Maximum Ratings

$T = 25 \, ^\circ\text{C}$, unless otherwise specified

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
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<tbody>
<tr>
<td><strong>Buck Switch</strong></td>
<td></td>
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</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CE}$</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td>$I_C$</td>
<td>$T = T_{\text{th}}$, $T_s = 80 , ^\circ\text{C}$</td>
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<td>A</td>
</tr>
<tr>
<td>Repetitive peak collector current</td>
<td>$I_{CRM}$</td>
<td>$T_s$ limited by $T_{\text{th}}$</td>
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<tr>
<td>Total power dissipation</td>
<td>$P_{tot}$</td>
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<td>W</td>
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<td>Gate-emitter voltage</td>
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<td>±20</td>
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<tr>
<td>Maximum junction temperature</td>
<td>$T_{\text{th}}$</td>
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<td>175</td>
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# Maximum Ratings

$T_i = 25 \, ^\circ\text{C}$, unless otherwise specified

<table>
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<th>Parameter</th>
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<tr>
<td>Peak Repetitive Reverse Voltage</td>
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<td>V</td>
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<tr>
<td>Continuous (direct) forward current</td>
<td>$I_F$</td>
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<td>A</td>
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<td>$I_{FRM}$</td>
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<td>W</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
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<td>175</td>
<td>°C</td>
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<tr>
<td><strong>Boost Switch</strong></td>
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<tr>
<td>Collector-emitter voltage</td>
<td>$V_{CES}$</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td>$I_C$</td>
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<td>Repetitive peak collector current</td>
<td>$I_{CRM}$</td>
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<tr>
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<td>$T_i = T_{jmax}$, $T_i = 80 , ^\circ\text{C}$</td>
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<td>Gate-emitter voltage</td>
<td>$V_{GES}$</td>
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<td>±20</td>
<td>V</td>
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<td>Maximum junction temperature</td>
<td>$T_{jmax}$</td>
<td></td>
<td>175</td>
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<td><strong>Boost Diode</strong></td>
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<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{RRM}$</td>
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<td>$I_F$</td>
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<td>W</td>
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<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
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### Maximum Ratings

\( T_i = 25 \, ^\circ C \), unless otherwise specified

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<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
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<th>Unit</th>
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<tr>
<td><strong>Module Properties</strong></td>
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<td></td>
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<tr>
<td><strong>Thermal Properties</strong></td>
<td></td>
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</tr>
<tr>
<td>Storage temperature</td>
<td>( T_{stg} )</td>
<td></td>
<td>-40...+125</td>
<td>( ^\circ C )</td>
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<tr>
<td>Operation temperature under switching condition</td>
<td>( T_{jop} )</td>
<td></td>
<td>-40...(( T_{\text{max}} ) - 25)</td>
<td>( ^\circ C )</td>
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<tr>
<td><strong>Isolation Properties</strong></td>
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<tr>
<td>Isolation voltage</td>
<td>( V_{\text{isol}} )</td>
<td>DC Test Voltage* ( c_p = 2 , s )</td>
<td>6000</td>
<td>V</td>
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<tr>
<td></td>
<td></td>
<td>AC Voltage ( c_p = 1 , \text{min} )</td>
<td>2500</td>
<td>V</td>
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<tr>
<td>Creepage distance</td>
<td></td>
<td></td>
<td>min. 12,7</td>
<td>mm</td>
</tr>
<tr>
<td>Clearance</td>
<td></td>
<td></td>
<td>8,07</td>
<td>mm</td>
</tr>
<tr>
<td>Comparative Tracking Index</td>
<td>CTI</td>
<td></td>
<td>&gt; 200</td>
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*100 % tested in production
## Characteristic Values

