40V N-Channel Power SpeedFET

• General Description

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

• Features

■AEC-Q101 Qualified

■Low $R_{DS(ON)}$ to minimize conductive loss

■Low Gate Charge for fast switching

■Low Thermal resistance

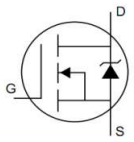
•Application

■BLDC Motor driver

■DC-DC

■Load Switch

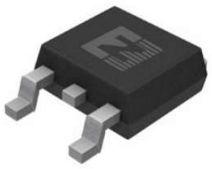
• Product Summary



V_{DS}= 40V

$R_{DS(ON)}$ = 2.6mΩ

I_D= 90A



TO-252

RoHS

REACH COMPLIANT

HF

•Ordering Information:

Part NO.	ZMSA024N04HD
Marking	ZMS024N04H
Packing Information	REEL TAPE
Basic ordering unit (pcs)	2500

•Absolute Maximum Ratings (T_A=25°C,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℃	-	90	A
	I_D	V_{GS}=10V,T_C=75°C	-	90	A
	I_D	V_{GS}=10V,T_C=100°C	-	87	A
Pulsed Drain Current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	360	A
Total Power Dissipation	P_D	T_C=25℃	-	118	W
Total Power Dissipation	P_D	T_A=25℃	-	2.4	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, Rg=25Ω,	-	120	mJ
		L=0.3mH, V_{GS}=10V, Rg=25Ω,	-	192	mJ
ESD Level (HBM)	CLASS 2				

•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	1.27	°C/W
Thermal resistance, junction-ambient	R_{thJA} ②	-	-	62	°C/W
Soldering temperature	Tsold	-	-	260	°C

•Electronic Characteristics (Tj=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=95uA, Tj=25℃	2	2.4	4	V
		V_{GS}=V_{DS}, I_D=250uA, Tj=25℃	2	2.5	4	V
		V_{GS}=V_{DS}, I_D=1mA, Tj=-55℃	-	-	4.3	V
		V_{GS}=V_{DS}, I_D=1mA, Tj=175℃	1.2	-	-	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}=40V, Tj=25℃	-	-	1	uA
		V_{GS}=0V, V_{DS}=40V, Tj=125℃	-	-	20	uA
		V_{GS}=0V, V_{DS}=40V, Tj=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=40A, Tj=25°C	-	2.5	3	mΩ
		V_{GS}=10V, I_D=90A, Tj=25°C	-	2.6	3.1	mΩ
		V_{GS}=10V, I_D=40A, Tj=125°C	-	3.8	4.6	mΩ
		V_{GS}=10V, I_D=40A, Tj=175°C	-	4.6	5.5	mΩ
		V_{GS}=10V, I_D=90A, Tj=175°C	-	4.8	5.7	mΩ
Forward Transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	27	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =0V,I_{SD}=40A	-	-	1.3	V
		V_{GS} =0V,I_{SD}=90A	-	-	1.4	V

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=25V，V_{GS}=0V	-	2245	2919	pF
Output capacitance	Coss		-	665	865	
Reverse transfer capacitance	Crss		-	28	42	
Gate Risistance	Rg	f = 1MHz	-	1.5	3	Ω
Total gate charge	Qg	V_{DD} = 25V,I_D = 90A, V_{GS} = 10V	-	34.4	45	nC
Gate - Source charge	Qgs		-	10.3	13	
Gate - Drain charge	Qgd		-	9.1	14	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=10V,V_{DS}=20V,R_G =3.3 Ω, I_D =40A	-	9	14	ns
Turn-ON Rise time	t_r		-	10	15	ns
Turn-Off Delay time	$t_{D(off)}$		-	16	24	ns
Turn-Off Fall time	t_f		-	10	15	ns
Reverse Recovery Time	t_{rr}	V_{DD}=40V, dI_S/dt = 100A/us, I_S=40A	-	39	59	ns
Reverse Recovery Charge	Q_{rr}		-	51	77	nC

