

Product Overview

The MSCSMC120AM04TBZ2AEG device is a phase leg 1200V, 266A Silicon Carbide (SiC) power module. The following figures show the electrical diagram and pinout location of the device.

Figure 1. Electrical Diagram

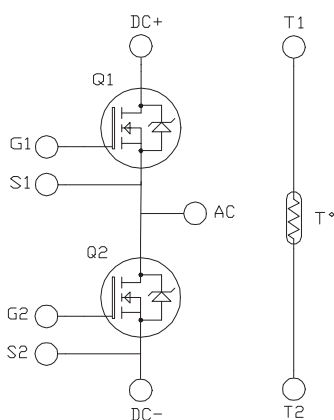
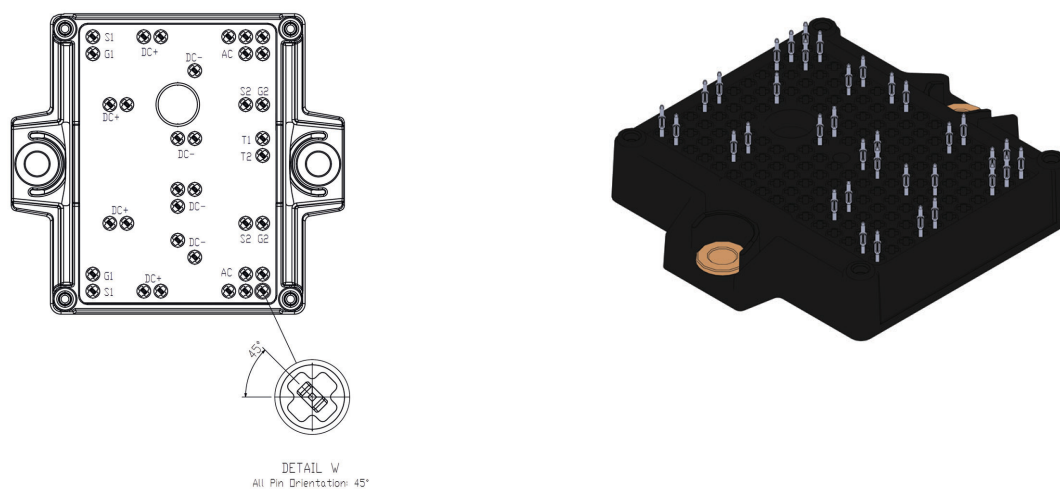


Figure 2. Pinout Location



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 MSCSMC120AM04TBZ2AEG device has the following key features:

- SiC Power MOSFET
 - Low switching and conduction losses
 - Low $R_{DS(on)}$ over temperature drift
- Ultra low weight and profile
- Internal thermistor for temperature monitoring
- AlN substrate for improved thermal performance

Benefits

The MSCSMC120AM04TBZ2AEG 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 MSCSMC120AM04TBZ2AEG device has the following applications:

- Motor Drives
- General Purpose Inverters
- DC/DC converters
- EV chargers
- Renewable energy

1. Electrical Specifications

The following sections show the electrical specifications of the MSCSMC120AM04TBZ2AEG device.

1.1. SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings (per SiC MOSFET) of the MSCSMC120AM04TBZ2AEG 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}	450	
V_{GS}	Gate-source voltage	-10/21	V
	Transient Gate - Source Voltage	-12/23	
$R_{DS(on)}$	Drain-source ON resistance	6	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 MSCSMC120AM04TBZ2AEG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions	Min.	Typ.	Max.	Unit
I_{DSS}	Zero gate voltage drain current	$V_{GS} = 0V$; $V_{DS} = 1200V$	—	—	90	μA
$R_{DS(on)}$	Drain-source ON resistance	$V_{GS} = 18V$ $I_D = 225A$	$T_J = 25\text{ }^{\circ}\text{C}$	—	4.7	m Ω
			$T_J = 150\text{ }^{\circ}\text{C}$	—	7.5	
			$T_J = 175\text{ }^{\circ}\text{C}$	—	8.5	
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}$; $I_D = 13.5\text{ mA}$	1.9	3	5	V
I_{GSS}	Gate-source leakage current	$V_{GS} = 18V$; $V_{DS} = 0V$	—	—	300	nA

