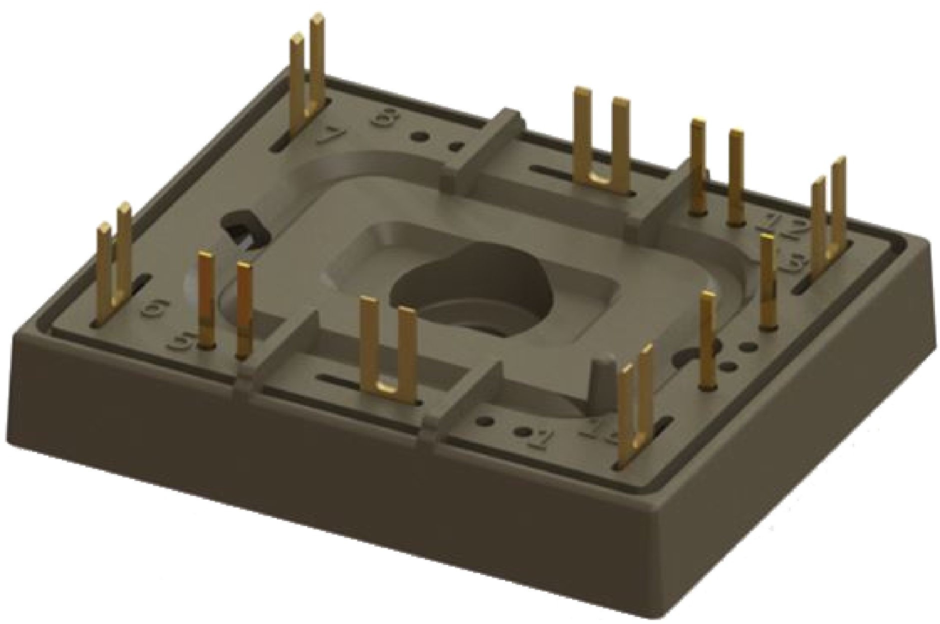
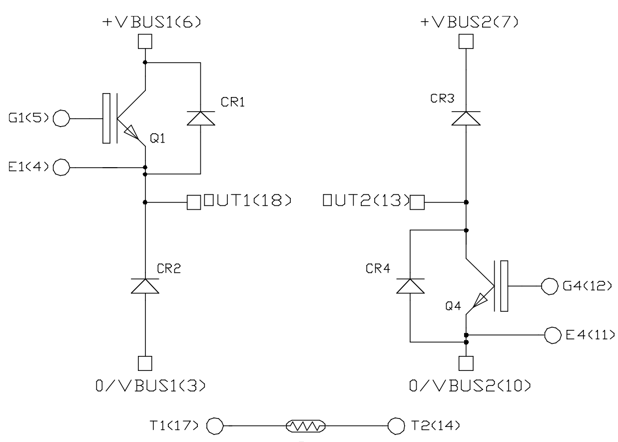
MSCGLQ50DH120CTBL2NG

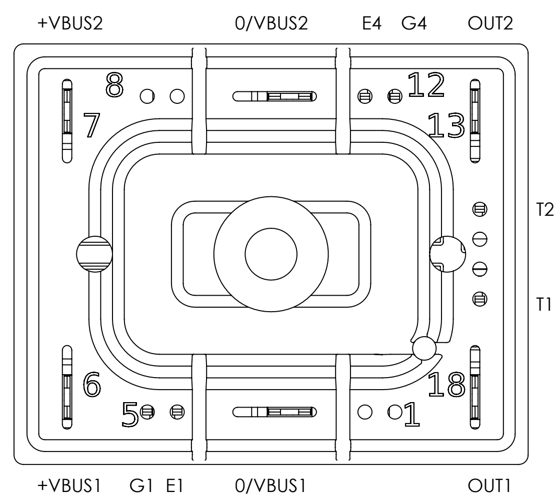
Asymmetrical Bridge High-Speed IGBT4 Power Module

Product Overview

The MSCGLQ50DH120CTBL2NG device is a 1200 V, 50 A asymmetrical bridge high-speed IGBT4 power module.







All ratings at T_J = 25°C, unless otherwise specified.

