●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

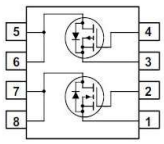
- ■Low $R_{DS(ON)}$ to minimize conductive loss
- ■Dual die in one package
- ■Low thermal resistance
- ■AEC-Q101 qualified

●Application

- ■BLDC motor driver
- ■Load switch

●Product Summary

DFN5*6



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

$R_{DS(ON)1}$ =12.3mR $R_{DS(ON)2}$ =29.3mR

I_{D1}=35A I_{D2}=-28A

RoHS REACH HF

●Ordering Information

Part NO.	ZMCA88403N
Marking	ZMC88403
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℃	-	35	A
	I_D	V_{GS}=10V, T_C=75℃	-	28	A
	I_D	V_{GS}=10V, T_C=100℃	-	24	A
Pulsed drain current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	140	A
Total power dissipation	P_D	T_C=25℃	-	36	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,	-	24	mJ
ESD level (HBM)			CLASS 1B		

●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℃	-	-28	A
	I_D	V_{GS}=-10V, T_C=75℃	-	-23	A
	I_D	V_{GS}=-10V, T_C=100℃	-	-20	A
Pulsed drain current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	-112	A
Total power dissipation	P_D	T_C=25℃	-	50	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,	-	15	mJ
ESD level (HBM)			CLASS 1B		

●Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC} （N-Channel）	-	-	4.2	°C/W
Thermal resistance, junction - case	R_{thJC}（P-Channel）	-	-	3	°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	1.2	1.7	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=10A, T_j=25℃	-	12.3	14.8	mΩ
		V_{GS}=4.5V, I_D=6A, T_j=25℃	-	17.3	20.8	mΩ
Forward transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	11	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 10A	-	-	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	-	1336	-	pF
Output capacitance	C_{oss}		-	83	-	pF
Reverse transfer capacitance	C_{rss}		-	50	-	pF
Gate resistance	R_g	f = 1MHz	-	1.7	-	Ω
Total gate charge	Q_g	V_{DD} = 25V, I_D = 10A, V_{GS} = 10V	-	20.2	-	nC
Gate-source charge	Q_{gs}		-	3.8	-	nC
Gate-drain charge	Q_{gd}		-	3.4	-	nC
Turn-on delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=25V, R_G =3.3Ω, I_D =10A	-	26	-	ns
Turn-on rise time	t_r		-	65	-	ns
Turn-off delay time	$t_{D(off)}$		-	71	-	ns
Turn-off fall time	t_f		-	56	-	ns
Reverse recovery time	t_{rr}	V_{DD}=25V, dIs/dt = 100A/us, I_S=10A	-	42	-	ns
Reverse recovery charge	Q_{rr}		-	52	-	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	-1.8	-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=-10A, T_j=25℃	-	29.3	35.2	mΩ
		V_{GS}=-4.5V, I_D=-6A, T_j=25℃	-	45.1	54.1	mΩ
Forward transconductance	g_{FS}	V_{DS} =-5V, I_{SD} = -10A	-	11	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = -10A	-	-	-1.3	V

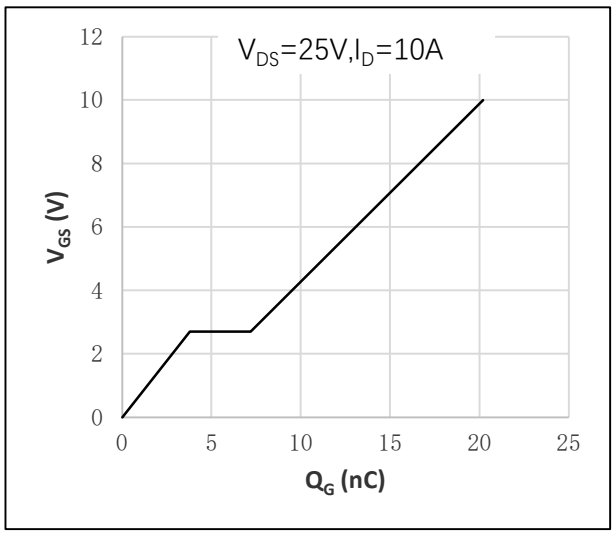
●P-Channel Dynamic Characteristics (T_j=25°C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=-25V, V_{GS}=0V	-	1363	-	pF
Output capacitance	C_{oss}		-	95	-	pF
Reverse transfer capacitance	C_{rss}		-	65	-	pF
Gate resistance	R_g	f = 1MHz	-	9.6	-	Ω
Total gate charge	Q_g	V_{DD} = -25V, I_D = -10A, V_{GS} = -10V	-	21.1	-	nC
Gate-source charge	Q_{gs}		-	5	-	nC