The following table lists the dynamic characteristics (per SiC MOSFET) of the MSCSMC120AM04TBZ2AEG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
C _{iss}	Input capacitance	V _{GS} = 0V		—	17.8	—	nF
C _{oss}	Output capacitance	V _{DS} = 1000V		—	0.8	—	
C _{rss}	Reverse transfer capacitance	f = 100 kHz		—	0.06	—	
Q _g	Total gate charge	V _{GS} = -5/18V		—	726	—	nC
Q _{gs}	Gate-source charge	V _{Bus} = 800V		—	210	—	
Q _{gd}	Gate-drain charge	I _D = 120A		—	120	—	
t _{d(on)}	Turn-on delay time	V _{GS} = -5/18V V _{Bus} = 600V I _D = 225A R _{Gon} = 2.7Ω R _{Goff} = 0.5Ω	T _J = 25 °C	—	61	—	ns
			T _J = 150 °C	—	56	—	
t _r	Rise time		T _J = 25 °C	—	31	—	
			T _J = 150 °C	—	27	—	
t _{d(off)}	Turn-off delay time		T _J = 25 °C	—	98	—	
			T _J = 150 °C	—	115	—	
t _f	Fall time		T _J = 25 °C	—	29	—	
			T _J = 150 °C	—	31	—	
E _{on}	Turn-on energy	V _{GS} = -5/18V V _{Bus} = 600V I _D = 225A R _{Gon} = 2.7Ω R _{Goff} = 0.5Ω di/dt = 5.8 kA/μs dv/dt = 24 kV/μs	T _J = 25 °C	—	4.6	—	mJ
			T _J = 150 °C	—	4.8	—	
			T _J = 25 °C	—	2	—	
E _{off}	Turn-off energy		T _J = 150 °C	—	2.3	—	
R _{Gint}	Internal gate resistance			—	3.2	—	Ω
R _{thjH}	Junction-to-heatsink thermal resistance	λ= 3.4 W/mK		—	0.196	—	°C/W

The following table lists the body diode ratings and characteristics (per SiC MOSFET) of the MSCSMC120AM04TBZ2AEG device.

Table 1-4. Body Diode Ratings and Characteristics

Symbol	Characteristic	Test Conditions		Min.	Typ.	Max.	Unit
V_{SD}	Diode forward voltage	$V_{GS} = -5V$ $I_{SD} = 225A$	$T_J = 25\text{ }^\circ\text{C}$	—	4.7	—	V
			$T_J = 150\text{ }^\circ\text{C}$	—	4.3	—	
t_{rr}	Reverse recovery time	$V_R = 600V$ $I_{SD} = 225A$	$T_J = 25\text{ }^\circ\text{C}$	—	26	—	ns
			$T_J = 150\text{ }^\circ\text{C}$	—	35	—	
Q_{rr}	Reverse recovery charge		$T_J = 25\text{ }^\circ\text{C}$	—	1.3	—	μC
			$T_J = 150\text{ }^\circ\text{C}$	—	2.9	—	
I_{rr}	Reverse recovery current	$V_{GS} = -5V$ $di_p/dt = 5.8\text{ kA}/\mu\text{s}$	$T_J = 25\text{ }^\circ\text{C}$	—	99	—	A
			$T_J = 150\text{ }^\circ\text{C}$	—	165	—	
E_{rr}	Reverse recovery energy		$T_J = 25\text{ }^\circ\text{C}$	—	0.24	—	mJ
			$T_J = 150\text{ }^\circ\text{C}$	—	0.84	—	

1.2. Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSMC120AM04TBZ2AEG 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		—	1.4	—	mΩ
L _{stray}	Module stray inductance between DC+ and DC−			—	7	—	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 MSCSMC120AM04TBZ2AEG 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 MSCSMC120AM04TBZ2AEG device.

