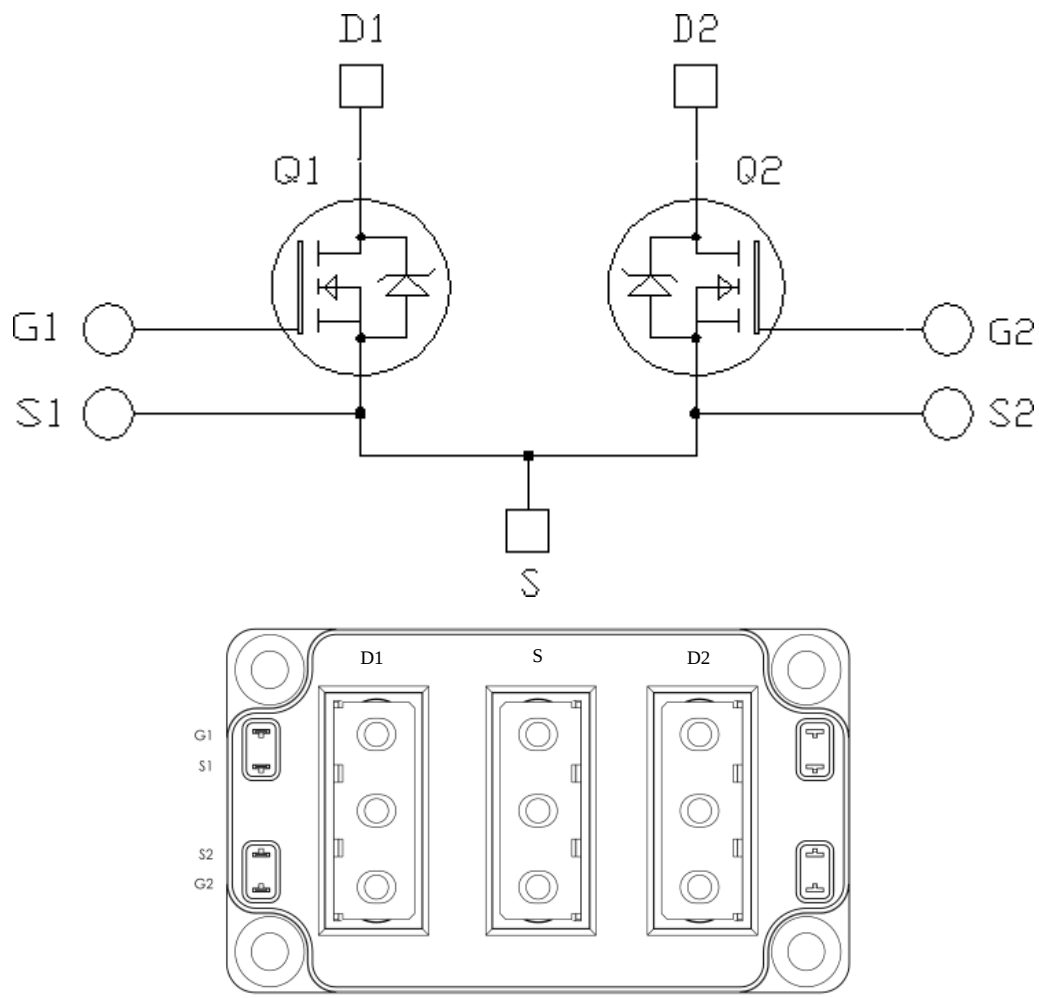


## Dual Common Source SiC MOSFET Power Module

### Product Overview

The MSCSM70DUM017AG device is a 700V/1021A dual common source silicon carbide (SiC) MOSFET power module.



All ratings 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

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The following are the key features of MSCSM70DUM017AG device:

- SiC Power MOSFET
  - Low  $R_{DS(on)}$
  - High temperature performance
- Kelvin source for easy drive
- Low stray inductance
- High level of integration
- Aluminum Nitride (AlN) substrate for improved thermal performance
- M5 power connectors

## Benefits

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The following are the benefits of MSCSM70DUM017AG device:

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

## Application

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The following are the applications of MSCSM70DUM017AG device:

- AC switches
- Switched mode power supplies
- Uninterruptible power supplies

### 1. Electrical Specifications

This section provides the electrical specifications of the MSCSM70DUM017AG device.

