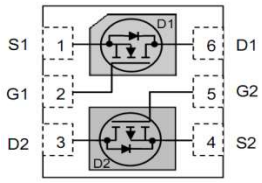
• General Description

It combines advanced 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.

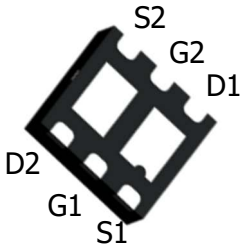
• Product Summary



V_{DS1} =20V
V_{DS2} =-20V
$R_{DS(ON)1}$ =33mΩ
$R_{DS(ON)2}$ =75mΩ
I_{D1} =4A
I_{D2} =-3A

• 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



DFN2*2

•Application

- ■ Power Management in Notebook Computer
- ■ BLDC Motor driver

•Ordering Information:

Part NO.	ZMC88212L
Marking	88212
Packing Information	REEL TAPE
Basic ordering unit (pcs)	4000

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

Parameter	**Symbol**	Rating	Unit
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	±12	V
Continuous Drain Current	$I_{D@}T_C$=25℃	4	A
	$I_{D@}T_C$=75℃	3	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℃	9	W
Total Power Dissipation	$P_D@T_A$=25℃	0.45	W
Operating Junction Temperature	T_J	-55 to 150	℃
Storage Temperature	T_{STG}	-55 to 150	℃
Single Pulse Avalanche Energy	E_{AS}	5	mJ

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

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	-20	V
Gate-Source Voltage	V_{GS}	±12	V
Continuous Drain Current	$I_{D@}T_C$=25℃	-3	A
	$I_{D@}T_C$=75℃	-2.3	A
	$I_{D@}T_C$=100℃	-1.9	A
Pulsed Drain Current ①	I_{DM}	-9	A
Total Power Dissipation	$P_D@T_C$=25℃	9	W
Total Power Dissipation	$P_D@T_A$=25℃	0.45	W
Operating Junction Temperature	T_J	-55 to 150	℃
Storage Temperature	T_{STG}	-55 to 150	℃
Single Pulse Avalanche Energy	E_{AS}	5	mJ

●Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	6.9	° C/W
Thermal resistance, junction - ambient	R_{thJA}	-	-	180	° C/W
Soldering temperature, wavesoldering for 10s	T_{sold}	-	-	265	° C

●N Channel Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA	20			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =250uA	0.5	0.8	1.2	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=20V, V_{GS} =0V			1.0	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=±12V, V_{DS} =0V			±100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=4.5V, I_D=4A		33	45	mΩ
		V_{GS}=2.5V, I_D=3A		40	60	mΩ
Forward Transconductance	g_{FS}	V_{DS} =10V, I_D=1A		2		s

●Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Input capacitance	Ciss	VDS=15V f = 1MHz	-	293	-	pF
Output capacitance	Coss		-	28	-	
Reverse transfer capacitance	Crss		-	25	-	

●Gate Charge characteristics(T_a = 25℃)

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Total gate charge	Qg	VDD =15V ID = 4A VGS = 10V	-	8	-	nC
Gate - Source charge	Qgs		-	0.4	-	
Gate - Drain charge	Qgd		-	1.5	-	

●P Channel Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	V_{GS} =0V, I_D =-250uA	-20			V
Gate Threshold Voltage	$V_{GS(TH)}$	V_{GS} =V_{DS}, I_D =-250uA	-0.5	-0.8	-1.2	V
Drain-Source Leakage Current	I_{DSS}	V_{DS}=-20V, V_{GS} =0V			-1.0	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=±12V, V_{DS} =0V			±100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=-4.5V, I_D=-3A		70	85	mΩ
		V_{GS}=-2.5V, I_D=-2.5A		80	110	mΩ
Forward Transconductance	g_{FS}	V_{DS} =-10V, I_D=-1A		1.5		s

●Electronic Characteristics

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Input capacitance	Ciss	VDS=-15V f = 1MHz	-	430	-	pF
Output capacitance	Coss		-	74	-	
Reverse transfer capacitance	Crss		-	68	-	

●Gate Charge characteristics(T_a = 25℃)

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Total gate charge	Qg	V_{DD} = -15V I_D = -3A V_{GS} = -10V	-	10.7	-	nC
Gate - Source charge	Qgs		-	0.6	-	
Gate - Drain charge	Qgd		-	2.2	-	

