

Product Overview

The MSCSMC120HM14TBZ2EG device is a full bridge 1200V, 83A Silicon Carbide (SiC) power module. The following figures show the electrical diagram and pinout location of the device.

Figure 1. Electrical Diagram

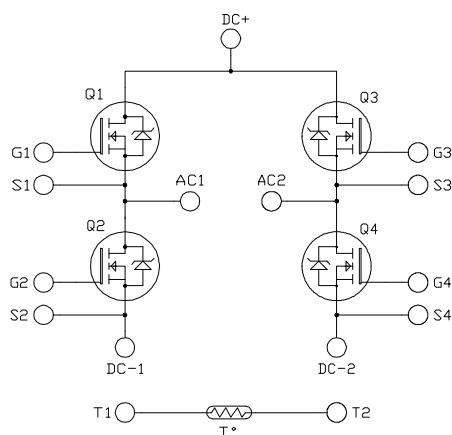
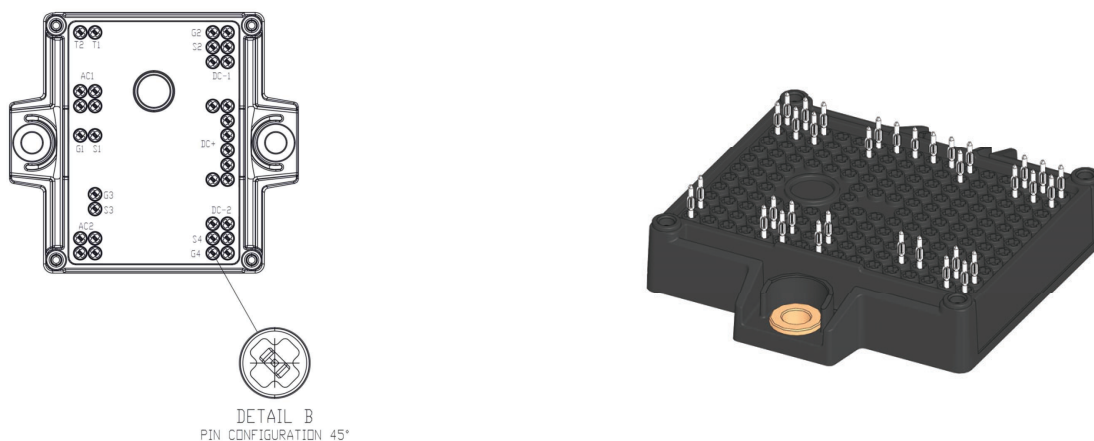


Figure 2. Pinout Location



Note: All ratings are at $T_j = 25\text{ }^{\circ}\text{C}$, unless otherwise specified.



These devices are sensitive to electrostatic discharge. Proper handling procedures must be followed.

Features

The MSCSMC120HM14TBZ2EG device has the following key features:

- SiC Power MOSFET
 - Low switching and conduction losses
 - Low $R_{DS(on)}$
- Ultra low weight and profile
- Internal thermistor for temperature monitoring
- Al_2O_3 substrate

Benefits

The MSCSMC120HM14TBZ2EG device has the following benefits:

- Superior efficiency performance
- Superior performance over temperature due to low $R_{DS(on)}$ increase at elevated temperatures
- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction-to-heatsink thermal resistance
- Press-fit terminals for easy assembly
- Low profile
- RoHS Compliant

Application

The MSCSMC120HM14TBZ2EG device has the following applications:

- High efficiency converters and inverters
- DC/DC converters
- EV chargers
- Renewable energy

1. Electrical Specifications

The following sections show the electrical specifications of the MSCSMC120HM14TBZ2EG device.

1.1. SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings (per SiC MOSFET) of the MSCSMC120HM14TBZ2EG device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter	Maximum Ratings	Unit
V_{DS}	Drain-source voltage	1200	V
I_D	Continuous drain current	$T_H = 25\text{ }^{\circ}\text{C}$	A
		$T_H = 50\text{ }^{\circ}\text{C}$	
I_{DM}	Pulsed drain current, t_p limited by T_{Jmax}	150	
V_{GS}	Gate-source voltage	-10/21	V
	Transient Gate - Source Voltage	-12/23	
$R_{DS(on)}$	Drain-source ON resistance	18	m Ω
P_D	Power dissipation	$T_H = 25\text{ }^{\circ}\text{C}$	W

