

## SiC MOSFET Power Module



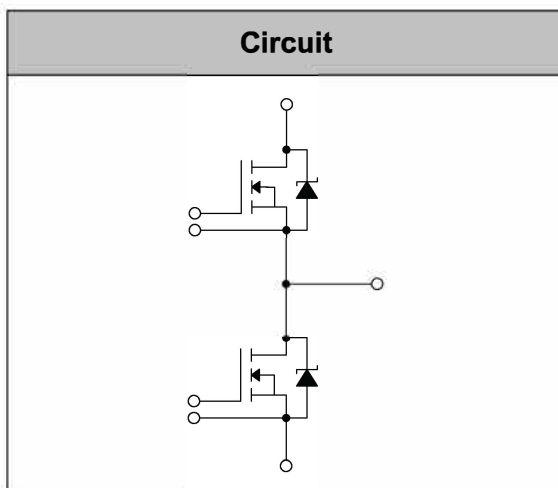
|              |               |
|--------------|---------------|
| $V_{DS}$     | 1200V         |
| $I_D$        | 440A          |
| $R_{DS(on)}$ | 3.2m $\Omega$ |

### Applications

- Induction Heating
- Motor Drives
- Solar and Wind Inverters
- UPS and SMPS

### Features

- Industry Standard 62mm Footprint
- Ultra Low Loss, High-Frequency Operation
- Zero Reverse Recovery from Diodes
- Zero Turn-off Tail Current from MOSFET
- Normally-off, Fail-safe Device Operation
- Copper Baseplate and Si<sub>3</sub>N<sub>4</sub> Insulator



### ■ MOSFET

#### Absolute Maximum Ratings ( $T_{VJ}=25^{\circ}\text{C}$ Unless Otherwise Specified)

| PARAMETER                     | SYMBOL        | CONDITIONS                                     | VALUE  | UNIT               |
|-------------------------------|---------------|--|--------|--------------------|
| Drain-Source Voltage          | $V_{DS,max}$  | $V_{GS}=0\text{ V}$ , $I_{DS}=400\mu\text{A}$  | 1200   | V                  |
| Continuous Drain Current      | $I_D$         | $V_{GS}=18\text{V}$ , $T_C=25^{\circ}\text{C}$ | 440    | A                  |
|                               |               | $V_{GS}=18\text{V}$ , $T_C=80^{\circ}\text{C}$ | 355    |                    |
| Pulse Drain Current           | $I_{D,pulse}$ | Pulse width $t_p$ limited by $T_{VJ,max}$      | 890    | A                  |
| Power Dissipation             | $P_{D,MOS}$   | $T_C=25^{\circ}\text{C}$                       | 1400   | W                  |
| Recommend Gate Source Voltage | $V_{GS,op}$   | Static, recommended DC operating values        | -10/24 | V                  |
| Maximum Gate Source Voltage   | $V_{GS,max}$  | Absolute maximum values                        | -11/26 | V                  |
| Maximum Junction Temperature  | $T_{VJ,max}$  |  | 175    | $^{\circ}\text{C}$ |

