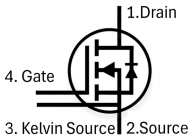
• General Description

This silicon carbide Power MOSFET device has been developed using ZMJ's advanced 2nd generation SiC MOSFET technology. The device features a very low RDS(on) over the entire temperature range combined with low capacitances and very high switching operations. It improves application performance in frequency, energy efficiency, system size and weight reduction.

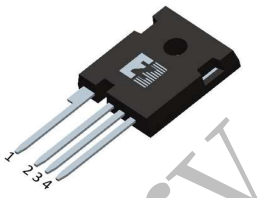
• Product Summary



V_{DS}= 1200V
$R_{DS(ON)}$ = 37mΩ
I_D= 54A

• Features

■High Blocking Voltage
■High Speed Switching With Low Capacitances
■Low $R_{DS(ON)}$ to Minimize Conductive Loss
■Low Gate Charge For Fast Switching
■Low Thermal Resistance
■100% Avalanche Tested
■AEC-Q101 Qualified



TO-247-4

•Application

■Motor Drives
■On Board Charger
■DC-DC
■Auxiliary Drives

•Ordering Information:

Part NO.	ZMCA040R120C4
Marking	ZMC040R120
Packing Information	TUBE
Basic ordering unit (pcs)	600

•Absolute Maximum Ratings (T_A=25°C,unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-Source Voltage	V_{DS}		-	1200	V
Gate-Source Voltage①	V_{GS}	Transient Voltage	-10	25	V
	V_{GS}	Static Voltage	-10	24	V
Recommended turn on gate voltage	$V_{GS(on)}$		15	18	V
Recommended turn off gate voltage	$V_{GS(off)}$		-4	0	V
Continuous Drain Current	I_D	V_{GS}=18V,T_C=25°C	-	54	A
	I_D	V_{GS}=18V,T_C=75°C	-	44	A
	I_D	V_{GS}=18V,T_C=100°C	-	38	A
Pulsed Drain Current ①	I_{DM}	Pulsed; t_p ≤ 10 μs; T_C = 25 °C;	-	216	A
Total Power Dissipation	P_D	T_C=25℃	-	221	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}=18V, Rg=25Ω,	-	529	mJ
ESD Level (HBM)	CLASS 2				

•Thermal resistance

Parameter	Symbol	Min.	Typ.	Max.	Unit
Thermal resistance, junction - case	R_{thJC}	-	-	0.68	°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	1200	-	-	V
Gate Threshold Voltage	$VGS_{(TH)}$	V_{GS}=V_{DS}, I_D=5mA	2	2.8	4	V
Drain-Source Leakage Current	I_{DSS}	V_{GS}=0V, V_{DS}=1200V	-	-	10	uA
Gate- Source Leakage Current	I_{GSS}	V_{GS}=-10V, V_{DS} =0V	-	-	-100	nA
	I_{GSS}	V_{GS}=25V, V_{DS} =0V	-	-	100	nA
Static Drain-source On Resistance	$R_{DS(ON)}$	V_{GS}=18V, I_D=30A, Tj=25°C	-	37	44	mΩ
		V_{GS}=18V, I_D=30A, Tj=175°C	-	62.5	-	mΩ
		V_{GS}=15V, I_D=30A, Tj=25°C	-	44	-	mΩ
Forward Transconductance	g_{FS}	V_{DS} =10V, I_{SD} =30A	-	7.5	-	S
Diode Forward Voltage	V_{FSD}	V_{GS} =-4V,I_{SD} =30A	-	4.4	5	V

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

Parameter	Symbol	Condition	Min.	Typ.	Max.	Unit
Input capacitance	Ciss	f = 100KHz, V_{DS}=800V, V_{GS}=0V	-	2226	-	pF
Output capacitance	Coss		-	95	-	
Reverse transfer capacitance	Crss		-	3	-	
Output Charge	Q_{oss}	f = 100KHz,V_{GS}=0V, V_{DS}=0V to 800V	-	131	-	nC
Coss Stored Energy	E_{oss}		-	36	-	uJ
Gate Risistance	Rg	f = 1MHz	-	0.9	-	Ω
Total gate charge	Qg	V_{DD} = 800V,I_D = 30A, V_{GS} = -4V/18V	-	87.1	-	nC
Gate - Source charge	Qgs		-	27.5	-	
Gate - Drain charge	Qgd		-	29.3	-	
Turn-ON Delay time	$t_{D(on)}$	V_{GS}=-4V/18V,V_{DS}=800V,R_G =10Ω, I_D =30A	-	18	-	ns
Turn-ON Rise time	t_r		-	36	-	ns
Turn-Off Delay time	$t_{D(off)}$		-	48	-	ns
Turn-Off Fall time	t_f		-	71	-	ns
Turn-On Energy	Eon		-	1068	-	uJ
Turn-Off Energy	Eoff		-	1080	-	uJ
Reverse Recovery Time	t_{rr}	V_{DD}=100V, dI_S/dt = 260A/us, I_S=30A	-	24	-	ns
Reverse Recovery Charge	Q_{rr}		-	50	-	nC

