| | | | |
|---|---|---|---|
| $V_{RSM}$ | = | 4000 | V |
| $I_{F(AV)M}$ | = | 5200 | A |
| $I_{F(RMS)}$ | = | 8200 | A |
| $I_{FSM}$ | = | $85 \times 10^3$ | A |
| $V_{F0}$ | = | 0.8 | V |
| $r_F$ | = | 0.086 | mΩ |

# Rectifier Diode
# 5SDD 54N4000

Doc. No. 5SYA1171-00 Dec. 03

- **Patented free-floating silicon technology**
- **Very low on-state losses**
- **Optimum power handling capability**



## Blocking

***Maximum rated values*** [1)]

| Parameter | Symbol | Conditions | Value | Unit |
|---|---|---|---|---|
| Repetitive peak reverse voltage | $V_{RRM}$ | f = 50 Hz, $t_p$ = 10ms, $T_j$ = 0...150°C | 3600 | V |
| Non - repetitive peak reverse voltage | $V_{RSM}$ | f = 5 Hz, $t_p$ = 10ms, $T_j$ = 0...150°C | 4000 | V |

***Characteristic values***

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Max. (reverse) leakage current | $I_{RRM}$ | $V_{RRM}$, Tj = 150°C | | | 400 | mA |

## Mechanical data

***Maximum rated values*** [1)]

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Mounting force | $F_M$ | | 81 | 90 | 108 | kN |
| Acceleration | a | Device unclamped | | | 50 | $m/s^2$ |
| Acceleration | a | Device clamped | | | 100 | $m/s^2$ |

***Characteristic values***

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Weight | m | | | | 2.8 | kg |
| Housing thickness | H | $F_M$ = 90 kN, $T_a$ = 25 °C | | | 35.9 | mm |
| Surface creepage distance | $D_S$ | | 56 | | | mm |
| Air strike distance | $D_a$ | | 22 | | | mm |

1) Maximum rated values indicate limits beyond which damage to the device may occur

## On-state

***Maximum rated values*** [1)]

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Max. average on-state current | $I_{F(AV)M}$ | 50 Hz, Half sine wave, $T_C$ = 85 °C | | | 5200 | A |
| Max. RMS on-state current | $I_{F(RMS)}$ | | | | 8200 | A |
| Max. peak non-repetitive surge current | $I_{FSM}$ | $t_p$ = 10 ms, $T_j$ = 150°C, $V_R$ = 0 V | | | $85\times10^3$ | A |
| Limiting load integral | $I^2t$ | | | | $36.3\times10^6$ | $A^2s$ |
| Max. peak non-repetitive surge current | $I_{FSM}$ | $t_p$ = 8.3 ms, $T_j$ = 150°C, $V_R$ = 0 V | | | $90\times10^3$ | A |
| Limiting load integral | $I^2t$ | | | | $34.6\times10^6$ | $A^2s$ |

***Characteristic values***

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| On-state voltage | $V_F$ | $I_F$ = 5000 A, $T_j$ = 150°C | | | 1.23 | V |
| Threshold voltage | $V_{(T0)}$ | $T_j$ = 150°C<br>$I_T$ = 2500...7500 A | | | 0.8 | V |
| Slope resistance | $r_T$ | | | | 0.086 | mΩ |

## Switching

***Characteristic values***

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Recovery charge | $Q_{rr}$ | $di_F/dt$ = -10 A/µs, $V_R$ = 200 V<br>$I_{FRM}$ = 4000 A, $T_j$ = 150°C | | | 18000 | µAs |

# Thermal

***Maximum rated values*** [1)]

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Operating junction temperature range | $T_{vj}$ | | 0 | | 150 | °C |
| Storage temperature range | $T_{stg}$ | | -40 | | 150 | °C |