The following table lists the electrical characteristics (per SiC MOSFET) of the MSCSMC120HM14TBZ2EG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0V$; $V_{DS} = 1200V$	—	—	30	μA
$R_{DS(on)}$	Drain-source ON resistance	$V_{GS} = 18V$ $I_D = 75A$	$T_J = 25\text{ }^{\circ}\text{C}$	—	14	m Ω
			$T_J = 150\text{ }^{\circ}\text{C}$	—	22.4	
			$T_J = 175\text{ }^{\circ}\text{C}$	—	25.2	
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$; $I_D = 4.5\text{ mA}$	1.9	3	5	V
I_{GSS}	Gate-source leakage current	$V_{GS} = 18V$; $V_{DS} = 0V$	—	—	150	nA

The following table lists the dynamic characteristics (per SiC MOSFET) of the MSCSMC120HM14TBZ2EG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0V		—	5938	—	pF
C _{oss}	Output capacitance	V _{DS} = 1000V		—	267	—	
C _{rss}	Reverse transfer capacitance	f = 100 kHz		—	20	—	
Q _g	Total gate charge	V _{GS} = -5/18V		—	242	—	nC
Q _{gs}	Gate-source charge	V _{Bus} = 800V		—	70	—	
Q _{gd}	Gate-drain charge	I _D = 40A		—	40	—	
t _{d(on)}	Turn-on delay time	V _{GS} = -5/18V V _{Bus} = 600V I _D = 75A R _{Gon} = 10Ω R _{Goff} = 6Ω	T _J = 25 °C	—	49	—	ns
			T _J = 150 °C	—	46	—	
t _r	Rise time		T _J = 25 °C	—	26	—	
			T _J = 150 °C	—	23	—	
t _{d(off)}	Turn-off delay time		T _J = 25 °C	—	87	—	
			T _J = 150 °C	—	104	—	
t _f	Fall time		T _J = 25 °C	—	27	—	
			T _J = 150 °C	—	30	—	
E _{on}	Turn-on energy	V _{GS} = -5/18V V _{Bus} = 600V I _D = 75A R _{Gon} = 10Ω R _{Goff} = 6Ω di/dt = 3.4 kA/μs dv/dt = 30 kV/μs	T _J = 25 °C	—	1.6	—	mJ
			T _J = 150 °C	—	1.7	—	
			T _J = 25 °C	—	0.5	—	
E _{off}	Turn-off energy		T _J = 150 °C	—	0.6	—	
R _{Gint}	Internal gate resistance			—	4.5	—	Ω
R _{thjH}	Junction-to-heatsink thermal resistance	λ= 3.4 W/mK		—	0.67	—	°C/W

The following table lists the body diode ratings and characteristics (per SiC MOSFET) of the MSCSMC120HM14TBZ2EG device.

Table 1-4. Body Diode Ratings and Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
V _{SD}	Diode forward voltage	V _{GS} = -5V I _{SD} = 75A	T _J = 25 °C	—	4.7	—	V
			T _J = 150 °C	—	4.3	—	
t _{rr}	Reverse recovery time	V _R = 600V I _{SD} = 75A V _{GS} = -5V di _F /dt = 3.4 kA/μs	T _J = 25 °C	—	28	—	ns
			T _J = 150 °C	—	38	—	
Q _{rr}	Reverse recovery charge		T _J = 25 °C	—	0.5	—	μC
			T _J = 150 °C	—	1.1	—	
I _{rr}	Reverse recovery current		T _J = 25 °C	—	34	—	A
			T _J = 150 °C	—	60	—	
E _{rr}	Reverse recovery energy		T _J = 25 °C	—	0.07	—	mJ
			T _J = 150 °C	—	0.26	—	

1.2. Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSMC120HM14TBZ2EG device.

Table 1-5. Thermal and Package Characteristics

Symbol	Characteristic			Min.	Typ.	Max.	Unit
V _{ISOL}	RMS isolation voltage, any terminal-to-case t = 1 min, 50/60 Hz			3000	—	—	V
T _J	Operating junction temperature range			–40	—	175	°C
T _{JOP}	Recommended junction temperature under switching conditions			–40	—	T _{Jmax} –25	
T _{STG}	Storage temperature range			–40	—	125	
T _C	Operating case temperature			–40	—	125	
τM	Mounting torque	To heatsink	M4	1.5	—	2	N.m
R	Module lead resistance terminal-to-chip	Per switch		—	2.2	—	mΩ
L _{stray}	Module stray inductance between DC+ and DC–			—	9	—	nH
Wt	Package weight			—	40	—	g

Note: T_J > 150°C is only allowed for operation at overload conditions

The following table lists the temperature sensor characteristics of the MSCSMC120HM14TBZ2EG device.