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

Features

The following are the key features of MSCGLQ50DH120CTBL2NG device:

- High speed IGBT4
  - Low voltage drop
  - Low leakage current
  - Low switching losses
- SiC Schottky Diode
  - Zero reverse recovery
  - Zero forward recovery
  - Temperature independent switching behavior
  - Positive temperature coefficient on VF
- Very low stray inductance
- Ultra low weight and profile
- Kelvin source for easy drive
- Si3N4 substrate with thick copper for improved thermal performance
- Internal thermistor for temperature monitoring
- Extended temperature range

Benefits

The following are the benefits of MSCGLQ50DH120CTBL2NG device:

- High efficiency converter
- Outstanding performance at high frequency operation
- Direct mounting to heatsink (isolated package)
- Low junction-to-heatsink thermal resistance
- Low profile
- RoHS Compliant
- Solderable terminals both for power and signal for easy PCB mounting
- Very integrated power conversion system

Application

The following are the applications of MSCGLQ50DH120CTBL2NG device:

- High reliability power systems
- High Efficiency AC/DC and DC/AC converters
- Motor control

1. Electrical Specifications

This section provides the electrical specifications of MSCGLQ50DH120CTBL2NG device.

1.1 IGBT4 Characteristics (Per IGBT)

The following table lists the absolute maximum ratings of MSCGLQ50DH120CTBL2NG device.

Table 1-1. Absolute Maximum Ratings

Symbol	Parameter		Maximum Ratings	Unit
V_{CES}	Collector-Emitter voltage		1200	V
I_C	Continuous collector current	T_H = 25°C	110	A
		T_H = 100°C	50	
I_{CM}	Pulsed collector current	T_H = 25°C	180	
V_{GE}	Gate-Emitter voltage		±20	V
P_D	Power dissipation	T_H = 25 °C	375	W

The following table lists the electrical characteristics of MSCGLQ50DH120CTBL2NG device.

Table 1-2. Electrical Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
I_{CES}	Zero gate voltage collector current	V_{GE} = 0 V V_{CE} = 1200 V		—	—	25	µA
$V_{CE(sat)}$	Collector emitter saturation voltage	V_{GE} = 15 V	T_J = 25°C	1.7	2.05	2.4	V
		I_C = 50 A	T_J = 150°C	—	2.6	—	
$V_{GE(th)}$	Gate threshold voltage	V_{GE} = V_{CE} I_C = 1.7 mA		5.3	5.8	6.3	V
I_{GES}	Gate-Emitter leakage current	V_{GE} = 20 V V_{CE} = 0 V		—	—	150	nA

The following table lists the dynamic characteristics of MSCGLQ50DH120CTBL2NG device.

Table 1-3. Dynamic Characteristics

Symbol	Characteristic	Test Conditions		Min	Typ	Max	Unit
C_{ies}	Input capacitance	V_{GE} = 0 V V_{CE} = 25 V f = 1 MHz		—	2770	—	pF
C_{oes}	Output capacitance			—	185	—	
C_{res}	Reverse transfer capacitance			—	160	—	
Q_g	Total gate charge	V_{GE} = 15 V V_{CE} = 960 V I_C = 50 A		—	230	—	nC
$T_{d(on)}$	Turn-on delay time	V_{GE} = ±15 V V_{Bus} = 600 V I_C = 50 A R_G = 10 Ω	T_J = 150°C	—	30	—	ns
T_r	Rise time			—	49	—	
$T_{d(off)}$	Turn-off delay time			—	366	—	
T_f	Fall time				48	—	
E_{on}	Turn-on switching energy	V_{GE} = ±15 V V_{Bus} = 600 V I_C = 50 A R_G = 10 Ω	T_J = 150°C	—	2.8	—	mJ
E_{off}	Turn-off switching energy		T_J = 150°C	—	2.8	—	
R_G	Integrated gate resistor			—	4	—	Ω
I_{SC}	Short circuit data	V_{GE} ≤ 15 V V_{Bus} = 900 V t_p ≤ 10 µs	T_j = 150°C	—	190		A
R_{thJH}	Junction-to-heatsink thermal resistance	λpaste = 3.4 W/mK		—	0.4	—	°C/W

1.2 Chopper SiC Diode Ratings and Characteristics (Per SiC Diode)

The following table lists the chopper SiC diode ratings and characteristics of MSCGLQ50DH120CTBL2NG device.

