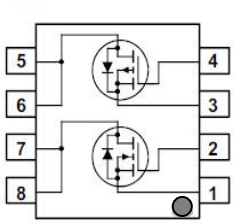
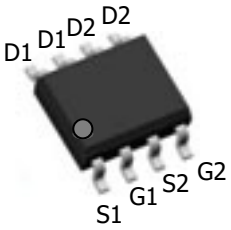
• General Description

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

• Product Summary



V_{DS1} =40V
V_{DS2} =-40V
$R_{DS(ON)1}$ =20mΩ
$R_{DS(ON)2}$ =45mΩ
I_{D1} =6.3A
I_{D2} =-4.0A



SOP8

• Features

- Advance high cell density Trench technology
- Low $R_{DS(ON)}$ to minimize conductive loss
- Low Gate Charge for fast switching
- Dual DIE in one package

•Application

- Power Management in Notebook Computer
- BLDC Motor driver

•Ordering Information:

Part NO.	ZMC88405S
Marking	ZMC88405
Packing Information	REEL TAPE
Basic ordering unit (pcs)	4000

•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	34	° C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	180	° C/W
Soldering temperature, reflow soldering (max)	T_{sold}	-	-	260	° C

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	40	V
Gate-Source Voltage	V_{GS}	±20	V
Continuous Drain Current	I_D@T_C =25℃	6.3	A
	I_D@T_C =75℃	4.8	A
	I_D@T_C=100℃	4.0	A

Pulsed Drain Current ①	I_{DM}	18.9	A
Total Power Dissipation	P_D@T_C=25℃	3.6	W
Total Power Dissipation	P_D@T_A=25℃	0.69	W
Operating Junction Temperature	T_J	-55 to 150	℃
Storage Temperature	T_{STG}	-55 to 150	℃
Single Pulse Avalanche Energy	E_{AS}	14	mJ

•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	1.4	1.6	2.5	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=40V, V_{GS} =0V			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=6A		20	28	mΩ
		V_{GS}=4.5V, I_D=4A		33	45	mΩ
Forward Transconductance	g_{FS}	V_{DS} =25V, I_D=5A		1.8		s
Source-drain voltage	V_{SD}	Is=6A			1.28	V

•N Channel Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=25V	-	805	-	pF
Output capacitance	Coss		-	94	-	
Reverse transfer capacitance	Crss		-	58	-	
Gate Risistance	Rg	f = 1MHz		1.2		Ω
Total gate charge	Qg	V_{DD} = 15V I_D = 6A V_{GS} = 10V	-	12	-	nC
Gate - Source charge	Qgs		-	3.1	-	
Gate - Drain charge	Qgd		-	2.8	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=10V,V_{DS}=15V R_G =6Ω, I_D =6A		6		ns
Turn-ON Rise time	t_r			16		ns
Turn-Off Delay time	$t_{D(off)}$			28		ns
Turn-Off Fall time	t_f			8		ns
Reverse Recovery Time	t_{RR}	V_{DD} = 20 V, dI_S/dt=100A/us, I_S = 6 A		18		ns
Reverse Recovery Charge	Q_{RR}			11		nC

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	-40	V
Gate-Source Voltage	V_{GS}	±20	V
Continuous Drain Current	I_D@T_C =25℃	-4	A
	I_D@T_C =75℃	-3.0	A
	I_D@T_C=100℃	-2.5	A
Pulsed Drain Current ①	I_{DM}	-12	A
Total Power Dissipation	P_D@T_C=25℃	3.6	W
Total Power Dissipation	P_D@T_A=25℃	0.69	W
Operating Junction Temperature	T_J	-55 to 150	℃
Storage Temperature	T_{STG}	-55 to 150	℃
Single Pulse Avalanche Energy	E_{AS}	15	mJ

●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	-1.4		-2.5	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=-40V, V_{GS} =0V			-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=-5A		46	57	mΩ
		V_{GS}=-4.5V, I_D=-4A		70	90	mΩ
Forward Transconductance	g_{FS}	V_{DS} =-10V, I_D=-4A		1.2		s
Source-drain voltage	V_{SD}	Is=-5A			1.28	V

●P Channel Dynamic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=25V	-	838	-	pF
Output capacitance	Coss		-	94	-	pF
Reverse transfer capacitance	Crss		-	70	-	pF
Gate Risistance	Rg	f = 1MHz		9.3		Ω
Total gate charge	Qg	V_{DD} = 15V, I_D = 5A, V_{GS} = 10V	-	15.3	-	nC
Gate - Source charge	Qgs		-	3.6	-	nC
Gate - Drain charge	Qgd		-	2.3	-	nC

Turn-ON Delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=15V, R_G =6Ω, I_D =5A		13.2		ns
Turn-ON Rise time	t_r			15		ns
Turn-Off Delay time	$t_{D(off)}$			46		ns
Turn-Off Fall time	t_f			19		ns
Reverse Recovery Time	t_{RR}	V_{DD} = 20 V, dI_S/dt=100A/us, I_S = 5 A		25		ns
Reverse Recovery Charge	Q_{RR}			20		nC

