●General Description

It combines advanced trench MOSFET technology with a low resistance package to provide extremely low $R_{DS(ON)}$.

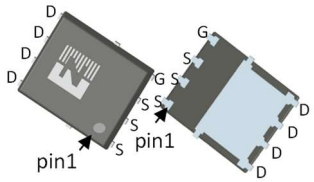
●Features

- ■Low $R_{DS(ON)}$ to minimize conductive loss
- ■Low Gate Charge for fast switching
- ■Low thermal resistance
- ■AEC-Q101 qualified

●Application

- ■BLDC motor driver
- ■DC-DC
- ■Load switch

●Product Summary



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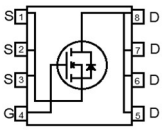


V_{DS}=40V

$R_{DS(ON)}$ =3.9mR

I_D=89A

RoHS REACH COMPLIANT HF

●Ordering Information

Part NO.	ZMSA040N04HNCU
Marking	ZMS040N04H
Packing information	REEL TAPE
Basic ordering unit (pcs)	3000

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

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}	25℃≤Tj≤175℃	-	40	V
Gate-source voltage①	V_{GS}	DC; -55℃≤Tj≤175℃	-20	20	V
Continuous drain current	I_D	V_{GS}=10V, T_C=25℃	-	89	A
	I_D	V_{GS}=10V, T_C=75℃	-	73	A
	I_D	V_{GS}=10V, T_C=100℃	-	63	A
Pulsed drain current	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	356	A
Diode continuous current	I_S	V_{GS}=0V, T_C=25℃	-	55	A
Diode pulse current	$I_{S,pulse}$	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	220	A
Total power dissipation	P_D	V_{GS}＞6V, T_C=25℃	-	71	W
Total power dissipation	P_D	V_{GS}＞6V, 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

Single pulse avalanche energy	E_{AS}	L=0.5mH, V_{GS}=10V, R_g=25Ω	-	78	mJ
ESD level (HBM)			CLASS 1C		

●Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	2.1	°C/W
Thermal resistance, junction - ambient	R_{thJA}②	-	-	45	°C/W
Soldering temperature	T_{sold}	-	-	260	°C

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

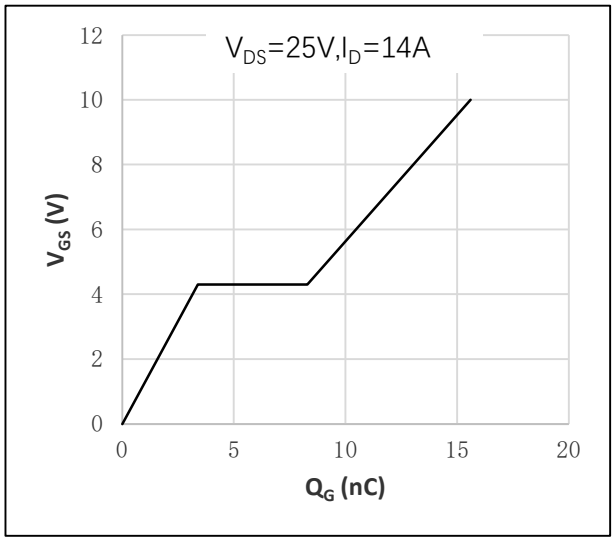
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA, T_j=25℃	40	-	-	V
		V_{GS} =0V, I_D =250uA, T_j=-55℃	38.7	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=250uA, T_j=25℃	2	2.7	4	V
		V_{GS}=V_{DS}, I_D=1mA, T_j=-55℃	-	-	4.5	V
		V_{GS}=V_{DS}, I_D=1mA, T_j=175℃	1.3	-	-	V
Drain-source leakage current	I_{DSS}	V_{GS}=0V, V_{DS}=40V, T_j=25℃	-	-	1	uA
		V_{GS}=0V, V_{DS}=40V, T_j=175℃	-	-	500	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=14A, T_j=25℃	-	3.9	4.9	mΩ
		V_{GS}=10V, I_D=14A, T_j=175℃	-	7.1	-	mΩ
Forward transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	16	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 14A	-	0.8	1.3	V

