOT23-6

•Ordering Information:

Part NO.	ZMCA88402U
Marking	88402
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

•N Channel Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		40	V
Gate-Source Voltage①	V_{GS}		±20	V
Continuous Drain Current	I_D	T_C=25℃	3.8	A
	I_D	T_C=75℃	3	A
	I_D	T_C=100℃	2	A
Pulsed Drain Current	I_{DM}	Pulsed; t_p ≤ 10 μs; T_{mb} = 25 °C;	11.4	A
Total Power Dissipation	P_D	T_C=25℃	2	W
Total Power Dissipation	P_D	T_A=25℃	0.7	W
Operating Junction Temperature	T_J		-55 to +150	℃
Storage Temperature	T_{STG}		-55 to +150	℃
Single Pulse Avalanche Energy	E_{AS}	L=0.1mH, V_{GS}=10V, Rg=25Ω,	1.5	mJ
		L=0.5mH, V_{GS}=10V, Rg=25Ω,	3.15	mJ
ESD Level (HBM)	CLASS 1A			

●P Channel Absolute Maximum Ratings (T_C=25℃)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		-40	V
Gate-Source Voltage②	V_{GS}		±20	V
Continuous Drain Current	I_D	T_C=25℃	-2.4	A
	I_D	T_C=75℃	-2	A
	I_D	T_C=100℃	-2	A
Pulsed Drain Current	I_{DM}	Pulsed; t_p ≤ 10 μs; T_{mb} = 25 °C;	-7.2	A
Total Power Dissipation	P_D	T_C=25℃	2	W
Total Power Dissipation	P_D	T_A=25℃	0.7	W
Operating Junction Temperature	T_J		-55 to +150	℃
Storage Temperature	T_{STG}		-55 to +150	℃
Single Pulse Avalanche Energy	E_{AS}	L=0.1mH, V_{GS}=-10V, Rg=25Ω,	1.5	mJ
		L=0.5mH, V_{GS}=-10V, Rg=25Ω,	3	mJ
ESD Level (HBM)	CLASS 1A			

●Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	80	°C/W
Thermal resistance, junction-ambient③	R_{thJA}		-	180	°C/W
Soldering temperature	Tsold		-	260	°C

●N Channel Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA	40			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =250uA	1.3	1.7	2.5	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}= 40V			1.0	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=±20V, V_{DS} = 0V			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D= 4A		38	49	mΩ
		V_{GS}=4.5V, I_D= 3A		60	78	mΩ
Forward Transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 1A		1.8		s
Diode Forward Voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 4A			1.3	V

●N Channel Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=25V	-	463	-	pF
Output capacitance	Coss		-	38	-	
Reverse transfer capacitance	Crss		-	27	-	
Gate Risistance	Rg	f = 1MHz	-	1.4		Ω
Total gate charge	Qg	V_{DD} =15V, I_D =2A, V_{GS} =10V	-	6.5	-	nC
	Qg (4.5v)		-	3.1	-	
Gate - Source charge	Qgs		-	1.4	-	
Gate - Drain charge	Qgd		-	1.2	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=10V,V_{DS}=15V, R_G =3.3Ω, I_D =2A	-	9	-	ns
Turn-ON Rise time	t_r		-	2	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	10	-	ns
Turn-Off Fall time	t_f		-	8	-	ns
Reverse Recovery Time	t_{RR}	V_{DD}=20V, dI_S/dt = 100A/us, I_S=2A	-	32	-	ns
Reverse Recovery Charge	Q_{RR}		-	25	-	nC

●P Channel Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V, I_D =-250uA	-40			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =-250uA	-1.3	-1.7	-2.5	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}= -40V			1.0	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=±20V, V_{DS} = 0V			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D= -4A		96	130	mΩ
		V_{GS}=-4.5V, I_D= -3A		170	220	mΩ
Forward Transconductance	g_{FS}	V_{DS} =-5V, I_{SD} = -1A		1.2		s
Diode Forward Voltage	V_{FSD}	V_{GS} =0V, I_{SD} = -4A			1.3	V

