

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 $R_{DS(on)}$ 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.

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

Application

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

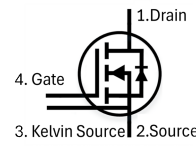
Ordering Information:

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

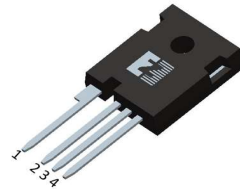
Absolute Maximum Ratings ($T_A=25^{\circ}\text{C}$, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Max.	Unit
Drain-Source Voltage	V_{DS}		-	1200	V
Gate-Source Voltage ^①	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	$V_{GS}=18\text{V}, T_C=25^{\circ}\text{C}$	-	54	A
	I_D	$V_{GS}=18\text{V}, T_C=75^{\circ}\text{C}$	-	44	A
	I_D	$V_{GS}=18\text{V}, T_C=100^{\circ}\text{C}$	-	38	A
Pulsed Drain Current ^①	I_{DM}	Pulsed; $t_p \leq 10 \mu\text{s}; T_C = 25^{\circ}\text{C};$	-	216	A
Total Power Dissipation	P_D	$T_C=25^{\circ}\text{C}$	-	221	W
Total Power Dissipation	P_D	$T_A=25^{\circ}\text{C}$	-	3.8	W
Operating Junction Temperature	T_J		-55	175	$^{\circ}\text{C}$
Storage Temperature	T_{STG}		-55	175	$^{\circ}\text{C}$
Single Pulse Avalanche Energy	E_{AS}	$L=0.5\text{mH}, V_{GS}=18\text{V}, R_g=25\Omega,$	-	529	mJ
ESD Level (HBM)	CLASS 2				

Product Summary



$V_{DS} = 1200\text{V}$
 $R_{DS(on)} = 37\text{m}\Omega$
 $I_D = 54\text{A}$



TO-247-4



•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}	$V_{GS}=0V, I_D=250\mu A$	1200	-	-	V
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}, I_D=5mA$	2	2.8	4	V
Drain-Source Leakage Current	I_{DSS}	$V_{GS}=0V, V_{DS}=1200V$	-	-	10	μA
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	$R_{DS(ON)}$	$V_{GS}=18V, I_D=30A, T_J=25^\circ C$	-	37	44	m Ω
		$V_{GS}=18V, I_D=30A, T_J=175^\circ C$	-	62.5	-	m Ω
		$V_{GS}=15V, I_D=30A, T_J=25^\circ C$	-	44	-	m Ω
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	C_{iss}	$f=100KHz, V_{DS}=800V, V_{GS}=0V$	-	2226	-	pF
Output capacitance	C_{oss}		-	95	-	
Reverse transfer capacitance	C_{rss}		-	3	-	
Output Charge	Q_{oss}	$f=100KHz, V_{GS}=0V, V_{DS}=0V \text{ to } 800V$	-	131	-	nC
Coss Stored Energy	E_{oss}		-	36	-	μJ
Gate Resistance	R_g	$f=1MHz$	-	0.9	-	Ω
Total gate charge	Q_g	$V_{DD}=800V, I_D=30A, V_{GS}=-4V/18V$	-	87.1	-	nC
Gate - Source charge	Q_{gs}		-	27.5	-	
Gate - Drain charge	Q_{gd}		-	29.3	-	
Turn-ON Delay time	$t_{D(on)}$	$V_{GS}=-4V/18V, V_{DS}=800V, R_G=10\Omega, I_D=30A$	-	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	E_{on}		-	1068	-	μJ
Turn-Off Energy	E_{off}		-	1080	-	μJ
Reverse Recovery Time	t_{rr}		-	24	-	ns
Reverse Recovery Charge	Q_{rr}	$V_{DD}=100V, dI_S/dt=260A/\mu s, I_S=30A$	-	50	-	nC

Fig.1 Gate-source voltage as a function of gate charge; Typical values; $T_j=25^\circ\text{C}$

