●General Description

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

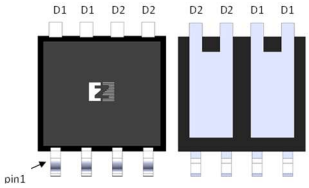
●Features

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

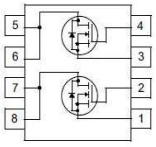
●Application

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

●Product Summary



LFPAK56D



V_{DS}=40V

$R_{DS(ON)}$ =4.1mR

I_D=96A

RoHS REACH COMPLIANT HF

●Ordering Information

Part NO.	ZMDA68410HLF
Marking	68410H
Packing information	REEL TAPE
Basic ordering unit (pcs)	3000

●Absolute Maximum Ratings FET1 and FET2 (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℃	-	96	A
	I_D	V_{GS}=10V, T_C=75℃	-	78	A
	I_D	V_{GS}=10V, T_C=100℃	-	68	A
Pulsed drain current	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	384	A
Diode continuous current	I_S	V_{GS}=0V, T_C=25℃	-	63	A
Diode pulse current	$I_{S,pulse}$	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	252	A
Total power dissipation	P_D	V_{GS}>6V, T_C=25℃	-	82	W
Total power dissipation	P_D	V_{GS}>6V, T_A=25℃	-	1.7	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,	-	61	mJ

Single pulse avalanche energy	E_{AS}	L=0.5mH, V_{GS}=10V, R_g=25Ω,	-	110	mJ
ESD level (HBM)			CLASS 1B		

●Thermal resistance FET1 and FET2

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	1.84	°C/W
Thermal resistance, junction - ambient	R_{thJA}②	-	-	86	°C/W
Soldering temperature	T_{sold}	-	-	260	°C

●Electronic Characteristics FET1 and FET2 (T_j=25°C, unless otherwise specified)

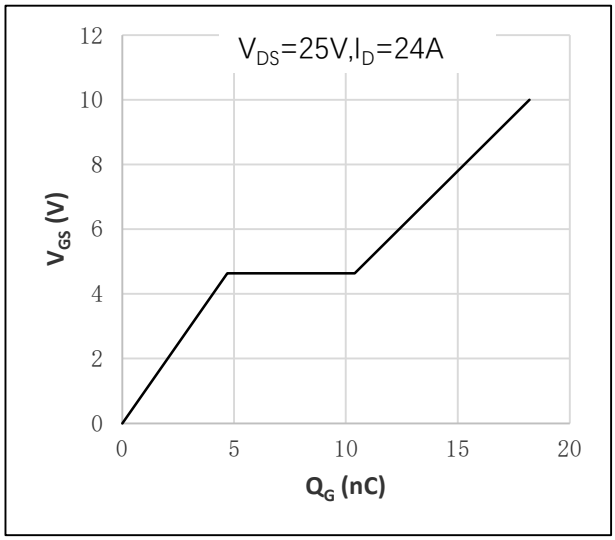
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA	40	-	-	V
		V_{GS} =0V, I_D =250uA,T_j=-55℃	38	-	-	V
Gate threshold voltage	$V_{GS(th)}$	V_{GS}=V_{DS}, I_D=250uA	2	2.8	4	V
		V_{GS}=V_{DS}, I_D=1mA,T_j=175℃	1.2	-	-	V
		V_{GS}=V_{DS}, I_D=1mA,T_j=-55℃	-	-	4.3	V
Drain-source leakage current	I_{DSS}	V_{GS}=0V, V_{DS}=40V	-	-	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=24A, T_j=25℃	-	4.1	4.9	mΩ
		V_{GS}=10V, I_D=24A, T_j=175℃	-	7.4	8.9	mΩ
Forward transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	12.8	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 24A	-	-	1.3	V

●Dynamic characteristics FET1 and FET2 (T_j=25°C, unless otherwise specified)

