

● General Description

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

● Features

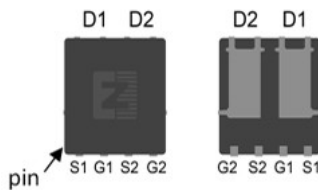
- Low $R_{DS(ON)}$ to minimize conductive loss
- Low Gate Charge for fast switching
- Low thermal resistance
- AEC-Q101 qualified

● Application

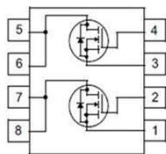
- BLDC motor driver
- DC-DC
- Load switch



● Product Summary



DFN5*6



$V_{DS}=40V$

$R_{DS(ON)}=7.4m\Omega$

$I_D=49A$



● Ordering Information

Part NO.	ZMDA68412HNVL
Marking	ZMD68412H
Packing information	REEL TAPE
Basic ordering unit (pcs)	3000

● Absolute Maximum Ratings ($T_A=25^\circ\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}	$25^\circ\text{C} \leq T_J \leq 175^\circ\text{C}$	-	40	V
Gate-source voltage ^①	V_{GS}	DC; $-55^\circ\text{C} \leq T_J \leq 175^\circ\text{C}$	-20	20	V
Continuous drain current	I_D	$V_{GS}=10V, T_C=25^\circ\text{C}$	-	49	A
	I_D	$V_{GS}=10V, T_C=75^\circ\text{C}$	-	40	A
	I_D	$V_{GS}=10V, T_C=100^\circ\text{C}$	-	35	A
Pulsed drain current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}; T_C = 25^\circ\text{C};$	-	196	A
Diode continuous current	I_S	$V_{GS}=0V, T_C=25^\circ\text{C}$	-	29	A
Diode pulse current	$I_{S,pulse}$	Pulsed; $t_p \leq 10 \mu\text{s}; T_C = 25^\circ\text{C};$	-	116	A
Total power dissipation	P_D	$V_{GS} > 6V, T_C=25^\circ\text{C}$	-	38	W
Total power dissipation	P_D	$V_{GS} > 6V, T_A=25^\circ\text{C}$	-	3.3	W
Operating junction temperature	T_J		-55	175	$^\circ\text{C}$
Storage temperature	T_{STG}		-55	175	$^\circ\text{C}$
Single pulse avalanche energy	E_{AS}	$L=0.1mH, V_{GS}=10V, R_g=25\Omega$	-	23	mJ

Single pulse avalanche energy	E_{AS}	$L=0.5\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$	-	47	mJ
ESD level (HBM)	CLASS 1B				

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	4	°C/W
Thermal resistance, junction - ambient	$R_{thJA}^{(2)}$	-	-	45	°C/W
Soldering temperature	T_{sold}	-	-	260	°C

● Electronic Characteristics ($T_j=25^\circ\text{C}$, unless otherwise specified)

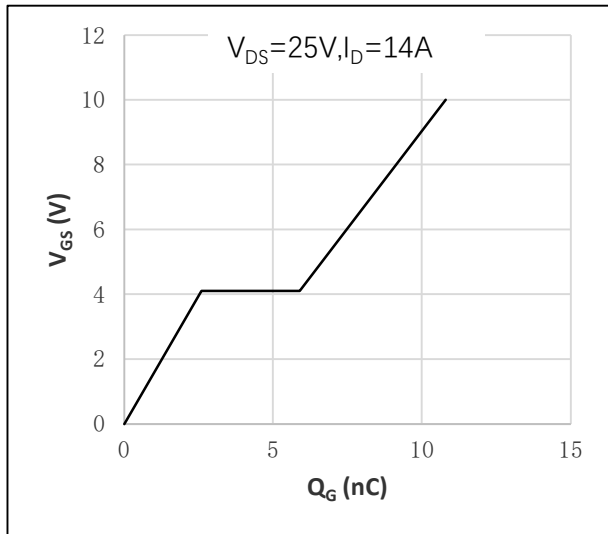
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	40	-	-	V
		$V_{GS}=0\text{V}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	38.6	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	2	2.5	4	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	-	-	4.5	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=175^\circ\text{C}$	1.3	-	-	V
Drain-source leakage current	I_{DSS}	$V_{GS}=0\text{V}$, $V_{DS}=40\text{V}$, $T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{GS}=0\text{V}$, $V_{DS}=40\text{V}$, $T_j=175^\circ\text{C}$	-	-	500	μA
Gate- source leakage current	I_{GSS}	$V_{GS}=\pm 20\text{V}$, $V_{DS}=0\text{V}$	-	-	± 100	nA
Static drain-source on resistance	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=14\text{A}$, $T_j=25^\circ\text{C}$	-	7.4	9	m Ω
		$V_{GS}=10\text{V}$, $I_D=14\text{A}$, $T_j=175^\circ\text{C}$	-	12.9	-	m Ω
Forward transconductance	g_{FS}	$V_{DS}=5\text{V}$, $I_{SD}=10\text{A}$	-	14	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=0\text{V}$, $I_{SD}=14\text{A}$	-	0.9	1.3	V