#### 1.1 SiC MOSFET Characteristics (Per SiC MOSFET)

The following table lists the absolute maximum ratings of MSCSM70DUM017AG device.

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

| Symbol       | Parameter                  |                                    | Maximum Ratings | Unit       |
|--------------|----------------------------|------------------------------------|-----------------|------------|
| $V_{DSS}$    | Drain-Source voltage       |                                    | 700             | V          |
| $I_D$        | Continuous drain current   | $T_C = 25\text{ }^{\circ}\text{C}$ | 1021            | A          |
|              |                            | $T_C = 80\text{ }^{\circ}\text{C}$ | 812             |            |
| $I_{DM}$     | Pulsed drain current       |                                    | 2000            |            |
| $V_{GSmax}$  | Gate-Source voltage        |                                    | -10/25          | V          |
| $R_{DS(on)}$ | Drain-Source ON resistance |                                    | 2.1             | m $\Omega$ |
| $P_D$        | Power dissipation          | $T_C = 25\text{ }^{\circ}\text{C}$ | 2750            | W          |

The following table lists the electrical characteristics of MSCSM70DUM017AG device.

**Table 1-2. Electrical Characteristics**

| Symbol       | Characteristic                  | Test Conditions                           |                                     | Min. | Typ. | Max. | Unit       |
|--------------|---------------------------------|-------------------------------------------|-------------------------------------|------|------|------|------------|
| $I_{DSS}$    | Zero gate voltage drain current | $V_{GS} = 0V$<br>$V_{DS} = 700V$          |                                     | —    | —    | 450  | $\mu A$    |
| $R_{DS(on)}$ | Drain-Source on resistance      | $V_{GS} = 20V$<br>$I_D = 360A$            | $T_J = 25\text{ }^{\circ}\text{C}$  | —    | 1.7  | 2.1  | m $\Omega$ |
|              |                                 |                                           | $T_J = 175\text{ }^{\circ}\text{C}$ | —    | 2.1  | —    |            |
| $V_{GS(th)}$ | Gate threshold voltage          | $V_{GS} = V_{DS}$<br>$I_D = 36\text{ mA}$ |                                     | 1.9  | 2.4  | —    | V          |
| $I_{GSS}$    | Gate-Source leakage current     | $V_{GS} = 20V$<br>$V_{DS} = 0V$           |                                     | —    | —    | 900  | nA         |

The following table lists the dynamic characteristics of MSCSM70DUM017AG device.

**Table 1-3. Dynamic Characteristics**

| Symbol              | Characteristic                      | Test Conditions                                                                                         | Min. | Typ. | Max.  | Unit |
|---------------------|-------------------------------------|---------------------------------------------------------------------------------------------------------|------|------|-------|------|
| C <sub>iss</sub>    | Input capacitance                   | V <sub>GS</sub> = 0V                                                                                    | —    | 40.5 | —     | nF   |
| C <sub>oss</sub>    | Output capacitance                  | V <sub>DS</sub> = 700V                                                                                  | —    | 4.6  | —     |      |
| C <sub>rss</sub>    | Reverse transfer capacitance        | f = 1 MHz                                                                                               | —    | 0.26 | —     |      |
| Q <sub>g</sub>      | Total gate charge                   | V <sub>GS</sub> = -5V/20V                                                                               | —    | 1935 | —     | nC   |
| Q <sub>gs</sub>     | Gate-Source charge                  | V <sub>Bus</sub> = 470V                                                                                 | —    | 522  | —     |      |
| Q <sub>gd</sub>     | Gate-Drain charge                   | I <sub>D</sub> = 360A                                                                                   | —    | 315  | —     |      |
| T <sub>d(on)</sub>  | Turn-on delay time                  | V <sub>GS</sub> = -5V/20V                                                                               | —    | 78   | —     | ns   |
| T <sub>r</sub>      | Rise time                           | V <sub>Bus</sub> = 400V                                                                                 | —    | 125  | —     |      |
| T <sub>d(off)</sub> | Turn-off delay time                 | I <sub>D</sub> = 720A                                                                                   | —    | 214  | —     |      |
| T <sub>f</sub>      | Fall time                           | R <sub>Gon</sub> = 3.1Ω<br>R <sub>Goff</sub> = 1.8Ω                                                     | —    | 92   | —     |      |
| E <sub>on</sub>     | Turn-on energy                      | V <sub>GS</sub> = -5V/20V                                                                               | —    | 10.9 | —     | mJ   |
| E <sub>off</sub>    | Turn-off energy                     | V <sub>Bus</sub> = 400V<br>I <sub>D</sub> = 720A<br>R <sub>Gon</sub> = 3.1Ω<br>R <sub>Goff</sub> = 1.8Ω | —    | 15.8 | —     |      |
| R <sub>Gint</sub>   | Internal gate resistance            |                                                                                                         | —    | 0.63 | —     | Ω    |
| R <sub>thJC</sub>   | Junction-to-case thermal resistance |                                                                                                         | —    | —    | 0.055 | °C/W |

