

-40V P-Channel Power MOSFET

• General Description

It combines 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
- High GOX reliability
- Low Thermal resistance

• Application

- BLDC Motor driver
- DC-DC
- Load Switch

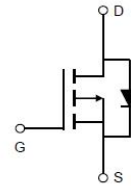
• Ordering Information:

Part NO.	ZMA390P04T
Marking	390P04
Packing Information	REEL TAPE
Basic ordering unit (pcs)	3000

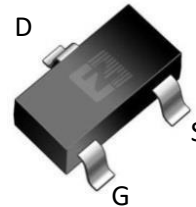
• Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		-40	V
Gate-Source Voltage	V_{GS}		± 20	V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	-3.4	A
	I_D	$T_C=75^\circ\text{C}$	-2.6	A
	I_D	$T_C=100^\circ\text{C}$	-2.2	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^\circ\text{C}$;	-13.6	A
Total Power Dissipation	P_D	$T_C=25^\circ\text{C}$	2	W
Total Power Dissipation	P_D	$T_A=25^\circ\text{C}$	0.7	W
Operating Junction Temperature	T_J		-55 to +150	$^\circ\text{C}$
Storage Temperature	T_{STG}		-55 to +150	$^\circ\text{C}$
Single Pulse Avalanche Energy	E_{AS}	$L=0.1\text{mH}$, $V_{GS}=-10\text{V}$, $R_g=25\Omega$,	5	mJ
		$L=0.5\text{mH}$, $V_{GS}=-10\text{V}$, $R_g=25\Omega$,	9	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = -40\text{V}$
 $R_{DS(ON)} = 49\text{m}\Omega$
 $I_D = -3.4\text{A}$



SOT-23-3



•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	80	$^{\circ}C/W$
Thermal resistance, junction-ambient ^①	R_{thJA}		-	180	$^{\circ}C/W$
Soldering temperature	T_{sold}		-	260	$^{\circ}C$

•Electronic Characteristics

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}	$V_{GS} = 0V, V_{DS} = -40V$			1.0	μA
Gate- Source Leakage Current	I_{GSS}	$V_{GS} = \pm 20V, V_{DS} = 0V$			100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	$V_{GS} = -10V, I_D = -3.4A$		49	70	m Ω
		$V_{GS} = -4.5V, I_D = -3A$		71	100	m Ω
Forward Transconductance	g_{FS}	$V_{DS} = -5V, I_{SD} = -1A$		3		S
Diode Forward Voltage	V_{FSD}	$V_{GS} = 0V, I_{SD} = -3.4A$			1.3	V

•Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit	
Input capacitance	C_{iss}	$f = 1MHz, V_{DS} = -25V$	-	838	-	pF	
Output capacitance	C_{oss}		-	94	-		
Reverse transfer capacitance	C_{rss}		-	70	-		
Gate Resistance	R_g	$f = 1MHz$	-	9		Ω	
Total gate charge	Q_g	$V_{DD} = -15V, I_D = -1A, V_{GS} = -10V$	-	15	-	nC	
	$Q_g(-4.5v)$		-	7.3	-		
	Gate - Source charge		Q_{gs}	-	2.3		-
	Gate - Drain charge		Q_{gd}	-	3.6		-
Turn-ON Delay time	$t_{D(on)}$	$V_{GS} = -10V, V_{DS} = -15V, R_G = 3.3\Omega, I_D = -1A$	-	9	-	ns	
Turn-ON Rise time	t_r		-	12	-	ns	
Turn-Off Delay time	$t_{D(off)}$		-	19	-	ns	
Turn-Off Fall time	t_f		-	6	-	ns	