● Dynamic characteristics ($T_j=25^\circ\text{C}$, unless otherwise specified)

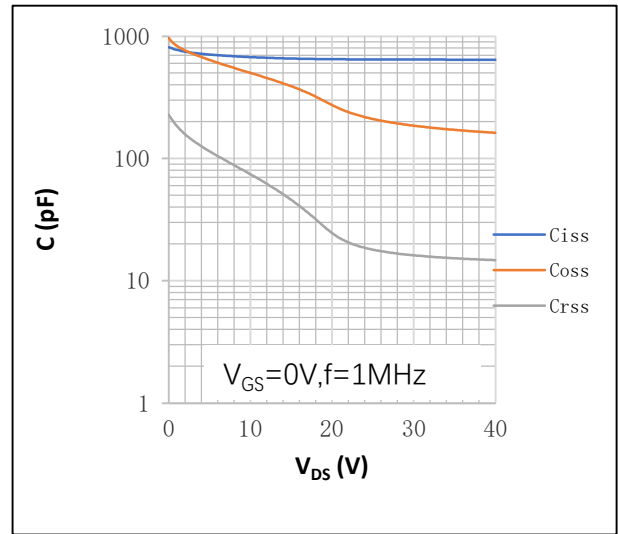
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1\text{MHz}$, $V_{DS}=25\text{V}$, $V_{GS}=0\text{V}$	-	648	-	pF
Output capacitance	C_{oss}		-	211	-	pF
Reverse transfer capacitance	C_{rss}		-	18	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	1.4	-	Ω
Total gate charge	Q_g	$V_{DD}=25\text{V}$, $I_D=14\text{A}$, $V_{GS}=10\text{V}$	-	10.8	-	nC
Gate-source charge	Q_{gs}		-	2.6	-	nC
Gate-drain charge	Q_{gd}		-	3.3	-	nC

Turn-on delay time	$t_{D(on)}$	$V_{GS}=10V, V_{DS}=25V,$ $R_G=3.3\Omega, I_D=14A$	-	6	-	ns
Turn-on rise time	t_r		-	5	-	ns
Turn-off delay time	$t_{D(off)}$		-	15	-	ns
Turn-off fall time	t_f		-	4	-	ns
Reverse recovery time	t_{rr}	$V_{DD}=25V, di_s/dt = 100A/us,$ $I_S=14A$	-	31	-	ns
Reverse recovery charge	Q_{rr}		-	44	-	nC

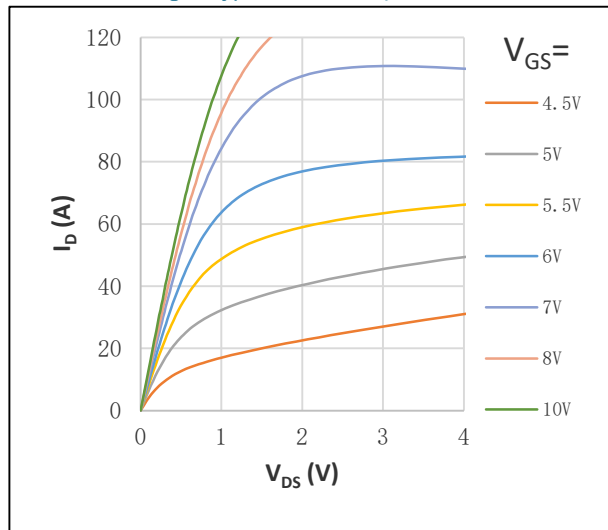
● Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$