Table 1-4. Chopper SiC Diode Ratings and Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Peak repetitive reverse voltage		—	—	1200	V
I_{RM}	Reverse leakage current	V_R = 1200 V, T_J = 25°C	—	10	200	µA
I_{RM}	Reverse leakage current	V_R = 1200 V, T_J = 175°C	—	150	—	µA
I_F	DC forward current	T_H = 100°C	—	30	—	A
V_F	Diode forward voltage	I_F = 30 A, T_J = 25°C	—	1.5	1.8	V
V_F	Diode forward voltage	I_F = 30 A, T_J = 175°C	—	2.1	—	V
Q_C	Total capacitive charge	V_R = 600 V	—	130	—	nC
C	Total capacitance	f = 1 MHz, V_R = 400 V	—	141	—	pF
C	Total capacitance	f = 1 MHz, V_R = 800 V	—	105	—	pF
R_{thJH}	Junction-to-heatsink thermal resistance	λpaste = 3.4 W/mK	—	0.854	—	°C/W

1.3 IGBT Parallel SiC Diode Ratings and Characteristics (Per SiC Diode)

The following table lists the IGBT parallel SiC diode ratings and characteristics of MSCGLQ50DH120CTBL2NG device.

Table 1-5. IGBT Parallel SiC Diode Ratings and Characteristics

Symbol	Characteristic	Test Conditions	Min	Typ	Max	Unit
V_{RRM}	Peak repetitive reverse voltage		—	—	1200	V
I_{RM}	Reverse leakage current	V_R = 1200 V, T_J = 25°C	—	10	200	µA
I_{RM}	Reverse leakage current	V_R = 1200 V, T_J = 175°C	—	50	—	µA
I_F	DC forward current	T_H = 110°C	—	10	—	A
V_F	Diode forward voltage	I_F = 10 A, T_J = 25°C	—	1.5	1.8	V
V_F	Diode forward voltage	I_F = 10 A, T_J = 175°C	—	2.1	—	V
Q_C	Total capacitive charge	V_R = 600 V	—	48	—	nC
C	Total capacitance	f = 1 MHz, V_R = 400 V	—	55	—	pF
C	Total capacitance	f = 1 MHz, V_R = 800 V	—	43	—	pF
R_{thJH}	Junction-to-heatsink thermal resistance	λpaste = 3.4 W/mK	—	1.63	—	°C/W

1.4 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of MSCGLQ50DH120CTBL2NG device.

Table 1-6. Thermal and Package Characteristics

Symbol	Characteristic			Min	Typ	Max	Unit
V_{ISOL}	RMS isolation voltage, any terminal to case t = 1 min, 50 Hz/60 Hz			2500	—	—	V
T_J	Operating junction temperature range			–55	—	175	°C
T_{JOP}	Recommended junction temperature under switching conditions			–55	—	T_{Jmax}–25	
T_{STG}	Storage case temperature			–55	—	125	
T_C	Operating case temperature			–55	—	125	
Torque	Mounting torque	To heatsink	M4	1.5	—	2	N.m
Wt	Package weight			—	21.5	—	g

The following table lists the temperature sensor NTC of MSCGLQ50DH120CTBL2NG device.

Table 1-7. Temperature Sensor NTC

Symbol	Characteristic		Min	Typ	Max	Unit
R_{25}	Resistance at 25 °C		—	50	—	kΩ
$\Delta R_{25}/R_{25}$	—		—	5	—	%
$B_{25/85}$	T_{25} = 298.15 K		—	3952	—	K
ΔB/B	—	T_C = 100°C	—	4	—	%

