

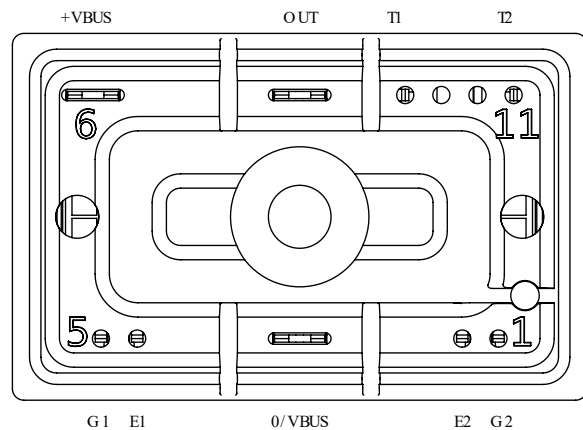
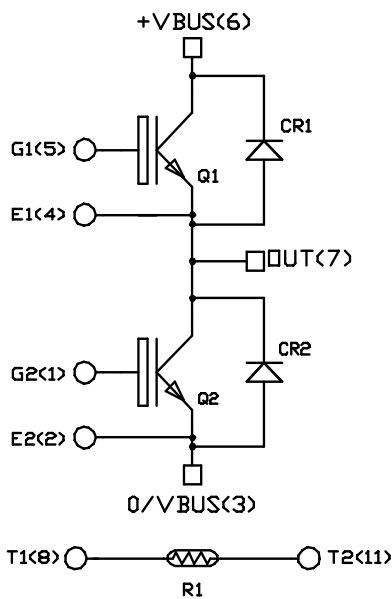
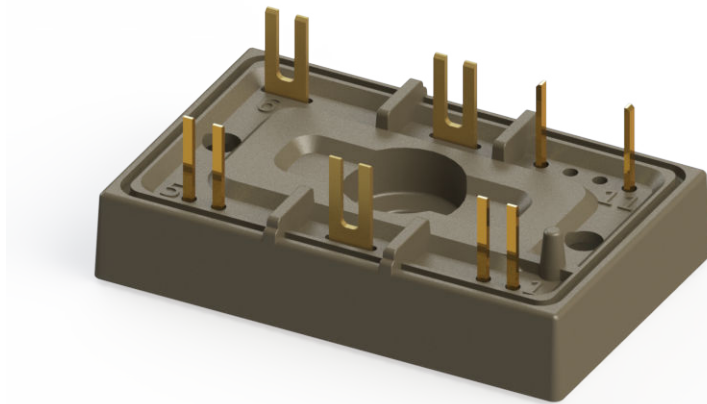


# MSCGLQ50A120CTBL1NG

## Phase Leg High-Speed IGBT4 Power Module

### Product Overview

The MSCGLQ50A120CTBL1NG device is a 1200 V, 50 A phase leg high-speed IGBT4 power module.



All ratings at  $T_J = 25^\circ\text{C}$ , unless otherwise specified.

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

## Features

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The following are the key features of MSCGLQ50A120CTBL1NG 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  $V_F$
- Very low stray inductance
- Ultra-low weight and profile
- Kelvin emitter for easy drive
- $\text{Si}_3\text{N}_4$  substrate with thick copper for improved thermal performance
- Internal thermistor for temperature monitoring
- Extended temperature range

## Benefits

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The following are the benefits of MSCGLQ50A120CTBL1NG 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

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The following are the applications of MSCGLQ50A120CTBL1NG 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 MSCGLQ50A120CTBL1NG device.

### 1.1 IGBT4 Characteristics (Per IGBT)

The following table lists the absolute maximum ratings of MSCGLQ50A120CTBL1NG device.

**Table 1-1. Absolute Maximum Ratings**

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

The following table lists the electrical characteristics of MSCGLQ50A120CTBL1NG device.

**Table 1-2. Electrical Characteristics**

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

# MSCGLQ50A120CTBL1NG

## Electrical Specifications

The following table lists the dynamic characteristics of MSCGLQ50A120CTBL1NG device.

**Table 1-3. Dynamic Characteristics**

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

### 1.2 SiC Diode Characteristics (Per SiC Diode)

The following table lists the SiC diode characteristics of MSCGLQ50A120CTBL1NG device.