Table 1-6. Temperature Sensor Characteristics

Symbol	Characteristic	Min.	Typ.	Max.	Unit
R ₂₅	Resistance @ 25°C	—	5	—	kΩ
ΔR ₂₅ /R ₂₅		—	5	—	%
B _{25/50}	T ₂₅ = 298.15 K	—	3380	—	K
ΔB/B		—	2	—	%

Note:

$$R_T = \frac{R_{25}}{\exp\left[B_{25/50}\left(\frac{1}{T_{25}} - \frac{1}{T}\right)\right]}$$

Where

- T: Thermistor temperature
- R_T: Thermistor value at T

Note: For more information, see the latest application note on NTC temperature sensor, available on the Microchip website.

1.3. Typical SiC MOSFET Performance Curve

This section shows the typical SiC MOSFET performance curves of the MSCSMC120HM14TBZ2EG device.

Figure 1-1. Output Characteristics, $T_J = 25^\circ\text{C}$

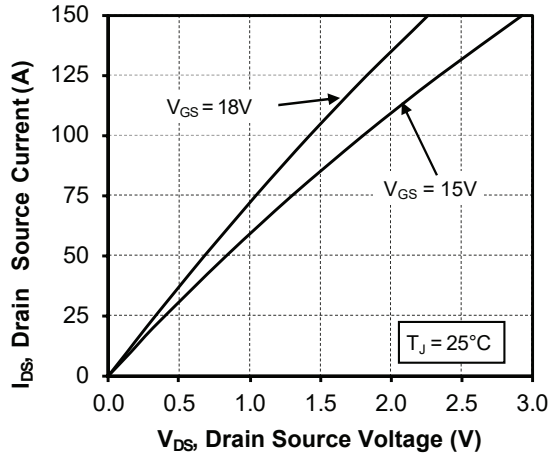


Figure 1-2. Output Characteristics, $T_J = 150^\circ\text{C}$

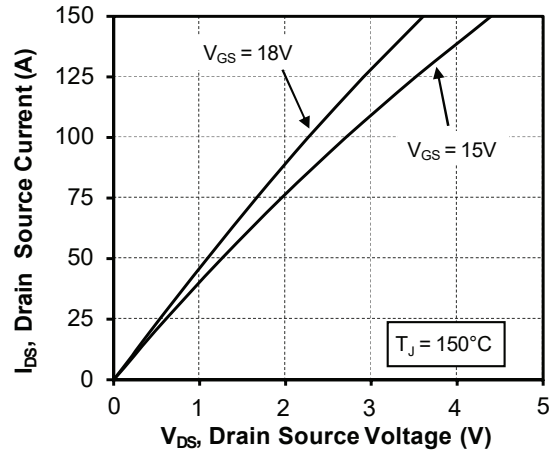


Figure 1-3. Output Characteristics, $T_J = 175^\circ\text{C}$

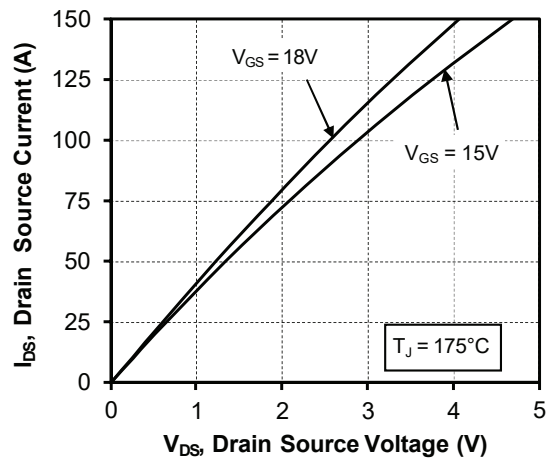


Figure 1-4. Switching Energy vs. Current

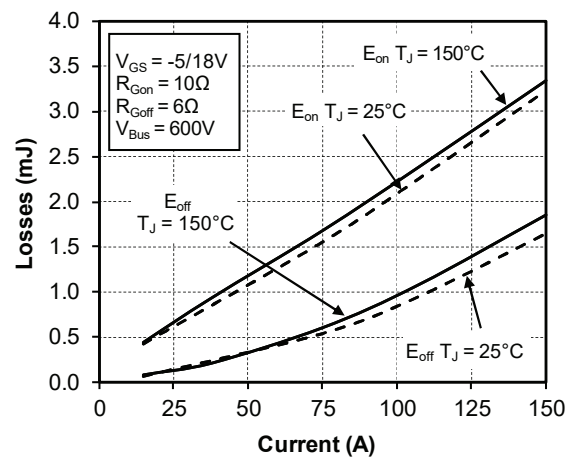