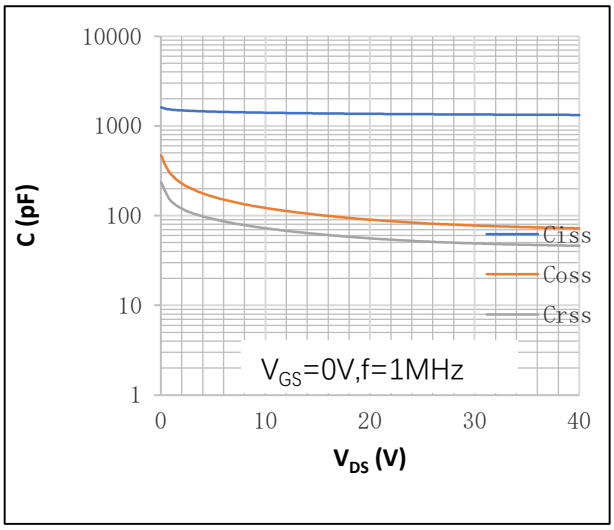
Gate-drain charge	Q_{gd}		-	2.1	-	nC
Turn-on delay time	$t_{D(on)}$	V_{GS}=-10V, V_{DS}=-25V, R_G =3.3Ω, I_D =-10A	-	6	-	ns
Turn-on rise time	t_r		-	51	-	ns
Turn-off delay time	$t_{D(off)}$		-	13	-	ns
Turn-off fall time	t_f		-	3	-	ns
Reverse recovery time	t_{rr}	V_{DD}=-25V, dI_S/dt =-100A/us, I_S=-10A	-	17	-	ns
Reverse recovery charge	Q_{rr}		-	19	-	nC

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

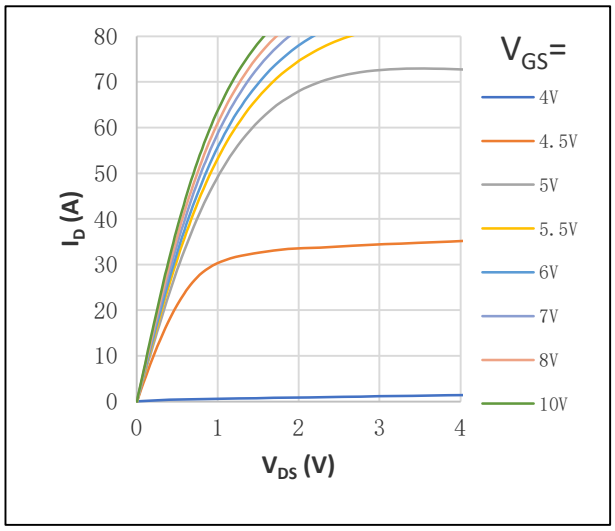
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



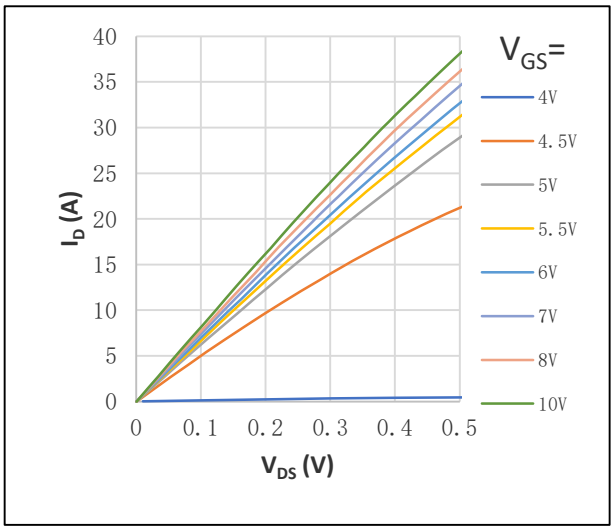
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



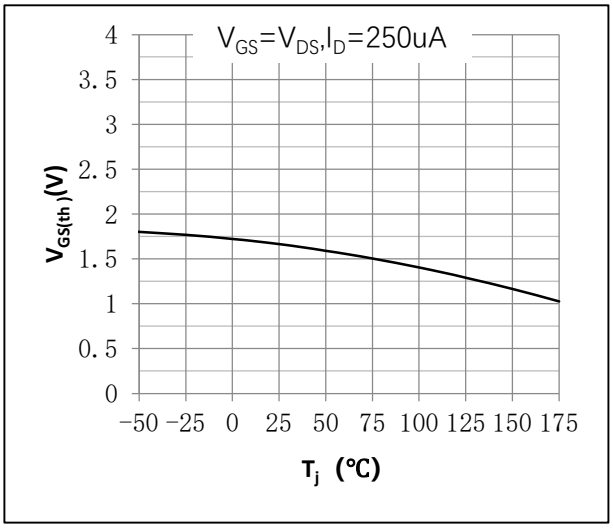
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values: T_j=25℃



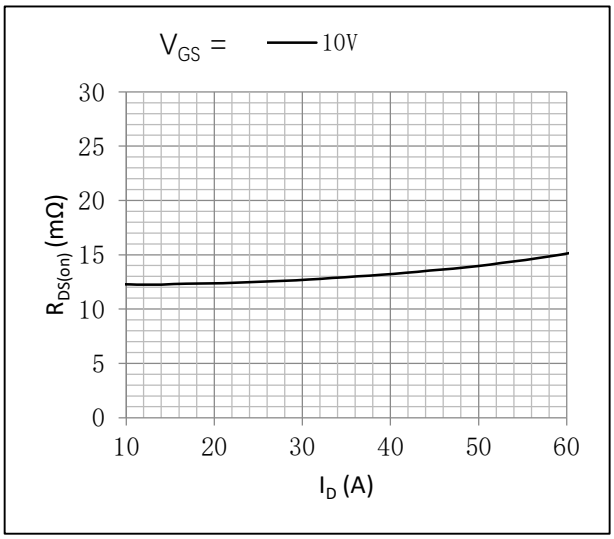
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



