

-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

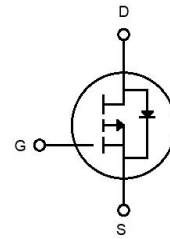
• Ordering Information:

Part NO.	ZMA040P04D
Marking	ZM040P04
Packing Information	REEL TAPE
Basic ordering unit (pcs)	2500

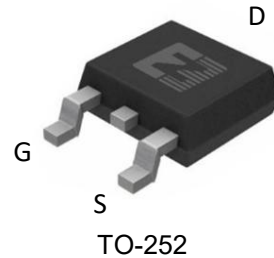
• Absolute Maximum Ratings ($T_C=25^\circ\text{C}$)

Parameter	Symbol	Conditions	Value	Unit
Drain-Source Voltage	V_{DS}		-40	V
Gate-Source Voltage ^①	V_{GS}		±20	V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	-85	A
	I_D	$T_C=75^\circ\text{C}$	-81	A
	I_D	$T_C=100^\circ\text{C}$	-70	A
Pulsed Drain Current	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}$; $T_{mb} = 25^\circ\text{C}$;	-340	A
Total Power Dissipation	P_D	$T_C=25^\circ\text{C}$	107	W
Total Power Dissipation	P_D	$T_A=25^\circ\text{C}$	2.4	W
Operating Junction Temperature	T_J		-55 to +175	°C
Storage Temperature	T_{STG}		-55 to +175	°C
Single Pulse Avalanche Energy	E_{AS}	L=0.1mH, $V_{GS}=-10\text{V}$, $R_g=25\Omega$,	240	mJ
		L=0.5mH, $V_{GS}=-10\text{V}$, $R_g=25\Omega$,	504	mJ
ESD Level (HBM)	CLASS 2			

• Product Summary



$V_{DS} = -40\text{V}$
 $R_{DS(ON)} = 4\text{m}\Omega$
 $I_D = -85\text{A}$



•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}		-	1.4	°C/W
Thermal resistance, junction-ambient ^②	R_{thJA}		-	62	°C/W
Soldering temperature	T_{sold}		-	260	°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	$R_{DS(ON)}$	$V_{GS} = -10V, I_D = -40A$		4	5.2	m Ω
		$V_{GS} = -4.5V, I_D = -25A$		7	8.4	m Ω
Forward Transconductance	g_{FS}	$V_{DS} = -5V, I_{SD} = -20A$		28		S
Diode Forward Voltage	V_{FSD}	$V_{GS} = 0V, I_{SD} = -40A$			1.3	V

•Dynamic characteristics

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	C_{iss}	$f = 1MHz, V_{DS} = -25V$	-	10120	-	pF
Output capacitance	C_{oss}		-	762	-	
Reverse transfer capacitance	C_{rss}		-	646	-	
Gate Resistance	R_g	$f = 1MHz$	-	3		Ω
Total gate charge	Q_g	$V_{DD} = -15V, I_D = -20A, V_{GS} = -10V$	-	172	-	nC
	$Q_g(-4.5v)$		-	83	-	
Gate - Source charge	Q_{gs}		-	21	-	
Gate - Drain charge	Q_{gd}		-	32	-	
Turn-ON Delay time	$t_{D(on)}$		-	44	-	
Turn-ON Rise time	t_r	$V_{GS} = -10V, V_{DS} = -15V,$	-	27	-	ns
Turn-Off Delay time	$t_{D(off)}$	$R_G = 3.3\Omega, I_D = -20A$	-	80	-	ns
Turn-Off Fall time	t_f		-	79	-	ns

