●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

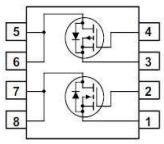
- ■Low $R_{DS(ON)}$ to minimize conductive loss
- ■Dual die in one package
- ■Low thermal resistance
- ■AEC-Q101 qualified

●Application

- ■BLDC motor driver
- ■Load switch

●Product Summary

DFN5*6



V_{DS1}=40V V_{DS2}=-40V

$R_{DS(ON)1}$ =6.4mR $R_{DS(ON)2}$ =10.4mR

I_{D1}=64A I_{D2}=-61A

RoHS REACH COMPLIANT HF

●Ordering Information

Part NO.	ZMCA88408N
Marking	ZMC88408
Packing information	REEL TAPE
Basic ordering unit (pcs)	3000

●N-Channel Absolute Maximum Ratings（T_A=25℃,unless otherwise specified）

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}		-	40	V
Gate-source voltage①	V_{GS}		-20	20	V
Continuous drain current	I_D	V_{GS}=10V, T_C=25℃	-	64	A
	I_D	V_{GS}=10V, T_C=75℃	-	52	A
	I_D	V_{GS}=10V, T_C=100℃	-	45	A
Pulsed drain current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	256	A
Diode continuous current	I_S	V_{GS}=0V, T_C=25℃	-	42	A
Diode pulse current	$I_{S,pulse}$	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	168	A
Total power dissipation	P_D	T_C=25℃	-	54	W
Total power dissipation	P_D	T_A=25℃	-	3.3	W
Operating junction temperature	T_J		-55	175	℃
Storage temperature	T_{STG}		-55	175	℃

Single pulse avalanche energy	E_{AS}	L=0.1mH, V_{GS}=10V, R_g=25Ω,	-	45	mJ
ESD level (HBM)			CLASS 1C		

●P-Channel Absolute Maximum Ratings（T_A=25℃,unless otherwise specified）

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}		-	-40	V
Gate-source voltage①	V_{GS}		-20	20	V
Continuous drain current	I_D	V_{GS}=-10V, T_C=25℃	-	-61	A
	I_D	V_{GS}=-10V, T_C=75℃	-	-50	A
	I_D	V_{GS}=-10V, T_C=100℃	-	-43	A
Pulsed drain current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	-244	A
Diode continuous current	I_S	V_{GS}=0V, T_C=25℃	-	-61	A
Diode pulse current	$I_{S,pulse}$	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	-244	A
Total power dissipation	P_D	T_C=25℃	-	79	W
Total power dissipation	P_D	T_A=25℃	-	3.3	W
Operating junction temperature	T_J		-55	175	℃
Storage temperature	T_{STG}		-55	175	℃
Single pulse avalanche energy	E_{AS}	L=0.1mH, V_{GS}=-10V, R_g=25Ω,	-	174	mJ
ESD level (HBM)			CLASS 2		

●Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC} （N-Channel）	-	-	2.8	°C/W
Thermal resistance, junction - case	R_{thJC}（P-Channel）	-	-	1.9	°C/W
Thermal resistance, junction - ambient②	R_{thJA}	-	-	45	°C/W
Soldering temperature(total time<10s)	T_{sold}	-	-	260	°C

●N-Channel Electronic Characteristics (T_j=25°C, unless otherwise specified)

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	2	2.7	4	V
Drain-source leakage current	I_{DSS}	V_{GS}=0V, V_{DS}=40V	-	-	1	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=16A, T_j=25℃	-	6.4	7.7	mΩ
Forward transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	11	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 16A	-	0.8	1.3	V

●N-Channel Dynamic Characteristics (T_j=25°C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=25V, V_{GS}=0V	-	859	-	pF
Output capacitance	C_{oss}		-	277	-	pF
Reverse transfer capacitance	C_{rss}		-	19	-	pF
Gate resistance	R_g	f = 1MHz	-	2.1	-	Ω
Total gate charge	Q_g	V_{DD} = 25V, I_D = 16A, V_{GS} = 10V	-	14.5	-	nC
Gate-source charge	Q_{gs}		-	2.8	-	nC
Gate-drain charge	Q_{gd}		-	5.2	-	nC
Turn-on delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=25V, R_G =3.3Ω, I_D =16A	-	5	-	ns
Turn-on rise time	t_r		-	10	-	ns
Turn-off delay time	$t_{D(off)}$		-	8	-	ns
Turn-off fall time	t_f		-	3	-	ns
Reverse recovery time	t_{rr}	V_{DD}=25V, dIs/dt = 100A/us, I_S=16A	-	30	-	ns
Reverse recovery charge	Q_{rr}		-	21	-	nC

●P-Channel Electronic Characteristics (T_j=25°C, unless otherwise specified)

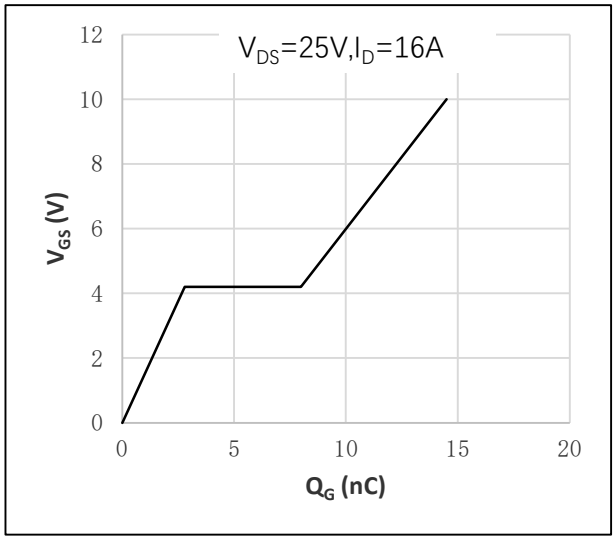
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	V_{GS} =0V, I_D =-250uA	-40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=-250uA	-1.3	-2	-2.5	V
Drain-source leakage current	I_{DSS}	V_{GS}=0V, V_{DS}=-40V	-	-	-1	uA
Gate- source leakage current	I_{GSS}	V_{GS}=±20V, V_{DS} =0V	-	-	±100	nA
Static drain-source on resistance	$R_{DS(ON)}$	V_{GS}=-10V, I_D=-16A, T_j=25℃	-	10.4	12.5	mΩ
		V_{GS}=-4.5V, I_D=-9A, T_j=25℃	-	19	23	mΩ
Forward transconductance	g_{FS}	V_{DS} =-5V, I_{SD} = -10A	-	13	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = -16A	-	-0.8	-1.3	V