Fig.1 Gate-source voltage as a function of gate charge;Typical values;Tj=25°C

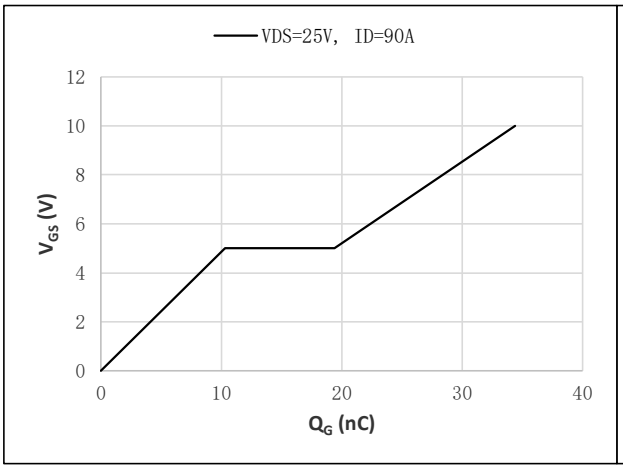


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage;Typical values;Tj=25°C

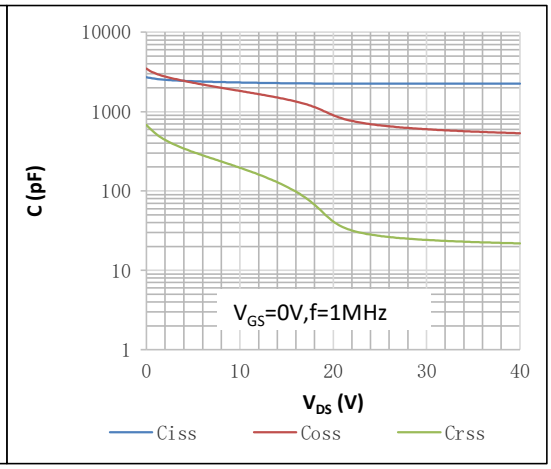


Fig.3 Output characteristics: drain current as a function of drain-source voltage;Typical values; Tj=25°C

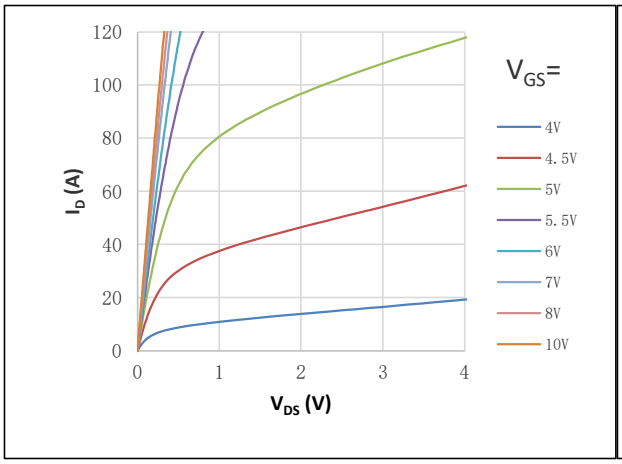


Fig.4 Output characteristics: drain current as a function of drain-source voltage;Typical values:Expanded curve;Tj=25°C

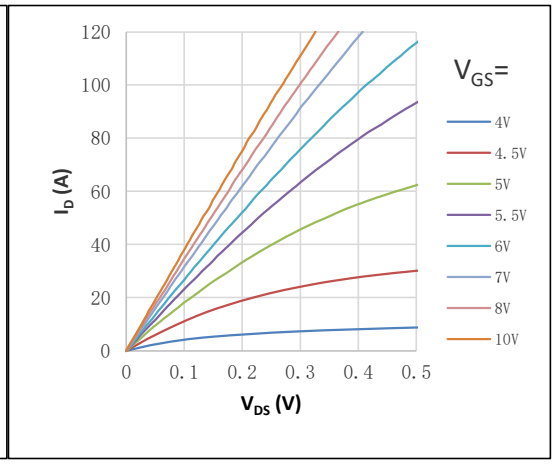


Fig.5 Gate-source threshold voltage as a function of junction temperature;Typical values