Fig.1 Gate-Charge Characteristics

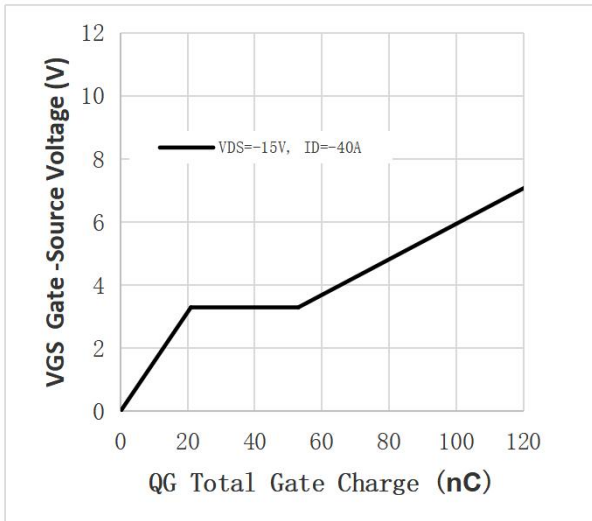


Fig.2 Capacitance Characteristics

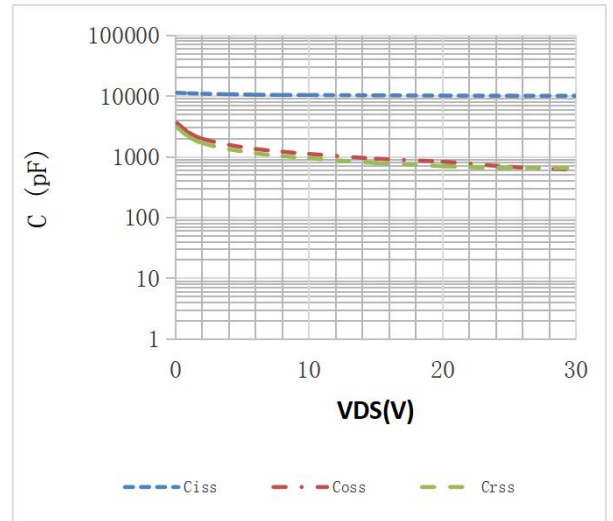


Fig.3 Power Dissipation

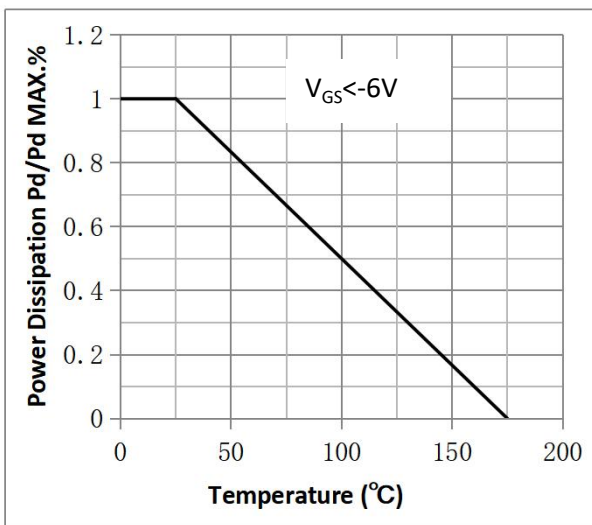


Fig.4 Typical output Characteristics

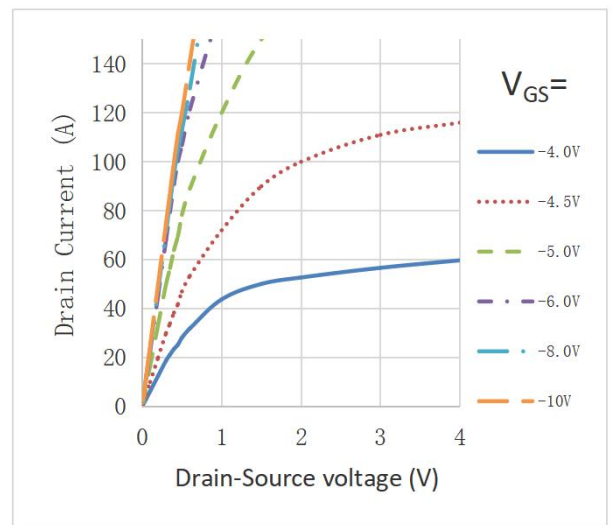


Fig.5 Threshold Voltage V.S Junction Temperature

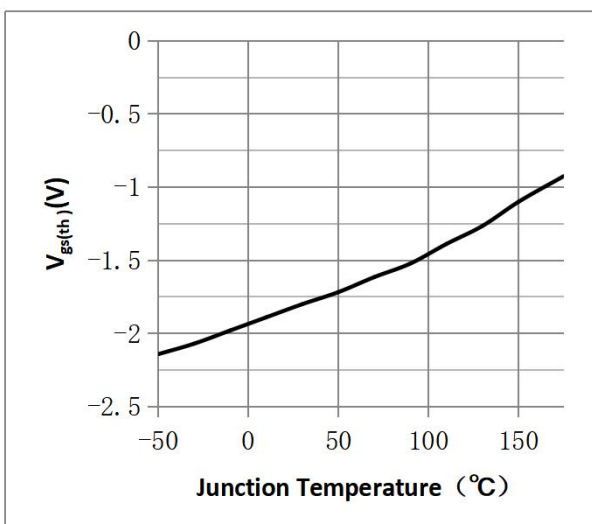