**Table 1-4. SiC Diode Characteristics**

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

### 1.3 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of MSCGLQ50A120CTBL1NG device.

**Table 1-5. Thermal and Package Characteristics**

Symbol	Characteristic	Min	Typ	Max	Unit		
V <sub>ISOL</sub>	RMS isolation voltage, any terminal to case t = 1 min, 50 Hz/60 Hz	2500	—	—	V		
T <sub>J</sub>	Operating junction temperature range	-55	—	175	°C		
T <sub>JOP</sub>	Recommended junction temperature under switching conditions	-55	—	T <sub>Jmax</sub> -25			
T <sub>STG</sub>	Storage case temperature	-55	—	125			
T <sub>C</sub>	Operating case temperature	-55	—	125			
Torque	Mounting torque	To heatsink	M4	1.5	—	2	N.m
Wt	Package weight	—	13.5	—	g		

The following table lists the temperature sensor NTC of MSCGLQ50A120CTBL1NG device.

**Table 1-6. Temperature Sensor NTC**

Symbol	Characteristic	Min	Typ	Max	Unit
R <sub>25</sub>	Resistance at 25 °C	—	50	—	kΩ
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	—	%

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

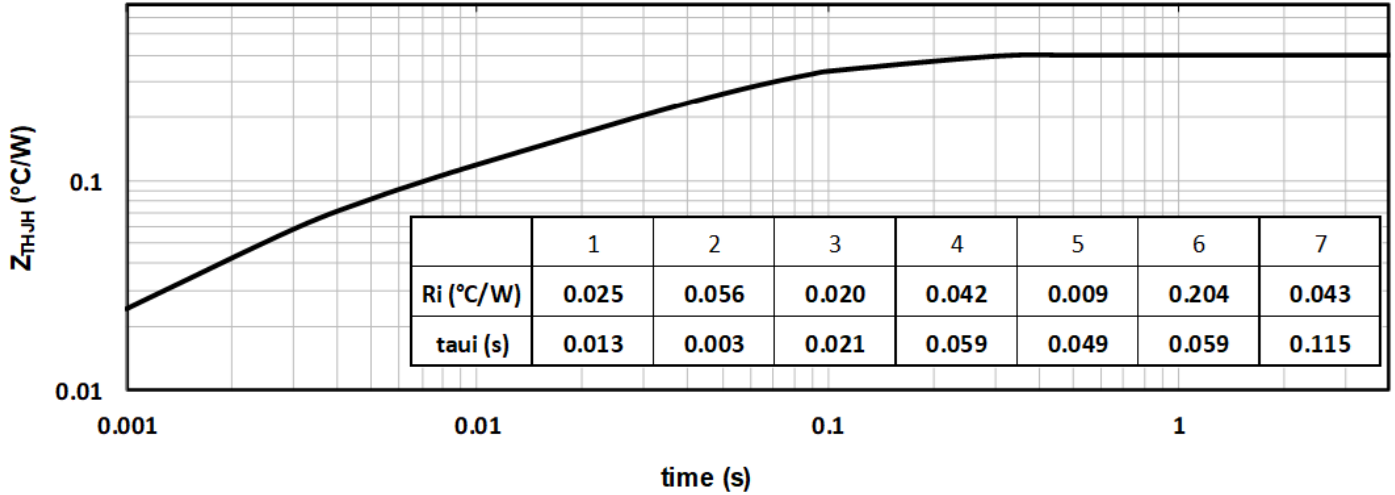
T: Thermistor temperature  
R<sub>T</sub>: Thermistor value at T

**Note:** See [APT0406—Using NTC Temperature Sensor Integrated into Power Module](#) for more information.

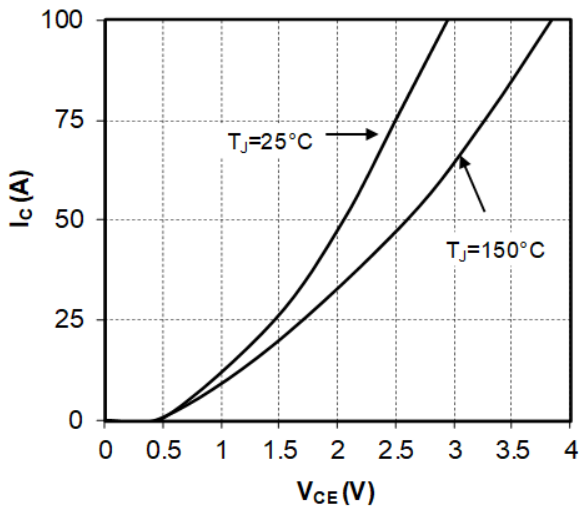
### 1.4 Typical IGBT4 Performance Curve (Per IGBT)

This section shows the typical IGBT4 performance curves of MSCGLQ50A120CTBL1NG device.