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

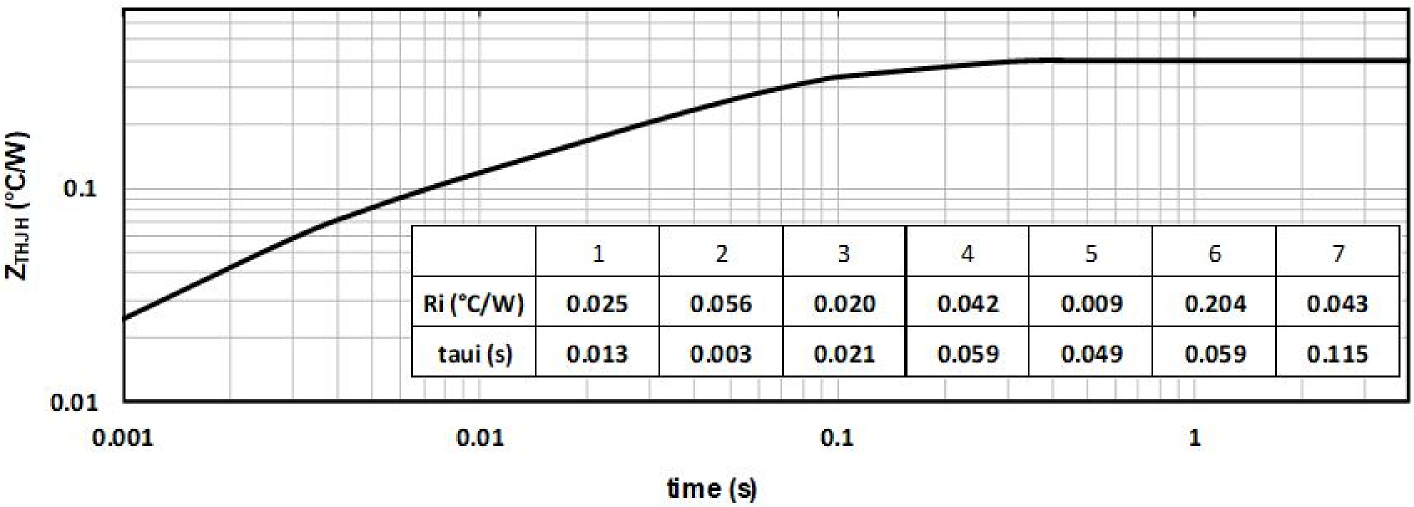
T: Thermistor temperature
R_T: Thermistor value at T

Note: See APT0406—Using NTC Temperature Sensor Integrated into Power Module for more information.

1.5 Typical IGBT4 Performance Curve (Per IGBT)

This section shows the typical IGBT 4 performance curves of MSCGLQ50DH120CTBL2NG device.

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



	1	2	3	4	5	6	7
Ri (°C/W)	0.025	0.056	0.020	0.042	0.009	0.204	0.043
taui (s)	0.013	0.003	0.021	0.059	0.049	0.059	0.115

Figure 1-2. Output Characteristics (V_{GE} = 15 V)

