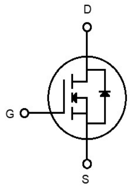
60V N-Channel Planar Power MOSFET

• General Description

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

• Product Summary



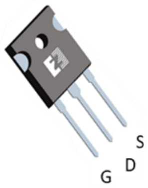
V_{DS}= 60V

$R_{DS(ON)}$ = 4.9mΩ

I_D= 199A

• Features

- ■AEC-Q101 Qualified
- ■Low $R_{DS(ON)}$ to minimize conductive loss
- ■Low Gate Charge for fast switching
- ■Low Thermal resistance



TO-247

•Application

- ■BLDC Motor driver
- ■DC-DC
- ■Load Switch

•Ordering Information:

Part NO.	ZMPA060N06C
Marking	ZMP060N06
Packing Information	TUBE
Basic ordering unit (pcs)	400

•Absolute Maximum Ratings (T$_A$=25°C,unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-Source Voltage	V_{DS}		-	60	V
Gate-Source Voltage[①]	V_{GS}		-20	20	V
Continuous Drain Current	I_D	V_{GS}=10V,T_C=25℃	-	199	A
	I_D	V_{GS}=10V,T_C=75°C	-	162	A
	I_D	V_{GS}=10V,T_C=100°C	-	141	A
Pulsed Drain Current[①]	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	796	A
Total Power Dissipation	P_D	T_C=25℃	-	500	W
Total Power Dissipation	P_D	T_A=25℃	-	3.8	W
Operating Junction Temperature	T_J		-55	175	℃
Storage Temperature	T_{STG}		-55	175	℃
Single Pulse Avalanche Energy	E_{AS}	L=0.5mH, V_{GS}=10V, Rg=25Ω,	-	2304	mJ
ESD Level (HBM)		CLASS 2			

●Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.3	°C/W
Thermal resistance, junction-ambient	R_{thJA} ②	-	-	40	°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	60	-	-	V
Gate Threshold Voltage	$VGS_{(TH)}$	V_{GS}=V_{DS}, I_D=250uA, Tj=25℃	1	1.5	2	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}=60V, Tj=25°C	-	-	1	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=20A, Tj=25°C	-	4.9	6	mΩ
		V_{GS}=10V, I_D=20A, Tj=175°C	-	10.3	-	mΩ
		V_{GS}=4.5V, I_D=10A, Tj=25°C	-	6.7	8.0	mΩ
		V_{GS}=4.5V, I_D=10A, Tj=175°C	-	14.1	-	mΩ
Forward Transconductance	g_{FS}	V_{DS} =5V, I_{SD} = 10A	-	30	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =0V, I_{SD} = 20A	-	-	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}=30V, V_{GS}=0V	-	6423	-	pF
Output capacitance	Coss		-	1327	-	
Reverse transfer capacitance	Crss		-	358	-	
Gate Risistance	Rg	f = 1MHz	-	1.2	-	Ω
Total gate charge	Qg	V_{DD} = 30V,I_D = 20A, V_{GS} = 10V	-	215	-	nC
Gate - Source charge	Qgs		-	17	-	
Gate - Drain charge	Qgd		-	58	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=10V,V_{DS}=30V,R_G =3.3 Ω, I_D =20A	-	28	-	ns
Turn-ON Rise time	t_r		-	80	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	102	-	ns
Turn-Off Fall time	t_f		-	35	-	ns
Reverse Recovery Time	t_{rr}	V_{DD}=30V, dI_S/dt = 100A/us, I_S=20A	-	105	-	ns
Reverse Recovery Charge	Q_{rr}		-	275	-	nC