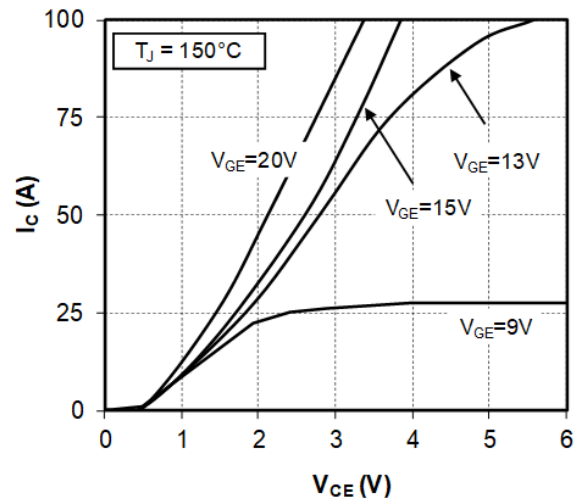
**Figure 1-1. Junction-to-Heatsink Thermal Impedance**



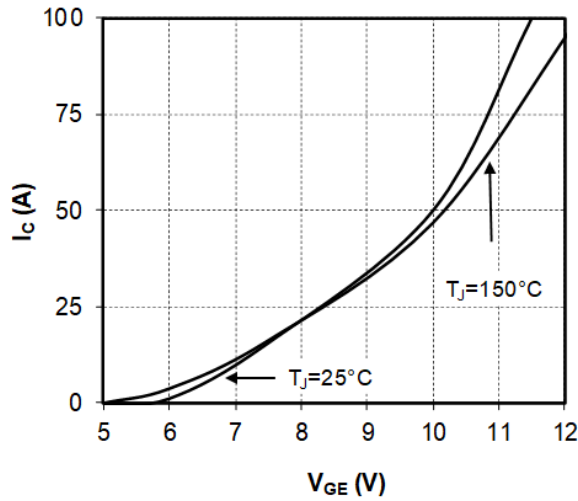
**Figure 1-2. Output Characteristics ( $V_{GE} = 15\text{ V}$ )**



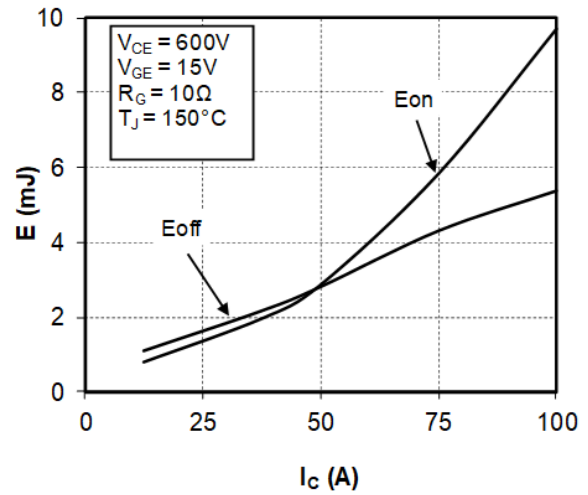
**Figure 1-3. Output Characteristics**



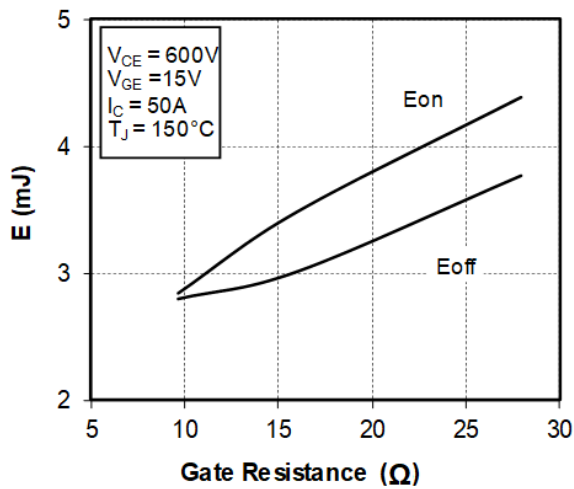
**Figure 1-4. Transfer Characteristics**