***Characteristic values***

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---|---|---|---|---|---|---|
| Thermal resistance junction to case | $R_{th(j-c)}$ | Double-side cooled<br>$F_m$ = 81...108 kN | | | 5.7 | K/kW |
| | $R_{th(j-c)A}$ | Anode-side cooled<br>$F_m$ = 81...108 kN | | | 11.4 | K/kW |
| | $R_{th(j-c)C}$ | Cathode-side cooled<br>$F_m$ = 81...108 kN | | | 11.4 | K/kW |
| Thermal resistance case to heatsink | $R_{th(c-h)}$ | Double-side cooled<br>$F_m$ = 81...108 kN | | | 1 | K/kW |
| | $R_{th(c-h)}$ | Single-side cooled<br>$F_m$ = 81...108 kN | | | 2 | K/kW |

**Analytical function for transient thermal impedance:**

$$Z_{th(j-c)}(t) = \sum_{i=1}^{n} R_{th\,i}(1 - e^{-t/\tau_i})$$

| i | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| $R_{th\,i}$(K/kW) | 3.728 | 1.248 | 0.433 | 0.292 |
| $\tau_i$(s) | 0.8115 | 0.1014 | 0.0089 | 0.0015 |

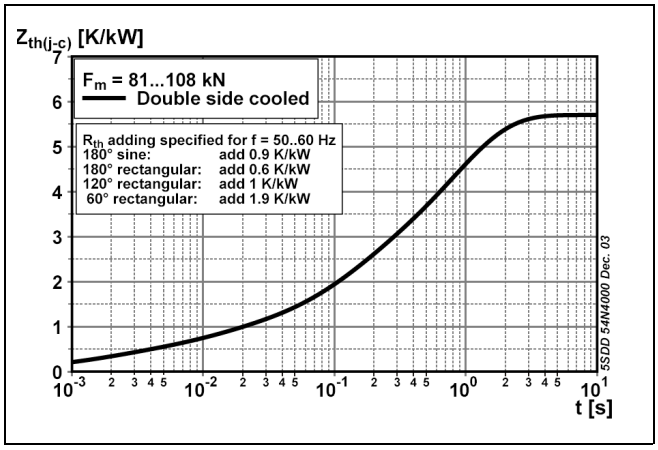


**Fig. 1** Transient thermal impedance junction-to-case.

**Max. on-state characteristic model:**

$$V_{F25} = A_{Tvj} + B_{Tvj} \cdot I_F + C_{Tvj} \cdot \ln(I_F + 1) + D_{Tvj} \cdot \sqrt{I_F}$$

Valid for $I_F$ = 300 – 110000 A

| $A_{25}$ | $B_{25}$ | $C_{25}$ | $D_{25}$ |
|---|---|---|---|
| $486.40 \times 10^{-3}$ | $45.53 \times 10^{-6}$ | $65.82 \times 10^{-3}$ | $68.19 \times 10^{-15}$ |

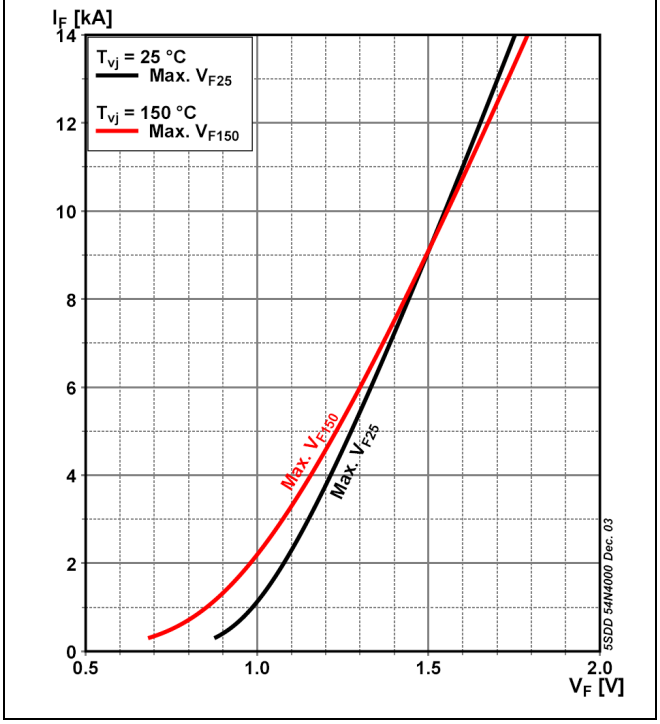


**Fig. 2** Isothermal on-state characteristics

**Max. on-state characteristic model:**

$$V_{F150} = A_{Tvj} + B_{Tvj} \cdot I_F + C_{Tvj} \cdot \ln(I_F + 1) + D_{Tvj} \cdot \sqrt{I_F}$$

