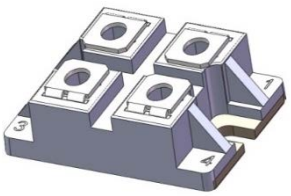
N-Channel SiC Power MOSFET & SiC SBD

Description

The AKM1CM040N120EC is a high blocking voltage N-Channel SiC power MOSFET. This device provide excellent performance for high voltage power supplies or pulse circuits.

These SiC MOS Module series are ideally suited for Solar and UPS Inverters, High Voltage DC/DC Converters, Motor Drivers, Switch Mode Power Supplies where switching losses are significant portion of the total losses.



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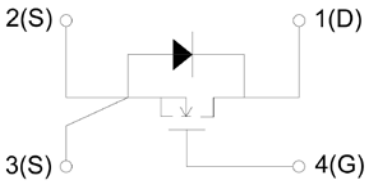


Internal Circuit

Features

- Typical on-Resistance: $R_{DS\ (on)}$=40mΩ @V_G=18V
- High Blocking Voltage
- High Speed Switching with Low Capacitance
- Good Stability and Uniformity with High E_{AS}

Applications

- Solar and UPS Inverters
- High Voltage DC/DC Converters
- Motor Drivers
- Switch Mode Power Supplies
- Battery Chargers

Absolute Maximum Ratings @T_C=25 ℃ unless otherwise noted

Symbol	Parameter		Ratings	Unit
V_{DSS}	Drain to Source Voltage		1200	V
V_{GSS}	Gate to Source Voltage		-10/+25	V
V_{GSop}	Recommended operation Values of Gate−Source Voltage		-5/+20	V
I_D	Drain Current	T_C=25℃	70	A
		T_C=100℃	48	A
I_{DM}	Pulsed Drain Current (Note 1)		160	A
P_D	Maximum Power Dissipation	T_C=25℃	420	W
E_{AS}	Single Pulsed Avalanche Energy (Note 2)		150	mJ
T_J	Operating Junction Temperature Range		-55~+175	℃
T_{STG}	Storage Temperature Range		-55~+175	℃

Static Electrical Characteristics @T_C=25 ℃ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
BV_{DSS}	Drain to Source Breakdown Voltage	V_{GS}=0V, I_D=100uA	1200	-	-	V
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=10mA	2.0	2.5	4.0	V
		V_{DS}=V_{GS}, I_D=10mA T_C=175 ℃	-	1.8	-	
$R_{DS(on)}$	Static Drain-Source On-Resistance	V_{GS}=20V, I_D=33.3A	-	40	52	mΩ
		V_{GS}=20V, I_D=33.3A T_C=175 ℃	-	65	-	
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=V_{DSS}, V_{GS}=0V	-	-	100	uA
I_{GSS+}	Gate to Source Leakage Current	V_{GS}=20V, V_{DS}=0V	-	-	±250	nA
I_{GSS-}	Gate to Source Leakage Current	V_{GS}=-5V, V_{DS}=0V	-	-	±250	nA
g_{fs}	Transconductance	V_{DS}=20V, I_D=40A	-	20.5	-	S
		V_{DS}=20V, I_D=40A, T_C=175 ℃	-	19	-	

Switching Characteristics @T_C=25 ℃ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=1000V, f=1.0MHz, V_{AC}=25mV	-	2950	-	pF
C_{oss}	Output Capacitance		-	170	-	pF
C_{rss}	Reverse Transfer Capacitance		-	7	-	pF
Q_g	Total Gate Charge	I_D=40A, V_{DD}=800V V_{GS}=-5V/20V (Note 3)	-	142	-	nC
Q_{gs}	Gate to Source Charge		-	37	-	nC
Q_{gd}	Gate to Drain Charge		-	18	-	nC
$t_{d(on)}$	Turn-on Delay Time	I_D=40A, V_{DD}=800V, R_L=20Ω, V_{GS} = −5/20V, $R_{G(ext)}$=2.5Ω, (Note 3)	-	12	-	ns
t_r	Turn-on Rise Time		-	10	-	ns
$t_{d(off)}$	Turn-off Delay Time		-	25	-	ns
t_f	Turn-off Fall Time		-	6.2	-	ns

Note:

1. Repetitive rating: pulse-width limited by maximum junction temperature
2. V_{DD}=100V, L=1mH, V_{clamp}=1600V, V_G=10V, I_D=19.0A
3. Essentially independent of operating temperature typical characteristics

