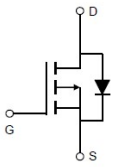
-40V P-Channel Power MOSFET

• General Description

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

• Product Summary



V_{DS}= -40V
$R_{DS(ON)}$ = 96mΩ
I_D= -1.8A

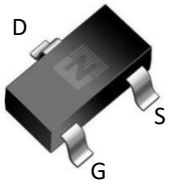
• Features

■AEC-Q101 Qualified

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

■High GOX reliability

■Low Thermal resistance



SOT-23-3

•Application

■BLDC Motor driver

■DC-DC

■Load Switch

•Ordering Information:

Part NO.	ZMA950P04T1
Marking	950P04
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

•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 Voltage	V_{GS}		-20	20	V
Continuous Drain Current	I_D	VGS=-10V,T_A=25°C	-	-1.8	A
	I_D	VGS=-10V,T_A=75°C	-	-1.4	A
	I_D	VGS=-10V,T_A=100°C	-	-1.1	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leqslant$ 10 μs; T_A = 25 °C;	-	-7.2	A
Total Power Dissipation	P_D	T_A=25°C(t≤10s)	-	0.6	W
Total Power Dissipation	P_D	T_A=25°C (Steady-state)	-	0.4	W
Operating Junction Temperature	T_J		-55	150	℃
Storage Temperature	T_{STG}		-55	150	℃
Single Pulse Avalanche Energy	E_{AS}	L=0.1mH, V_{GS}=-10V, Rg=25Ω,	-	7.2	mJ
		L=0.5mH, V_{GS}=-10V, Rg=25Ω,	-	13.0	mJ
ESD Level (HBM)	CLASS 1B				

•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction-ambient①	R_{thJA}(t≤10s)	-	-	220	°C/W
Thermal resistance, junction-ambient①	R_{thJA}(Steady-state)	-	-	300	°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=-250uA,T_j=25℃	-1.3	-2	-2.5	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}=-40V,T_j=25℃	-	-	1.0	uA
		V_{GS}=0V, V_{DS}=-40V,T_j=150℃	-	-	100	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=-1.5A,T_j=25°C	-	96	115	mΩ
		V_{GS}=-10V, I_D=-1.5A,T_j=150°C	-	154	-	mΩ
		V_{GS}=-4.5V,I_D=-1A,T_j=25°C	-	152	200	mΩ
		V_{GS}=-4.5V,I_D=-1A,T_j=150°C	-	228	-	mΩ
Forward Transconductance	g_{FS}	V_{DS} =-5V, I_D = -1.5A	-	2.7	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =0V, I_{SD} = -1.5A	-	-	-1.3	V

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 1MHz, V_{DS}=-20V,VGS=0V	-	391	-	pF
Output capacitance	Coss		-	33	-	
Reverse transfer capacitance	Crss		-	22	-	
Gate Risistance	Rg	f = 1MHz,VGS=0V	-	17	-	Ω
Total gate charge	Qg	V_{DD} = -20V, I_D = -1.5A, V_{GS} = -10V	-	6.8	-	nC
	Qg (-4.5V)		-	3.2	-	
Gate - Source charge	Qgs		-	1.9	-	
Gate - Drain charge	Qgd		-	0.8	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=-10V, V_{DS}=-20V, R_G =3.3Ω, I_D =-1.5A	-	3.2	-	ns
Turn-ON Rise time	t_r		-	18.7	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	16.9	-	ns
Turn-Off Fall time	t_f		-	22.5	-	ns
Reverse Recovery Time	t_{rr}	V_{DD}=-20V, dI_S/dt = 100A/us, I_S=-1.5A	-	11	-	ns
Reverse Recovery Charge	Q_{rr}		-	6	-	nC