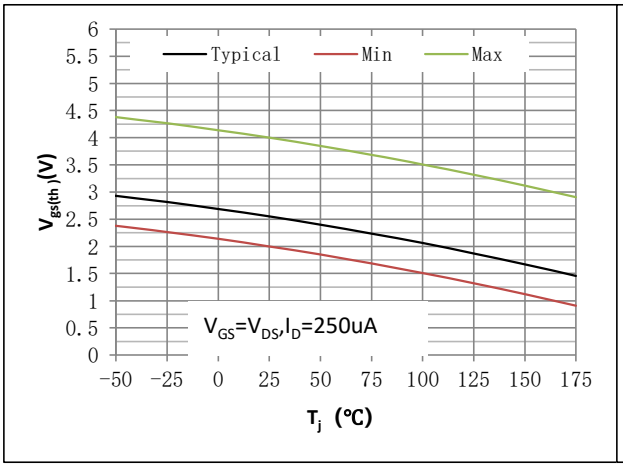


Fig.6 Drain-source on-state resistance as a function of drain current;Typical values;Tj=25°C

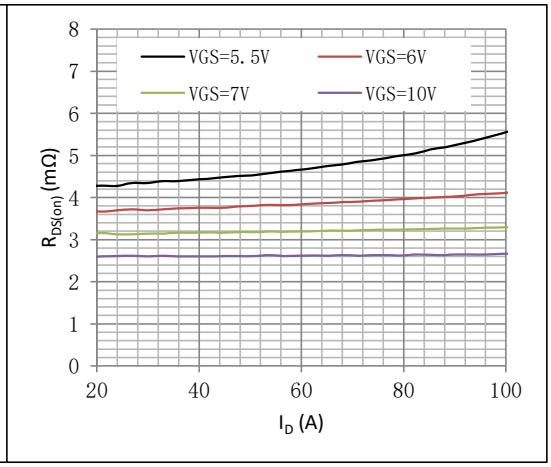
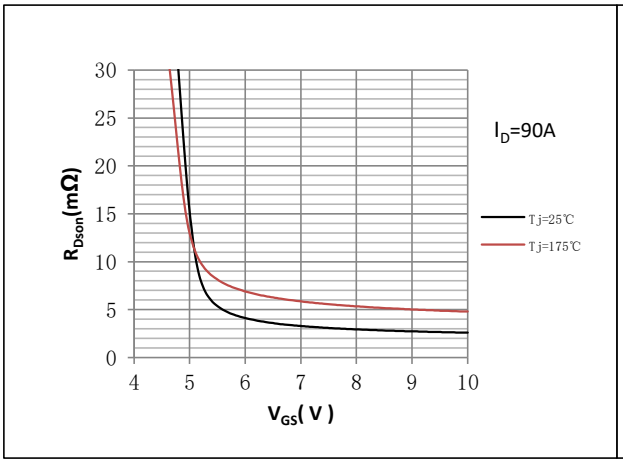


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance=RDSon/RDSon(25°C)



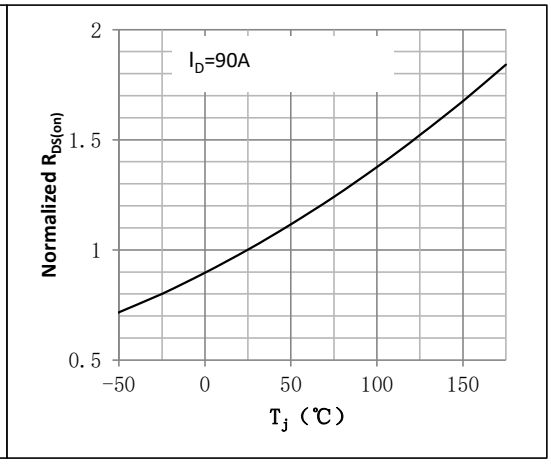
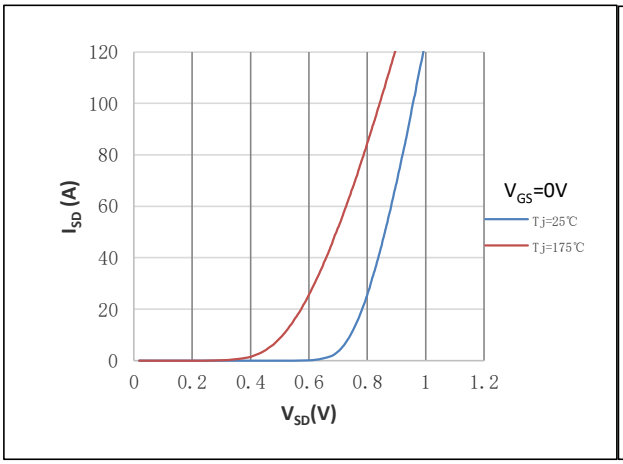