**■ MOSFET**
**Characteristic Values ( $T_{VJ}=25^{\circ}\text{C}$  Unless Otherwise Specified)**

| PARAMETER  | SYMBOL        | CONDITIONS  | VALUE |       |      | UNIT                 |
|--|---------------|---|-------|-------|------|----------------------|
|  |               |   | Min.  | Typ.  | Max. |                      |
| Drain-Source Breakdown Voltage   | $V_{(BR)DSS}$ | $V_{GS}=0V, I_D=400\mu A$   | 1200  |       |      | V                    |
| Gate Threshold Voltage   | $V_{GS(th)}$  | $V_{DS}=V_{GS}, I_D=80mA$   | 1.9   | 3.0   | 4.7  | V                    |
|  |               | $V_{DS}=V_{GS}, I_D=80mA, T_{VJ}=175^{\circ}\text{C}$                         |       | 4.7   |      |                      |
| Zero Gate Voltage Drain Current  | $I_{DSS}$     | $V_{DS}=1200V, V_{GS}=0V$   |       | 4     | 300  | $\mu A$              |
| Gate-Source Leakage Current  | $I_{GSS}$     | $V_{DS}=0V, V_{GS}=18V$   |       | 1     | 400  | nA                   |
| Drain-Source On-Resistance   | $R_{DS(on)}$  | $I_D=300A, V_{GS}=15V$  |       |       | 6    | m $\Omega$           |
|  |               | $I_D=300A, V_{GS}=18V$  |       | 3.2   | 4.1  |                      |
|  |               | $I_D=300A, V_{GS}=15V, T_{VJ}=175^{\circ}\text{C}$                            |       |       |      |                      |
|  |               | $I_D=300A, V_{GS}=18V, T_{VJ}=175^{\circ}\text{C}$                            |       | 4.8   |      |                      |
| Transconductance   | $g_{fs}$      | $V_{DS}=20V, I_D=300A$  |       | 247.1 |      | S                    |
|  |               | $V_{DS}=20V, I_D=300A, T_{VJ}=175^{\circ}\text{C}$                            |       | 239.3 |      |                      |
| Internal Gate Resistance   | $R_{G(int.)}$ | $f=1MHz, V_{AC}=25mV$   |       | 0.12  |      | $\Omega$             |
| Input Capacitance  | $C_{iss}$     | $V_{GS}=0V,$  |       | 25.1  |      | nF                   |
| Output Capacitance   | $C_{oss}$     | $V_{DS}=800V,$<br>$f=100kHz,$   |       | 1.2   |      |                      |
| Reverse Transfer Capacitance   | $C_{rss}$     | $V_{AC}=25mV$   |       | 0.02  |      |                      |
| Gate to Source Charge  | $Q_{GS}$      | $V_{DD}=800V,$<br>$V_{GS}=-5/18V,$<br>$I_D=300A$                              |       | 224   |      | nC                   |
| Gate to Drain Charge   | $Q_{GD}$      |   |       | 440   |      |                      |
| Total Gate Charge  | $Q_G$         |   |       | 940   |      |                      |
| Turn On Delay Time   | $t_{d(on)}$   | $V_{DS}=800V,$<br>$V_{GS}=-3/18V,$<br>$I_D=240A,$<br>$R_{G(ext)}=2.7\ \Omega$ |       | 20    |      | ns                   |
| Rise Time  | $t_r$         |   |       | 34    |      |                      |
| Turn Off Delay Time  | $t_{d(off)}$  |   |       | 48    |      |                      |
| Fall Time  | $t_f$         |   |       | 15    |      |                      |
| Turn-on Switching Energy, $T_{VJ}=25^{\circ}\text{C}$<br>$T_{VJ}=175^{\circ}\text{C}$  | $E_{on}$      |   |       |       | 3.5  | mJ                   |
|  |               |   |       |       | 4.52 |                      |
| Turn-off Switching Energy, $T_{VJ}=25^{\circ}\text{C}$<br>$T_{VJ}=175^{\circ}\text{C}$ | $E_{off}$     |   |       |       | 1.38 | mJ                   |
|  |               |   |       | 1.87  |      |                      |
| MOSFET Thermal Resistance,<br>Junction to Case   | $R_{thJC}$    | JESD51-14   |       | 0.095 |      | $^{\circ}\text{C/W}$ |

# MC045HF12SCC2

## ■ Body diode

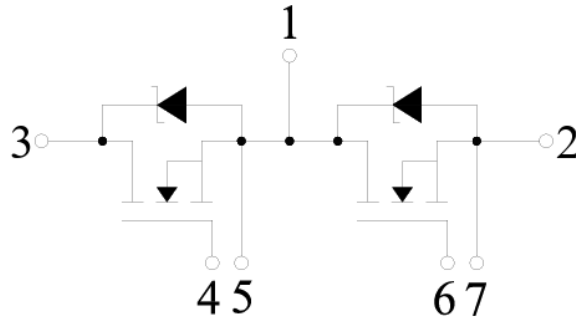
Characteristic Values ( $T_{VJ}=25^{\circ}\text{C}$  Unless Otherwise Specified)

| PARAMETER  | SYMBOL   | CONDITIONS   | VALUE |              |      | UNIT          |
|--|----------|--|-------|--------------|------|---------------|
|  |          |  | Min.  | Typ.         | Max. |               |
| Inverse Diode Forward Voltage  | $V_{SD}$ | $V_{GS}=0V, I_S=240A$  |       | 3.51         |      | V             |
|  |          | $V_{GS}=0V, I_S=240A, T_{VJ}=175^{\circ}\text{C}$                                |       | 3.2          |      |               |
| Continuous Diode Forward Current   | $I_S$    | $V_{GS}=0V, T_c=25^{\circ}\text{C}$  |       |              | 430  | A             |
| Reverse Recovery Time  | $t_{rr}$ | $V_{GS}=-3V, I_S=240A, V_R=800V,$<br>$di/dt=4.63A/ns, T_{VJ}=25^{\circ}\text{C}$ |       | 20           |      | ns            |
| Reverse Recovery Charge  | $Q_{rr}$ |  |       | 2.27         |      | $\mu\text{C}$ |
| Peak Reverse Recovery Current  | $I_{rm}$ |  |       | 197.8        |      | A             |
| Reverse Recovery Energy, $T_{VJ}=25^{\circ}\text{C}$<br>$T_{VJ}=150^{\circ}\text{C}$ | $E_{RR}$ | $V_{DD}=600V, I_D=300A$<br>$V_{GS}=-3V/18V, R_{G(ext)}=2.7\Omega$                |       | 0.83<br>1.01 |      | mJ            |