The following table lists the body diode ratings and characteristics of MSCSM70DUM017AG device.

**Table 1-4. Body Diode Ratings and Characteristics**

| Symbol          | Characteristic           | Test Conditions                                          | Min. | Typ. | Max. | Unit |
|-----------------|--------------------------|----------------------------------------------------------|------|------|------|------|
| V <sub>SD</sub> | Diode forward voltage    | V <sub>GS</sub> = 0V<br>I <sub>SD</sub> = 360A           | —    | 3.4  | —    | V    |
|                 |                          | V <sub>GS</sub> = -5V<br>I <sub>SD</sub> = 360A          | —    | 3.8  | —    |      |
| t <sub>rr</sub> | Reverse recovery time    | I <sub>SD</sub> = 360A                                   | —    | 38   | —    | ns   |
| Q <sub>rr</sub> | Reverse recovery charge  | V <sub>GS</sub> = -5V                                    | —    | 2862 | —    | nC   |
| I <sub>rr</sub> | Reverse recovery current | V <sub>R</sub> = 400V<br>di <sub>F</sub> /dt = 10000A/μs | —    | 133  | —    | A    |

### 1.2 Thermal and Package Characteristics

The following table lists the thermal and package characteristics of the MSCSM70DUM017AG device.

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

| Symbol            | Characteristic                                                     |               |    | Min. | Max.                  | Unit |
|-------------------|--------------------------------------------------------------------|---------------|----|------|-----------------------|------|
| V <sub>ISOL</sub> | RMS isolation voltage, any terminal to case t = 1 min, 50 Hz/60 Hz |               |    | 4000 | —                     | V    |
| T <sub>J</sub>    | Operating junction temperature range                               |               |    | −40  | 175                   | °C   |
| T <sub>JOP</sub>  | Recommended junction temperature under switching conditions        |               |    | −40  | T <sub>Jmax</sub> −25 |      |
| T <sub>STG</sub>  | Storage case temperature                                           |               |    | −40  | 125                   |      |
| T <sub>C</sub>    | Operating case temperature                                         |               |    | −40  | 125                   |      |
| Torque            | Mounting torque                                                    | To heatsink   | M6 | 3    | 5                     | N.m  |
|                   |                                                                    | For terminals | M5 | 2    | 3.5                   |      |
| Wt                | Package weight                                                     |               |    | —    | 320                   | g    |

### 1.3 Typical SiC MOSFET Performance Curve (Per SiC MOSFET)

This section shows the typical SiC MOSFET performance curves of the MSCSM70DUM017AG device.

