## flow BOOST

**Features**
- High efficiency dual boost
- Ultra fast switching frequency
- Low Inductance Layout
- 1200V IGBT and 1200V Si diode

**Target Applications**
- solar inverter

**Types**
- V23990-P629-L59-PM
- V23990-P629-L58-PM
- V23990-P629-L58Y-PM

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**Maximum Ratings**

\(T_j=25°C\), unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bypass Diode (D7, D8)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repetitive peak reverse voltage</td>
<td>(V_{RRM})</td>
<td>(T_j=25°C)</td>
<td>1600</td>
<td>V</td>
</tr>
<tr>
<td>DC forward current</td>
<td>(I_{EAV})</td>
<td>(T_j=T_{j,max}) (T_s=80°C) (T_r=80°C)</td>
<td>34</td>
<td>A</td>
</tr>
<tr>
<td>Surge forward current</td>
<td>(I_{FOM})</td>
<td>(t_s=10\mu s) (\sin 180°) (T_j=25°C)</td>
<td>220</td>
<td>A</td>
</tr>
<tr>
<td>(I_t)-value</td>
<td>(I_t^2)</td>
<td></td>
<td>240</td>
<td>A²s</td>
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<tr>
<td>Power dissipation</td>
<td>(P_{tot})</td>
<td>(T_j=T_{j,max}) (T_s=80°C) (T_r=80°C)</td>
<td>42</td>
<td>W</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>(T_{j,max})</td>
<td></td>
<td>150</td>
<td>°C</td>
</tr>
<tr>
<td><strong>Boost IGBT (T1, T2)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter break down voltage</td>
<td>(V_{CE})</td>
<td>(T_j=25°C)</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>DC collector current</td>
<td>(I_C)</td>
<td>(T_j=T_{j,max}) (T_s=80°C) (T_r=80°C)</td>
<td>40</td>
<td>A</td>
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<tr>
<td>Pulsed collector current</td>
<td>(I_{CEM})</td>
<td>(t_t), limited by (T_{j,max})</td>
<td>120</td>
<td>A</td>
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<td>Power dissipation</td>
<td>(P_{tot})</td>
<td>(T_j=T_{j,max}) (T_s=80°C) (T_r=80°C)</td>
<td>113</td>
<td>W</td>
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<tr>
<td>Gate-emitter peak voltage</td>
<td>(V_{GE})</td>
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<td>±20</td>
<td>V</td>
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<tr>
<td>Short circuit ratings</td>
<td>(t_{SC}) (V_{CC})</td>
<td>(T_j≤150°C) (V_{CC}=15V)</td>
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<td>μs</td>
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<tr>
<td>Maximum Junction Temperature</td>
<td>(T_{j,max})</td>
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<td>175</td>
<td>°C</td>
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</table>
### Maximum Ratings

