General Description

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

Features

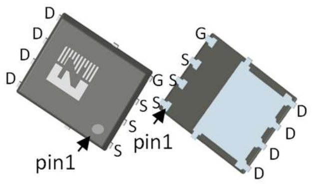
- ■Low $R_{DS(ON)}$ to minimize conductive loss
- ■Low Gate Charge for fast switching
- ■Low thermal resistance
- ■AEC-Q101 qualified

Application

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

ZMJSEMI Automotive

Product Summary



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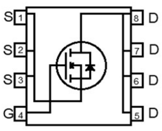


V_{DS}=40V

$R_{DS(ON)}$ =2.9mR

I_D=100A

RoHS REACH HF

Ordering Information

Part NO.	ZMA023N04N
Marking	ZM023N04
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}		-	40	V
Gate-source voltage①	V_{GS}		-20	20	V
Continuous drain current	I_D	V_{GS}=10V, T_C=25℃	-	100	A
	I_D	V_{GS}=10V, T_C=75℃	-	100	A
	I_D	V_{GS}=10V, T_C=100℃	-	100	A
Pulsed drain current	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C	-	400	A
Diode continuous current	I_S	V_{GS}=0V, T_C=25℃	-	100	A
Diode pulse current	$I_{S,pulse}$	V_{GS}=0V, Pulsed, t_p ≤ 10 μs, T_C = 25 °C	-	400	A
Total power dissipation	P_D	T_C=25℃	-	197	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	-	180	mJ
		L=0.5mH, V_{GS}=10V, R_g=25Ω	-	324	mJ

ESD level (HBM)		CLASS 2

Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.76	°C/W
Thermal resistance, junction - ambient	R_{thJA} ②	-	-	45	°C/W
Soldering temperature	T_{sold}	-	-	260	°C

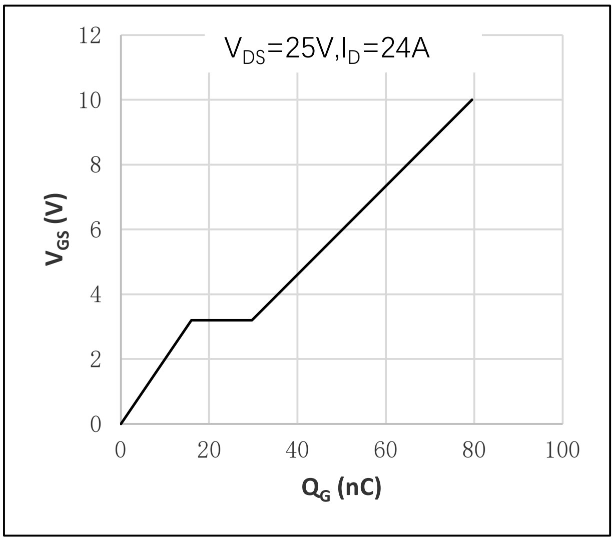
Electronic Characteristics (T_j=25°C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	V_{GS} =0V, I_D =250uA	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=24A, T_j=25℃	-	2.9	3.5	mΩ
		V_{GS}=10V, I_D=24A, T_j=175℃	-	5.4	-	mΩ
		V_{GS}=4.5V, I_D=12A, T_j=25℃	-	4.1	-	mΩ
Forward transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	26	-	S
Diode forward voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 24A	-	0.8	1.3	V

