

● General Description

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

● Features

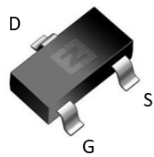
- Low $R_{DS(ON)}$ to minimize conductive loss
- Low Gate Charge for fast switching
- Low thermal resistance
- AEC-Q101 qualified

● Application

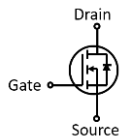
- BLDC motor driver
- DC-DC
- Load switch



● Product Summary



SOT23-3



$V_{DS}=60V$

$R_{DS(ON)}=46.6m\Omega$

$I_D=3.4A$



● Ordering Information

Part NO.	ZMA500N06T
Marking	500N06
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}	$25^\circ\text{C} \leq T_J \leq 150^\circ\text{C}$	-	60	V
Gate-source voltage ^①	V_{GS}	DC; $-55^\circ\text{C} \leq T_J \leq 150^\circ\text{C}$	-20	20	V
Continuous drain current	I_D	$V_{GS}=10V, T_A=25^\circ\text{C}$	-	3.4	A
	I_D	$V_{GS}=10V, T_A=75^\circ\text{C}$	-	2.6	A
	I_D	$V_{GS}=10V, T_A=100^\circ\text{C}$	-	2.1	A
Pulsed drain current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}; T_A = 25^\circ\text{C};$	-	13.6	A
Diode continuous current	I_S	$V_{GS}=0V, T_A=25^\circ\text{C}$	-	1	A
Diode pulse current	$I_{S,pulse}$	Pulsed; $t_p \leq 10 \mu\text{s}; T_A = 25^\circ\text{C};$	-	4	A
Total power dissipation	P_D	$V_{GS} > 6V, T_A=25^\circ\text{C}$	-	1.3	W
Operating junction temperature	T_J		-55	150	$^\circ\text{C}$
Storage temperature	T_{STG}		-55	150	$^\circ\text{C}$
Single pulse avalanche energy	E_{AS}	$L=0.1mH, V_{GS}=10V, R_g=25\Omega$	-	6	mJ

Single pulse avalanche energy	E_{AS}	$L=0.5\text{mH}$, $V_{GS}=10\text{V}$, $R_g=25\Omega$	-	17	mJ
ESD level (HBM)	CLASS 1B				

● Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - ambient	$R_{thJA}^{(2)}$	-	-	100	°C/W
Soldering temperature	T_{sld}	-	-	260	°C

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

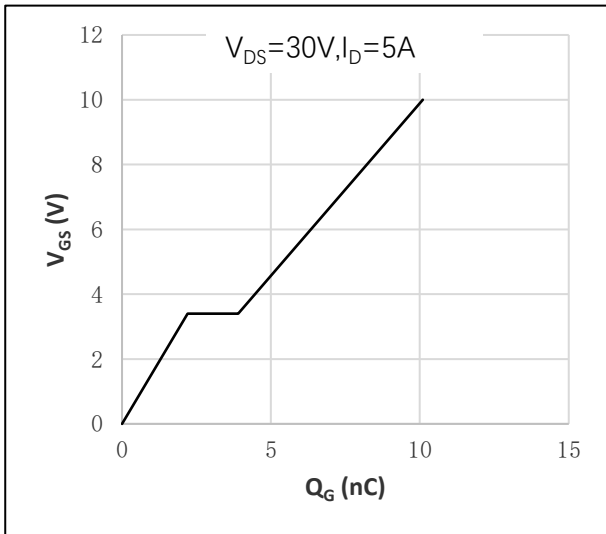
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0\text{V}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	60	-	-	V
		$V_{GS}=0\text{V}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	56.1	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}$, $I_D=250\mu\text{A}$, $T_j=25^\circ\text{C}$	1.3	1.6	2.5	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=-55^\circ\text{C}$	-	-	2.7	V
		$V_{GS}=V_{DS}$, $I_D=1\text{mA}$, $T_j=150^\circ\text{C}$	0.9	-	-	V
Drain-source leakage current	I_{DSS}	$V_{GS}=0\text{V}$, $V_{DS}=60\text{V}$, $T_j=25^\circ\text{C}$	-	-	1	μA
		$V_{GS}=0\text{V}$, $V_{DS}=60\text{V}$, $T_j=150^\circ\text{C}$	-	-	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	$R_{DS(ON)}$	$V_{GS}=10\text{V}$, $I_D=5\text{A}$, $T_j=25^\circ\text{C}$	-	46.6	58.3	m Ω
		$V_{GS}=10\text{V}$, $I_D=5\text{A}$, $T_j=150^\circ\text{C}$	-	87.8	-	m Ω
		$V_{GS}=4.5\text{V}$, $I_D=3\text{A}$, $T_j=25^\circ\text{C}$	-	51.5	64.4	m Ω
Forward transconductance	g_{FS}	$V_{DS}=5\text{V}$, $I_D=10\text{A}$	-	7	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=0\text{V}$, $I_{SD}=5\text{A}$	-	0.9	1.3	V