Fig.1 Gate-Charge Characteristics

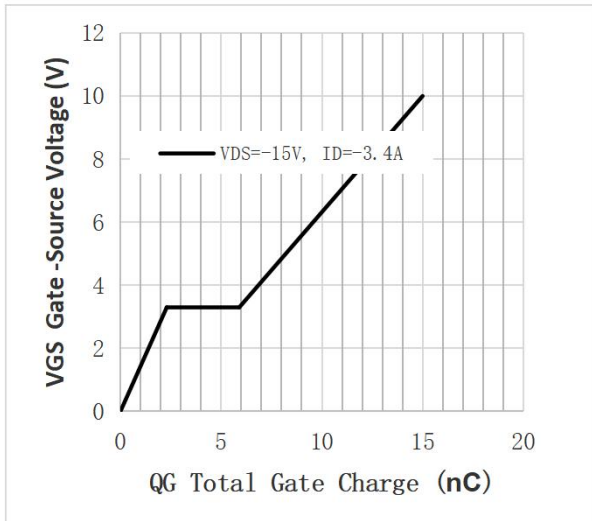


Fig.2 Capacitance Characteristics

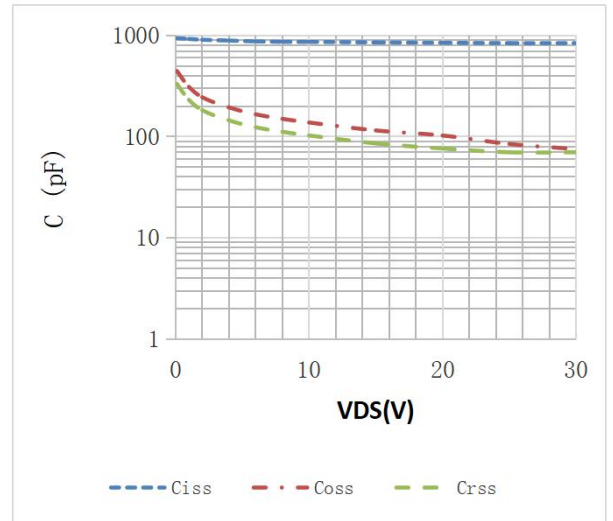


Fig.3 Power Dissipation

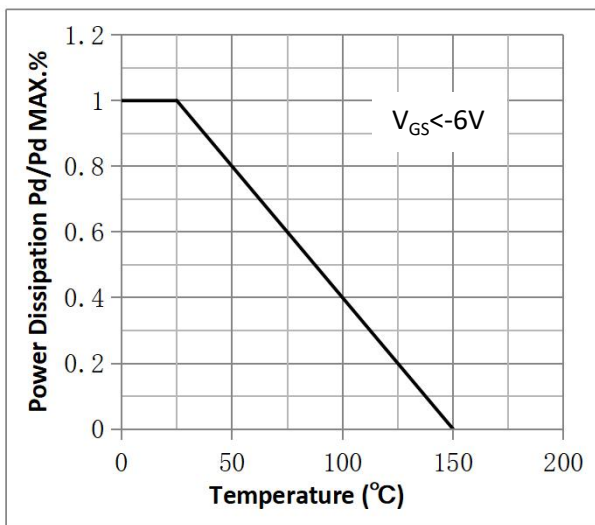


Fig.4 Typical output Characteristics

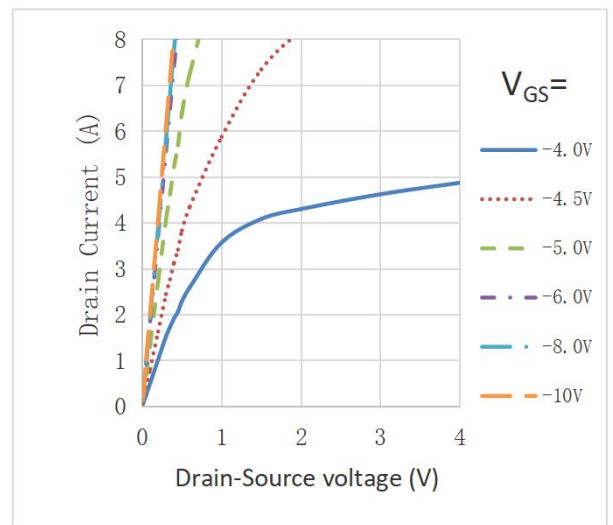


Fig.5 Threshold Voltage V.S Junction Temperature

