

● General Description

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

● Features

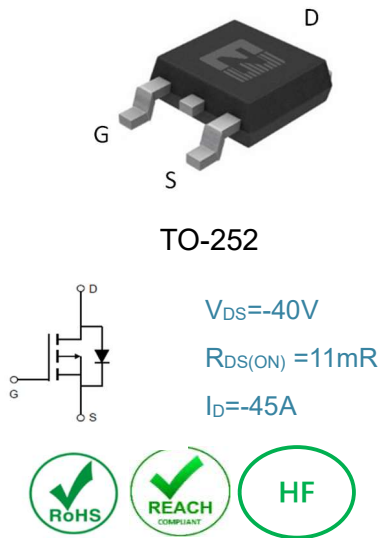
- Low $R_{DS(ON)}$ to minimize conductive loss
- High GOX reliability
- Low thermal resistance
- AEC-Q101 qualified

● Application

- BLDC motor driver
- DC-DC
- Load switch



● Product Summary



● Ordering Information

Part NO.	ZMA120P04D
Marking	ZM120P04
Packing information	REEL TAPE
Basic ordering unit (pcs)	2500

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

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-source voltage	V_{DS}		-	-40	V
Gate-source voltage ^①	V_{GS}		-20	20	V
Continuous drain current	I_D	$V_{GS} = -10V, T_C = 25^\circ C$	-	-45	A
	I_D	$V_{GS} = -10V, T_C = 75^\circ C$	-	-42	A
	I_D	$V_{GS} = -10V, T_C = 100^\circ C$	-	-37	A
Pulsed drain current ^①	I_{DM}	Pulsed; $t_p \leq 10 \mu s; T_C = 25^\circ C$;	-	-180	A
Total power dissipation	P_D	$T_C = 25^\circ C$	-	75	W
Total power dissipation	P_D	$T_A = 25^\circ C$	-	2.4	W
Operating junction temperature	T_J		-55	175	$^\circ C$
Storage temperature	T_{STG}		-55	175	$^\circ C$
Single pulse avalanche energy	E_{AS}	$L = 0.1mH, V_{GS} = -10V, R_g = 25\Omega$,	-	80	mJ
		$L = 0.5mH, V_{GS} = -10V, R_g = 25\Omega$,	-	168	mJ
ESD level (HBM)			CLASS 2		

● Thermal Resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	2	°C/W
Thermal resistance, junction - ambient ^②	R_{thJA}	-	-	62	°C/W
Soldering temperature(total time<10s)	T_{sold}	-	-	260	°C

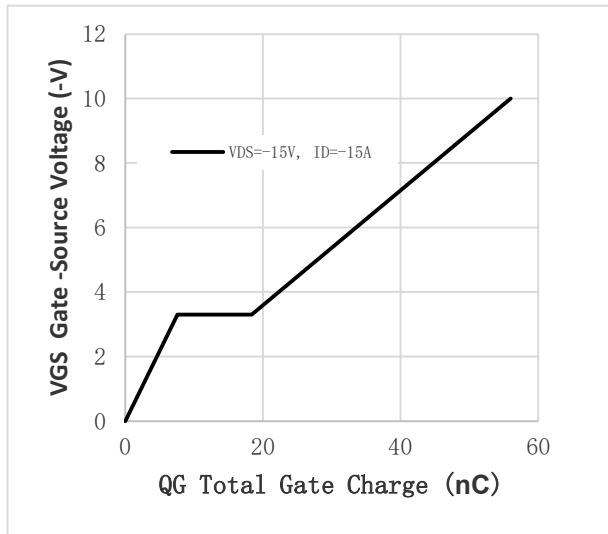
● Electronic Characteristics ($T_j=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Drain-source breakdown voltage	BV_{DSS}	$V_{GS}=0V, I_D=-250\mu A$	-40	-	-	V
Gate threshold voltage	$V_{GS(th)}$	$V_{GS}=V_{DS}, I_D=-250\mu A$	-1.3	-1.8	-2.5	V
Drain-source leakage current	I_{DSS}	$V_{GS}=0V, V_{DS}=-40V$	-	-	-1	μA
Gate- source leakage current	I_{GSS}	$V_{GS}=\pm 20V, V_{DS}=0V$	-	-	± 100	nA
Static drain-source on resistance	$R_{DS(on)}$	$V_{GS}=-10V, I_D=-15A, T_j=25^{\circ}\text{C}$	-	11	14	m Ω
		$V_{GS}=-4.5V, I_D=-10A, T_j=25^{\circ}\text{C}$	-	17	21	m Ω
Forward transconductance	g_{FS}	$V_{DS}=-5V, I_{SD}=-10A$	-	18	-	S
Diode forward voltage	V_{FSD}	$V_{GS}=0V, I_{SD}=-15A$	-	-	-1.3	V