●P-Channel Dynamic Characteristics (T_j=25°C, unless otherwise specified)

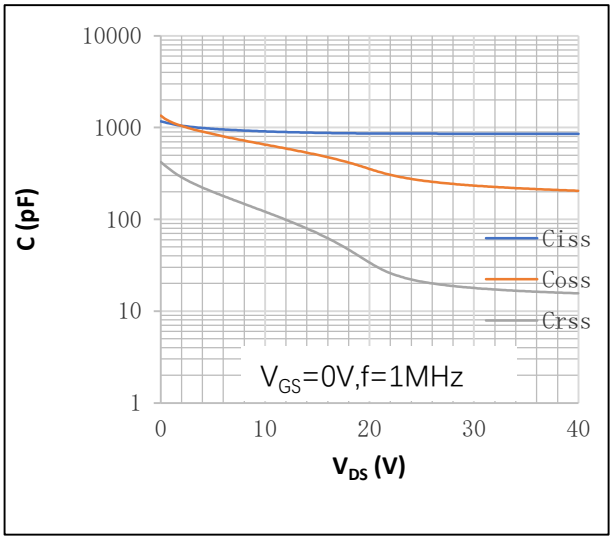
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=-25V，V_{GS}=0V	-	2573	-	pF
Output capacitance	C_{oss}		-	544	-	pF
Reverse transfer capacitance	C_{rss}		-	39	-	pF
Gate resistance	R_g	f = 1MHz	-	5.2	-	Ω
Total gate charge	Q_g	V_{DD} = -25V, I_D = -16A, V_{GS} = -10V	-	39.5	-	nC
Total gate charge(-4.5V)	Q_g		-	19.8	-	nC
Gate-source charge	Q_{gs}		-	7.8	-	nC
Gate-drain charge	Q_{gd}		-	9.1	-	nC
Turn-on delay time	$t_{D(on)}$	V_{GS}=-10V, V_{DS}=-25V, R_G =3.3Ω, I_D =-16A	-	15	-	ns
Turn-on rise time	t_r		-	9	-	ns
Turn-off delay time	$t_{D(off)}$		-	19	-	ns
Turn-off fall time	t_f		-	25	-	ns
Reverse recovery time	t_{rr}	V_{DD}=-25V, dI_S/dt =-100A/us, I_S=-16A	-	35	-	ns
Reverse recovery charge	Q_{rr}		-	28	-	nC

●N-Channel Characteristics Curve (T_j=25°C, unless otherwise specified)

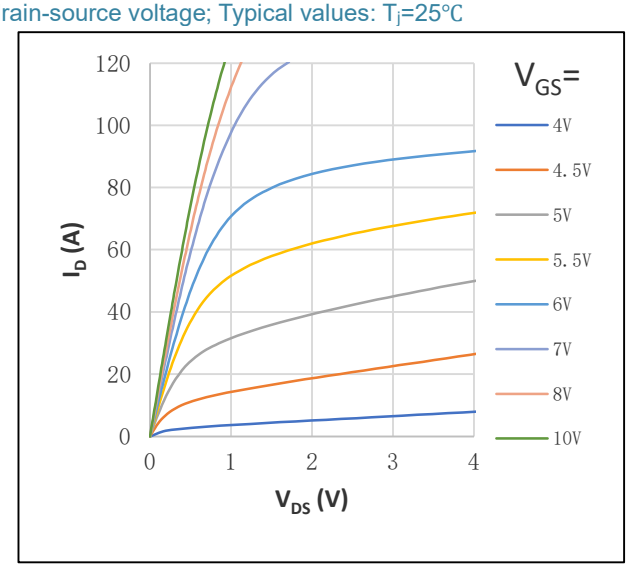
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



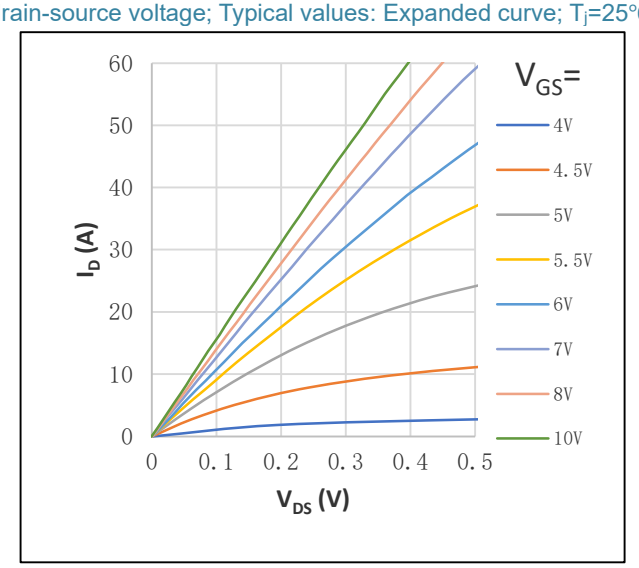
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



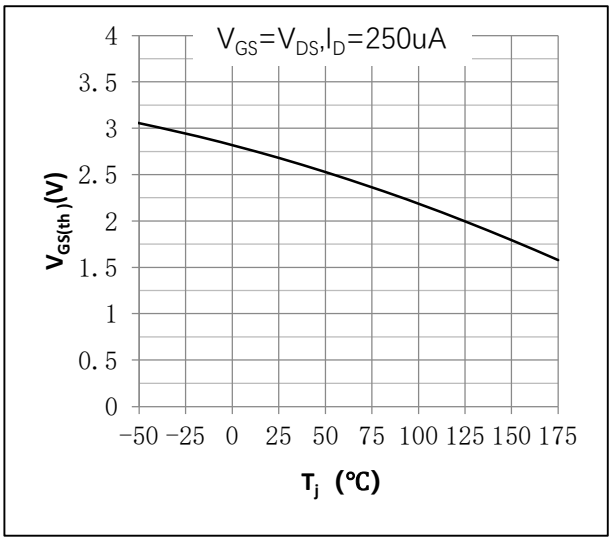
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values: T_j=25℃