●N Channel characteristics curve

Fig.1 Power Dissipation

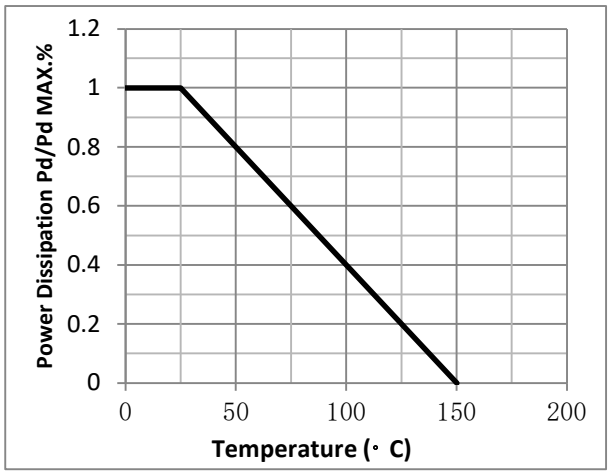


Fig.2 Typical output Characteristics

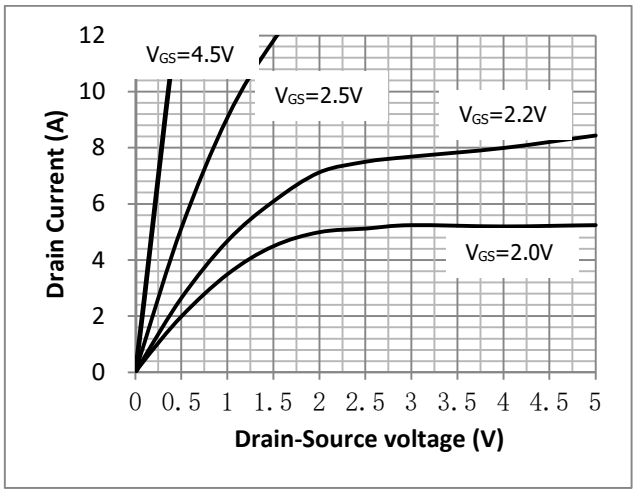


Fig.3 Threshold Voltage V.S Junction Temperature

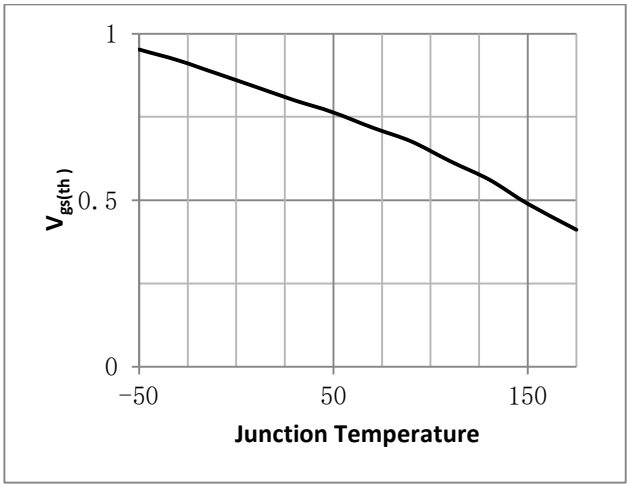