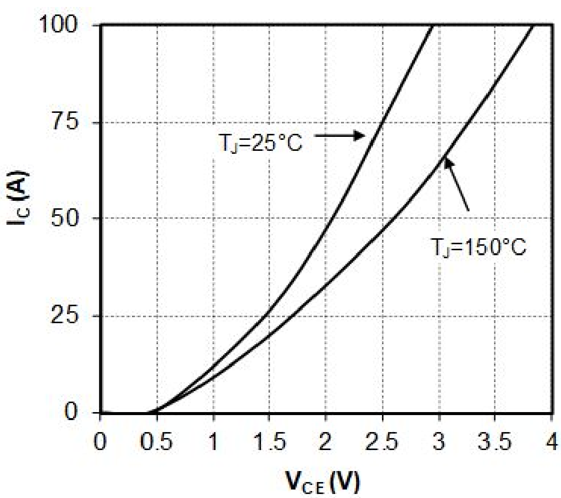


Figure 1-3. Output Characteristics

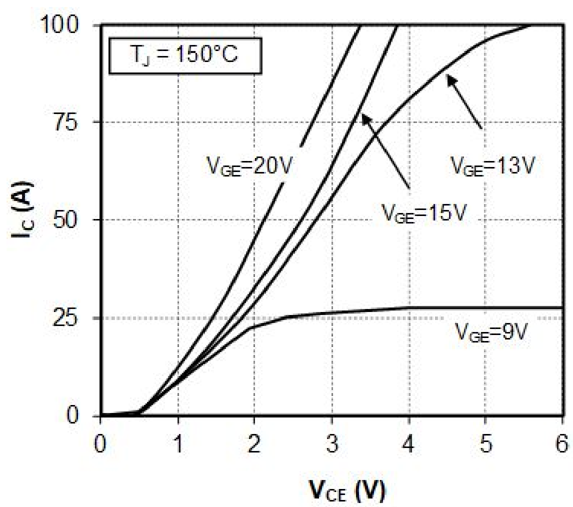


Figure 1-4. Transfer Characteristics

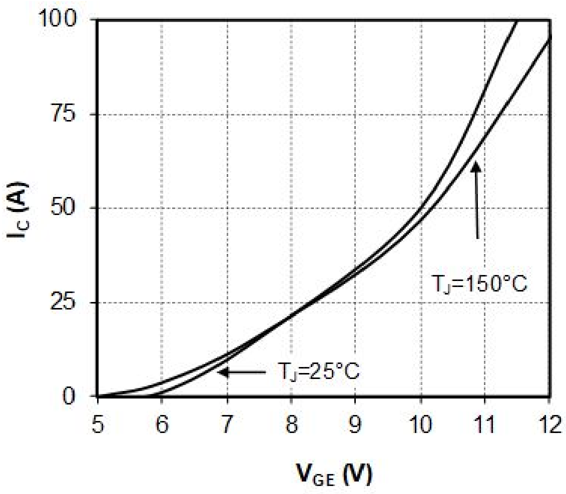


Figure 1-5. Energy losses vs. Collector Current

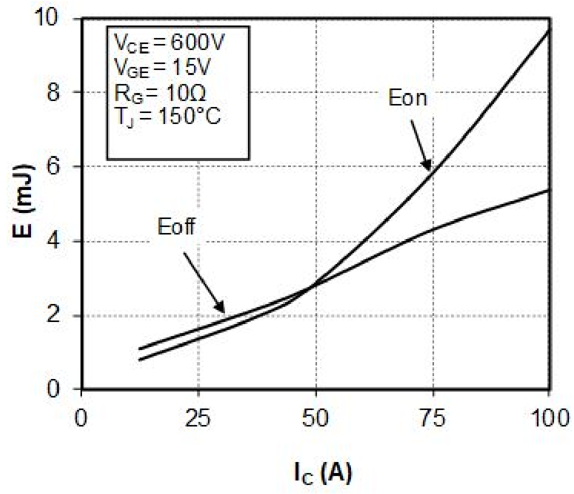


Figure 1-6. Switching Energy Losses vs. Gate Resistance

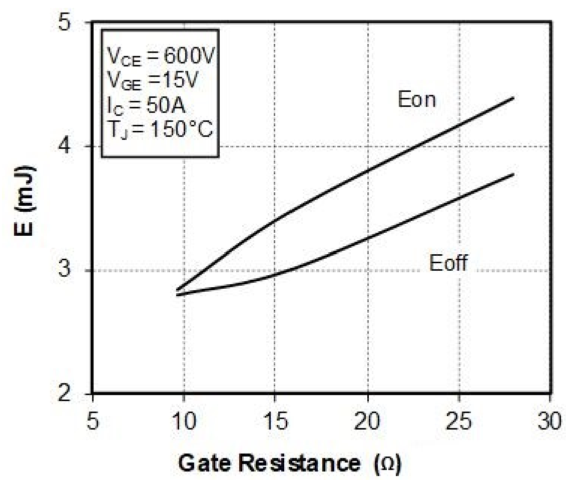
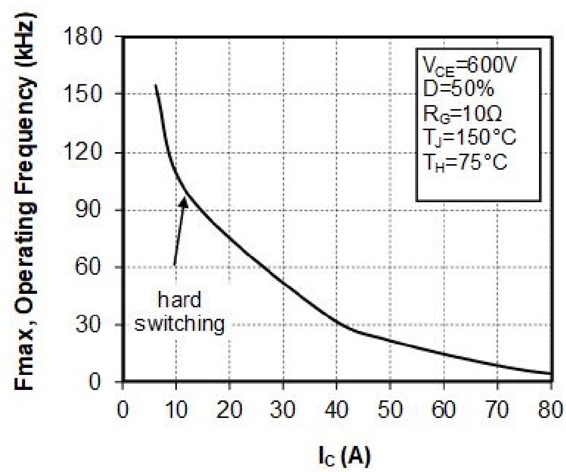


