

• 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.

• 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

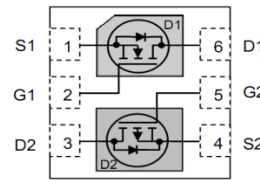
• Ordering Information:

Part NO.	ZMC88213L
Marking	88213
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

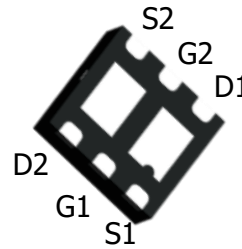
• N Channel Absolute Maximum Ratings ($T_C = 25^\circ\text{C}$)

Parameter	Symbol	Rating	Unit
Drain-Source Voltage	V_{DS}	20	V
Gate-Source Voltage	V_{GS}	± 12	V
Continuous Drain Current	$I_{D@T_C=25^\circ\text{C}}$	6	A
	$I_{D@T_C=75^\circ\text{C}}$	4.5	A
	$I_{D@T_C=100^\circ\text{C}}$	3.7	A
Pulsed Drain Current ^①	I_{DM}	18	A
Total Power Dissipation	$P_D@T_C=25^\circ\text{C}$	9	W
Total Power Dissipation	$P_D@T_A=25^\circ\text{C}$	0.45	W
Operating Junction Temperature	T_J	-55 to 150	$^\circ\text{C}$
Storage Temperature	T_{STG}	-55 to 150	$^\circ\text{C}$
Single Pulse Avalanche Energy	E_{AS}	5	mJ

• Product Summary



$V_{DS1} = 20\text{V}$
 $V_{DS2} = -20\text{V}$
 $R_{DS(ON)1} = 25\text{m}\Omega$
 $R_{DS(ON)2} = 45\text{m}\Omega$
 $I_{D1} = 6\text{A}$
 $I_{D2} = -5\text{A}$



DFN2*2

•P Channel Absolute Maximum Ratings (T_C =25°C)

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°C}	-5	A
	I _{D@T_C=75°C}	-3.8	A
	I _{D@T_C=100°C}	-3.1	A
Pulsed Drain Current ④	I _{DM}	-15	A
Total Power Dissipation	P _{D@T_C=25°C}	9	W
Total Power Dissipation	P _{D@T_A=25°C}	0.45	W
Operating Junction Temperature	T _J	-55 to 150	°C
Storage Temperature	T _{STG}	-55 to 150	°C
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		25	32	mΩ
		V _{GS} =2.5V, I _D =3A		30	50	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	f = 1MHz	-	498	-	pF
Output capacitance	Coss		-	56	-	
Reverse transfer capacitance	Crss		-	27	-	

•Gate Charge characteristics(T_a = 25°C)

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Total gate charge	Qg	V _{DD} = 15V	-	13	-	nC
Gate - Source charge	Qgs	I _D = 4A	-	0.6	-	
Gate - Drain charge	Qgd	V _{GS} = 10V	-	2.5	-	

•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		45	60	mΩ
		V _{GS} = -2.5V, I _D = -2.5A		56	78	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	f = 1MHz	-	609	-	pF
Output capacitance	Coss		-	61	-	
Reverse transfer capacitance	Crss		-	45	-	

•Gate Charge characteristics(T_a = 25°C)

Parameter	Symbol	Condition	Min.	Typ	Max.	Unit
Total gate charge	Qg	V _{DD} = -15V	-	14	-	nC
Gate - Source charge	Qgs	I _D = -3A	-	0.7	-	
Gate - Drain charge	Qgd	V _{GS} = -10V	-	3.2	-	