Fig.4 Resistance V.S Drain Current

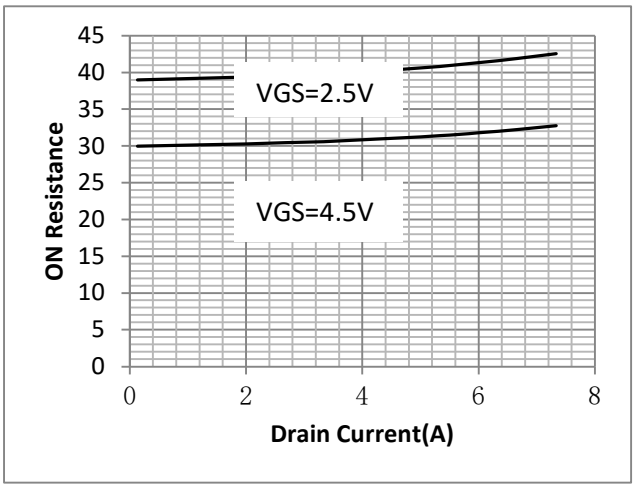


Fig.5 On-Resistance VS Gate Source Voltage

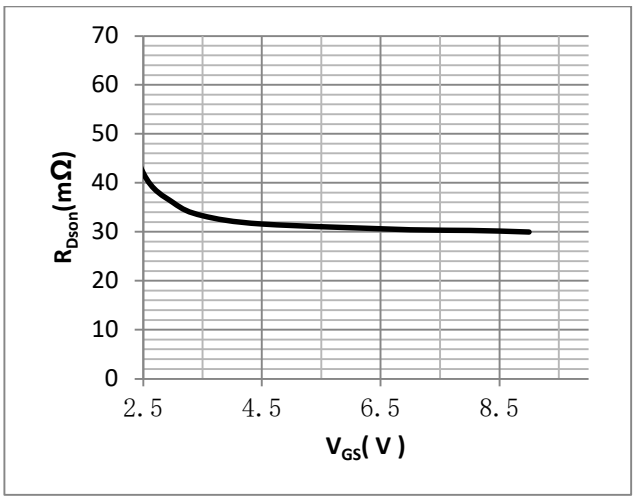


Fig.6 On-Resistance V.S Junction Temperature

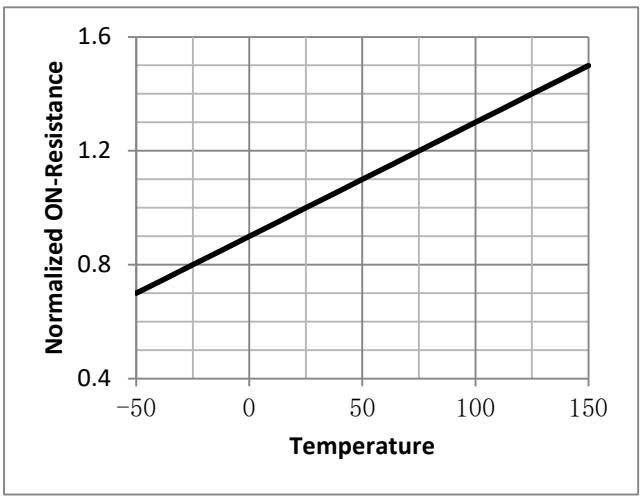