•N Channel characteristics curve

Fig.1 Power Dissipation Derating Curve

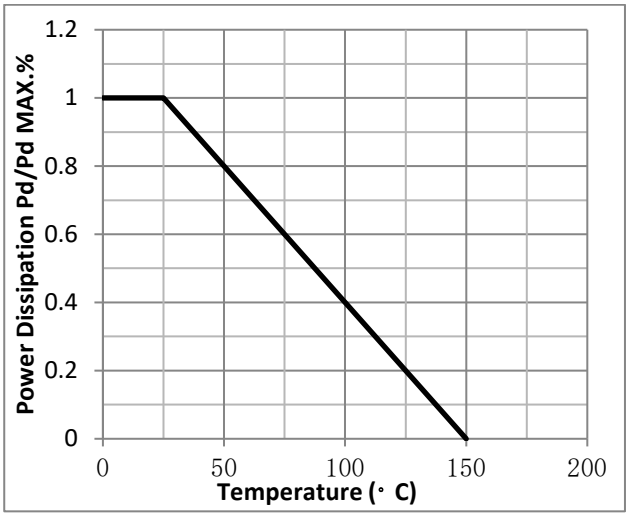


Fig.2 Typical output Characteristics

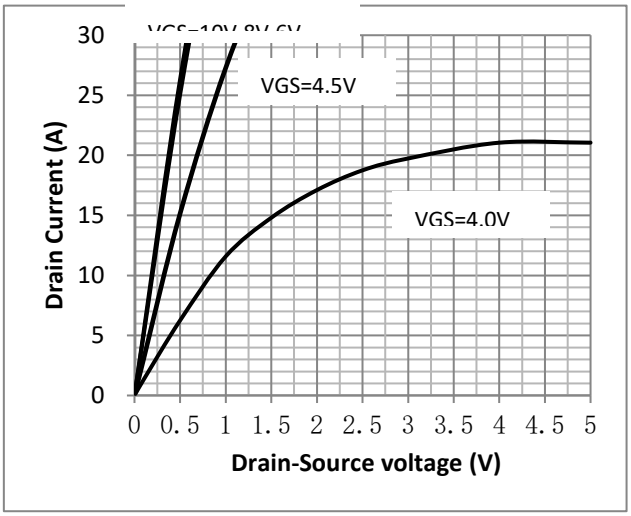


Fig.3 Threshold Voltage V.S Junction Temperature

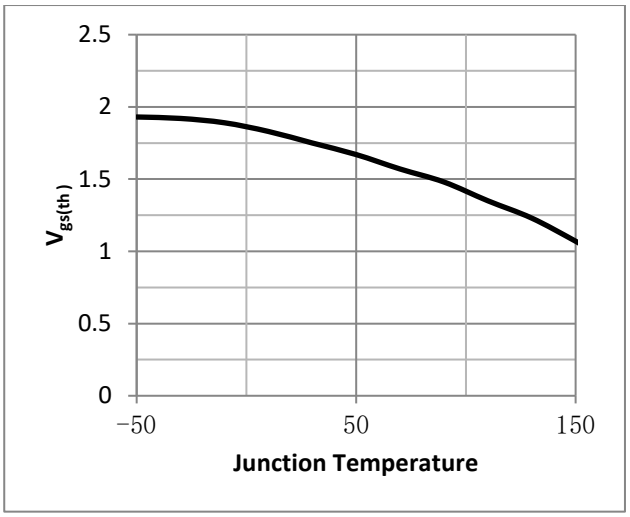


Fig.4 Resistance V.S Drain Current