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

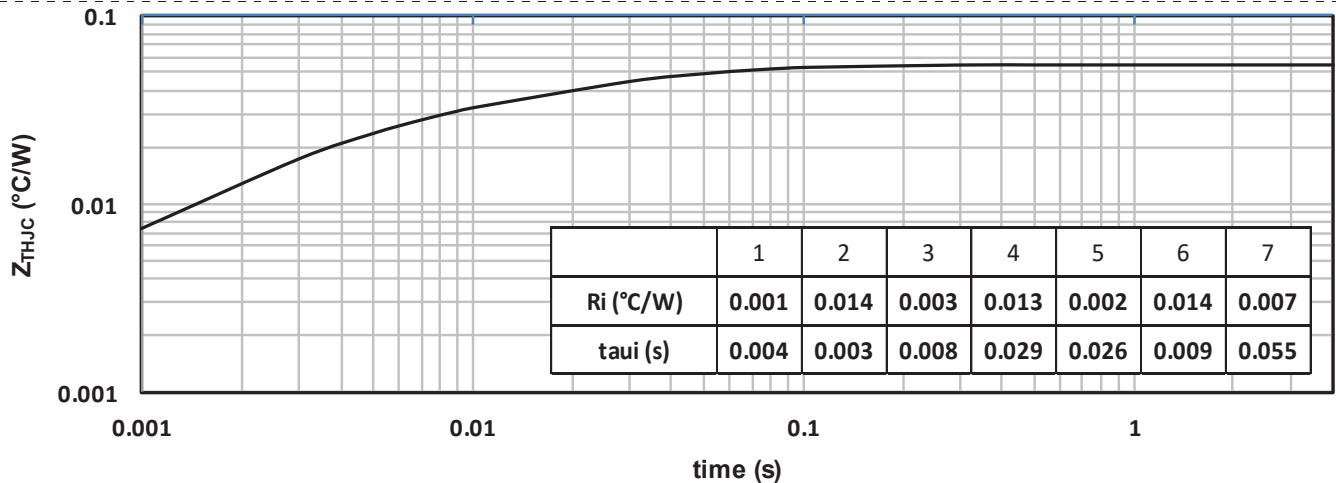


Figure 1-2. Output Characteristics,  $T_J = 25^\circ\text{C}$

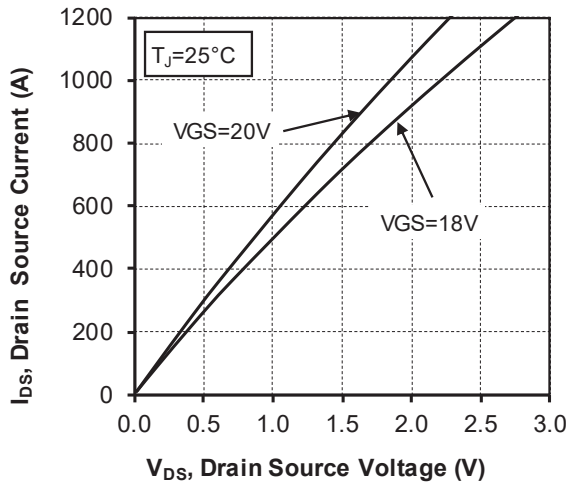


Figure 1-3. Output Characteristics,  $T_J = 175^\circ\text{C}$

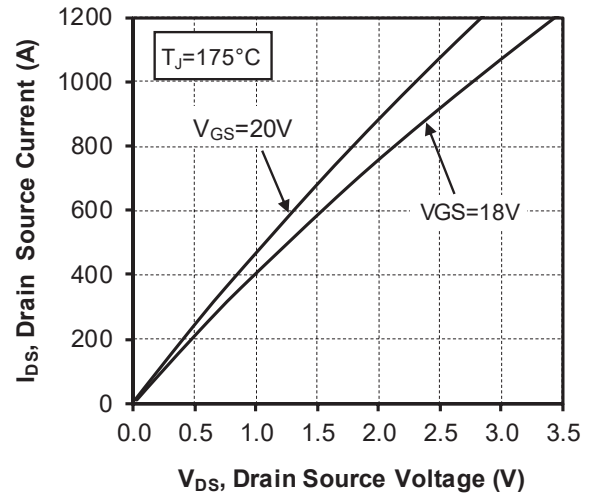


Figure 1-4. Normalized  $R_{DS(on)}$  vs. Temperature

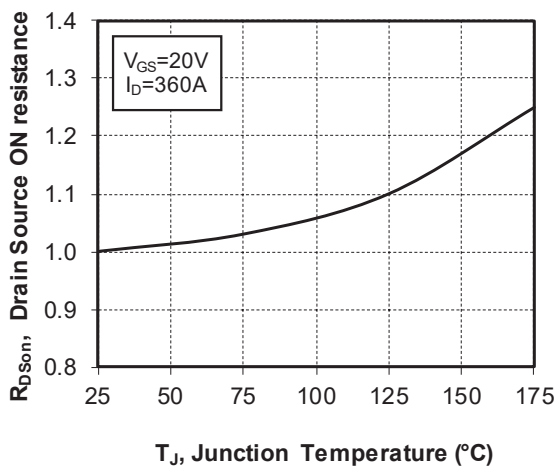


Figure 1-5. Transfer Characteristics