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

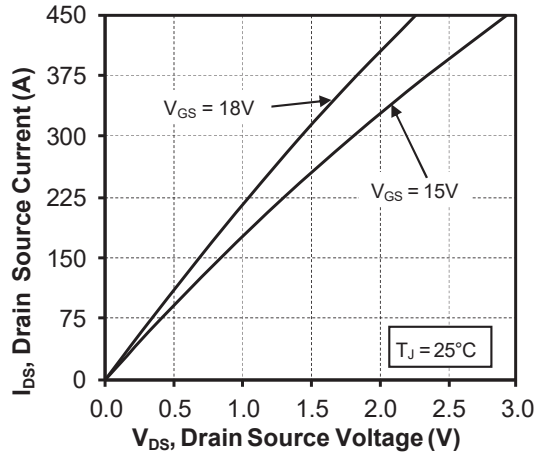


Figure 1-2. Output Characteristics, $T_J = 150^\circ\text{C}$

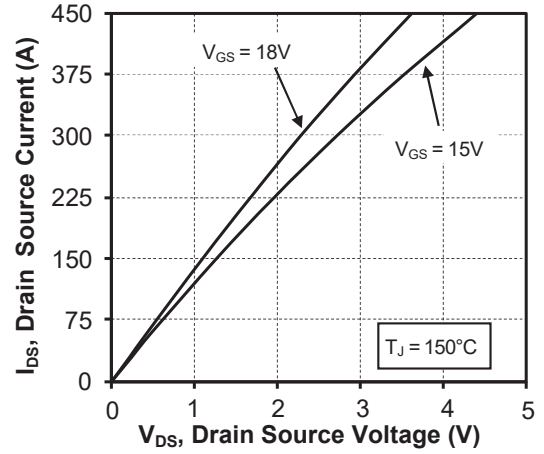


Figure 1-3. Output Characteristics, $T_J = 175^\circ\text{C}$

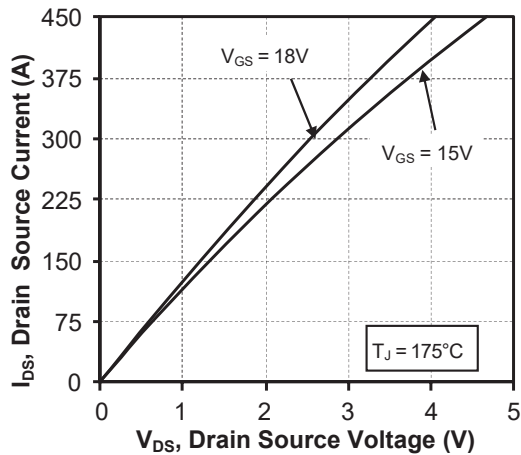


Figure 1-4. Switching Energy vs. Current

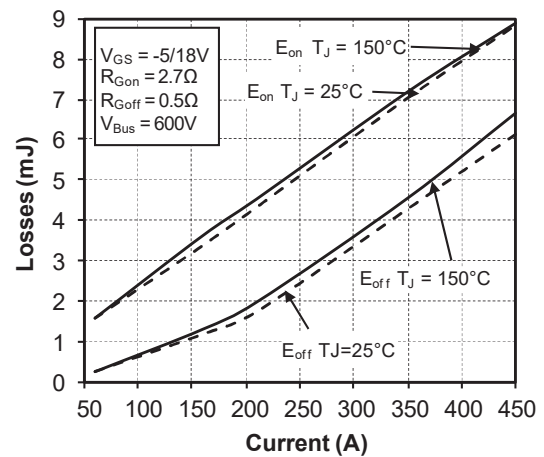


Figure 1-5. Switching Energy vs. R_G

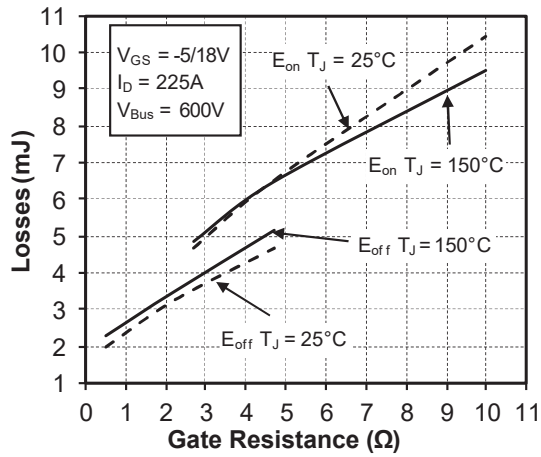