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

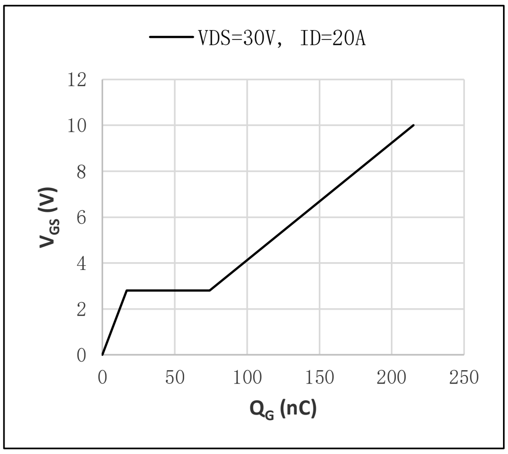


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage;Typical values;Tj=25°C

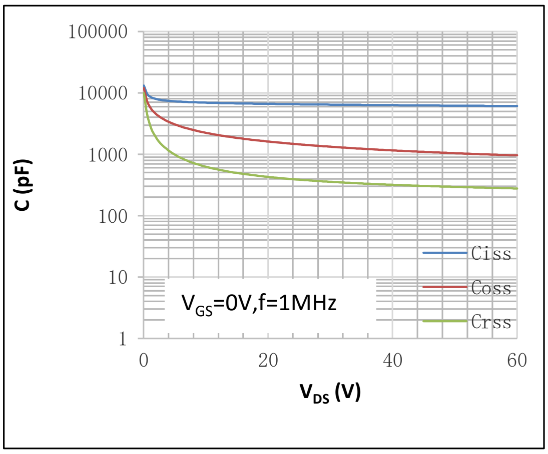


Fig.3 Output characteristics: drain current as a function of drain-source voltage;Typical values; Tj=25°C

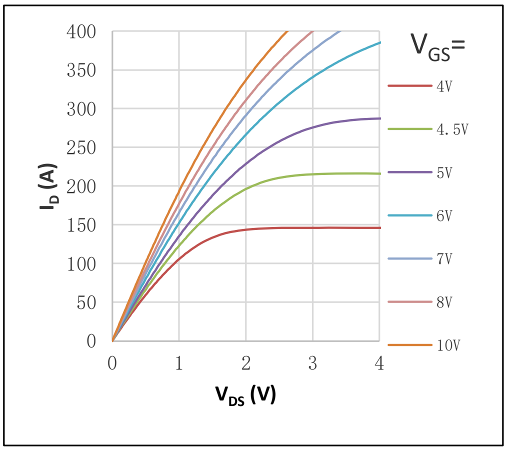


Fig.4 Output characteristics: drain current as a function of drain-source voltage;Typical values:Expanded curve;Tj=25°C

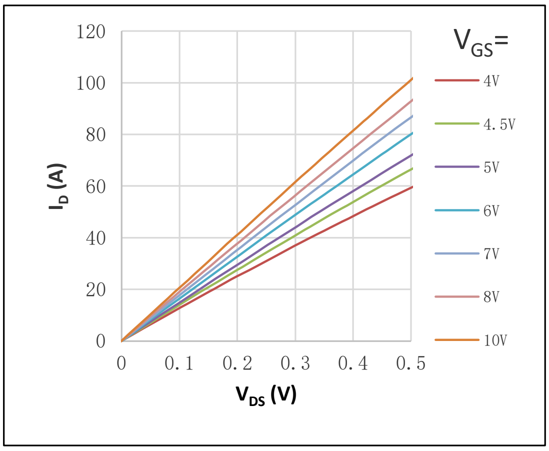


Fig.5 Gate-source threshold voltage as a function of junction temperature;Typical values

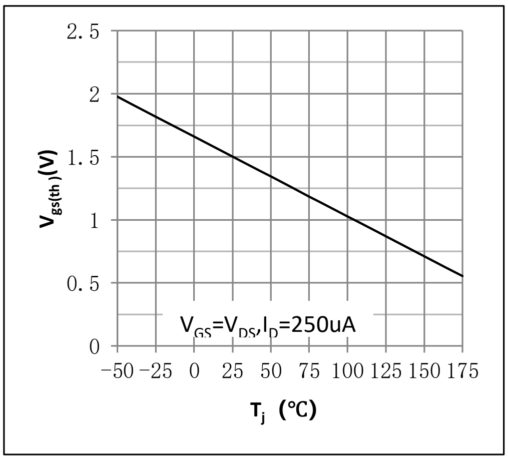


Fig.6 Drain-source on-state resistance as a function of drain current;Typical values;Tj=25°C