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

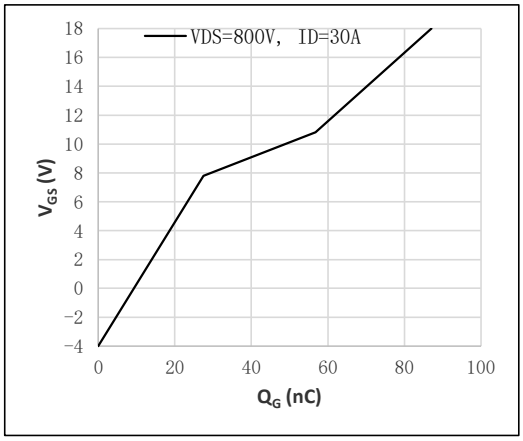


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage;Typical values;Tj=25°C

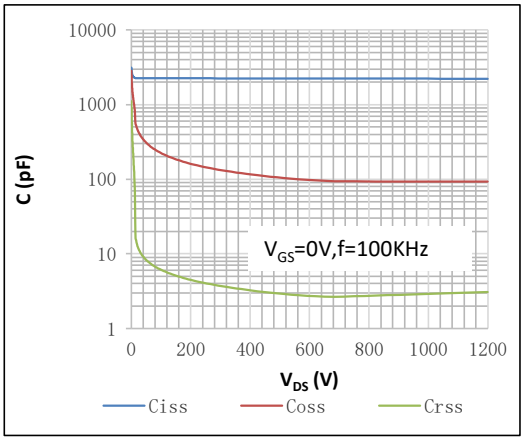


Fig.3 Output characteristics: drain current as a function of drain-source voltage;Typical values; Tj=25°C

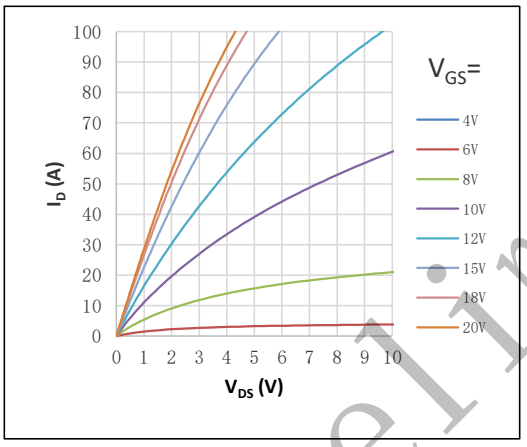


Fig.4 Output characteristics: drain current as a function of drain-source voltage;Typical values:Expanded curve;Tj=25°C

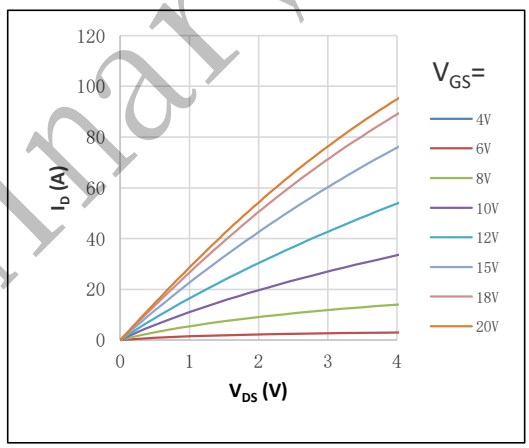


Fig.5 Gate-source threshold voltage as a function of junction temperature;Typical values

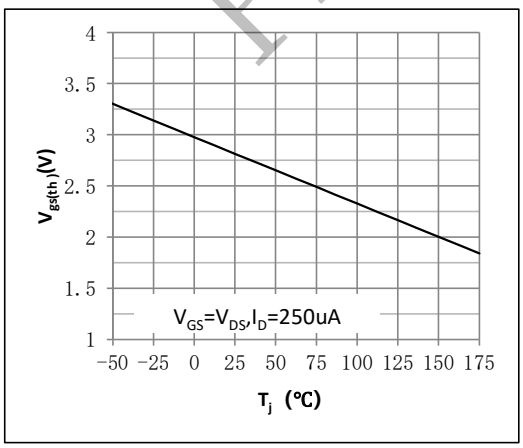


Fig.6 Drain-source on-state resistance as a function of drain current;Typical values;Tj=25°C