**Parameter**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
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<tr>
<td><strong>Boost IGBT Protection Diode (D9, D10)</strong></td>
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<tr>
<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{BSM}$</td>
<td>$T_j=25^\circ C$</td>
<td>1200</td>
<td>V</td>
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<td>DC forward current</td>
<td>$I_F$</td>
<td>$T_j=T_{jmax}$</td>
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<td>A</td>
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<td>$T_s=80^\circ C$</td>
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<td>A</td>
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<tr>
<td>Surge forward current</td>
<td>$I_{FSM}$</td>
<td>$t_f=10,ms$, $sin, 180^\circ$, $T_j=T_{jmax}$</td>
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<td>Power dissipation</td>
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<td>$T_s=80^\circ C$</td>
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<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
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<td>150</td>
<td>°C</td>
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<td><strong>Boost FWD (D1, D4)</strong></td>
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<tr>
<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{BSM}$</td>
<td>$T_j=25^\circ C$</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>DC forward current</td>
<td>$I_F$</td>
<td>$T_j=T_{jmax}$</td>
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<td>A</td>
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<tr>
<td>$T_s=80^\circ C$</td>
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<td>Surge forward current</td>
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<td>Power dissipation</td>
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<td>$T_s=80^\circ C$</td>
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<td>W</td>
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<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
<td></td>
<td>175</td>
<td>°C</td>
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<tr>
<td><strong>Thermal Properties</strong></td>
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<td></td>
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<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td></td>
<td>-40...+125</td>
<td>°C</td>
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<tr>
<td>Operation temperature under switching condition</td>
<td>$T_{op}$</td>
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<td>-40...+(T_{jmax} - 25)</td>
<td>°C</td>
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<td><strong>Insulation Properties</strong></td>
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<td>Insulation voltage</td>
<td>$V_m$</td>
<td>$t=2s$</td>
<td>DC voltage</td>
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<td>Creepage distance</td>
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<td>min 12,7</td>
<td>mm</td>
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<tr>
<td>Clearance</td>
<td></td>
<td></td>
<td>min 12,7</td>
<td>mm</td>
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## Characteristic Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boost IGBT (T1 , T2 )</td>
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<td></td>
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<td></td>
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<tr>
<td>Gate emitter threshold voltage</td>
<td>( V_{GE(th)} )</td>
<td>( V_{CE}=V_{GS} )</td>
<td>0,0015</td>
<td>5,2</td>
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<td>Collector-emitter saturation voltage</td>
<td>( V_{CEsat} )</td>
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<td>1,7</td>
<td>2,6</td>
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<td>Collector-emitter cut-off</td>
<td>( I_{CES} )</td>
<td>0</td>
<td>0.25</td>
<td>mA</td>
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<td>Gate-emitter leakage current</td>
<td>( I_{GE} )</td>
<td>20</td>
<td>200</td>
<td>nA</td>
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<td>Integrated Gate resistor</td>
<td>( R_{gin} )</td>
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<td>none</td>
<td>Ω</td>
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<tr>
<td>Turn-on delay time</td>
<td>( \tau_{on} )</td>
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<td>22</td>
<td>ns</td>
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<tr>
<td>Rise time</td>
<td>( \tau_{r} )</td>
<td>( R_{goff}=4 \Omega ) ( V_{Rgon}=4 \Omega )</td>
<td>21</td>
<td>ns</td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>( \tau_{off} )</td>
<td>15</td>
<td>24</td>
<td>ns</td>
</tr>
<tr>
<td>Fall time</td>
<td>( \tau_{f} )</td>
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<td>225</td>
<td>ms</td>
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<td>Turn-on energy loss</td>
<td>( E_{on} )</td>
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<td>1,09</td>
<td>mWs</td>
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<tr>
<td>Turn-off energy loss</td>
<td>( E_{off} )</td>
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<td>1,01</td>
<td>mWs</td>
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<tr>
<td>Input capacitance</td>
<td>( C_{in} )</td>
<td>f=1MHz</td>
<td>150</td>
<td>pF</td>
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<tr>
<td>Output capacitance</td>
<td>( C_{out} )</td>
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<td>135</td>
<td>pF</td>
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<td>Gate charge</td>
<td>( Q_{ge} )</td>
<td>15</td>
<td>600</td>
<td>nC</td>
</tr>
<tr>
<td>Thermal resistance chip to heatsink</td>
<td>( R_{th(j-c)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>0.84</td>
<td>K/W</td>
</tr>
<tr>
<td>Thermal resistance chip to case</td>
<td>( R_{th(j-s)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>0.56</td>
<td>K/W</td>
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<tr>
<td>Boost IGBT Protection Diode (D9 , D11)</td>
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<td></td>
</tr>
<tr>
<td>Diode forward voltage</td>
<td>( V_{F} )</td>
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<td>0.7</td>
<td>1.5</td>
</tr>
<tr>
<td>Thermal resistance chip to heatsink</td>
<td>( R_{th(j-c)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>2.72</td>
<td>K/W</td>
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<tr>
<td>Thermal resistance chip to case</td>
<td>( R_{th(j-s)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>1.80</td>
<td>K/W</td>
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<tr>
<td>Boost FWD (D1 , D4)</td>
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<tr>
<td>Forward voltage</td>
<td>( V_{F} )</td>
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<td>0.7</td>
<td>2.28</td>
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<tr>
<td>Reverse leakage current</td>
<td>( I_{R} )</td>
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<td>60</td>
<td>μA</td>
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<tr>
<td>Peak recovery current</td>
<td>( I_{pk} )</td>
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<td>63</td>
<td>A</td>
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<tr>
<td>Reverse recovery time</td>
<td>( \tau_{r} )</td>
<td>( R_{goff}=4 \Omega )</td>
<td>83</td>
<td>ns</td>
</tr>
<tr>
<td>Reverse recovery charge</td>
<td>( Q_{rr} )</td>
<td></td>
<td>2.25</td>
<td>μC</td>
</tr>
<tr>
<td>Reverse recovered energy</td>
<td>( E_{rec} )</td>
<td></td>
<td>2.42</td>
<td>mWs</td>
</tr>
<tr>
<td>Peak rate of fall of recovery current</td>
<td>( \frac{dV_{F}}{dt}_{\text{max}} )</td>
<td></td>
<td>5104</td>
<td>A/μs</td>
</tr>
<tr>
<td>Thermal resistance chip to heatsink</td>
<td>( R_{th(j-c)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>1.07</td>
<td>K/W</td>
</tr>
<tr>
<td>Thermal resistance chip to case</td>
<td>( R_{th(j-s)} )</td>
<td>Thermal grease thickness≤50um ( k = 1 \text{ W/mK} )</td>
<td>0.71</td>
<td>K/W</td>
</tr>
</tbody>
</table>
## Characteristic Values