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

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



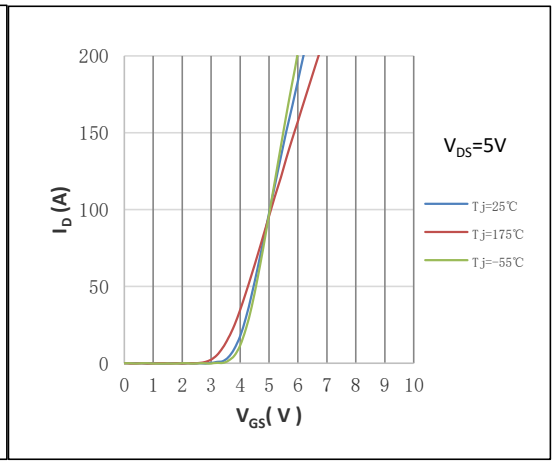
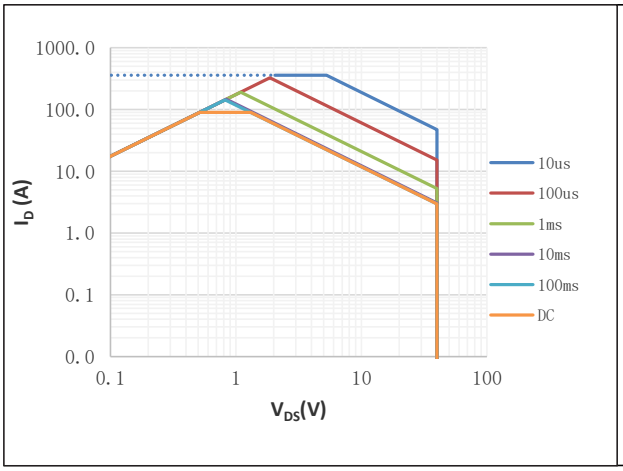


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

Fig.12 Continuous drain current as a function of case temperaturease③;Calculative values



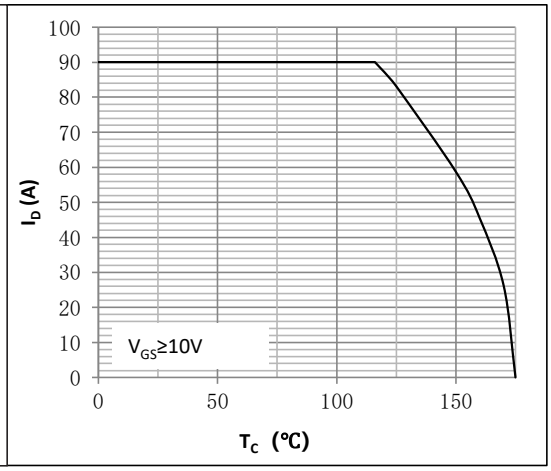


Fig.13 Drain-source breakdown voltage as a function of junction temperature;Typical values

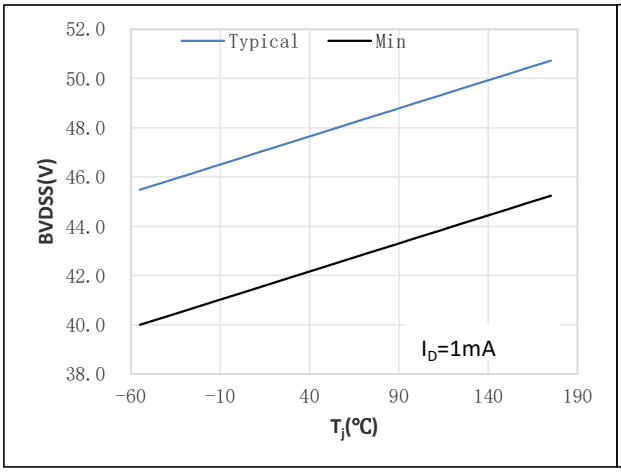


Fig.14 Normalized total power dissipation as a function of case temperature;Calculative values