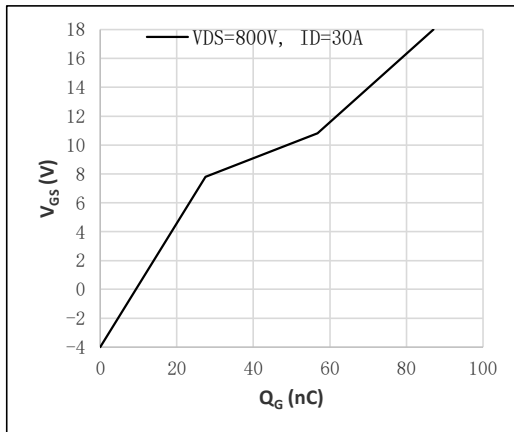


Fig.2 Input, output and reverse transfer capacitances as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$

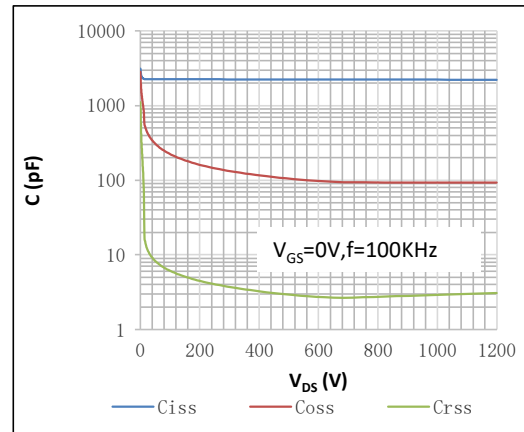


Fig.3 Output characteristics: drain current as a function of drain-source voltage; Typical values; $T_j=25^\circ\text{C}$

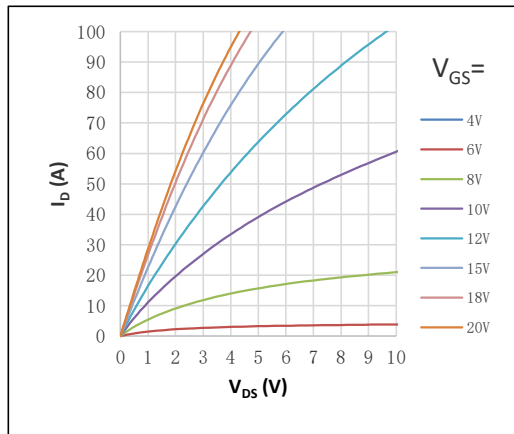


Fig.4 Output characteristics: drain current as a function of drain-source voltage; Typical values: Expanded curve; $T_j=25^\circ\text{C}$

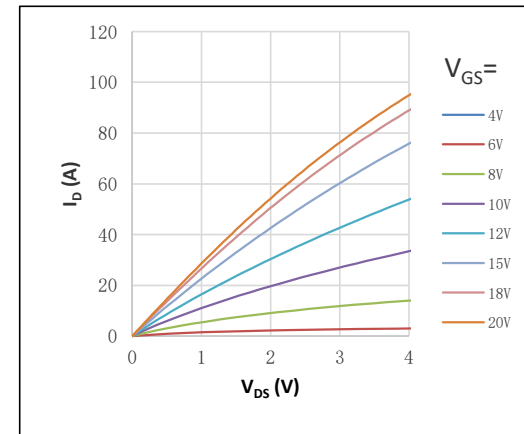


Fig.5 Gate-source threshold voltage as a function of junction temperature; Typical values

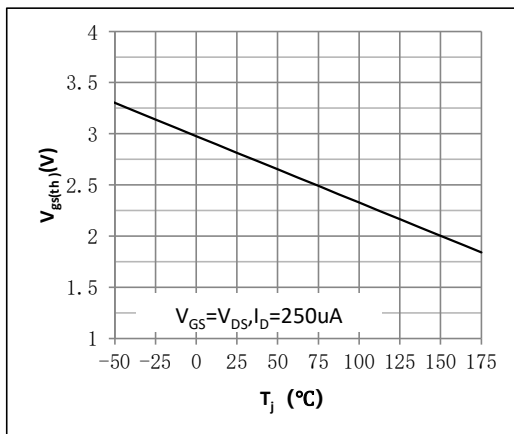


Fig.6 Drain-source on-state resistance as a function of drain current; Typical values; $T_j=25^\circ\text{C}$