Valid for $I_F$ = 300 – 110000 A

| $A_{150}$ | $B_{150}$ | $C_{150}$ | $D_{150}$ |
|---|---|---|---|
| $22.00 \times 10^{-3}$ | $49.09 \times 10^{-6}$ | $113.10 \times 10^{-3}$ | $-20.75 \times 10^{-15}$ |

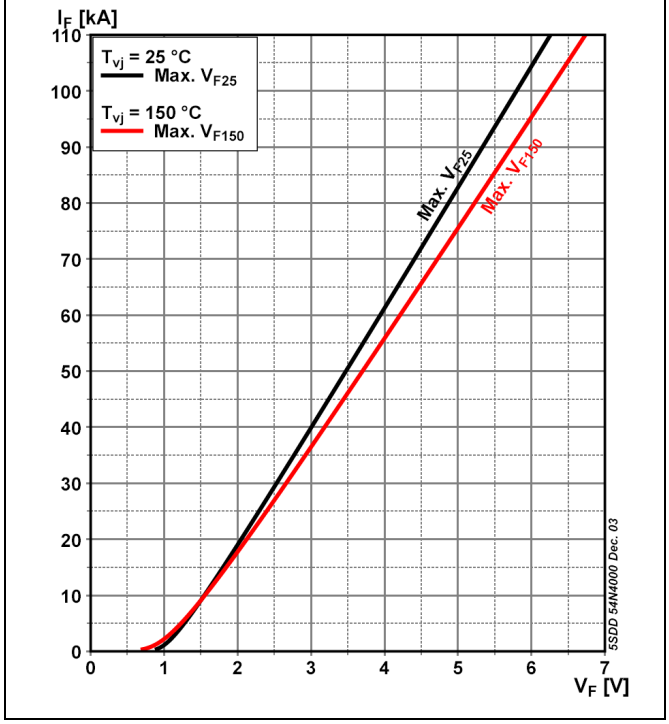


**Fig. 3** Isothermal on-state characteristics

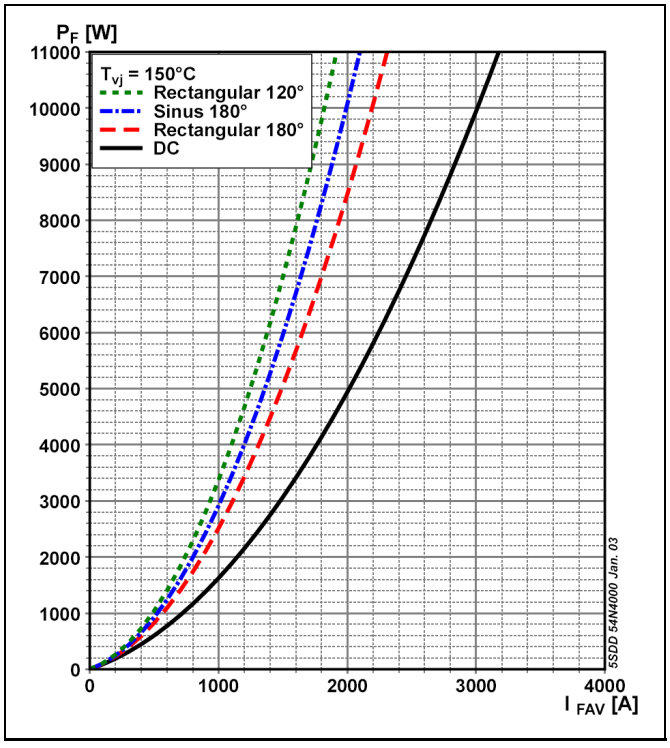