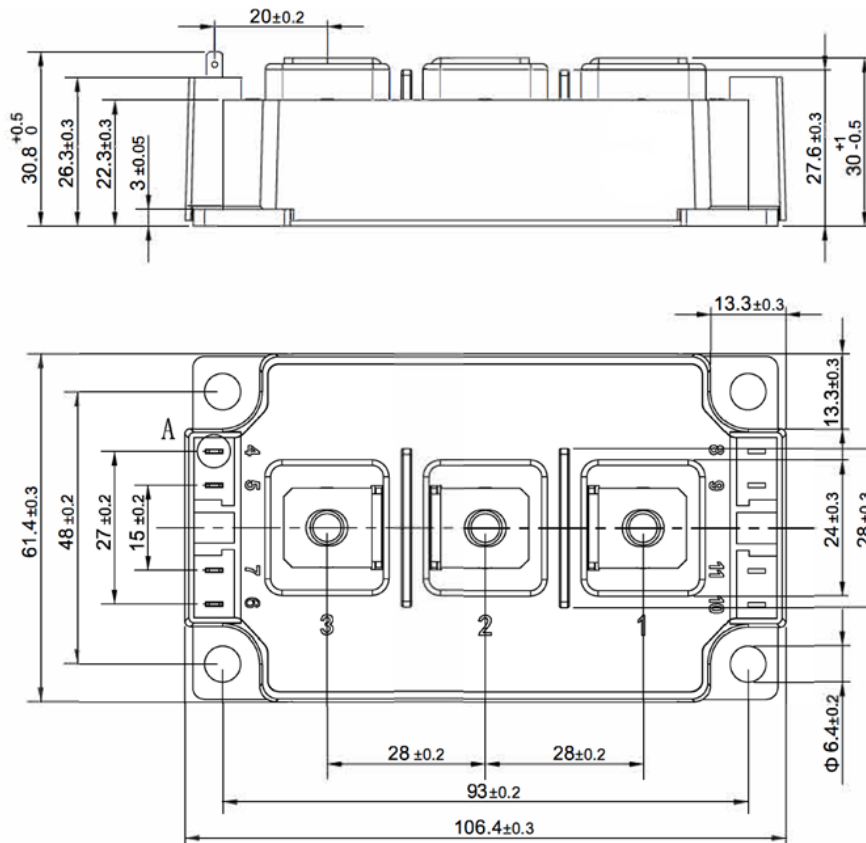
## ■ Module Characteristics

| PARAMETER                      | SYMBOL      | CONDITIONS                            | VALUE |      |      | UNIT               |
|--------------------------------|-------------|---------------------------------------|-------|------|------|--------------------|
|                                |             |                                       | Min.  | Typ. | Max. |                    |
| Isolation Breakdown Voltage    | $V_{isol}$  | AC, 50Hz (R.M.S), $t=1\text{minute}$  |       | 4000 |      | V                  |
| Stray Inductance               | $L_{stray}$ | Between DC- and DC+, $f=10\text{MHz}$ |       | 11   |      | nH                 |
| Operating Junction Temperature | $T_{VJ,op}$ |                                       | -40   |      | 175  | $^{\circ}\text{C}$ |
| Storage Temperature            | $T_{stg}$   |                                       | -40   |      | 125  | $^{\circ}\text{C}$ |
| Module Electrodes Torque       | $M_t$       | Recommended (M6)                      | 3.0   |      | 6.0  | Nm                 |
| Module to Sink Torque          | $M_s$       | Recommended (M6)                      | 3.0   |      | 6.0  | Nm                 |
| Weight                         | $W$         |                                       |       | 340  |      | g                  |

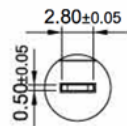
■ Schematic and Pin Out



■ Package Dimensions (mm)



View A  
scale 3:1



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