●P Channel Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=-25V	-	421	-	pF
Output capacitance	Coss		-	47	-	
Reverse transfer capacitance	Crss		-	35	-	
Gate Risistance	Rg	f = 1MHz	-	9.2		Ω
Total gate charge	Qg	V_{DD} = -15V, I_D = -2A, V_{GS} = -10V	-	7.3	-	nC
	Qg (4.5v)		-	3.5	-	
Gate - Source charge	Qgs		-	1.8	-	
Gate - Drain charge	Qgd		-	1.3	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=-10V,V_{DS}=-15V, R_G =3.3Ω, I_D =-2A	-	10	-	ns
Turn-ON Rise time	t_r		-	7	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	13	-	ns
Turn-Off Fall time	t_f		-	16	-	ns
Reverse Recovery Time	t_{RR}	V_{DD}=-20V, dI_S/dt = 100A/us, I_S=-2A	-	42	-	ns
Reverse Recovery Charge	Q_{RR}		-	43	-	nC

• N Channel characteristics curve

Fig.1 Gate-Charge Characteristics

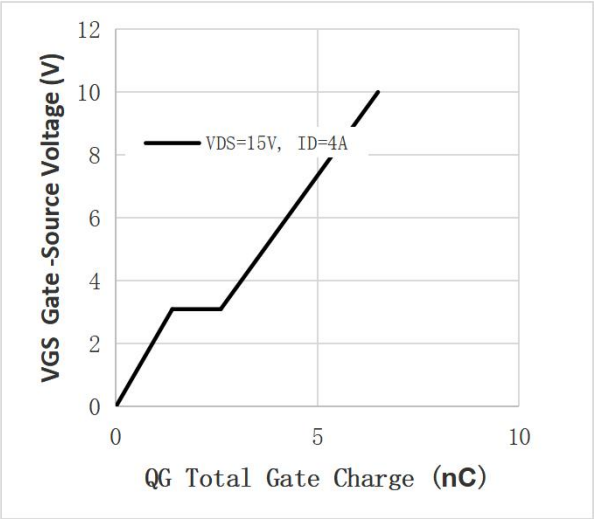


Fig.2 Capacitance Characteristics

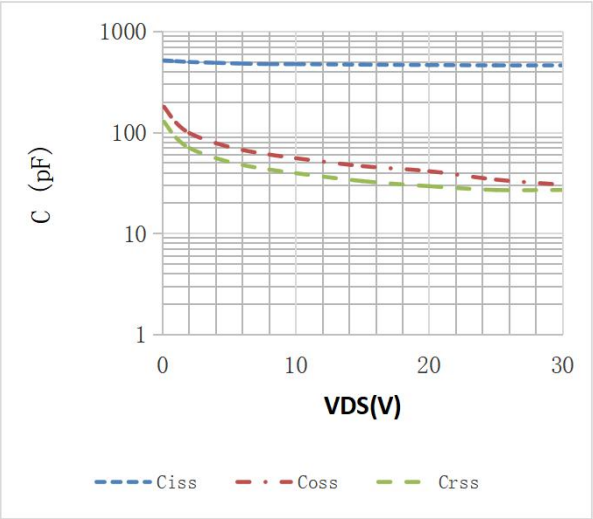


Fig.3 Power Dissipation

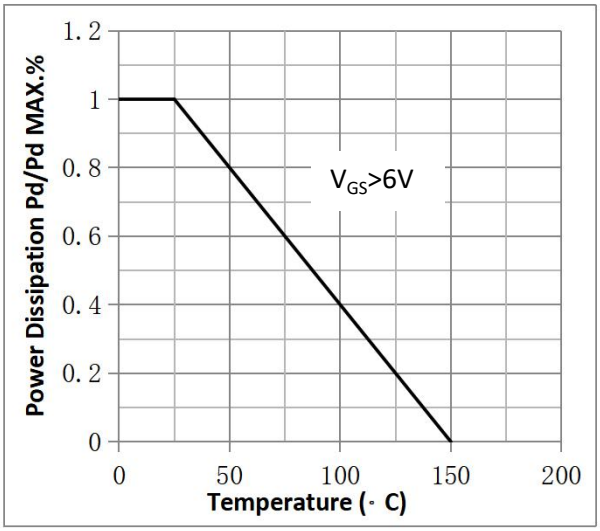


Fig.4 Typical output Characteristics

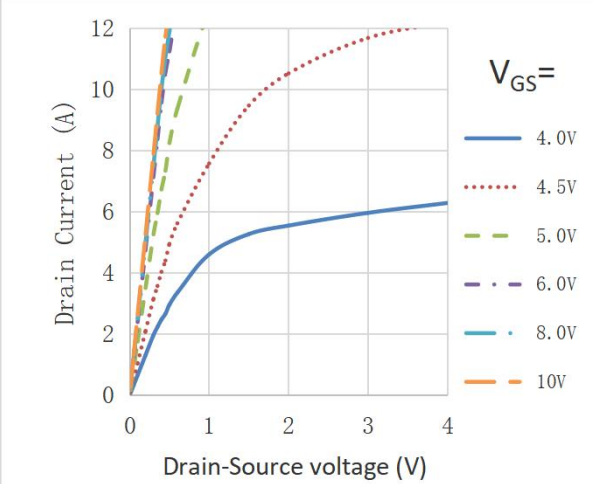


Fig.5 Threshold Voltage V.S Junction Temperature

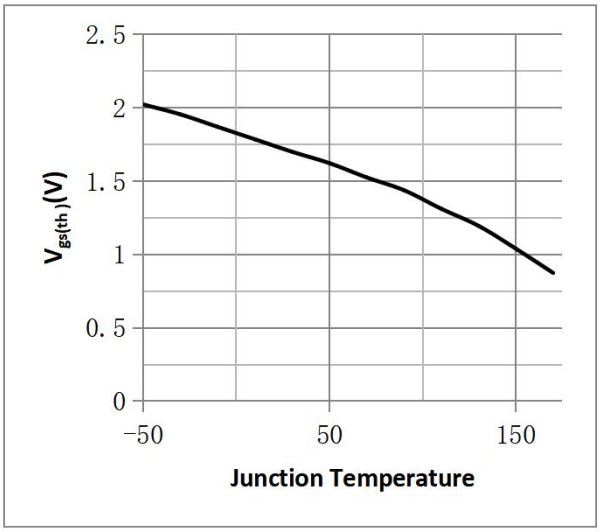