•N Channel characteristics curve

Fig.1 Power Dissipation

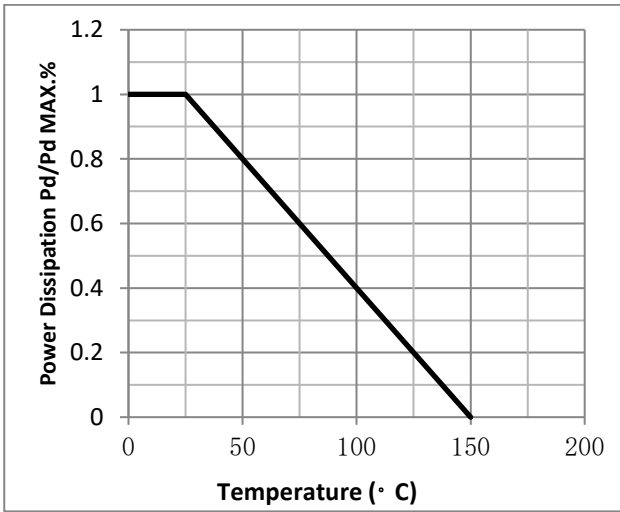


Fig.2 Typical output Characteristics

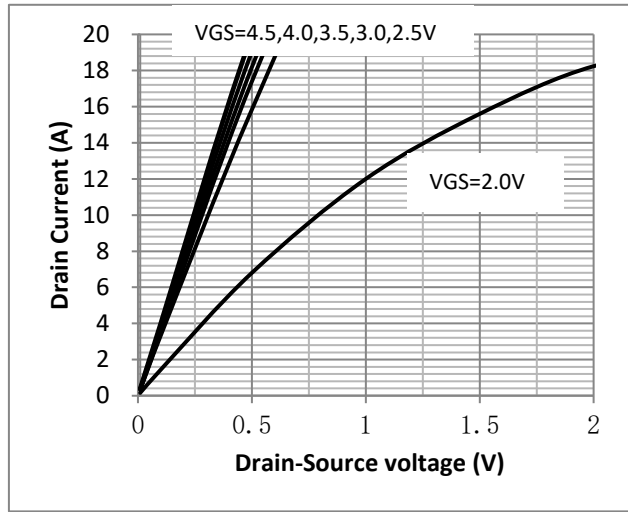


Fig.3 Threshold Voltage V.S Junction Temperature

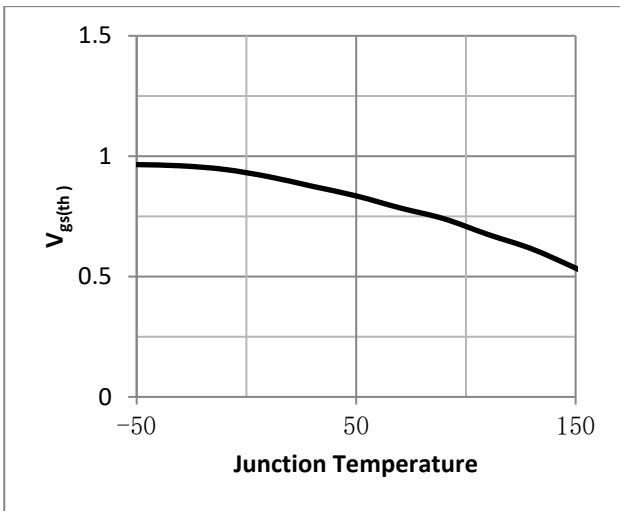