**Fig. 4** On-state power losses vs average on-state current.

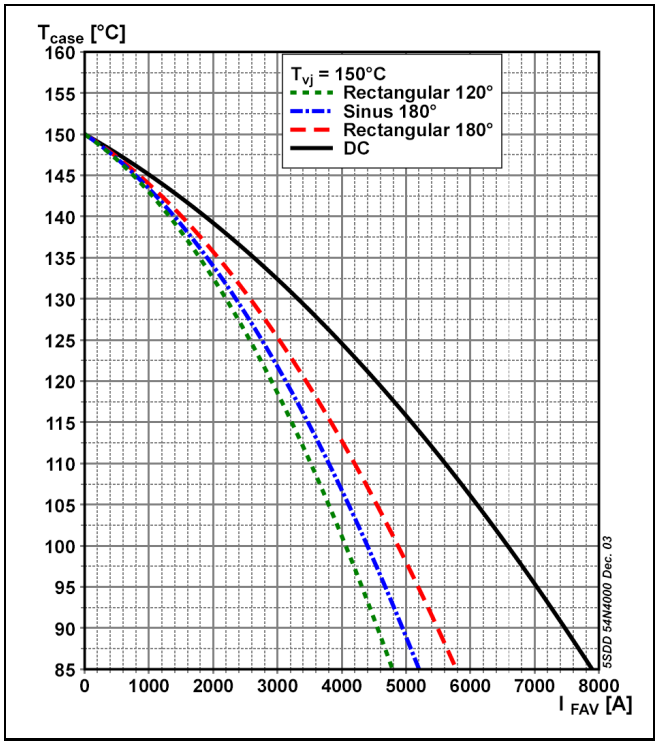


**Fig. 5** Max. permissible case temperature vs average on-state current.

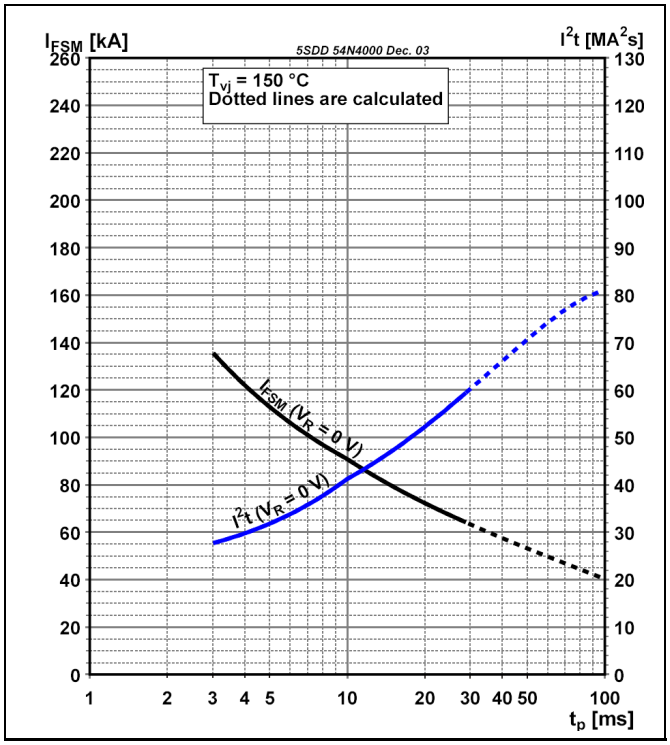


**Fig. 6** Surge on-state current vs. pulse length. Half-sine wave.

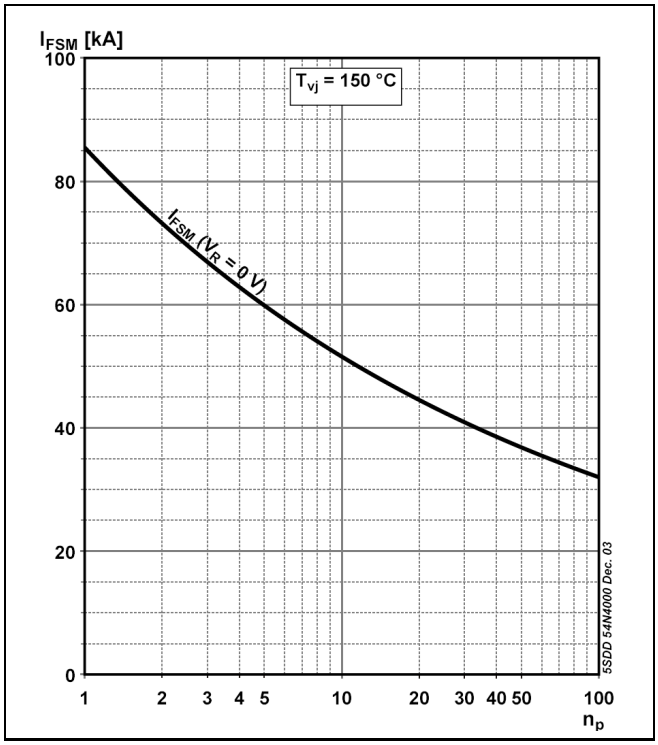


**Fig. 7** Surge on-state current vs. number of pulses. Half-sine wave, 10 ms, 50Hz.

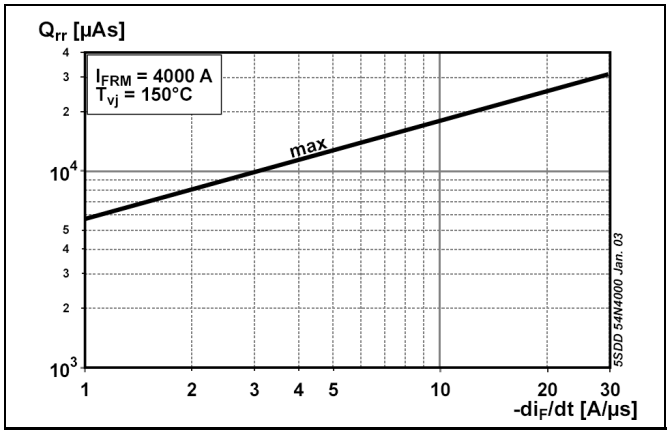