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

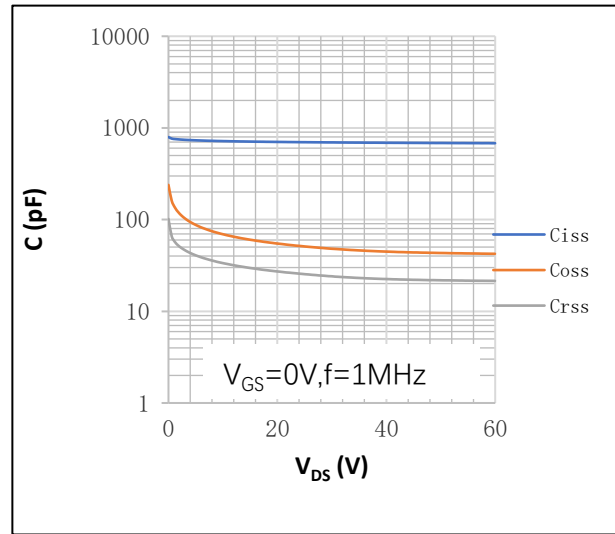
Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1\text{MHz}$, $V_{DS}=30\text{V}$, $V_{GS}=0\text{V}$	-	695	-	pF
Output capacitance	C_{oss}		-	48	-	pF
Reverse transfer capacitance	C_{rss}		-	24	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	1	-	Ω
Total gate charge	Q_g	$V_{DD}=30\text{V}$, $I_D=5\text{A}$, $V_{GS}=10\text{V}$	-	10.1	-	nC
	$Q_g(4.5\text{V})$		-	4.9	-	nC
Gate-source charge	Q_{gs}		-	2.2	-	nC
Gate-drain charge	Q_{gd}		-	1.7	-	nC
Turn-on delay time	$t_{D(on)}$	$V_{GS}=10\text{V}$, $V_{DS}=30\text{V}$,	-	2	-	ns

Turn-on rise time	t_r	$R_G = 3.3\Omega$, $I_D = 5A$	-	3	-	ns
Turn-off delay time	$t_{D(off)}$		-	10	-	ns
Turn-off fall time	t_f		-	7	-	ns
Reverse recovery time	t_{rr}	$V_{DD} = 30V$, $dI_S/dt = 100A/\mu s$,	-	30	-	ns
Reverse recovery charge	Q_{rr}	$I_S = 5A$	-	28	-	nC

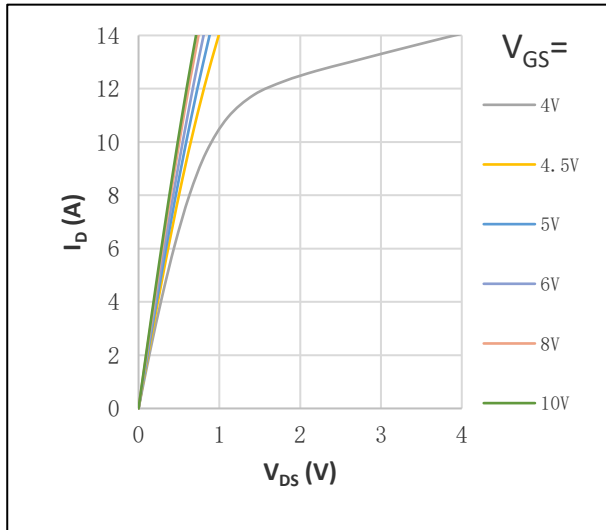
● Fig.1 Gate-source voltage as a function of gate charge;
Typical values; $T_j=25^\circ\text{C}$