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<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
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<th>Value</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Gate-emitter threshold voltage</td>
<td>$V_{GE(th)}$</td>
<td>$V_{CE}$ = $V_{CE}$</td>
<td>0,0015</td>
<td>25</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>$V_{Cesat}$</td>
<td>15</td>
<td>150</td>
<td>25</td>
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<tr>
<td>Collector-emitter cut-off current</td>
<td>$I_{ces}$</td>
<td>0</td>
<td>650</td>
<td>25</td>
</tr>
<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{ges}$</td>
<td>20</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Collector-emitter cut-off current</td>
<td>$I_{ces}$</td>
<td>0</td>
<td>650</td>
<td>25</td>
</tr>
<tr>
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<td>$I_{ges}$</td>
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<td>25</td>
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<td>$I_{ces}$</td>
<td>0</td>
<td>650</td>
<td>25</td>
</tr>
<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{ges}$</td>
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<td>0</td>
<td>25</td>
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<tr>
<td>Input capacitance</td>
<td>$C_{in}$</td>
<td>$f = 1$ MHz</td>
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<tr>
<td>Reverse transfer capacitance</td>
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<td>Gate charge</td>
<td>$Q_{g}$</td>
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<td>520</td>
<td>150</td>
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<td>Thermal</td>
<td>$R_{th(j-s)}$</td>
<td>$h_{junis} = 3,4$ W/mK (PSX)</td>
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<td>K/W</td>
</tr>
<tr>
<td>Turn-on delay time</td>
<td>$t_{on}$</td>
<td>$R_{off} = 8$ Ω</td>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td>Rise time</td>
<td>$t_{r}$</td>
<td>$R_{off} = 8$ Ω</td>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>$t_{off}$</td>
<td>$R_{off} = 8$ Ω</td>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td>Fall time</td>
<td>$t_{f}$</td>
<td>$R_{off} = 8$ Ω</td>
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<td>125</td>
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<tr>
<td>Turn-on energy (per pulse)</td>
<td>$E_{on}$</td>
<td>$Q_{vad} = 3,8$ μC</td>
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<td>125</td>
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<tr>
<td>Turn-off energy (per pulse)</td>
<td>$E_{off}$</td>
<td>$Q_{vad} = 7,7$ μC</td>
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<td>125</td>
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</table>
### Characteristic Values

<table>
<thead>
<tr>
<th>Parameter</th>
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<tbody>
<tr>
<td>Buck Diode</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>Static</strong></td>
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<tr>
<td>Forward voltage</td>
<td>$V_{F}$</td>
<td>150</td>
<td>1,56</td>
<td>V</td>
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<tr>
<td>Reverse leakage current</td>
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<td>µA</td>
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<tr>
<td><strong>Thermal</strong></td>
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<td></td>
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<td></td>
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<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{th(j-s)}$</td>
<td>λ_paste = 3,4 W/mK (PSX)</td>
<td>0,75</td>
<td>K/W</td>
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<tr>
<td><strong>Dynamic</strong></td>
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<tr>
<td>Peak recovery current</td>
<td>$I_{RM}$</td>
<td>±15</td>
<td>47</td>
<td>A</td>
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<td>$t_{RR}$</td>
<td>25</td>
<td>132</td>
<td>ns</td>
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<tr>
<td>Recovered charge</td>
<td>$Q_r$</td>
<td>di/dt = 1547 A/µs</td>
<td>3,77</td>
<td>µC</td>
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<tr>
<td>Reverse recovered energy</td>
<td>$E_{rec}$</td>
<td>25</td>
<td>0,39</td>
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<td>Peak rate of fall of recovery current</td>
<td>$</td>
<td>di/dt</td>
<td>_{max}$</td>
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Copyright Vincotech
### Characteristic Values

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<tr>
<td>Gate-emitter threshold voltage</td>
<td>$V_{GE(th)}$</td>
<td>$V_{CE} = 0$, $0.0015$</td>
<td>$0.25$</td>
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<tr>
<td>Collector-emitter saturation voltage</td>
<td>$V_{CEsat}$</td>
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<td>150</td>
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<td>Collector-emitter cut-off current</td>
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<tr>
<td>Output capacitance</td>
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<td>Gate charge</td>
<td>$Q_{g}$</td>
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<td>520</td>
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<tr>
<td>Thermal resistance junction to sink</td>
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<tr>
<td>Turn-on delay time</td>
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<td>Fall time</td>
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<td>Turn-on energy (per pulse)</td>
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<td>Turn-off energy (per pulse)</td>
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## Characteristic Values