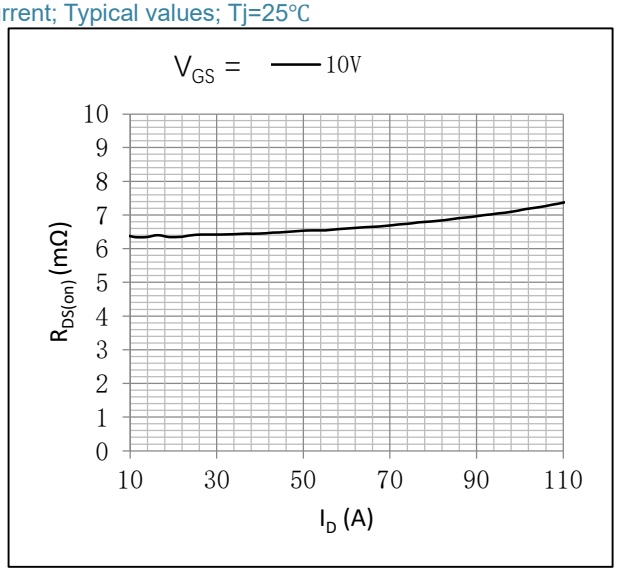
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



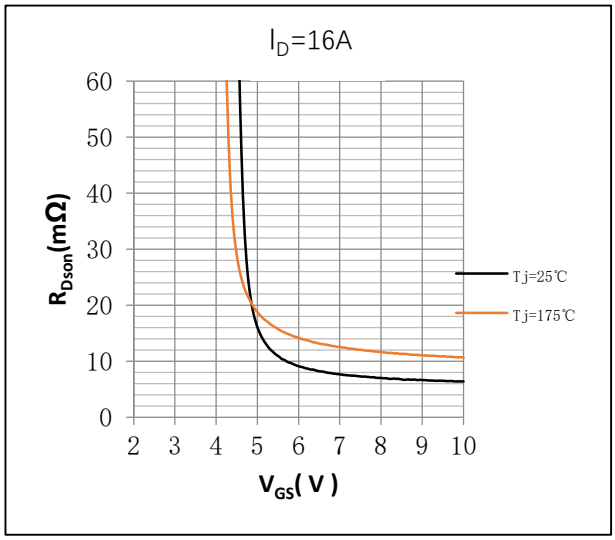
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



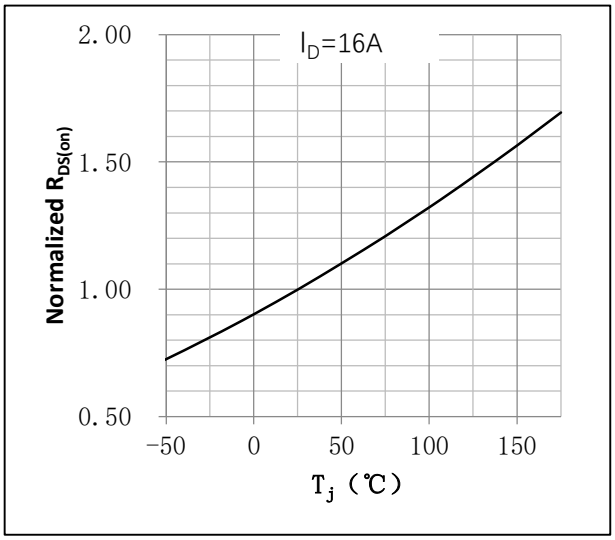
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



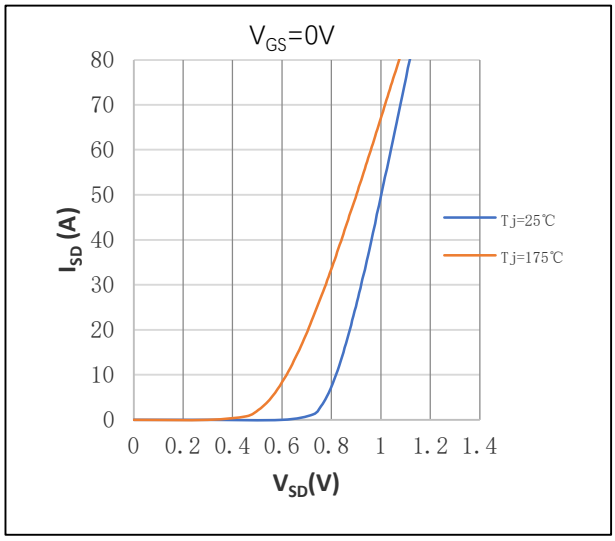
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



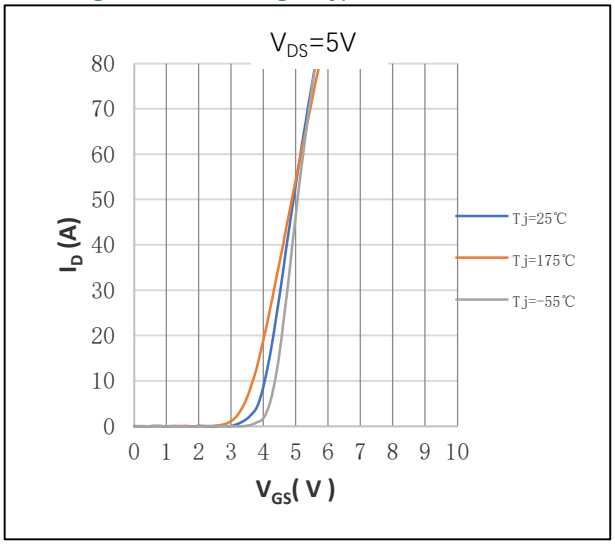
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