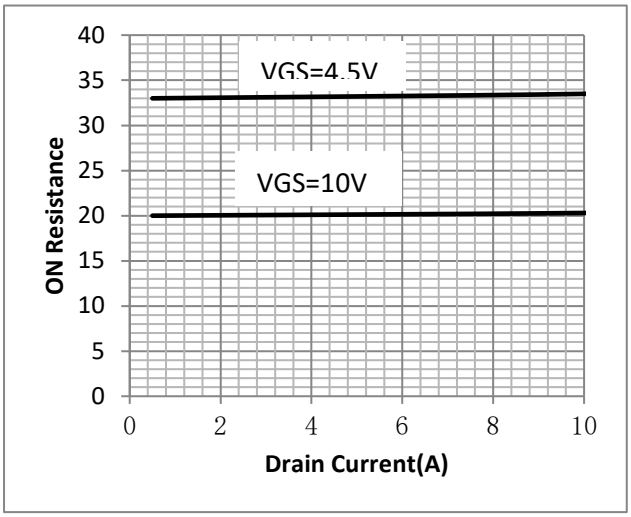


Fig.5 On-Resistance VS Gate Source Voltage

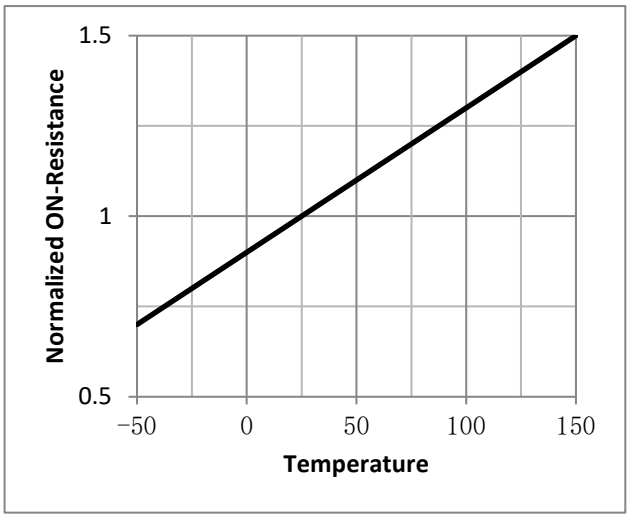


Fig.6 On-Resistance V.S Junction Temperature

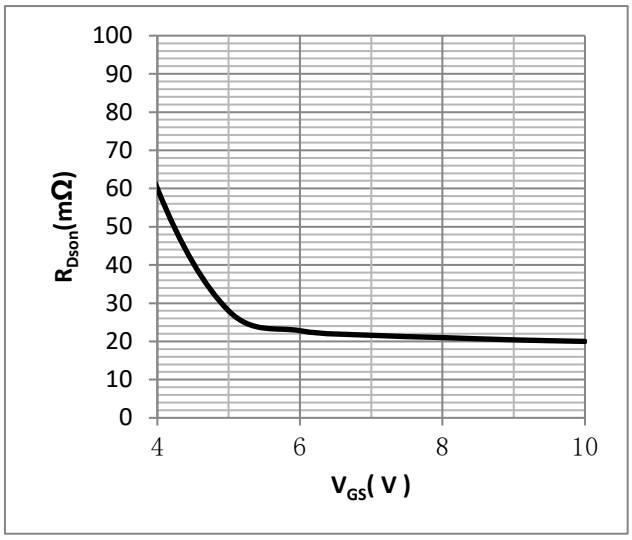


Fig.7 SOA Maximum Safe Operating Area

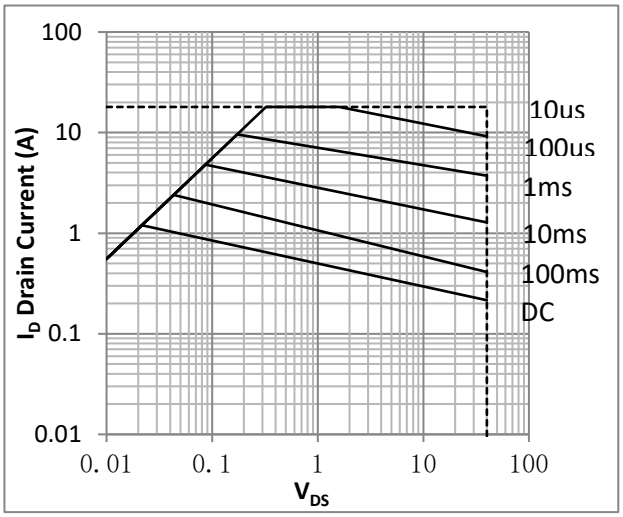


Fig.8 ID-Junction Temperature

