

**MSCMC170AM08CT6LIAG**

**Datasheet**

**Very Low Stray Inductance Phase Leg SiC MOSFET Power  
Module**

Final

May 2018



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# 1 Revision History

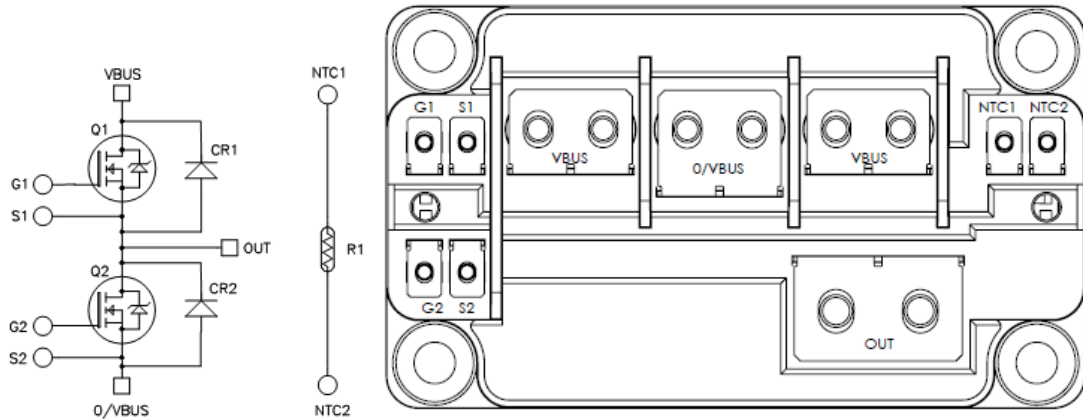
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The revision history describes the changes that were implemented in the document. The changes are listed by revision, starting with the most current publication.

## 1.1 Revision A

Revision A was published in May 2018. It is the first publication of this document.

## 2 Product Overview



### 2.1 Features

The following are key features of the MSCMC170AM08CT6LIAG device:

- Very low stray inductance
- Internal thermistor for temperature monitoring
- M4 and M5 power connectors
- M2.5 signal connectors
- AlN substrate for improved thermal performance

#### SiC power MOSFET

- Low  $R_{DS(on)}$
- High temperature performance

#### SiC Schottky diode

- Zero reverse recovery
- Zero forward recovery
- Temperature independent switching behavior
- Positive temperature coefficient on VF

### 2.2 Benefits

The following are the benefits of the MSCMC170AM08CT6LIAG device:

- Outstanding performance at high-frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction to case thermal resistance
- Low profile
- RoHS compliant

### 2.3 Applications

The MSCMC170AM08CT6LIAG device is designed for the following applications:

- Motor control

\*All ratings taken at  $T_j = 25\text{ }^\circ\text{C}$  unless otherwise specified.

Caution: These devices are sensitive to electrostatic discharge. Proper handling procedures should be followed.

## 3 Electrical Specifications

This section details the electrical specifications for the MSCMC170AM08CT6LIAG device.

### 3.1 Absolute Maximum Ratings

The following table shows the SiC MOSFET absolute maximum ratings (per SiC MOSFET) for the MSCMC170AM08CT6LIAG device.

**Table 1 • Absolute Maximum Ratings**

Symbol	Parameter	Max Ratings	Unit
$V_{DS}$	Drain-source voltage	1700	V
$I_D$	Continuous drain current	$T_C = 25\text{ }^\circ\text{C}$	280
		$T_C = 80\text{ }^\circ\text{C}$	207
$I_{DM}$	Pulsed drain current	560	
$V_{GS}$	Gate-source voltage	-5 to 23	V
$V_{GSOP}$	Gate-source voltage; recommended operation values	-5 to 18	
$R_{DS(on)}$	Drain-source ON resistance	11.7	m $\Omega$
$P_D$	Power dissipation	$T_C = 25\text{ }^\circ\text{C}$	1780

### 3.2 Electrical Performance

The following tables show the SiC MOSFET characteristics (per SiC MOSFET) of the MSCMC170AM08CT6LIAG device.