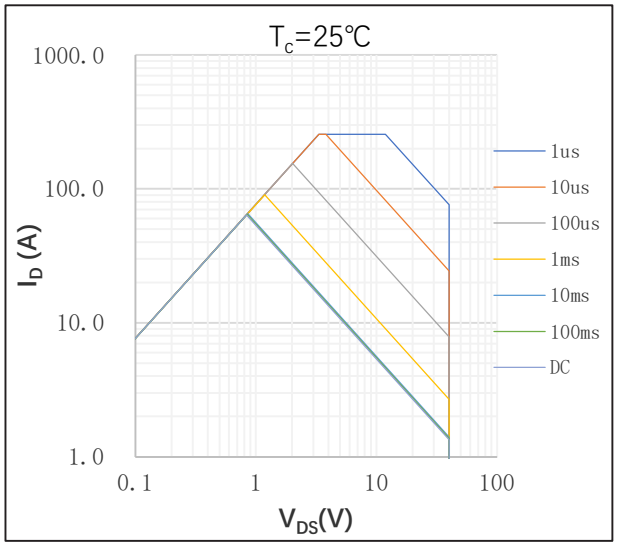
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



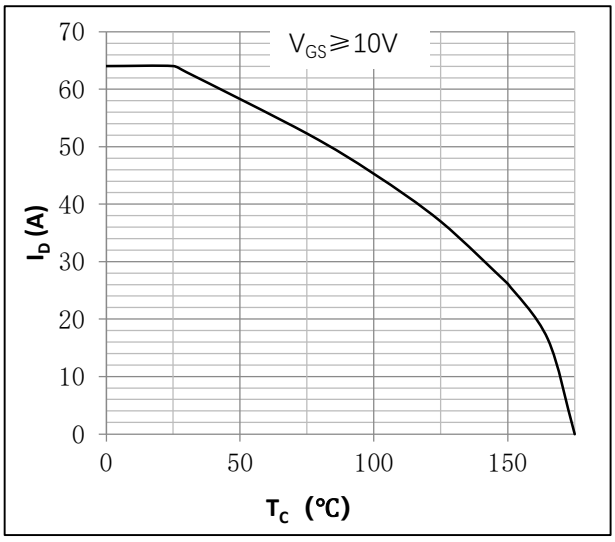
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



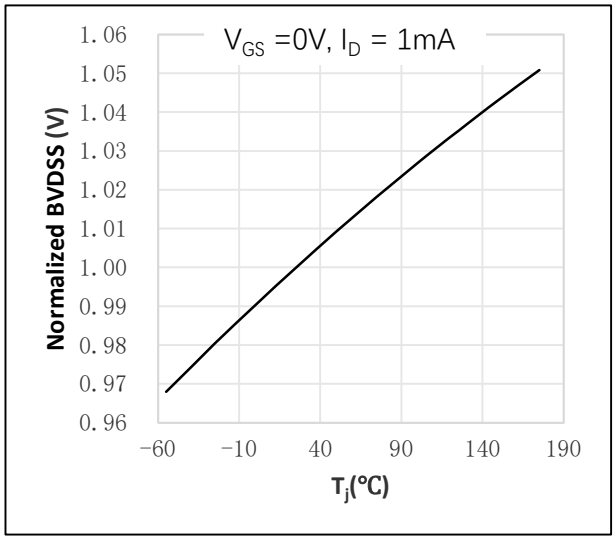
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



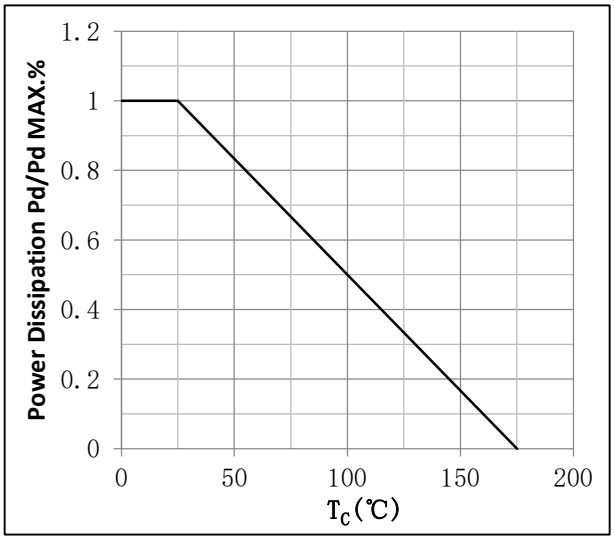
●Fig.12 Continuous drain current as a function of case temperature[3] ;Calculative values



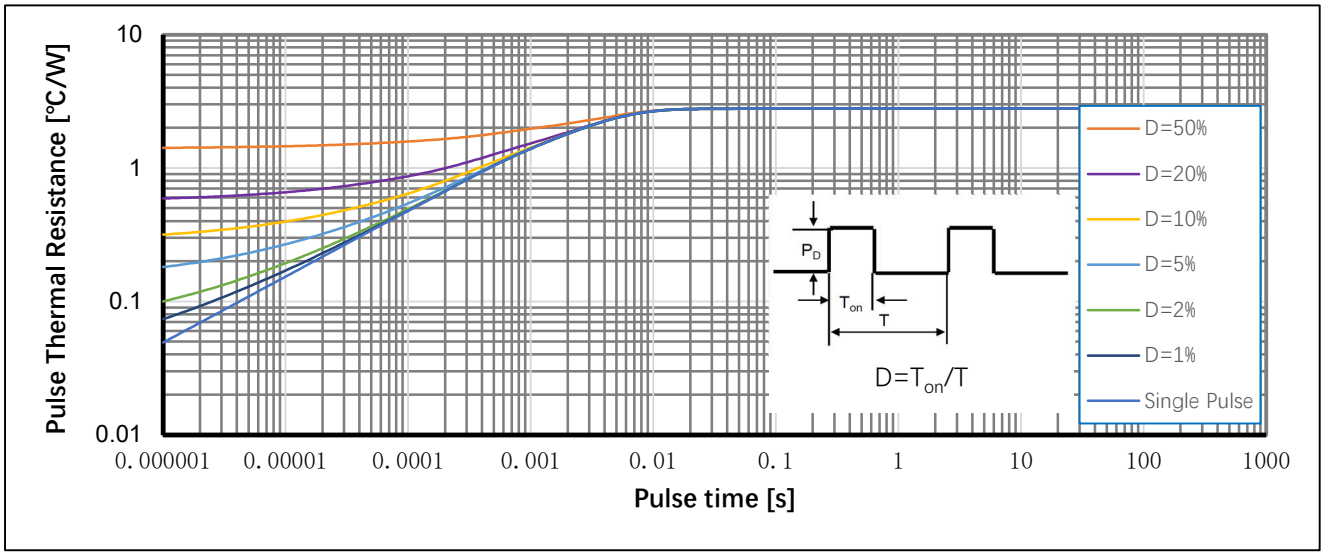
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values



