

# STARPOWER

## SEMICONDUCTOR

## SiC MOSFET

# MD30HTS120P8HT

**1200V/3.02mΩ 6 in one-package**

## General Description

STARPOWER SiC MOSFET Power Module provides very low  $R_{DS(on)}$  as well as high blocking voltage.

It's designed for the applications such as hybrid and electric vehicle.

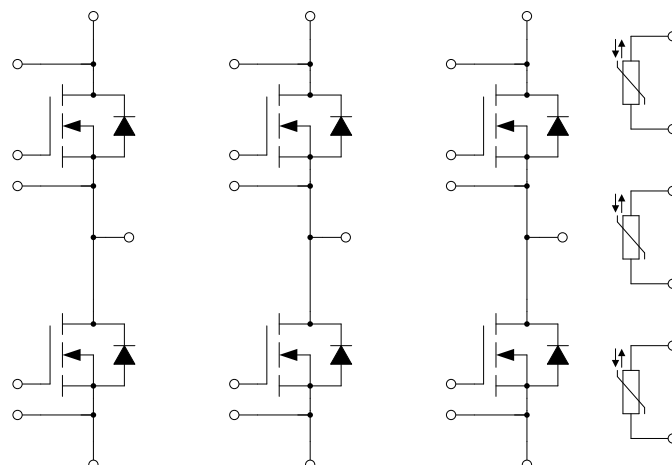
## Features

- SiC power MOSFET
- High blocking voltage with low  $R_{DS(on)}$
- Easy to parallel and simple to drive
- Low inductance case avoid oscillations
- Isolated copper pinfin baseplate using  $Si_3N_4$  AMB technology

## Typical Applications

- Automotive application
- Hybrid and electric vehicle
- Inverter for motor drive

## Equivalent Circuit Schematic



**Absolute Maximum Ratings**  $T_F=25^{\circ}\text{C}$  unless otherwise noted

**MOSFET**

| Symbol       | Description                                                                          | Value  | Unit |
|--------------|--------------------------------------------------------------------------------------|--------|------|
| $V_{DSS}$    | Drain-Source Voltage                                                                 | 1200   | V    |
| $V_{GSSmax}$ | Gate-Source Voltage                                                                  | -8/+19 | V    |
| $V_{GSSop}$  | Gate-Source Voltage                                                                  | -4/+15 | V    |
| $I_D$        | Drain Current $T_{vj}=175^{\circ}\text{C}$                                           | 370    | A    |
| $I_{DRM}$    | Repetitive Peak Drain Current tp limited by $T_{vjop}$                               | 740    | A    |
| $P_D$        | Maximum Power Dissipation<br>@ $T_F=65^{\circ}\text{C}$ $T_{vj}=175^{\circ}\text{C}$ | 555    | W    |

**Body Diode**

| Symbol | Description                                 | Value | Unit |
|--------|---------------------------------------------|-------|------|
| $I_S$  | Source Current $T_{vj}=175^{\circ}\text{C}$ | TBD   | A    |

**Module**

| Symbol      | Description                         | Value       | Unit               |
|-------------|-------------------------------------|-------------|--------------------|
| $T_{vjmax}$ | Maximum Junction Temperature        | 175         | $^{\circ}\text{C}$ |
| $T_{vjop}$  | Operating Junction Temperature      | -40 to +175 | $^{\circ}\text{C}$ |
| $T_{STG}$   | Storage Temperature Range           | -40 to +125 | $^{\circ}\text{C}$ |
| $V_{ISO}$   | Isolation Voltage RMS,f=50Hz,t=1min | 2500        | V                  |