**Table 2 • Electrical Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$I_{DSS}$	Zero gate voltage drain current	$V_{GS} = 0\text{ V}, V_{DS} = 1700\text{ V}$		60	600	$\mu\text{A}$
$R_{DS(on)}$	Drain-source on resistance	$V_{GS} = 20\text{ V}, I_D = 300\text{ A}$		7.5	11.7	m $\Omega$
		$V_{GS} = 18\text{ V}, I_D = 300\text{ A}$	$T_j = 150\text{ }^\circ\text{C}$	15		
$V_{GS(th)}$	Gate threshold voltage	$V_{GS} = V_{DS}, I_D = 108\text{ mA}$	2	2.4	4	V
$I_{GSS}$	Gate-source leakage current	$V_{GS} = 20\text{ V}, V_{DS} = 0\text{ V}$			3.6	$\mu\text{A}$

**Table 3 • Dynamic Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$C_{iss}$	Input capacitance	$V_{GS} = 0\text{ V}$		22		nF
$C_{oss}$	Output capacitance	$V_{DS} = 1000\text{ V}$		1.03		
$C_{rss}$	Reverse transfer capacitance	$f = 1\text{ MHz}$		0.04		
$Q_g$	Total gate charge	$V_{GS} = -5\text{ to }20\text{ V}$		1128		nC
$Q_{gs}$	Gate-source charge	$V_{Bus} = 1200\text{ V}$		264		
$Q_{gd}$	Gate-drain charge	$I_D = 300\text{ A}$		342		
$T_{d(on)}$	Turn-on delay time	$V_{GS} = -5\text{ to }20\text{ V}$		105		ns

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$T_r$	Rise time	$V_{Bus} = 900\text{ V}$		75		
$T_{d(off)}$	Turn-off delay time	$I_D = 300\text{ A}$		210		
$T_f$	Fall time	$R_G = 3.3\ \Omega$		55		
$E_{on}$	Turn on energy	Inductive switching	$T_j = 150\text{ }^\circ\text{C}$	13.2		mJ
$E_{off}$	Turn off energy	$V_{GS} = -5\text{ to }20\text{ V}$ $V_{Bus} = 900\text{ V}$ $I_D = 300\text{ A}$ $R_G = 3.3\ \Omega$	$T_j = 150\text{ }^\circ\text{C}$	9		
$R_{Gint}$	Internal gate resistance			0.9		$\Omega$
$R_{thJC}$	Junction-to-case thermal resistance				0.07	$^\circ\text{C/W}$

**Table 4 • Body Diode Ratings and Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{SD}$	Diode forward voltage	$V_{GS} = -5\text{ V}$ $I_{SD} = 150\text{ A}$	$T_j = 25\text{ }^\circ\text{C}$ $T_j = 150\text{ }^\circ\text{C}$	4.1 3.6		V
$t_{rr}$	Reverse recovery time	$I_{SD} = 300\text{ A}$		70		ns
$Q_{rr}$	Reverse recovery charge	$V_{GS} = -5\text{ V}$		3.2		$\mu\text{C}$
$I_{rr}$	Reverse recovery current	$V_R = 1200\text{ V}$ $di_r/dt = 8400\text{ A}/\mu\text{s}$		84		A

The following table shows the SiC diode characteristics of the MSCMC170AM08CT6LIAG device (per SiC diode).

**Table 5 • SiC Diode Characteristics**

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
$V_{RRM}$	Peak repetitive reverse voltage				1700	V
$I_{RM}$	Reverse leakage current	$V_R = 1700\text{ V}$	$T_j = 25\text{ }^\circ\text{C}$ $T_j = 175\text{ }^\circ\text{C}$	0.48 1	3 6.4	mA
$I_F$	DC forward current		$T_c = 125\text{ }^\circ\text{C}$	200		A
$V_F$	Diode forward voltage	$I_F = 200\text{ A}$	$T_j = 25\text{ }^\circ\text{C}$ $T_j = 175\text{ }^\circ\text{C}$	1.6 2.5	1.9 2.8	V
$Q_C$	Total capacitive charge	$V_R = 1100\text{ V}$		1480		nC
$C$	Total capacitance	$f = 1\text{ MHz}, V_R = 400\text{ V}$ $f = 1\text{ MHz}, V_R = 800\text{ V}$		960 936		pF
$R_{thJC}$	Junction-to-case thermal resistance				0.086	$^\circ\text{C/W}$

The following tables show the thermal and package characteristics of the MSCMC170AM08CT6LIAG device.

