

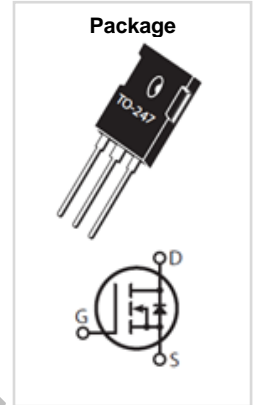
MSC040SMA120B

Advanced Technical Information
 1200V, 40mΩ

Silicon Carbide N-Channel Power MOSFET

DESCRIPTION

Silicon carbide (SiC) power MOSFET product line from Microsemi increase your performance over silicon MOSFET and silicon IGBT solutions while lowering your total cost of ownership for high-voltage applications.



FEATURES / TYPICAL APPLICATIONS

SiC MOSFET Features:

- Low capacitances and low gate charge
- Fast switching speed due to low internal gate resistance (ESR)
- Stable operation at high junction temperature, $T_{J(max)} = +175^{\circ}\text{C}$
- Fast and reliable body diode
- Superior avalanche ruggedness
- RoHS Compliant

SiC MOSFET Benefits:

- High efficiency to enable lighter/compact system
- Simple to drive and easy to parallel
- Improved thermal capabilities and lower switching losses
- Eliminates the need of external freewheeling diode
- Lower system cost of ownership

Applications:

- PV inverter, converter and industrial motor drives
- Smart grid transmission & distribution
- Induction heating, and welding
- H/EV powertrain and EV charger
- Power supply and distribution

MAXIMUM RATINGS

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain-Source Voltage	1200	V
I_D	Continuous Drain Current @ $T_c = 25^{\circ}\text{C}$	62	A
	Continuous Drain Current @ $T_c = 100^{\circ}\text{C}$	44	
I_{DM}	Pulsed Drain Current ①	154	
V_{GS}	Gate-Source Voltage	-10 to 25	V
P_D	Total Power Dissipation @ $T_c = 25^{\circ}\text{C}$	311	W
	Linear Derating Factor	2.12	W/ $^{\circ}\text{C}$

THERMAL AND MECHANICAL CHARACTERISTICS

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-Case Thermal Resistance		0.35	0.47	$^{\circ}\text{C}/\text{W}$
T_J, T_{stg}	Operating Junction and Storage Temperature	-55		175	$^{\circ}\text{C}$
T_L	Soldering Temperature for 10 Seconds (1.6mm from case)			260	
Torque	Mounting Torque (TO-247 Package), 6-32 or M3 screw			10	in-lbf
				1.1	N-m

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STATIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)DSS}$	Drain-Source Breakdown Voltage	$V_{GS} = 0V, I_D = 100\mu A$	1200			V
$R_{DS(on)}$	Drain-Source On Resistance ②	$V_{GS} = 20V, I_D = 40A$		40	50	mΩ
$V_{GS(th)}$	Gate-Source Threshold Voltage	$V_{GS} = V_{DS}, I_D = 1mA$	1.8	2.6		V
$\Delta V_{GS(th)} / \Delta T_J$	Threshold Voltage Coefficient			-4.5		mV/°C
I_{DSS}	Zero Gate Voltage Drain Current	$V_{DS} = 1200V$ $V_{GS} = 0V$			100	μA
		$T_J = 25^\circ C$ $T_J = 125^\circ C$			500	
I_{GSS}	Gate-Source Leakage Current	$V_{GS} = +20V / -10V$			±100	nA