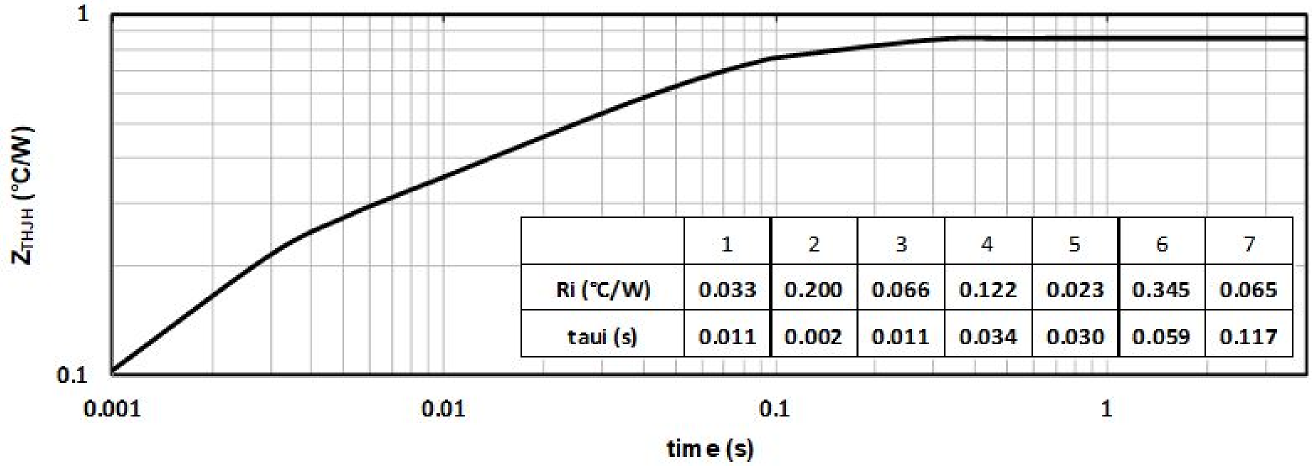
Figure 1-7. Operating Frequency vs. Collector Current



1.6 Typical Chopper SiC Diode Performance Curve (Per SiC Diode)

This section shows the typical chopper SiC diode performance curves of MSCGLQ50DH120CTBL2NG device.

Figure 1-8. Junction-to-Heatsink Thermal Impedance



	1	2	3	4	5	6	7
Ri (°C/W)	0.033	0.200	0.066	0.122	0.023	0.345	0.065
taui (s)	0.011	0.002	0.011	0.034	0.030	0.059	0.117

Figure 1-9. Forward Characteristics

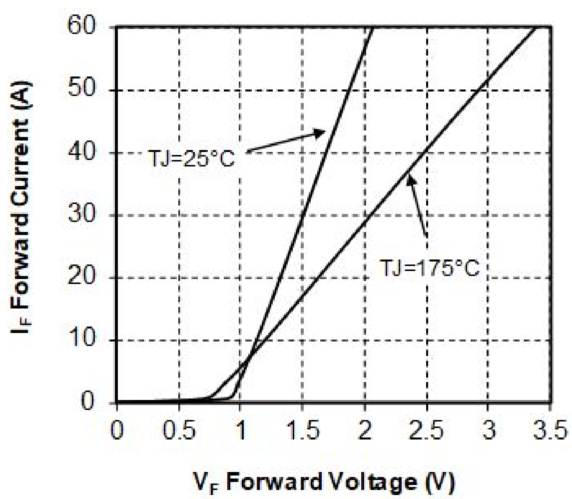
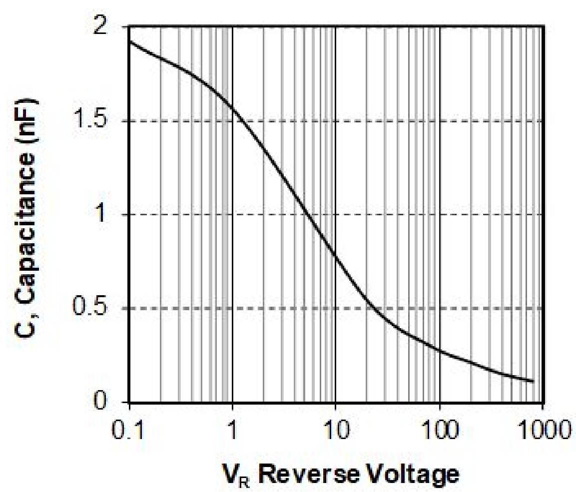