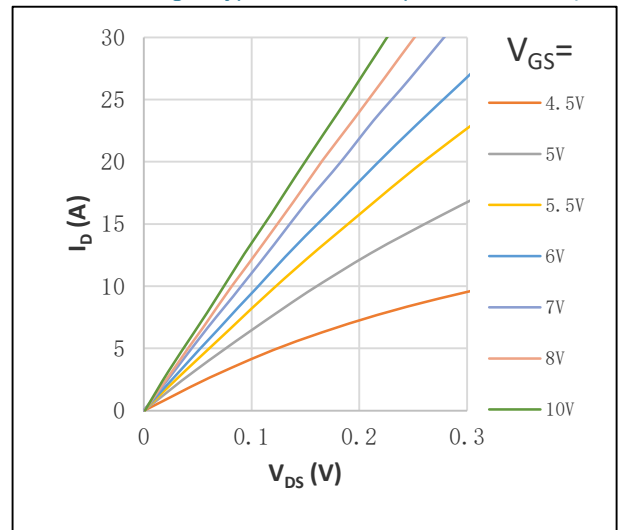
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



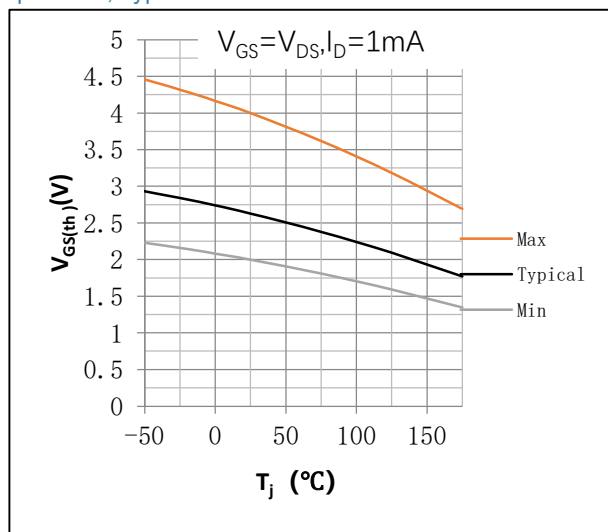
● Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



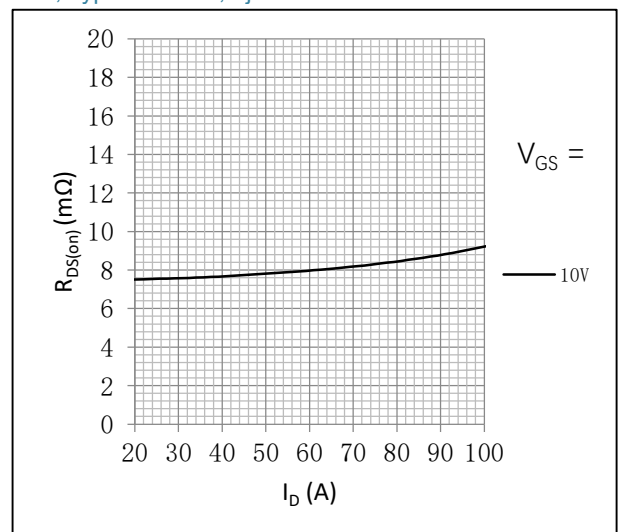
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$



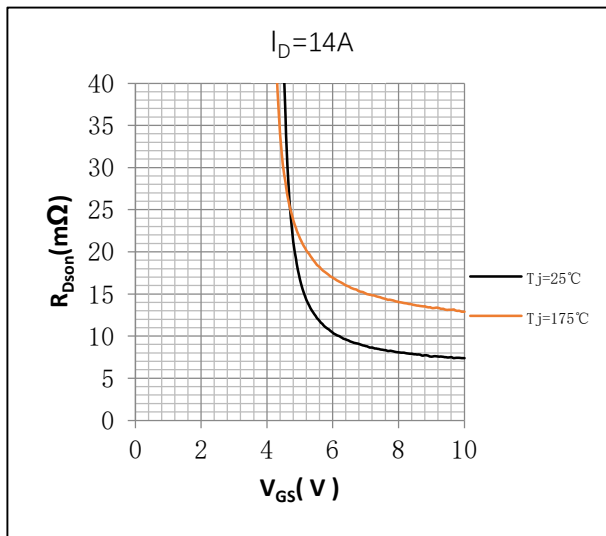
● Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/Min/Max values