Fig.7 Gate-Charge Characteristics

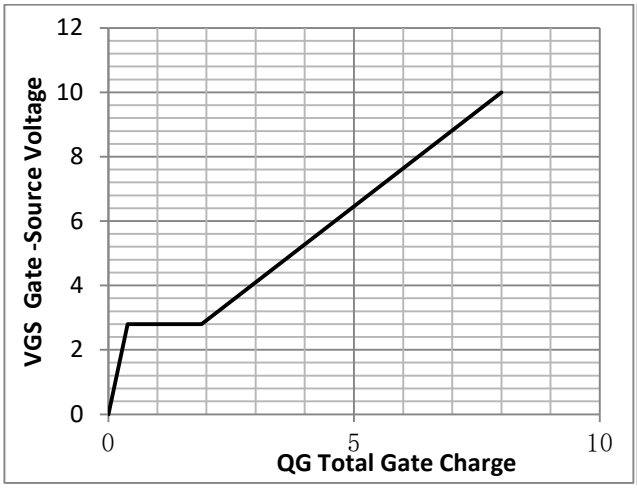


Fig.8 Capacitance Characteristics

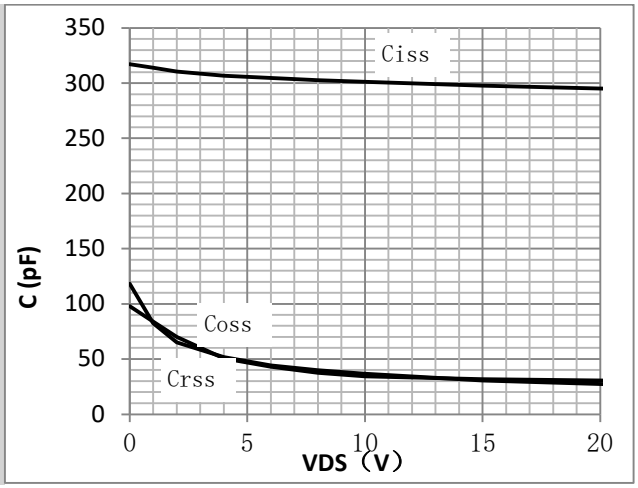


Fig.9 SOA Maximum Safe Operating Area

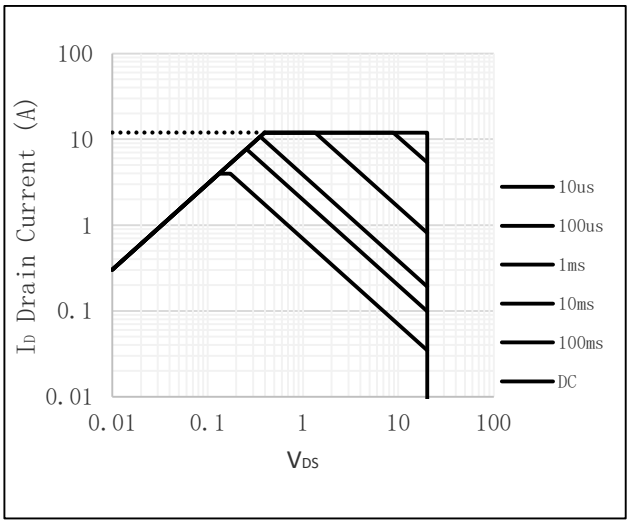
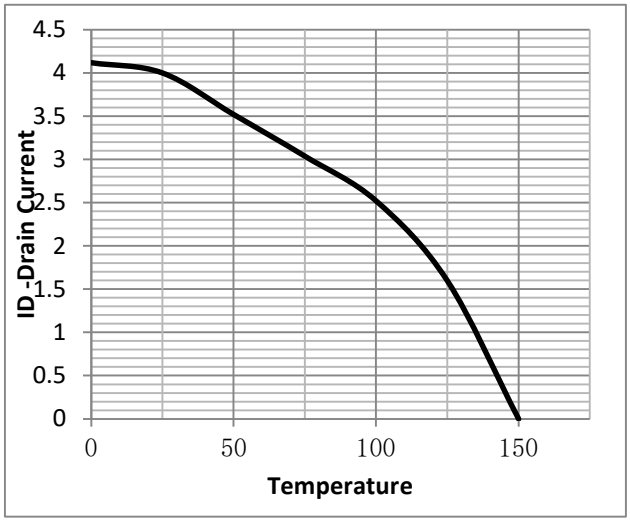