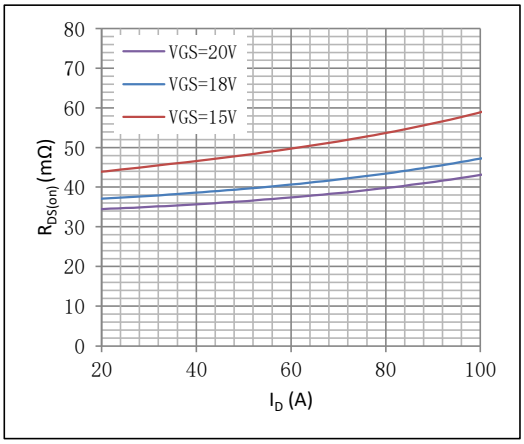


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

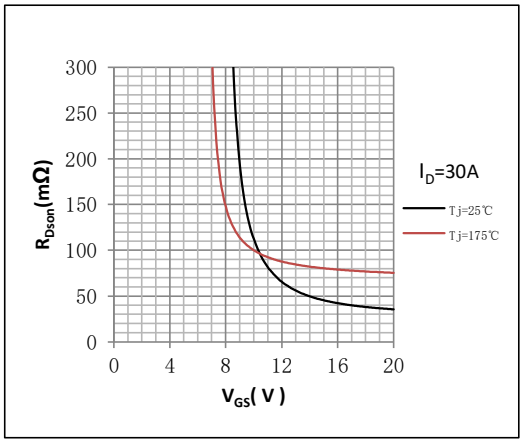


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

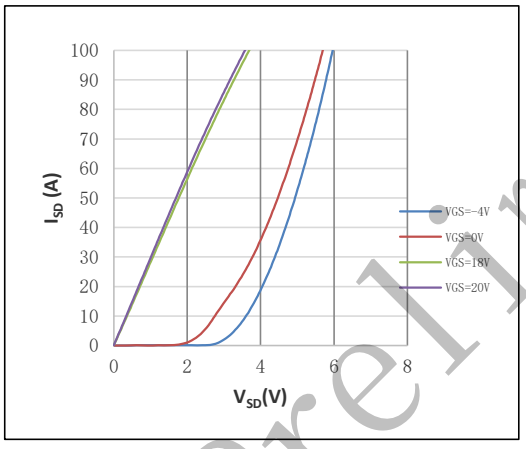


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

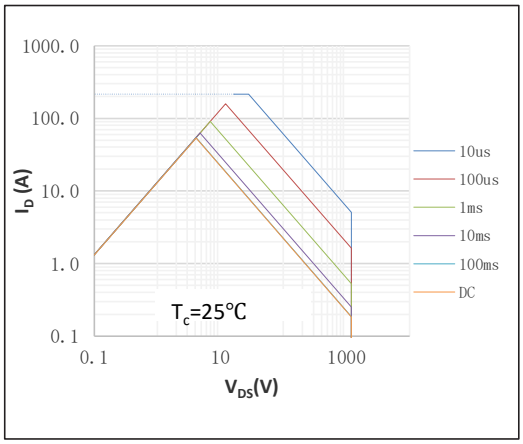


Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance=RDSon/RDSon(25℃)

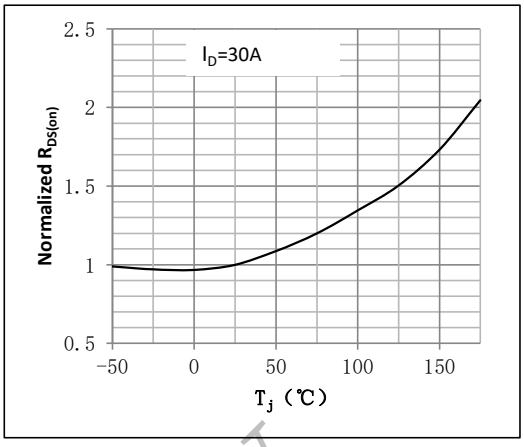


Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

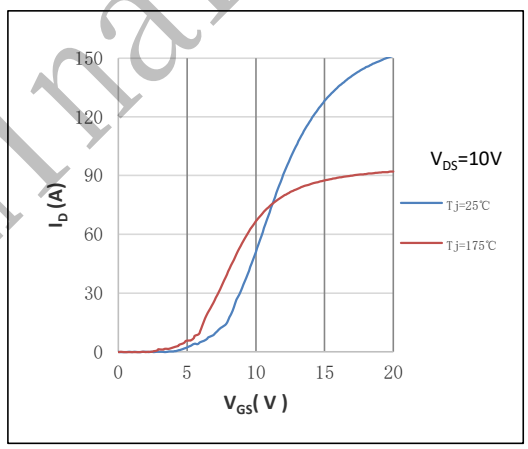


Fig.12 Continuous drain current as a function of case temperature[3];Calculative values