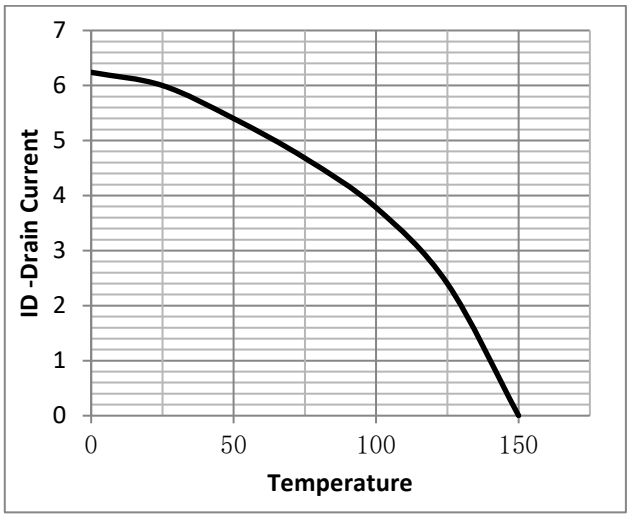


Figure 9. Diode Forward Voltage vs. Current

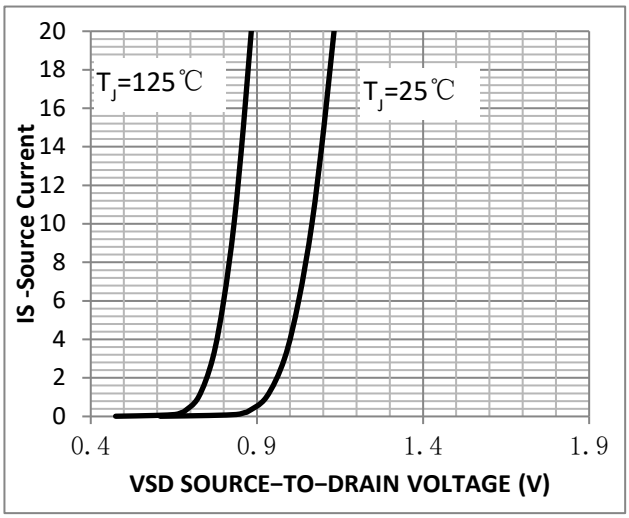


Figure 10. Transfer Characteristics

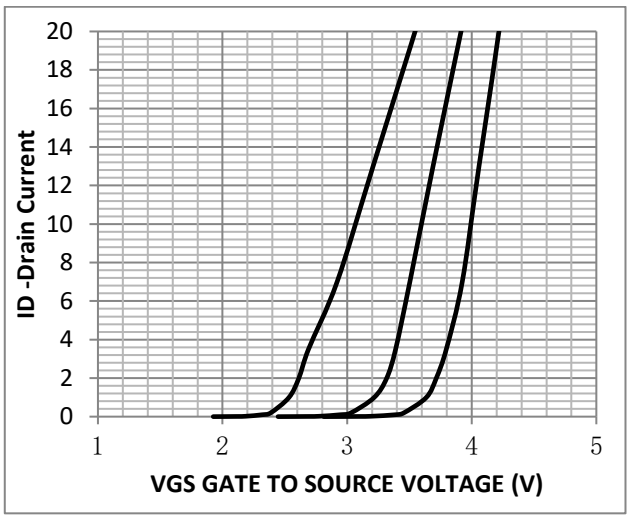


Figure 11. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

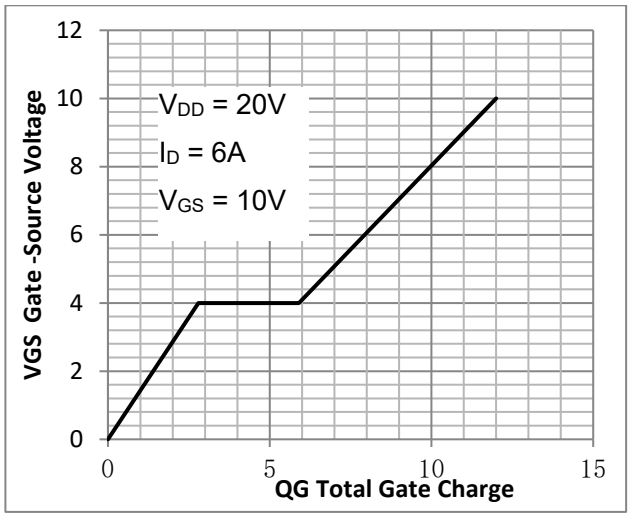
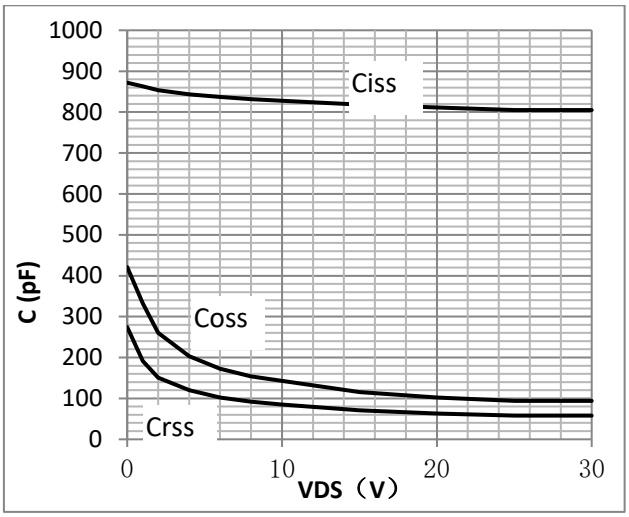