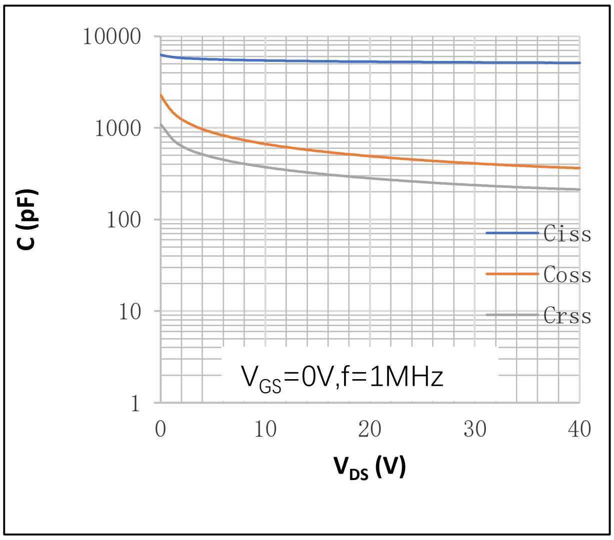
Dynamic characteristics (T_j=25°C, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	f = 1MHz, V_{DS}=25V, V_{GS}=0V	-	5236	-	pF
Output capacitance	C_{oss}		-	445	-	pF
Reverse transfer capacitance	C_{rss}		-	257	-	pF
Gate resistance	R_g	f = 1MHz	-	1.2	-	Ω
Total gate charge	Q_g	V_{DD} =25V, I_D = 24A, V_{GS} = 10V	-	79.5	-	nC
Total gate charge	$Q_{g\ (4.5V)}$		-	39.2	-	nC
Gate-source charge	Q_{gs}		-	16	-	nC
Gate-drain charge	Q_{gd}		-	13.7	-	nC
Turn-on delay time	$t_{D(on)}$	V_{GS}=10V, V_{DS}=25V, R_G =3.3Ω, I_D =24A	-	12	-	ns
Turn-on rise time	t_r		-	7	-	ns
Turn-off delay time	$t_{D(off)}$		-	53	-	ns
Turn-off fall time	t_f		-	14	-	ns
Reverse recovery time	t_{rr}	V_{DD}=25V, dI_S/dt = 100A/us, I_S=24A	-	22	-	ns
Reverse recovery charge	Q_{rr}		-	18	-	nC

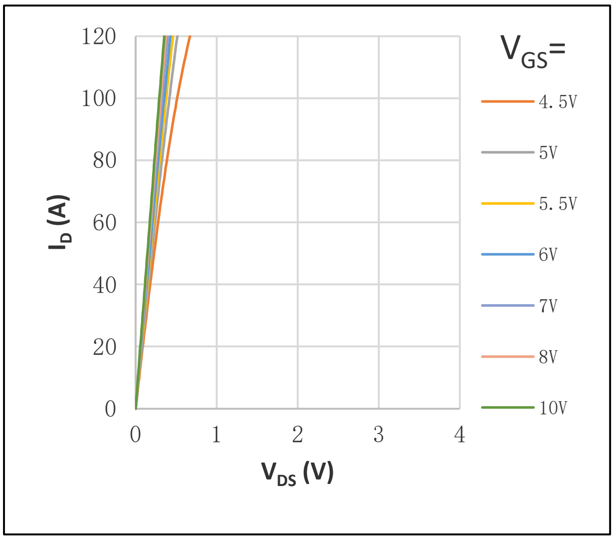
●Fig.1 Gate-source voltage as a function of gate charge; Typical values; T_j=25℃



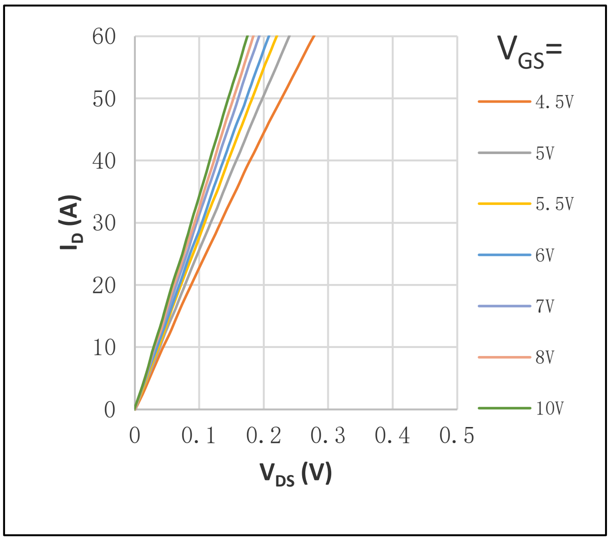
●Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; T_j=25℃