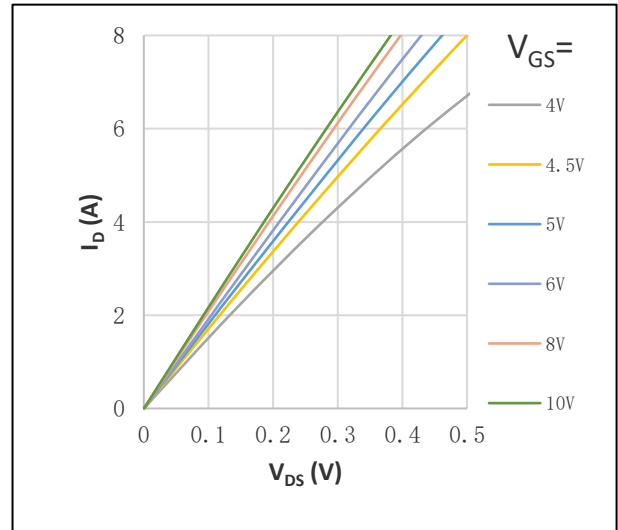
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



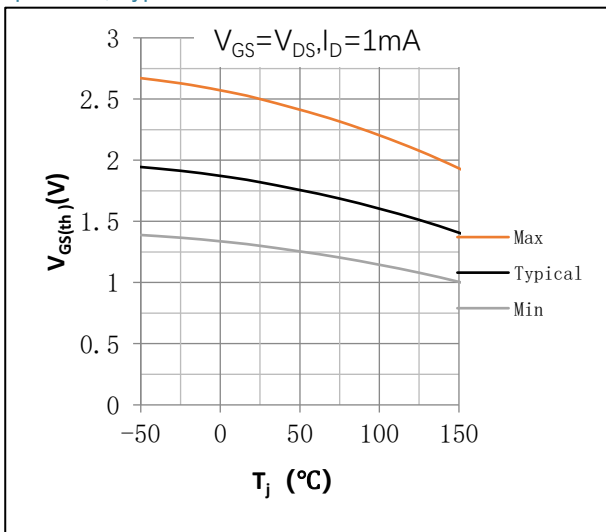
● Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$



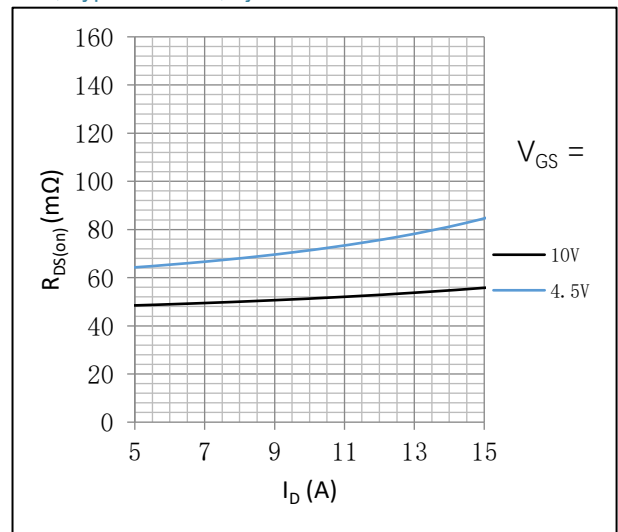
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$