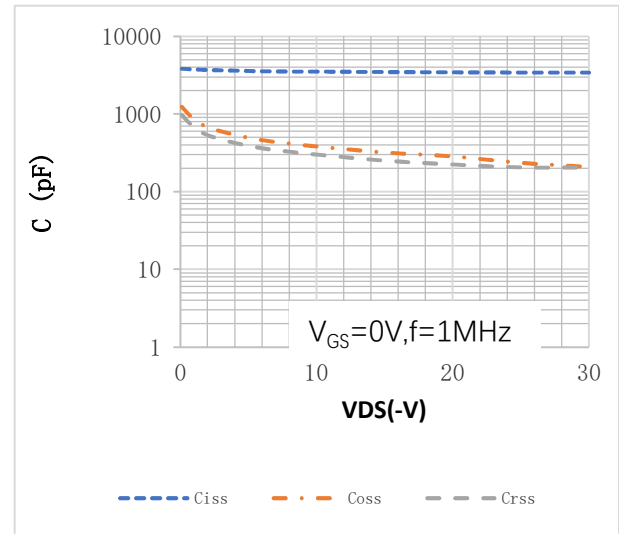
● Dynamic Characteristics ($T_j=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f=1\text{MHz}, V_{DS}=-25V, V_{GS}=0V$	-	3430	-	pF
Output capacitance	C_{oss}		-	262	-	pF
Reverse transfer capacitance	C_{rss}		-	206	-	pF
Gate resistance	R_g	$f=1\text{MHz}$	-	9	-	Ω
Total gate charge	Q_g	$V_{DD}=-15V, I_D=-20A, V_{GS}=-10V$	-	56	-	nC
	$Q_g(-4.5V)$		-	25	-	nC
Gate-source charge	Q_{gs}		-	7.6	-	nC
Gate-drain charge	Q_{gd}		-	10.8	-	nC
Turn-on delay time	$t_{D(on)}$	$V_{GS}=-10V, V_{DS}=-15V, R_G=3.3\Omega, I_D=-20A$	-	12	-	ns
Turn-on rise time	t_r		-	19	-	ns
Turn-off delay time	$t_{D(off)}$		-	94	-	ns
Turn-off fall time	t_f		-	35	-	ns
Reverse recovery time	t_{rr}	$V_{DD}=-20V, dI_S/dt=-100A/\mu s, I_S=-20A$	-	102	-	ns
Reverse recovery charge	Q_{rr}		-	385	-	nC

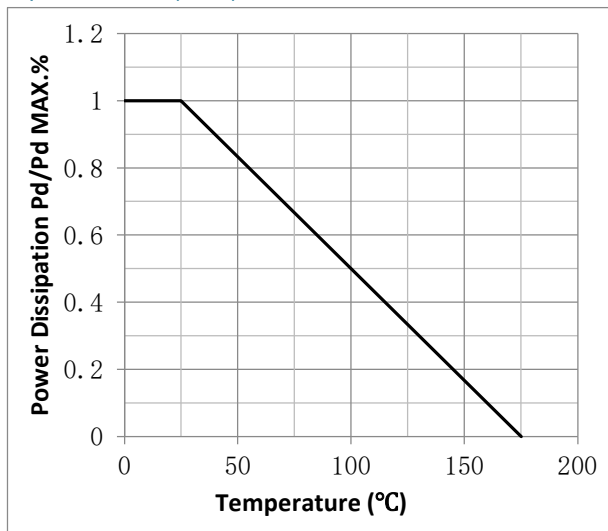
● Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_J=25^\circ\text{C}$