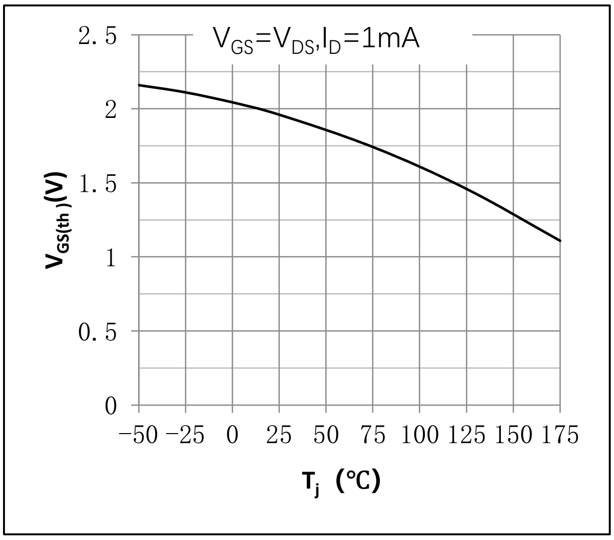
●Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; T_j=25℃



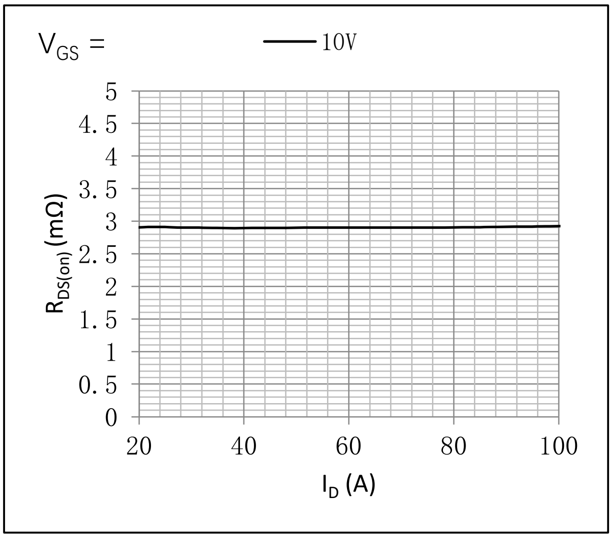
●Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; T_j=25℃



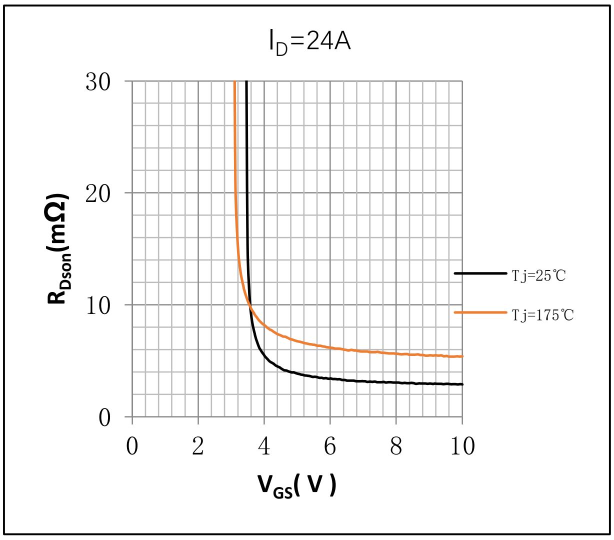
●Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



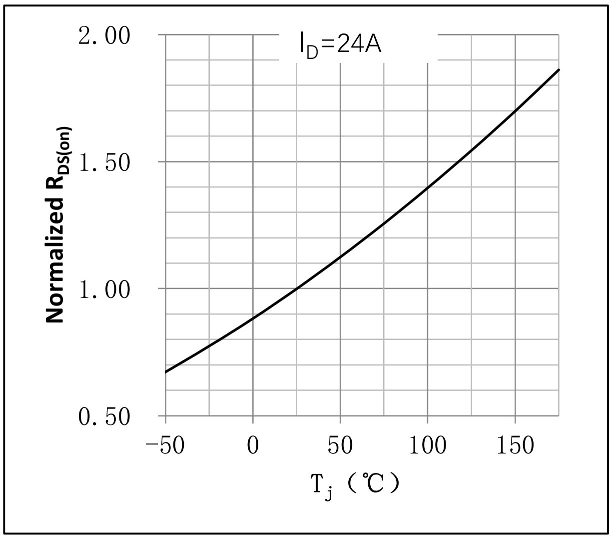
●Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; Tj=25℃