Fig.6 Resistance V.S Drain Current

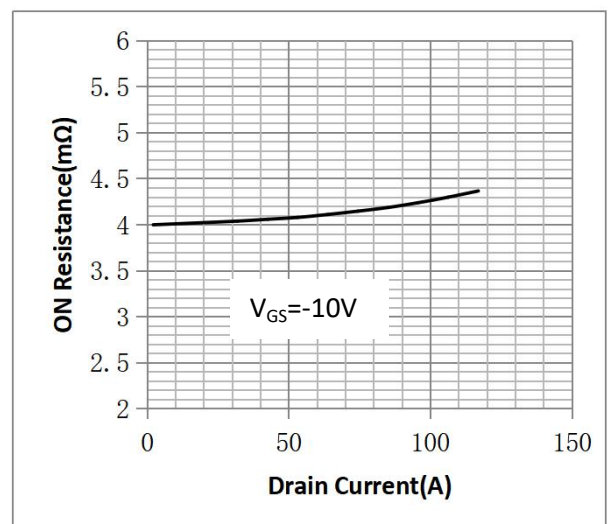


Fig.7 On-Resistance VS Gate Source Voltage

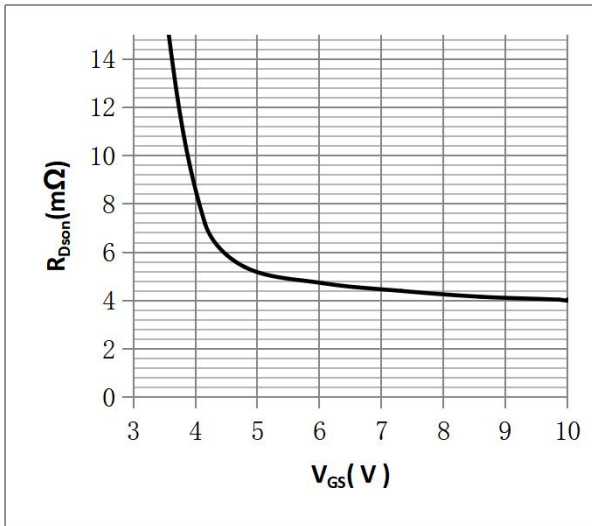


Fig.8 On-Resistance V.S Junction Temperature

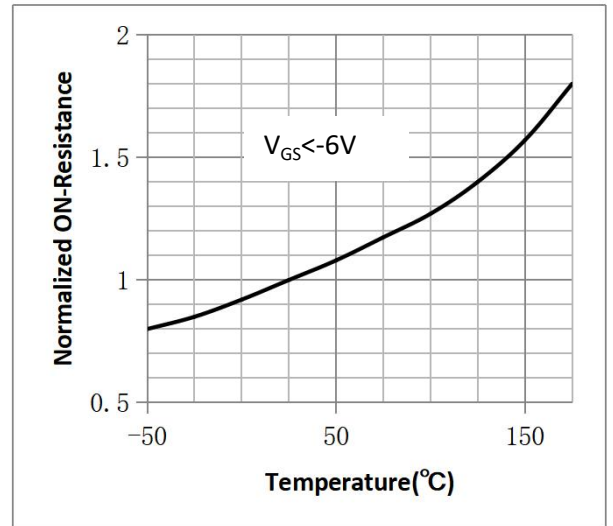


Figure 9. Diode Forward Voltage vs. Current

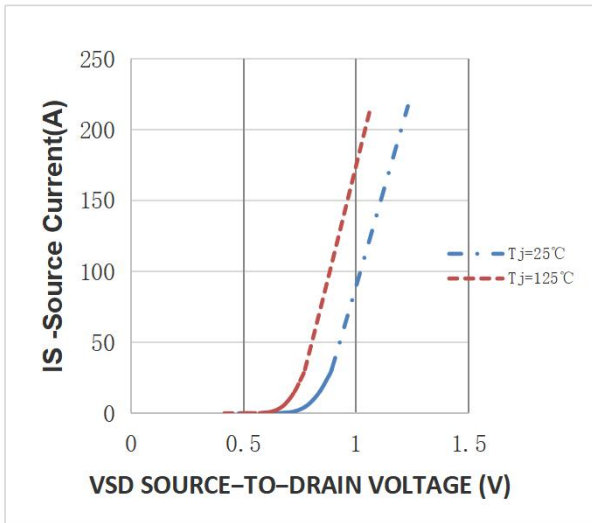


Figure 10. Transfer Characteristics