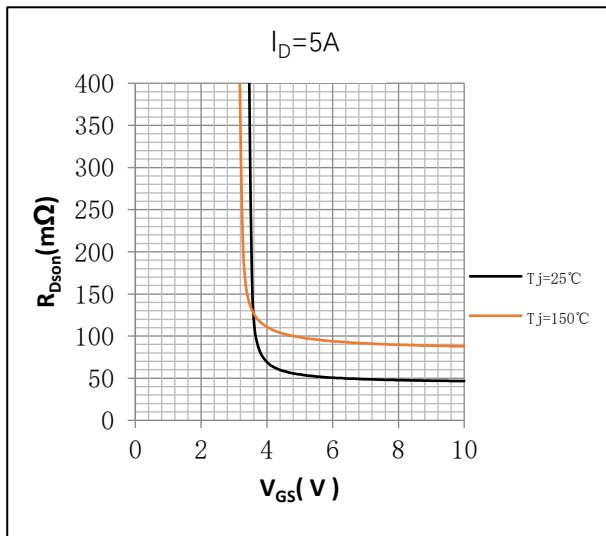
● Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical/Min/Max values



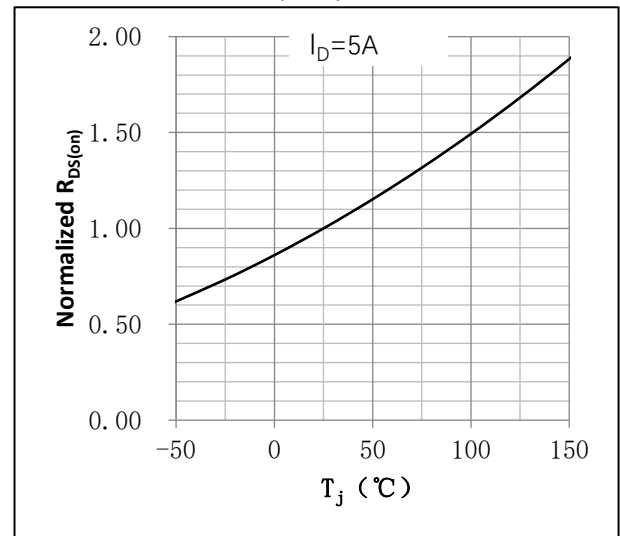
● Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$



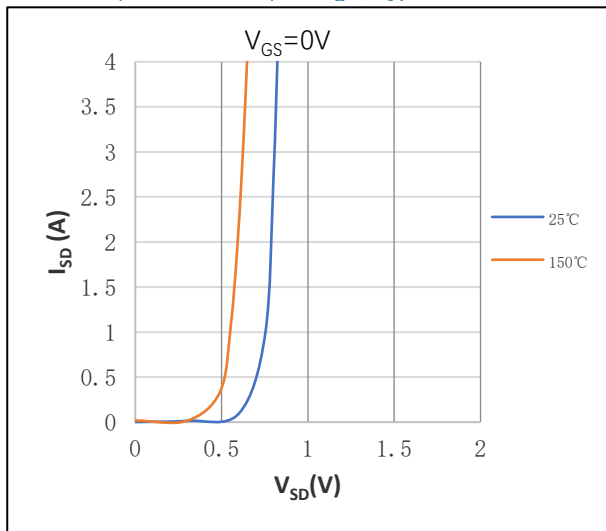
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



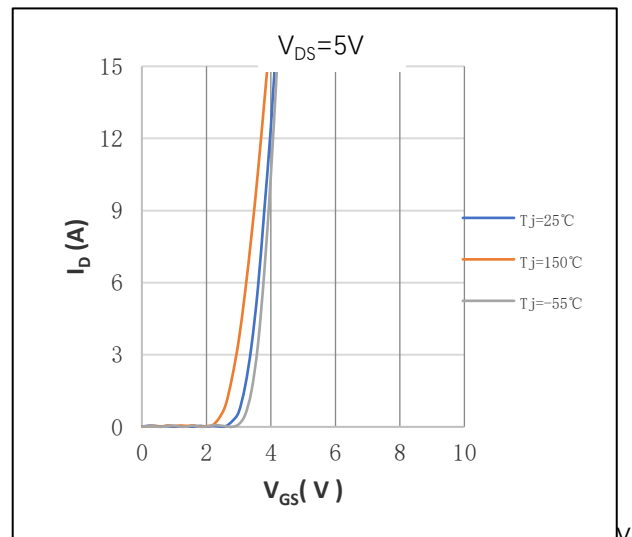
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance = $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$