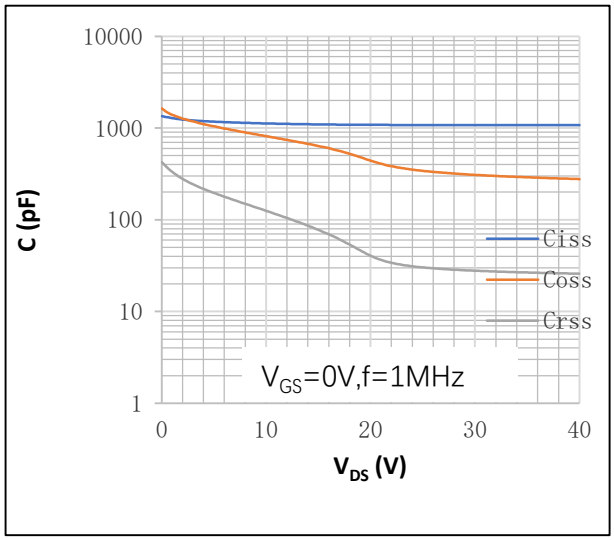
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=25V, V_{GS}=0V	-	1082	-	pF
Output capacitance	C_{oss}		-	335	-	pF
Reverse transfer capacitance	C_{rss}		-	36	-	pF
Gate resistance	R_g	f = 1MHz	-	2.5	-	Ω
Total gate charge	Q_g	V_{DD} = 25V, I_D = 24A, V_{GS} = 10V	-	18.2	-	nC
Gate-source charge	Q_{gs}		-	4.7	-	nC
Gate-drain charge	Q_{gd}		-	5.7	-	nC

Turn-on delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=32V, R_G =5Ω, I_D =20A	-	8	-	ns
Turn-on rise time	t_r		-	5	-	ns
Turn-off delay time	$t_{D(off)}$		-	13	-	ns
Turn-off fall time	t_f		-	8	-	ns
Reverse recovery time	t_{rr}	V_{DD}=20V, dI_S/dt = 100A/us, I_S=20A	-	21	-	ns
Reverse recovery charge	Q_{rr}		-	481	-	nC

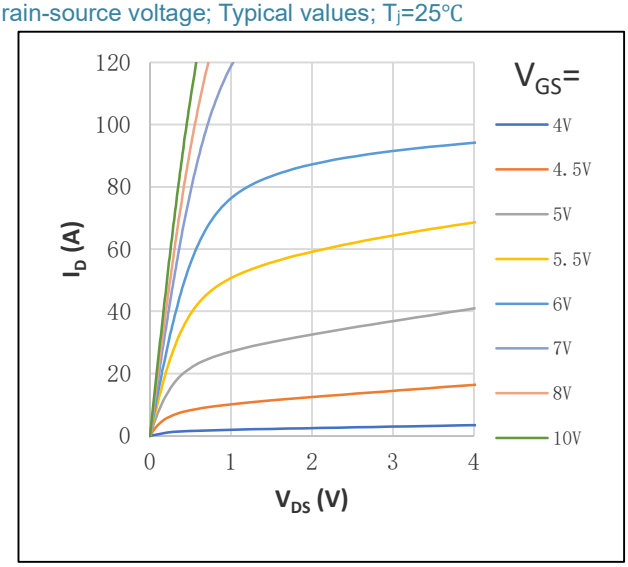
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



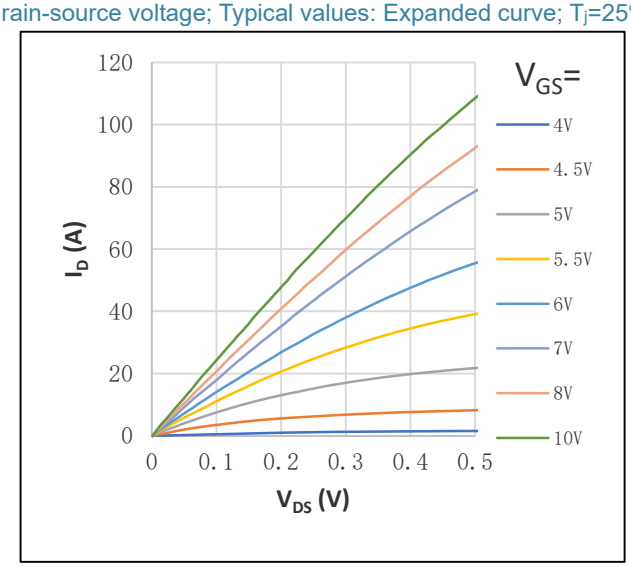
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