Fig.10 ID-Junction Temperature



●P Channel characteristics curve

Fig.1 Power Dissipation Derating Curve

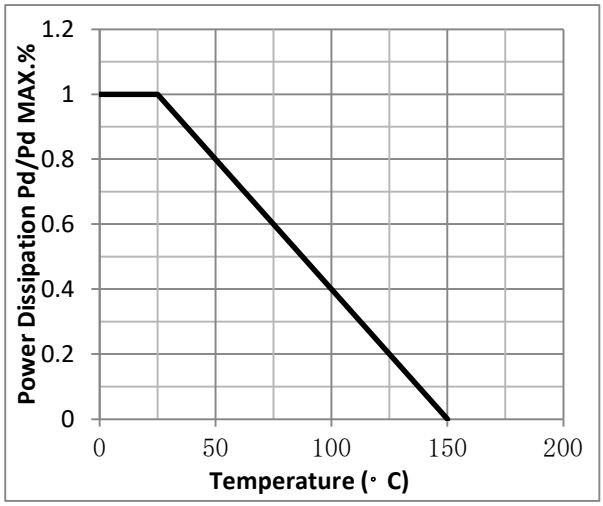


Fig.2 Typical output Characteristics

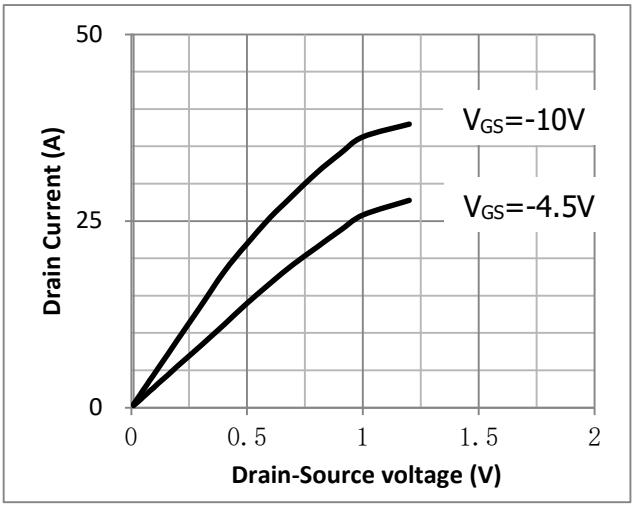


Fig.3 Threshold Voltage V.S Junction Temperature

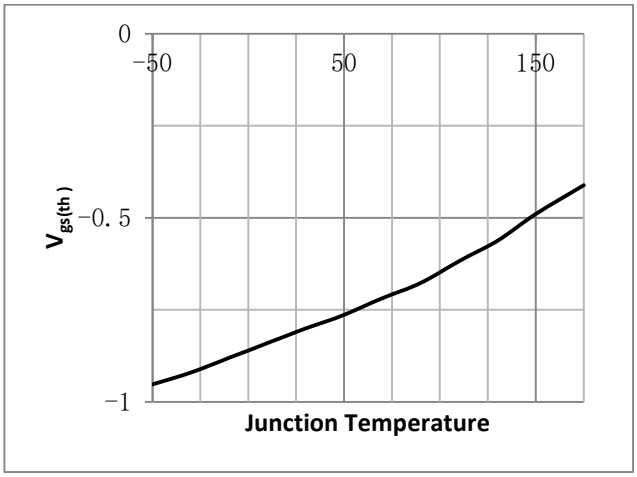


Fig.4 Resistance V.S Drain Current

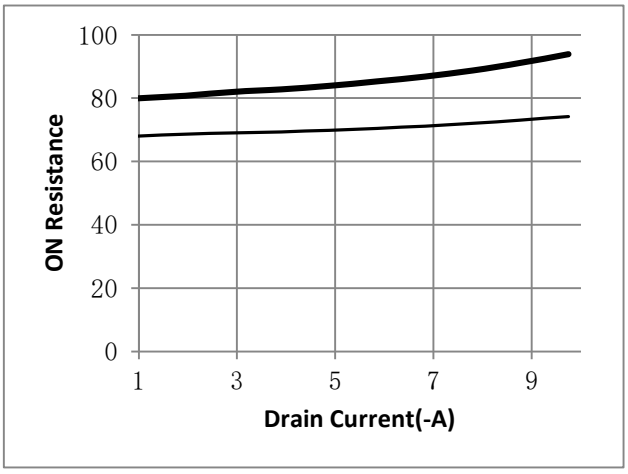


Fig.5 On-Resistance VS Gate Source Voltage