<table>
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<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>V_{GS} [V] or V_{GE} [V]</td>
<td>$V_{GS}$</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>$I_s$ [A] or $I_c$ [A]</td>
<td>$I_s$</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>$V_{r}$ [V] or $V_{CE}$ [V]</td>
<td>$V_r$</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>$V_{DS}$ [V]</td>
<td>$V_{DS}$</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
<tr>
<td>$I_C$ [A] or $I_F$ [A] or $I_D$ [A]</td>
<td>$I_C$</td>
<td>Min</td>
<td>Typ</td>
<td>Max</td>
</tr>
</tbody>
</table>

### Thermistor

- **Rated resistance**
  - $R$
  - Conditions: $T_j=25°C$
  - Value: 22 kΩ

- **Deviation of R100**
  - $\Delta R_{100}$
  - R100=1486Ω
  - Conditions: $T_c=100°C$
  - Value: -4,5 +4,5 %

- **Power dissipation**
  - $P$
  - Conditions: $T_j=25°C$
  - Value: 210 mW

- **Power dissipation constant**
  - $B_{(5/25)}$
  - Conditions: $T_j=25°C$
  - Value: 3,5 mW/K

- **B-value**
  - $B_{(4.5/25)}$
  - Conditions: $T_j=25°C$
  - Value: 3884 K

- **B-value**
  - $B_{(3.5/25)}$
  - Conditions: $T_j=25°C$
  - Value: 3964 K

- **Vincotech NTC Reference**
  - Value: F
Boost IGBT Protection Diode

**Figure 1**
Typical FWD forward current as a function of forward voltage

\[ I_F = f(V_F) \]

At
\[ t_p = 250 \ \mu s \]

**Figure 2**
Diode transient thermal impedance as a function of pulse width

\[ Z_{thJH} = f(t_p) \]

At
\[ D = \frac{t_p}{T_{Rth}} \]
\[ R_{thJH} = 2.72 \ \text{K/W} \]

**Figure 3**
Power dissipation as a function of heatsink temperature

\[ P_{tot} = f(T_J) \]

At
\[ T_J = 150 \ ^\circ C \]

**Figure 4**
Forward current as a function of heatsink temperature

\[ I_F = f(T_J) \]

At
\[ T_J = 150 \ ^\circ C \]
**INPUT BOOST**

**Figure 3**
**BOOST IGBT**

Typical output characteristics

\[ I_C = f(V_{CE}) \]

At

\[ t_p = 250 \, \mu s \]

\[ T_j = 25 \, ^\circ C \]

\[ V_{GS} \] from 7 V to 17 V in steps of 1 V

![Typical output characteristics graph]

**Figure 4**
**BOOST FWD**

Typical output characteristics

\[ I_C = f(V_{CE}) \]

At

\[ t_p = 250 \, \mu s \]

\[ T_j = 125 \, ^\circ C \]

\[ V_{GS} \] from 7 V to 17 V in steps of 1 V

![Typical output characteristics graph]

**Figure 3**
**BOOST IGBT**

Typical transfer characteristics

\[ I_C = f(V_{CE}) \]

![Typical transfer characteristics graph]

**Figure 4**
**BOOST FWD**

Typical FWD forward current as a function of forward voltage

\[ I_F = f(V_F) \]

At

\[ t_p = 250 \, \mu s \]

\[ T_j = T_{j_{\max}} - 25 \, ^\circ C \]

\[ V_{DS} = 10 \, V \]

![Typical FWD forward current graph]
**Figure 5**
Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at

- \( T_J = 25/125 \, ^\circ C \)
- \( V_{DS} = 700 \, V \)
- \( V_{GS} = 15 \, V \)
- \( R_{gon} = 4 \, \Omega \)
- \( I_D = 24 \, A \)

**Figure 6**
Typical switching energy losses as a function of gate resistor

\[ E = f(R_G) \]