●Dynamic characteristics (T_j=25°C, unless otherwise specified)

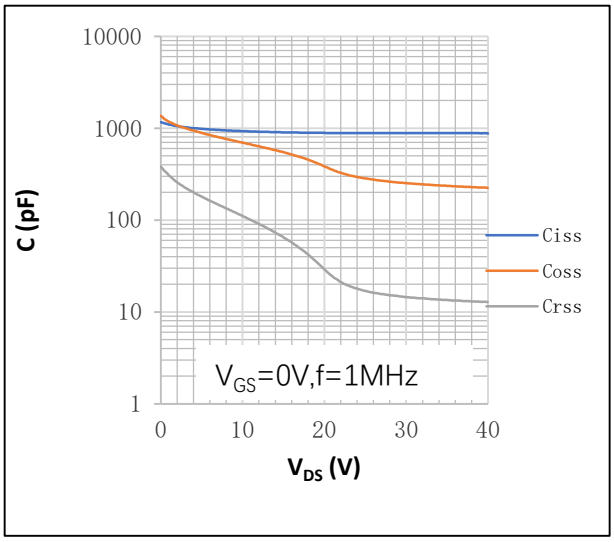
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=25V, V_{GS}=0V	-	887	-	pF
Output capacitance	C_{oss}		-	285	-	pF
Reverse transfer capacitance	C_{rss}		-	17	-	pF
Gate resistance	R_g	f = 1MHz	-	1	-	Ω
Total gate charge	Q_g	V_{DD} = 25V, I_D = 14A, V_{GS} = 10V	-	15.6	-	nC
Gate-source charge	Q_{gs}		-	3.4	-	nC
Gate-drain charge	Q_{gd}		-	4.9	-	nC

Turn-on delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=25V, R_G =3.3Ω, I_D =14A	-	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, dI_S/dt = 100A/us, I_S=14A	-	30	-	ns
Reverse recovery charge	Q_{rr}		-	21	-	nC

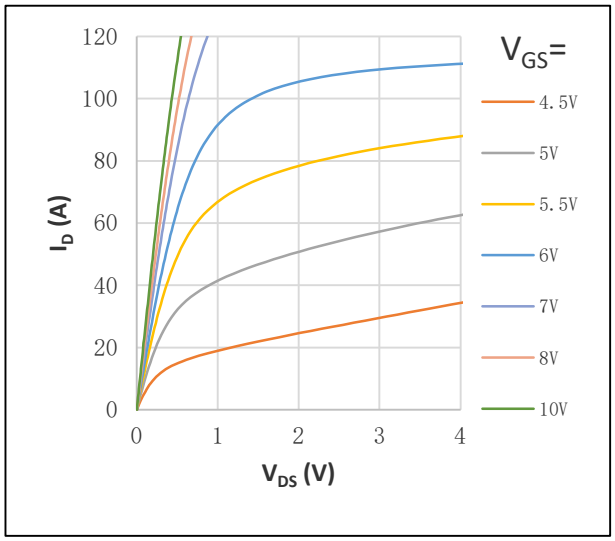
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



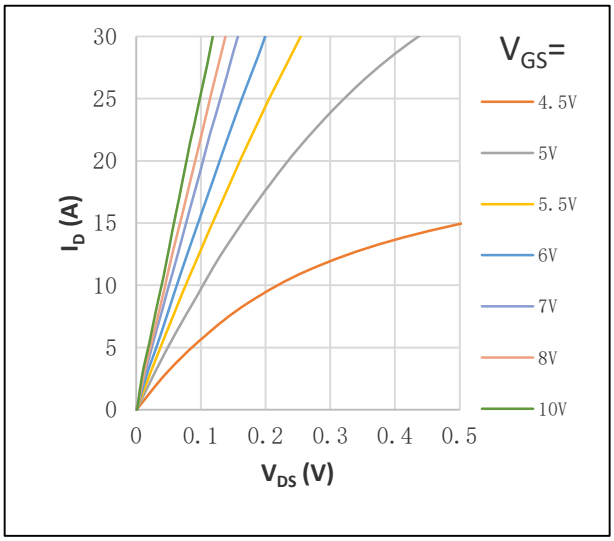
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