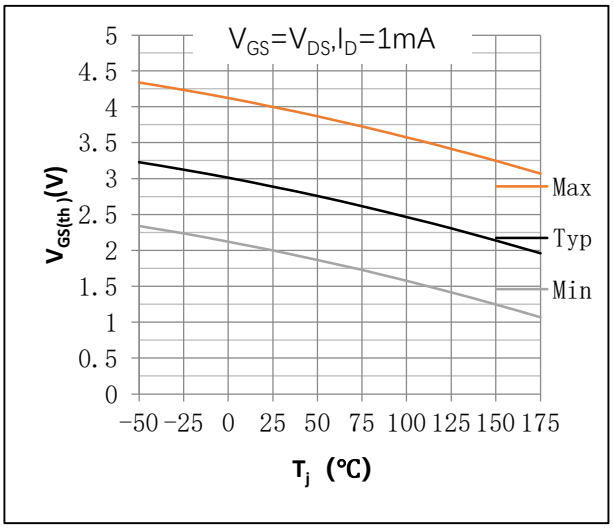
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; T_j=25℃



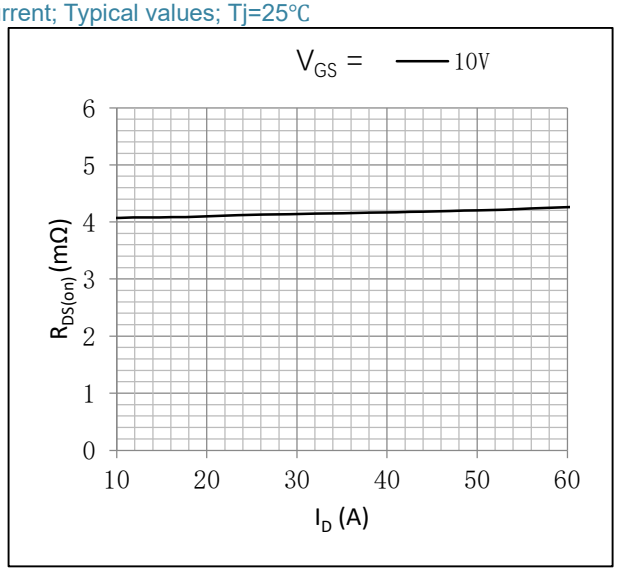
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



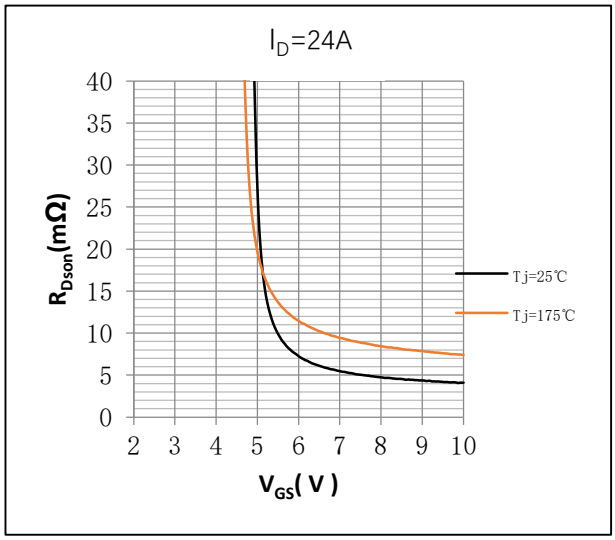
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/min/max values



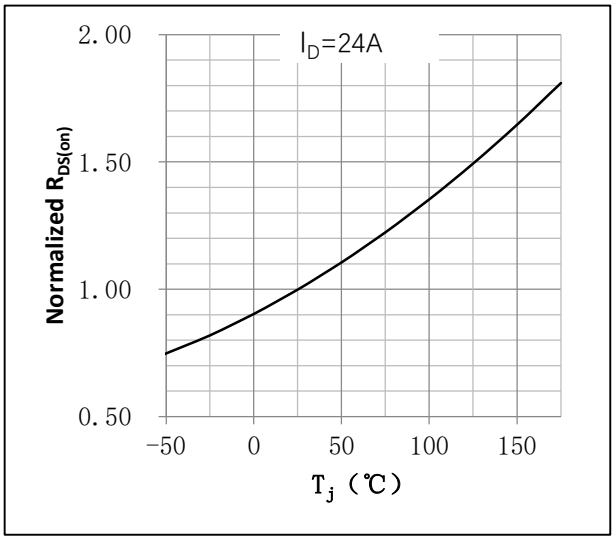
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