●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =P_d/P_d(25℃)

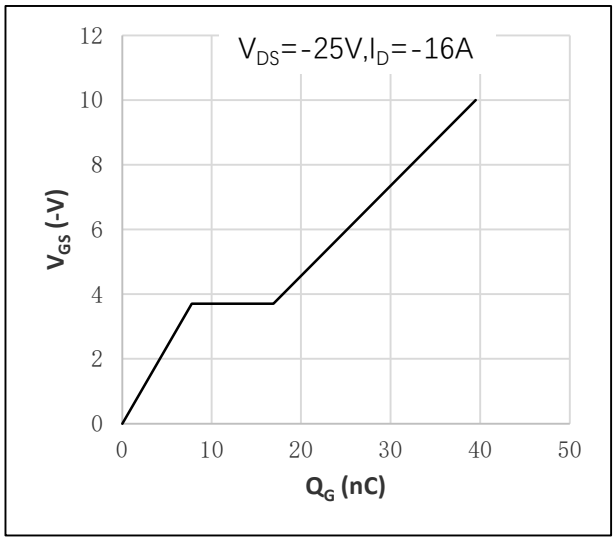


●Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

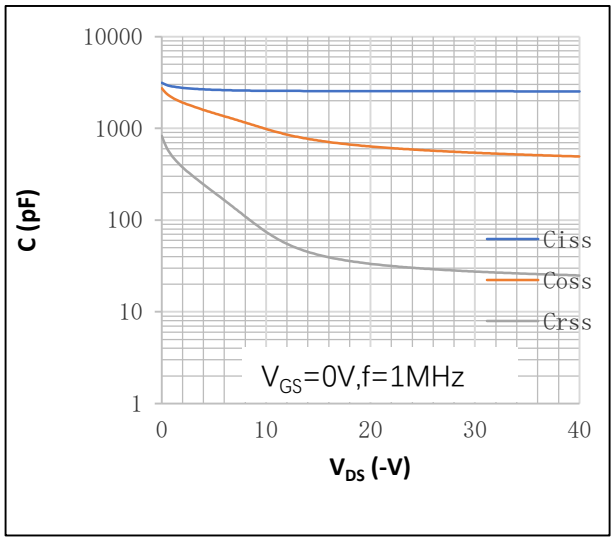


●P-Channel Characteristics Curve (T_j=25°C, unless otherwise specified)

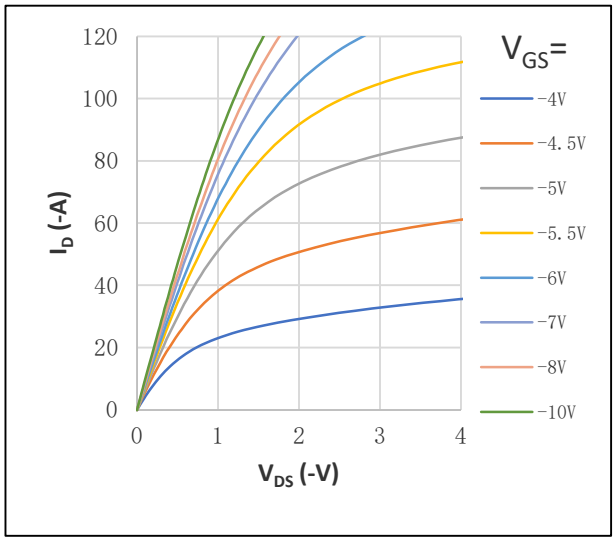
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



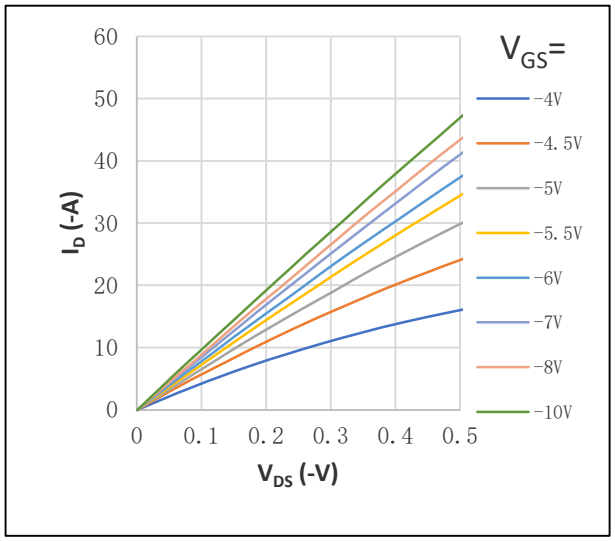
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



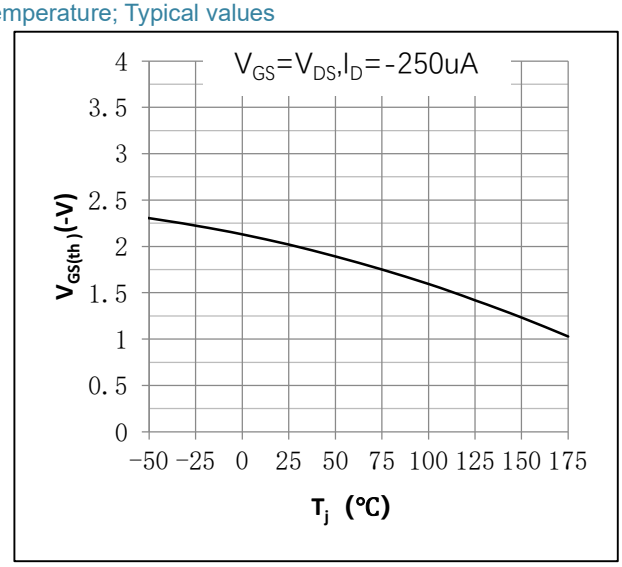
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values: T_j=25℃