Diode Characteristics @T_C=25 ℃ unless otherwise noted

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
V_F	Drain-Source Diode Forward Voltage	I_F=20A	-	1.45	1.8	V
		I_F=20A, T_C=175 ℃	-	1.75	2.5	
I_R	Reverse Current	V_R=1200V	-	10	50	uA
C	Total Capacitance	V_R=0V, *f*=1MHz	-	1280	-	pF
Q_c	Reverse Recovery Charge	V_R=800V, I_F=20A di/dt=1000A/us	-	51	-	nC
T_{rr}	Reverse Recovery Time	V_R=800V, I_F=20A di/dt=1000A/us	-	20	-	ns

Thermal Characteristics

Symbol	Parameter	Ratings	Unit
$R_{th\ (J\text{-}C),\ MOSFET}$	Thermal Resistance, Junction to case, MOSFET	0.35	℃/W
$R_{th\ (J\text{-}C),\ Diode}$	Thermal Resistance, Junction to case, Diode	0.4	℃/W
$R_{th\ (C\text{-}S)}$	Thermal Resistance, Case to Sink	0.05	℃/W

Typical Performance Characteristics

Fig. 1. Typical Output Characteristics @ 25℃

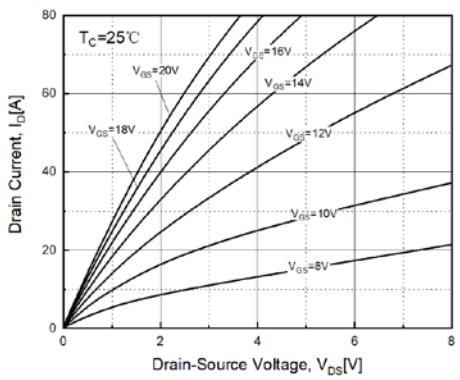
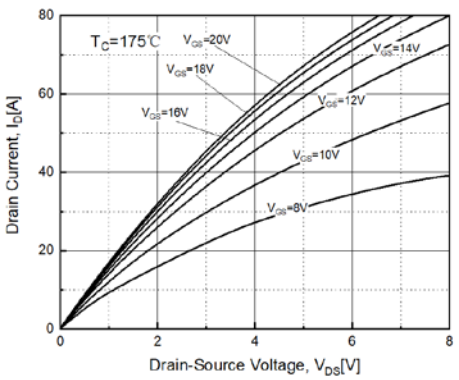