Fig.12 Capacitance Variation



•P Channel characteristics curve

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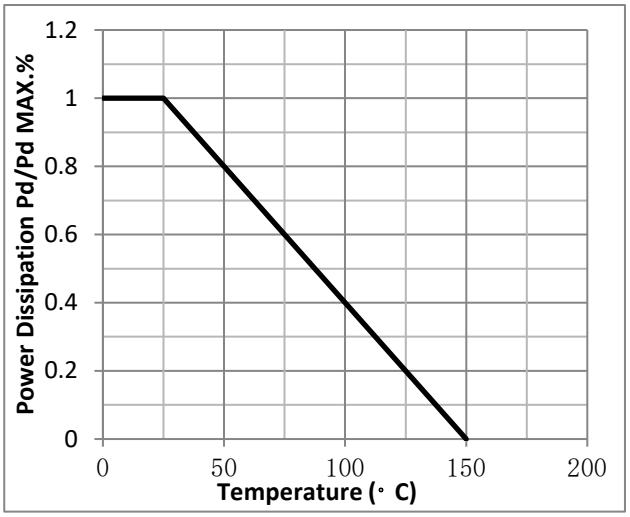
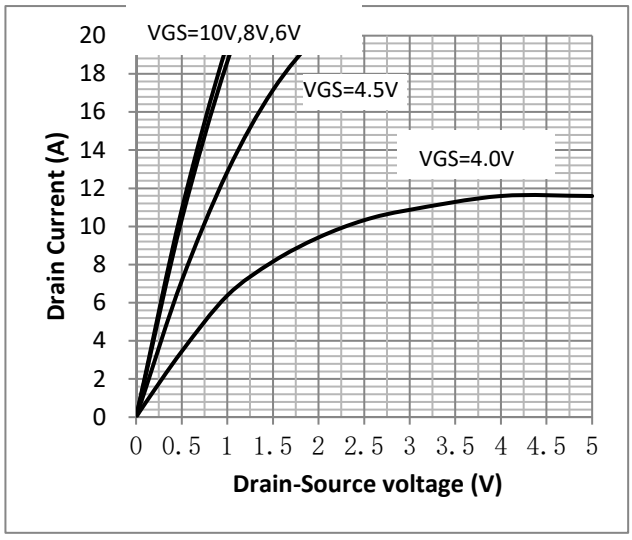


Fig.2 Typical output Characteristics



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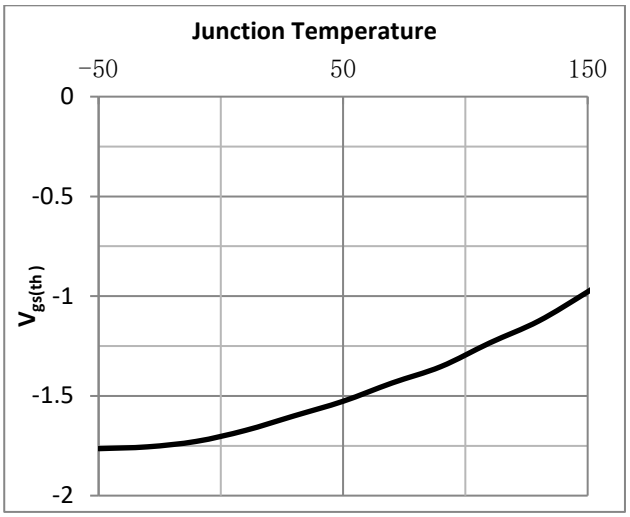