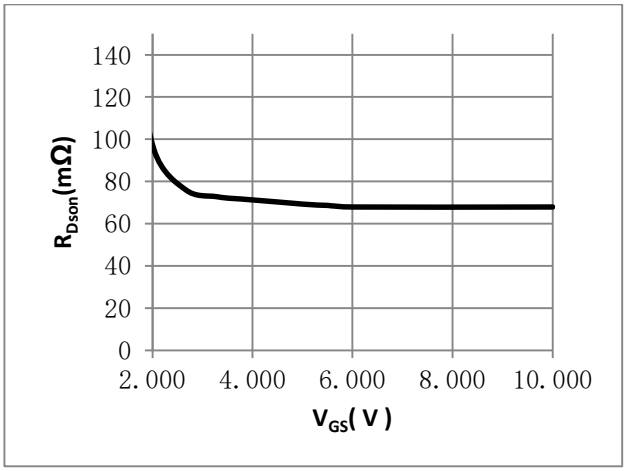


Fig.6 On-Resistance V.S Junction Temperature

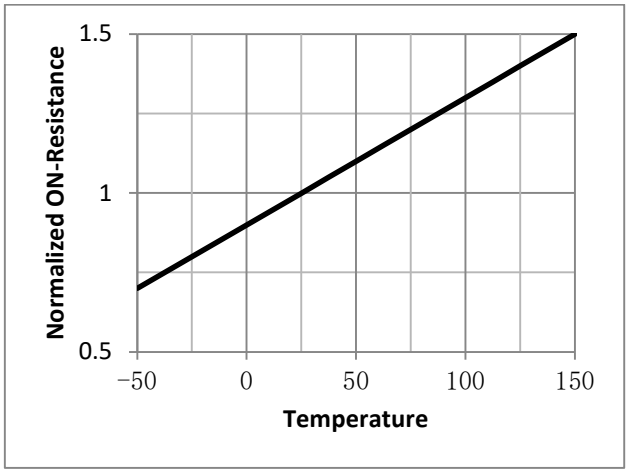


Fig.7 Capacitance Characteristics

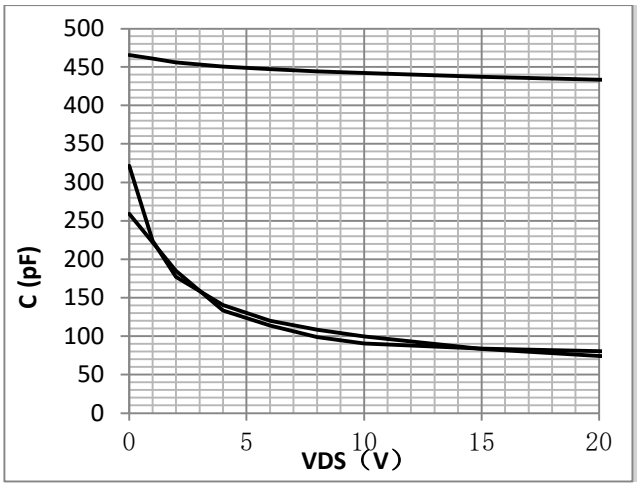


Fig.8 Gate-Charge Characteristics

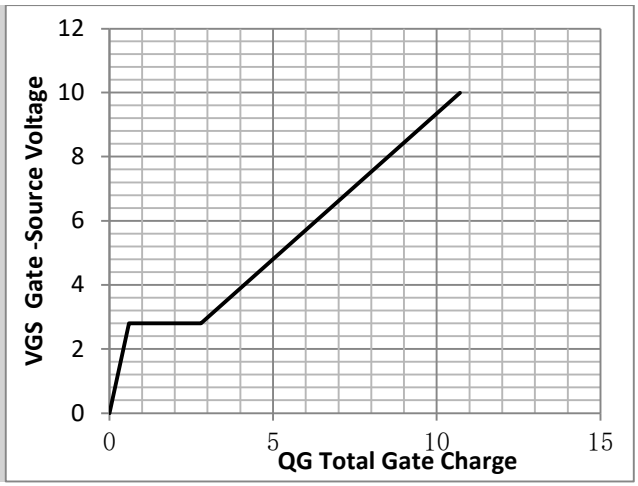


Fig.9 SOA Maximum Safe Operating Area

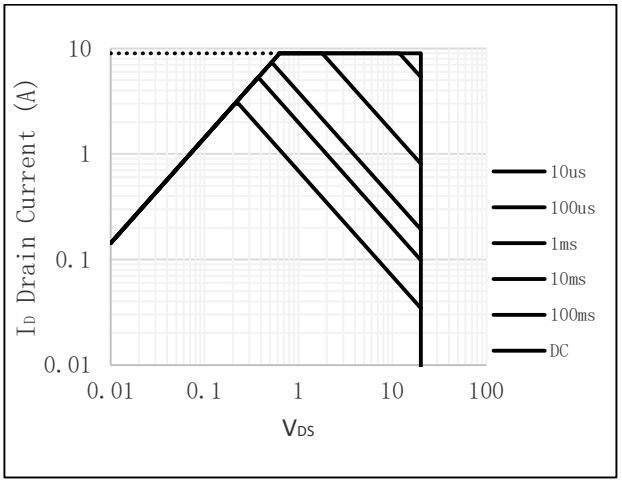
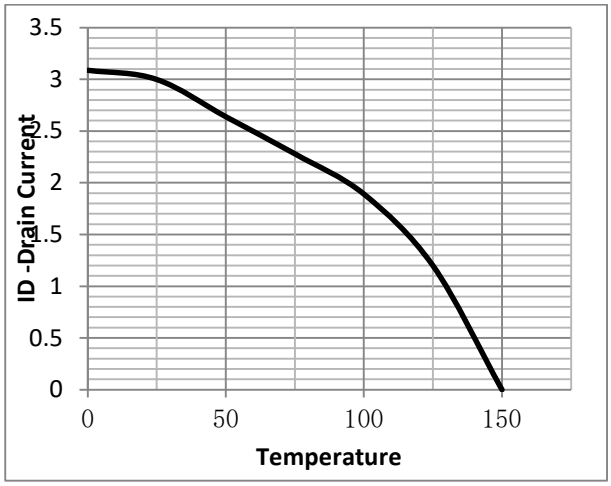