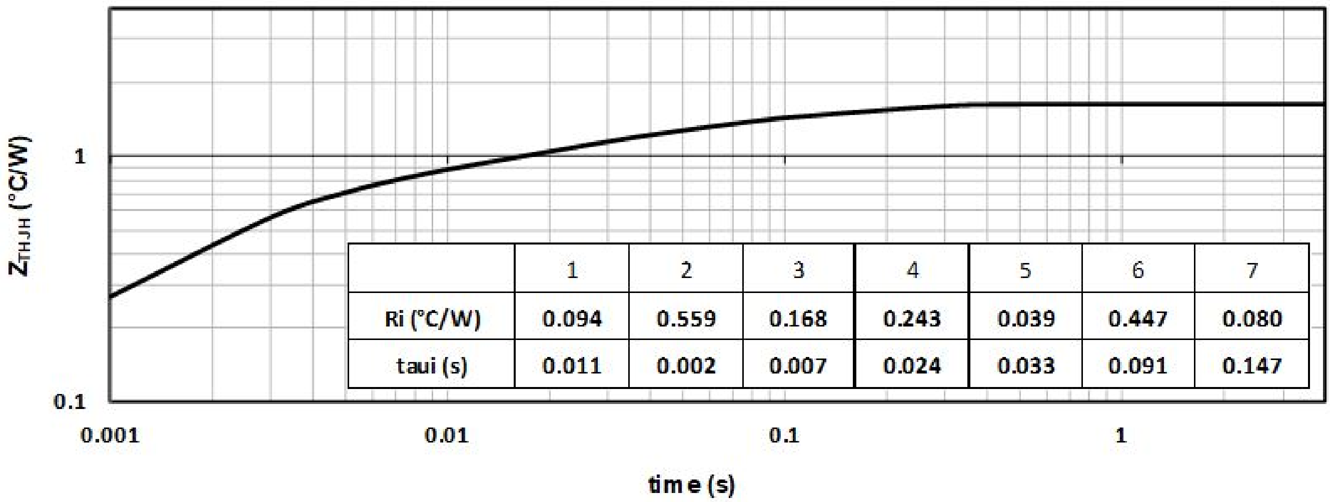
Figure 1-10. Capacitance vs. Reverse Voltage



1.7 Typical IGBT Parallel SiC Diode Performance Curve (Per SiC Diode)

This section shows the typical IGBT parallel SiC diode performance curves of MSCGLQ50DH120CTBL2NG device.

Figure 1-11. Junction-to-Heatsink Thermal Impedance



	1	2	3	4	5	6	7
Ri (°C/W)	0.094	0.559	0.168	0.243	0.039	0.447	0.080
taui (s)	0.011	0.002	0.007	0.024	0.033	0.091	0.147

Figure 1-12. Forward Characteristics

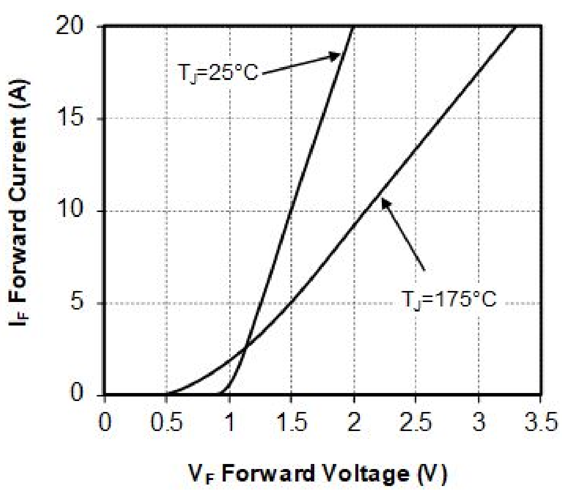
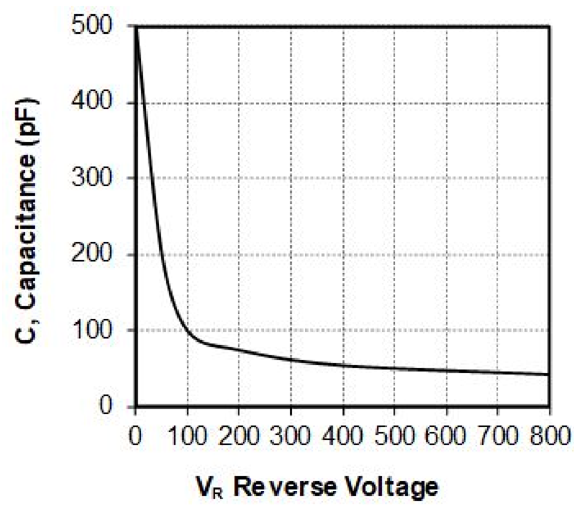