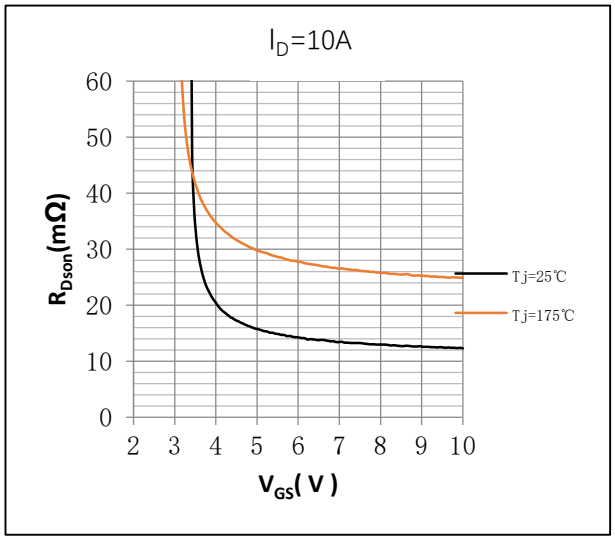
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



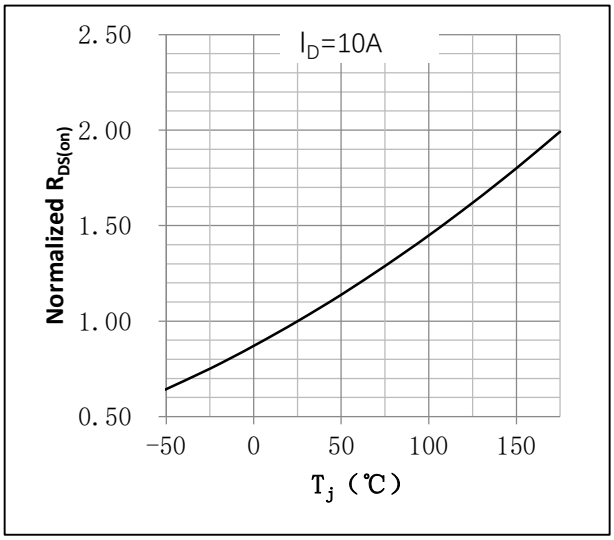
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



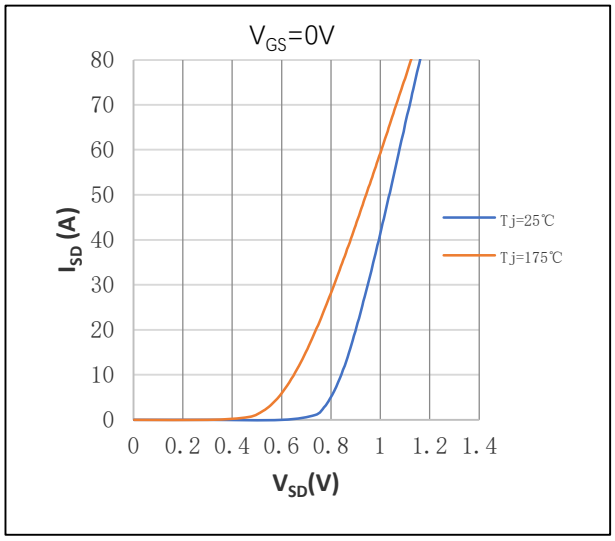
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



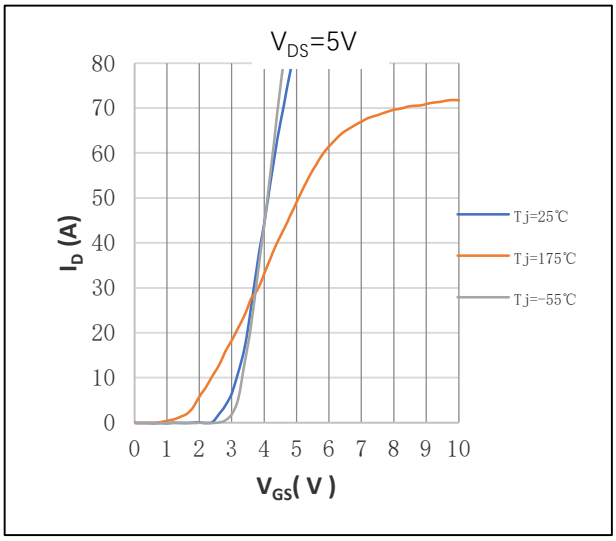
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



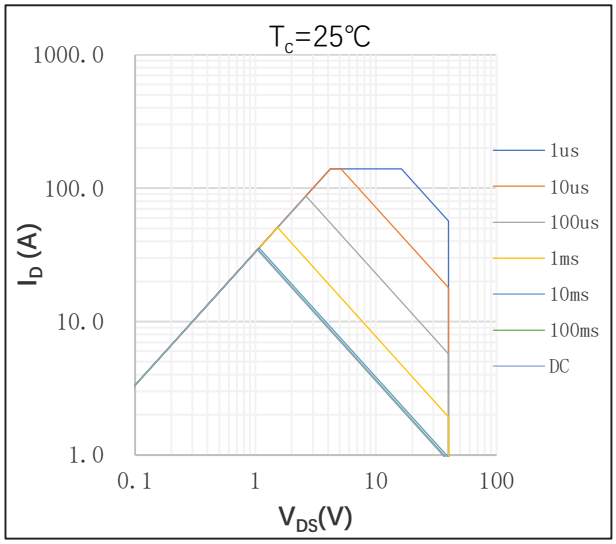
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