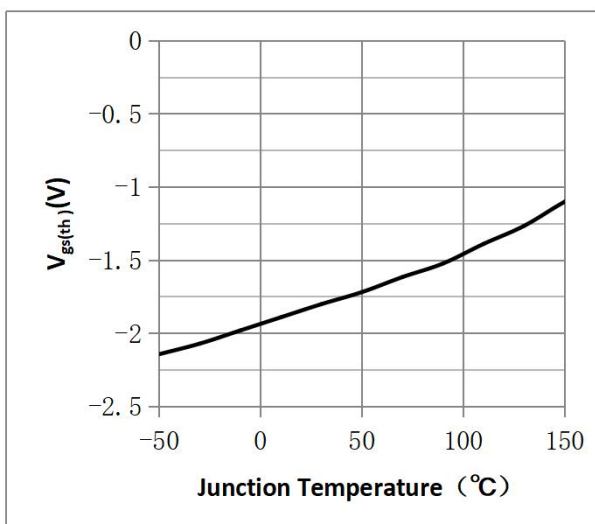


Fig.6 Resistance V.S Drain Current

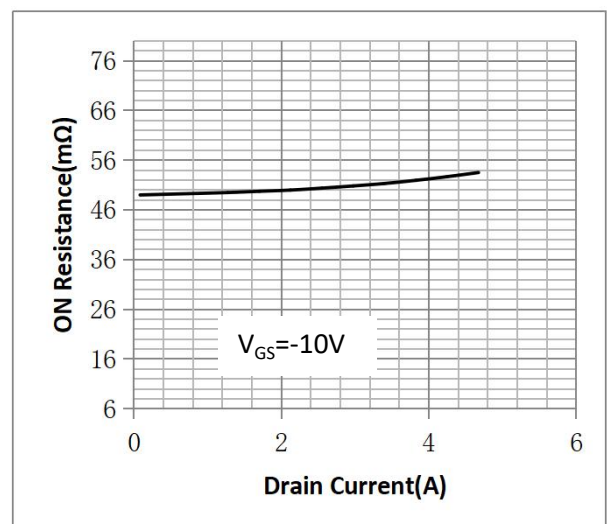


Fig.7 On-Resistance VS Gate Source Voltage

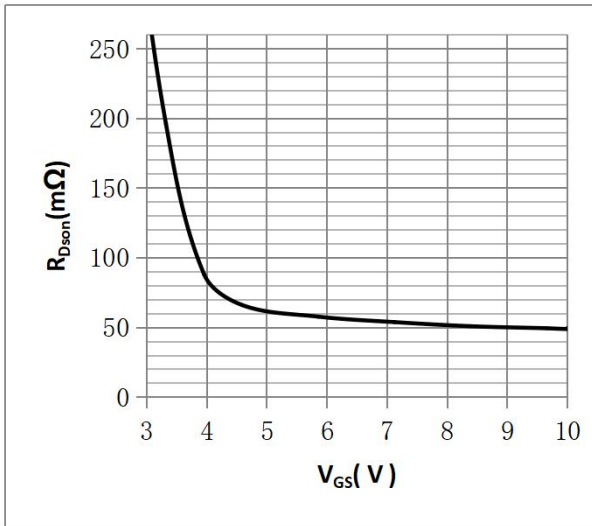


Fig.8 On-Resistance V.S Junction Temperature

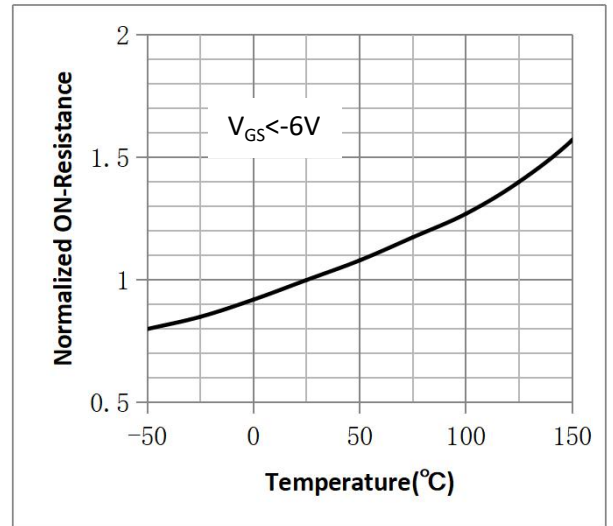