Fig.4 Resistance V.S Drain Current

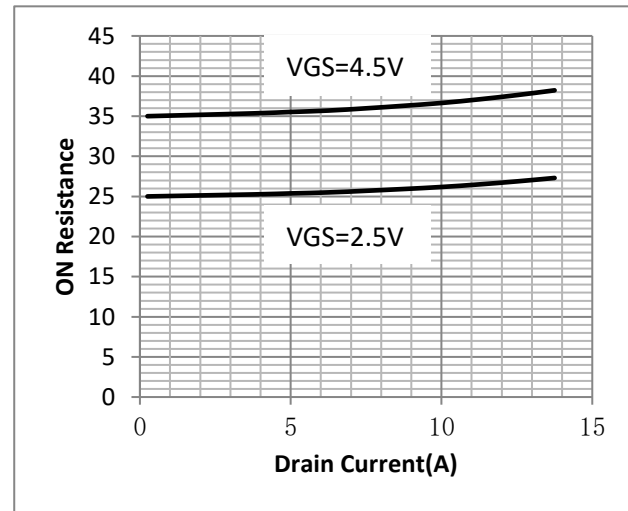


Fig.5 On-Resistance VS Gate Source Voltage

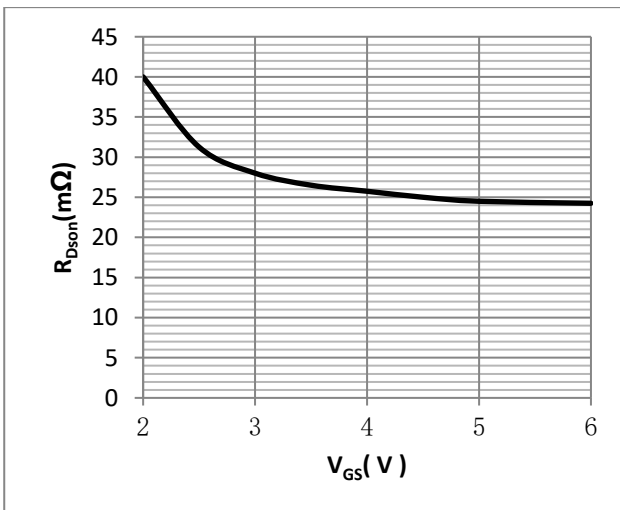


Fig.6 On-Resistance V.S Junction Temperature

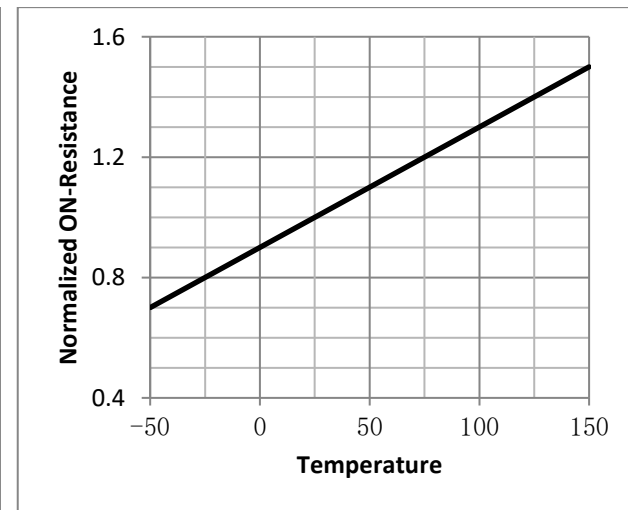