Fig.10 ID-Junction Temperature



●Test Circuit

Fig.1 Gate Charge Measurement Circuit

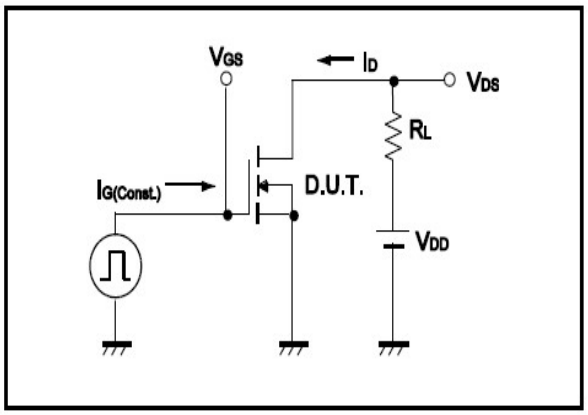


Fig.2 Gate Charge Waveform

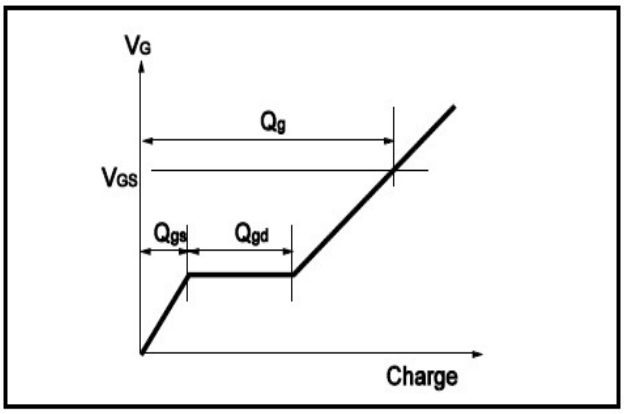


Fig.3 Switching Time Measurement Circuit

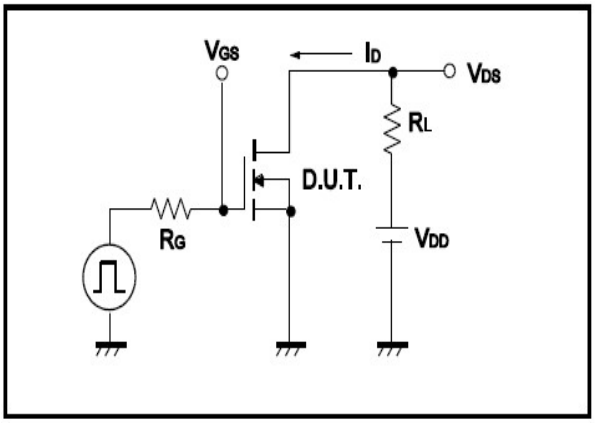


Fig.4 Switching Time Waveform

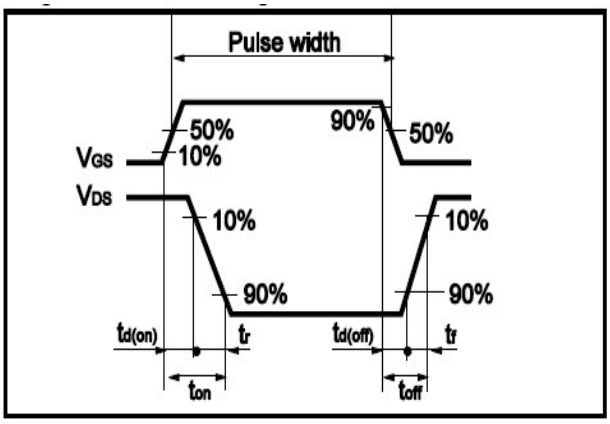


Fig.5 Avalanche Measurement Circuit