Fig.6 Resistance V.S Drain Current

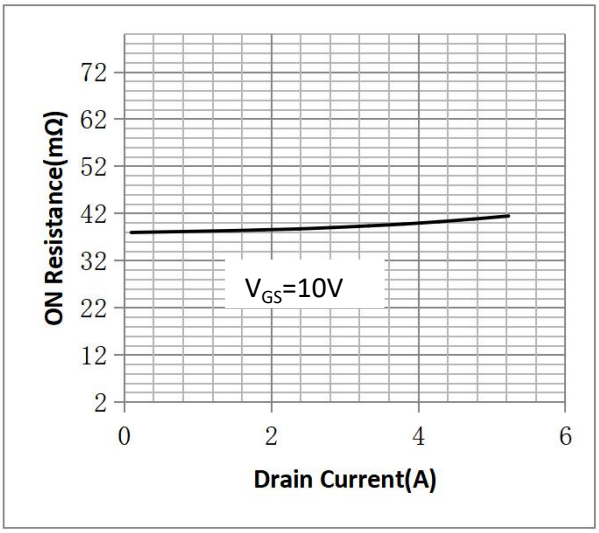


Fig.7 On-Resistance VS Gate Source Voltage

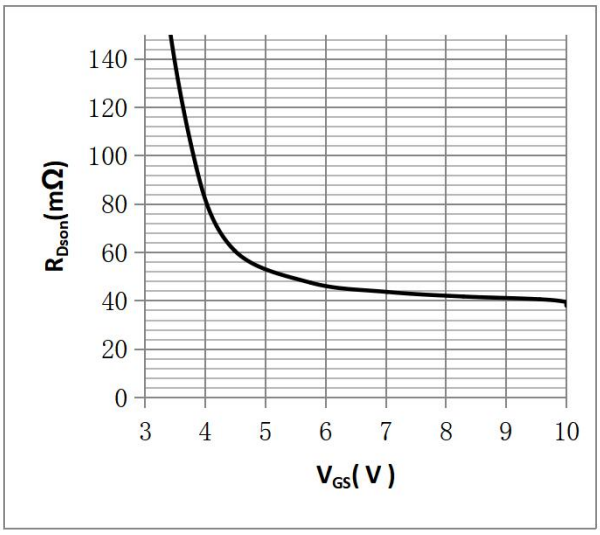


Fig.8 On-Resistance V.S Junction Temperature

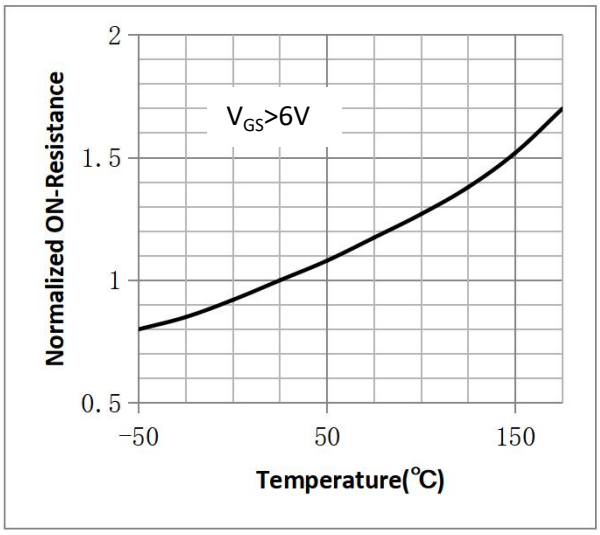


Figure 9. Diode Forward Voltage vs. Current

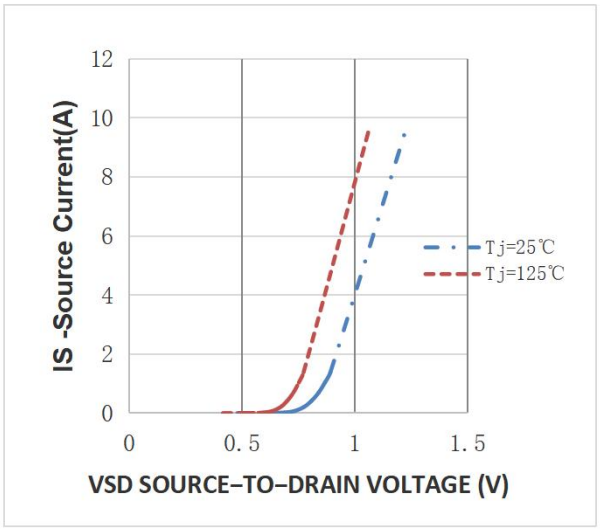


Figure 10. Transfer Characteristics

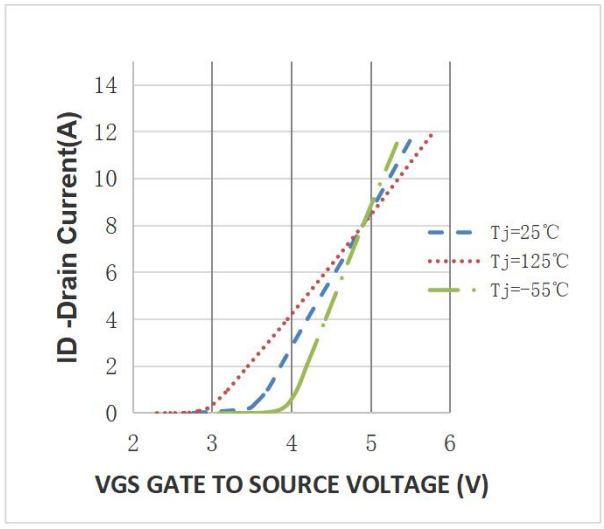


Fig.11 Safe Operating Area

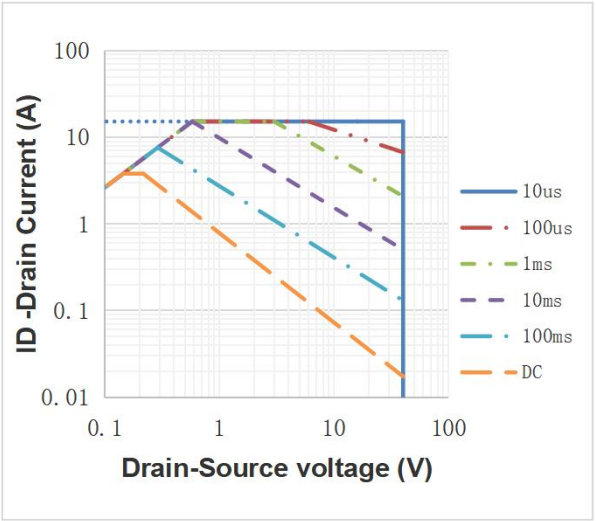
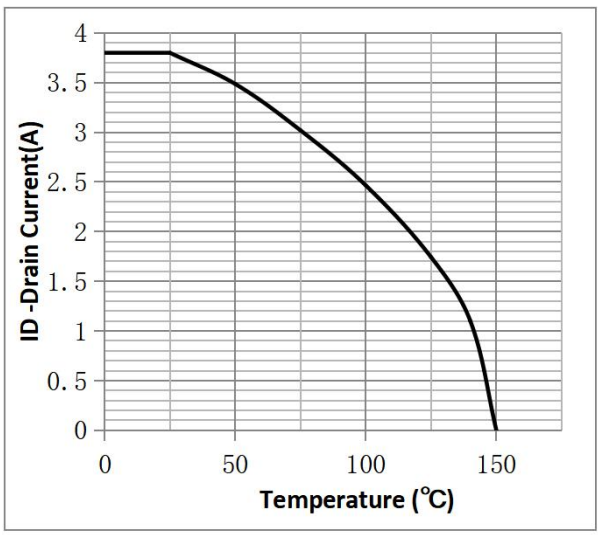