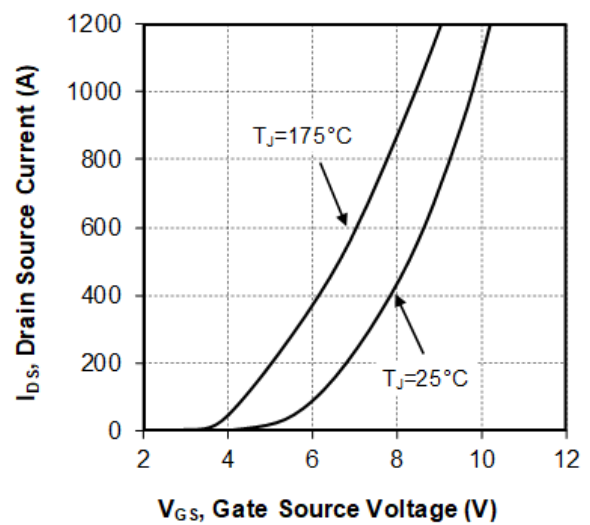


Figure 1-6. Capacitance vs. Drain Source Voltage

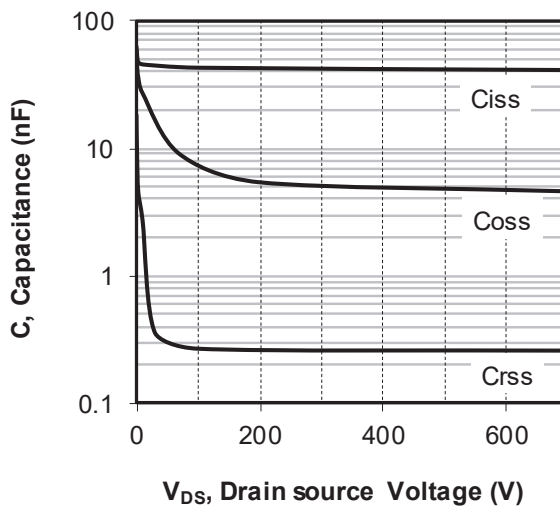


Figure 1-7. Gate Charge vs. Gate Source Voltage

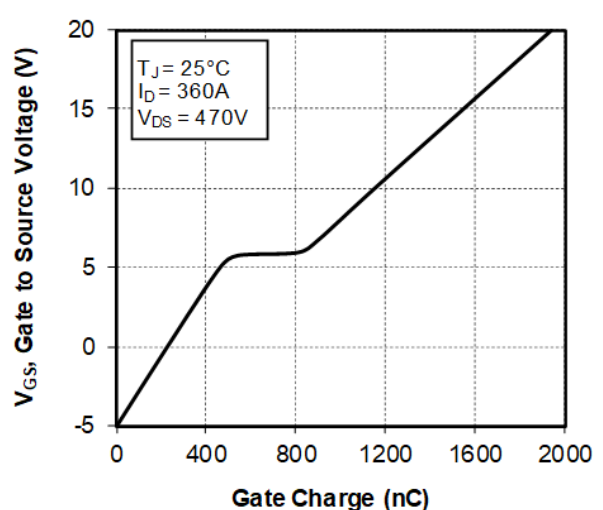


Figure 1-8. Body Diode Characteristics,  $T_J = 25^\circ\text{C}$

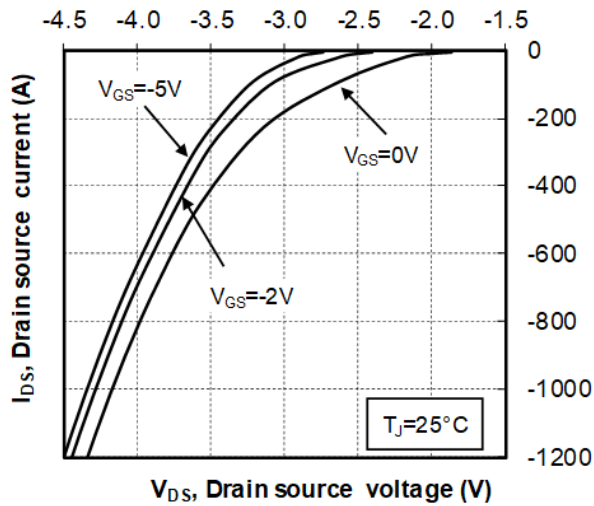


Figure 1-9. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 25^\circ\text{C}$