Fig.4 Resistance V.S Drain Current

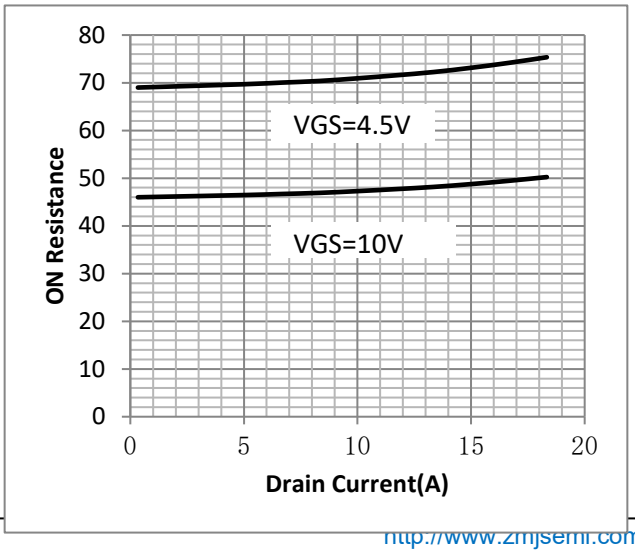


Fig.5 On-Resistance VS Gate Source Voltage

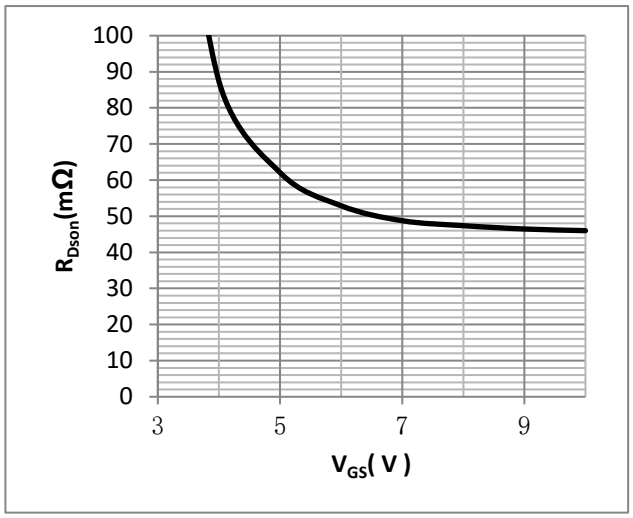


Fig.6 On-Resistance V.S Junction Temperature

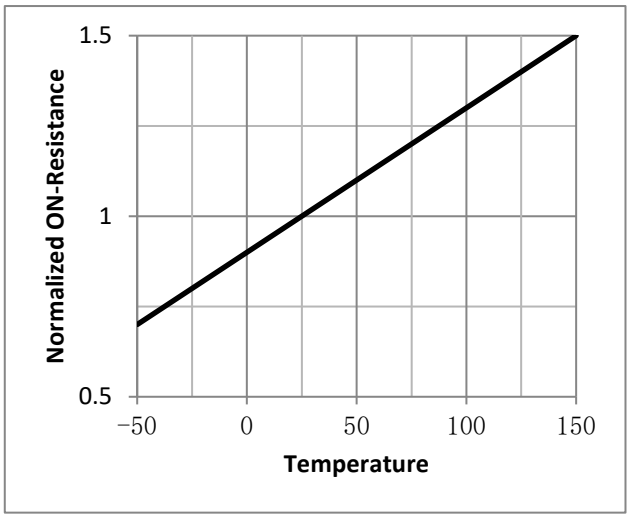
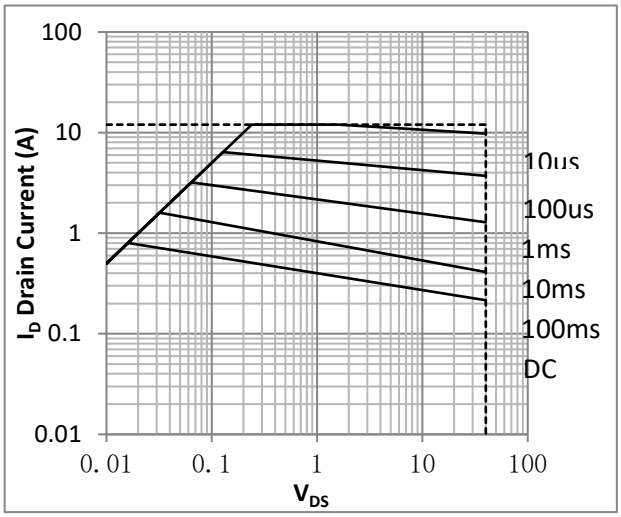


Fig.7 SOA Maximum Safe Operating Area



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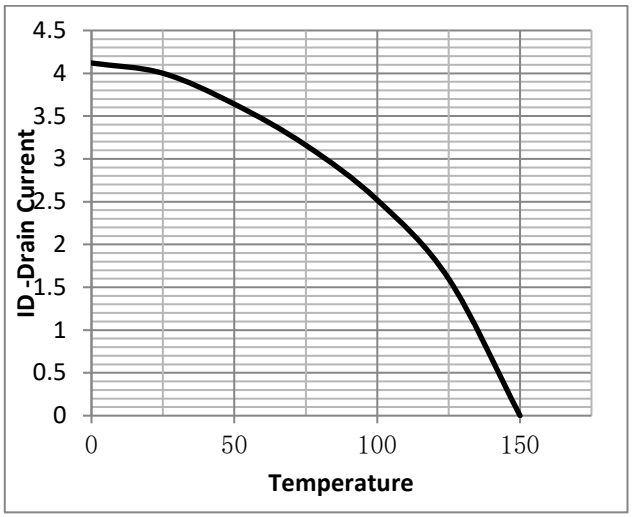

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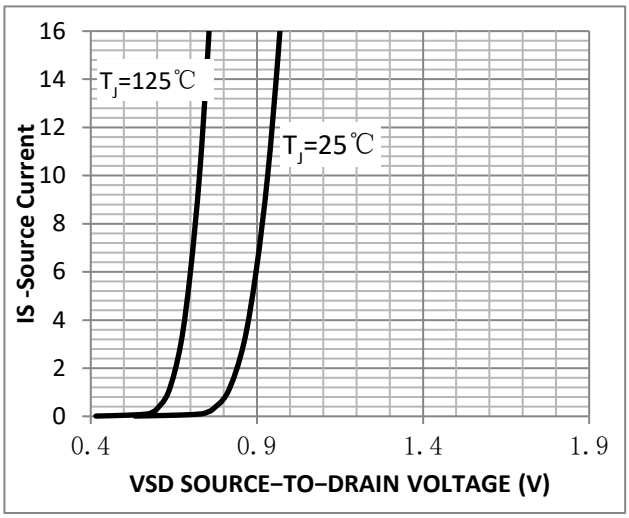