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<tr>
<td></td>
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<td>$V_{GE}$</td>
<td>$V_{GS}$</td>
<td>$I_{C}$</td>
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<td>1,56</td>
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<tr>
<td>Reverse voltage</td>
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<td>25</td>
<td>7,6</td>
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<td>$R_{04-0}$</td>
<td>$\lambda_{paste} = 3.4 \text{ W/mK (PSX)}$</td>
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<td>K/W</td>
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<td>Peak recovery current</td>
<td>$I_{\text{max}}$</td>
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<td>54</td>
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<td>Reverse recovery time</td>
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<td>Recovered charge</td>
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<td>0,37</td>
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<td>Deviation of $R_{25}$</td>
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<td>Power dissipation</td>
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<td>5</td>
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<td>Power dissipation constant</td>
<td>$B_{25(85)}$</td>
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<td>B-value</td>
<td>$B_{25(85)}$</td>
<td>25</td>
<td>4000</td>
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</table>

### Boost Diode

#### Static

- **Forward voltage**
  - Symbol: $V_T$
  - Conditions: 150 [V]
  - Values: 25 [V], 1,56 [V], 1,50 [V], 1,48 [V]
- **Reverse leakage current**
  - Symbol: $I_r$
  - Conditions: 650 [A]
  - Values: 25 [A], 7,6 [µA]

#### Thermal

- **Thermal resistance junction to sink**
  - Symbol: $R_{04-0}$
  - Conditions: $\lambda_{paste} = 3,4 \text{ W/mK (PSX)}$
  - Value: 0,75 [K/W]

#### Dynamic

- **Peak recovery current**
  - Symbol: $I_{\text{max}}$
  - Conditions: 150 [A]
  - Values: 25 [A], 80 [A], 82 [A]
- **Reverse recovery time**
  - Symbol: $t_{rr}$
  - Conditions: 150 [ns]
  - Values: 25 [ns], 137 [ns], 197 [ns], 229 [ns]
- **Recovered charge**
  - Symbol: $Q_r$
  - Conditions: 150 [µC]
  - Values: 25 [µC], 3,72 [µC], 7,61 [µC], 8,53 [µC]
- **Reverse recovered energy**
  - Symbol: $E_{rec}$
  - Conditions: 150 [mWs]
  - Values: 25 [mWs], 0,37 [mWs], 0,75 [mWs], 0,82 [mWs]
- **Peak rate of fall of recovery current**
  - Symbol: $(di/dt)_{\text{max}}$
  - Conditions: 150 [A/µs]
  - Values: 25 [A/µs], 851 [A/µs], 847 [A/µs], 893 [A/µs]

#### Thermistor

- **Rated resistance**
  - Symbol: $R$
  - Conditions: 25 [kΩ]
  - Values: 25 [kΩ], 22 [kΩ]
- **Deviation of $R_{25}$**
  - Symbol: $A_{R25}$
  - Conditions: 1484 [Ω]
  - Values: 100 [%], 5 [%]
- **Power dissipation**
  - Symbol: $P$
  - Conditions: 25 [mW]
  - Values: 25 [mW], 5 [mW]
- **Power dissipation constant**
  - Symbol: $B_{25(85)}$
  - Conditions: 25 [mW/K]
  - Values: 25 [mW/K], 3962 [K]
- **B-value**
  - Symbol: $B_{25(85)}$
  - Conditions: 25 [K]
  - Values: 25 [K], 4000 [K]
- **Vincotech NTC Reference**
  - Values: 1 [%]
Buck Switch Characteristics

**figure 1. IGBT**
Typical output characteristics

$I_C = f(V_{CE})$

<table>
<thead>
<tr>
<th>$V_{CE}$</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
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<tbody>
<tr>
<td>$I_C$</td>
<td>50</td>
<td>40</td>
<td>30</td>
<td>20</td>
<td>10</td>
<td>0</td>
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</table>

$\tau_p = 250 \, \mu s$

$V_{CE} = 15 \, V$

$T_j: 125\, ^{\circ}C$

$T_j: 150\, ^{\circ}C$

**figure 2. IGBT**
Typical output characteristics

$I_C = f(V_{GE})$

<table>
<thead>
<tr>
<th>$V_{GE}$</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
<th>14</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C$</td>
<td>150</td>
<td>125</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
<td>10</td>
<td>5</td>
<td>0</td>
</tr>
</tbody>
</table>