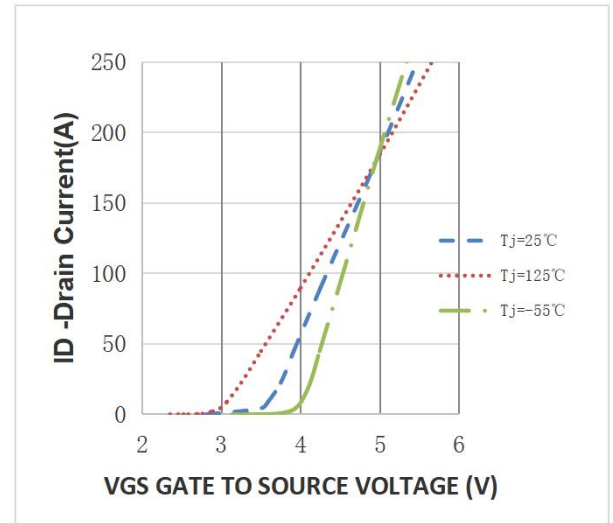


Fig.11 Safe Operating Area

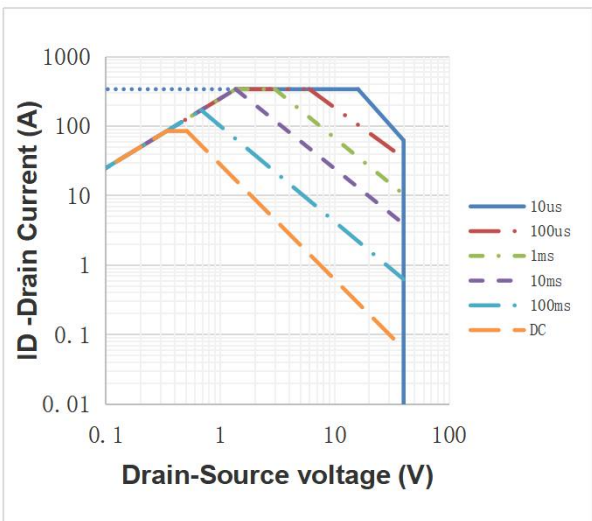
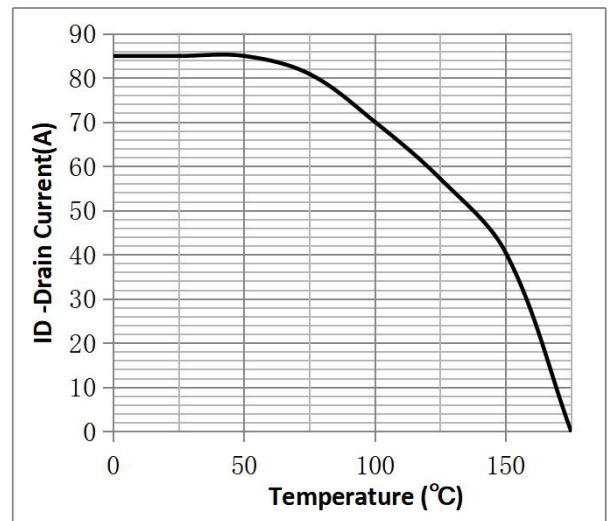
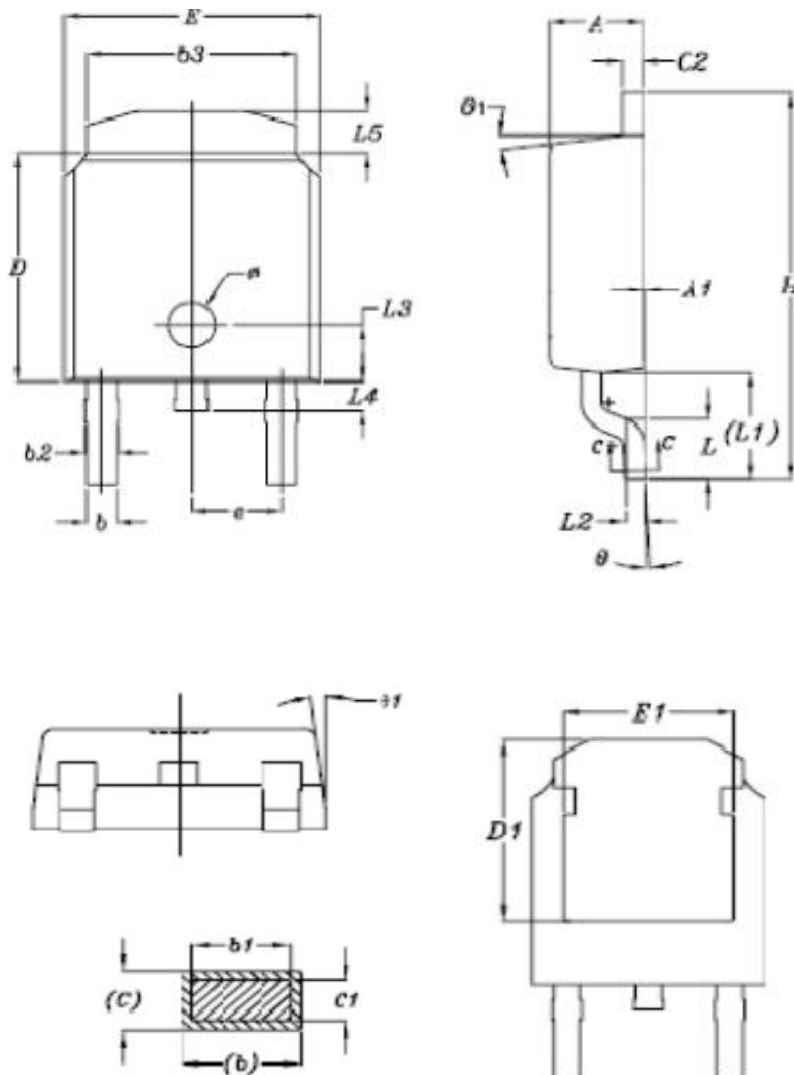


Fig.12 ID vs. Junction Temperature^③



•TO-252 Package Outline

SYMBOL	min	max	SYMBOL	min	max
A	2.18	2.39	E1	4.30	4.50
A1	-	0.13	e	2.29BSC	
b	0.70	0.89	H	9.4	10.41
b2	0.76	1.14	L	1.4	1.78
b3	5.10	5.50	L1	2.6	2.9
C	0.46	0.61	L2	0.51BSC	
c2	0.46	0.89	L4	0.6	0.9
D	5.97	6.22	L5	0.89	1.27
D1	5.20	5.40	θ	1°	5°
E	6.35	6.73			



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	2021.2.3	
B	2021.11.7	1.Modified Typical output Characteristics curve
C	2022.9.6	1.Add Reach,HF figure
D	2022.10.30	1.ID figure modify 2.Rthjc limit modify 3. Add Dynamic characteristics
E	2023.10.10	1.Modified package outline