Figure 1-6. Junction-to-Heatsink Thermal Impedance

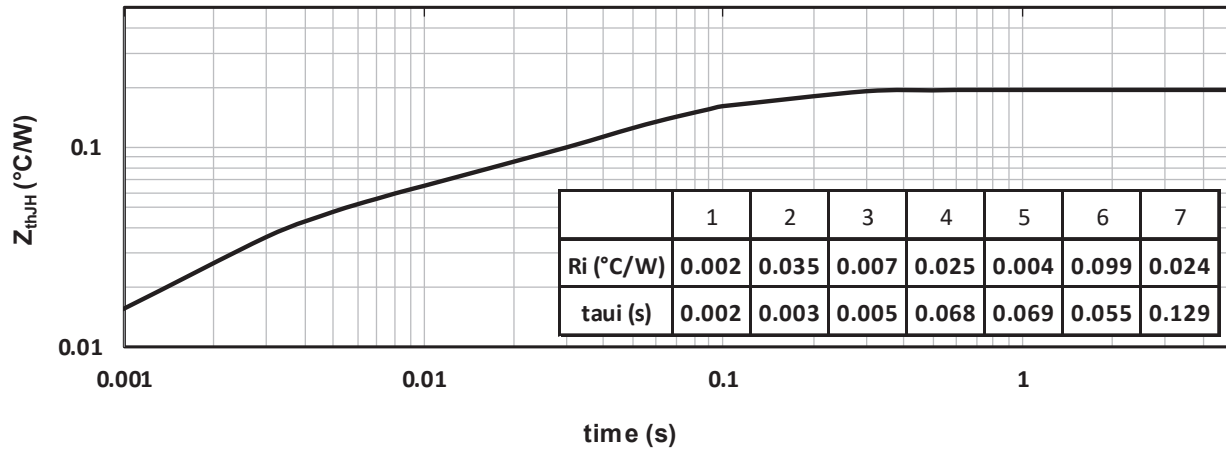


Figure 1-7. Capacitance vs. Drain Source Voltage

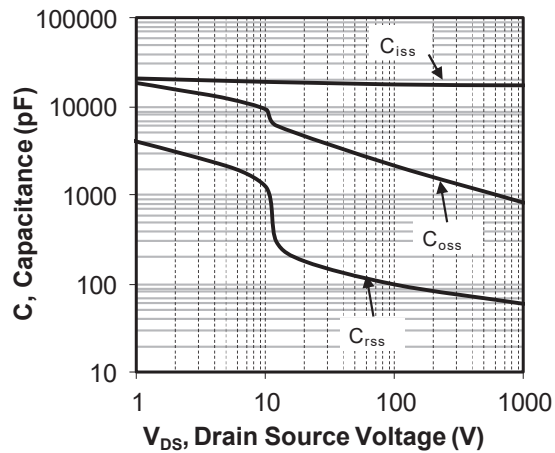


Figure 1-8. Gate Charge vs. Gate Source Voltage

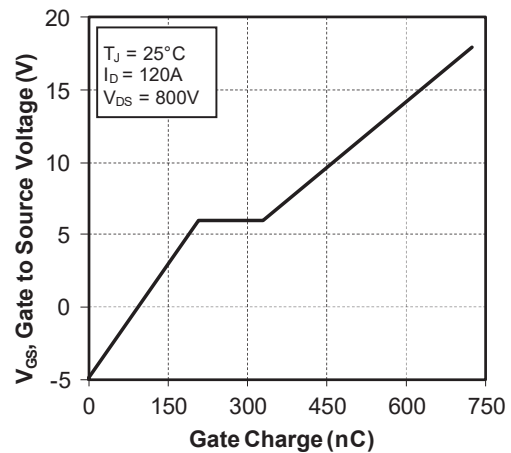


Figure 1-9. Body Diode Characteristics, $T_J = 25^\circ\text{C}$

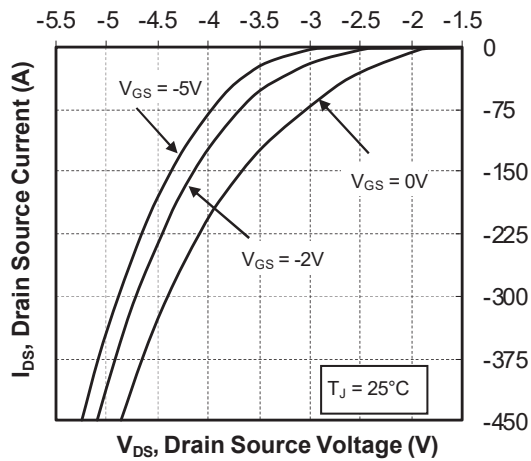


Figure 1-10. 3rd Quadrant Characteristics, $T_J = 25^\circ\text{C}$