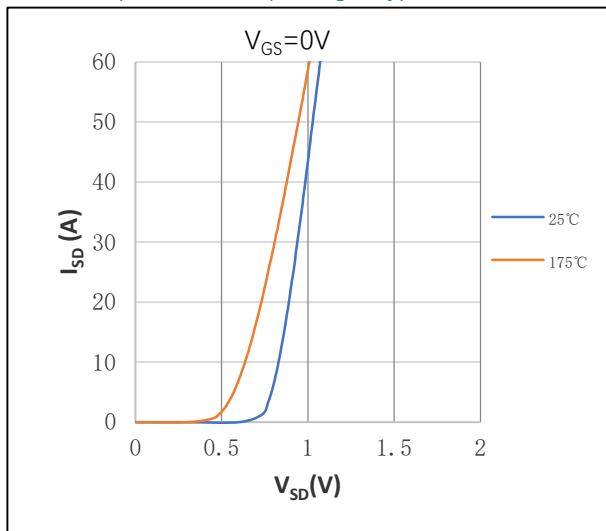
● Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$



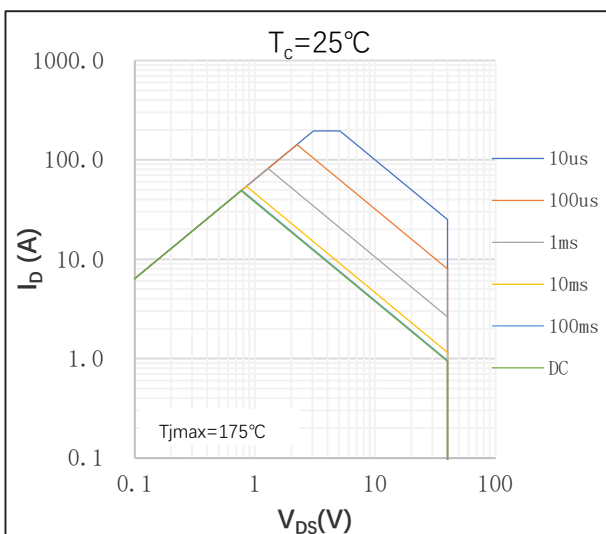
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



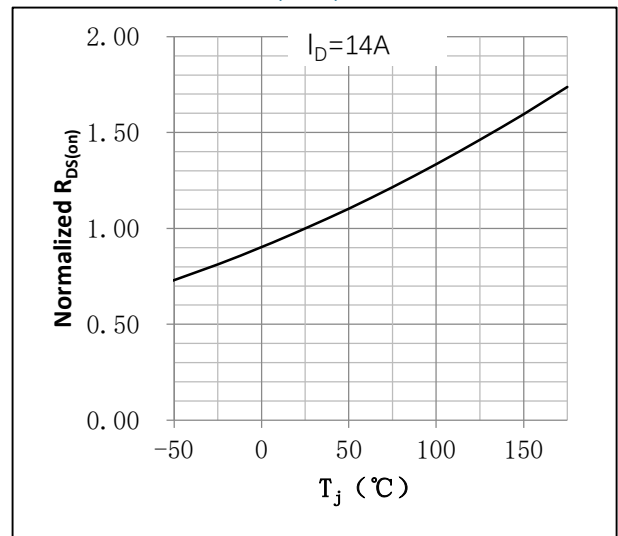
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



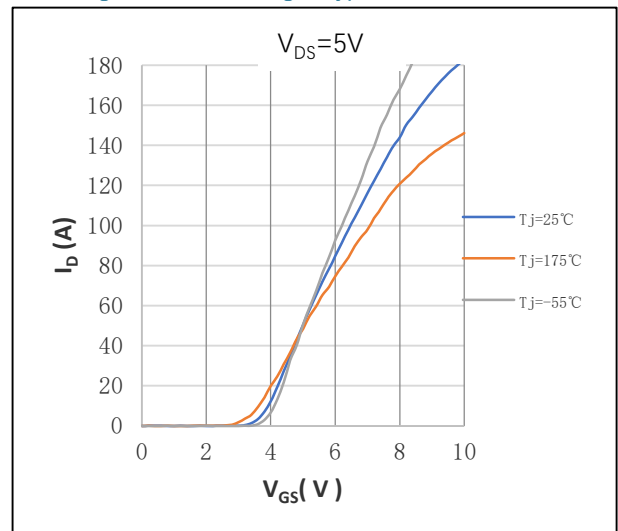
● Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