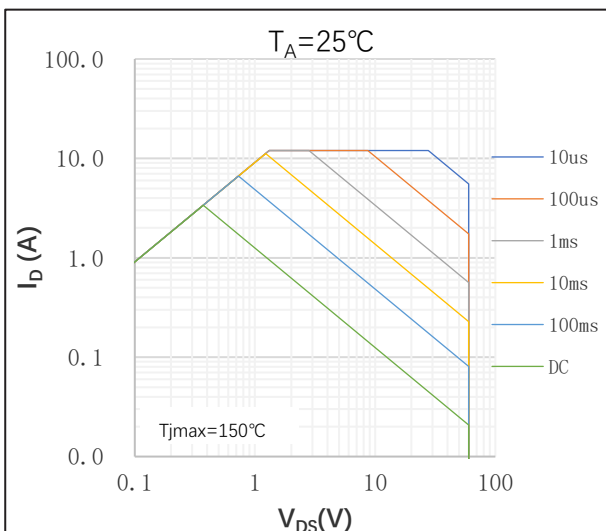
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



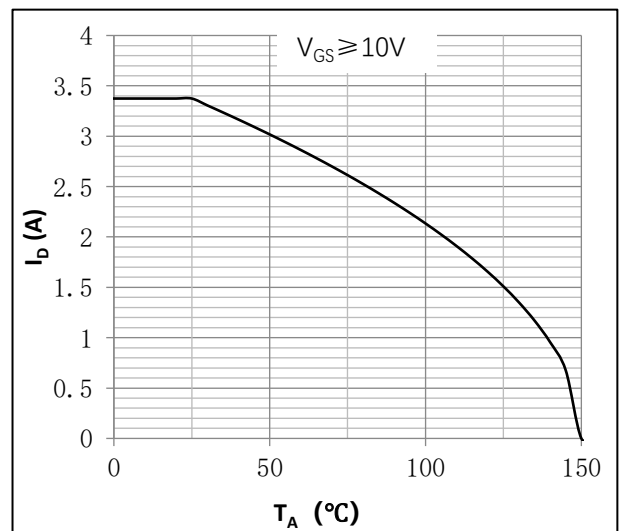
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



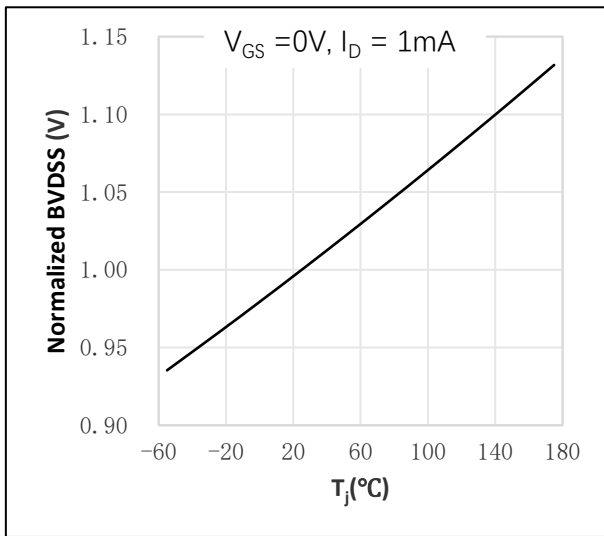
● Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage; Calculative values