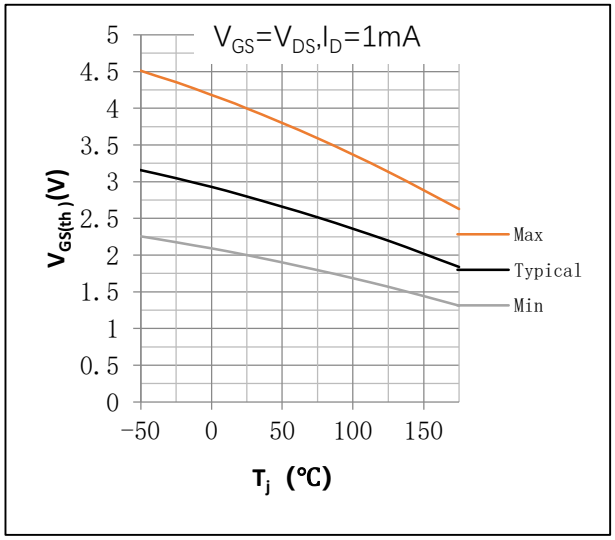
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; T_j=25℃



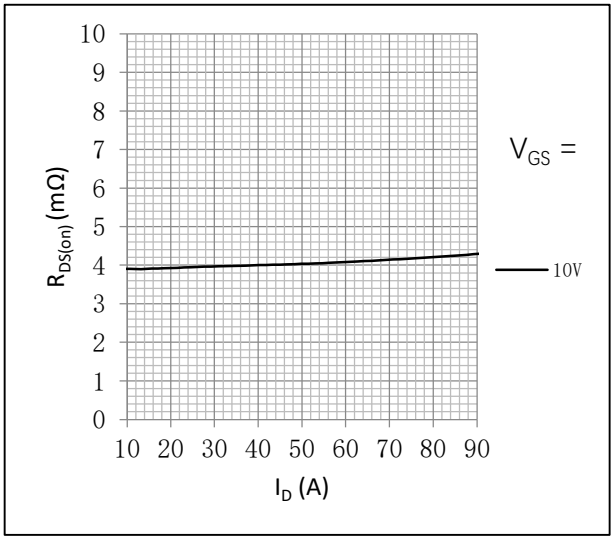
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



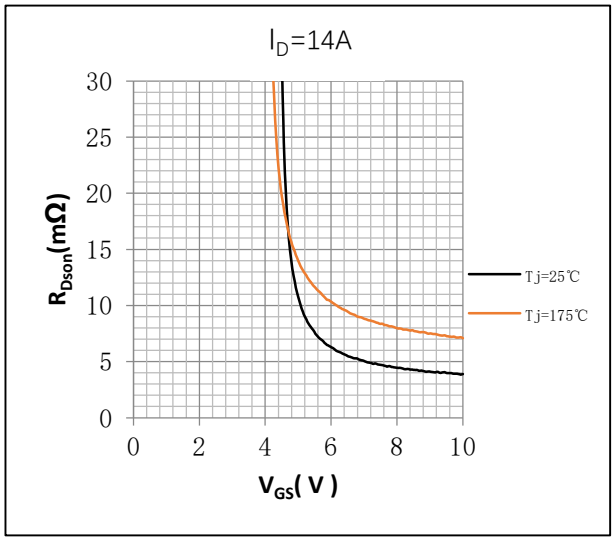
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/Min/Max values