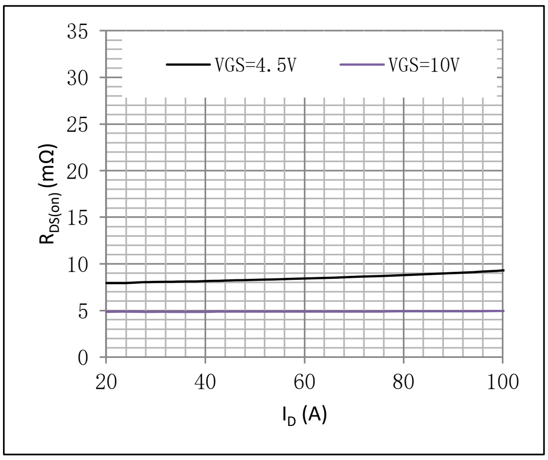


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

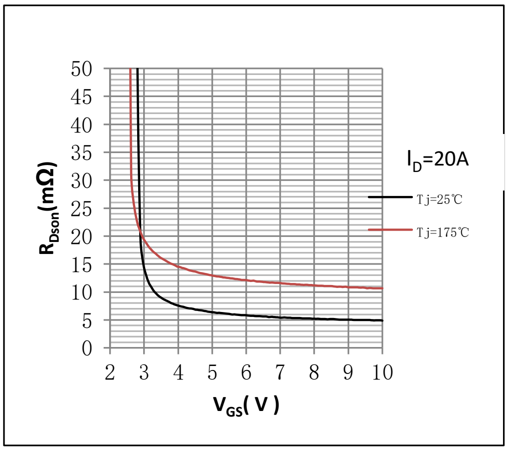


Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance=RDSon/RDSon(25℃)

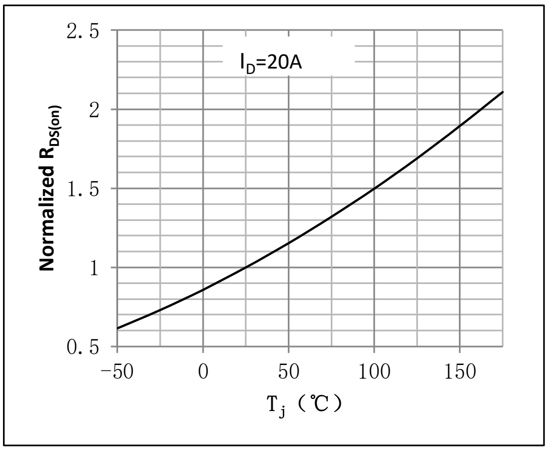


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

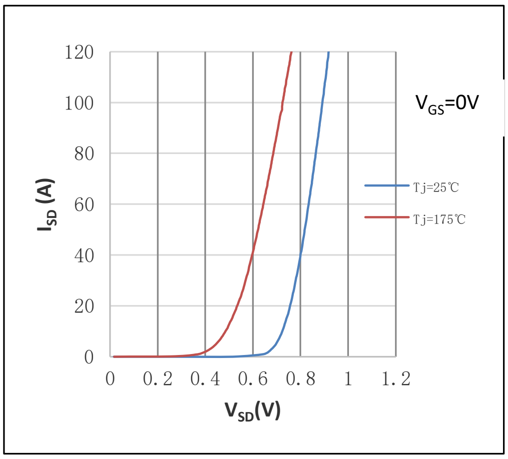


Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

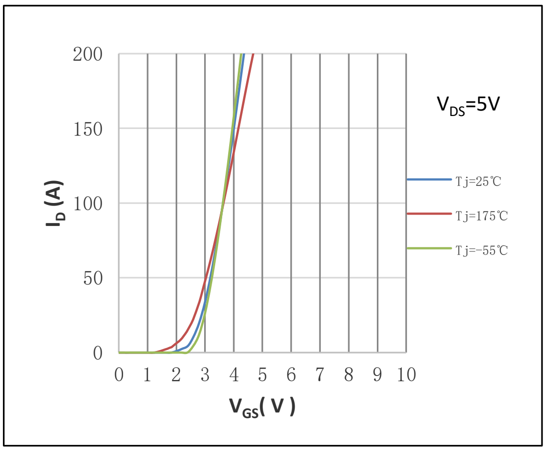


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

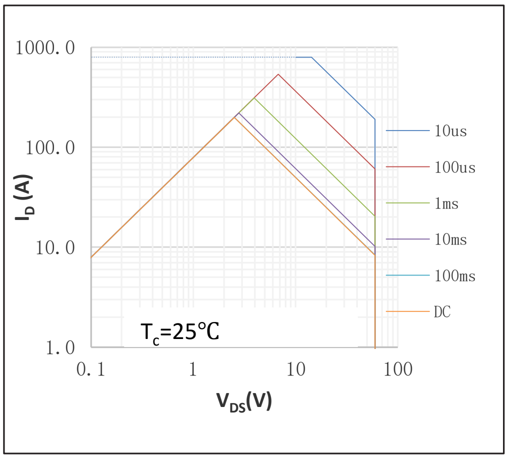


Fig.12 Continuous drain current as a function of case temperaturease[③];Calculative values