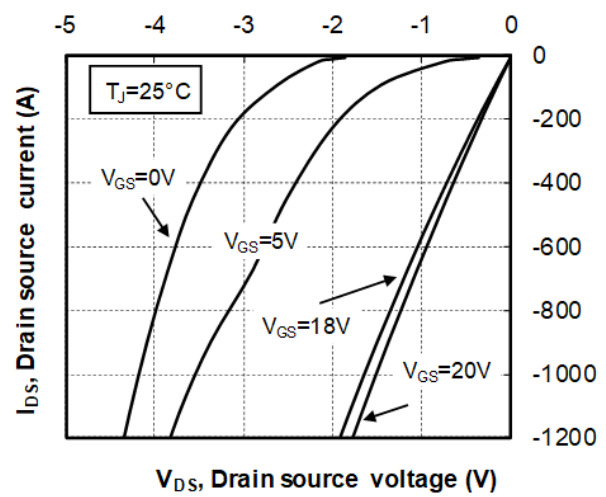


Figure 1-10. Body Diode Characteristics,  $T_J = 175^\circ\text{C}$

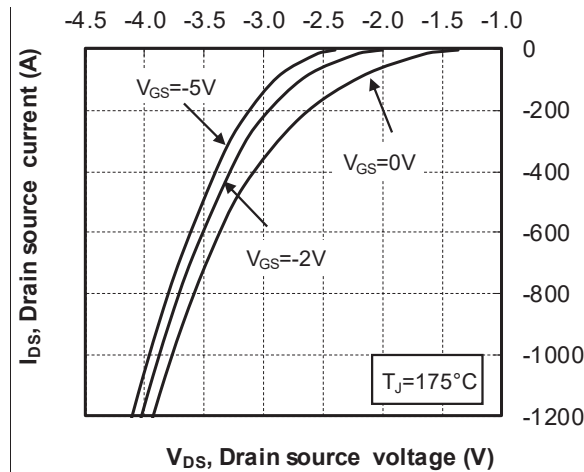


Figure 1-11. 3<sup>rd</sup> Quadrant Characteristics,  $T_J = 175^\circ\text{C}$

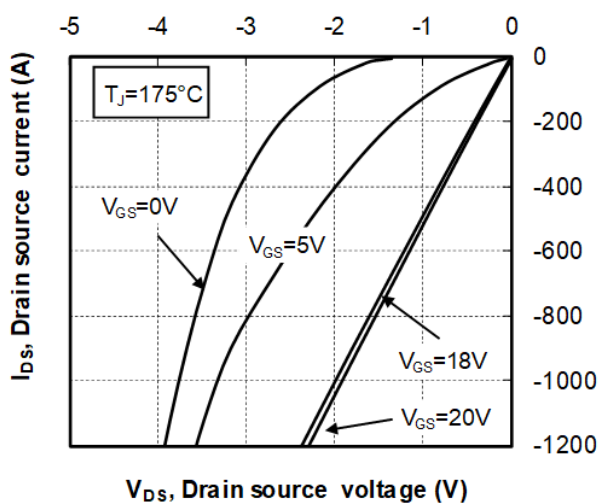