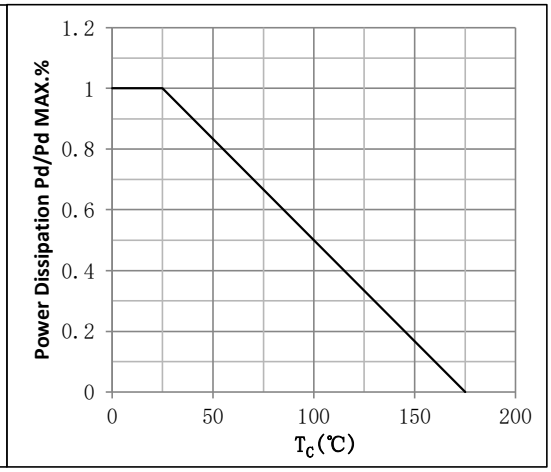


Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

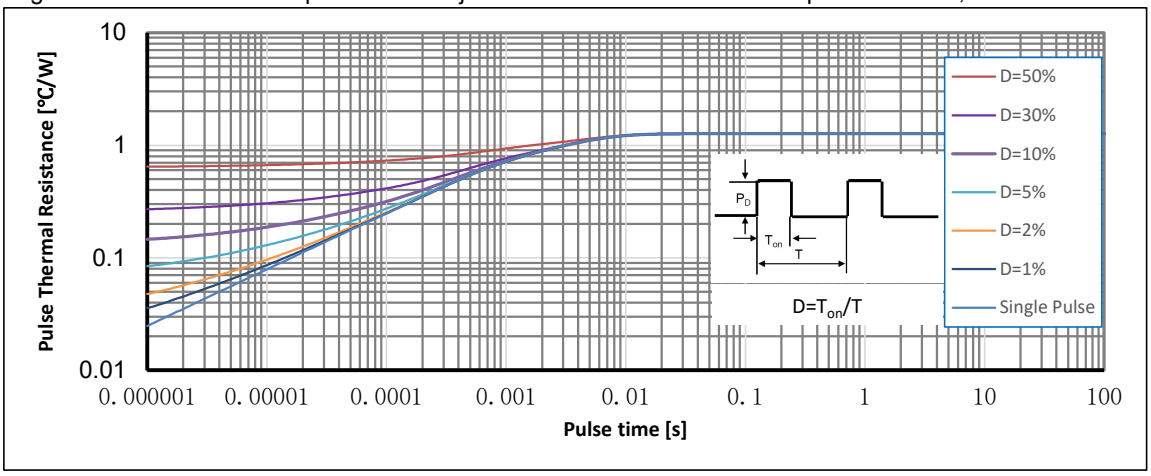
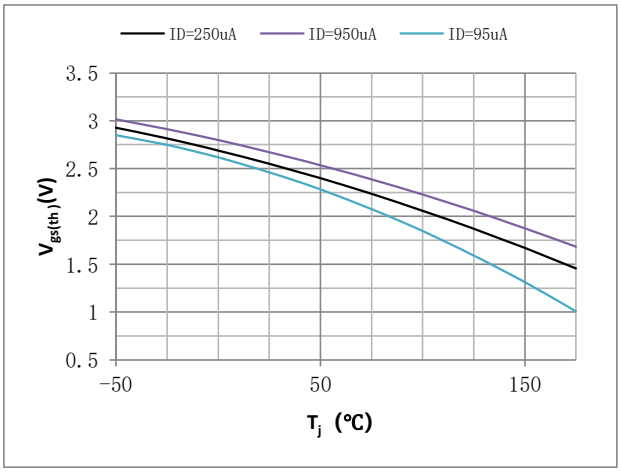
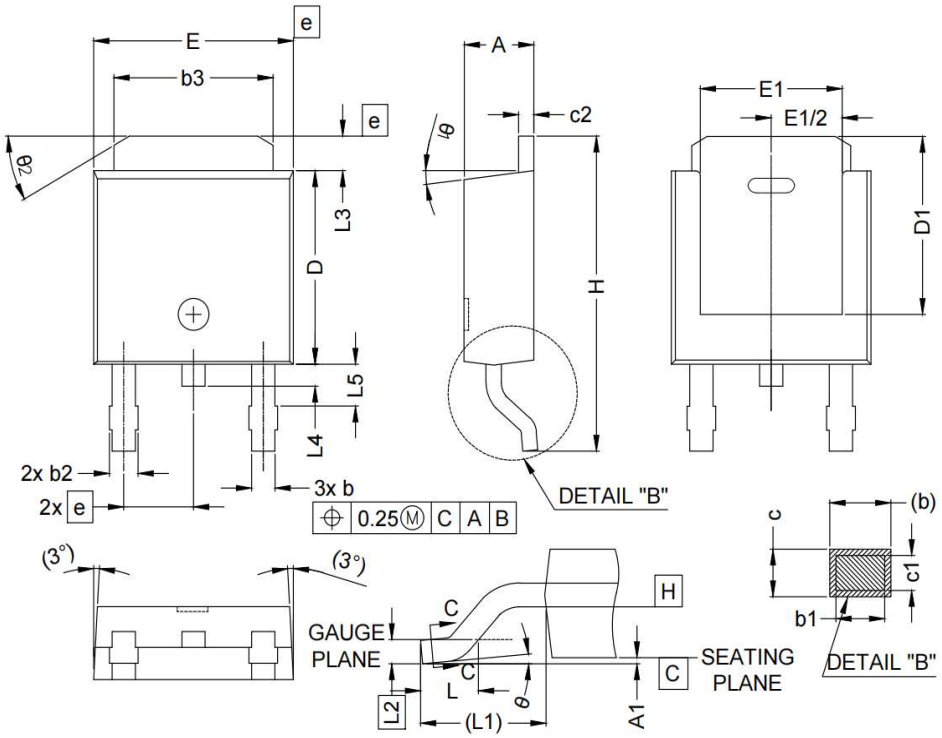