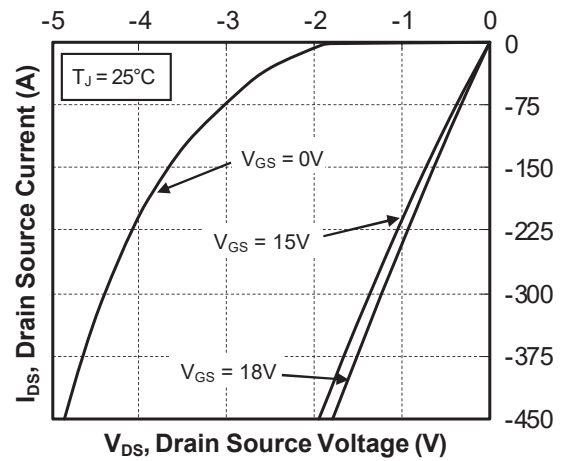


Figure 1-11. Body Diode Characteristics, $T_J = 150^\circ\text{C}$

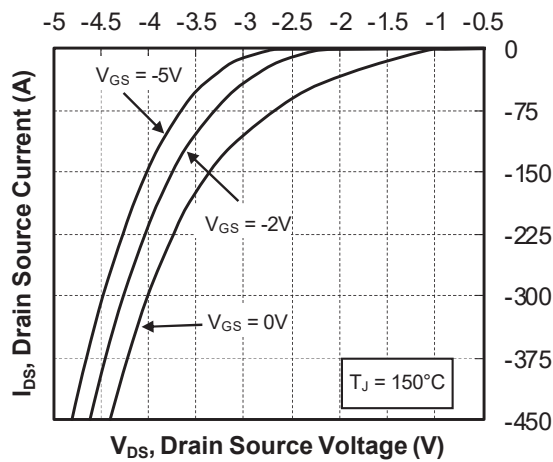


Figure 1-12. 3rd Quadrant Characteristics, $T_J = 150^\circ\text{C}$

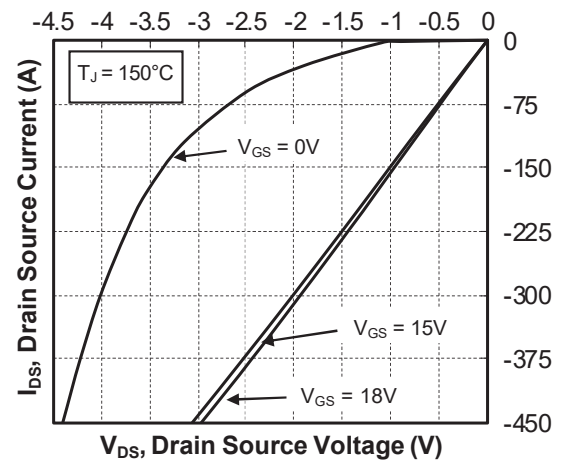


Figure 1-13. Body Diode Characteristics, $T_J = 175^\circ\text{C}$

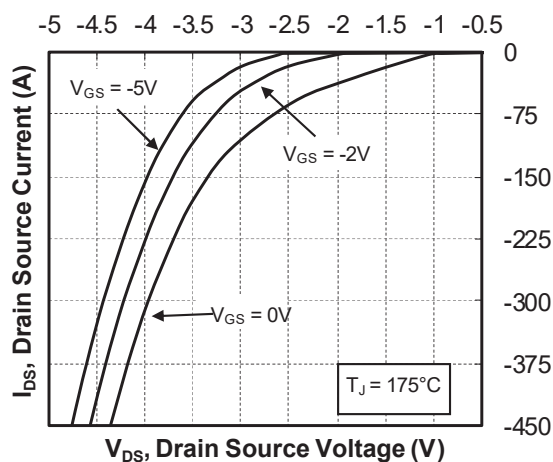


Figure 1-14. 3rd Quadrant Characteristics, $T_J = 175^\circ\text{C}$

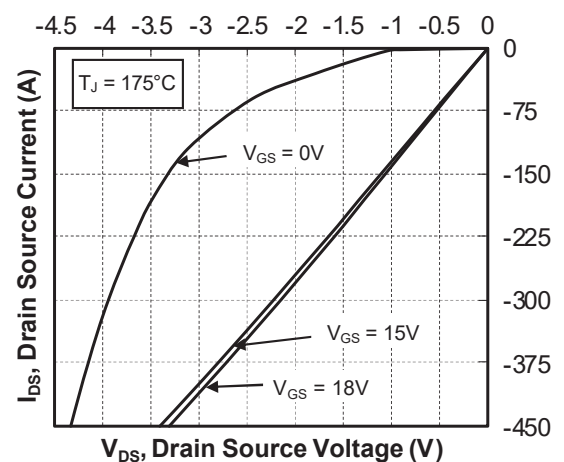