**Table 6 • Package Characteristics**

Symbol	Characteristic		Min	Max	Unit	
V <sub>ISOL</sub>	RMS isolation voltage, any terminal to case t = 1 min, 50 to 60 Hz		4000		V	
T <sub>J</sub>	Operating junction temperature range	SiC MOSFET	-40	150	°C	
		SiC diode	-40	175		
T <sub>JOP</sub>	Recommended junction temperature under switching conditions		-40	T <sub>Jmax</sub> -25		
T <sub>STG</sub>	Storage temperature range		-40	125		
T <sub>C</sub>	Operating case temperature		-40	125		
Torque	Mounting torque	For terminals	M2.5	0.4	0.6	N.m
			M4	2	3	
			M5	2	3.5	
		To heatsink	M6	3	5	
L <sub>DC</sub>	Module stray inductance between VBUS and 0/VBUS			3	nH	
Wt	Package weight			320	g	

**Table 7 • Temperature Sensor NTC**

Symbol	Characteristic	Min	Typ	Max	Unit
R <sub>25</sub>	Resistance at 25 °C		50		k Ω
ΔR <sub>25</sub> /R <sub>25</sub>			5		%
B <sub>25/85</sub>	T <sub>25</sub> = 298.15 K		3952		K
ΔB/B	T <sub>C</sub> = 100 °C		4		%

**Note:** See the APT0406 Application Note at [www.microsemi.com](http://www.microsemi.com).

**Figure 1 • NTC Formula**

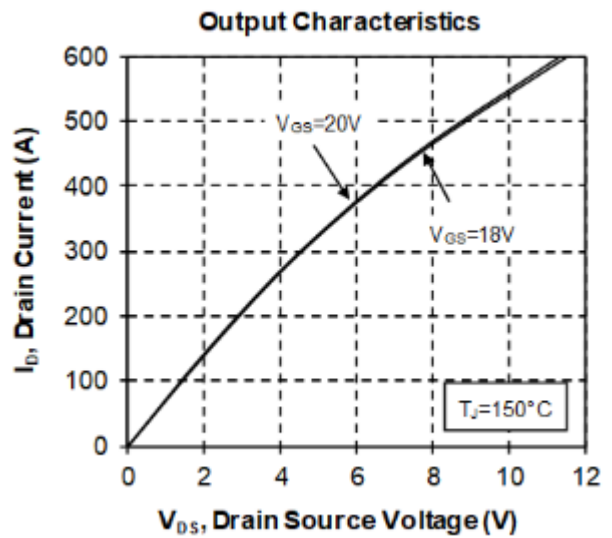
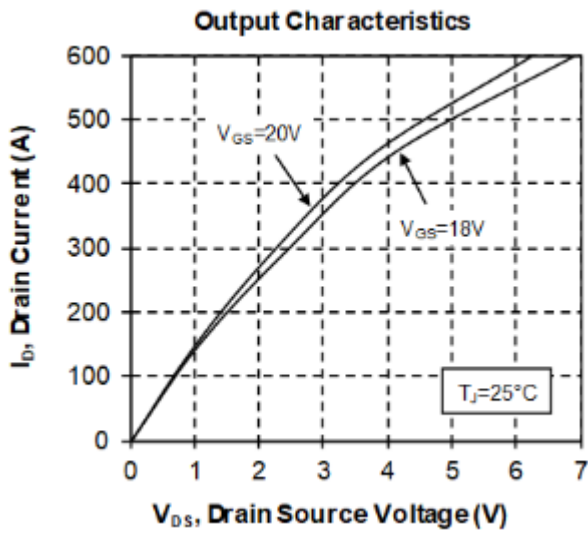
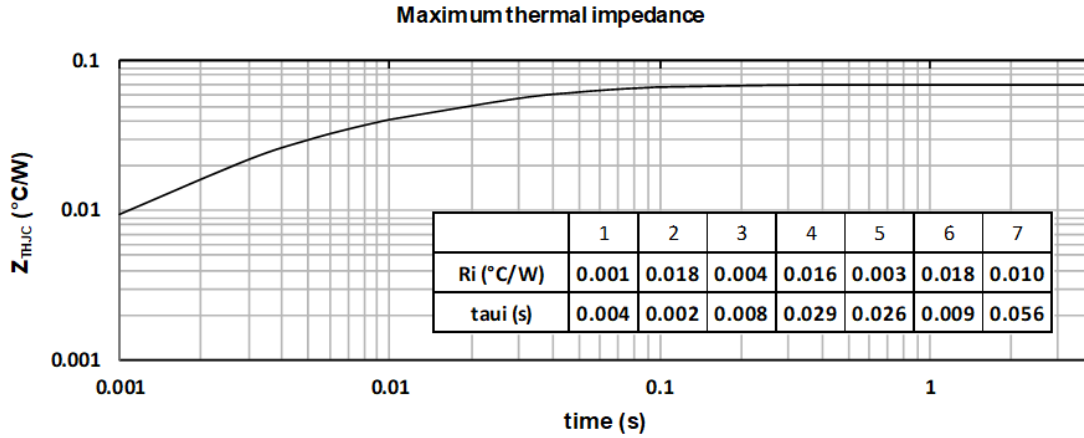
$$R_T = \frac{R_{25}}{\exp \left[ B_{25/85} \left( \frac{1}{T_{25}} - \frac{1}{T} \right) \right]}$$