Figure 10. Transfer Characteristics

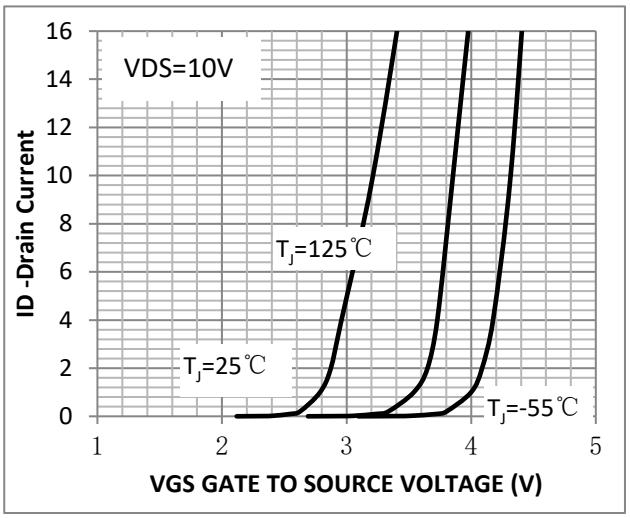


Figure 11. Gate−to−Source and Drain−to−Source Voltage vs. Total Charge

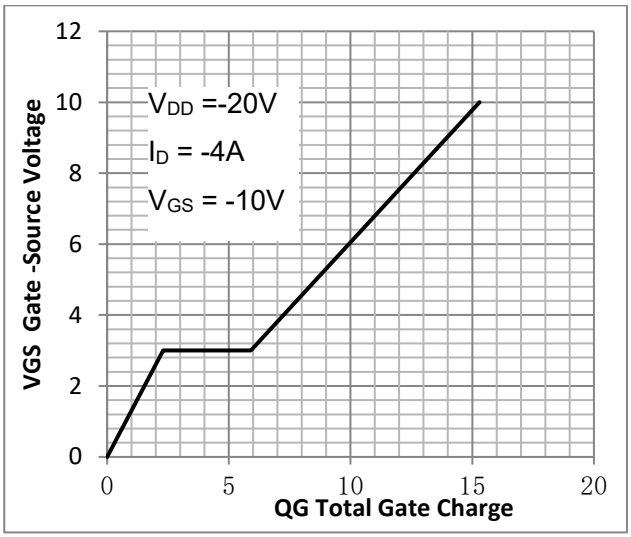
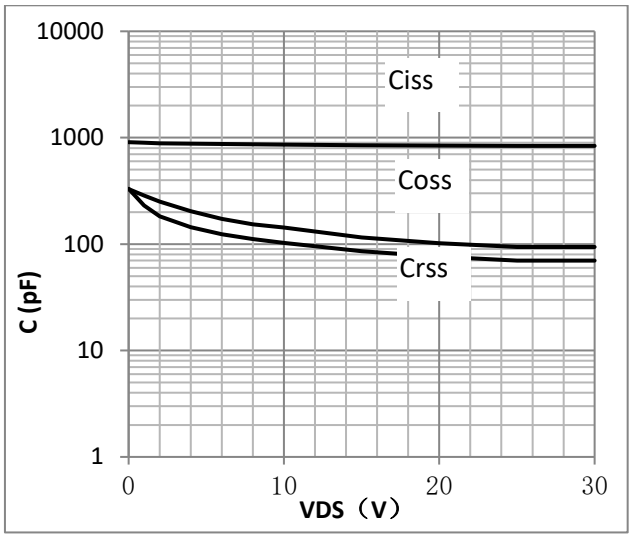