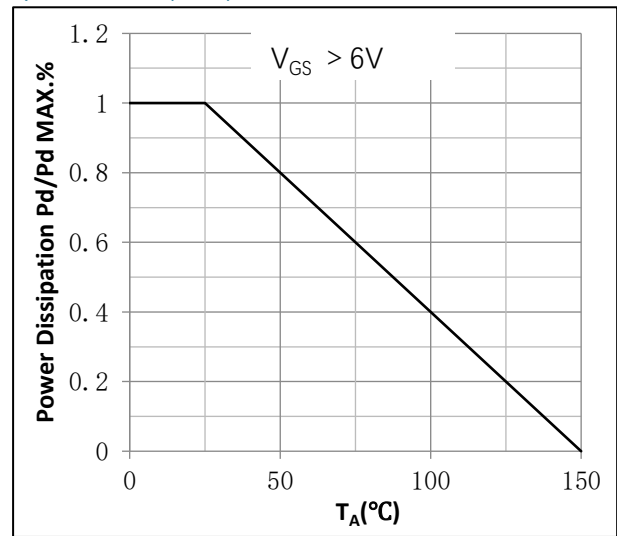
● Fig.12 Continuous drain current as a function of ambient temperature^③; Calculative values



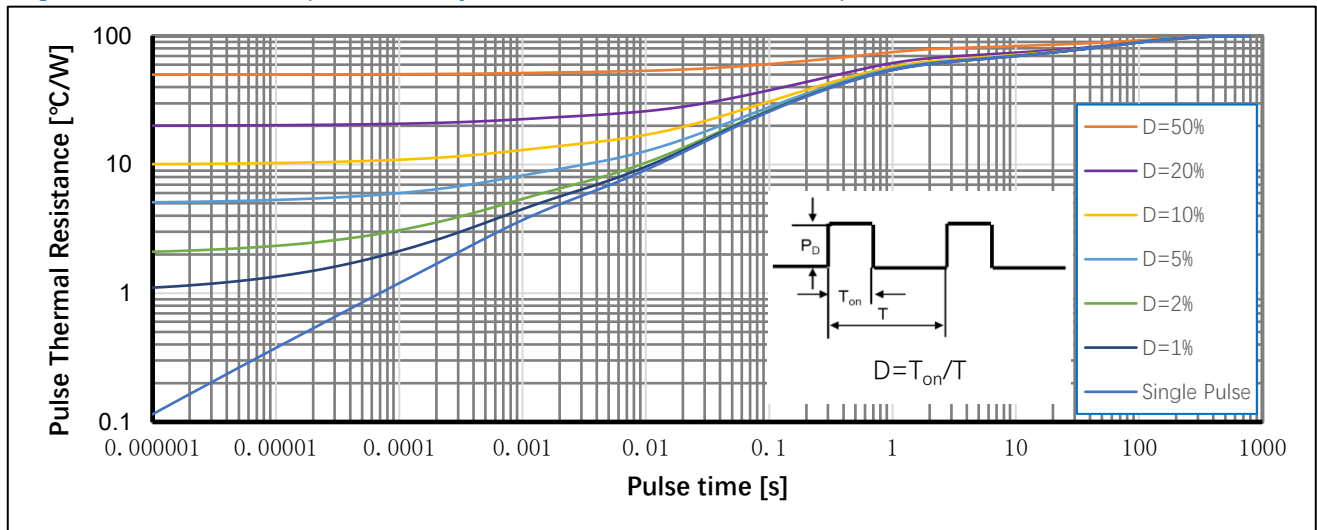
● Fig.13 Drain-source breakdown voltage as a function of junction temperature; Normalized values