T: thermistor temperature R<sub>T</sub>: thermistor value at T

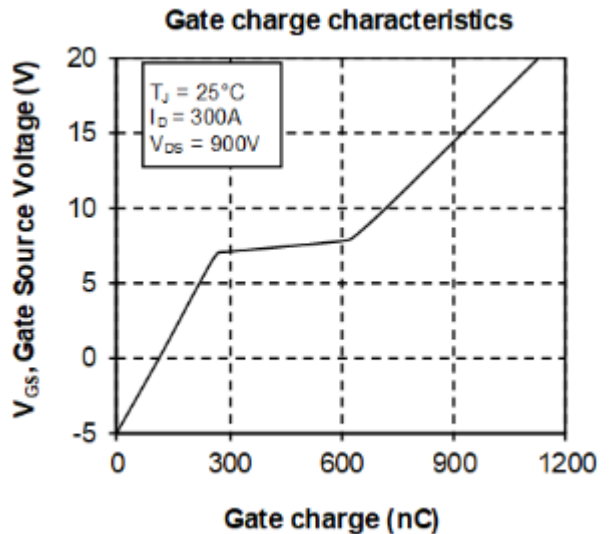
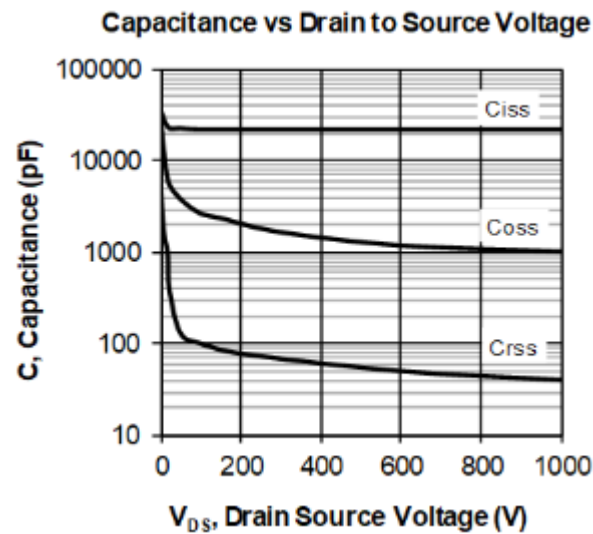
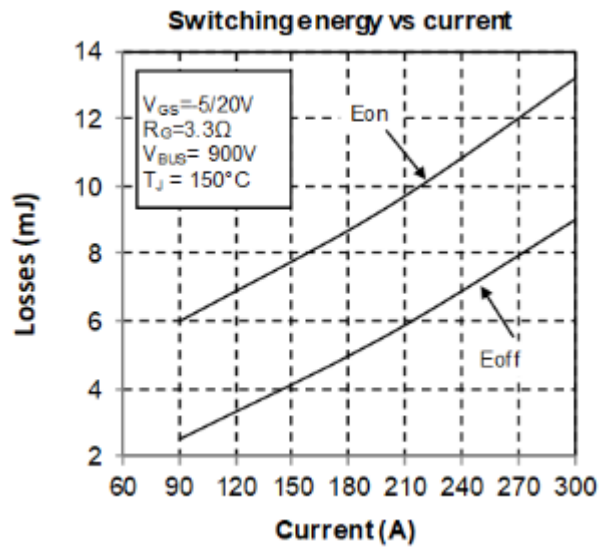