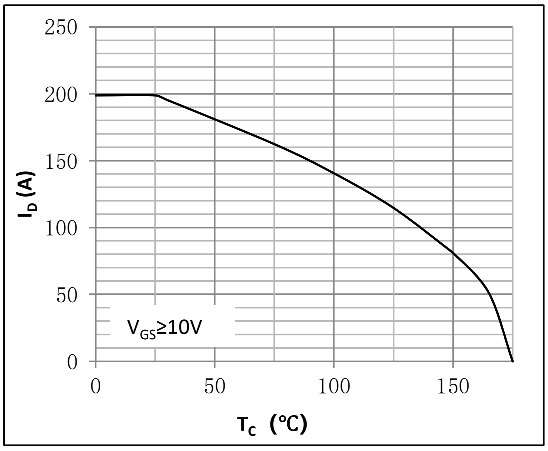


Fig.13 Drain-source breakdown voltage as a function of junction temperature;Typical values
Normalized BVDSS=BVDSS/BVDSS(25°C)

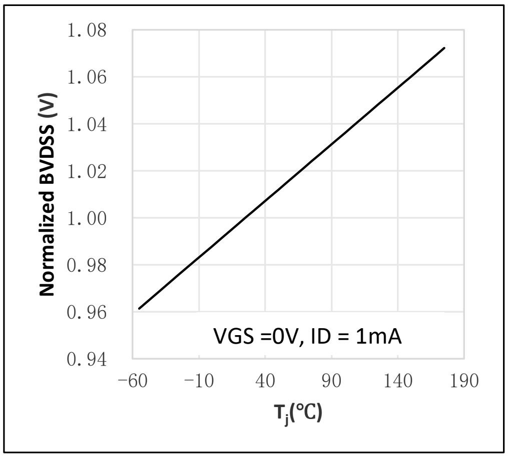


Fig.14 Normalized total power dissipation as a function of case temperature;Calculative values
Normalized Power Dissipation=Pd/Pd(25°C)