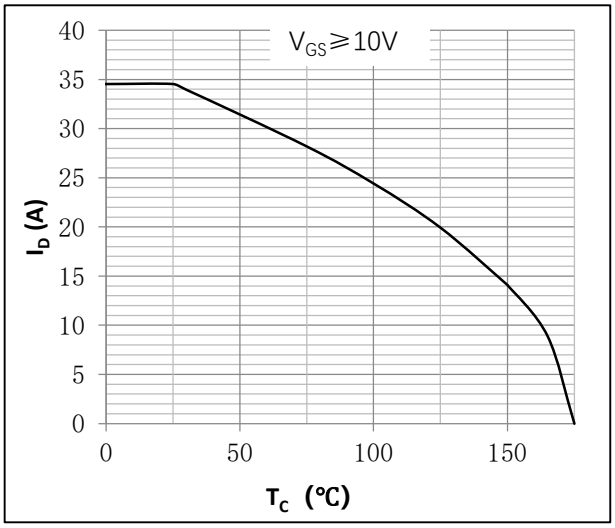
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



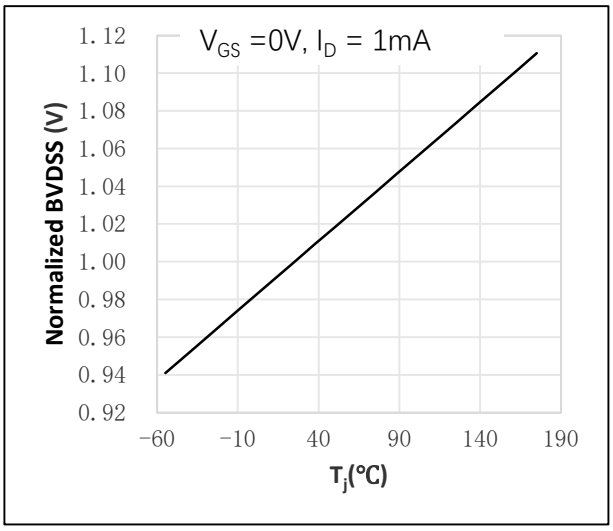
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



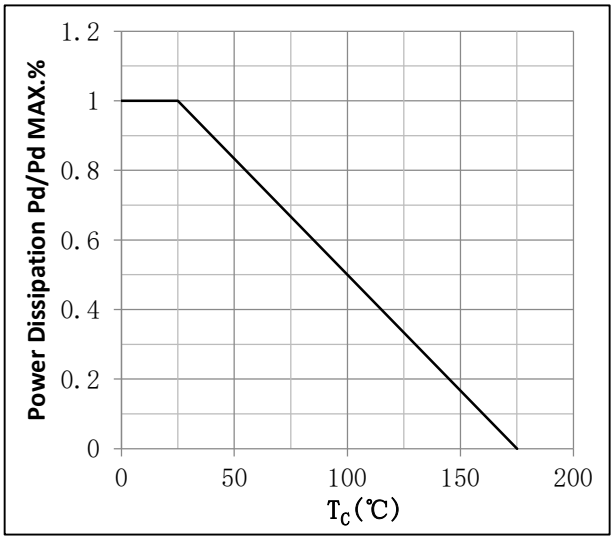
●Fig.12 Continuous drain current as a function of case temperature[3] ;Calculative values



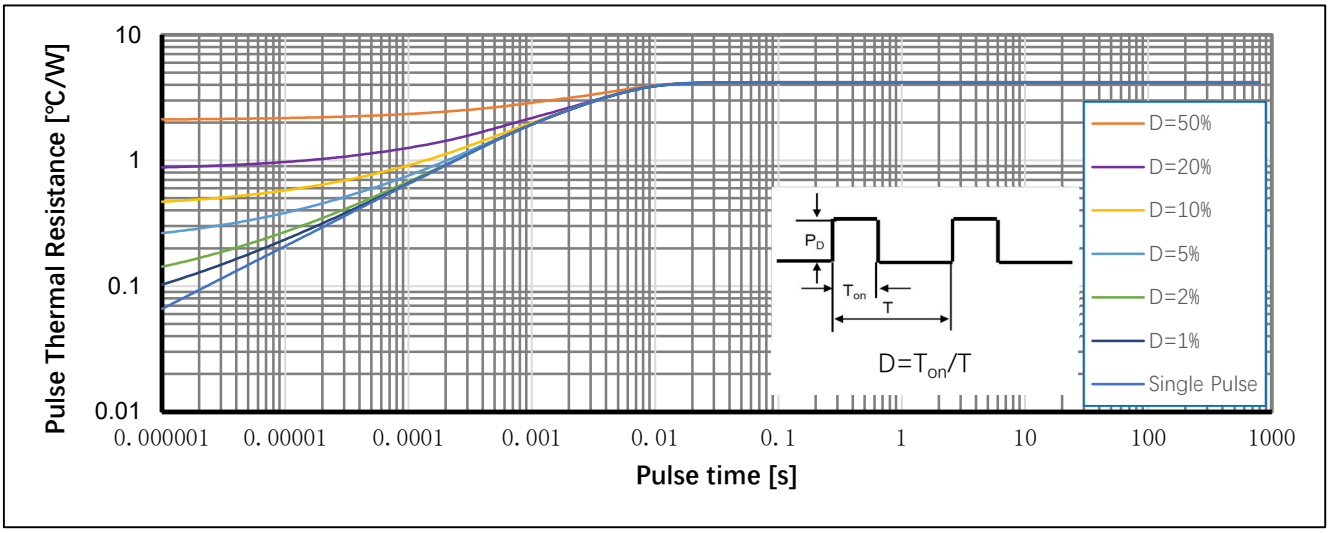
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values