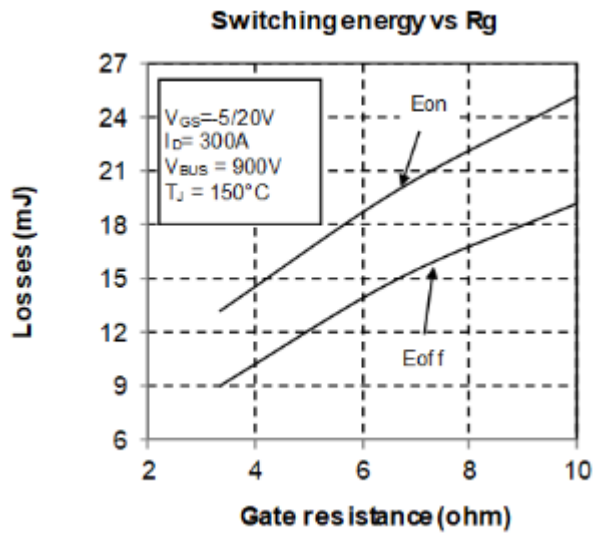
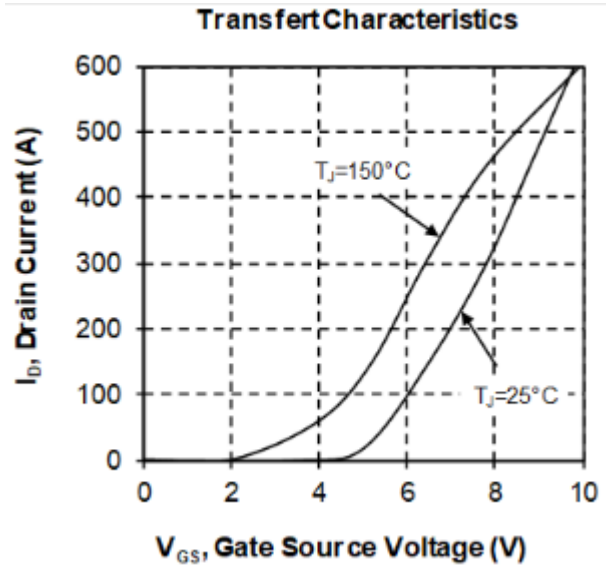
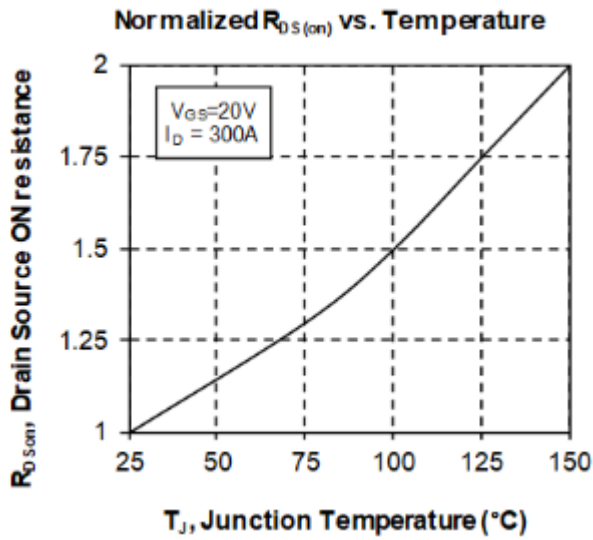
### 3.3 Typical Performance Curves