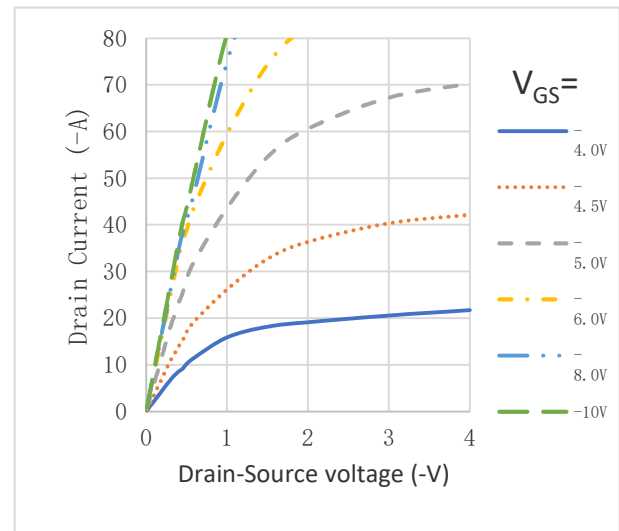
● Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_J=25^\circ\text{C}$



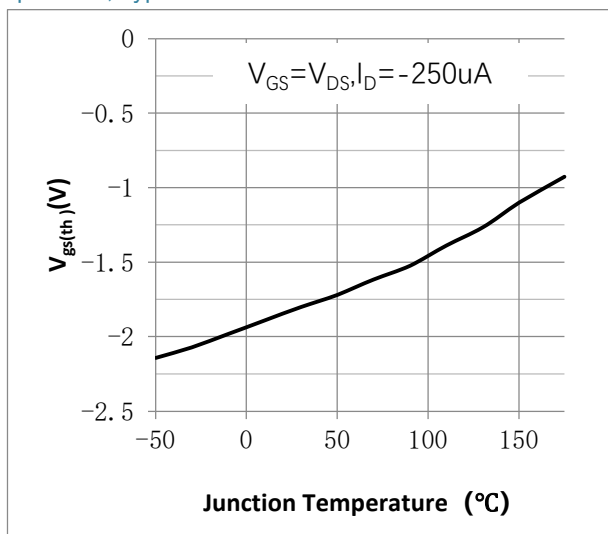
● Fig.3 Normalized total power dissipation as a function of case temperature; Calculative values Normalized Power Dissipation = $P_d/P_d(25^\circ\text{C})$



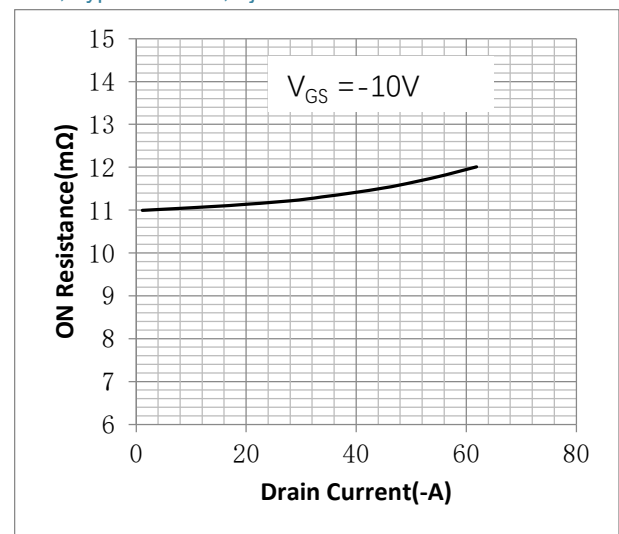
● Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_J=25^\circ\text{C}$



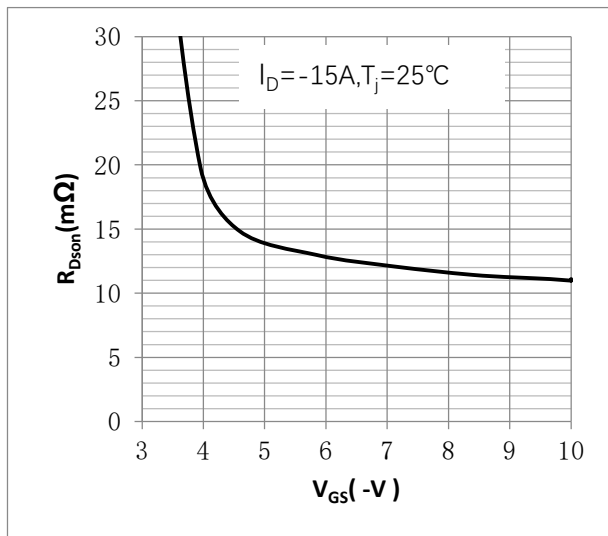
● Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values



