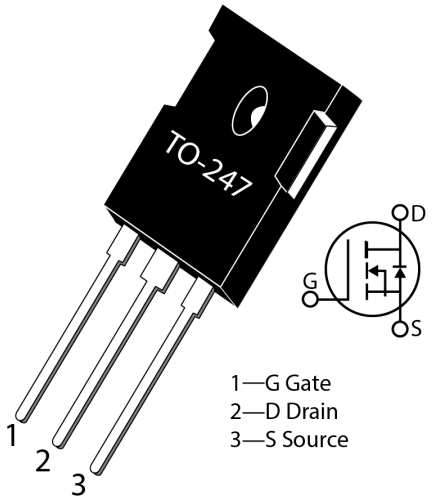
MSC280SMA120B Silicon Carbide N-Channel Power MOSFET

1 Product Overview

This section shows the product overview for the MSC280SMA120B device.



1.1 Features

The following are key features of the MSC280SMA120B device:

- 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 °C
- Fast and reliable body diode
- Superior avalanche ruggedness
- RoHS compliant

1.2 Benefits

The following are benefits of the MSC280SMA120B device:

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

1.3 Applications

The MSC280SMA120B device is designed for the following applications:

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

2 Device Specifications

This section shows the specifications for the MSC280SMA120B device.

2.1 Absolute Maximum Ratings

The following table shows the absolute maximum ratings for the MSC280SMA120B device.

Table 1 • Absolute Maximum Ratings

Symbol	Parameter	Ratings	Unit
V_{DSS}	Drain-source voltage	1200	V
I_D	Continuous drain current at T_C = 25 °C	9.4	A
	Continuous drain current at T_C = 100 °C	6.6	
I_{DM}	Pulsed drain current[1]	20	
V_{GS}	Gate-source voltage	25 to –10	V
P_D	Total power dissipation at T_C = 25 °C	55	W
	Linear derating factor	0.37	W/°C

Note:

1. Repetitive rating: pulse width and case temperature limited by maximum junction temperature.

The following table shows the thermal and mechanical characteristics of the MSC280SMA120B device.

Table 2 • Thermal and Mechanical Characteristics

Symbol	Characteristic	Min	Typ	Max	Unit
$R_{\theta JC}$	Junction-to-case thermal resistance		1.8	2.7	°C/W
T_J	Operating junction temperature	–55		175	°C
T_{STG}	Storage temperature	–55		175	
T_L	Soldering temperature for 10 seconds (1.6 mm from case)			260	
	Mounting torque, 6-32 or M3 screw			10	lbf-in
				1.1	N-m
Wt	Package weight		0.22		oz
			6.2		g

2.2 Electrical Performance

The following table shows the static characteristics for the MSC280SMA120B device. T_J = 25 °C unless otherwise specified.

Table 3 • Static Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{(BR)\ DSS}$	Drain-source breakdown voltage	V_{GS} = 0 V, I_D = 100 µA	1200			V
$R_{DS(on)}$	Drain-source on resistance [1]	V_{GS} = 20 V, I_D = 5 A		280	350	mΩ
$V_{GS(th)}$	Gate-source threshold voltage	V_{GS} = V_{DS}, I_D = 1 mA	1.8	2.8		V
$\Delta V_{GS(th)}/\Delta T_J$	Threshold voltage coefficient	V_{GS} = V_{DS}, I_D = 1 mA		TBD		mV/°C
I_{DSS}	Zero gate voltage drain current	V_{DS} = 1200 V, V_{GS} = 0 V			100	µA
		V_{DS} = 1200 V, V_{GS} = 0 V T_J = 125 °C			500	
I_{GSS}	Gate-source leakage current	V_{GS} = 20 V/–10 V			±100	nA

Note:

1. Pulse test: pulse width < 380 µs, duty cycle < 2%.

The following table shows the dynamic characteristics for the MSC280SMA120B device. T_J = 25 °C unless otherwise specified.