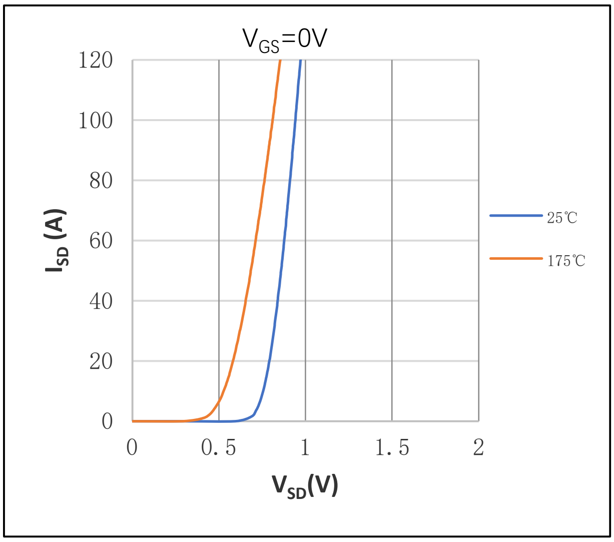
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



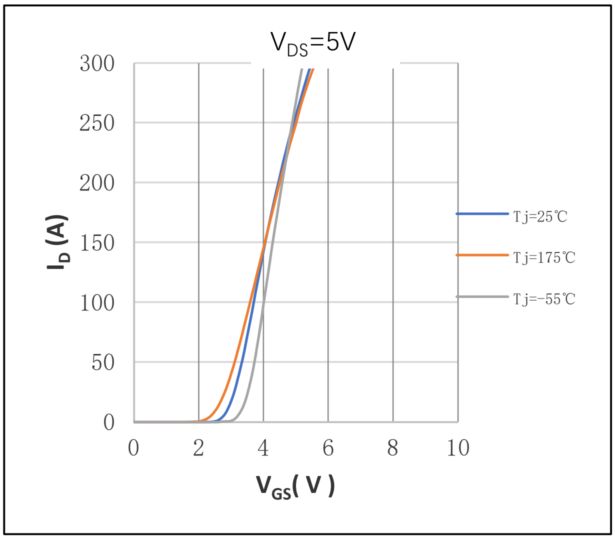
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance=R_{DSon}/R_{DSon}(25℃)



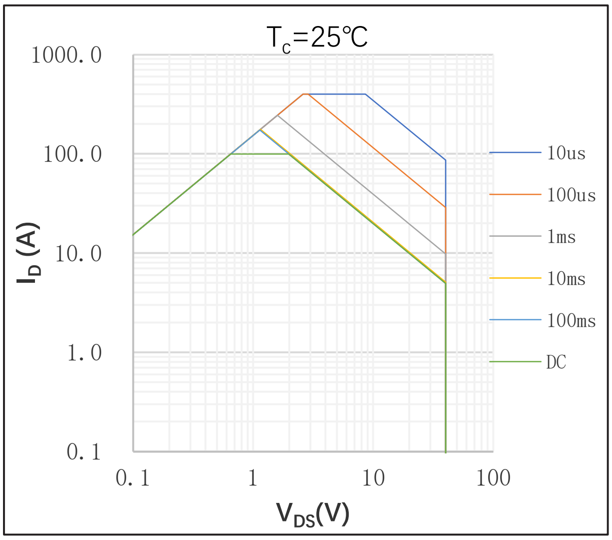
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



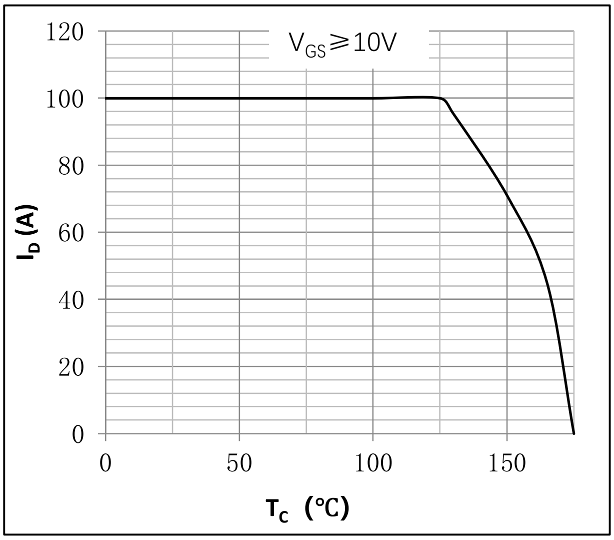
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