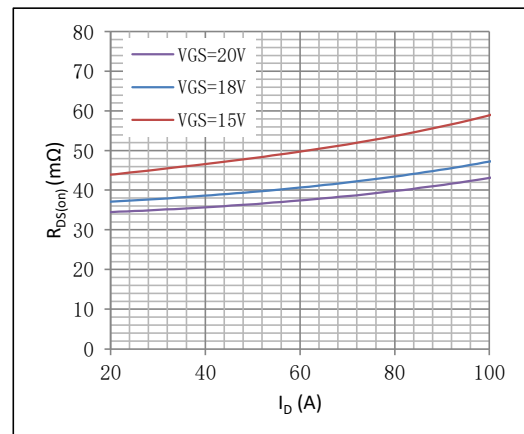


Fig.7 Drain-source on-state resistance as a function of gate-source voltage;Typical values

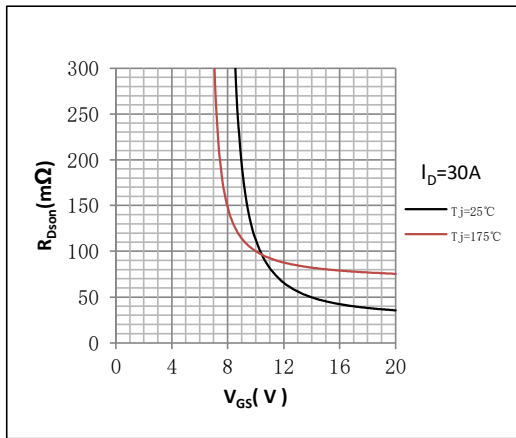


Figure 9. Source (diode forward) current as a function of source-drain (diode forward) voltage ;Typical values

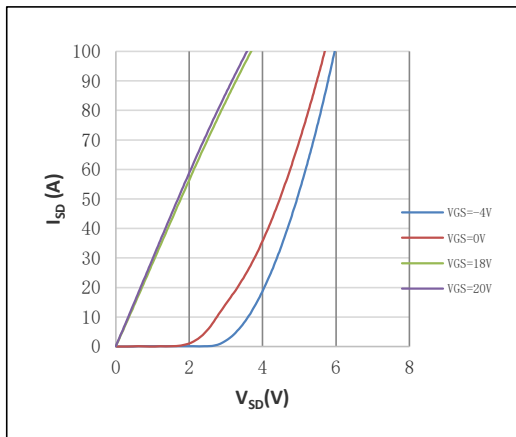


Fig.11 Safe operating area: continuous and peak drain currents as a function of drain-source voltage;Calculative values

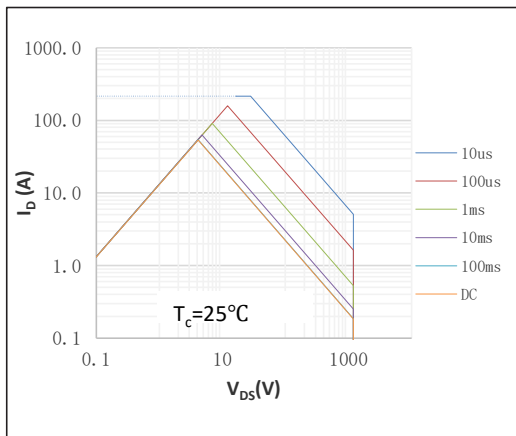


Fig.8 Normalized drain-source on-state resistance factor as a function of junction temperature;Typical values
Normalized On-Resistance= $R_{DS(on)}/R_{DS(on)}(25^{\circ}\text{C})$

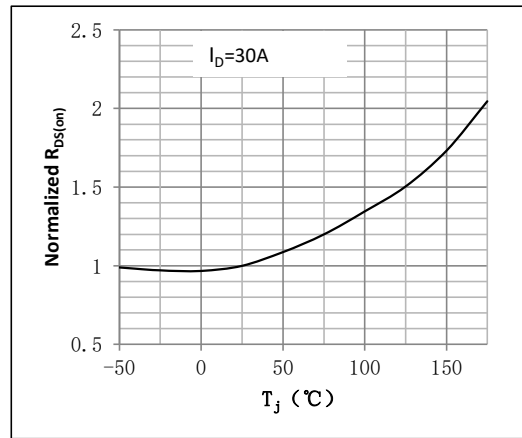


Figure 10. Transfer characteristics: drain current as a function of gate-source voltage;Typical values