Table 4 • Dynamic Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
C_{iss}	Input capacitance	V_{GS} = 0 V, V_{DD} = 1000 V, V_{AC} = 25 mV ƒ = 1 MHz		300		pF
C_{rss}	Reverse transfer capacitance			5		
C_{oss}	Output capacitance			30		
Q_g	Total gate charge	V_{GS} = –5 V/20 V, V_{DD} = 800 V, I_D = 5 A		20		nC
Q_{gs}	Gate-source charge			TBD		
Q_{gd}	Gate-drain charge			TBD		

2.3 Body Diode Characteristics

The following table shows the body diode characteristics for the MSC280SMA120B device. T_J = 25 °C unless otherwise specified.

Table 5 • Body Diode Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{SD}	Diode forward voltage	I_{SD} = 5 A, V_{GS} = 0 V		3.5		V
		I_{SD} = 5 A, V_{GS} = –5 V		3.7		V
t_{rr}	Reverse recovery time	I_{SD} = 5 A, V_{GS} = –5 V, V_{DD} = 800 V dI/dt = –1000 A/µs		30		ns
Q_{rr}	Reverse recovery charge			60		nC
I_{RRM}	Reverse recovery current			2		A

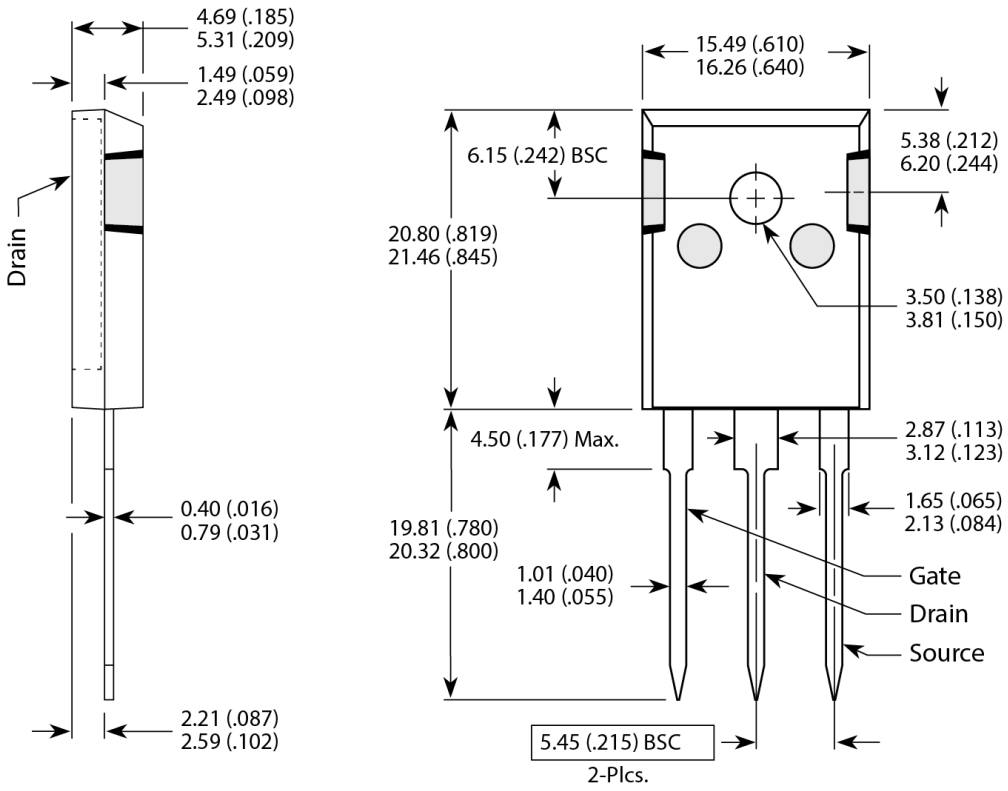
3 Package Specification

This section shows the package specification for the MSC280SMA120B device.

3.1 Package Outline Drawing

This section shows the TO-247 package drawing for the MSC280SMA120B device. The dimensions in the figure below are in millimeters and (inches).

Figure 1 • Package Outline Drawing



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