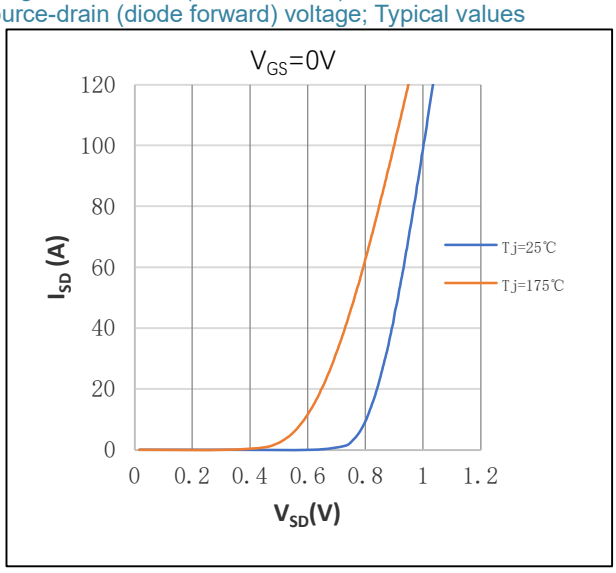
●Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



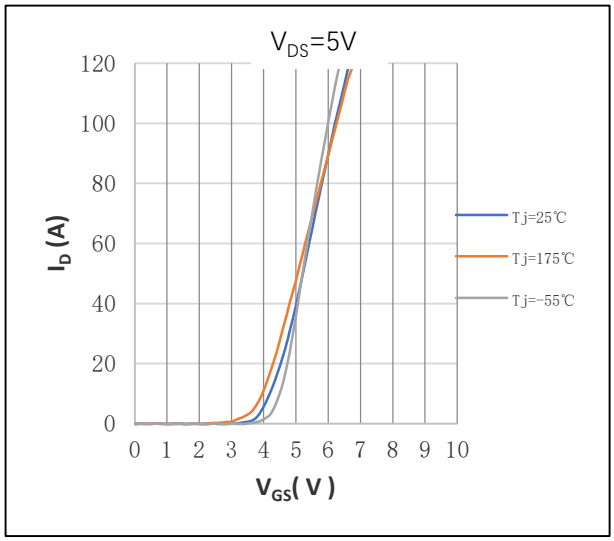
●Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



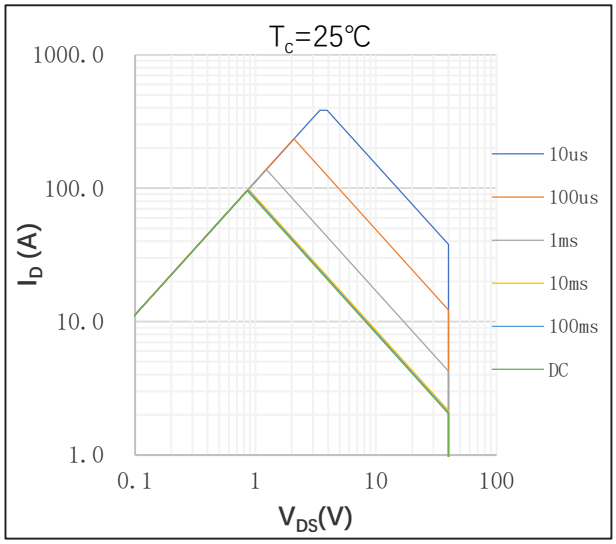
●Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



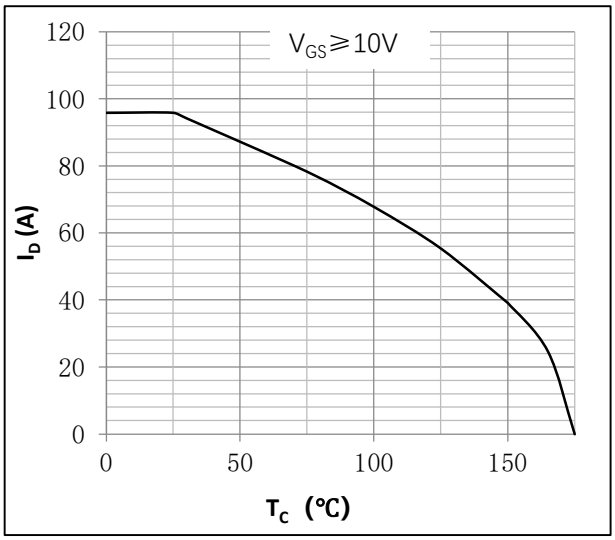
●Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