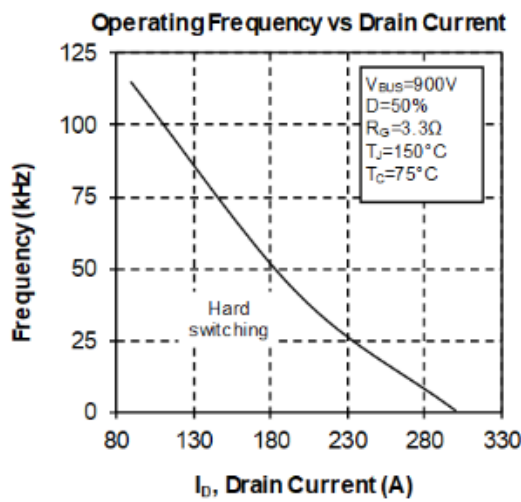
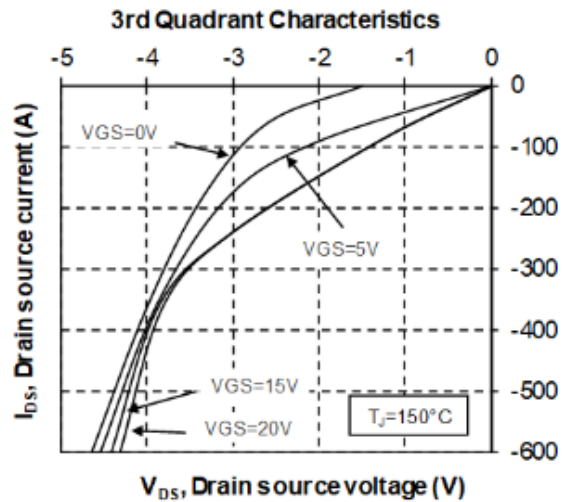
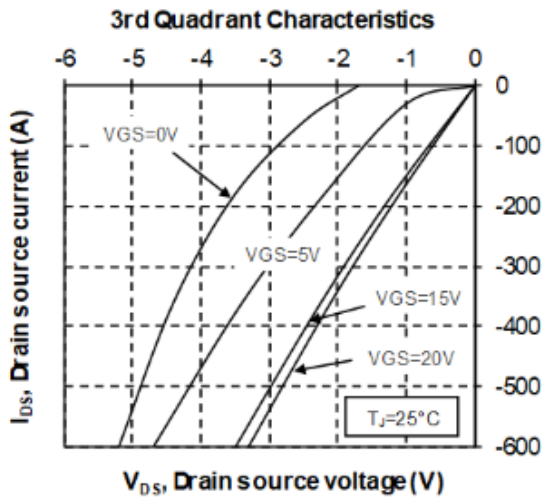
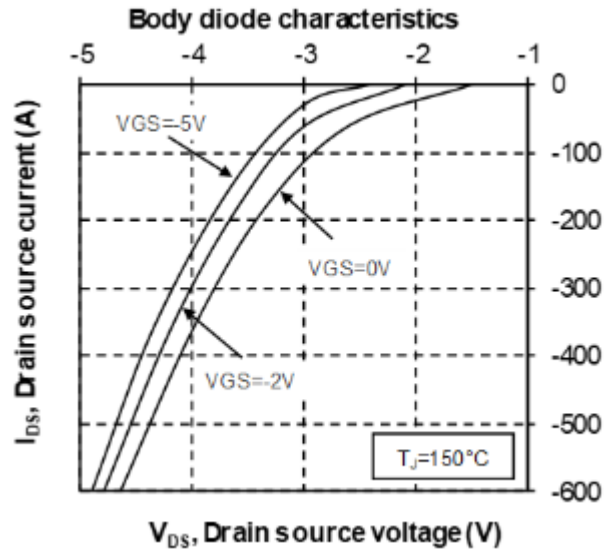
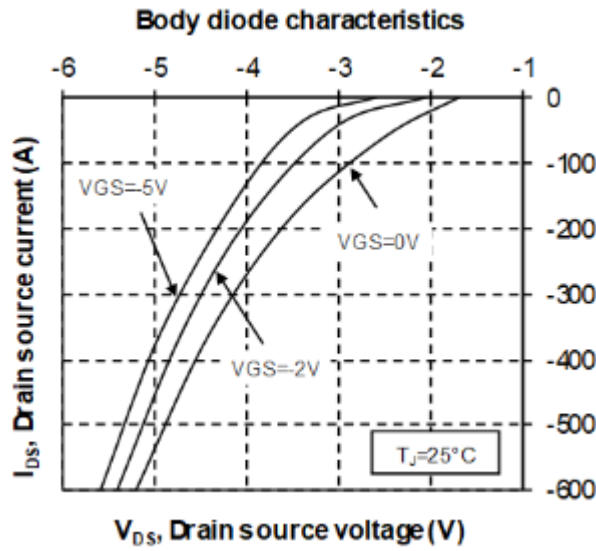
This section shows the typical performance curves for the MSCMC170AM08CT6LIAG device.