Figure 1-5. Switching Energy vs. R_G

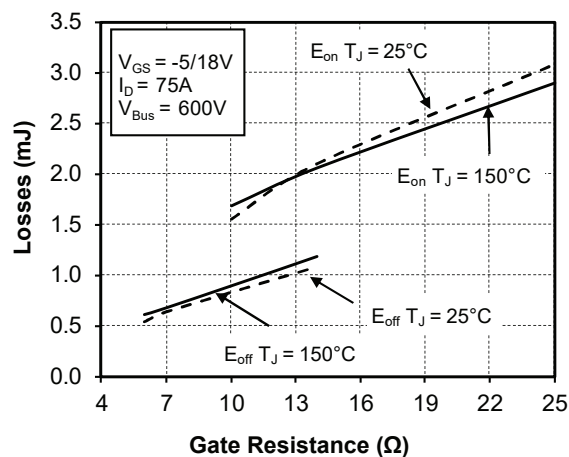


Figure 1-6. Junction-to-Heatsink Thermal Impedance

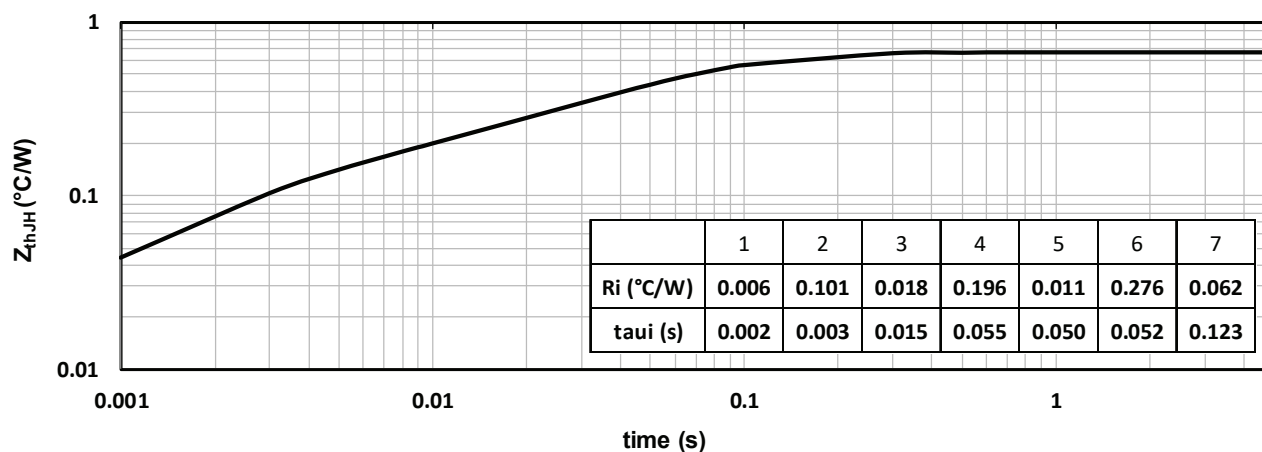


Figure 1-7. Capacitance vs. Drain Source Voltage

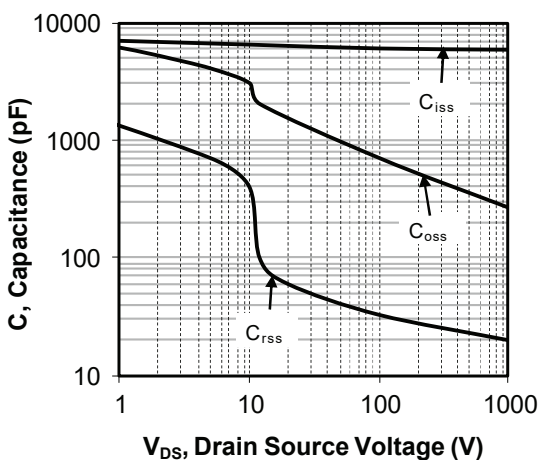


Figure 1-8. Gate Charge vs. Gate Source Voltage

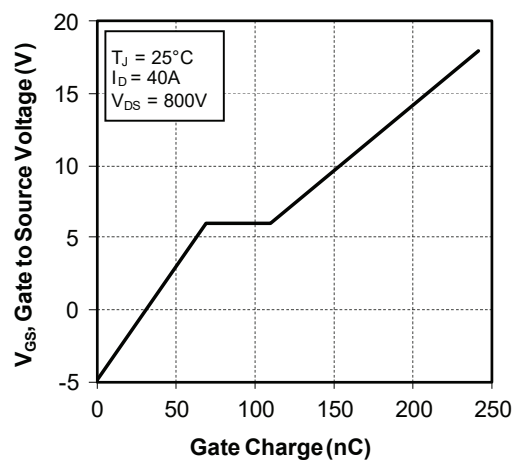


Figure 1-9. Body Diode Characteristics, $T_J = 25^\circ\text{C}$

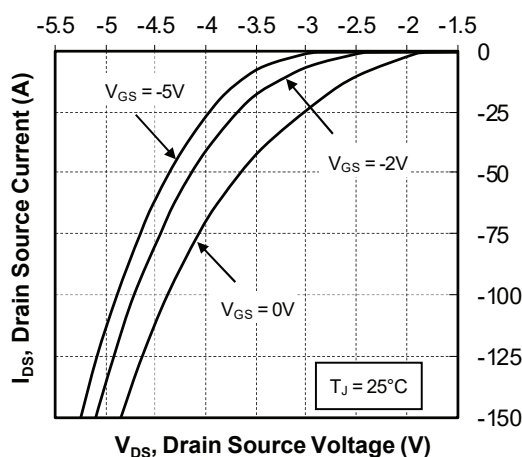