Fig.7 Gate-Charge Characteristics

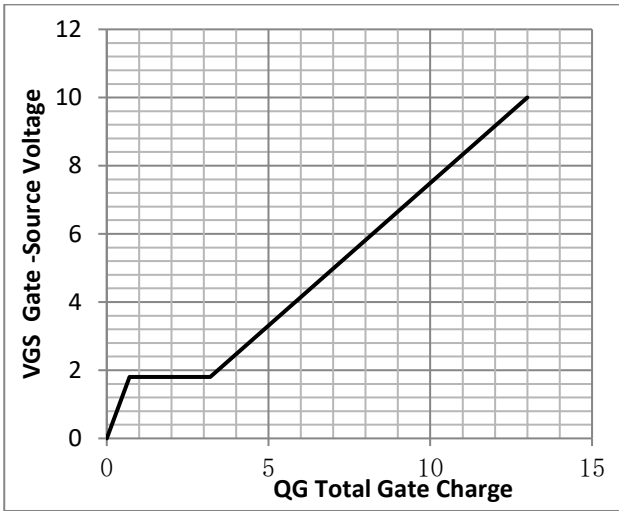


Fig.8 Capacitance Characteristics

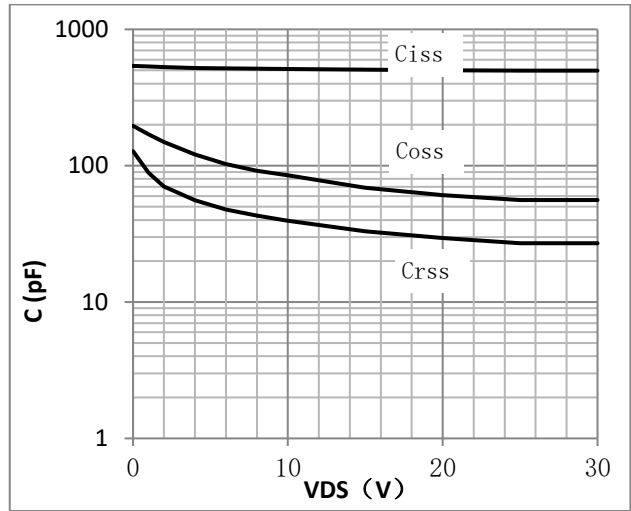


Fig.9 SOA Maximum Safe Operating Area

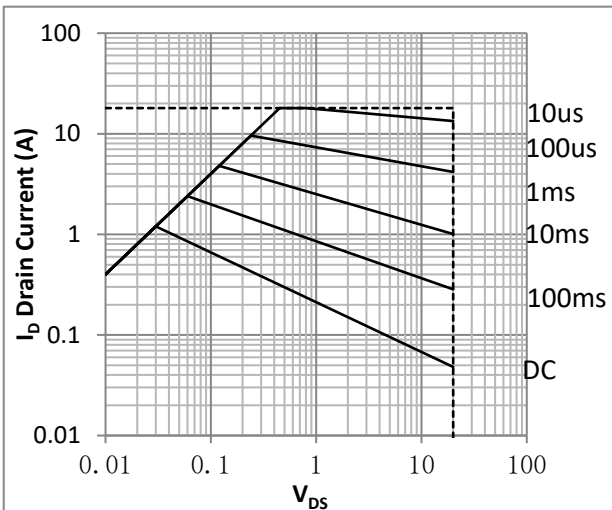
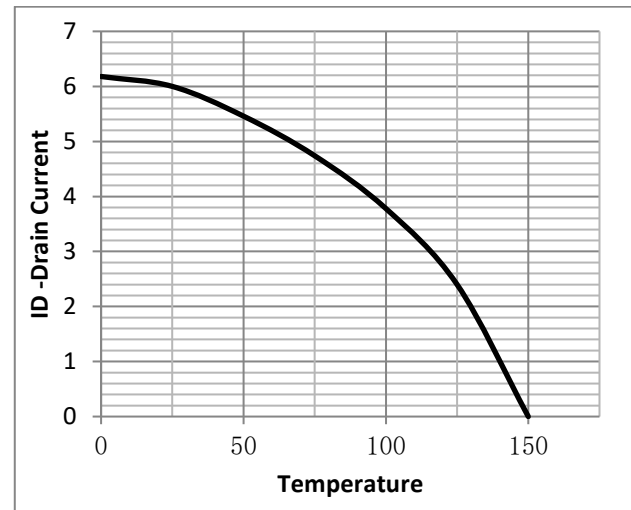