**Fig. 8** Recovery charge vs. decay rate of on-state current.

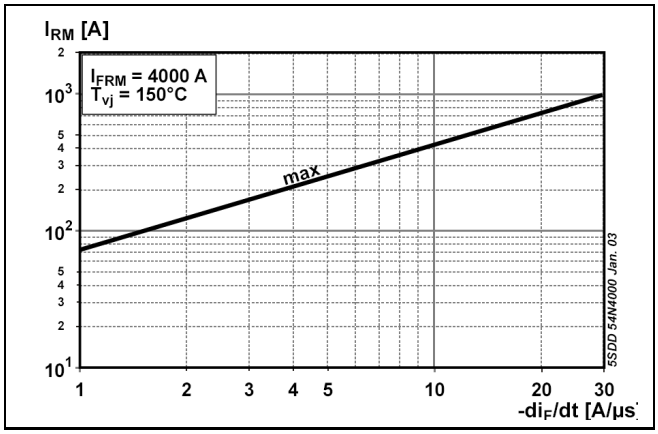


**Fig. 9** Peak reverse recovery current vs. decay rate of on-state current.

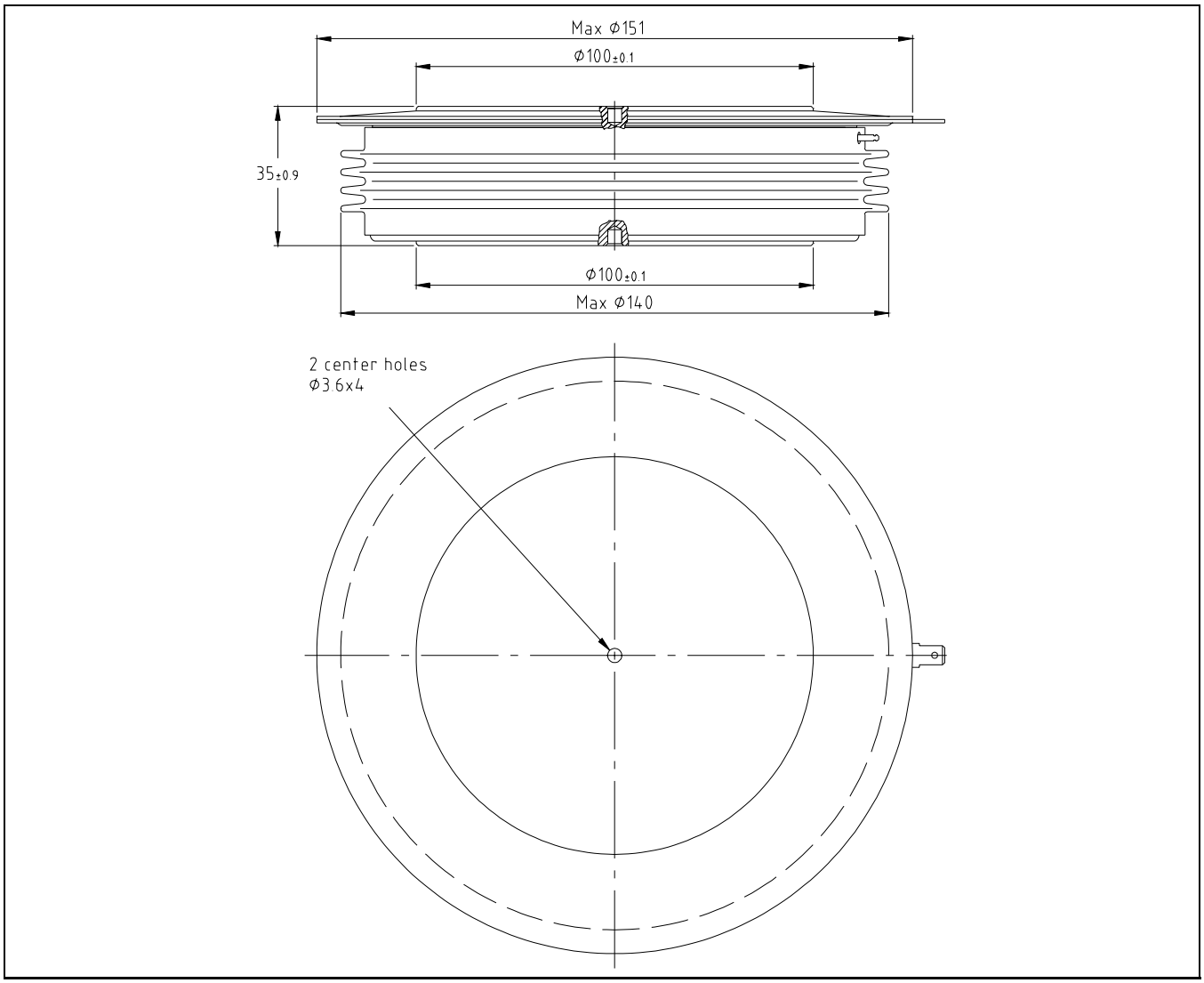


**Fig. 10** Outline drawing. All dimensions are in millimeters and represent nominal values unless stated otherwise.

## Related application notes:

| Doc. Nr | Titel |
|---|---|
| 5SYA 2020 | Design of RC-Snubbers for Phase Control Applications |
| 5SYA 2029 | Designing Large Rectifiers with High Power Diodes |
| 5SYA 2036 | Recommendations regarding mechanical clamping of Press Pack High Power Semiconductors |

Please refer to http://www.abb.com/semiconductors for actual versions.



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