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

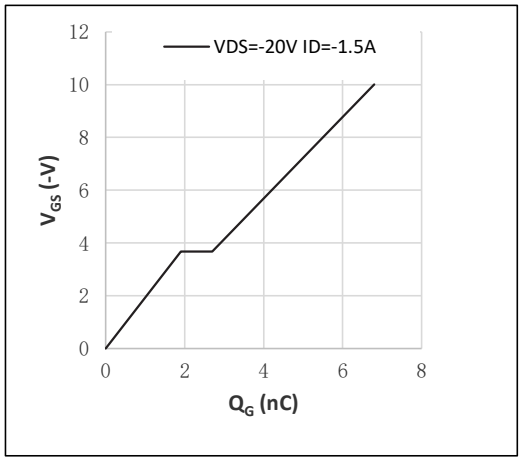


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage;Typical values;Tj=25°C

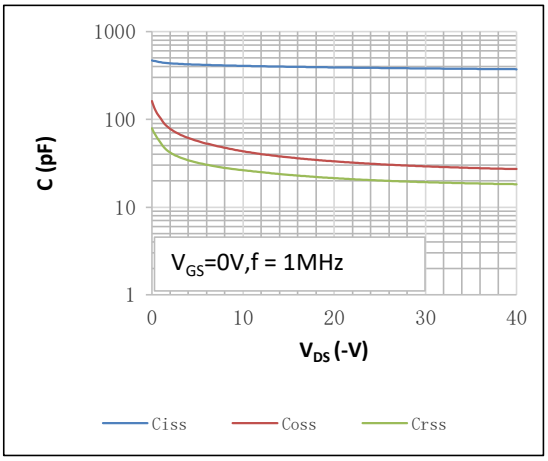


Fig.3 Output characteristics: drain current as a function of drain-source voltage;Typical values; Tj=25°C

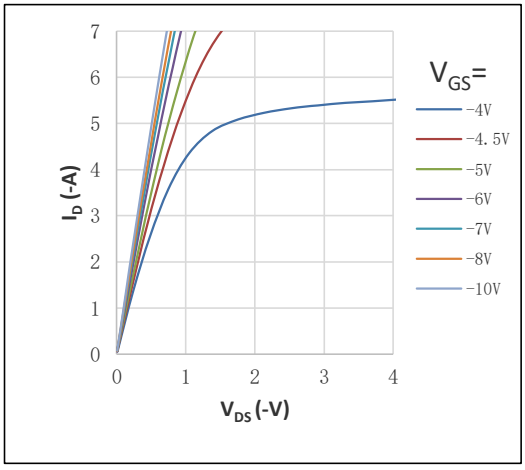


Fig.4 Output characteristics: drain current as a function of drain-source voltage;Typical values:Expanded curve;Tj=25°C

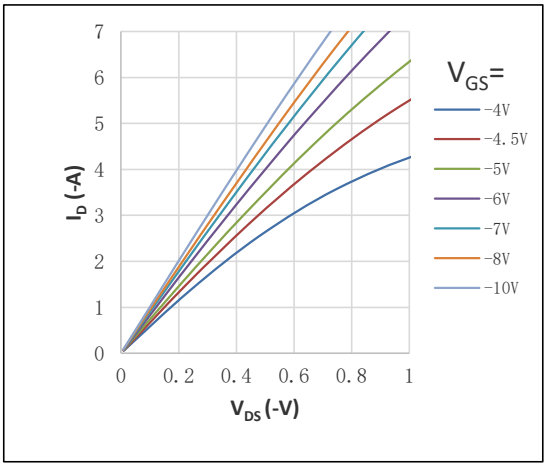


Fig.5 Gate-source threshold voltage as a function of junction temperature;Typical values

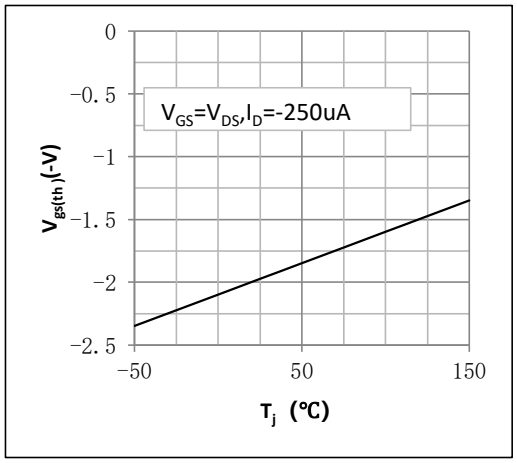


Fig.6 Drain-source on-state resistance as a function of drain current;Typical values;Tj=25 °C