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

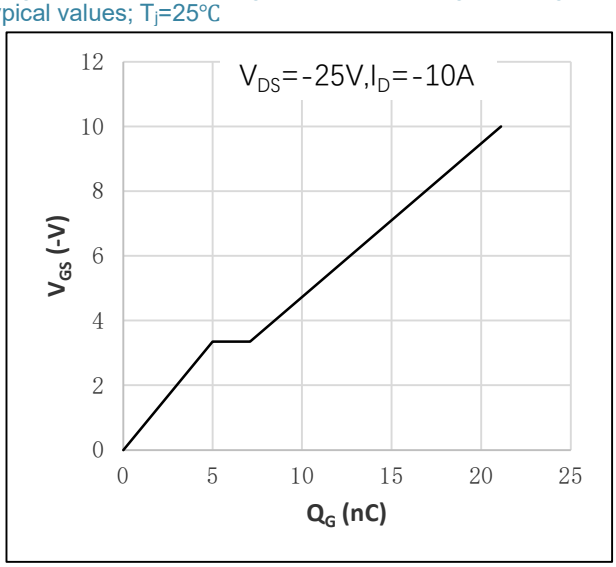


●Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

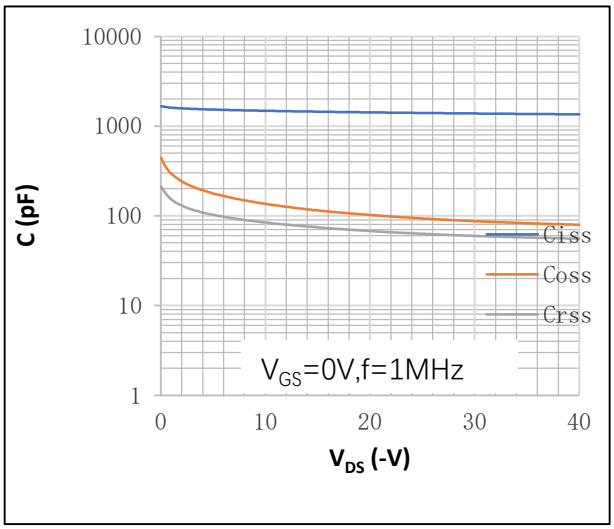


●P-Channel Characteristics Curve (T_j=25°C, unless otherwise specified)

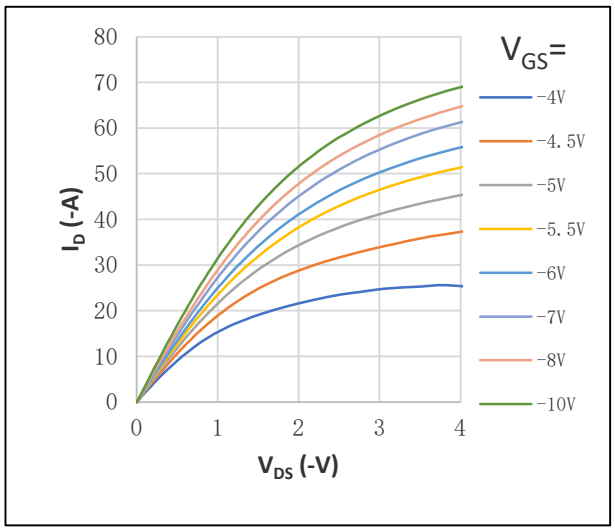
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



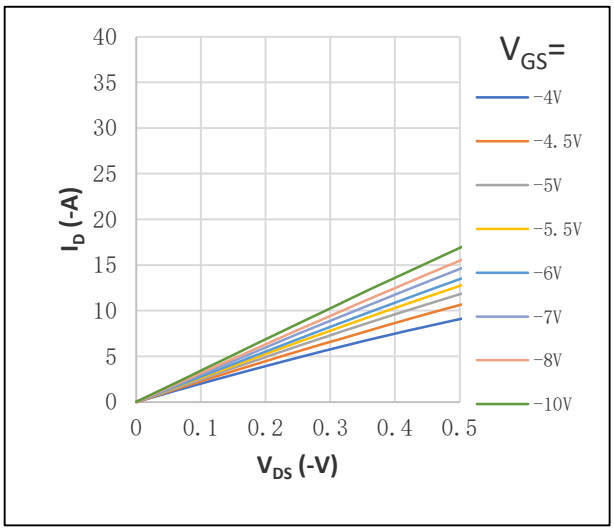
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



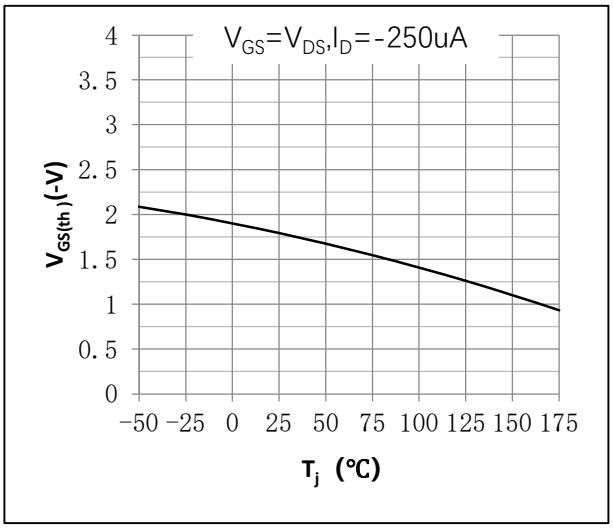
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values: T_j=25℃