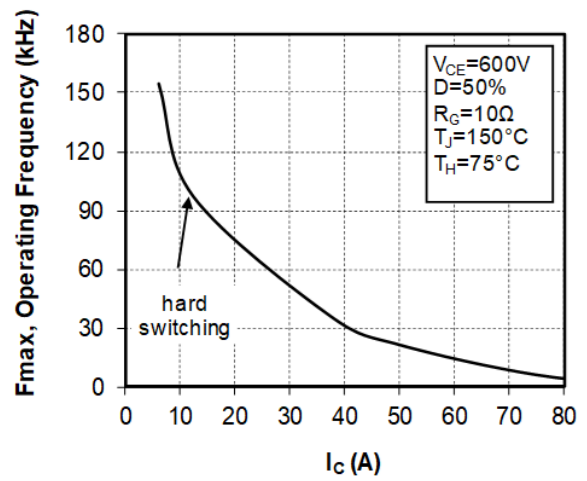
**Figure 1-5. Energy Losses vs. Collector Current**



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



**Figure 1-7. Operating Frequency vs. Collector Current**

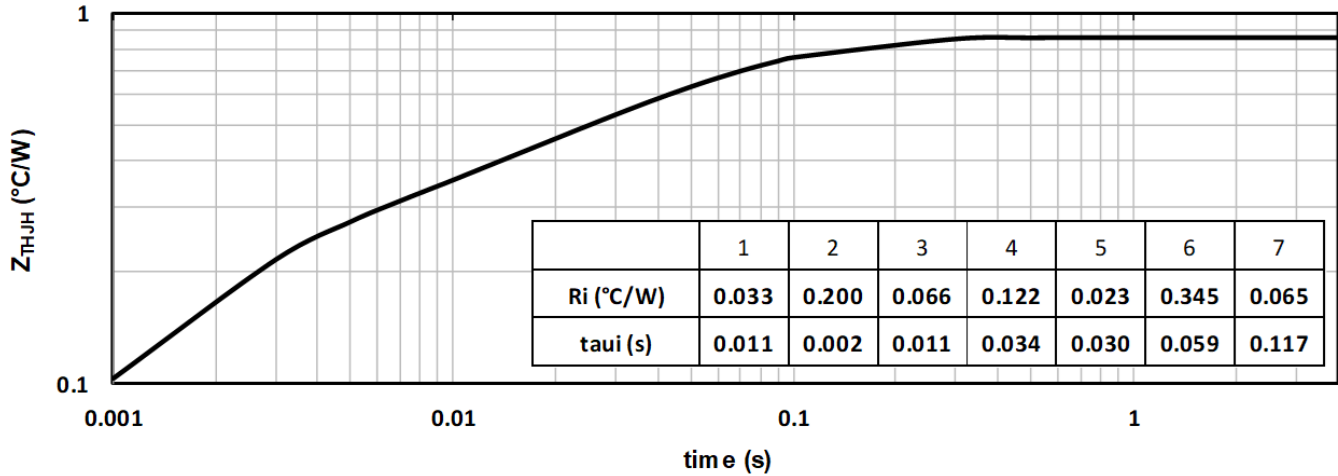




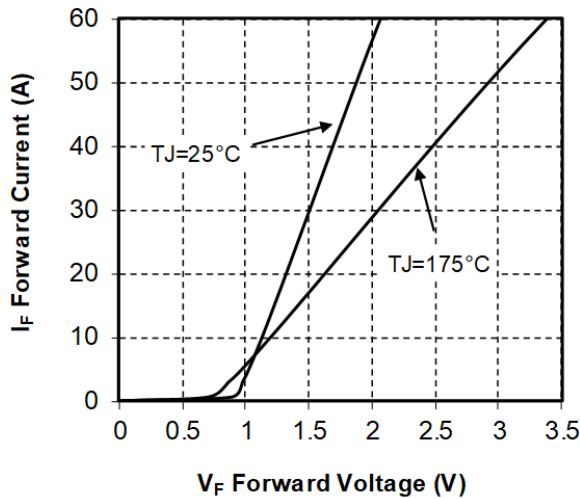
### 1.5 Typical SiC Diode Performance Curve (Per SiC Diode)

This section shows the typical SiC diode performance curves of MSCGLQ50A120CTBL1NG device.

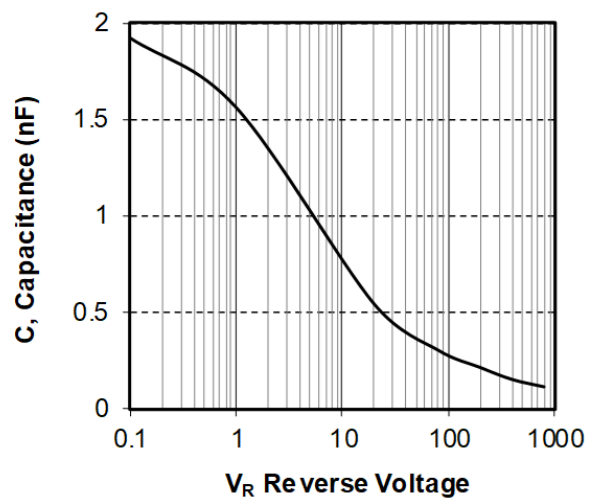
**Figure 1-8. Junction-to-Heatsink Thermal Impedance**