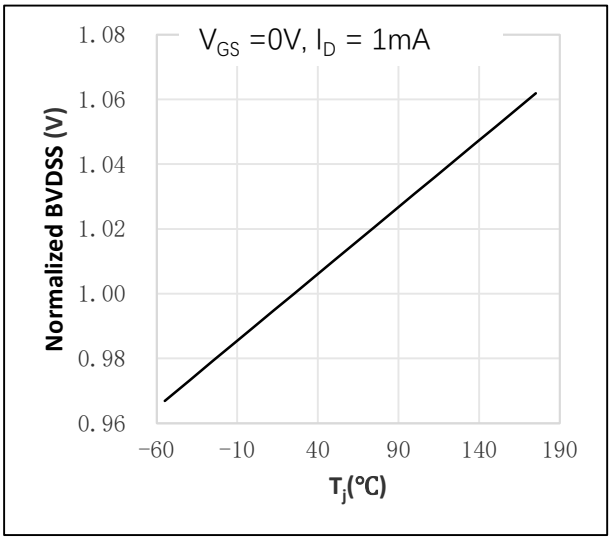
●Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



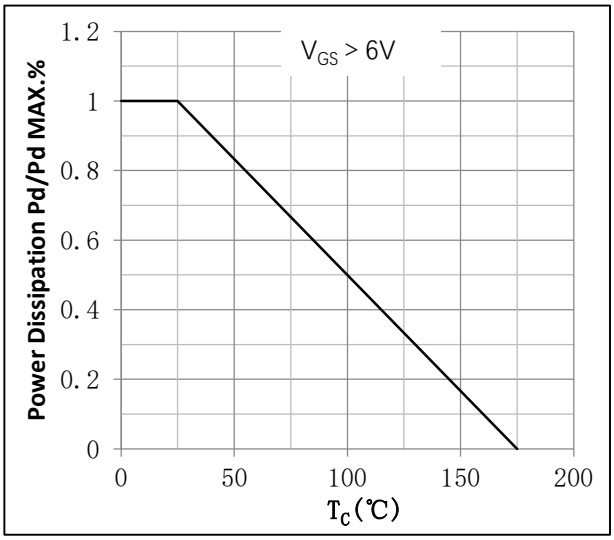
●Fig.12 Continuous drain current as a function of case temperature[3];Calculative values



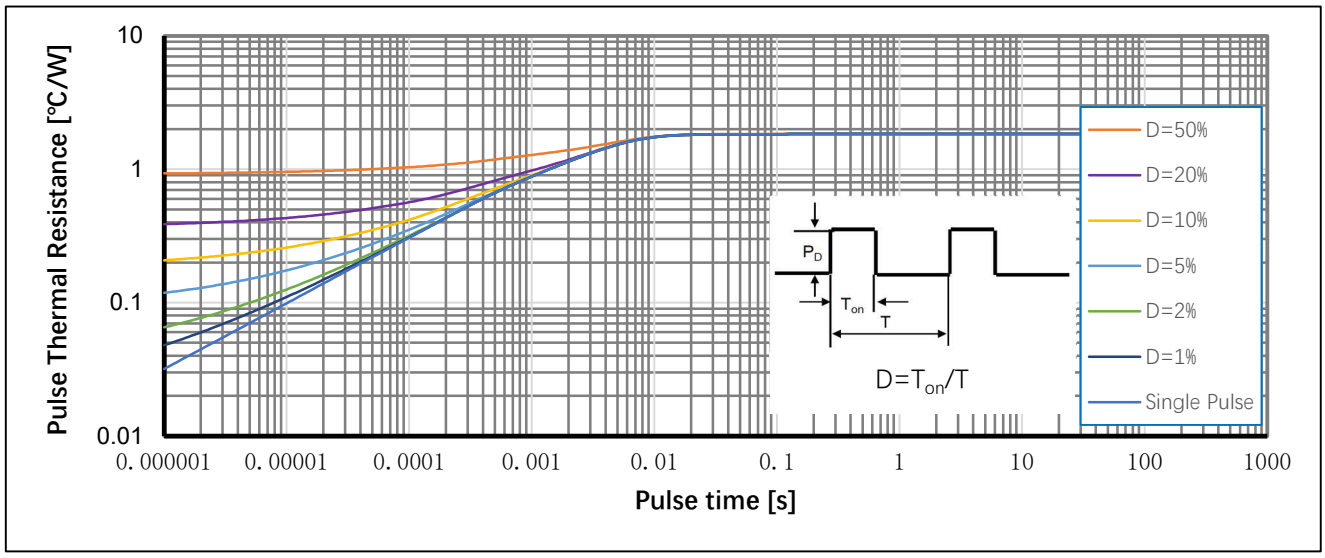
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values Normalized BV_{DSS} =BV_{DSS}/BV_{DSS}(25℃)