**MOSFET Characteristics**  $T_F=25^{\circ}\text{C}$  unless otherwise noted

| Symbol       | Parameter                         | Test Conditions                                                  | Min. | Typ. | Max. | Unit             |
|--------------|-----------------------------------|------------------------------------------------------------------|------|------|------|------------------|
| $R_{DS(on)}$ | Static Drain-Source On-Resistance | $I_D=70\text{A}, V_{GS}=15\text{V}, T_{vj}=25^{\circ}\text{C}$   |      | 3.02 |      | $\text{m}\Omega$ |
|              |                                   | $I_D=70\text{A}, V_{GS}=15\text{V}, T_{vj}=175^{\circ}\text{C}$  |      | 5.30 |      |                  |
| $V_{GS(th)}$ | Gate-Source Threshold Voltage     | $I_D=88\text{mA}, V_{DS}=V_{GS}, T_{vj}=25^{\circ}\text{C}$      | 1.8  | 2.5  | 3.2  | V                |
| $I_{DSS}$    | Drain-Source Leakage Current      | $V_{DS}=V_{DSS}, V_{GS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$    |      |      | 500  | $\mu\text{A}$    |
| $I_{GSS}$    | Gate-Source Leakage Current       | $V_{GS}=15\text{V}, V_{DS}=0\text{V}, T_{vj}=25^{\circ}\text{C}$ |      |      | 400  | nA               |
| $R_{Gint}$   | Internal Gate Resistance          |                                                                  |      | 1.00 |      | $\Omega$         |
| $C_{iss}$    | Input Capacitance                 | $V_{GS}=0\text{V}, V_{DS}=1000\text{V}, f=100\text{kHz}$         |      | 24.8 |      | nF               |
| $C_{oss}$    | Output Capacitance                |                                                                  |      | 0.88 |      | nF               |
| $C_{rss}$    | Reverse Transfer Capacitance      |                                                                  |      | 0.05 |      | nF               |
| $Q_g$        | Total Gate Charge                 | $I_D=290\text{A}, V_{DS}=800\text{V}, V_{GS}=-4/+15\text{V}$     |      | 1.00 |      | $\mu\text{C}$    |
| $t_{d(on)}$  | Turn-On Delay Time                | TBD                                                              |      | TBD  |      | ns               |
| $t_r$        | Rise Time                         |                                                                  |      | TBD  |      | ns               |
| $t_{d(off)}$ | Turn-Off Delay Time               |                                                                  |      | TBD  |      | ns               |
| $t_f$        | Fall Time                         |                                                                  |      | TBD  |      | ns               |
| $E_{on}$     | Turn-On Switching Loss            |                                                                  |      | TBD  |      | mJ               |
| $E_{off}$    | Turn-Off Switching Loss           |                                                                  |      | TBD  |      | mJ               |
| $t_{d(on)}$  | Turn-On Delay Time                | TBD                                                              |      | TBD  |      | ns               |
| $t_r$        | Rise Time                         |                                                                  |      | TBD  |      | ns               |
| $t_{d(off)}$ | Turn-Off Delay Time               |                                                                  |      | TBD  |      | ns               |
| $t_f$        | Fall Time                         |                                                                  |      | TBD  |      | ns               |
| $E_{on}$     | Turn-On Switching Loss            |                                                                  |      | TBD  |      | mJ               |
| $E_{off}$    | Turn-Off Switching Loss           |                                                                  |      | TBD  |      | mJ               |
| $t_{d(on)}$  | Turn-On Delay Time                | TBD                                                              |      | TBD  |      | ns               |
| $t_r$        | Rise Time                         |                                                                  |      | TBD  |      | ns               |
| $t_{d(off)}$ | Turn-Off Delay Time               |                                                                  |      | TBD  |      | ns               |
| $t_f$        | Fall Time                         |                                                                  |      | TBD  |      | ns               |
| $E_{on}$     | Turn-On Switching Loss            |                                                                  |      | TBD  |      | mJ               |
| $E_{off}$    | Turn-Off Switching Loss           |                                                                  |      | TBD  |      | mJ               |