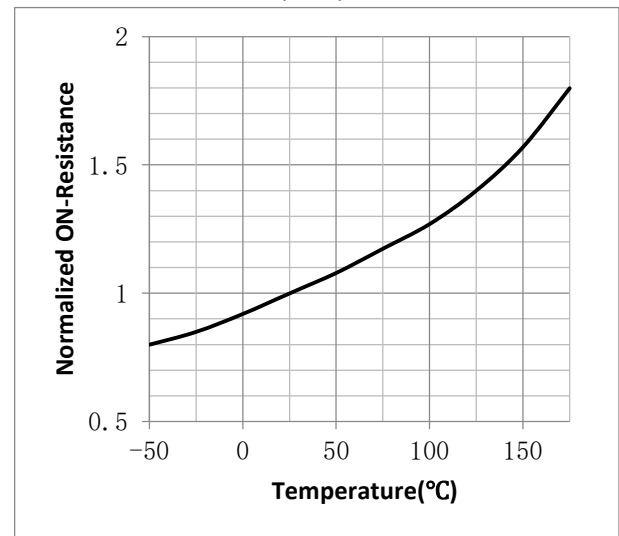
● Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_J=25^\circ\text{C}$



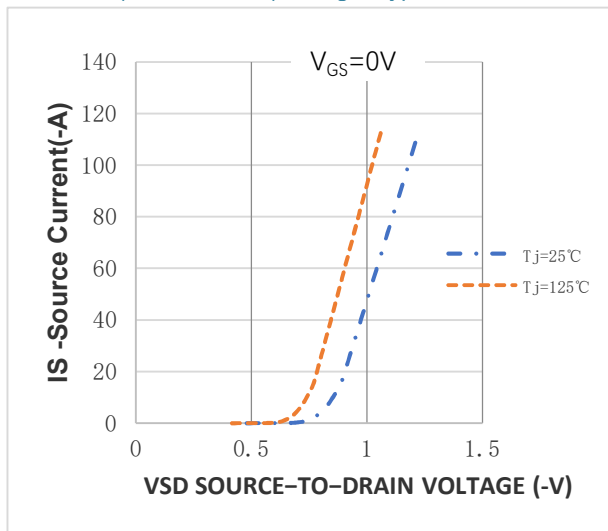
● Fig.7 Drain-source on-state resistance as a function of gate-source voltage; Typical values



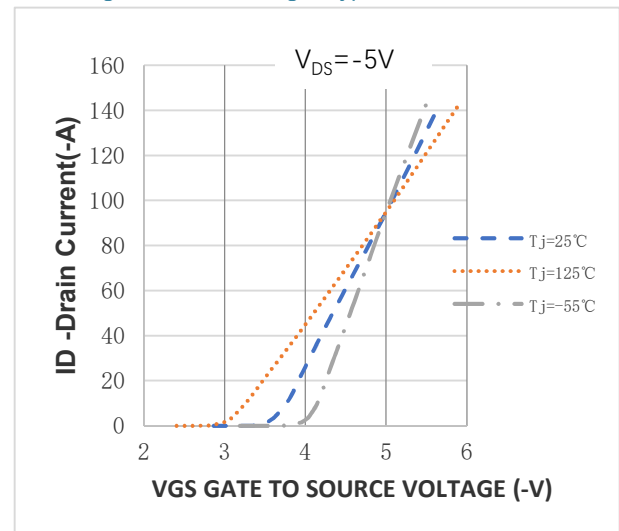
● Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature; Typical values Normalized On-Resistance= $R_{DS(on)}/R_{DS(on)}(25^\circ\text{C})$