Figure 1-15. Switching Times vs. Drain Current

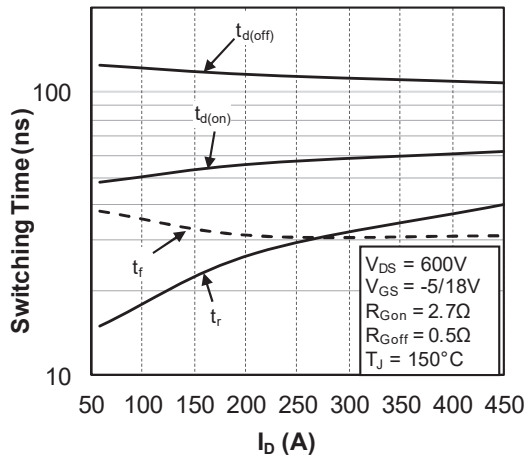


Figure 1-16. Switching Times vs. Gate Resistance

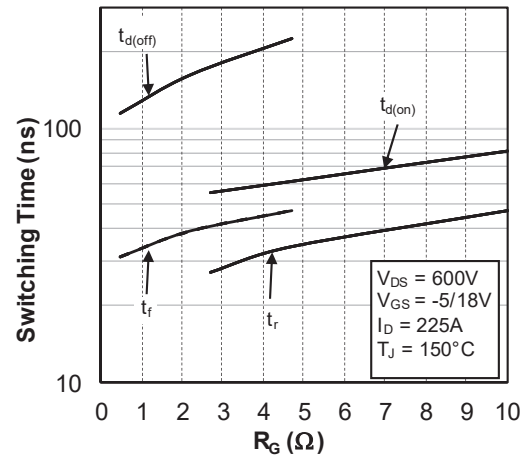


Figure 1-17. E_{rr} vs. Current

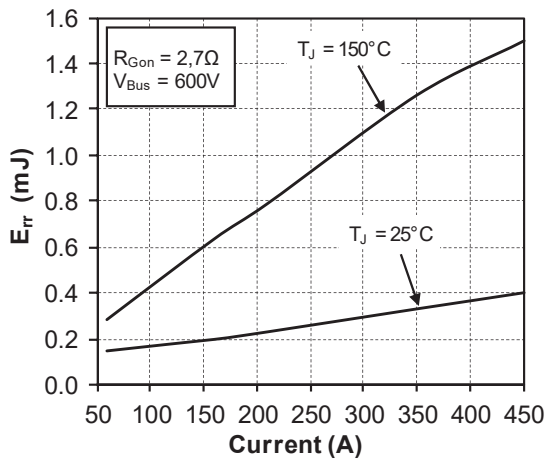


Figure 1-18. E_{rr} vs. Gate Resistance

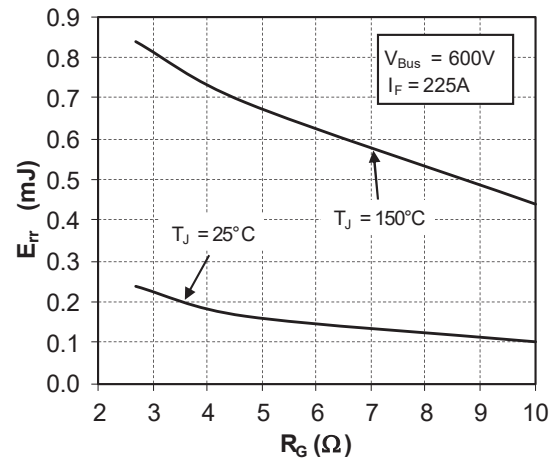


Figure 1-19. Operating Frequency vs. Drain Current

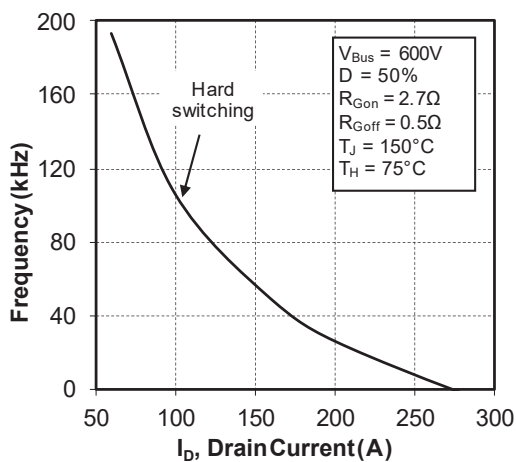
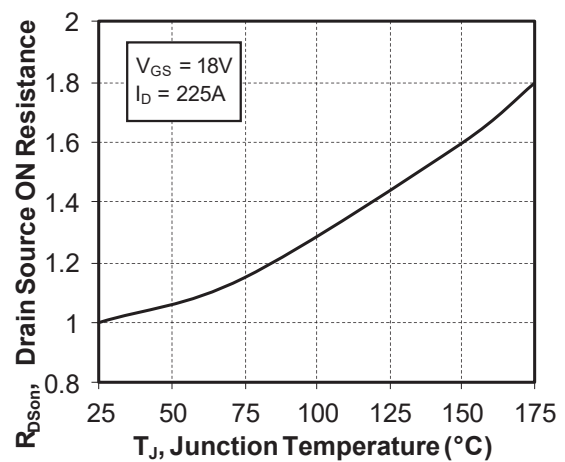