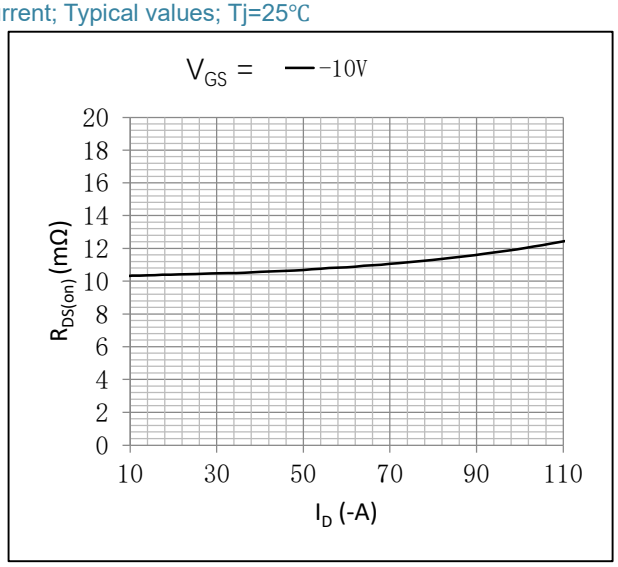
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



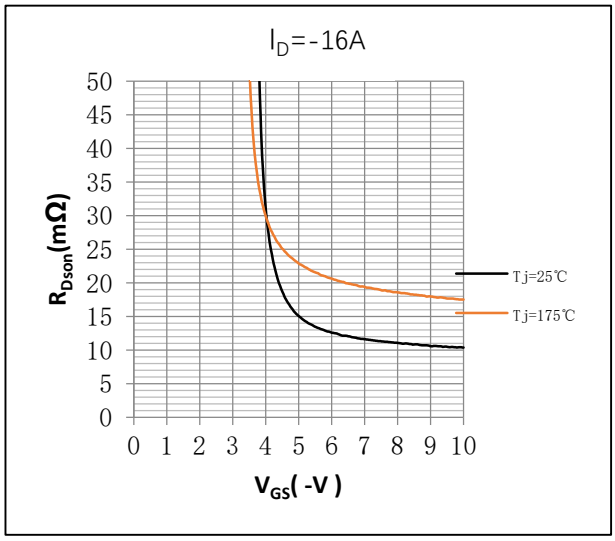
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



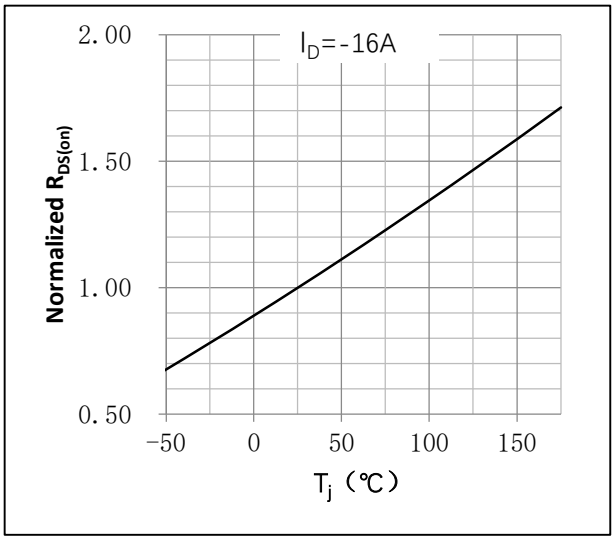
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



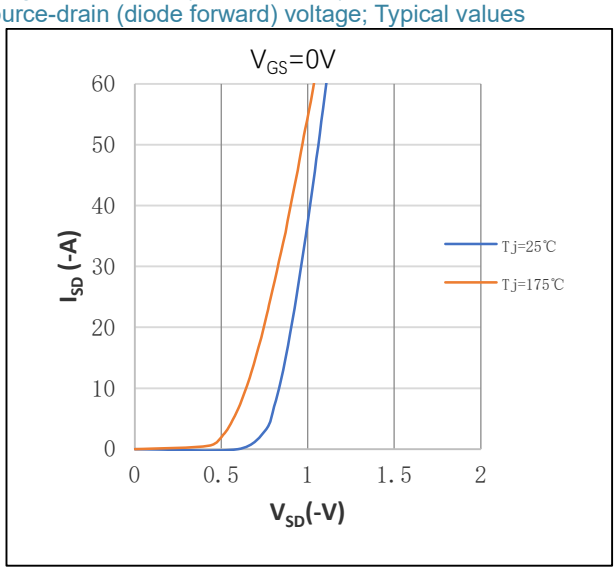
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



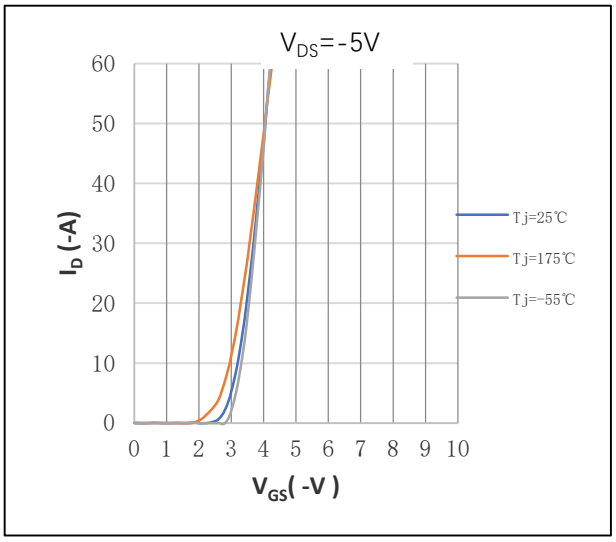
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