Figure 1-12. Turn On Energy vs.  $R_g$

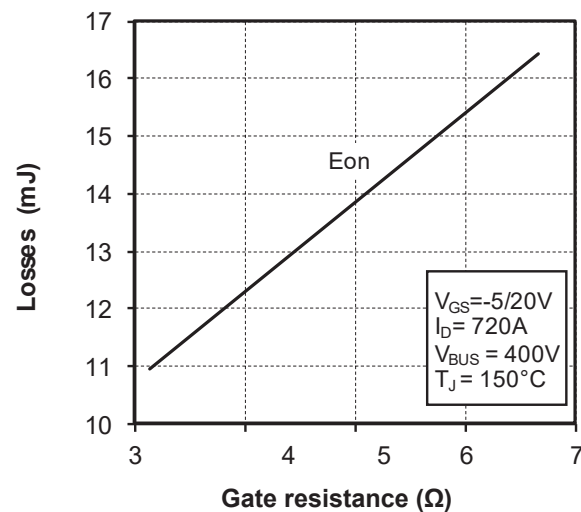


Figure 1-13. Turn Off Energy vs.  $R_g$

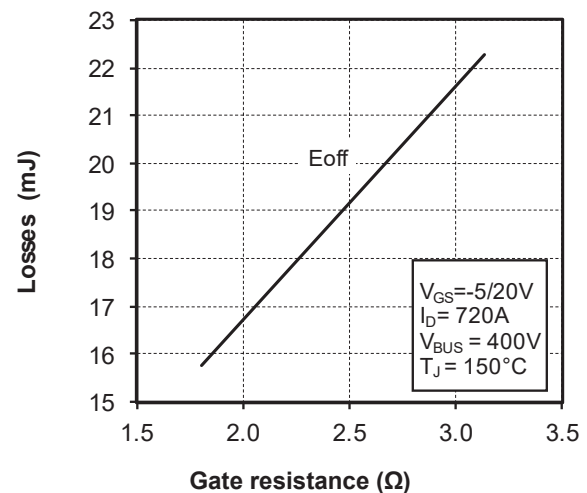


Figure 1-14. Switching Energy vs. Current

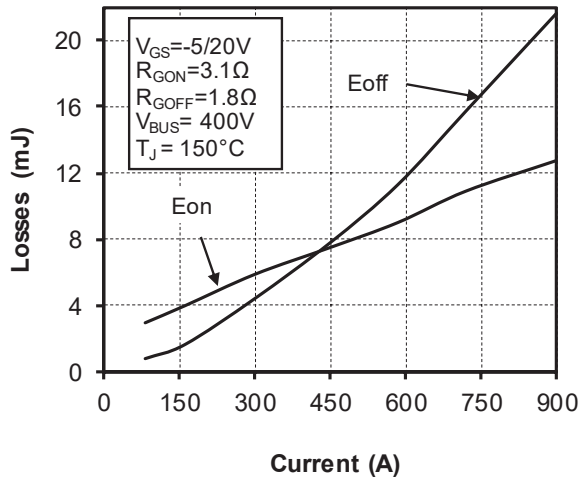
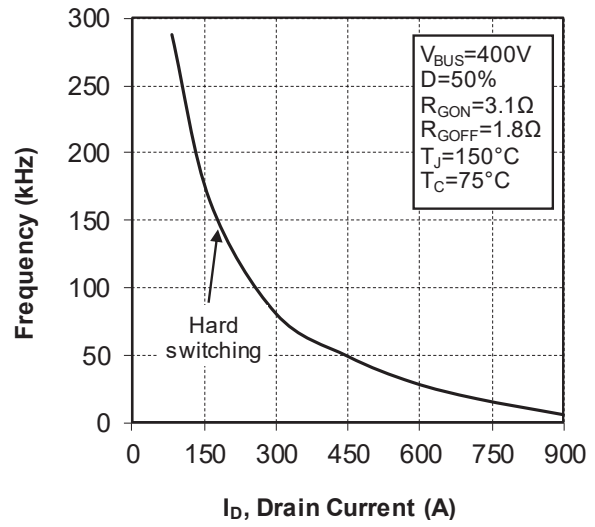