Fig.12 ID vs. Case Temperature④



•p Channel characteristics curve

Fig.1 Gate-Charge Characteristics

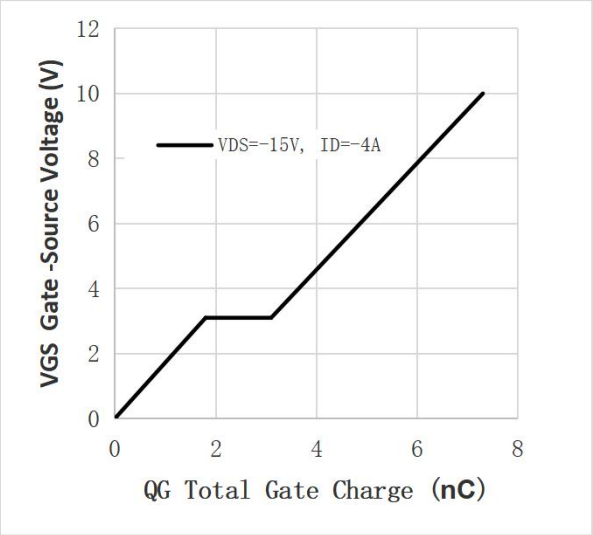


Fig.2 Capacitance Characteristics

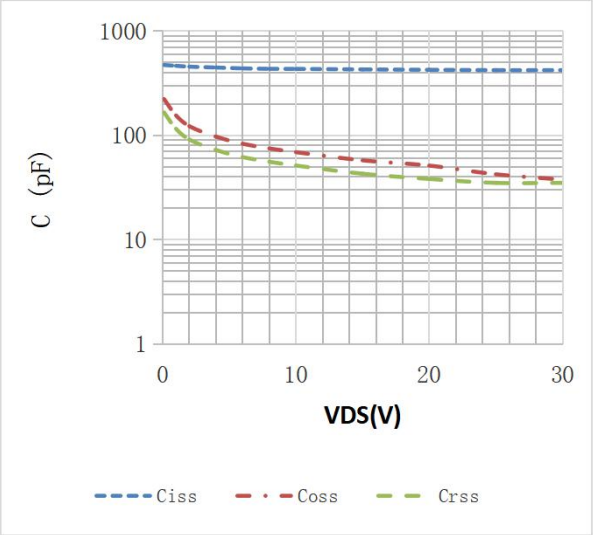


Fig.3 Power Dissipation

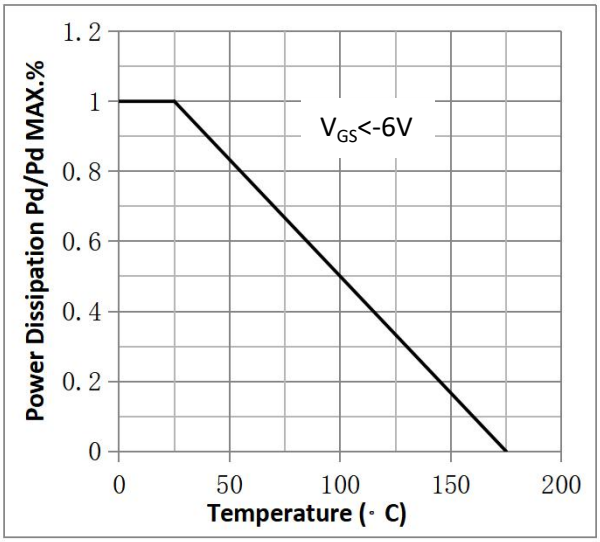


Fig.4 Typical output Characteristics

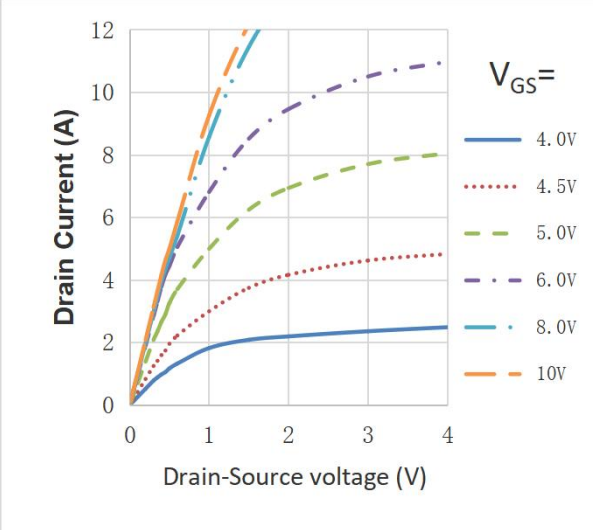


Fig.5 Threshold Voltage V.S Junction Temperature

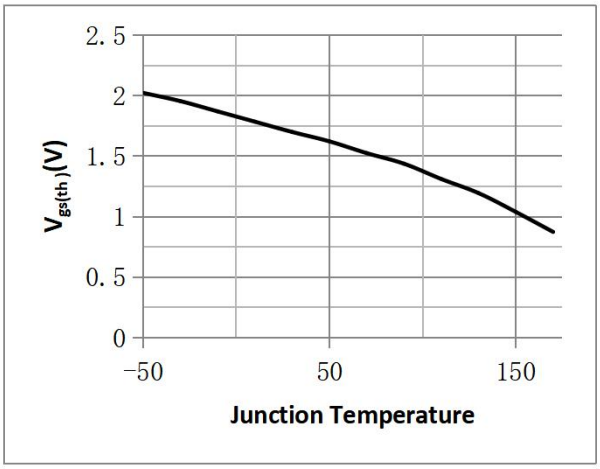