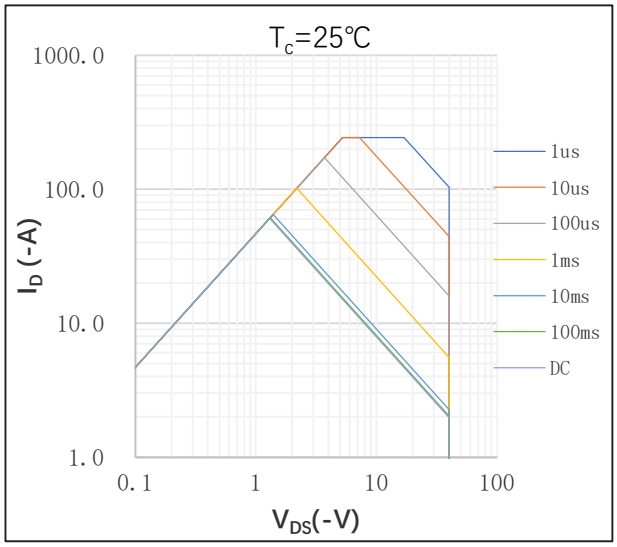
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



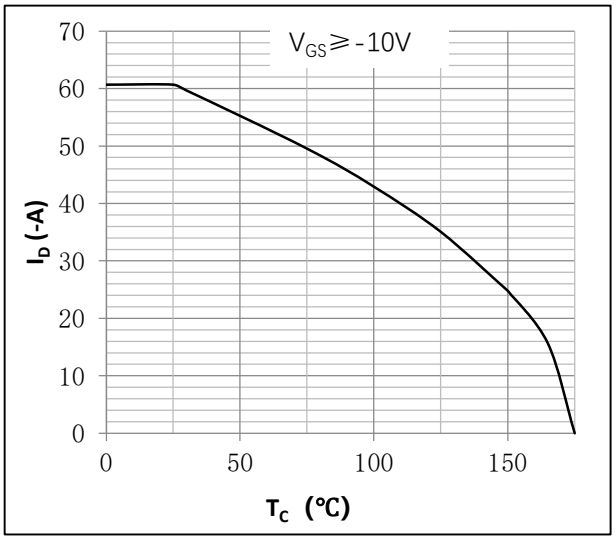
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



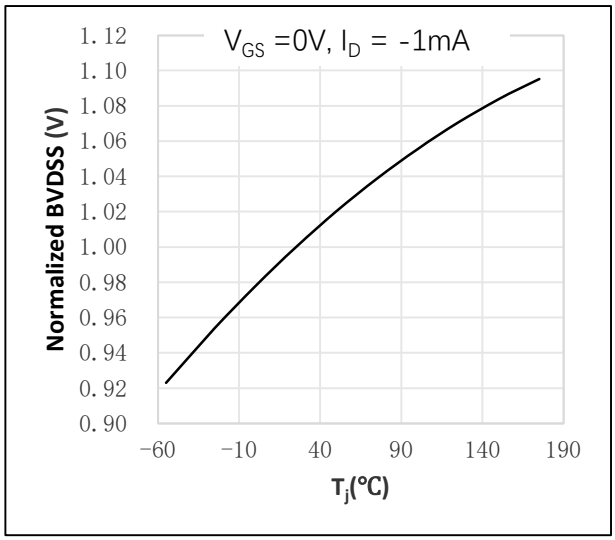
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



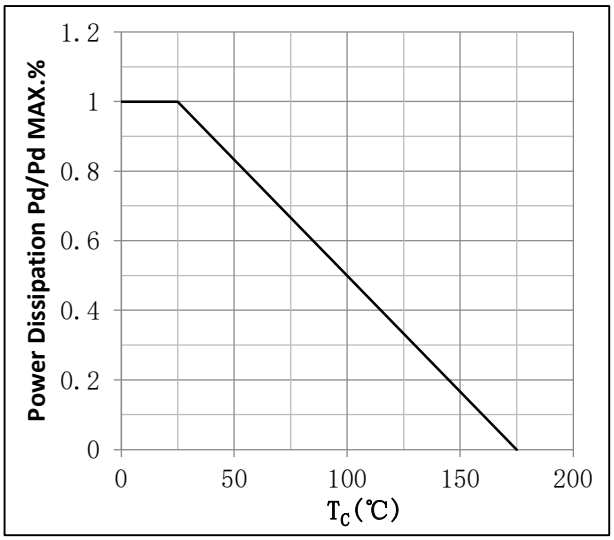
●Fig.12 Continuous drain current as a function of case temperature③ ;Calculative values



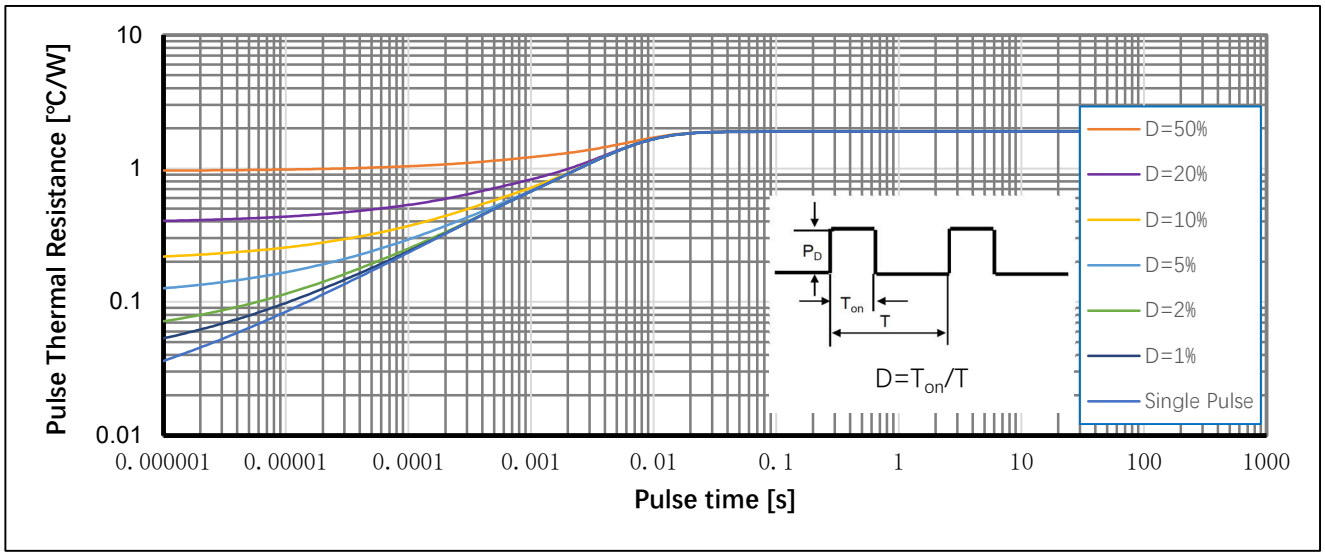
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values