Figure 9. Diode Forward Voltage vs. Current

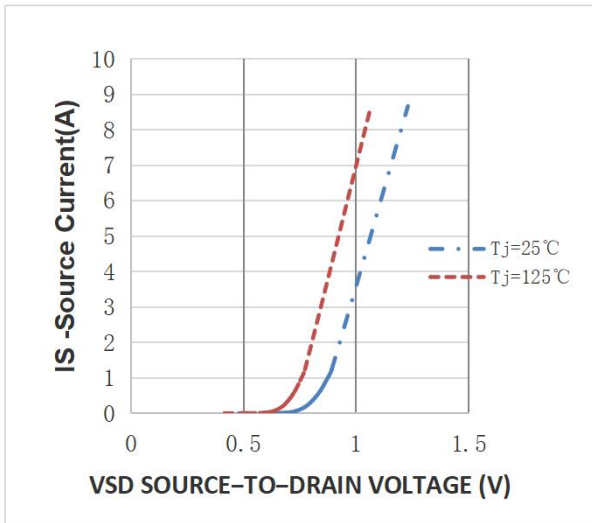


Figure 10. Transfer Characteristics

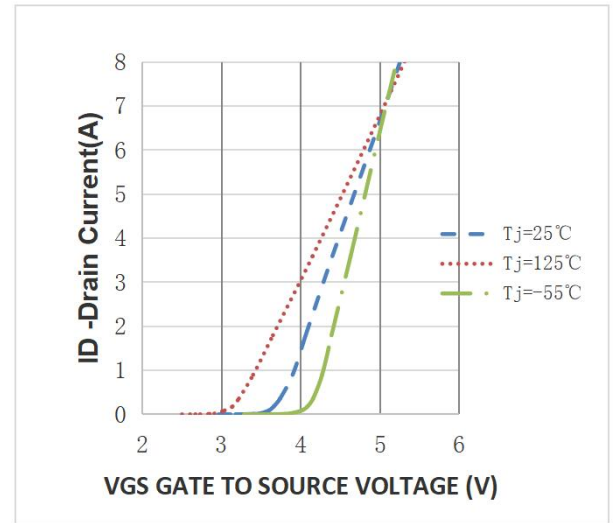


Fig.11 Safe Operating Area

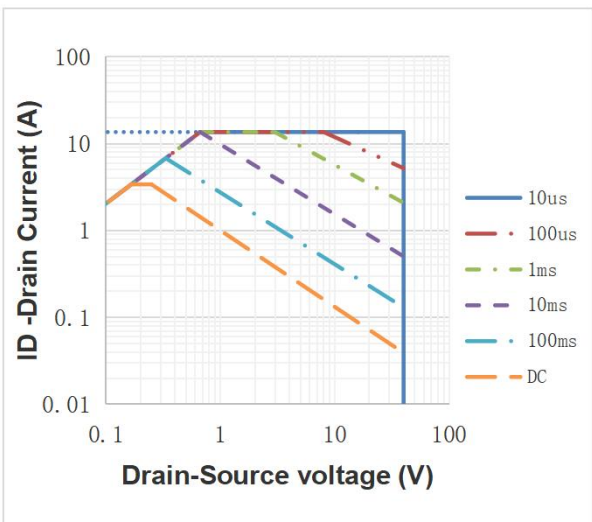
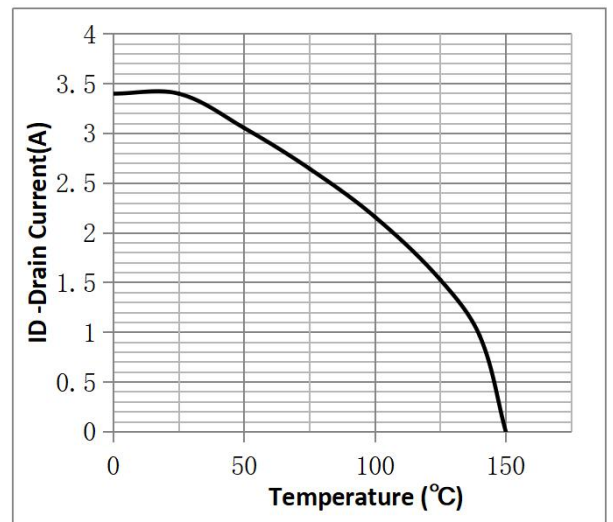
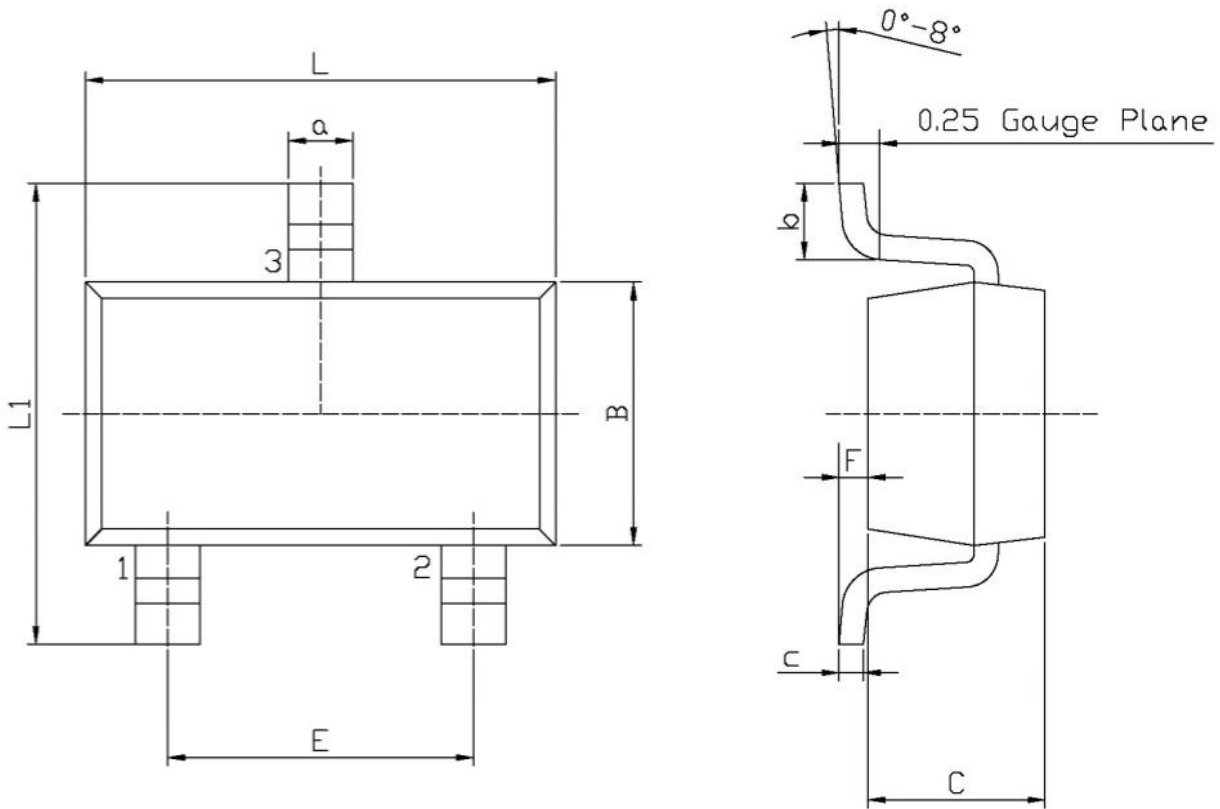


Fig.12 I_D vs. Case Temperature[Ⓢ]



•SOT-23-3 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			

Note:

- ① Device mounted on FR-4 substrate PC board, 2oz copper, with thermal bias to bottom layer 1inch square copper plate;
- ② 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	2021.12.3	NEW
B	2022.9.7	characteristics 3.ID and ID curve modified