$\tau_p = 250 \, \mu s$

$T_j: 150\, ^{\circ}C$

$V_{GE}$ from 7 V to 17 V in steps of 1 V

**figure 3. IGBT**
Typical transfer characteristics

$I_C = f(V_{GE})$

<table>
<thead>
<tr>
<th>$V_{GE}$</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_C$</td>
<td>150</td>
<td>125</td>
<td>100</td>
<td>75</td>
<td>50</td>
<td>25</td>
</tr>
</tbody>
</table>

$\tau_p = 100 \, \mu s$

$V_{CE} = 10 \, V$

$T_j: 125\, ^{\circ}C$

$T_j: 150\, ^{\circ}C$

**figure 4. IGBT**
Transient thermal impedance as function of pulse duration

$Z_{th(j-s)} = f(\tau_p)$

<table>
<thead>
<tr>
<th>$\tau_p$</th>
<th>10</th>
<th>20</th>
<th>30</th>
<th>40</th>
<th>50</th>
<th>60</th>
<th>70</th>
<th>80</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Z_{th}$</td>
<td>500</td>
<td>400</td>
<td>300</td>
<td>200</td>
<td>100</td>
<td>0</td>
<td>100</td>
<td>200</td>
<td>300</td>
</tr>
</tbody>
</table>

$D = \frac{\tau_p}{\tau}$

$R_{th(j-s)} = 0.65 \, K/W$

IGBT thermal model values

<table>
<thead>
<tr>
<th>$R$ (K/W)</th>
<th>$t$ (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.13E-01</td>
<td>1.23E-01</td>
</tr>
<tr>
<td>2.91E-01</td>
<td>8.56E-01</td>
</tr>
<tr>
<td>1.38E-01</td>
<td>1.33E-01</td>
</tr>
<tr>
<td>6.68E-02</td>
<td>8.32E-03</td>
</tr>
<tr>
<td>1.32E-02</td>
<td>2.63E-03</td>
</tr>
<tr>
<td>3.21E-02</td>
<td>3.23E-04</td>
</tr>
</tbody>
</table>

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19 Sep. 2017 / Revision 1
**Buck Switch Characteristics**

**figure 5.** IGBT  
Gate voltage vs gate charge  
\[ V_{GE} = f(Q_G) \]

**figure 6.** IGBT  
Safe operating area  
\[ I_C = f(V_{CE}) \]

- \( I_C = 150 \) A
- \( V_{JE} = 130 \) V
- \( V_{CE} = 520 \) V
- \( I_C = 150 \) A
- \( V_{JE} = 130 \) V
- \( V_{CE} = 520 \) V

- \( D = \) single pulse
- \( T_j = 80 \) °C
- \( V_{JE} = \pm 15 \) V
- \( T_j = T_{jmax} \)
Buck Diode Characteristics

**figure 1.** Typical forward characteristics

$I_s = f(V_f)$

<table>
<thead>
<tr>
<th>$V_f$ (V)</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_s$ (A)</td>
<td>0</td>
<td>50</td>
<td>150</td>
<td>250</td>
<td>350</td>
<td>450</td>
</tr>
</tbody>
</table>

$t_p = 250 \mu s$

$25 ^\circ C$

$125 ^\circ C$

$150 ^\circ C$

**figure 2.** Transient thermal impedance as a function of pulse width

$Z_{th(j-s)} = f(t_p)$

$D = \frac{t_p}{T}$

$R_{th(j-s)} = 0.75 \frac{K}{W}$

FWD thermal model values

<table>
<thead>
<tr>
<th>$R$ (K/W)</th>
<th>$\tau$ (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.72E-02</td>
<td>2.85E+00</td>
</tr>
<tr>
<td>1.70E-01</td>
<td>5.28E-01</td>
</tr>
<tr>
<td>3.46E-01</td>
<td>1.08E-01</td>
</tr>
<tr>
<td>8.77E-02</td>
<td>2.58E-02</td>
</tr>
<tr>
<td>4.87E-02</td>
<td>5.55E-03</td>
</tr>
<tr>
<td>2.04E-02</td>
<td>6.12E-04</td>
</tr>
</tbody>
</table>
Boost Switch Characteristics