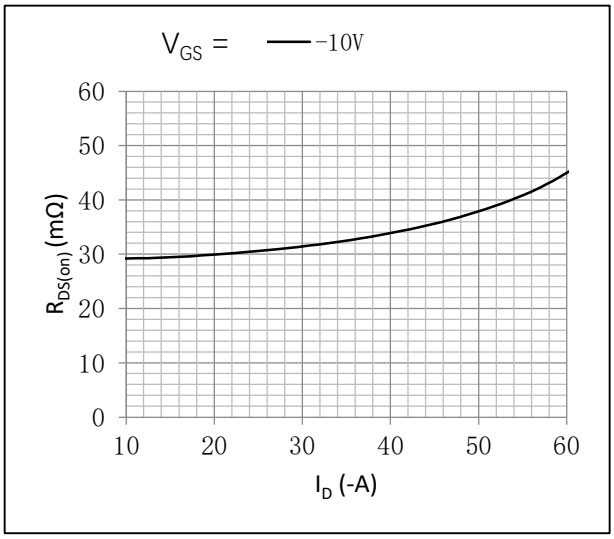
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



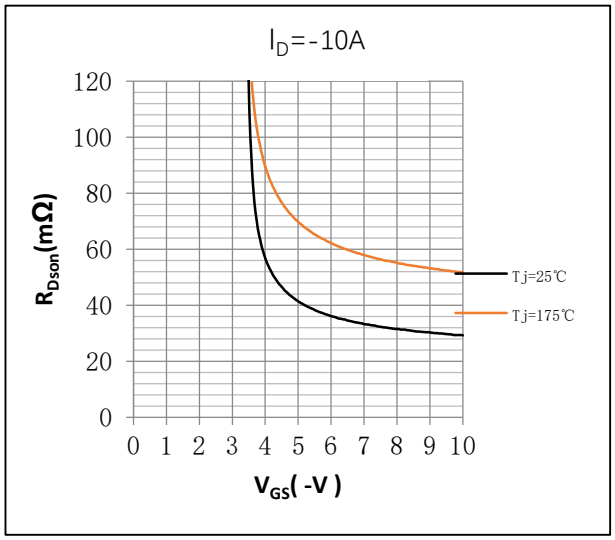
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



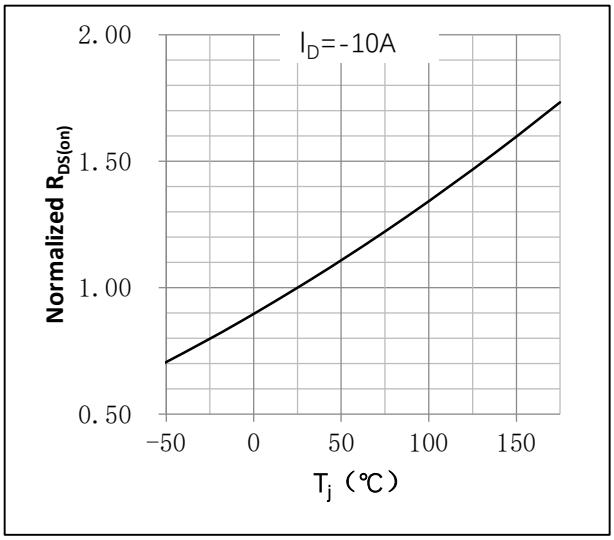
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



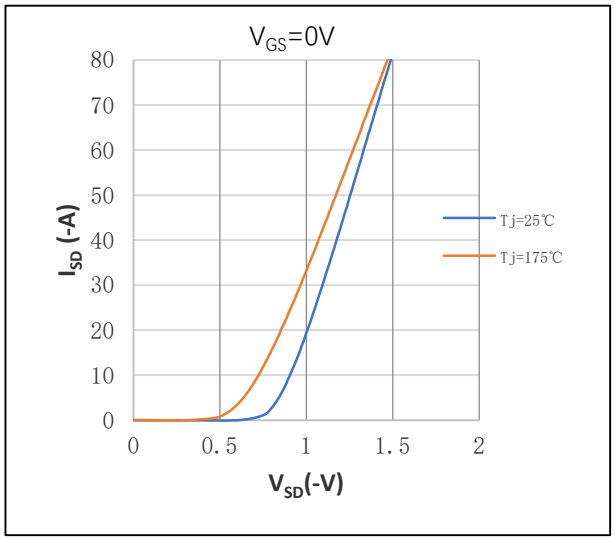
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