Figure 1-10. 3rd Quadrant Characteristics, $T_J = 25^\circ\text{C}$

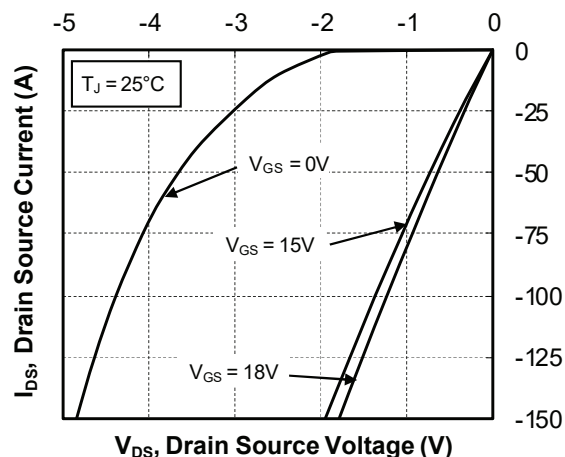


Figure 1-11. Body Diode Characteristics, $T_J = 150^\circ\text{C}$

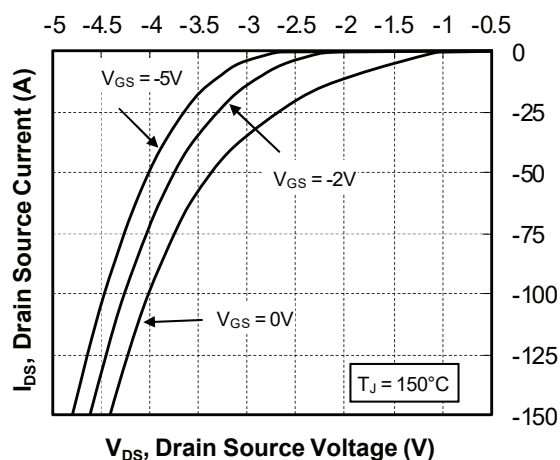


Figure 1-12. 3rd Quadrant Characteristics, $T_J = 150^\circ\text{C}$

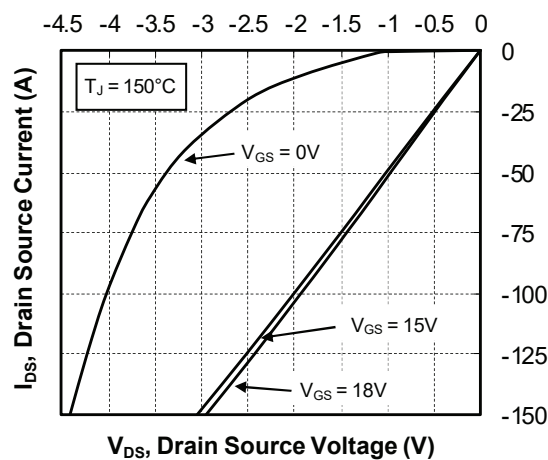


Figure 1-13. Body Diode Characteristics, $T_J = 175^\circ\text{C}$

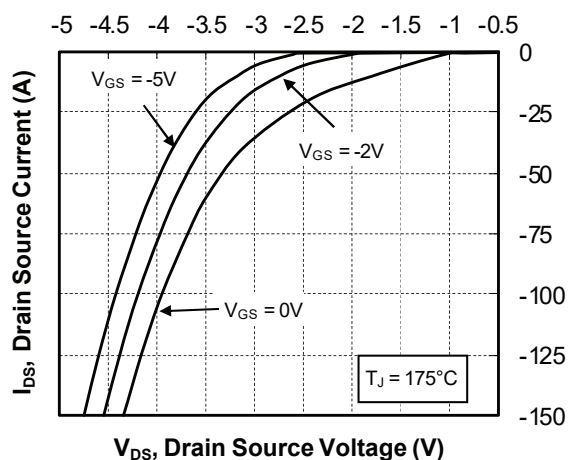


Figure 1-14. 3rd Quadrant Characteristics, $T_J = 175^\circ\text{C}$