**Body Diode Characteristics**  $T_F=25^{\circ}\text{C}$  unless otherwise noted

| Symbol    | Parameter                     | Test Conditions                                                    | Min. | Typ. | Max. | Unit          |
|-----------|-------------------------------|--------------------------------------------------------------------|------|------|------|---------------|
| $V_{SD}$  | Diode Forward Voltage         | $I_{SD}=35\text{A}, V_{GS}=-4\text{V}, T_{vj}=25^{\circ}\text{C}$  |      | 4.20 |      | V             |
|           |                               | $I_{SD}=35\text{A}, V_{GS}=-4\text{V}, T_{vj}=175^{\circ}\text{C}$ |      | TBD  |      |               |
| $Q_r$     | Diode Reverse Recovery Charge | TBD                                                                |      | TBD  |      | $\mu\text{C}$ |
| $I_{rrm}$ | Peak Reverse Recovery Current |                                                                    |      | TBD  |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |                                                                    |      | TBD  |      | mJ            |
| $Q_r$     | Diode Reverse Recovery Charge | TBD                                                                |      | TBD  |      | $\mu\text{C}$ |
| $I_{rrm}$ | Peak Reverse Recovery Current |                                                                    |      | TBD  |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |                                                                    |      | TBD  |      | mJ            |
| $Q_r$     | Diode Reverse Recovery Charge | TBD                                                                |      | TBD  |      | $\mu\text{C}$ |
| $I_{rrm}$ | Peak Reverse Recovery Current |                                                                    |      | TBD  |      | A             |
| $E_{rec}$ | Reverse Recovery Energy       |                                                                    |      | TBD  |      | mJ            |

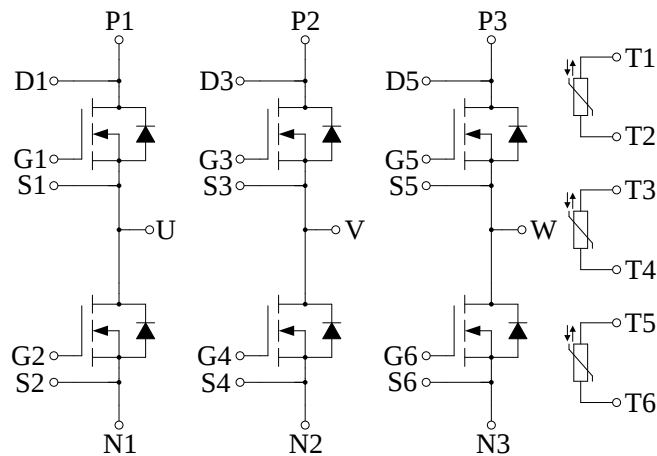
**NTC Characteristics**  $T_F=25^{\circ}\text{C}$  unless otherwise noted

| Symbol       | Parameter              | Test Conditions                                        | Min. | Typ. | Max. | Unit             |
|--------------|------------------------|--------------------------------------------------------|------|------|------|------------------|
| $R_{25}$     | Rated Resistance       |                                                        |      | 5.0  |      | $\text{k}\Omega$ |
| $\Delta R/R$ | Deviation of $R_{100}$ | $T_C=100^{\circ}\text{C}, R_{100}=493.3\Omega$         | -5   |      | 5    | %                |
| $P_{25}$     | Power Dissipation      |                                                        |      |      | 20.0 | mW               |
| $B_{25/50}$  | B-value                | $R_2=R_{25}\exp[B_{25/50}(1/T_2-1/(298.15\text{K}))]$  |      | 3375 |      | K                |
| $B_{25/80}$  | B-value                | $R_2=R_{25}\exp[B_{25/80}(1/T_2-1/(298.15\text{K}))]$  |      | 3411 |      | K                |
| $B_{25/100}$ | B-value                | $R_2=R_{25}\exp[B_{25/100}(1/T_2-1/(298.15\text{K}))]$ |      | 3433 |      | K                |