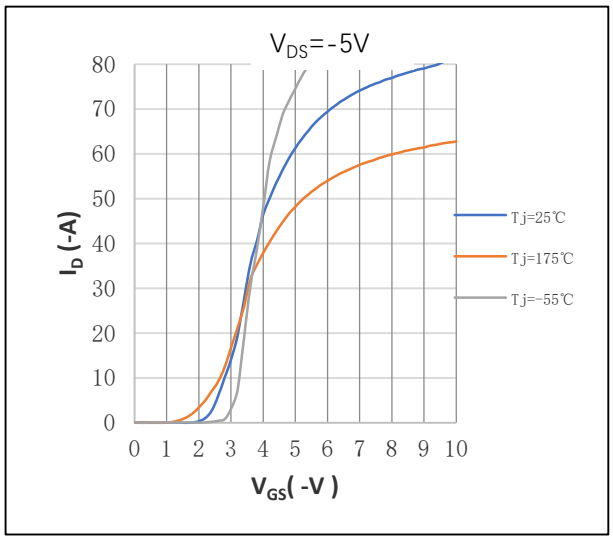
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



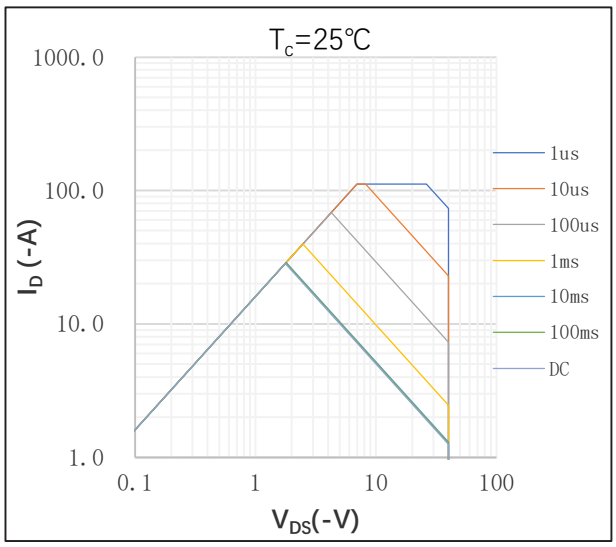
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



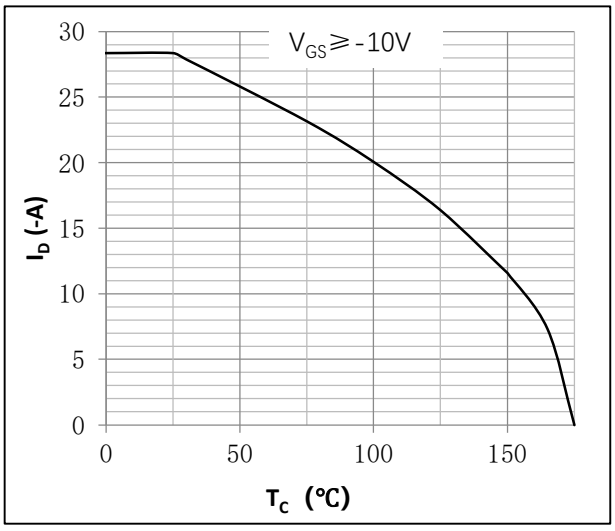
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



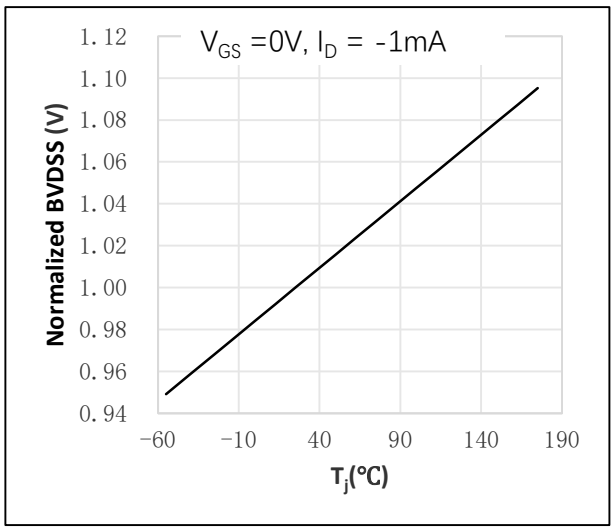
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



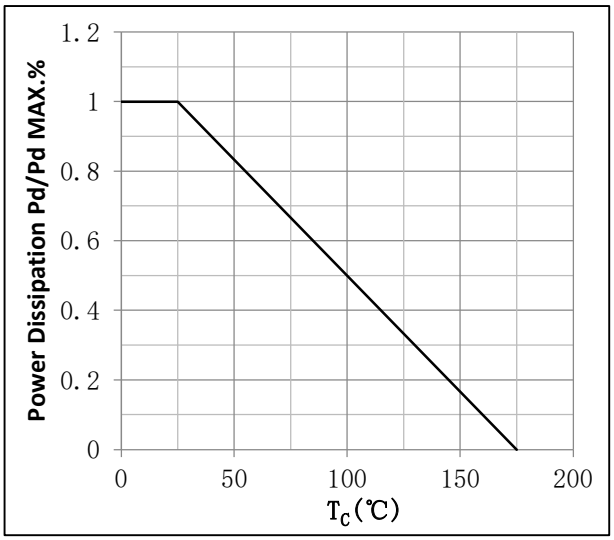
●Fig.12 Continuous drain current as a function of case temperature③ ;Calculative values



