1. **Applications**
   - Power Factor Correction
   - Solar Inverters
   - Uninterruptible Power Supplies
   - DC-DC Converters

2. **Features**
   1. Chip design of 2nd generation
   2. High non-repetitive peak forward surge current: $I_{FSM} = 97$ A
   3. Low junction capacitance: $C_J = 44$ pF (typ.)
   4. Low reverse current: $I_R = 0.6$ µA (typ.)

3. **Packaging and Internal Circuit**

   ![Diagram](image_url)

   - TO-220-2L
   - Heatsink
   - 1: Cathode
   - 2: Anode

Start of commercial production
2019-11
4. Absolute Maximum Ratings (Note) (Unless otherwise specified, $T_A = 25 \, ^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Note</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repetitive peak reverse voltage</td>
<td>$V_{RRM}$</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>Forward DC current</td>
<td>$I_{F(DC)}$</td>
<td>(Note 1)</td>
<td>12</td>
<td>A</td>
</tr>
<tr>
<td>Forward pulse current</td>
<td>$I_{FP}$</td>
<td>(Note 2)</td>
<td>120</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_D$</td>
<td>(Note 2)</td>
<td>115</td>
<td>W</td>
</tr>
<tr>
<td>Non-repetitive peak forward surge current</td>
<td>$I_{FSM}$</td>
<td>(Note 3)</td>
<td>97</td>
<td>A</td>
</tr>
<tr>
<td>Junction temperature</td>
<td>$T_J$</td>
<td></td>
<td>175</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td></td>
<td>-55 to 175</td>
<td>°C</td>
</tr>
<tr>
<td>Mounting torque</td>
<td>TOR</td>
<td></td>
<td>0.6</td>
<td>N · m</td>
</tr>
</tbody>
</table>

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings.

Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1: $t = 50 \, \mu s$
Note 2: $T_c = 25 \, ^\circ C$
Note 3: $f = 50 \, \text{Hz}$ (half-sine wave, $t = 10 \, \text{ms}$)

5. Thermal Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal resistance (junction-to-case)</td>
<td>$R_{th(j-c)}$</td>
<td></td>
<td>1.3</td>
<td>°C/W</td>
</tr>
<tr>
<td>Thermal resistance (junction-to-ambient)</td>
<td>$R_{th(j-a)}$</td>
<td></td>
<td>89</td>
<td>°C/W</td>
</tr>
</tbody>
</table>

6. Electrical Characteristics (Unless otherwise specified, $T_A = 25 \, ^\circ C$)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Symbol</th>
<th>Test Condition</th>
<th>Min</th>
<th>Typ.</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward voltage</td>
<td>$V_F(1)$</td>
<td>$I_F = 6 , A$ (pulse measurement)</td>
<td>—</td>
<td>1.2</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>Forward voltage</td>
<td>$V_F(2)$</td>
<td>$I_F = 12 , A$ (pulse measurement)</td>
<td>—</td>
<td>1.45</td>
<td>1.6</td>
<td>V</td>
</tr>
<tr>
<td>Reverse current</td>
<td>$I_R$</td>
<td>$V_R = 650 , V$ (pulse measurement)</td>
<td>—</td>
<td>0.6</td>
<td>60</td>
<td>µA</td>
</tr>
<tr>
<td>Junction capacitance</td>
<td>$C_j$</td>
<td>$V_R = 650 , V, f = 1 , \text{MHz}$</td>
<td>—</td>
<td>44</td>
<td>—</td>
<td>pF</td>
</tr>
</tbody>
</table>
7. Marking (Note)

![Marking Diagram](image)

Fig. 7.1 Marking

Note: A line under a Lot No. identifies the indication of product Labels.

 [[G]]/RoHS COMPATIBLE or [[G]]/RoHS [[Pb]]

Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product.


<table>
<thead>
<tr>
<th>Abbreviation Code</th>
<th>Part Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>S12E65F</td>
<td>TRS12E65F</td>
</tr>
</tbody>
</table>

8. Usage Considerations

(1) The absolute maximum ratings are rated values that must not be exceeded during operation, even for an instant.

The following are the recommended general derating methods for designing a circuit board using this device.

$V_{RRM}$ : $V_{RRM}$ has a temperature coefficient of 0.1 %/°C.

Take this coefficient into account when designing a circuit board that will be operated in a low-temperature environment.

$I_{F(DC)}$ : We recommend that the worst-case current be no greater than 80 % of the absolute maximum rating of $I_{F(DC)}$.

$I_{FP}$ : We recommend that the worst-case current be no greater than 80 % of the absolute maximum rating of $I_{FP}$.

$I_{FSM}$ : This rating specifies a non-repetitive limit value.

This only applies to an abnormal operation, which seldom occurs during the lifespan of a device.

$T_j$ : Derate device parameters in proportion to this rating in order to ensure high reliability.

We recommend that the junction temperature ($T_j$) of a device be kept below 140 °C.

(2) For other design considerations, see the Toshiba website.
9. Characteristics Curves (Note)

Note: The above characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.
Weight: 1.9 g (typ.)

<table>
<thead>
<tr>
<th>Package Name(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOSHIBA: 2-10AE1A</td>
</tr>
<tr>
<td>Nickname: TO-220-2L</td>
</tr>
</tbody>
</table>

Unit: mm
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