**Module Characteristics**  $T_F=25^{\circ}\text{C}$  unless otherwise noted

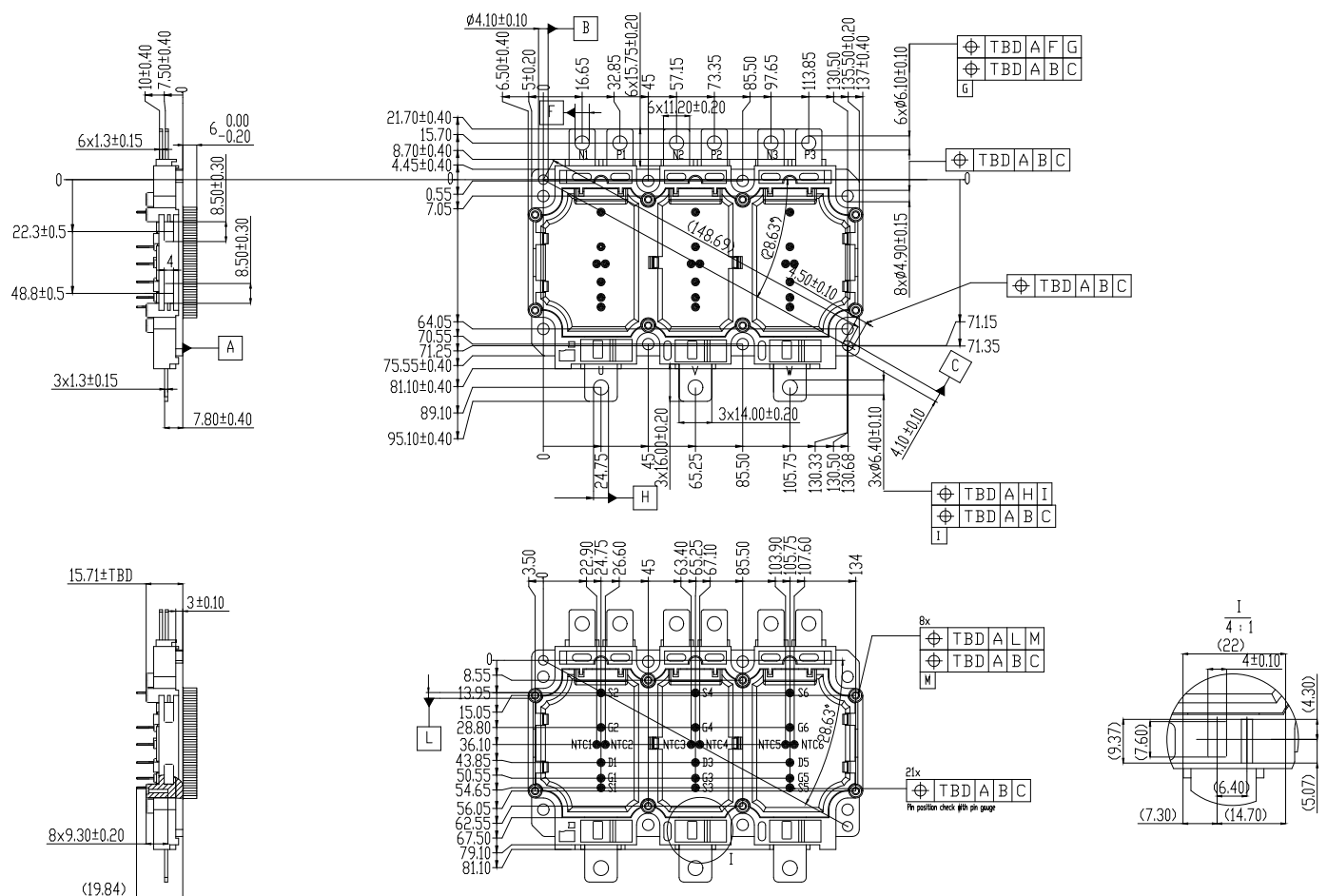
| Symbol        | Parameter                                                                                                       | Min. | Typ.  | Max.  | Unit             |
|---------------|-----------------------------------------------------------------------------------------------------------------|------|-------|-------|------------------|
| $L_{CE}$      | Stray Inductance                                                                                                |      | TBD   |       | nH               |
| $R_{CC'+EE'}$ | Module Lead Resistance, Terminal to Chip                                                                        |      | TBD   |       | $\text{m}\Omega$ |
| $R_{thJF}$    | Junction-to-Cooling Fluid (per MOSFET)<br>$\Delta V/\Delta t=8.0\text{dm}^3/\text{min}, T_F=65^{\circ}\text{C}$ |      | 0.180 | 0.198 | K/W              |
| G             | Weight of Module                                                                                                |      | TBD   |       | g                |

## Circuit Schematic



## Package Dimensions

### Dimensions in Millimeters



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