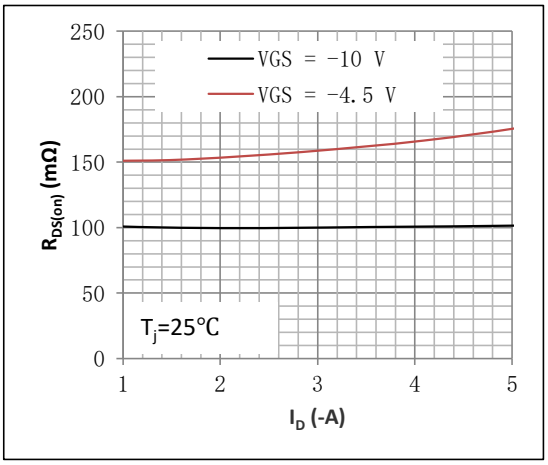


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

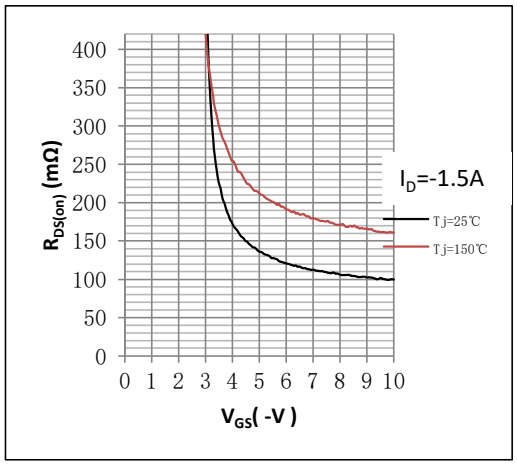


Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance=RDSon/RDSon(25 ℃)