Figure 1-20. Normalized $R_{DS(on)}$ vs. Temperature



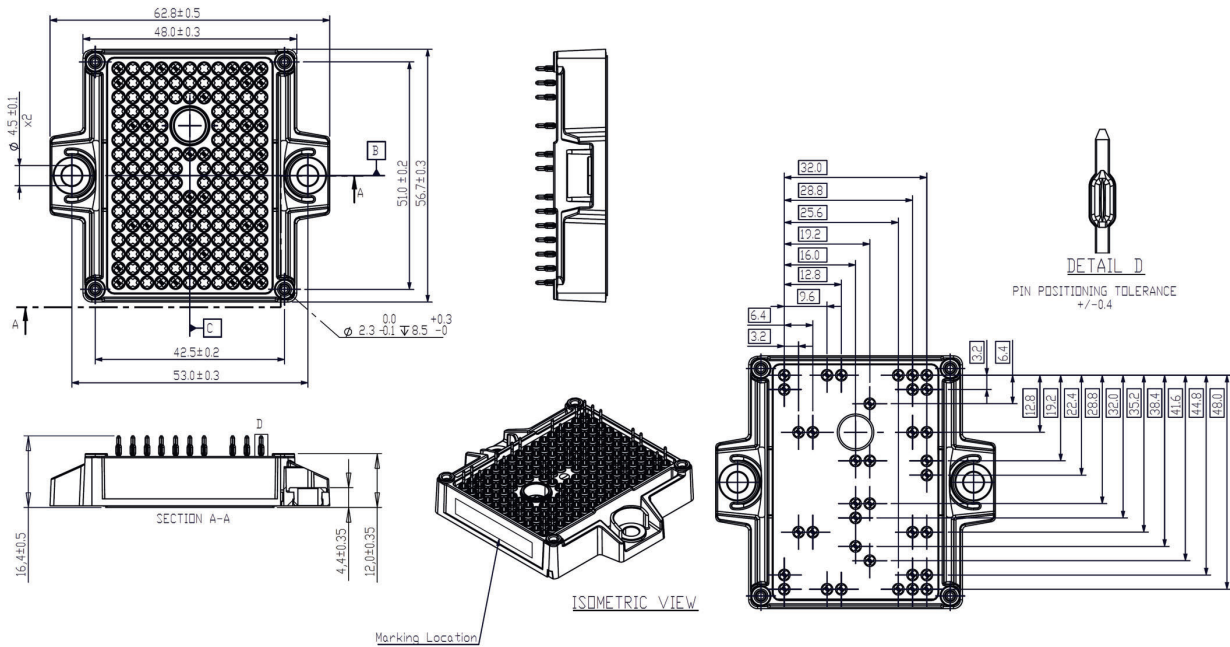
2. Package Specifications

The following section shows the package specification of the MSCSMC120AM04TBZ2AEG device.

2.1. Package Outline

The following figure shows the package outline drawing of the MSCSMC120AM04TBZ2AEG 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	03/2026	Initial Revision

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