Fig.10 ID-Junction Temperature



•P Channel characteristics curve

Fig.1 Power Dissipation Derating Curve

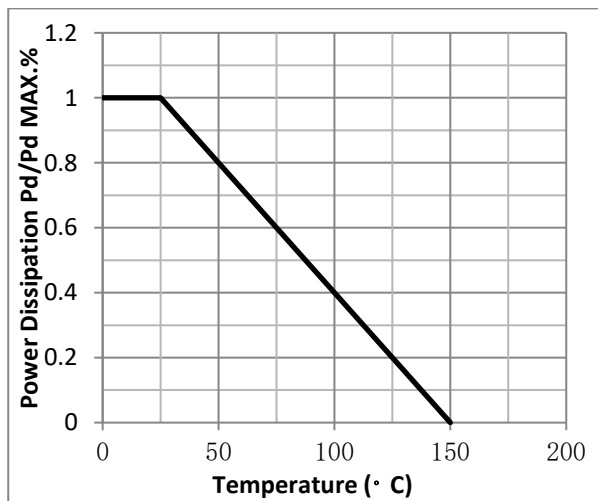


Fig.2 Typical output Characteristics

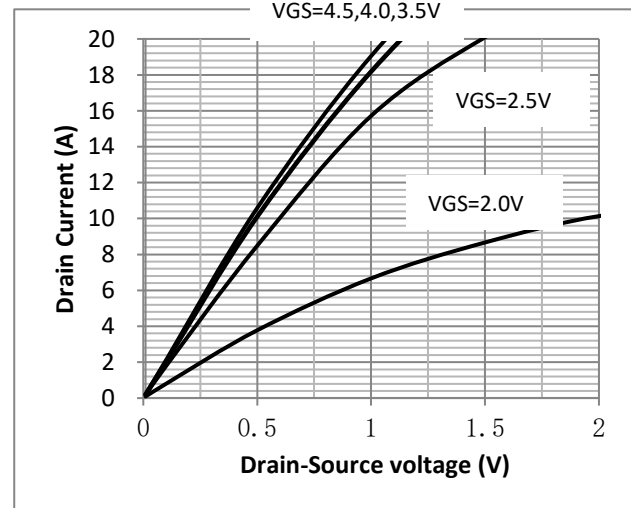


Fig.3 Threshold Voltage V.S Junction Temperature