The following section details the typical performance curves for the SiC MOSFET.



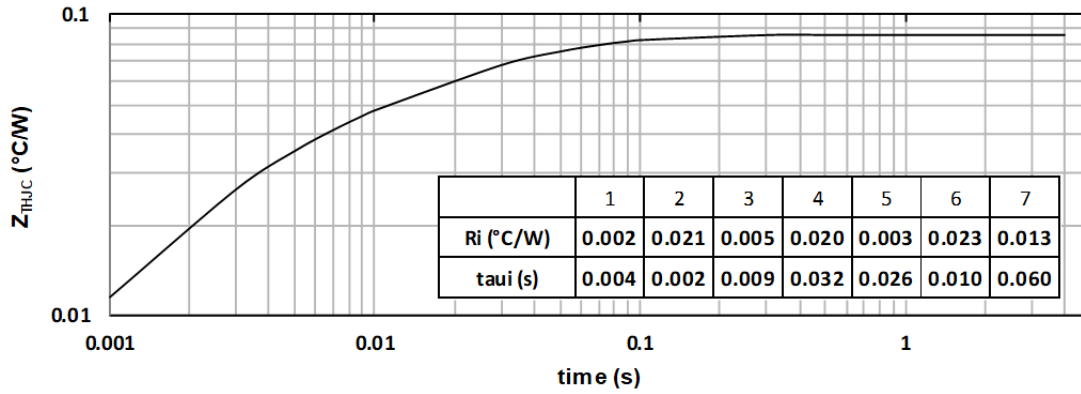




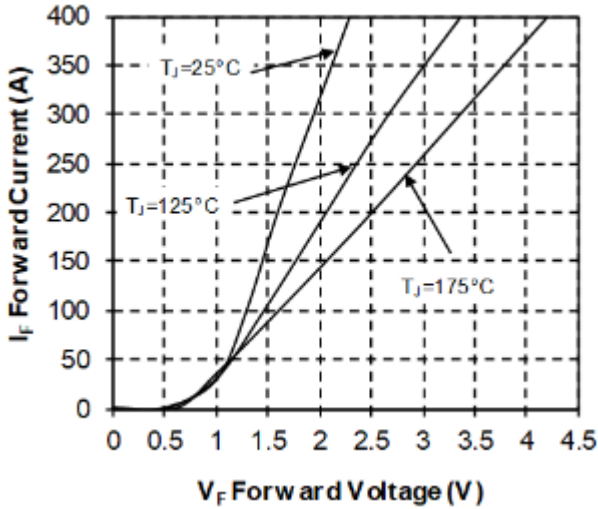


The following section details the typical performance curves for the SiC Diode.