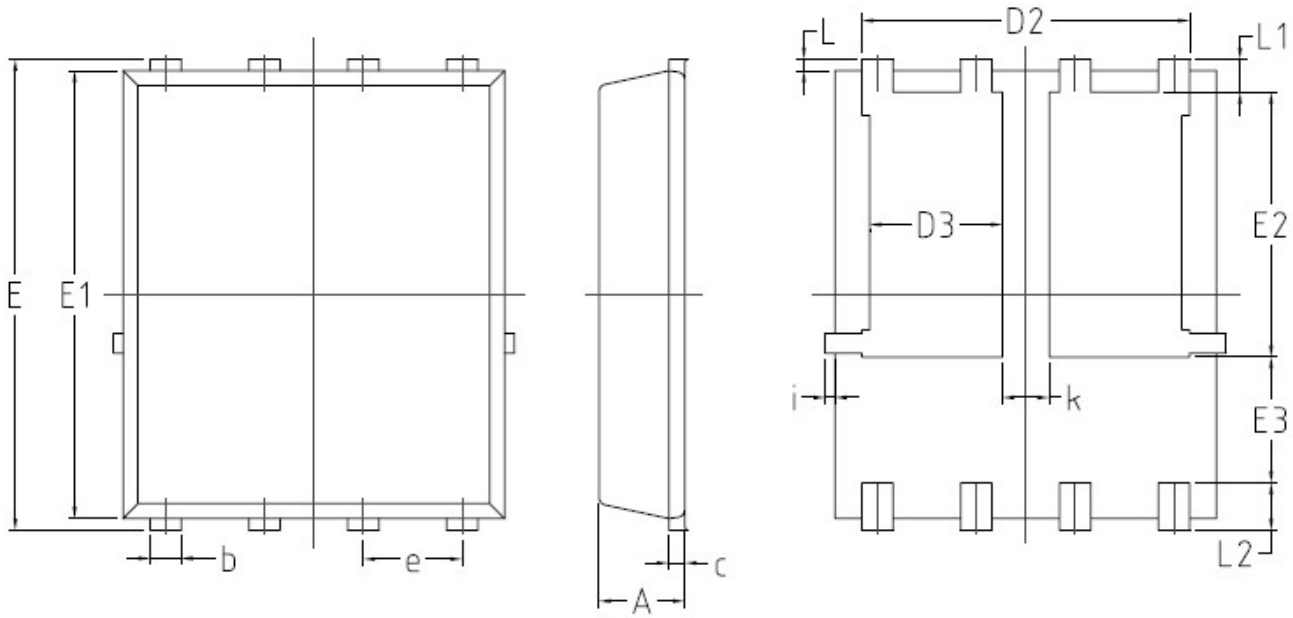
●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =Pd/Pd(25℃)

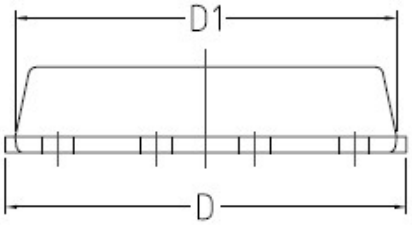


● Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



●Package Outline





SYMBOL	COMMON			
	MM		INCH	
	MIN.	MAX.	MIN.	MAX.
A	1.03	1.17	0.0406	0.0461
b	0.34	0.48	0.0134	0.0189
c	0.203 BSC		0.0080 BSC	
D	4.80	5.40	0.1890	0.2126
D1	4.80	5.00	0.1890	0.1969
D2	4.11	4.31	0.1620	0.1700
D3	1.60	1.80	0.0629	0.0708
E	5.95	6.15	0.2343	0.2421
E1	5.65	5.85	0.2224	0.2303
E2	3.30	3.50	0.1300	0.1378
⚠2 E3	1.40	/	0.0551	/
e	1.27 BSC		0.05 BSC	
L	0.05	0.25	0.0019	0.0098
L1	0.38	0.50	0.0150	0.0197
⚠2 L2	0.38	0.71	0.0150	0.0280
i	/	0.18	/	0.0070
k	0.5	0.7	0.0197	0.0276

Note

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

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

③Practically the current will be limited by PCB, thermal design and operating temperature. V_{GS}=10V (N-channel)/ -10V(P-channel).

Disclaimer

● Reproducing and modifying information of the document is prohibited without permission from ZMJ SEMICONDDUCTORS CO., LTD.

● ZMJ SEMICONDDUCTORS CO., LTD. reserves the rights to make changes of the content herein the document anytime without notification. Please refer to our website for the latest document.

● ZMJ SEMICONDDUCTORS CO., LTD. disclaims any and all liability arising out of the application or use of any product including damages incidentally and consequentially occurred.

● ZMJ SEMICONDDUCTORS CO., LTD. does not assume any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

● Applications shown on the herein document are examples of standard use and operation. Customers are responsible in comprehending the suitable use in particular applications. ZMJ SEMICONDDUCTORS CO., LTD. makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

● The products shown herein are not designed and authorized for equipments relating to human life and for any applications concerning life-saving or life-sustaining, such as medical instruments, aerospace machinery et cetera. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify ZMJ SEMICONDDUCTORS CO., LTD. for any damages resulting from such improper use or sale.

● Since ZMJ uses lot number as the tracking base, please provide the lot number for tracking when complaining.

●Revision History

Version	Date	Change
A	2025/10/17	New