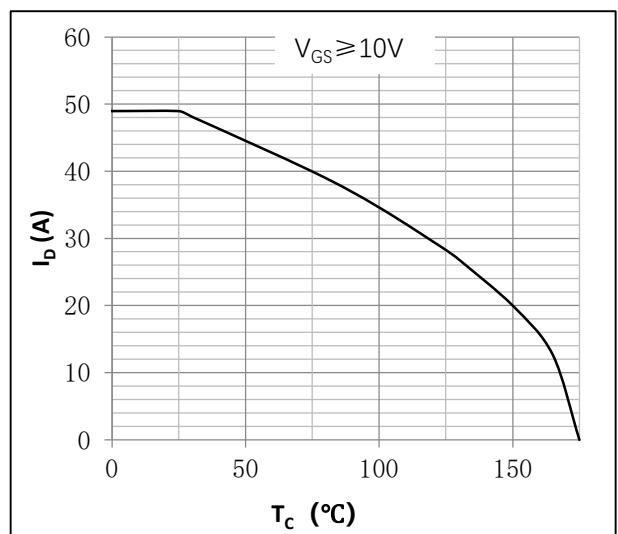
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance = $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$



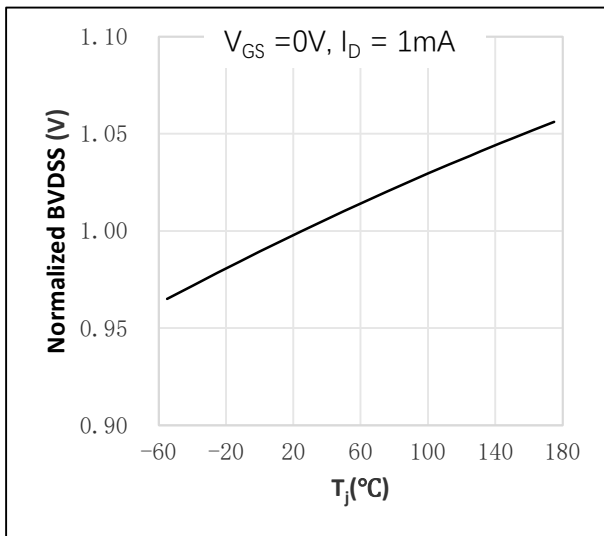
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



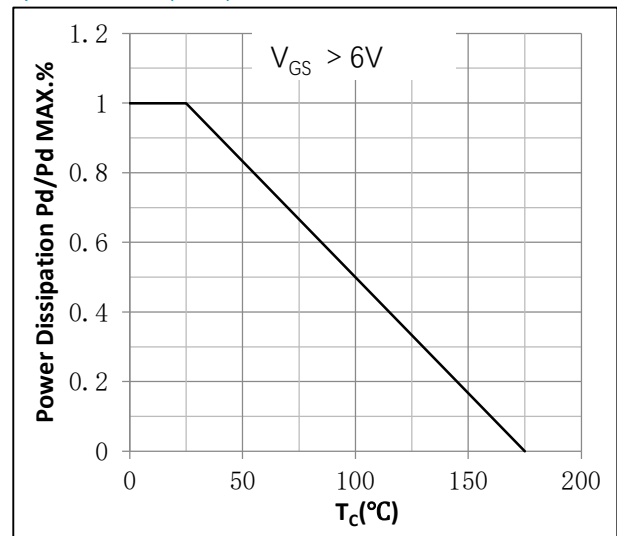
● Fig.12 Continuous drain current as a function of case temperature³; Calculative values