With an inductive load at

- \( T_J = 25/125 \, ^\circ C \)
- \( V_{DS} = 700 \, V \)
- \( V_{GS} = 15 \, V \)
- \( I_D = 24 \, A \)

**Figure 7**
Typical reverse recovery energy loss as a function of collector (drain) current

\[ E_{rec} = f(I_C) \]

With an inductive load at

- \( T_J = 25/125 \, ^\circ C \)
- \( V_{DS} = 700 \, V \)
- \( V_{GS} = 15 \, V \)
- \( R_{gon} = 4 \, \Omega \)

**Figure 8**
Typical reverse recovery energy loss as a function of gate resistor

\[ E_{rec} = f(R_G) \]

With an inductive load at

- \( T_J = 25/125 \, ^\circ C \)
- \( V_{DS} = 700 \, V \)
- \( V_{GS} = 15 \, V \)
- \( I_D = 24 \, A \)
Typical switching times as a function of collector current
\( t = f(I_C) \)

With an inductive load at:
- \( T_J = 125 \, ^\circ\text{C} \)
- \( V_{DS} = 700 \, \text{V} \)
- \( V_{GS} = 15 \, \text{V} \)
- \( I_F = 24 \, \text{A} \)
- \( R_{gon} = 4 \, \Omega \)
- \( R_{goff} = 4 \, \Omega \)

Typical reverse recovery time as a function of collector current
\( t_{rr} = f(I_C) \)

At:
- \( T_J = 25/125 \, ^\circ\text{C} \)
- \( V_{DS} = 700 \, \text{V} \)
- \( V_{GS} = 15 \, \text{V} \)
- \( R_{gon} = 4 \, \Omega \)
Typical reverse recovery charge as a function of collector current

\[ Q_{rr} = f(I_C) \]

**Figure 13**

At

- \( T_j = 25/125 \, ^\circ\text{C} \)
- \( V_{cc} = 700 \, \text{V} \)
- \( V_{gs} = 15 \, \text{V} \)
- \( R_{gon} = 4 \, \Omega \)

Typical reverse recovery current as a function of collector current

\[ I_{RRM} = f(I_C) \]

**Figure 15**

At

- \( T_j = 25/125 \, ^\circ\text{C} \)
- \( V_{cc} = 700 \, \text{V} \)
- \( I_F = 24 \, \text{A} \)
- \( V_{gs} = 15 \, \text{V} \)

Typical reverse recovery charge as a function of IGBT turn on gate resistor

\[ Q_{rr} = f(R_{gon}) \]

**Figure 14**

At

- \( T_j = 25/125 \, ^\circ\text{C} \)
- \( V_{cc} = 700 \, \text{V} \)
- \( I_F = 24 \, \text{A} \)
- \( V_{gs} = 15 \, \text{V} \)

Typical reverse recovery current as a function of IGBT turn on gate resistor

\[ I_{RRM} = f(R_{gon}) \]

**Figure 16**

At

- \( T_j = 25/125 \, ^\circ\text{C} \)
- \( V_{cc} = 700 \, \text{V} \)
- \( I_F = 24 \, \text{A} \)
- \( V_{gs} = 15 \, \text{V} \)
Figure 17  
**Typical rate of fall of forward and reverse recovery current as a function of collector current**

\[ \frac{dI_f}{dt}, \frac{dI_{rec}}{dt} = f(I_c) \]

- **At**
  - \( T_j = 25/125 \degree C \)
  - \( V_{EE} = 700 \) V
  - \( V_{DR} = 15 \) V
  - \( R_{gon} = 4 \) Ω

Figure 18  
**Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor**

\[ \frac{dI_f}{dt}, \frac{dI_{rec}}{dt} = f(R_{gon}) \]

- **At**
  - \( T_j = 25/125 \degree C \)
  - \( V_r = 700 \) V
  - \( I_f = 24 \) A
  - \( V_{EE} = 15 \) V

Figure 19  
**IGBT/MOSFET transient thermal impedance as a function of pulse width**

\[ Z_{thJH} = f(t_p) \]

- **At**
  - \( D = 0.5 \)
  - \( R_{thJH} = 0.84 \) K/W

Figure 20  
**FWD transient thermal impedance as a function of pulse width**

\[ Z_{thJH} = f(t_p) \]