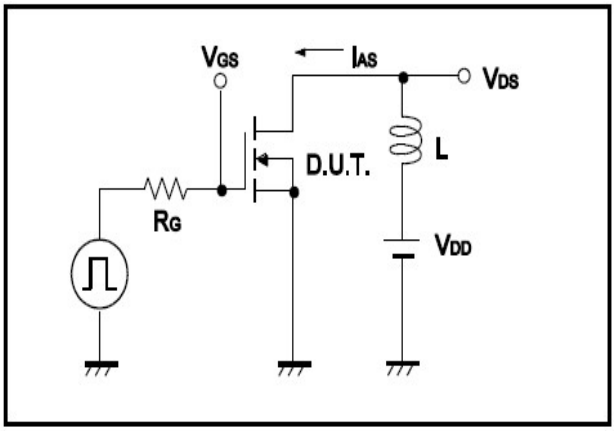
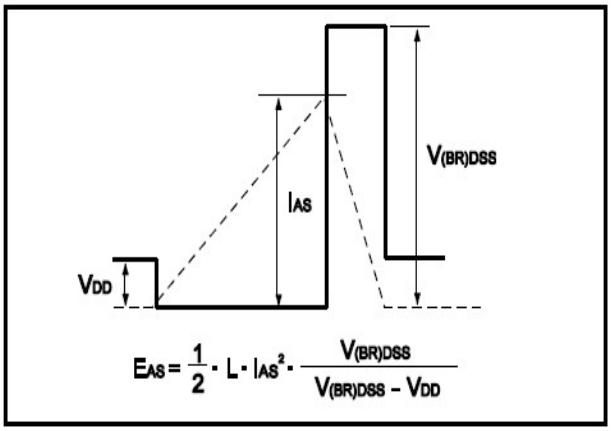
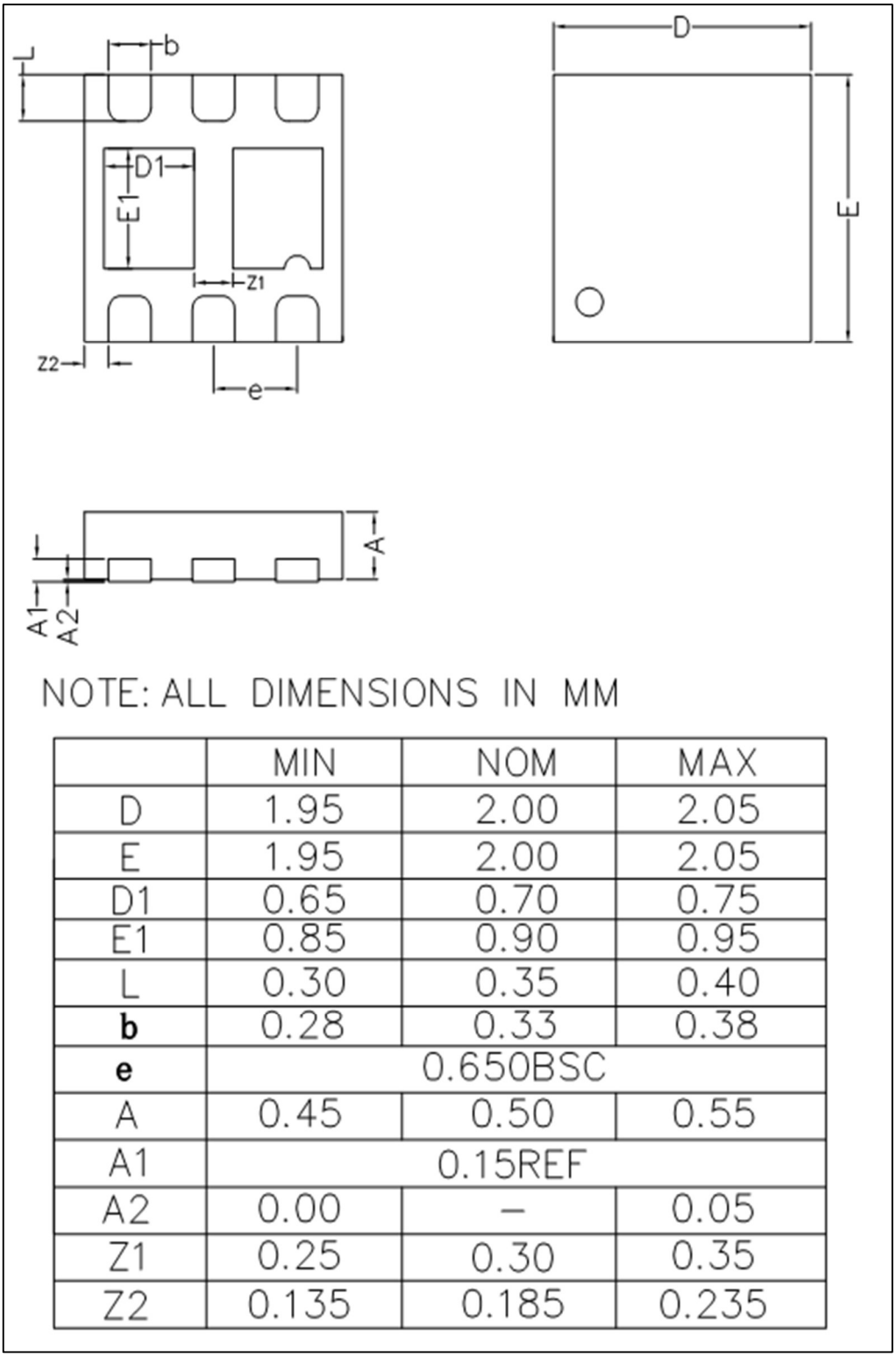


Fig.6 Avalanche Waveform



●Dimensions(DFN2*2)



NOTE: ALL DIMENSIONS IN MM

	MIN	NOM	MAX
D	1.95	2.00	2.05
E	1.95	2.00	2.05
D1	0.65	0.70	0.75
E1	0.85	0.90	0.95
L	0.30	0.35	0.40
b	0.28	0.33	0.38
e		0.650BSC	
A	0.45	0.50	0.55
A1		0.15REF	
A2	0.00	–	0.05
Z1	0.25	0.30	0.35
Z2	0.135	0.185	0.235