Fig.16 Gate-source threshold voltage as a function of junction temperature;Typical values



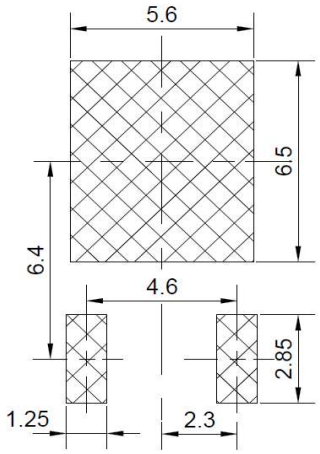
●TO-252 Package Outline



NOTE ; 1.0 DIMENSIONING & TOLERANCEING CONFIRM TO ASME Y14.5M-1994.
2.0 ALL DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
3.0 HEAT SINK SIDE FLASH IS MAX. 0.8mm.
4.0 RADIUS ON TERMINAL IS OPTIONAL.

SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.	SYMBOL	MIN.	MAX.
A	2.18	2.39	E	6.35	6.73	θ1	0°	15°
A1	-	0.13	E1	4.32	-	θ2	25°	35°
b	0.65	0.89	e	2.29 BSC				
b1	0.64	0.79	H	9.94	10.34			
b2	0.76	1.13	L	1.50	1.78			
b3	4.95	5.46	L1	2.74 REF				
c	0.46	0.61	L2	0.51 BSC				
c1	0.41	0.56	L3	0.89	1.27			
c2	0.46	0.60	L4	-	1.02			
D	5.97	6.22	L5	1.14	1.49			
D1	5.21	-	θ	0°	10°			

Land Pattern
(Only for Reference)



Note:

① Pulse : VGS=+20V/-20V, Duty cycle=50%,Tj=175℃, t=1000 hours; For DC， the following test conditions can be passed: VGS=+20V/-10V, Tj=175℃, t=1000 hours；

② Device 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. VGS=10V.

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Version	Date	Change
A	2025/5/23	New