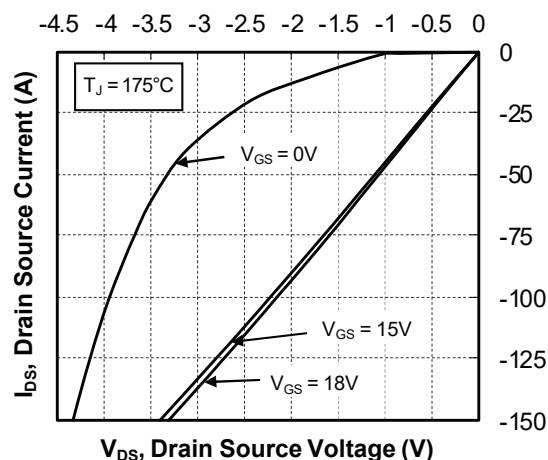


Figure 1-15. Switching Times vs. Drain Current

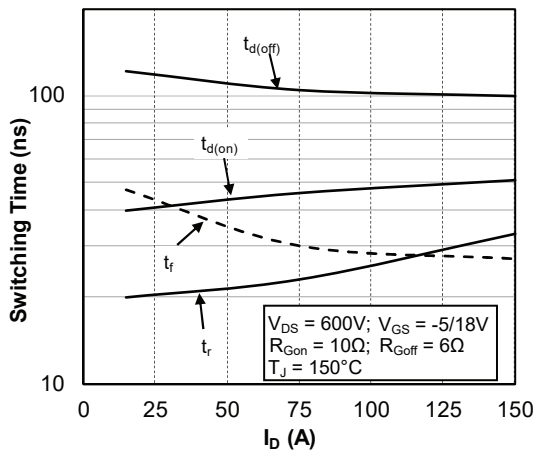


Figure 1-16. Switching Times vs. Gate Resistance

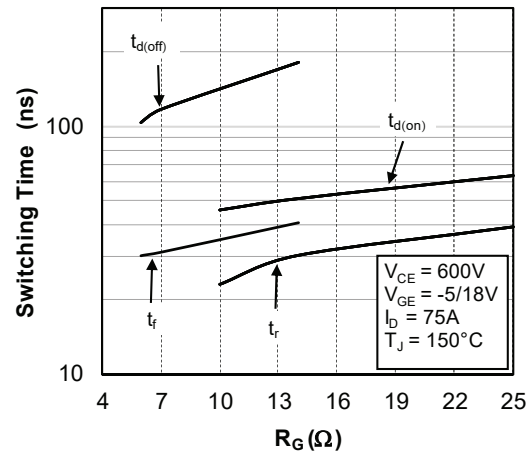


Figure 1-17. E_{rr} vs. Current

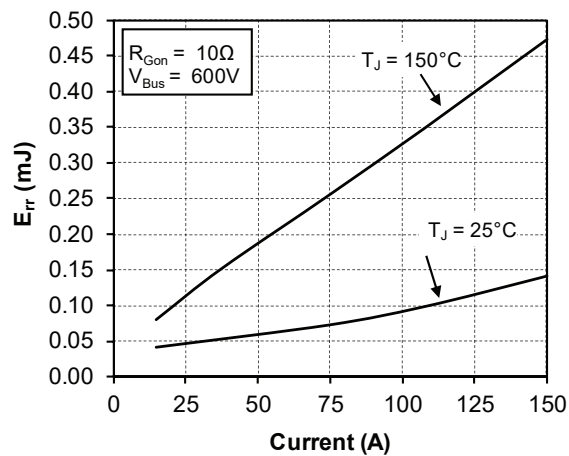


Figure 1-18. E_{rr} vs. Gate Resistance

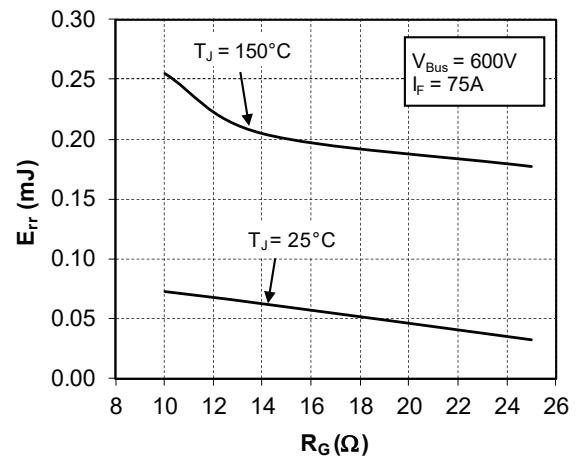


Figure 1-19. Operating Frequency vs. Drain Current

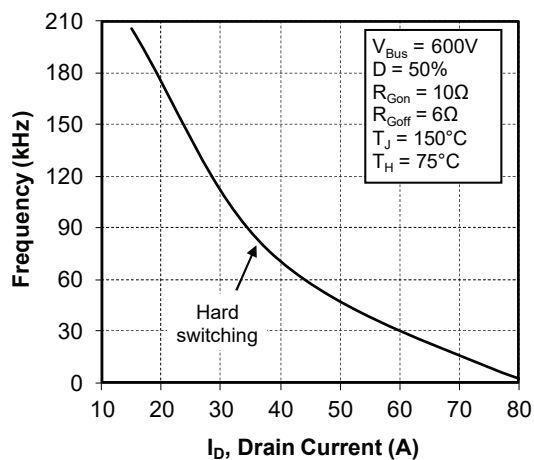
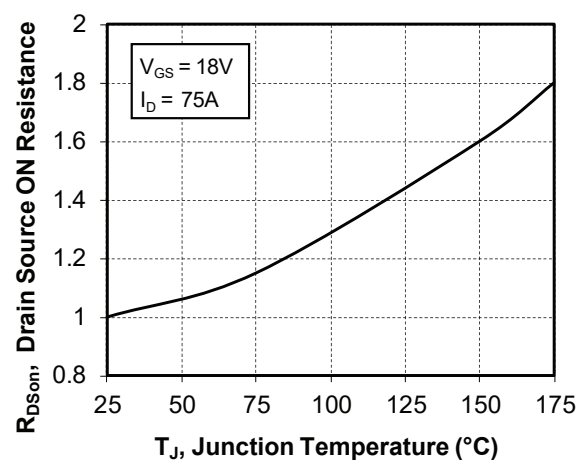