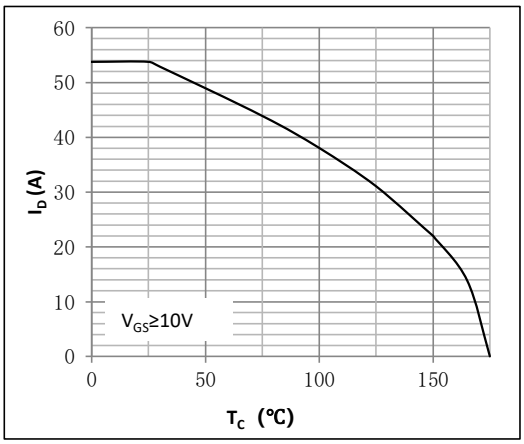


Fig.13 Drain-source breakdown voltage as a function of junction temperature;Typical values
Normalized BVDSS=BVDSS/BVDSS(25°C)

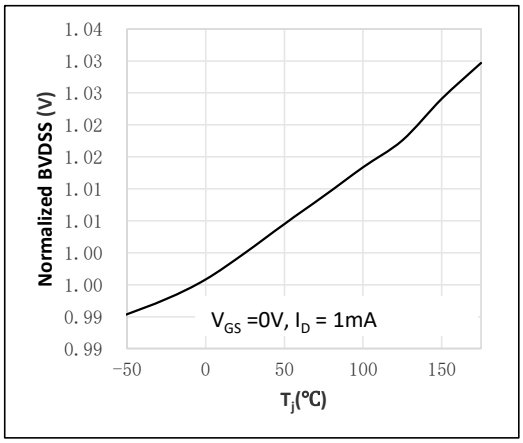


Fig.14 Normalized total power dissipation as a function of case temperature;Calculative values
Normalized Power Dissipation=Pd/Pd(25°C)