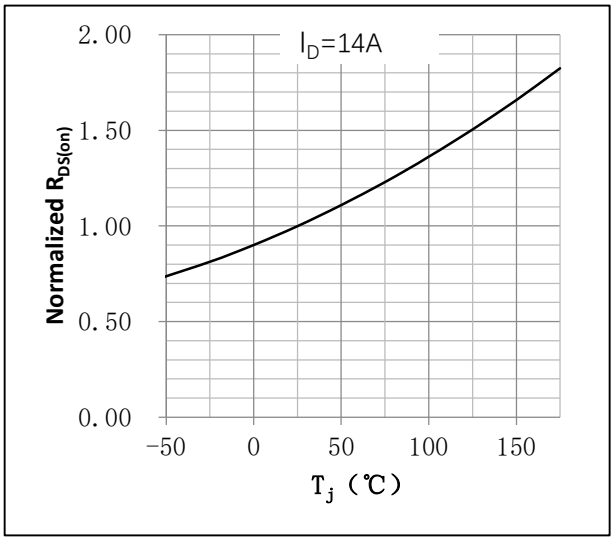
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



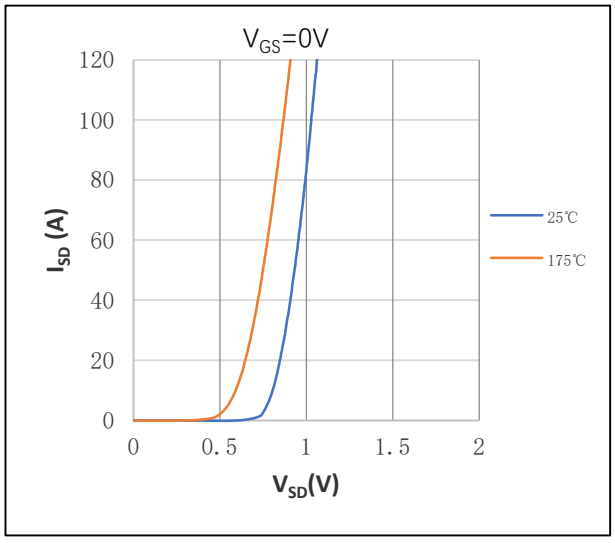
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



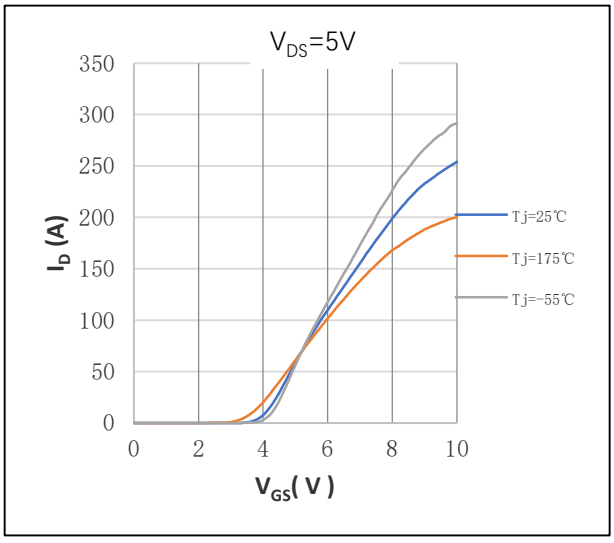
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



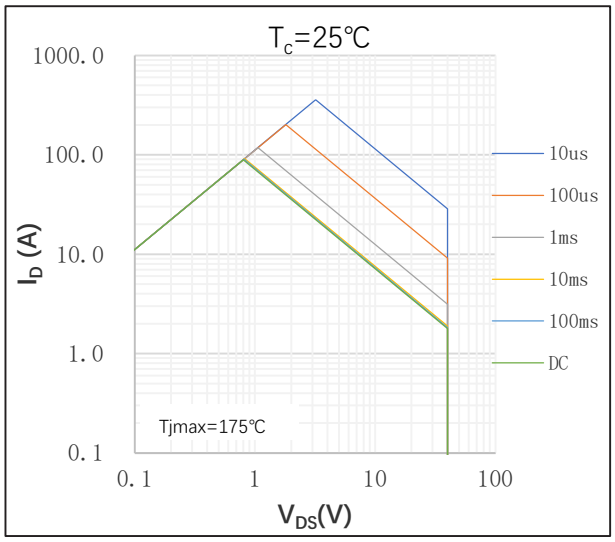
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