Fig.6 Resistance V.S Drain Current

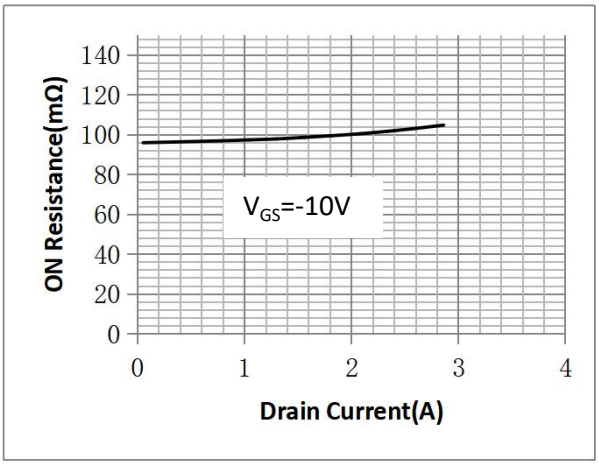


Fig.7 On-Resistance VS Gate Source Voltage

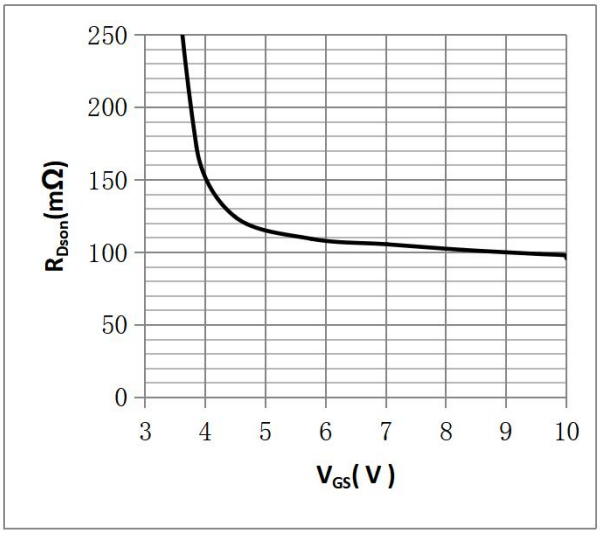


Fig.8 On-Resistance V.S Junction Temperature

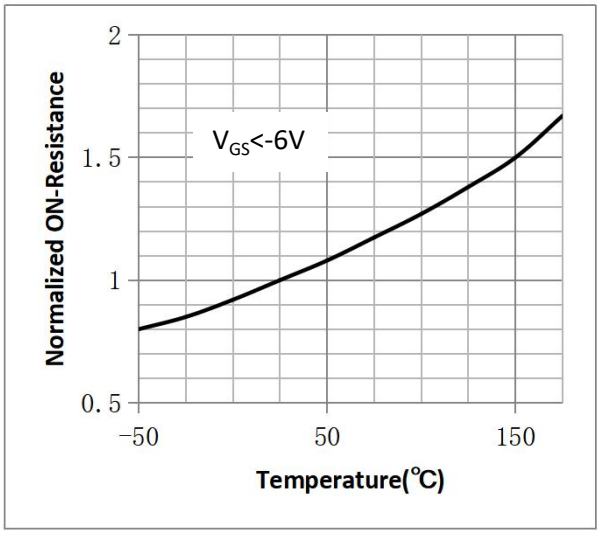


Figure 9. Diode Forward Voltage vs. Current

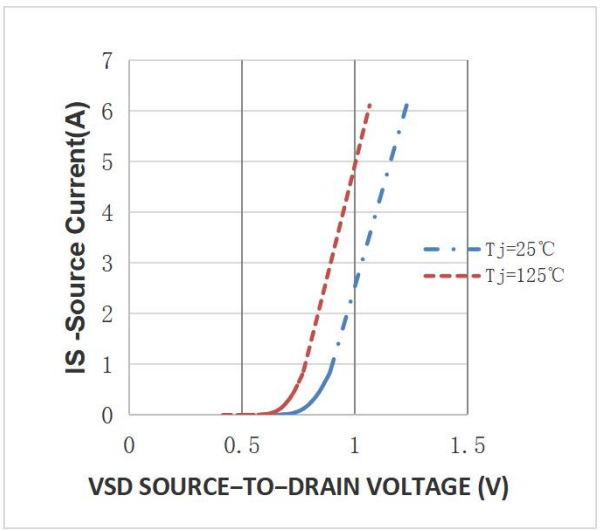


Figure 10. Transfer Characteristics

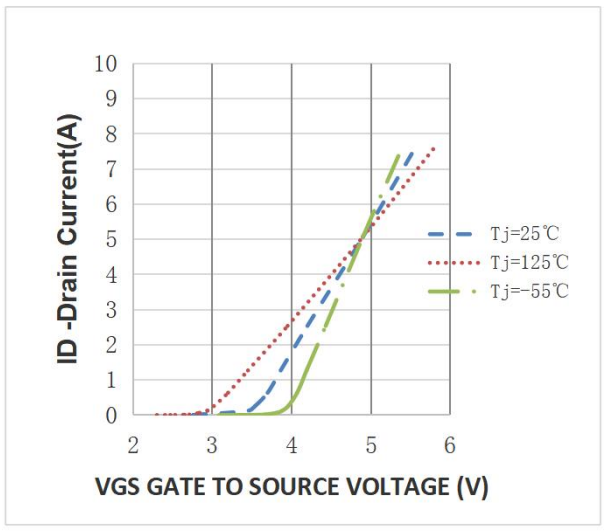


Fig.11 Safe Operating Area