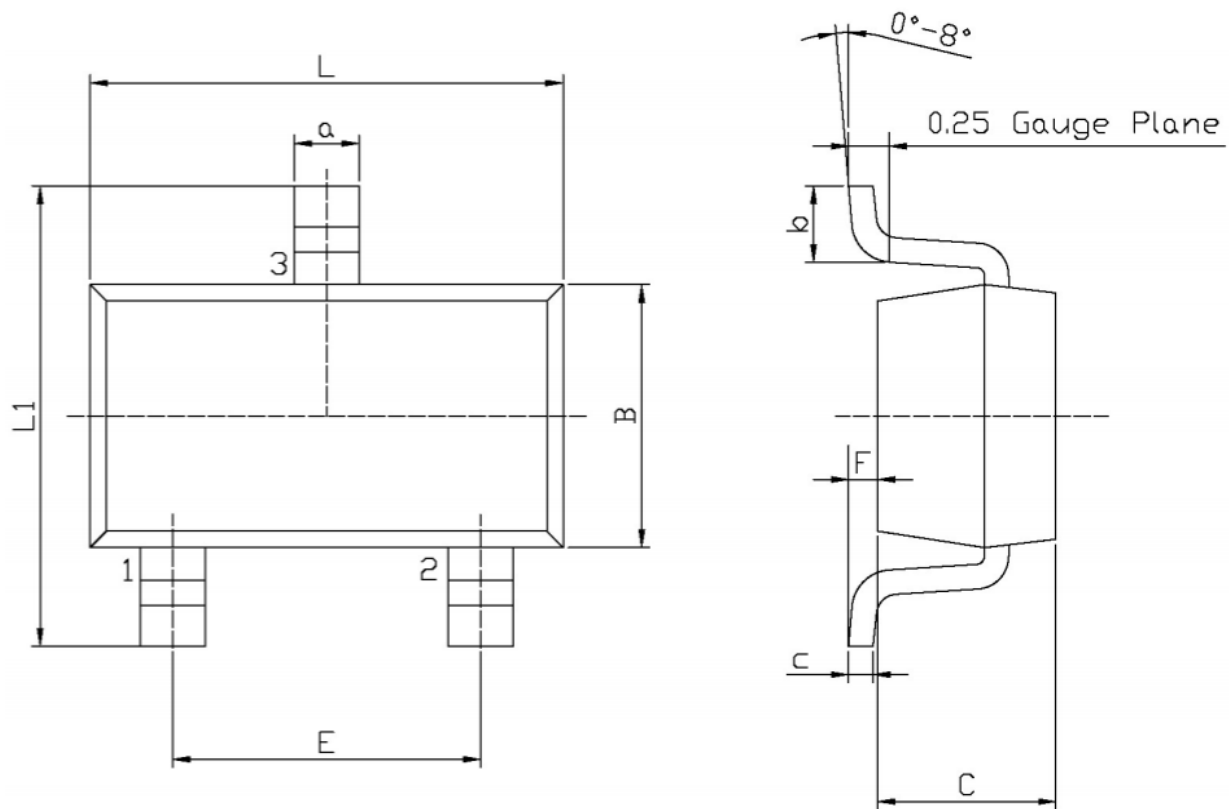
● Fig.14 Normalized total power dissipation as a function of ambient temperature; Calculative values Normalized Power Dissipation $= P_d / P_d(25^\circ C)$



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



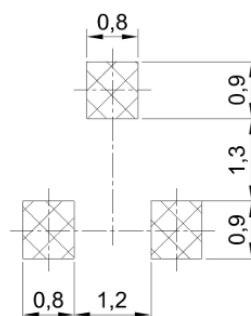
● Package Outline



Unit: mm

Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
L	2.82	3.02	a	0.35	0.50
B	1.50	1.70	C	0.10	0.20
C	0.90	1.30	b	0.35	0.55
L1	2.60	3.00	F	0	0.15
E	1.80	2.00			

Land Pattern
(Only for Reference)



● Note

- ① Pulse : $V_{GS}=+20V/-20V$, Duty cycle=50%, $T_j=150^{\circ}C$, $t=1000$ hours; For DC, the following test conditions can be passed: $V_{GS}=+20V/-10V$, $T_j=150^{\circ}C$, $t=1000$ hours;
- ② Device mounted on 1 square inch FR-4 substrate PCB, single-sided 1oz copper, mounting pad for drain 6 cm², tested in a still air environment with $T_A=25^{\circ}C$;
- 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	2021/5/10	New
B	2022/1/5	Change the symbol figure.
C	2022/9/10	1.Add Reach, HF figure; 2.ID modified.
D	2022/12/20	ID & Curve modified.
E	2026/9/4	Apply new datasheet format.