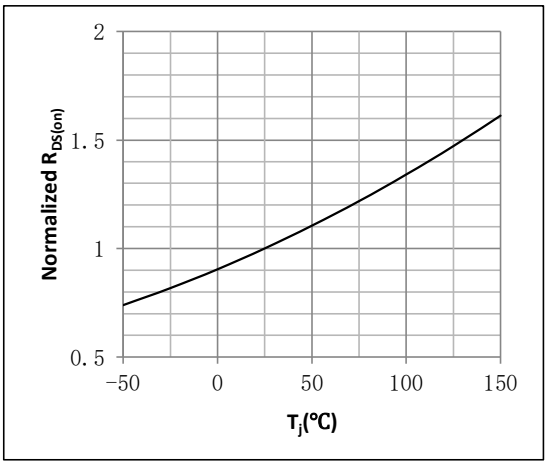


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

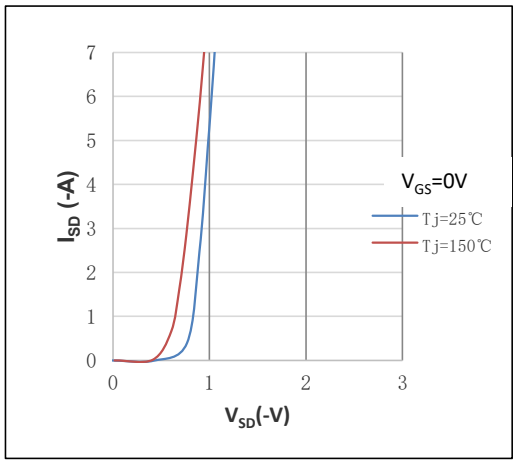


Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

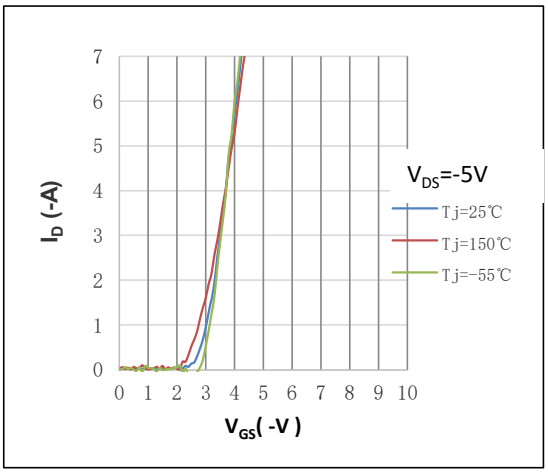


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

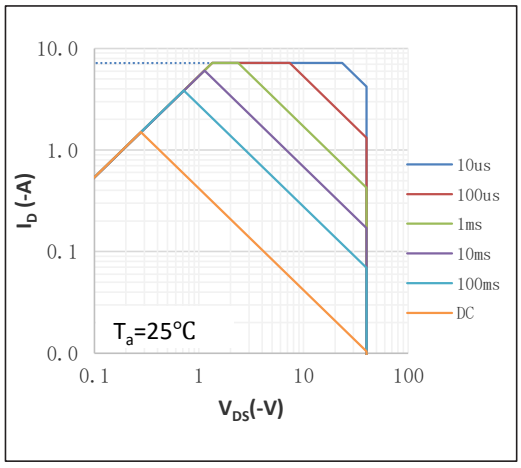


Fig.12 Continuous drain current as a function of ambient temperaturease③ ;Calculative values

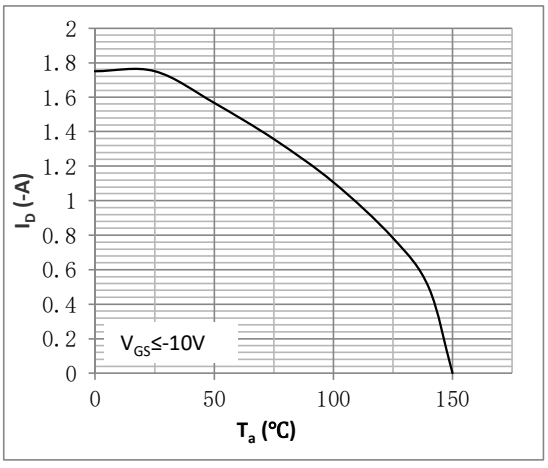


Fig.13 Drain-source breakdown voltage as a function of junction temperature;Typical values Normalized BVDSS=BVDSS/BVDSS(25°C)

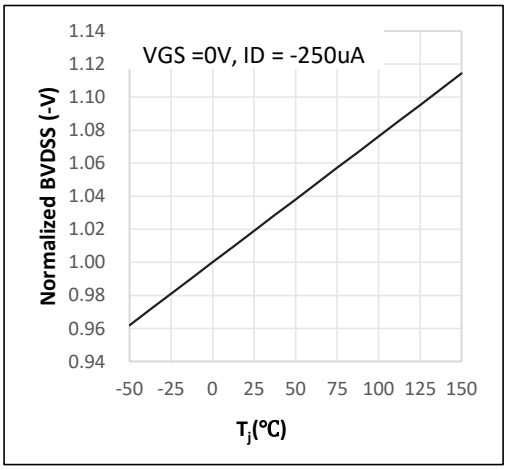


Fig.14 Normalized total power dissipation as a function of ambient temperature;Calculative values Normalized Power Dissipation= Pd/Pd(25°C)