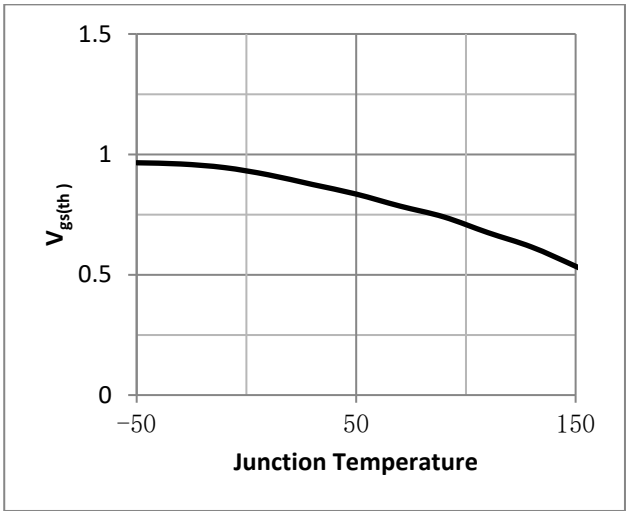


Fig.4 Resistance V.S Drain Current

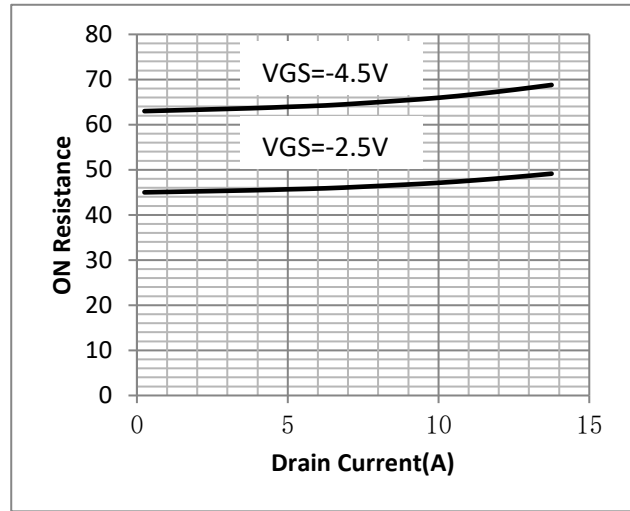


Fig.5 On-Resistance VS Gate Source Voltage

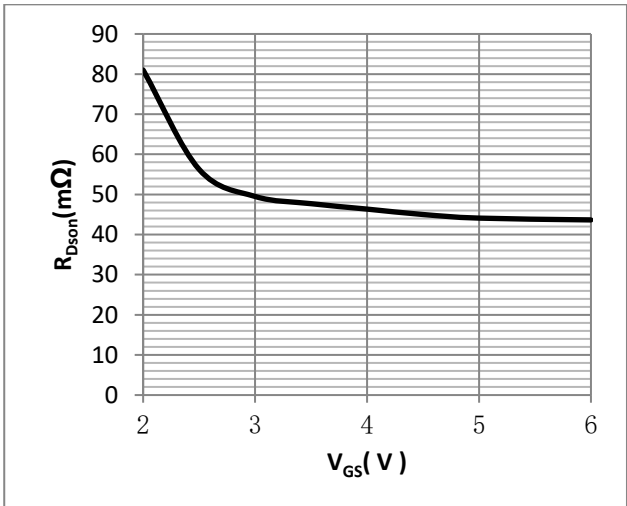


Fig.6 On-Resistance V.S Junction Temperature

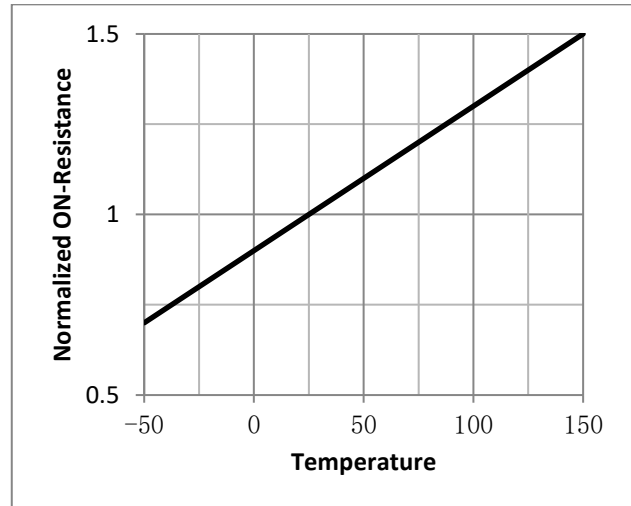