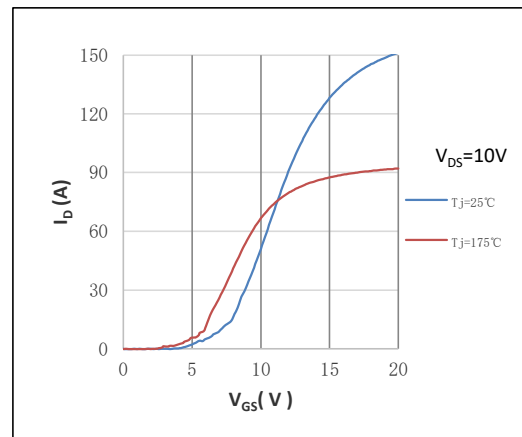


Fig.12 Continuous drain current as a function of case temperature^Θ;Calculative values

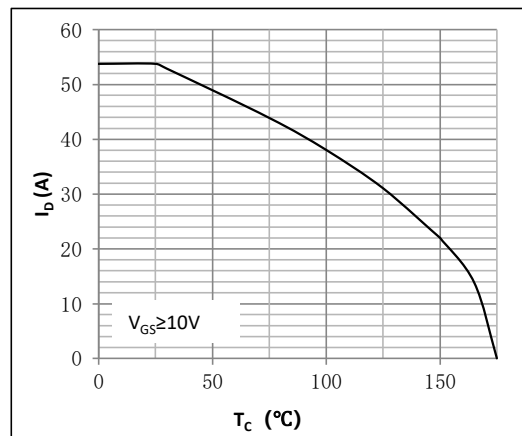


Fig.13 Drain-source breakdown voltage as a function of junction temperature; Typical values
Normalized BVDSS=BVDSS/BVDSS(25°C)

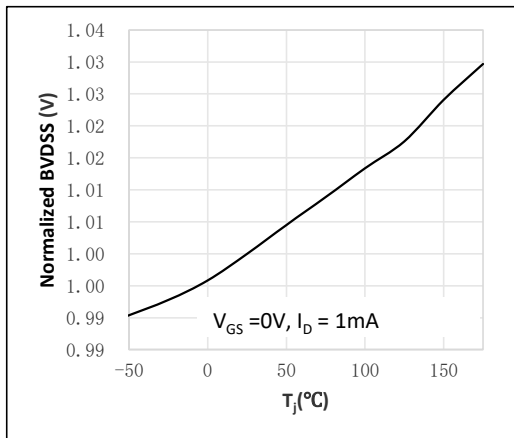


Fig.14 Normalized total power dissipation as a function of case temperature; Calculative values
Normalized Power Dissipation= $P_d/P_d(25^\circ C)$

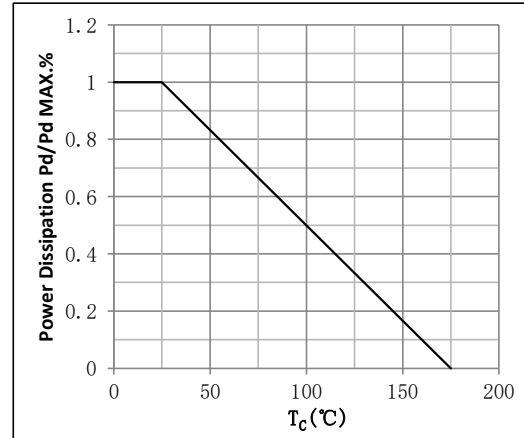


Fig.15 Transient thermal impedance from junction to case as a function of pulse duration; max values