Figure 1-15. Operating Frequency vs. Drain Current



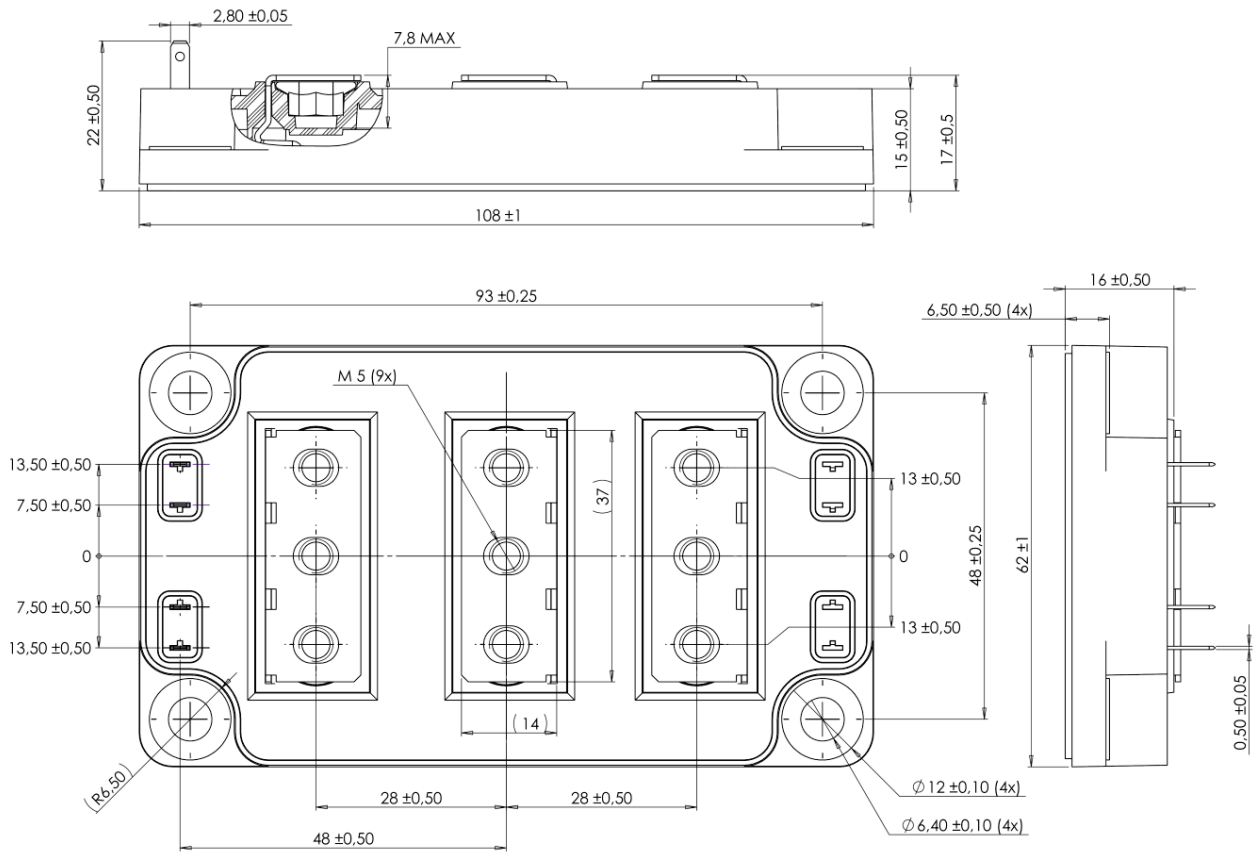
## 2. Package Specifications

The following section shows the package specification of the device.

### 2.1 Package Outline

The following figure shows the package outline drawing of the MSCSM70DUM017AG device. The dimensions in the following figure are in millimeters.

**Figure 2-1. Package Outline Drawing**



### 3. Revision History

| Revision | Date    | Description       |
|----------|---------|-------------------|
| A        | 12/2021 | Initial Revision. |

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