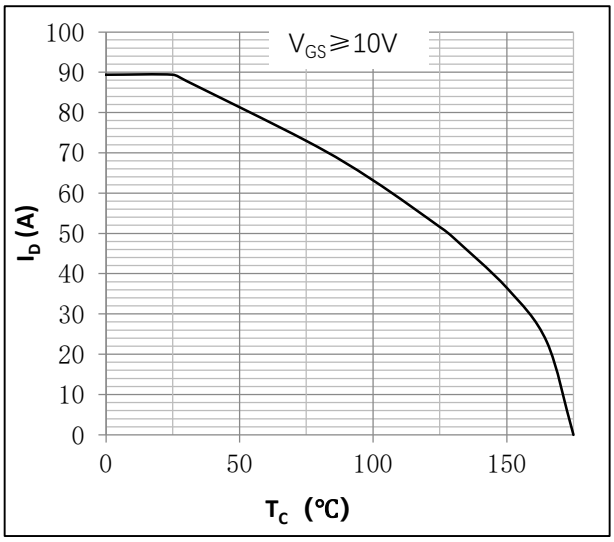
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



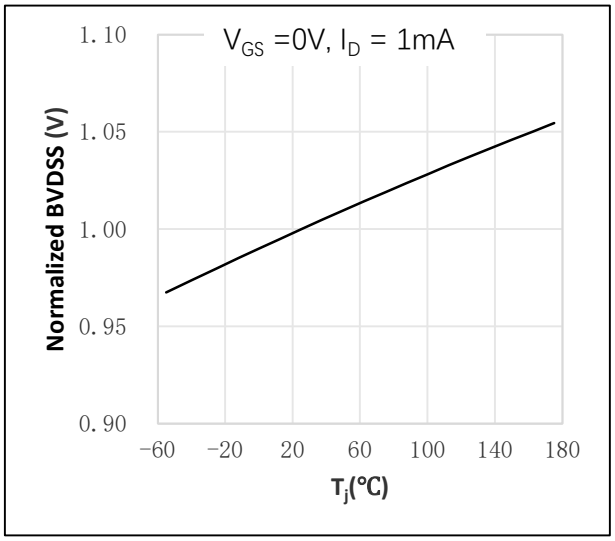
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



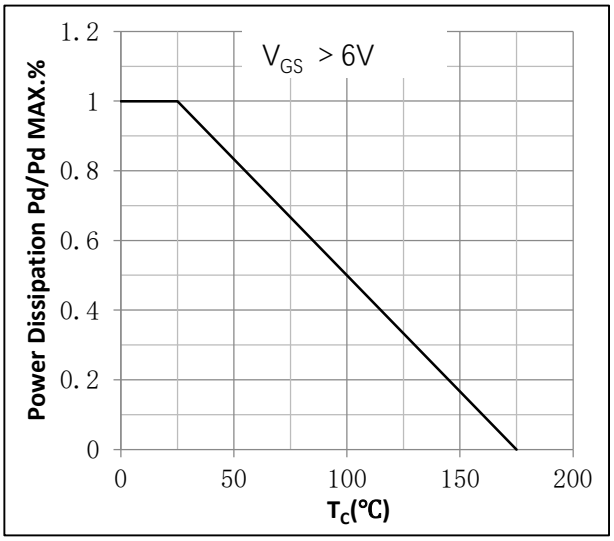
●Fig.12 Continuous drain current as a function of case temperature③;Calculative values