Figure 1. IGBT
Typical output characteristics
\[ I_C = f(V_{GE}) \]

Figure 2. IGBT
Typical output characteristics
\[ I_C = f(V_{CE}) \]

Figure 3. IGBT
Typical transfer characteristics
\[ I_C = f(V_{CE}) \]

Figure 4. IGBT
Transient thermal impedance as function of pulse duration
\[ Z_{th(j-s)} = f(t_p) \]

\[ t_p = 250 \ \mu s \quad 25 \ ^\circ C \]
\[ V_{CE} = 15 \ V \quad T_j = 125 \ ^\circ C \]
\[ = 150 \ ^\circ C \]
\[ 7 \ V \ to \ 17 \ V \ in \ steps \ of \ 1 \ V \]

\[ t_p = 100 \ \mu s \quad 25 \ ^\circ C \]
\[ V_{CE} = 10 \ V \quad T_j = 125 \ ^\circ C \]
\[ = 150 \ ^\circ C \]

\[ R_{th(j-s)} = 0,65 \ \Omega /W \]

<table>
<thead>
<tr>
<th>( R ) (K/W)</th>
<th>( t ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,13E-01</td>
<td>8,46E-01</td>
</tr>
<tr>
<td>2,91E-01</td>
<td>1,23E-01</td>
</tr>
<tr>
<td>1,38E-01</td>
<td>3,33E-02</td>
</tr>
<tr>
<td>6,68E-02</td>
<td>8,32E-03</td>
</tr>
<tr>
<td>1,32E-02</td>
<td>2,63E-03</td>
</tr>
<tr>
<td>3,21E-02</td>
<td>3,23E-04</td>
</tr>
</tbody>
</table>
Boost Switch Characteristics

**figure 5.**
Gate voltage vs gate charge

\[ V_{GE} = f(Q_G) \]

**figure 6.**
Safe operating area

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

- \( I_C = 150 \) A
- \( D = \) single pulse
- \( T_s = 80 \) °C
- \( V_{GE} = \pm 15 \) V
- \( T_j = T_{j\text{max}} \)
Boost Diode Characteristics

**Figure 1.**
Typical forward characteristics

\[ I_F = f(V_F) \]

**Figure 2.**
Transient thermal impedance as a function of pulse width

\[ Z_{th(j-s)} = f(t_p) \]

- \( t_p = 250 \mu s \)
- \( 25 \, ^{\circ}C \)
- \( 125 \, ^{\circ}C \)
- \( 150 \, ^{\circ}C \)

**FWD thermal model values**

<table>
<thead>
<tr>
<th>( R ) (K/W)</th>
<th>( \tau ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7,72E-02</td>
<td>2,85E+00</td>
</tr>
<tr>
<td>1,70E-01</td>
<td>5,28E-01</td>
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</tr>
<tr>
<td>4,87E-02</td>
<td>5,55E-03</td>
</tr>
<tr>
<td>2,04E-02</td>
<td>6,12E-04</td>
</tr>
</tbody>
</table>

\( D = \frac{t_p}{T} \)

\( R_{th(j-s)} = 0,75 \) K/W
Thermistor Characteristics

Figure 1. Typical NTC characteristic as a function of temperature

\[ R = f(T) \]

<table>
<thead>
<tr>
<th>( R ) (Ω)</th>
<th>( T ) (°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>25000</td>
<td>25</td>
</tr>
<tr>
<td>20000</td>
<td>50</td>
</tr>
<tr>
<td>15000</td>
<td>75</td>
</tr>
<tr>
<td>10000</td>
<td>100</td>
</tr>
<tr>
<td>5000</td>
<td>125</td>
</tr>
</tbody>
</table>

NTC-typical temperature characteristic
Buck Switching Characteristics

Figure 1. IGBT
Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at 25 °C
- \( V_{CE} = 150 \) V
- \( T_J = 125 \) °C
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 8 \) Ω
- \( I_{C} = 150 \) A

Figure 2. IGBT
Typical switching energy losses as a function of gate resistor

\[ E = f(R_g) \]