Figure 1-20. Normalized $R_{DS(on)}$ vs. Temperature



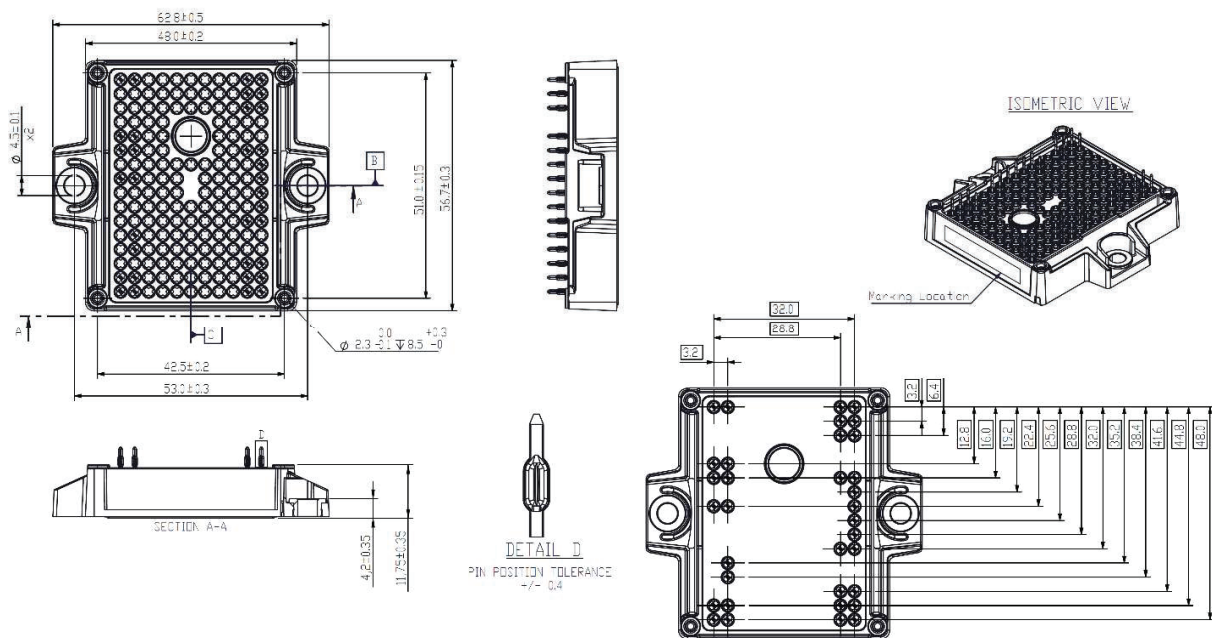
2. Package Specifications

The following section shows the package specification of the MSCSMC120HM14TBZ2EG device.

2.1. Package Outline

The following figure shows the package outline drawing of the MSCSMC120HM14TBZ2EG device. The dimensions in the following figure are in millimeters.

Figure 2-1. Package Outline Drawing



Note: PCB diameters of drill $\phi 1.15$ mm and copper thickness in hole 25-50 μ m.

Note: For more information, see the latest application note on mounting instruction for BZ pressfit power modules, available on the Microchip website.

3. Revision History

The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

Revision	Date	Description
A	04/2026	Initial Revision

Microchip Information

Trademarks

The “Microchip” name and logo, the “M” logo, and other names, logos, and brands are registered and unregistered trademarks of Microchip Technology Incorporated or its affiliates and/or subsidiaries in the United States and/or other countries (“Microchip Trademarks”). Information regarding Microchip Trademarks can be found at <https://www.microchip.com/en-us/about/legal-information/microchip-trademarks>.

ISBN: 979-8-3371-3087-3

Legal Notice

This publication and the information herein may be used only with Microchip products, including to design, test, and integrate Microchip products with your application. Use of this information in any other manner violates these terms. Information regarding device applications is provided only for your convenience and may be superseded by updates. It is your responsibility to ensure that your application meets with your specifications. Contact your local Microchip sales office for additional support or, obtain additional support at www.microchip.com/en-us/support/design-help/client-support-services.

THIS INFORMATION IS PROVIDED BY MICROCHIP “AS IS”. MICROCHIP MAKES NO REPRESENTATIONS OR WARRANTIES OF ANY KIND WHETHER EXPRESS OR IMPLIED, WRITTEN OR ORAL, STATUTORY OR OTHERWISE, RELATED TO THE INFORMATION INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF NON-INFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTIES RELATED TO ITS CONDITION, QUALITY, OR PERFORMANCE.

IN NO EVENT WILL MICROCHIP BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, INCIDENTAL, OR CONSEQUENTIAL LOSS, DAMAGE, COST, OR EXPENSE OF ANY KIND WHATSOEVER RELATED TO THE INFORMATION OR ITS USE, HOWEVER CAUSED, EVEN IF MICROCHIP HAS BEEN ADVISED OF THE POSSIBILITY OR THE DAMAGES ARE FORESEEABLE. TO THE FULLEST EXTENT ALLOWED BY LAW, MICROCHIP’S TOTAL LIABILITY ON ALL CLAIMS IN ANY WAY RELATED TO THE INFORMATION OR ITS USE WILL NOT EXCEED THE AMOUNT OF FEES, IF ANY, THAT YOU HAVE PAID DIRECTLY TO MICROCHIP FOR THE INFORMATION.

Use of Microchip devices in life support and/or safety applications is entirely at the buyer’s risk, and the buyer agrees to defend, indemnify and hold harmless Microchip from any and all damages, claims, suits, or expenses resulting from such use. No licenses are conveyed, implicitly or otherwise, under any Microchip intellectual property rights unless otherwise stated.

Microchip Devices Code Protection Feature

Note the following details of the code protection feature on Microchip products:

- Microchip products meet the specifications contained in their particular Microchip Data Sheet.
- Microchip believes that its family of products is secure when used in the intended manner, within operating specifications, and under normal conditions.
- Microchip values and aggressively protects its intellectual property rights. Attempts to breach the code protection features of Microchip products are strictly prohibited and may violate the Digital Millennium Copyright Act.
- Neither Microchip nor any other semiconductor manufacturer can guarantee the security of its code. Code protection does not mean that we are guaranteeing the product is “unbreakable”. Code protection is constantly evolving. Microchip is committed to continuously improving the code protection features of our products.