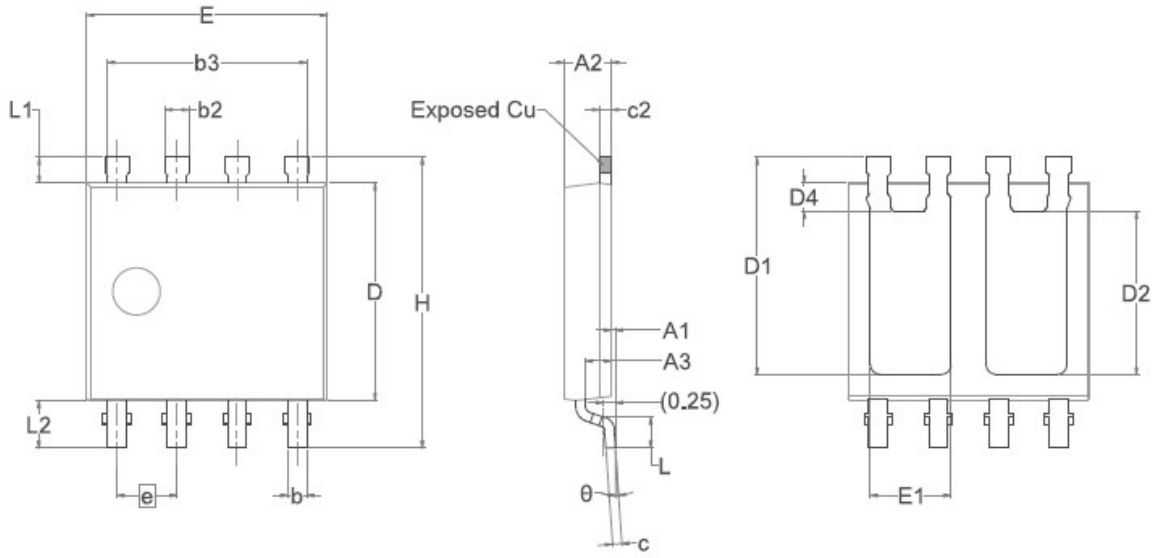
●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation =P_d/P_d(25℃)

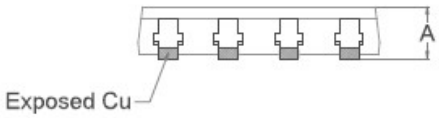


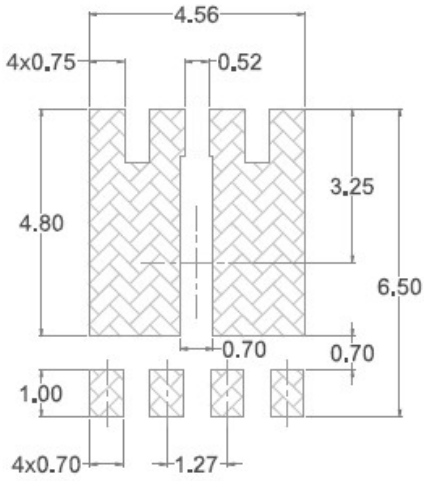
●Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



Package Outline







Land Pattern (Only for Reference)

SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	1.01	1.10	1.20
A1	0.00	---	0.15
A2	0.95	1.00	1.10
A3	0.50	0.55	0.65
b	0.35	0.40	0.50
b2	0.37	0.52	0.67
b3	4.21 REF.		
c	0.19	0.20	0.25
c2	0.22	0.25	0.28
D	4.45	4.60	4.70
D1	4.60 REF.		
D2	3.25	3.45	3.65
D4	0.45	0.60	0.75
E	4.90	5.10	5.30
E1	1.60	1.70	1.80
e	1.27 BSC.		
H	5.95	6.15	6.35
L	0.45	0.65	0.85
L1	0.40	0.55	0.70
L2	0.80	1.00	1.30
θ	0°	4°	8°

●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 TA=25°C;

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

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

●Revision History

Version	Date	Change
A	2025/11/7	New
B	2026/4/16	1. Update package name as LFPAK56D 2. Correct marking information. 3. Add Bvdss minimum value 4. Add VTH hot/cold spec. 5. Add diode current rating 6. Add IDSS hot spec.