Figure 1-13. Capacitance vs. Reverse Voltage



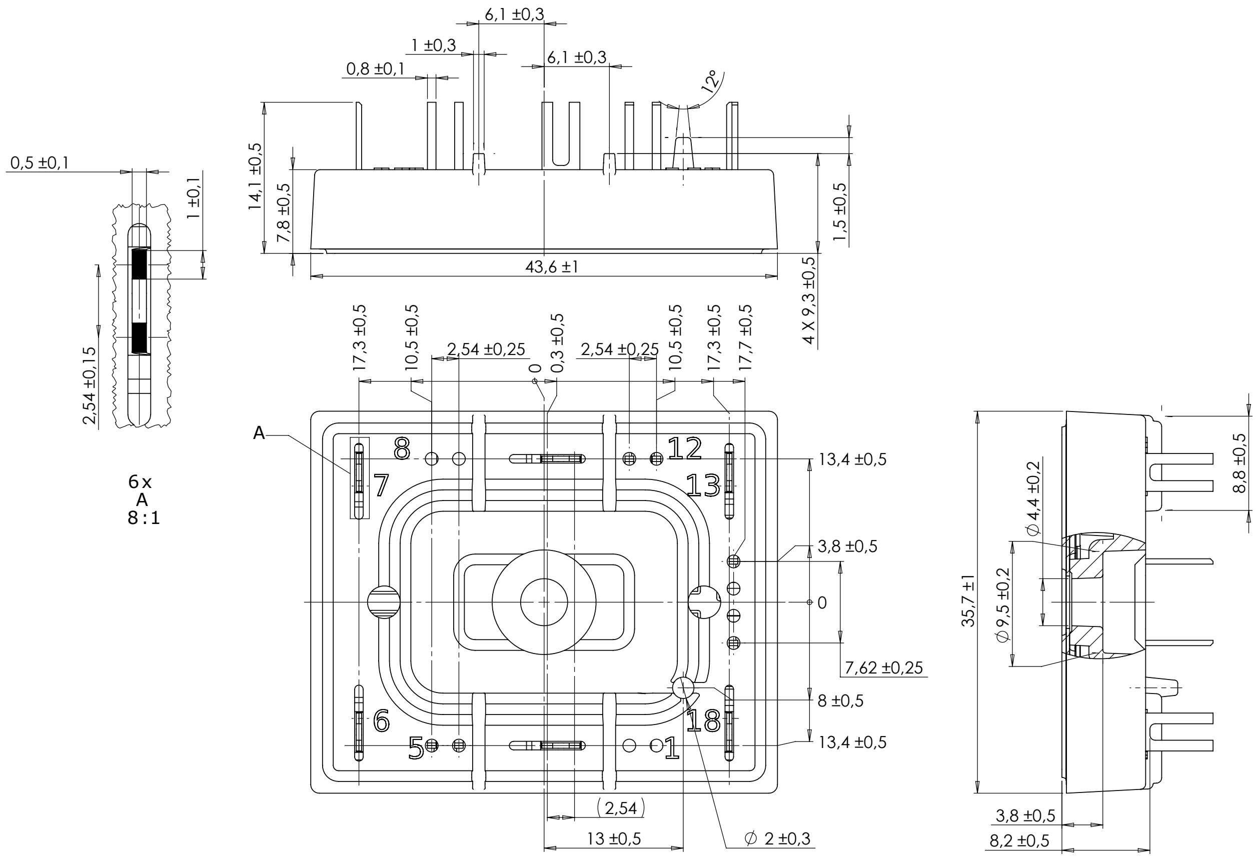
2. Package Specifications

The following section shows the package specification of MSCGLQ50DH120CTBL2NG device.

2.1 Package Outline

The following figure shows the package outline drawing of MSCGLQ50DH120CTBL2NG device. The dimensions in the following figure are in millimeters.

Figure 2-1. Package Outline Drawing



3. Revision History

Revision	Date	Description
A	07/2021	Initial Revision

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