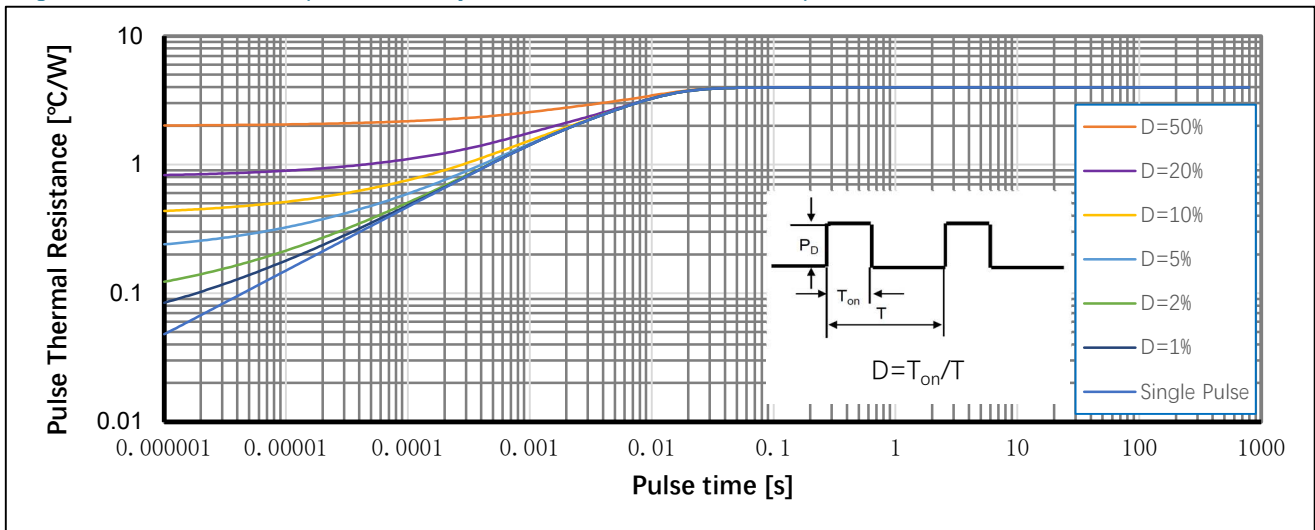
● Fig.13 Drain-source breakdown voltage as a function of junction temperature; Normalized values



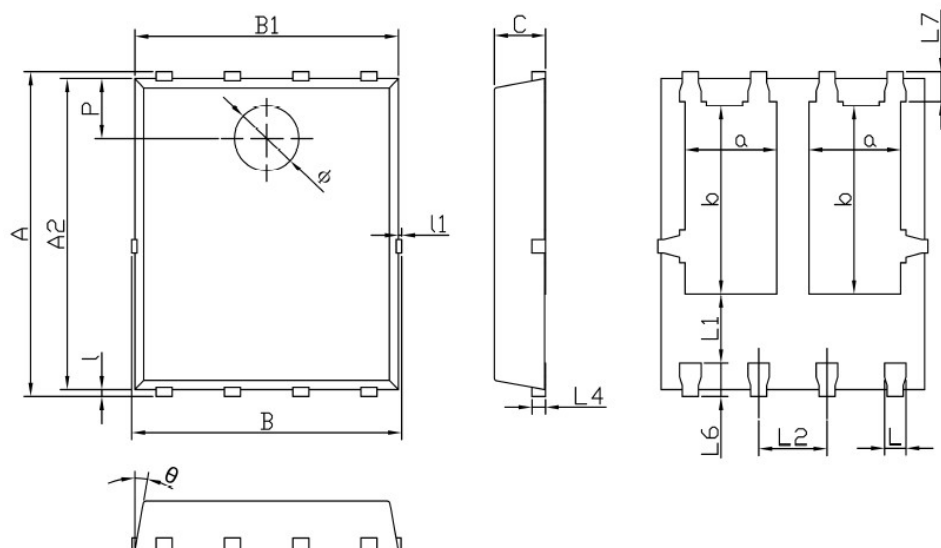
● Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation $= P_d/P_d(25^{\circ}\text{C})$



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



● Package Outline



Dimensions In Millimeters			
Symbol	MIN	TYP	MAX
A	5.90	6.00	6.10
a	1.605	1.705	1.805
A2	5.70	5.75	5.80
B	4.90	5.00	5.10
b	3.375	3.475	3.575
B1	4.80	4.90	5.00
C	0.90	0.95	1.00
L	0.35	0.40	0.45
l	0.06	0.13	0.20
L1	1.10	-	-
l1	-	-	0.10
L2	1.17	1.27	1.37
L4	0.21	0.26	0.34
L6	0.51	0.61	0.71
L7	0.45	0.55	0.65
P	1.00	1.10	1.20
θ	8°	10°	12°
φ	1.10	1.20	1.30

● Note

- ① Pulse : $V_{GS}=+20V/-20V$, Duty cycle=50%, $T_j=175^{\circ}C$, $t=1000$ hours; For DC, the following test conditions can be passed: $V_{GS}=+20V/-10V$, $T_j=175^{\circ}C$, $t=1000$ hours;
- ② Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ③ Practically 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	2026/8/18	New