With an inductive load at 25 °C
- \( V_{CE} = 150 \) V
- \( T_J = 125 \) °C
- \( V_{GE} = \pm 15 \) V
- \( I_{C} = 150 \) A

Figure 3. FWD
Typical reverse recovered energy loss as a function of collector current

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

With an inductive load at 25 °C
- \( V_{CE} = 150 \) V
- \( T_J = 125 \) °C
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 8 \) Ω
- \( I_{C} = 150 \) A

Figure 4. FWD
Typical reverse recovered energy loss as a function of gate resistor

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

With an inductive load at 25 °C
- \( V_{CE} = 150 \) V
- \( T_J = 125 \) °C
- \( V_{GE} = \pm 15 \) V
- \( I_{C} = 150 \) A

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Buck Switching Characteristics

Figure 5. IGBT
Typical switching times as a function of collector current

\[ t = f(I_C) \]

With an inductive load at
- \( T_j = 150 \, ^\circ\text{C} \)
- \( V_{CE} = 150 \, \text{V} \)
- \( V_{GE} = \pm 15 \, \text{V} \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, \text{A} \)

Figure 6. IGBT
Typical switching times as a function of gate resistor

\[ t = f(R_g) \]

With an inductive load at
- \( T_j = 150 \, ^\circ\text{C} \)
- \( V_{CE} = 150 \, \text{V} \)
- \( V_{GE} = \pm 15 \, \text{V} \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, \text{A} \)

Figure 7. FWD
Typical reverse recovery time as a function of collector current

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

At
- \( V_{CE} = 150 \, \text{V} \)
- \( V_{GE} = \pm 15 \, \text{V} \)
- \( T_j = 25 \, ^\circ\text{C} \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, \text{A} \)

Figure 8. FWD
Typical reverse recovery time as a function of IGBT turn on gate resistor

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

At
- \( V_{CE} = 150 \, \text{V} \)
- \( V_{GE} = \pm 15 \, \text{V} \)
- \( T_j = 25 \, ^\circ\text{C} \)
- \( I_C = 150 \, \text{A} \)
Buck Switching Characteristics

Figure 9. FWD
Typical recovered charge as a function of collector current

\[ Q_r = f(Ic) \]

\[ Q_r = f(R_{gon}) \]

At \( V_{CE} = 150 \, V \), \( T_j = 25 \, ^{\circ}C \)
- \( V_{GE} = \pm 15 \, V \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_c = 150 \, A \)

At \( V_{CE} = 150 \, V \), \( T_j = 125 \, ^{\circ}C \)

Figure 10. FWD
Typical recovered charge as a function of IGBT turn-on gate resistor

\[ Q_r = f(R_{gon}) \]

At \( V_{CE} = 150 \, V \), \( T_j = 25 \, ^{\circ}C \)
- \( V_{GE} = \pm 15 \, V \)
- \( I_c = 150 \, A \)

At \( V_{CE} = 150 \, V \), \( T_j = 125 \, ^{\circ}C \)

Figure 11. FWD
Typical peak reverse recovery current as a function of collector current

\[ I_{RM} = f(Ic) \]

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

At \( V_{CE} = 150 \, V \), \( T_j = 25 \, ^{\circ}C \)
- \( V_{GE} = \pm 15 \, V \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_c = 150 \, A \)

At \( V_{CE} = 150 \, V \), \( T_j = 125 \, ^{\circ}C \)

Figure 12. FWD
Typical peak reverse recovery current as a function of IGBT turn-on gate resistor

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

At \( V_{CE} = 150 \, V \), \( T_j = 25 \, ^{\circ}C \)
- \( V_{GE} = \pm 15 \, V \)
- \( I_c = 150 \, A \)

At \( V_{CE} = 150 \, V \), \( T_j = 125 \, ^{\circ}C \)
Buck Switching Characteristics

Typical rate of fall of forward and reverse recovery current as a function of collector current

\[
\frac{di_F}{dt}, \frac{di_{rr}}{dt} = f(I_{C})
\]

At \( V_{CE} = 150 \text{ V}, T_j = 25 \text{ °C} \)

At \( V_{CE} = \pm 15 \text{ V}, T_j = 125 \text{ °C} \)