$T_J = 25^\circ C$ unless otherwise specified

DYNAMIC CHARACTERISTICS

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit	
C_{iss}	Input Capacitance	$V_{GS} = 0V, V_{DD} = 1000V$ $f = 1MHz$		1990		pF	
C_{rss}	Reverse Transfer Capacitance			17			
C_{oss}	Output Capacitance			156			
Q_g	Total Gate Charge	$V_{GS} = -5/20V$ $V_{DD} = 800V$ $I_D = 40A$		140		nC	
Q_{gs}	Gate-Source Charge			30			
Q_{gd}	Gate-Drain Charge			28			
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 800V$ $V_{GS} = 0/20V$ $I_D = 40A$ $R_{G(ext)} = 5.3\Omega$ ③ $T_C = 25^\circ C$ Freewheeling Diode = MSC015SDA120B		10		ns	
t_r	Current Rise Time			10			
$t_{d(off)}$	Turn-Off Delay Time			55			
t_f	Current Fall Time			25			
E_{on2}	Turn-On Switching Energy ④				900		μJ
E_{off}	Turn-Off Switching Energy				585		
$t_{d(on)}$	Turn-On Delay Time	$V_{DD} = 800V$ $V_{GS} = 0/20V$ $I_D = 40A$ $R_{G(ext)} = 5.3\Omega$ ③ $T_C = 150^\circ C$ Freewheeling Diode = MSC015SDA120B		10		ns	
t_r	Current Rise Time			10			
$t_{d(off)}$	Turn-Off Delay Time			74			
t_f	Current Fall Time			37			
E_{on2}	Turn-On Switching Energy ④				900		μJ
E_{off}	Turn-Off Switching Energy				855		
ESR	Equivalent Series Resistance	$f = 1MHz, 25mV, \text{Drain Short}$		1.2		Ω	
SCWT	Short Circuit Withstand Time	$V_{DS} = 960V, V_{GS} = 20V, T_C = 25^\circ C$		3		μs	
E_{AS}	Avalanche Energy, Single Pulse	$V_{DS} = 150V, V_{GS} = 20V, I_D = 40A, T_C = 25^\circ C$		2000		mJ	

Symbol	Parameter	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode Forward Voltage	$I_{SD} = 40A, V_{GS} = 0V$		3.9		V
t_{rr}	Reverse Recovery Time	$I_{SD} = 40A, V_{GS} = 0V,$ $V_{DD} = 800V, di/dt = -1000A/\mu s$		100		ns
Q_{rr}	Reverse Recovery Charge				550	nC
I_{rrm}	Reverse Recovery Current				12.5	A

$T_J = 25^\circ C$ unless otherwise specified

① Repetitive Rating: Pulse width and case temperature limited by maximum junction temperature.

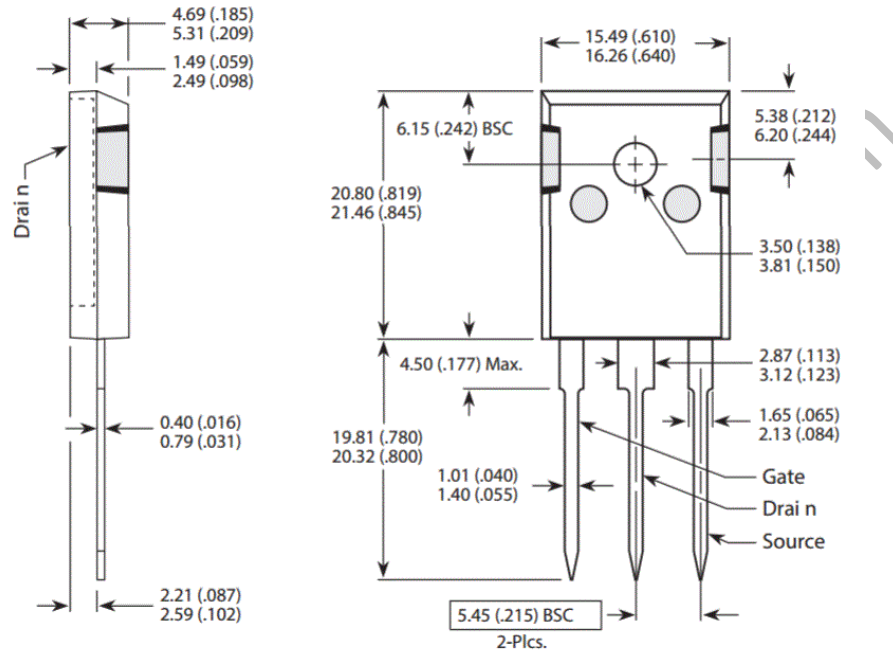
② Pulse test: Pulse Width < 380μs, duty cycle < 2%.

③ $R_{G(ext)}$ is total external gate resistance.

④ E_{on2} includes energy of MSC015SDA120B freewheeling diode.

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TO-247 (B) Package Outline



Dimensions in Millimeters (Inches)

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Microsemi Corporate Headquarters
One Enterprise, Aliso Viejo, CA 92656 USA
Within the USA: +1 (800) 713-4113
Outside the USA: +1 (949) 380-6100
Sales: +1 (949) 380-6136 Fax: +1
(949) 215-4996 email:
sales.support@microsemi.com
www.microsemi.com

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