- **At**
  - \( D = 0.5 \)
  - \( R_{thJH} = 1.07 \) K/W

**IGBT thermal model values**

<table>
<thead>
<tr>
<th>( R ) (K/W)</th>
<th>( \ Tau ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.107</td>
<td>1.413</td>
</tr>
<tr>
<td>0.391</td>
<td>0.188</td>
</tr>
<tr>
<td>0.223</td>
<td>0.056</td>
</tr>
<tr>
<td>0.092</td>
<td>0.011</td>
</tr>
<tr>
<td>0.030</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**FWD thermal model values**

<table>
<thead>
<tr>
<th>( R ) (K/W)</th>
<th>( \ Tau ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.027</td>
<td>8.145</td>
</tr>
<tr>
<td>0.098</td>
<td>1.332</td>
</tr>
<tr>
<td>0.284</td>
<td>0.228</td>
</tr>
<tr>
<td>0.405</td>
<td>0.069</td>
</tr>
<tr>
<td>0.171</td>
<td>0.014</td>
</tr>
</tbody>
</table>
Figure 21

**BOOST IGBT**

Power dissipation as a function of heatsink temperature

\[ P_{\text{tot}} = f(T_h) \]

At

\[ T_j = 175 \, ^\circ\text{C} \]

---

Figure 22

**BOOST IGBT**

Collector/Drain current as a function of heatsink temperature

\[ I_C = f(T_h) \]

At

\[ T_j = 175 \, ^\circ\text{C} \]

\[ V_{GS} = 15 \, \text{V} \]

---

Figure 23

**BOOST FWD**

Power dissipation as a function of heatsink temperature

\[ P_{\text{tot}} = f(T_h) \]

At

\[ T_j = 175 \, ^\circ\text{C} \]

---

Figure 24

**BOOST FWD**

Forward current as a function of heatsink temperature

\[ I_F = f(T_h) \]

At

\[ T_j = 175 \, ^\circ\text{C} \]
Figure 25  
**BOOST IGBT**  
Safe operating area as a function of drain-source voltage  
$I_C = f(V_{CE})$

**At**  
$D = $ single pulse  
$T_J = 80 \, ^\circ C$  
$V_{CE} = 15 \, V$  
$T_J = T_{\text{max}} \, ^\circ C$

Figure 26  
**BOOST IGBT**  
Gate voltage vs Gate charge  
$V_{GS} = f(Q_g)$

**At**  
$I_D = 24 \, A$

240V  
960V
Bypass Diode

**Figure 1**
Typical Diode forward current as a function of forward voltage
\[ I_F = f(V_F) \]

![Graph of typical diode forward current](image)

At
\[ t_p = 250 \, \mu s \]

**Figure 2**
Diode transient thermal impedance as a function of pulse width
\[ Z_{thJH} = f(t_p) \]

![Graph of diode transient thermal impedance](image)

At
\[ D = \frac{t_p}{T} \]
\[ R_{thJH} = 1,674 \, \text{K/W} \]

**Figure 3**
Power dissipation as a function of heatsink temperature
\[ P_{tot} = f(T_h) \]

![Graph of power dissipation](image)

At
\[ T_j = 150 \, ^\circ C \]

**Figure 4**
Forward current as a function of heatsink temperature
\[ I_F = f(T_h) \]

![Graph of forward current](image)

At
\[ T_j = 150 \, ^\circ C \]
Figure 1

Thermistor

Typical NTC characteristic as a function of temperature

\[ R_T = f(T) \]
Switching Definitions BOOST IGBT

**General conditions**

- $T_j = 125 \, ^\circ\text{C}$
- $R_{on} = 4 \, \Omega$
- $R_{off} = 4 \, \Omega$

**Turn-off Switching Waveforms & definition of $t_{off}$**

- $t_{off} = 0.29 \, \mu s$
- $t_{Eoff} = 0.42 \, \mu s$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CE}$ (0%)</td>
<td>0 V</td>
</tr>
<tr>
<td>$V_{CE}$ (100%)</td>
<td>15 V</td>
</tr>
<tr>
<td>$V_C$ (100%)</td>
<td>700 V</td>
</tr>
<tr>
<td>$I_C$ (100%)</td>
<td>24 A</td>
</tr>
</tbody>
</table>

**Turn-on Switching Waveforms & definition of $t_{on}$**

- $t_{on} = 0.02 \, \mu s$
- $t_{Eon} = 0.14 \, \mu s$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{CE}$ (0%)</td>
<td>0 V</td>
</tr>
<tr>
<td>$V_{CE}$ (100%)</td>
<td>15 V</td>
</tr>
<tr>
<td>$V_C$ (100%)</td>
<td>700 V</td>
</tr>
<tr>
<td>$I_C$ (100%)</td>
<td>24 A</td>
</tr>
</tbody>
</table>