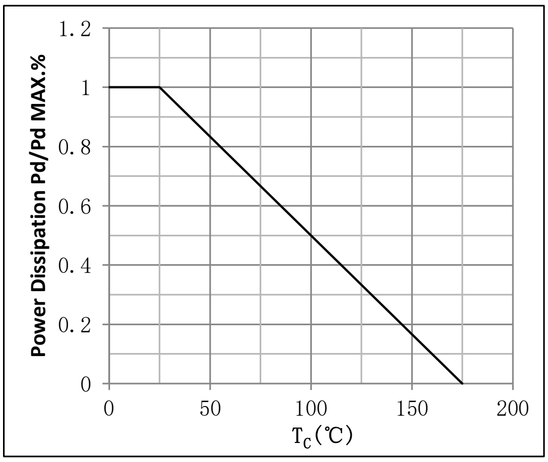
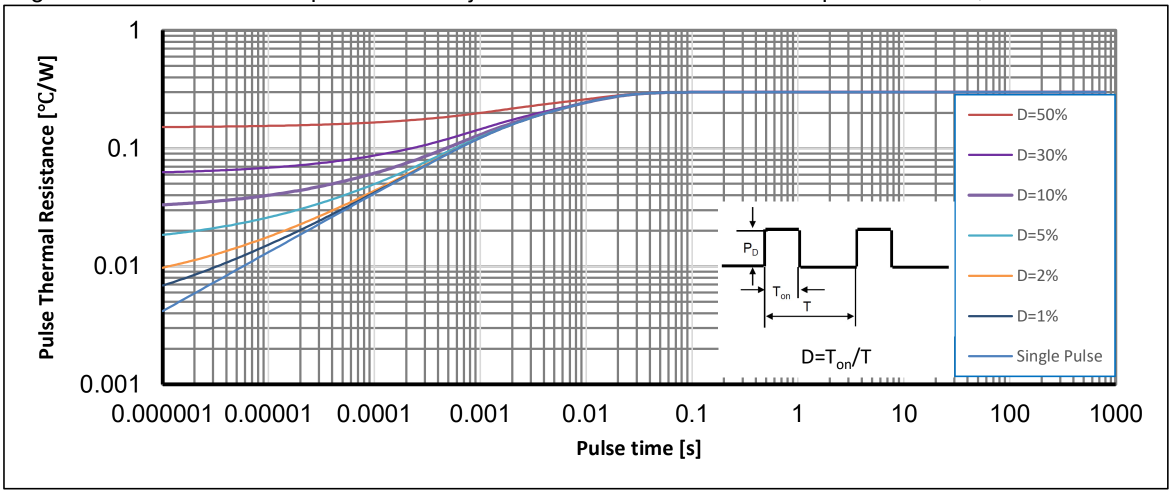
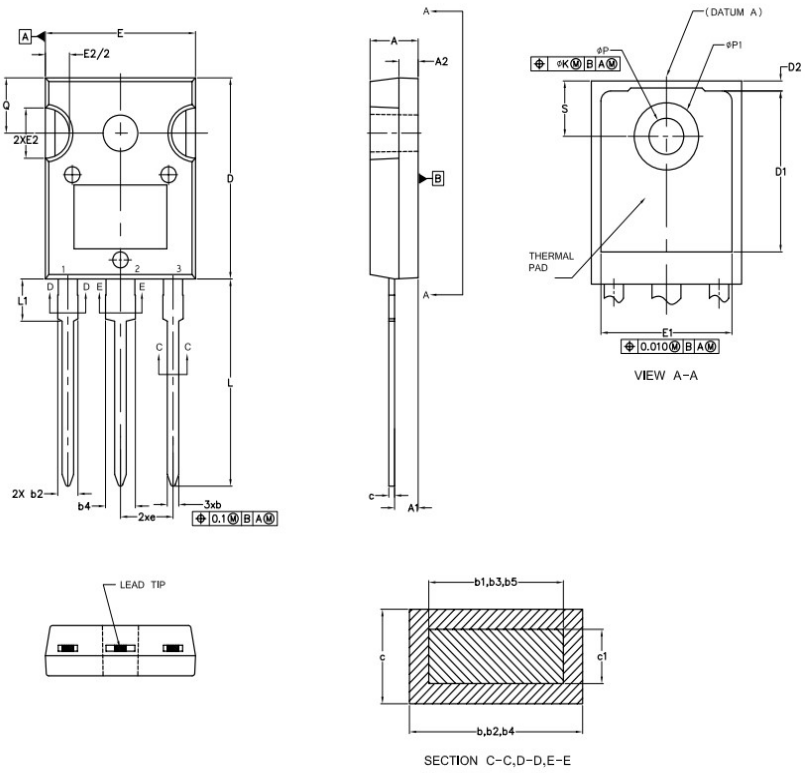


Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values



●TO-247 Package Outline



SYMBOLS	DIMENSIONS			
	mm		inch	
	MIN.	MAX.	MIN.	MAX.
A	4.83	5.13	0.190	0.20
A1	2.21	2.59	0.087	0.102
A2	1.50	2.49	0.059	0.098
b	0.99	1.40	0.039	0.055
b1	0.99	1.35	0.039	0.053
b2	1.65	2.39	0.065	0.094
b3	1.65	2.34	0.065	0.092
b4	2.59	3.43	0.102	0.135
b5	2.59	3.38	0.102	0.133
c	0.38	0.89	0.015	0.035
c1	0.38	0.84	0.015	0.033
D	19.71	20.70	0.776	0.815
D1	13.08	——	0.515	——
D2	0.51	1.35	0.020	0.053
E	15.29	15.87	0.602	0.625
E1	13.46	——	0.530	——
E2	4.52	5.49	0.178	0.216
e	5.46BSC		0.215BSC	
L	19.57	21.00	0.780	0.827
L1	3.71	4.29	0.146	0.169
φP	3.56	3.66	0.140	0.144
φP1	——	7.39	——	0.291
Q	5.31	5.69	0.209	0.224
S	5.51BSC		0.217BSC	

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	2025/4/7	New