Fig.7 Gate-Charge Characteristics

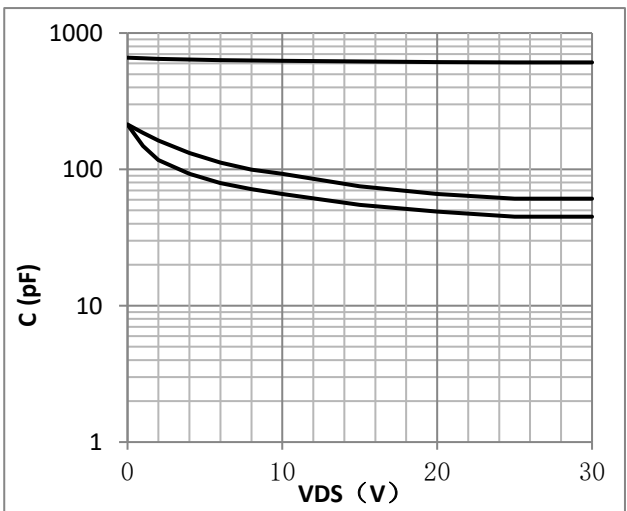


Fig.8 Capacitance Characteristics

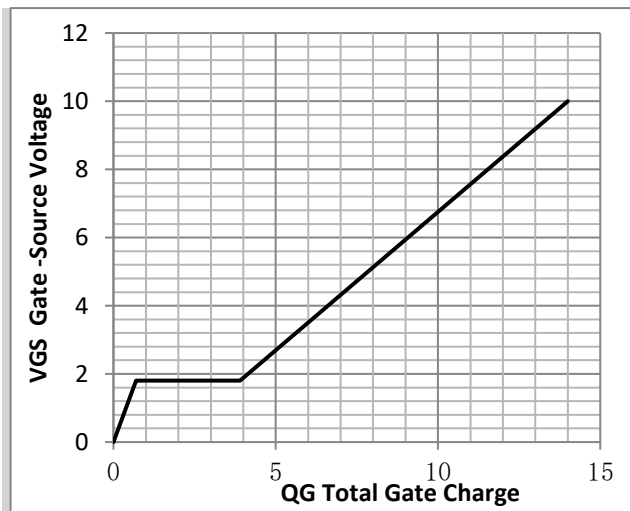


Fig.9 SOA Maximum Safe Operating Area

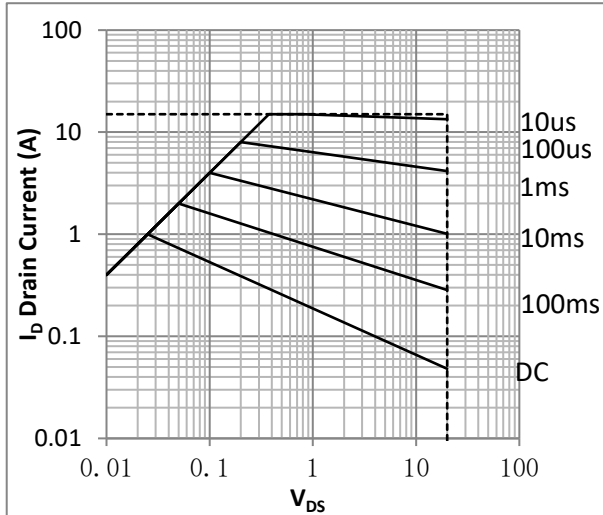
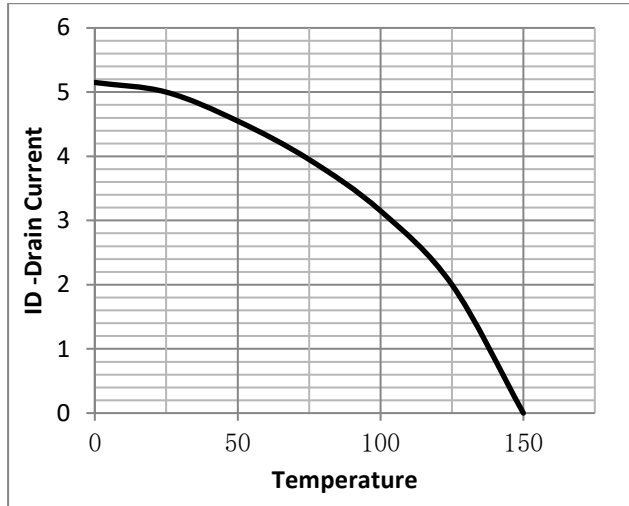