**Figure 1-9. Forward Characteristics**



**Figure 1-10. Capacitance vs. Reverse Voltage**



# MSCGLQ50A120CTBL1NG

## Package Specifications

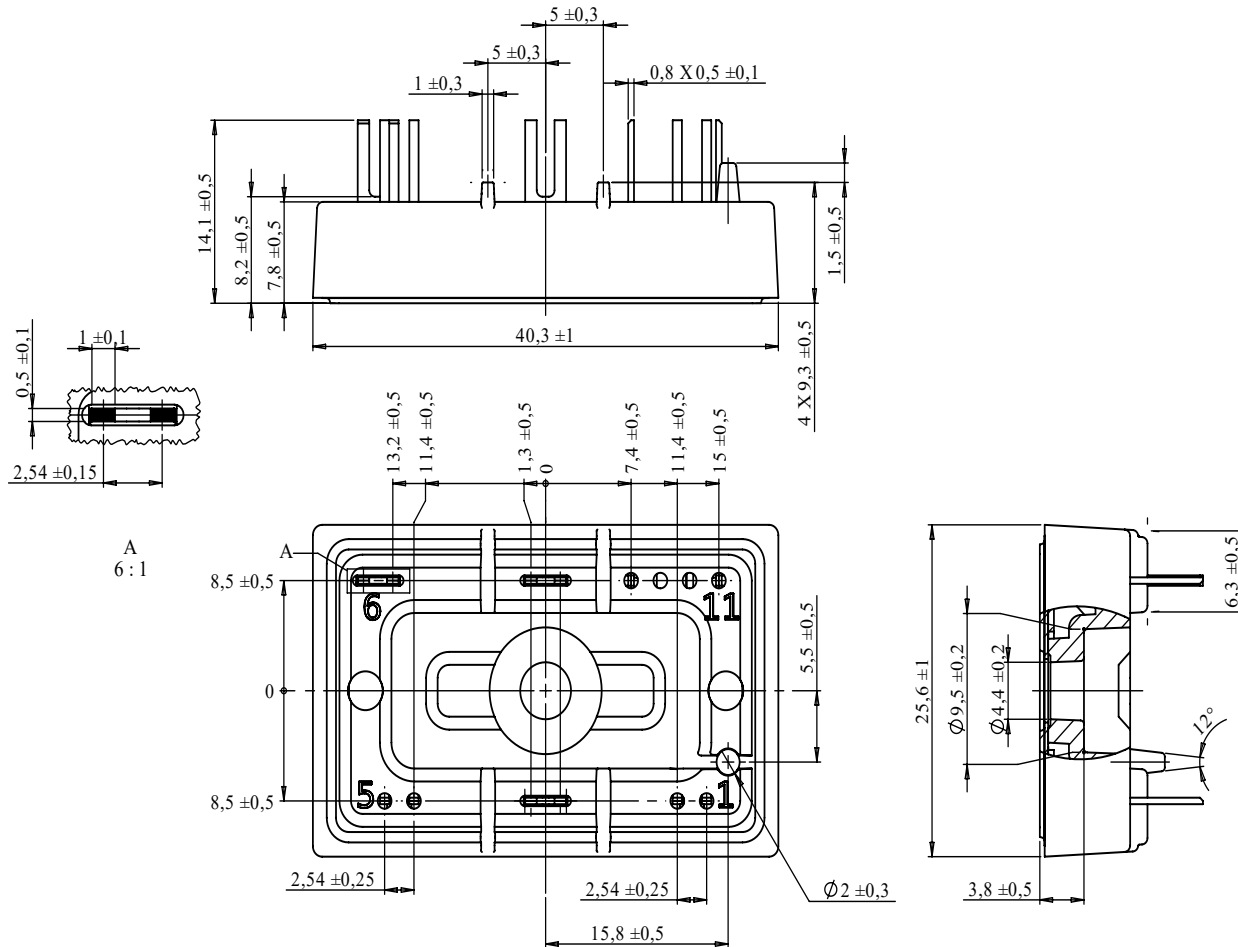
### 2. Package Specifications

The following section shows the package specification of MSCGLQ50A120CTBL1NG device.

#### 2.1 Package Outline

The following figure shows the package outline drawing of MSCGLQ50A120CTBL1NG 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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