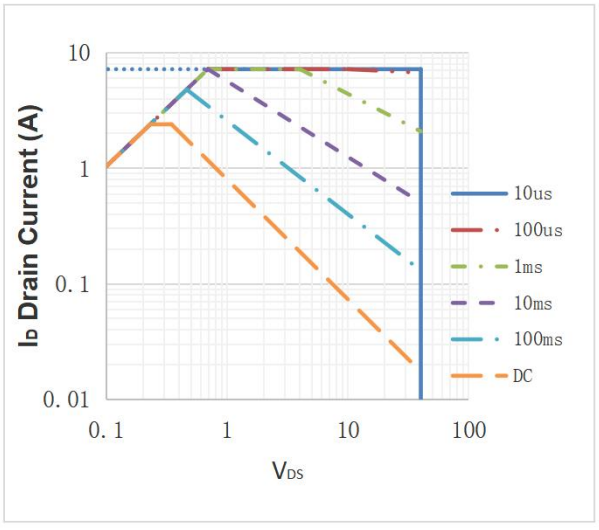
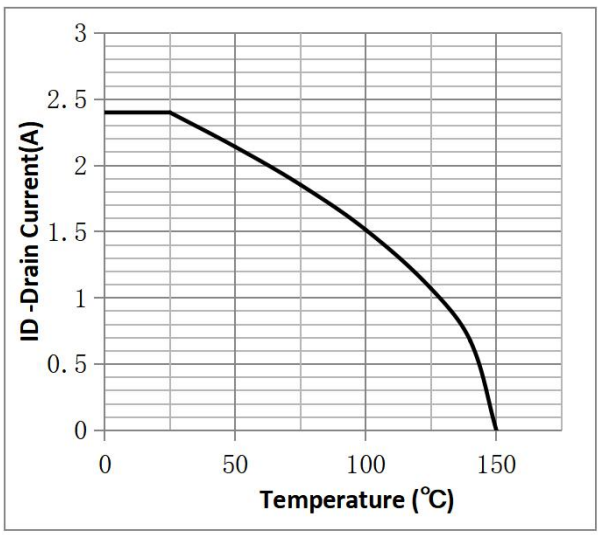
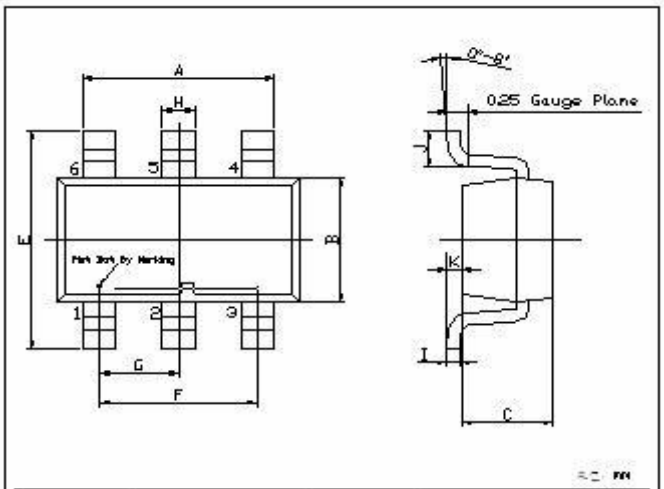


Fig.12 ID vs. Case Temperature④



●SOT23-6 Package Outline



A	2.92±0.1	G	0.95±0.1
B	1.60±0.1	H	0.40+0.1/-0.05
C	1.10±0.2	I	0.15±0.05
E	2.80±0.2	J	0.45±0.1
F	1.90±0.1	K	0-0.15

SOT23-6

Note:

① Pulse : VGS=+20V/-20V, Duty cycle=50%,Tj=175℃, t=1000 hours; For DC， the following test conditions can be passed: VGS=+20V/-10V, Tj=175℃, t=1000 hours；

② Pulse : VGS=+20V/-20V, Duty cycle=50%,Tj=175℃, t=1000 hours; For DC， the following test conditions can be passed: VGS=-20V/+10V, Tj=175℃, t=1000 hours；

③ Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate；

④ Practically the current will be limited by PCB, thermal design and operating temperature. VGS=10V (N channel)/-10V(P channel).

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Revision History

Version	Date	Change
A	2023.6.16	NEW