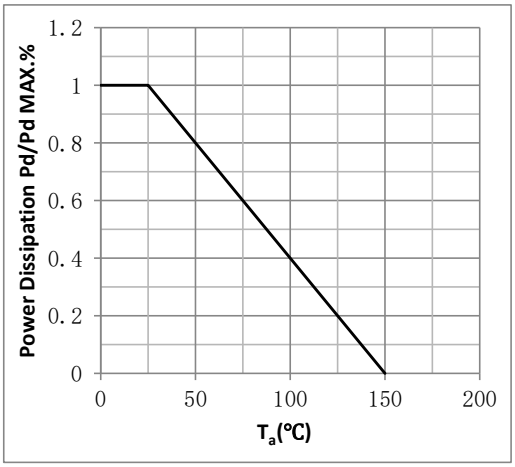
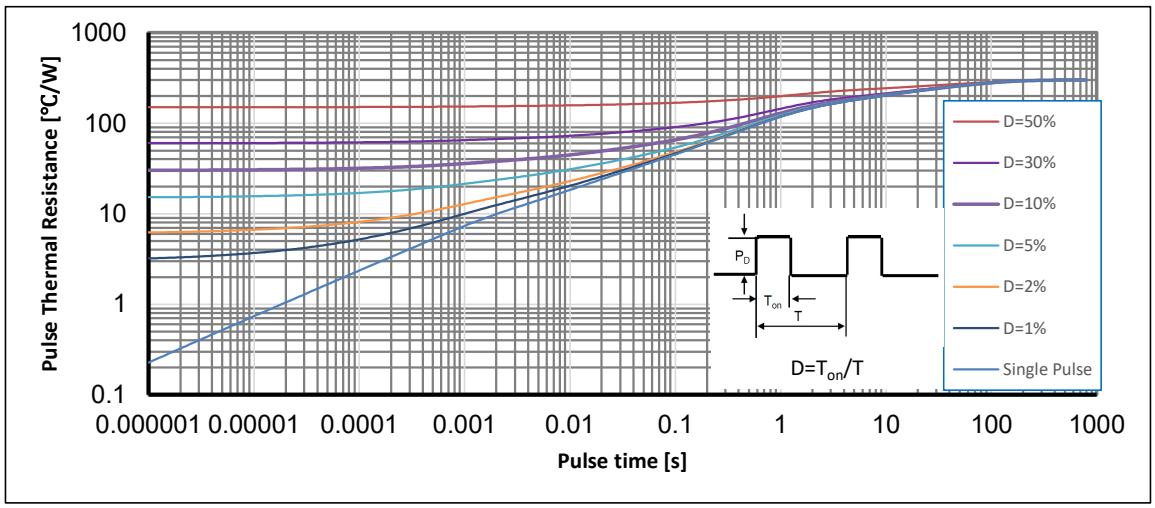
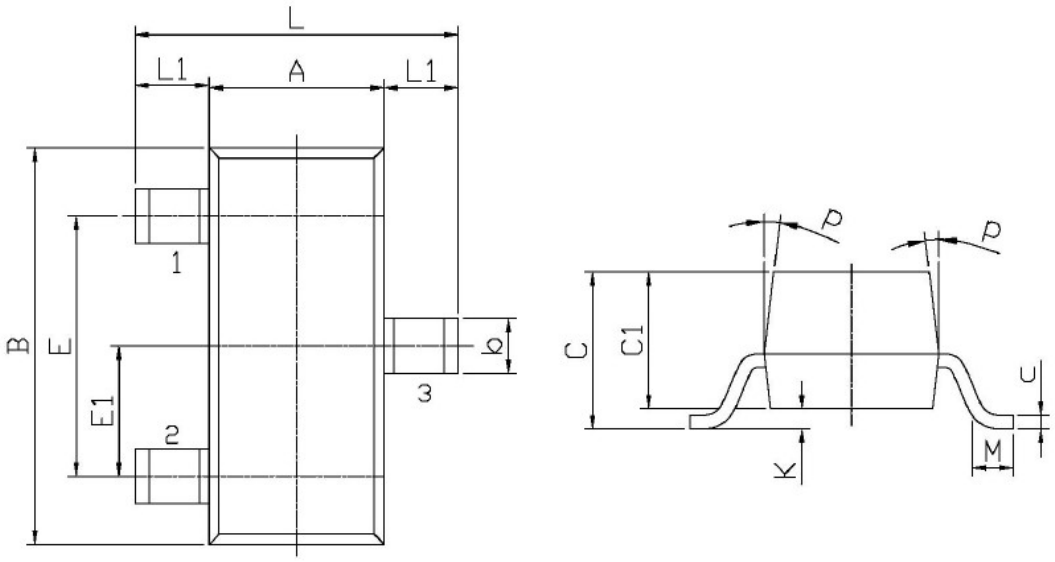


Fig.15 Transient thermal impedance from junction to ambient as a function of pulse duration; max values



●SOT-23-3 Package Outline



Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
L	2.2	2.7	C	1.30Max	
L1	0.45	0.65	C1	0.90	1.20
A	1.15	1.50	c	0.05	0.20
B	2.70	3.10	K	0	0.10
E	1.70	2.10	M	0.20MIN	
E1	0.85	1.05	P	7°	
b	0.35	0.55			

Note:

① Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate；

②Practically the current will be limited by PCB, thermal design and operating temperature. VGS=-10V.

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Revision History

Version	Date	Change
Preliminary	2025/2/9	NEW