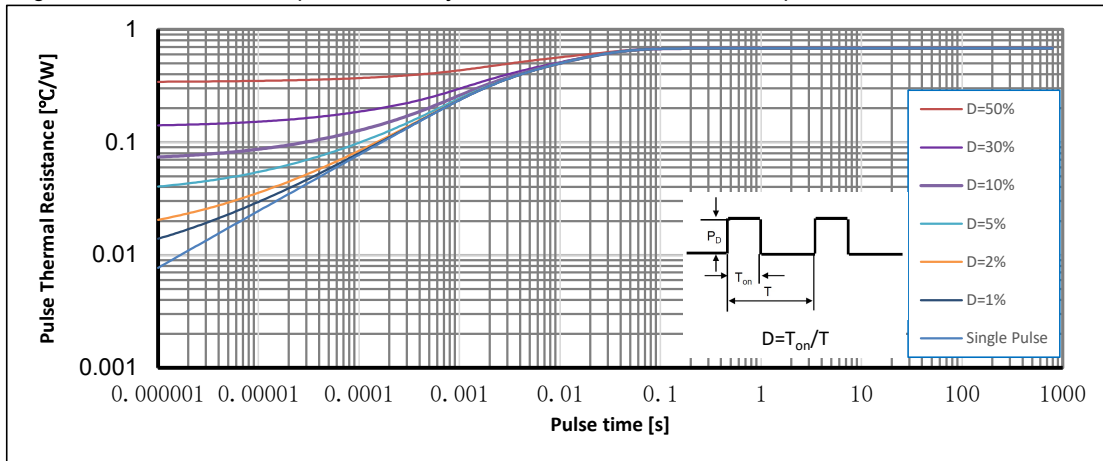
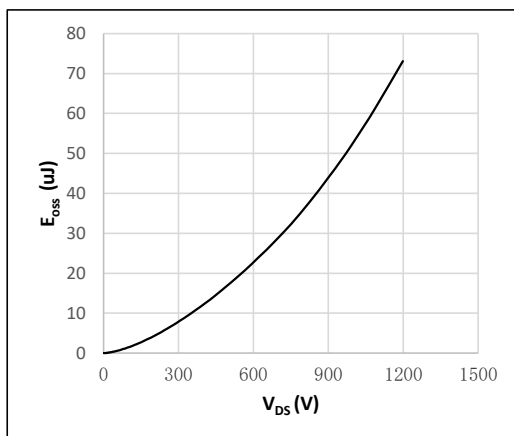
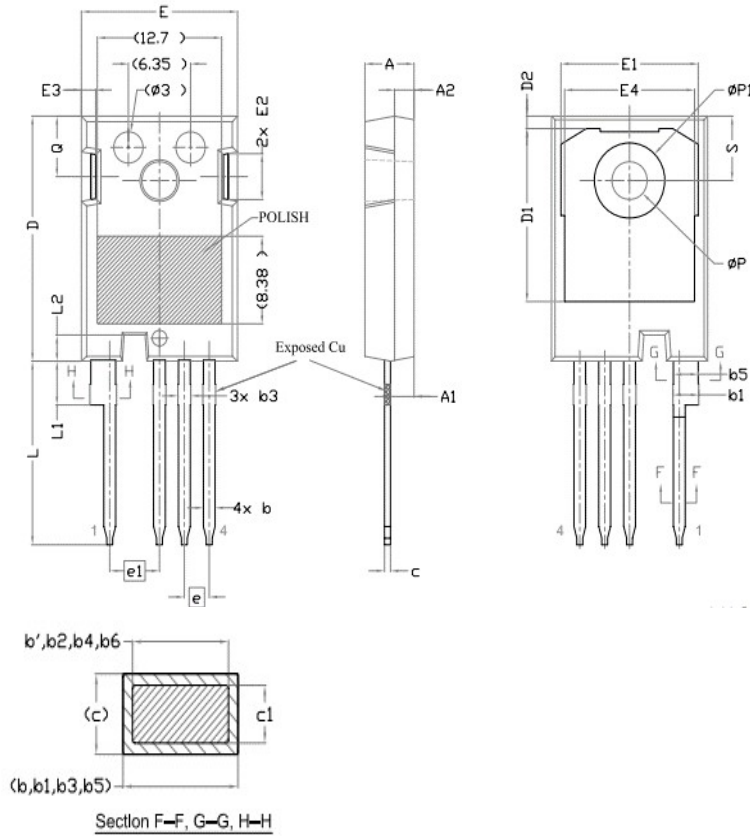


Fig.16 Output capacitor stored energy as a function of drain-source voltage; Typical values;
 $T_j=25^\circ C$



•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 R θ JA is measured with the device in a still environment with TA=25°C
- ② Practically 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