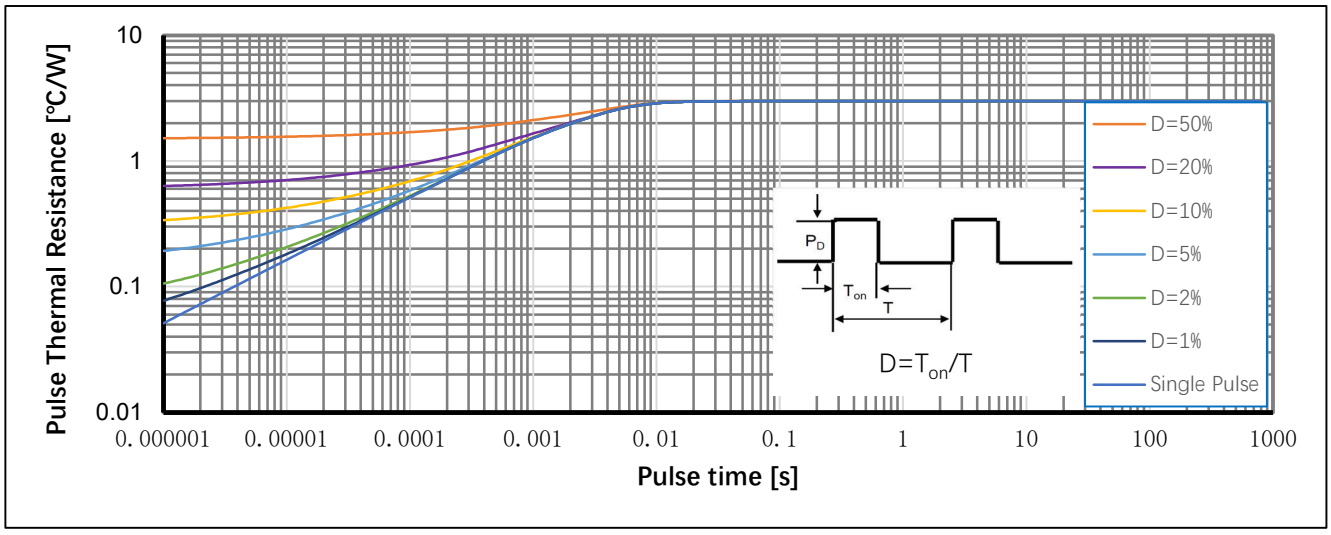
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values



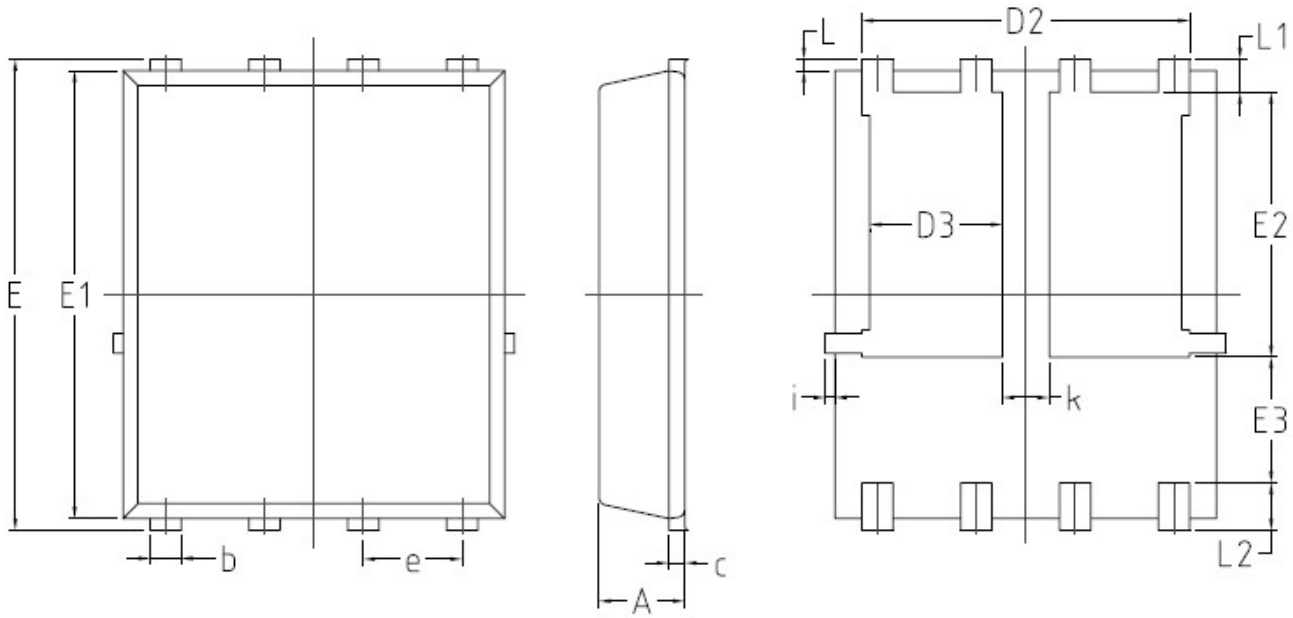
●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =Pd/Pd(25℃)

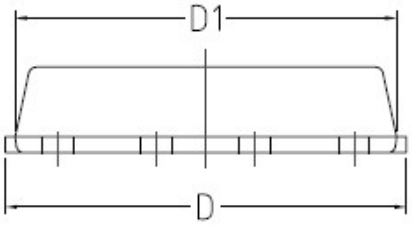


● Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



●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).

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●Revision History

Version	Date	Change
A	2025/8/27	New
B	2025/10/17	Correct Qg and switching time condition.