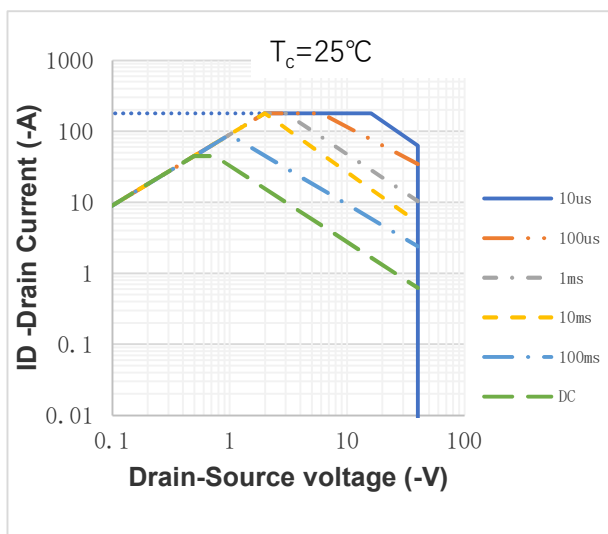
● Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage; Typical values



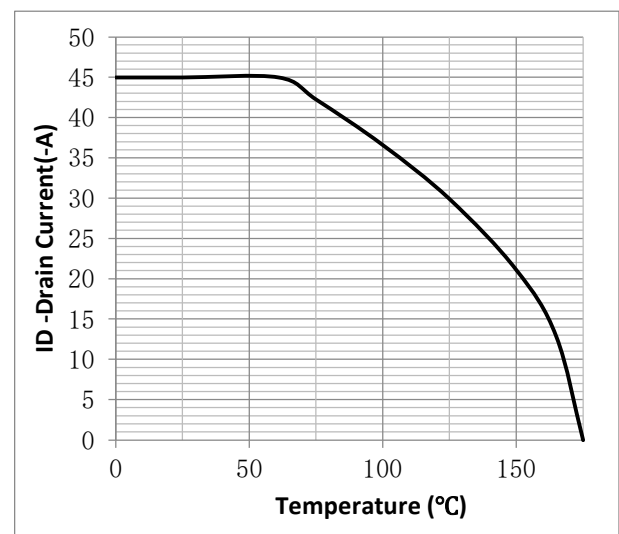
● Figure 10. Transfer characteristics: drain current as a function of gate-source voltage; Typical values



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

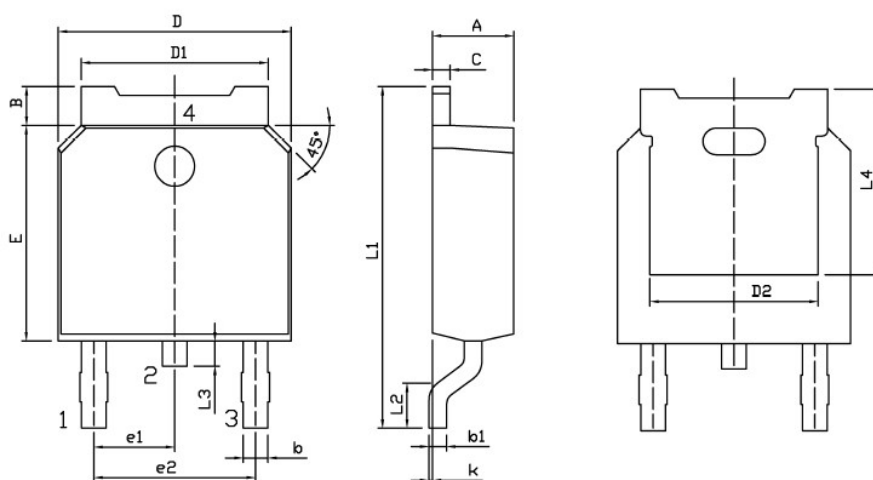


● Fig.12 Continuous drain current as a function of case temperature³; Calculative values



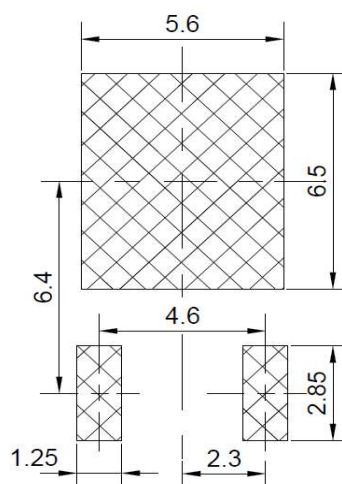
● Package Outline

Option L:

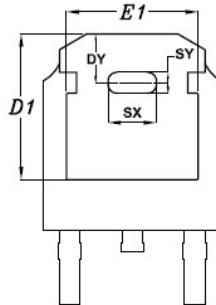
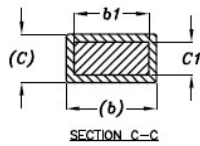
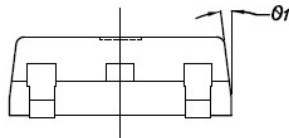
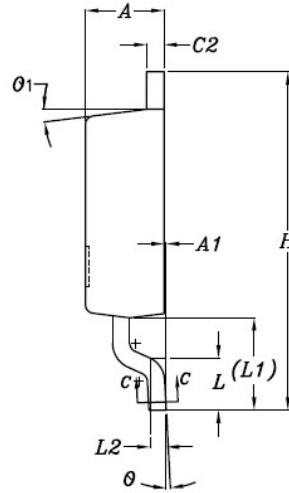
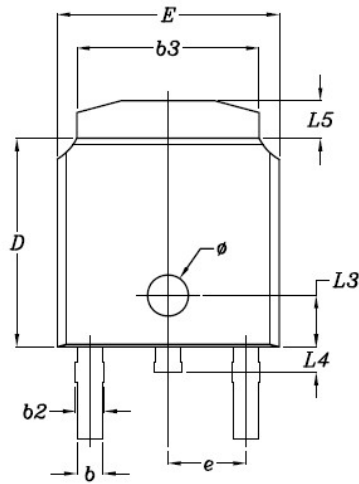


Land Pattern
(Only for Reference)

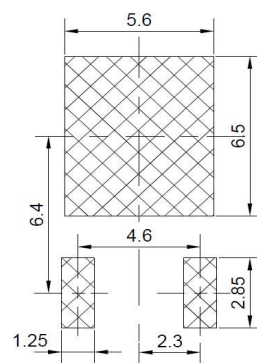
Dimensions In Millimeters					
Symbol	MIN	MAX	Symbol	MIN	MAX
A	2.20	2.40	E	5.95	6.25
B	0.95	1.25	e1	2.24	2.34
b	0.70	0.90	e2	4.43	4.73
b1	0.45	0.55	L1	9.85	10.35
C	0.45	0.55	L2	1.70	2.00
D	6.45	6.75	L3	0.60	0.90
D1	5.10	5.50	L4	5.05	
D2	4.85		k	0.00	0.10



Option Q:



I T E M	DIMENSIONS			
	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.18	2.39	0.086	0.094
A1	—	0.13	—	0.005
b	0.70	0.89	0.028	0.035
b1	0.70	0.86	0.028	0.034
b2	0.76	1.14	0.030	0.045
b3	4.95	5.46	0.195	0.215
c	0.46	0.61	0.018	0.024
c1	0.41	0.56	0.016	0.022
c2	0.46	0.89	0.018	0.035
D	5.97	6.22	0.235	0.245
D1	5.21	5.54	0.205	0.218
E	6.35	6.73	0.250	0.265
E1	4.32	5.27	0.170	0.207
e	2.29 BSC		0.090 BSC	
H	9.40	10.41	0.370	0.410
L	1.40	1.78	0.055	0.070
L1	2.60	2.90	0.102	0.114
L2	0.51 BSC		0.020 BSC	
L3	1.65	1.95	0.065	0.077
L4	0.60	0.90	0.024	0.035
L5	0.89	1.27	0.035	0.050
theta	1°	5°	1°	5°
theta1	7° REF		7° REF	
theta	1.20 REF		0.047 REF	
SX	1.52 REF		0.060 REF	
SY	0.50 REF		0.020 REF	
DY	1.70 REF		0.067 REF	

 Land Pattern
 (Only for Reference)


● 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	2021/2/25	New
B	2022/6/7	1.Add Reach,HF figure. 2.ID modify
C	2022/10/20	1.Add It is suitable for automotive application. 2.Add total time<10s 3.ID curve modified
D	2023/12/19	Correct SOA
E	2024/11/6	RDSon modified.
F	2025/11/14	1. Apply new datasheet format. 2. Update POD