Fig. 2. Typical Output Characteristics @ 175℃



Typical Performance Characteristics

Fig. 3. Normalized On-Resistance vs. Junction Temperature

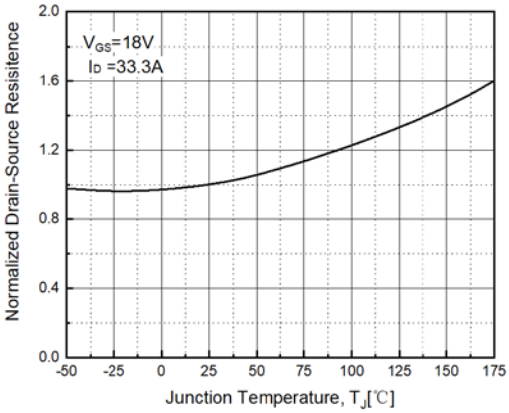


Fig. 4. On-Resistance vs. Drain Current for Various Temperatures

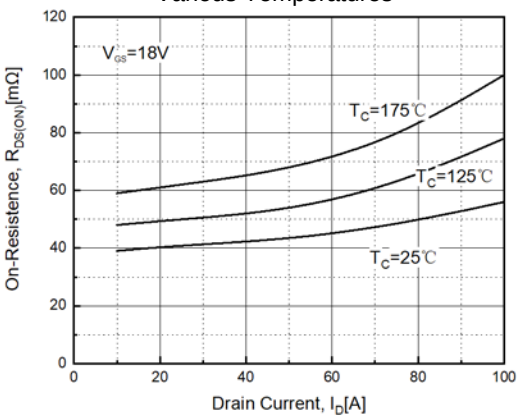


Fig. 5. On-Resistance vs. Drain Current for Various Gate Voltage

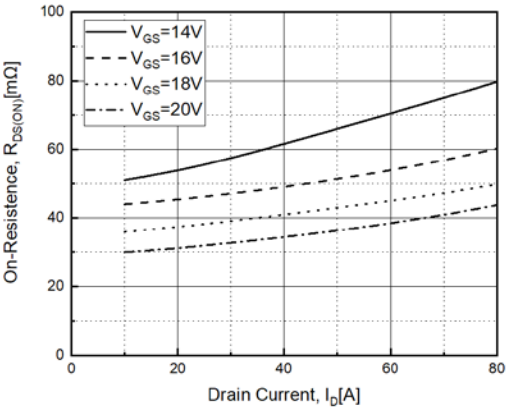


Fig. 6. Transfer Characteristics

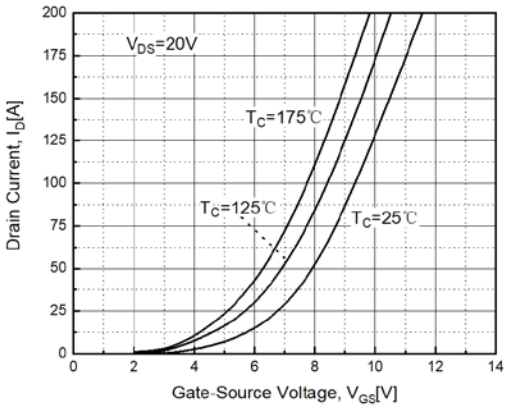


Fig. 7. Diode Forward Characteristics

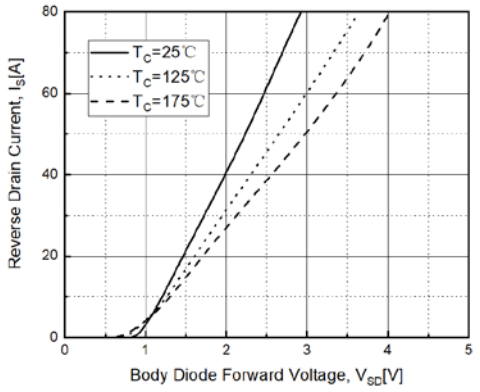
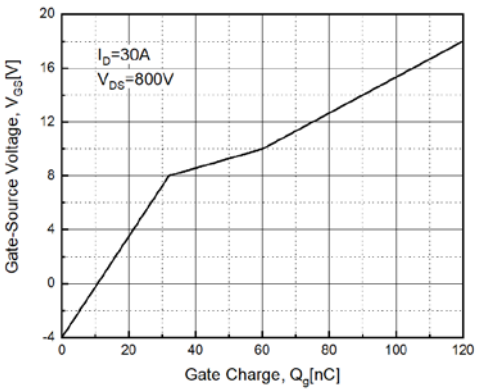


Fig. 8. Gate Charge Characteristics



Typical Performance Characteristics

Fig. 9. Capacitance vs. Drain-to-Source Voltage

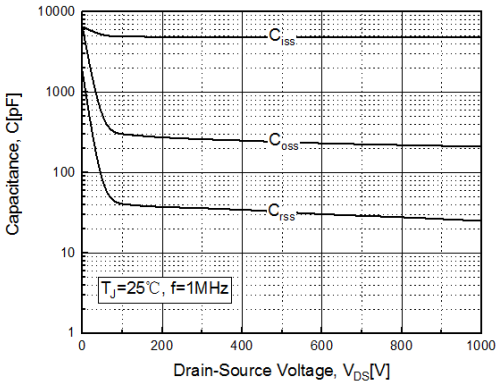
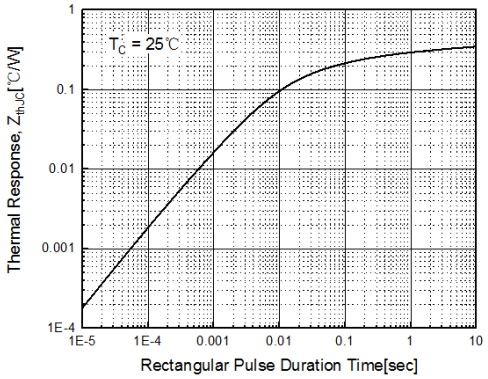


Fig. 10. Transient Thermal Impedance



Package Dimensions

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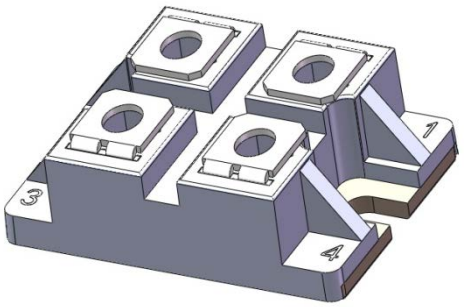

(Dimensions in Millimeters)