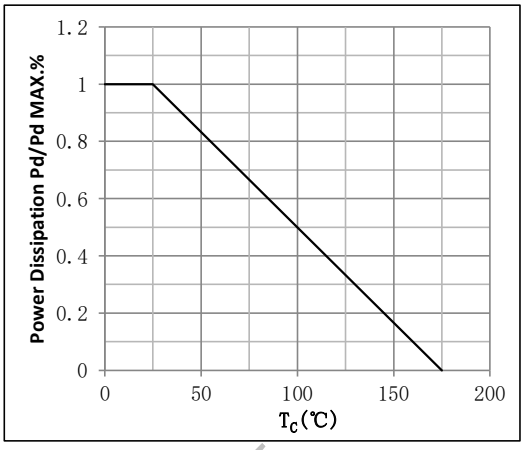


Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

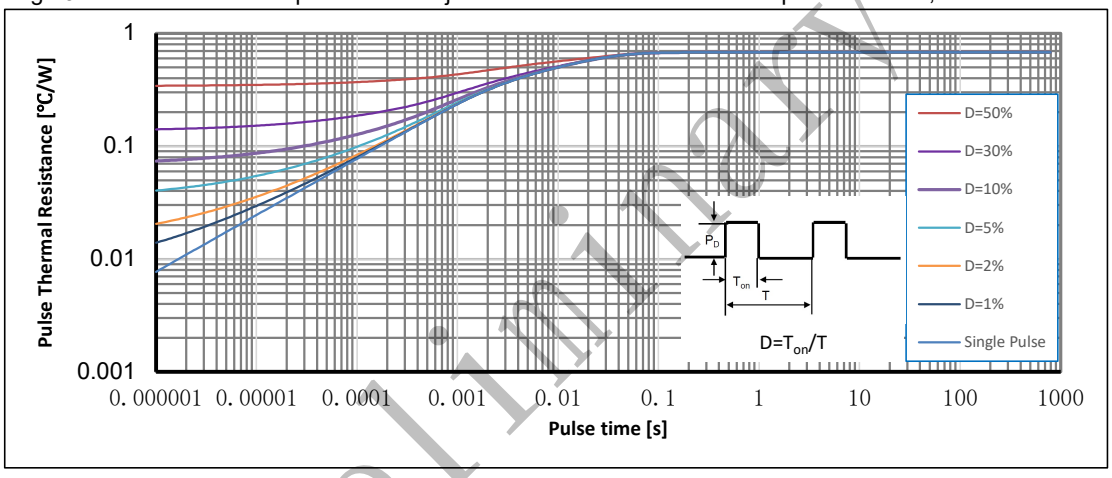
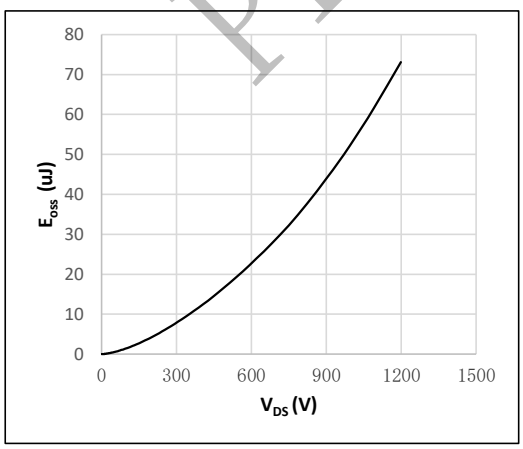
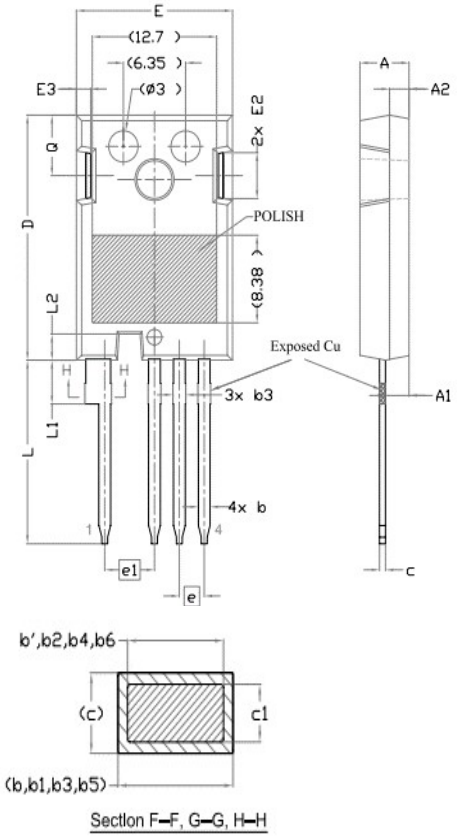
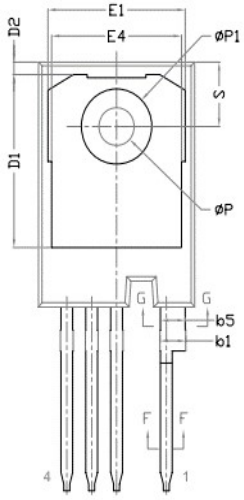


Fig.16 Output capacitor stored energy as a function of drain-source voltage;Typical values;
Tj=25°C



●TO-247-4 Package Outline





SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	4.83	5.02	5.21
A1	2.29	2.41	2.54
A2	1.91	2.00	2.16
b'	1.07	1.20	1.28
b	1.07	1.20	1.33
b1	2.39	2.67	2.94
b2	2.39	2.67	2.84
b3	1.07	1.30	1.60
b4	1.07	1.30	1.50
b5	2.39	2.53	2.69
b6	2.39	2.53	2.64
c	0.55	0.60	0.68
c1	0.55	0.60	0.65
D	23.30	23.45	23.60
D1	16.25	16.55	17.65
D2	0.95	1.19	1.25
E	15.75	15.94	16.13
E1	13.10	14.02	14.15
E2	3.68	4.40	5.10
E3	1.00	1.45	1.90
E4	12.38	13.26	13.43
e	2.54 BSC		
e1	5.08 BSC		
L	17.31	17.57	17.82
L1	3.97	4.19	4.37
L2	2.35	2.50	2.65
øP	3.51	3.61	3.65
øP1	7.19 REF.		
Q	5.49	5.79	6.00
S	6.04	6.17	6.30

Note:

① The value of RθJA is measured with the device in a still environment with TA=25℃

②Practically the current will be limited by PCB, thermal design and operating temperature. VGS=18V.

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Version	Date	Change
Preliminary	2025/2/19	New