**Turn-off Switching Waveforms & definition of $t_f$**

- $t_f = 0.06 \, \mu s$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_C$ (100%)</td>
<td>700 V</td>
</tr>
<tr>
<td>$I_C$ (100%)</td>
<td>24 A</td>
</tr>
</tbody>
</table>

**Turn-on Switching Waveforms & definition of $t_r$**

- $t_r = 0.01 \, \mu s$

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_C$ (100%)</td>
<td>700 V</td>
</tr>
<tr>
<td>$I_C$ (100%)</td>
<td>24 A</td>
</tr>
</tbody>
</table>
**Switching Definitions BOOST IGBT**

**Figure 5**

**Boost IGBT**

**Turn-off Switching Waveforms & definition of $t_{\text{Eoff}}$**

![Graph showing turn-off switching waveforms and definition of $t_{\text{Eoff}}$.]

- $P_{\text{Eoff}} (100\%) = 16.97\ kW$
- $E_{\text{Eoff}} (100\%) = 1.55\ mJ$
- $t_{\text{Eoff}} = 0.42\ \mu s$

**Figure 6**

**Boost IGBT**

**Turn-on Switching Waveforms & definition of $t_{\text{Eon}}$**

![Graph showing turn-on switching waveforms and definition of $t_{\text{Eon}}$.]

- $P_{\text{Eon}} (100\%) = 16.97\ kW$
- $E_{\text{Eon}} (100\%) = 1.85\ mJ$
- $t_{\text{Eon}} = 0.14\ \mu s$

**Figure 7**

**Boost IGBT**

**Gate voltage vs Gate charge (measured)**

![Graph showing gate voltage vs gate charge.]

- $V_{\text{GE,ref}} = 0\ V$
- $V_{\text{CE,ref}} = 15\ V$
- $V_{\text{C}} (100\%) = 700\ V$
- $I_{\text{d}} (100\%) = 24\ A$
- $Q_{\text{g}} = 144.01\ \text{nC}$

**Figure 8**

**Boost FWD**

**Turn-off Switching Waveforms & definition of $t_{\text{rr}}$**

![Graph showing turn-off switching waveforms and definition of $t_{\text{rr}}$.]

- $V_{\text{d}} (100\%) = 700\ V$
- $I_{\text{d}} (100\%) = 24\ A$
- $I_{\text{RRM}} (100\%) = -76\ A$
- $t_{\text{rr}} = 0.21\ \mu s$

---

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Switching Definitions BOOST FWD

**Figure 9**  
Turn-on Switching Waveforms & definition of \( t_{Qrr} \)  
(\( t_{Qrr} = \) integrating time for \( Q_{rr} \))

**Figure 10**  
Turn-on Switching Waveforms & definition of \( t_{Erec} \)  
(\( t_{Erec} = \) integrating time for \( E_{rec} \))

\[
\begin{align*}
I_d (100\%) &= 24 \text{ A} \\
Q_{rr} (100\%) &= 4.94 \mu\text{C} \\
t_{Qrr} &= 0.43 \mu\text{s} \\
P_{rec} (100\%) &= 16.97 \text{ kW} \\
E_{rec} (100\%) &= 2.36 \text{ mJ} \\
t_{Erec} &= 0.43 \mu\text{s}
\end{align*}
\]
Ordering Code and Marking - Outline - Pinout

### Ordering Code & Marking

<table>
<thead>
<tr>
<th>Version</th>
<th>Ordering Code</th>
<th>in DataMatrix as</th>
<th>in packaging barcode as</th>
</tr>
</thead>
<tbody>
<tr>
<td>without thermal paste 17mm housing</td>
<td>V23990-P629-L59-PM</td>
<td>P629-L59-PM</td>
<td>P629-L59-PM</td>
</tr>
<tr>
<td>without thermal paste 12mm housing</td>
<td>V23990-P629-L58-PM</td>
<td>P629-L58-PM</td>
<td>P629-L58-PM</td>
</tr>
<tr>
<td>without thermal paste 12mm housing with Press-fit pins</td>
<td>V23990-P629-L58Y-PM</td>
<td>P629-L58Y-PM</td>
<td>P629-L58Y-PM</td>
</tr>
</tbody>
</table>

### Outline

![Outline Diagram]

### Pinout

![Pinout Diagram]

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23 Febr. 2015 / Revision 2
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