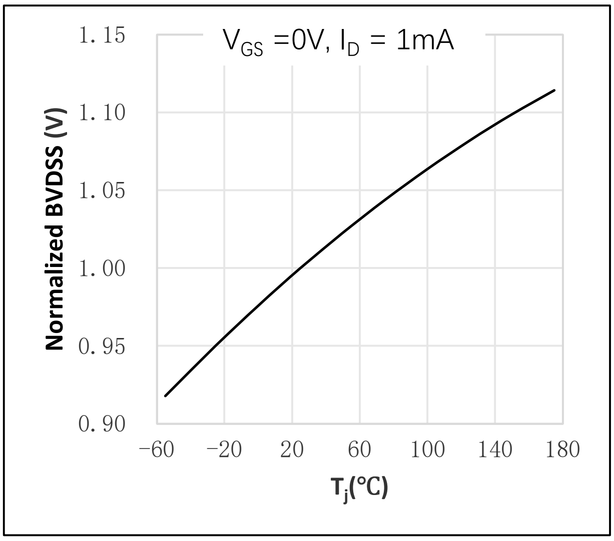
● Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



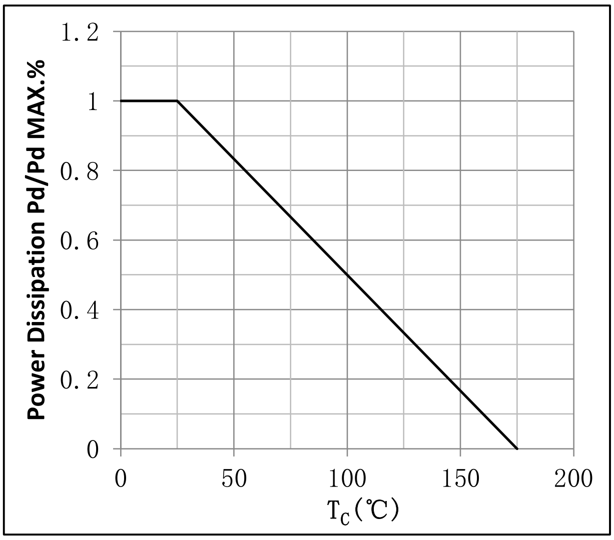
● Fig.12 Continuous drain current as a function of case temperature[3];Calculative values



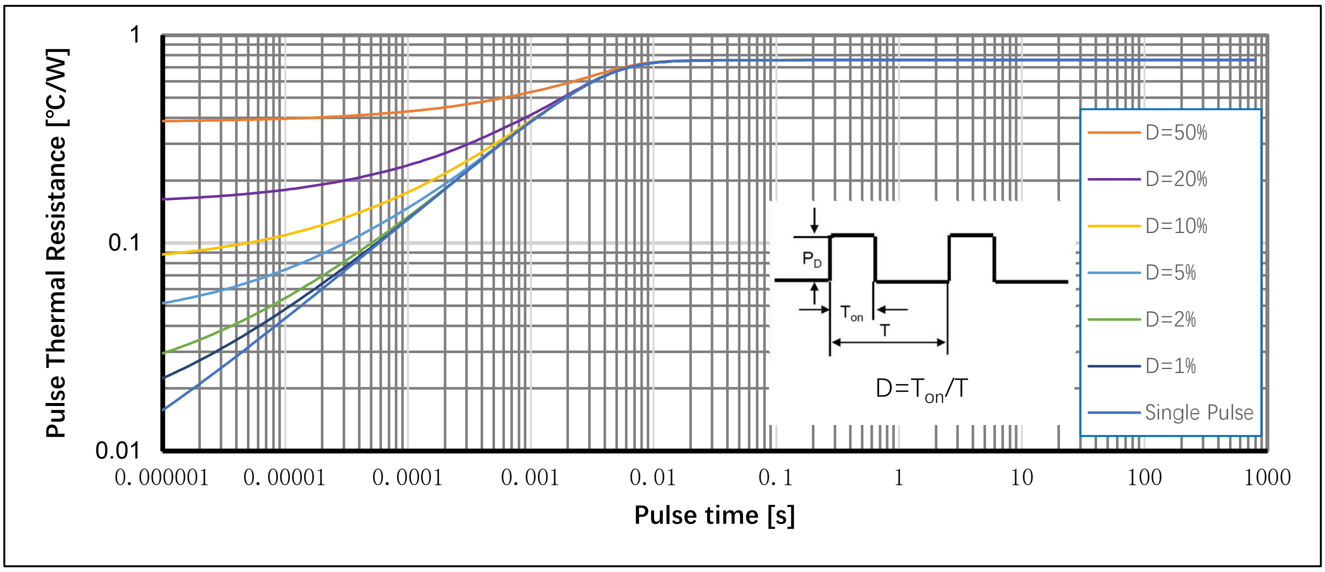
●Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values Normalized BV_{DSS} = $BV_{DSS}/BV_{DSS}(25℃)$