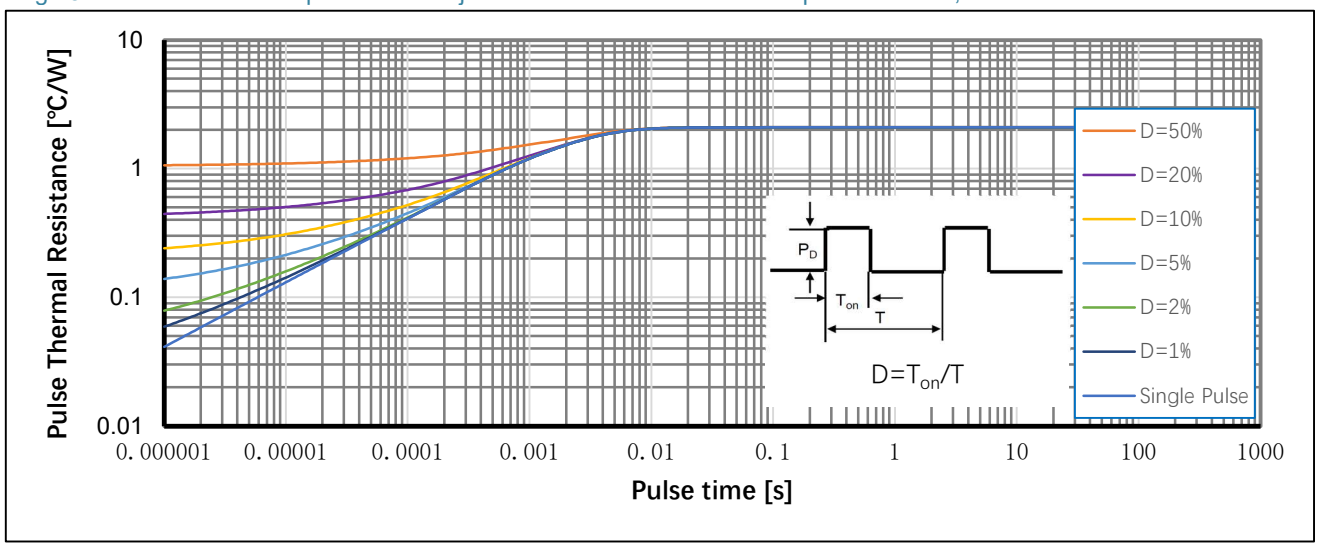
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Min values



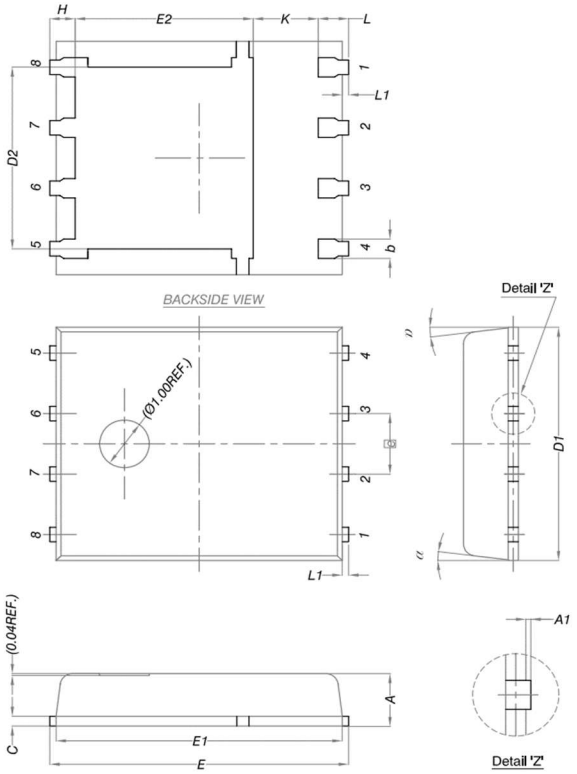
●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =P_d/P_d(25℃)



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



●Package Outline



DIM.	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0	-	0.05
b	0.33	0.41	0.51
C	0.20	0.25	0.30
D1	4.80	4.90	5.00
D2	3.61	3.81	3.96
E	5.90	6.00	6.10
E1	5.70	5.75	5.80
E2	3.38	3.58	3.78
e	1.27 BSC		
H	0.41	0.51	0.61
K	1.10	-	-
L	0.51	0.61	0.71
L1	0.06	0.13	0.20
α	0°	-	12°

●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;

② Device mounted on 1 square inch FR-4 substrate PCB, 1oz copper, minimum footprint, tested in a still air environment with T_A=25℃;

③Practically the current will be limited by PCB, thermal design and operating temperature. V_{GS}=10V.

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●Revision History

Version	Date	Change
A	2026/6/10	New