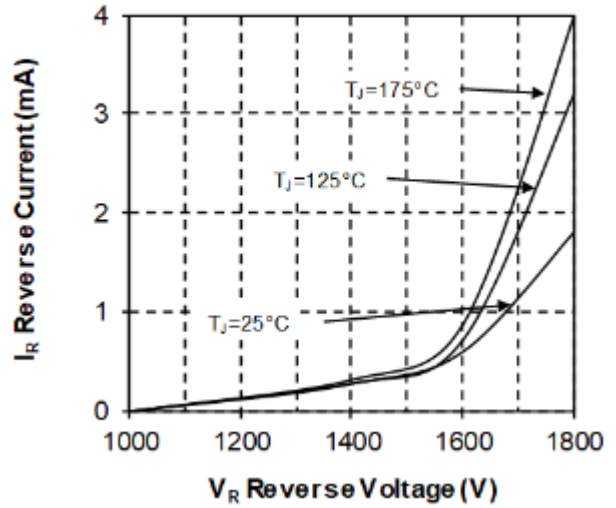
**Maximum thermal impedance**



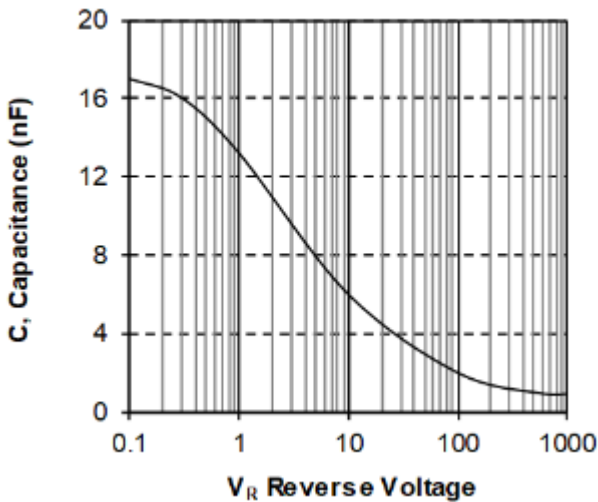
**Forward Characteristics**



**Reverse Characteristics**



**Capacitance vs. Reverse Voltage**

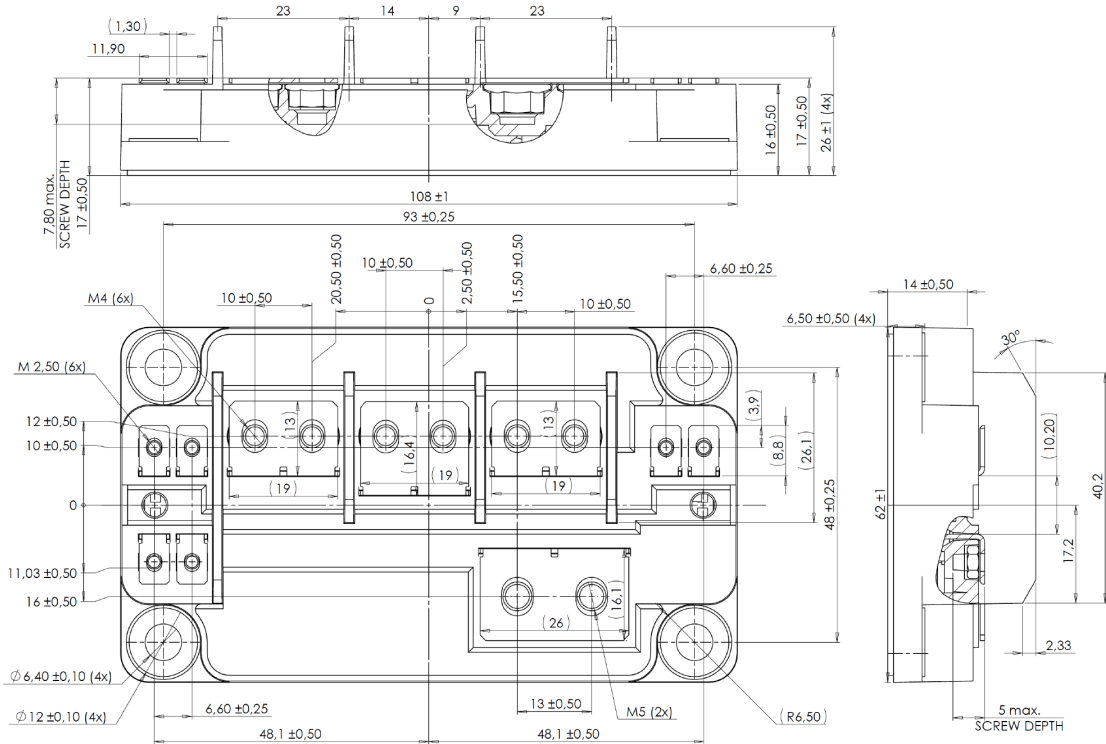


## 4 Package Specification

This section outlines the package specification for the MSCMC170AM08CT6LIAG device.

### 4.1 Package Outline Drawing

Figure 2 • Package Outline (Dimensions in mm)



See application note AN1911 - Mounting Instructions for SP6 Low Inductance Power Module at [www.microsemi.com](http://www.microsemi.com)

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