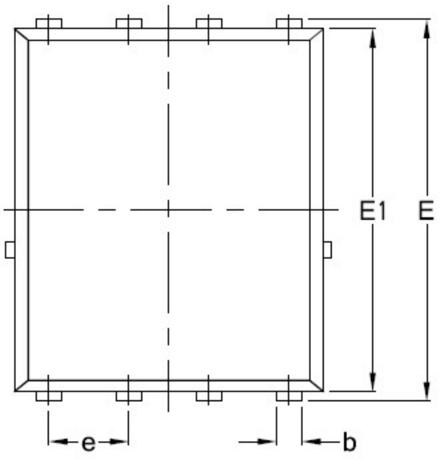
●Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation = $P_d/P_d(25℃)$

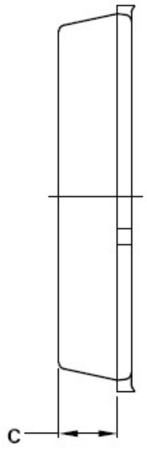


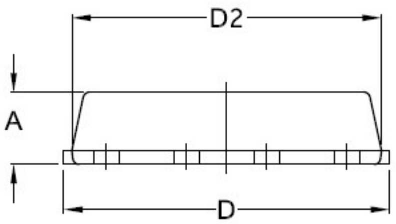
●Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

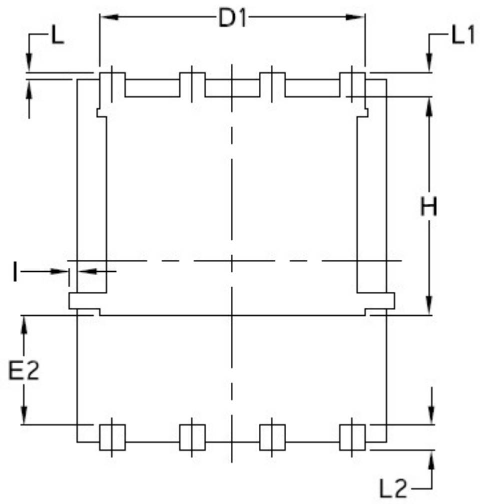


● Package Outline









	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	0.824	0.970	0.0324	0.0382
△3	D	4.80	5.40	0.1890	0.2126
	D1	4.11	4.31	0.1618	0.1697
△3	D2	4.80	5.00	0.1890	0.1969
	E	5.95	6.15	0.2343	0.2421
	E1	5.65	5.85	0.2224	0.2303
	E2	1.60	—	0.0630	—
	e	1.27 BSC		0.05 BSC	
△3	L	0.05	0.25	0.0020	0.0098
	L1	0.38	0.50	0.0150	0.0197
	L2	0.38	0.50	0.0150	0.0197
△4	H	3.30	3.50	0.1299	0.1378
	I	—	0.18	—	0.0070

●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.

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Revision History

Version	Date	Change
A	2021.5.10	New
B	2022.9.5	1. Add Reach, HF figure 2.ID modify
C	2022.11.30	Temperature change to case temperature
D	2026.1.20	Apply new datasheet format.
E	2026.1.28	Update RthJC and SOA curve.