Fig.10 I_D -Junction Temperature



•Test Circuit

Fig.1 Switching Time Measurement Circuit

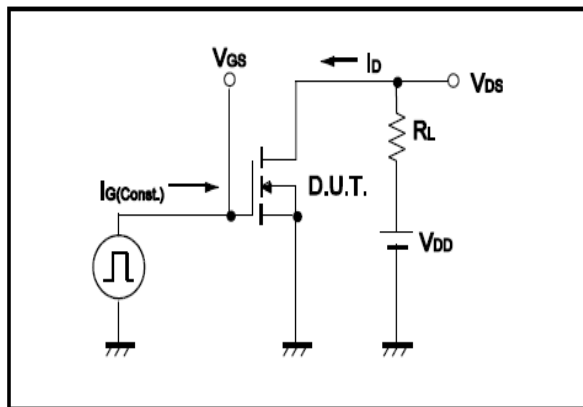


Fig.2 Gate Charge Waveform

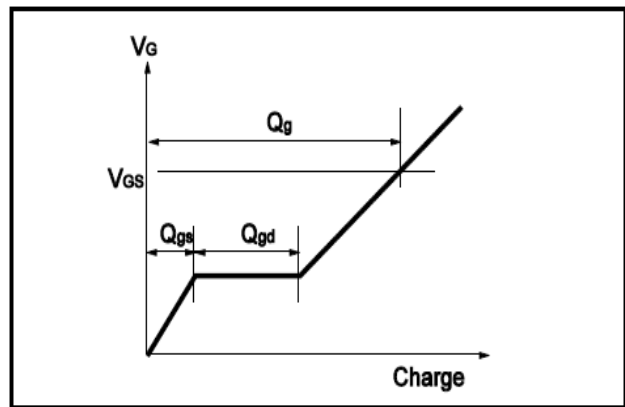


Fig.3 Switching Time Measurement Circuit

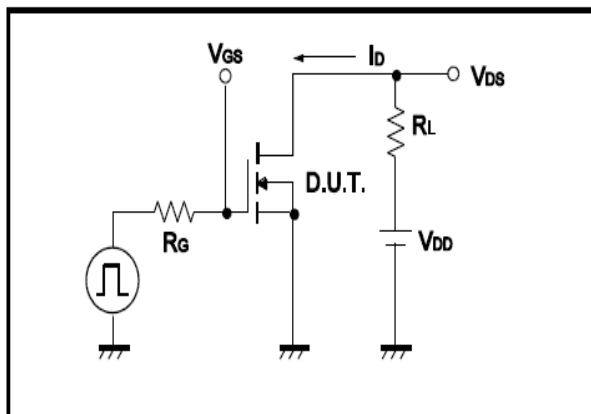


Fig.4 Gate Charge Waveform

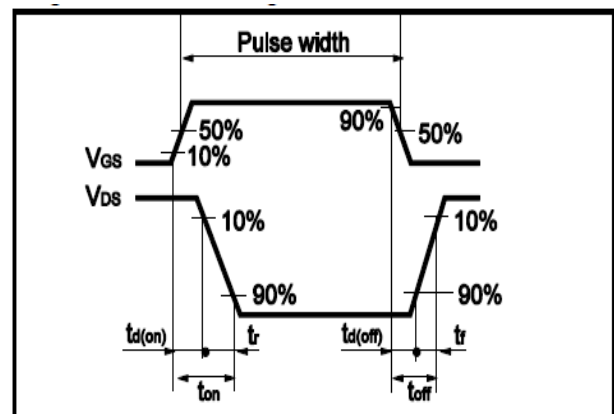


Fig.5 Avalanche Measurement Circuit

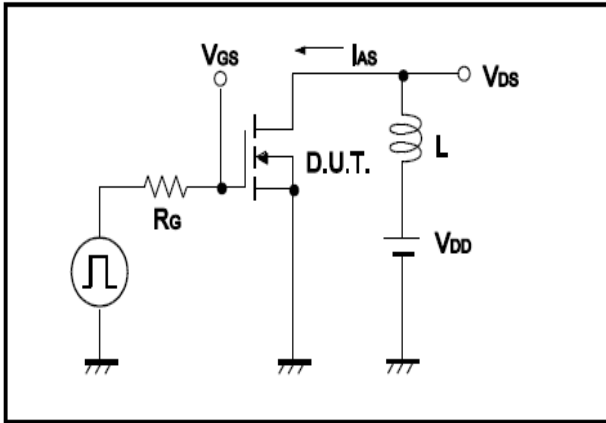
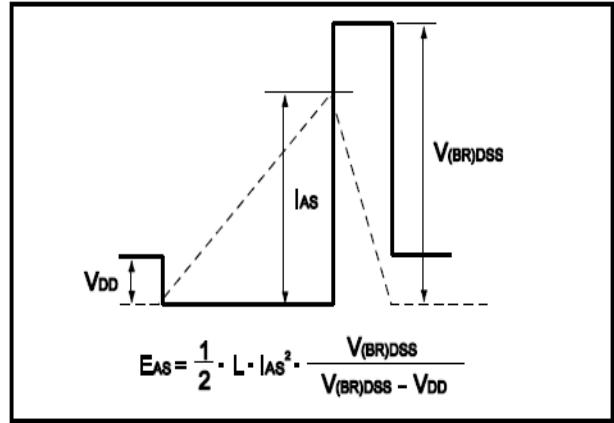


Fig.6 Avalanche Waveform





●Dimensions(DFN2*2)