Fig.12 Capacitance Variation



•Test Circuit

Fig.1 Switching Time Measurement Circuit

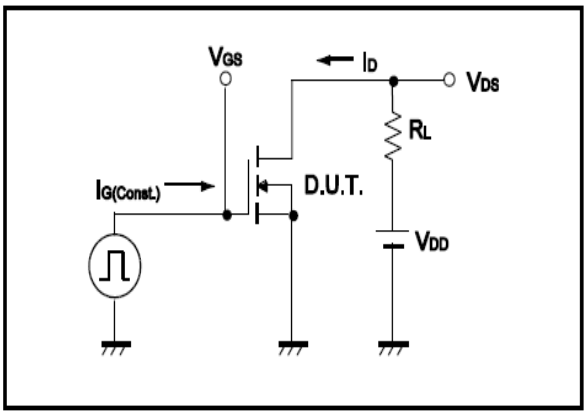


Fig.2 Gate Charge Waveform

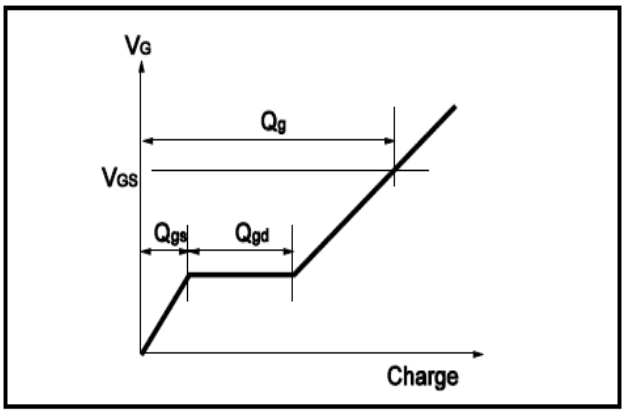


Fig.3 Switching Time Measurement Circuit

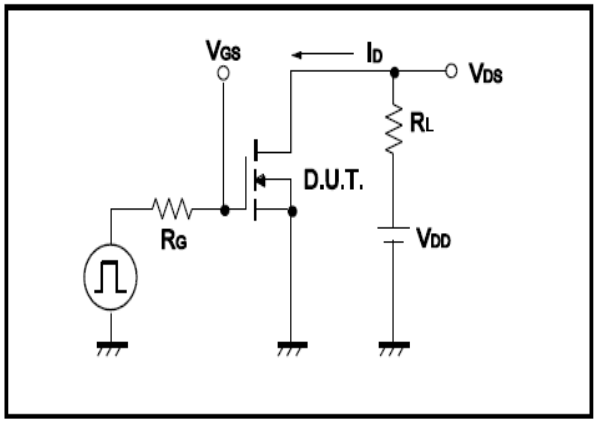


Fig.4 Gate Charge Waveform

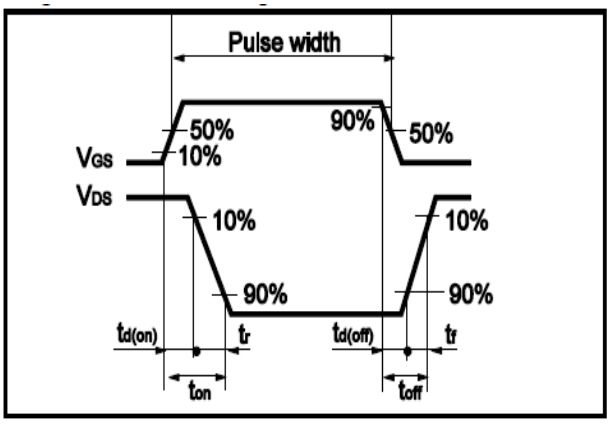


Fig.5 Avalanche Measurement Circuit

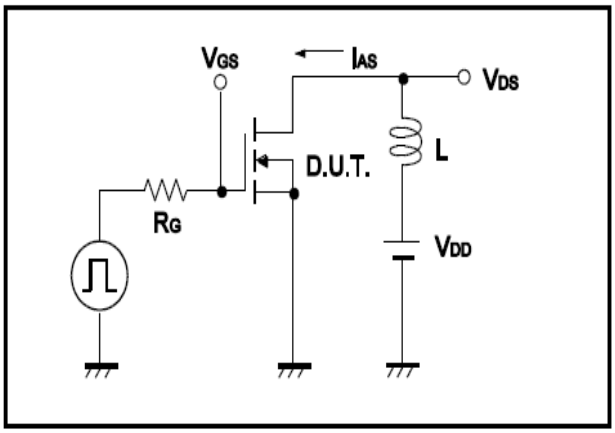
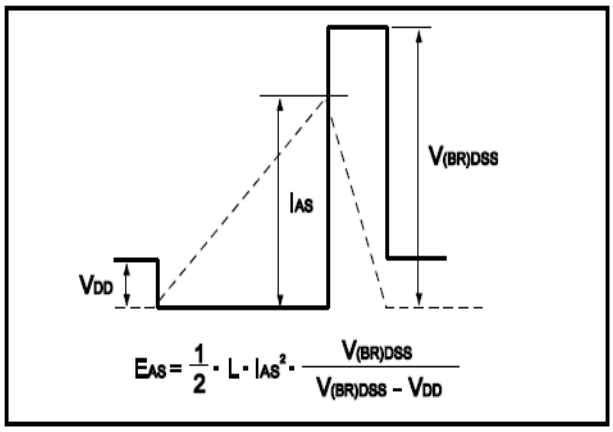


Fig.6 Avalanche Waveform



•Dimensions(SOP8)

Unit: mm

SYMBOL	min	TYP	max	SYMBOL	min		max
A	4.80		5.25	C	1.30		1.75
A1	0.37		0.49	C1	0.55		0.75
A2		1.27		C2	0.55		0.65
A3		0.41		C3	0.05		0.20
B	5.80		6.20	C4	0.10	0.20	0.23
B1	3.80		4.10	D		1.05	
B2		5.00		D1	0.40		0.62