R_{gon} = 8 Ω

I_{C} = 150 A

Figure 13. FWD

Reverse bias safe operating area

I_{C} = f(V_{CE})

At \( V_{CE} = 150 \text{ V}, T_j = 175 \text{ °C} \)

R_{_g} = 8 Ω

Figure 15. IGBT

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

\[
\frac{di_F}{dt}, \frac{di_{rr}}{dt} = f(R_{gon})
\]

At \( V_{CE} = 150 \text{ V}, T_j = 25 \text{ °C} \)

At \( V_{CE} = \pm 15 \text{ V}, T_j = 125 \text{ °C} \)

R_{goff} = 8 Ω

Figure 14. FWD
Buck Switching Definitions

General conditions

$T_1 = 125 \, ^\circ\text{C}$

$R_{\text{on}} = 8 \, \Omega$

$R_{\text{off}} = 8 \, \Omega$

Figure 1. Turn-off Switching Waveforms & definition of $t_{\text{Eoff}}$, $t_{\text{off}}$ ($t_{\text{Eoff}}$ = integrating time for $E_{\text{off}}$)

$V_{\text{GE}}(0\%) = -15 \, \text{V}$

$V_{\text{CE}}(0\%) = 15 \, \text{V}$

$I_{\text{C}}(100\%) = 150 \, \text{A}$

$t_{\text{off}} = 0.137 \, \mu\text{s}$

$t_{\text{Eoff}} = 0.245 \, \mu\text{s}$

Figure 2. Turn-on Switching Waveforms & definition of $t_{\text{Eon}}$, $t_{\text{on}}$ ($t_{\text{Eon}}$ = integrating time for $E_{\text{on}}$)

$V_{\text{CE}}(0\%) = 15 \, \text{V}$

$V_{\text{CE}}(100\%) = 15 \, \text{V}$

$I_{\text{C}}(100\%) = 150 \, \text{A}$

$t_{\text{on}} = 0.158 \, \mu\text{s}$

$t_{\text{Eon}} = 0.309 \, \mu\text{s}$

Figure 3. Turn-off Switching Waveforms & definition of $I_{\text{C}}$

$V_{\text{CE}}(10\%) = 150 \, \text{V}$

$I_{\text{C}}(10\%) = 150 \, \text{A}$

$I_{\text{C}}(90\%) = 150 \, \text{A}$

$t_{\text{Eoff}} = 0.030 \, \mu\text{s}$

$t_{\text{off}} = 0.061 \, \mu\text{s}$

Figure 4. Turn-on Switching Waveforms & definition of $I_{\text{C}}$

$V_{\text{CE}}(10\%) = 150 \, \text{V}$

$I_{\text{C}}(10\%) = 150 \, \text{A}$

$I_{\text{C}}(90\%) = 150 \, \text{A}$

$t_{\text{Eon}} = 0.030 \, \mu\text{s}$

$t_{\text{on}} = 0.061 \, \mu\text{s}$
**Buck Switching Characteristics**

**Figure 5.** IGBT Turn-off Switching Waveforms & definition of $t_{Eoff}$

- $P_{off}(100\%) = 22.46$ kW
- $E_{off}(100\%) = 1.37$ mJ
- $t_{Eoff} = 0.25$ µs

**Figure 6.** IGBT Turn-on Switching Waveforms & definition of $t_{Eon}$

- $P_{on}(100\%) = 22.46$ kW
- $E_{on}(100\%) = 0.77$ mJ
- $t_{Eon} = 0.31$ µs

**Figure 7.** FWD Turn-off Switching Waveforms & definition of $t_{rr}$

- $V_{F}(100\%) = 150$ V
- $I_{F}(100\%) = 150$ A
- $I_{rr}(100\%) = -78$ A
- $t_{rr} = 0.182$ µs
Buck Switching Characteristics

**Figure 8.** FWD
Turn-on Switching Waveforms & definition of $t_{Q_r}$ ($t_{Q_r} =$ integrating time for $Q_r$)

<table>
<thead>
<tr>
<th>$I_f$ (100%)</th>
<th>150 A</th>
</tr>
</thead>
<tbody>
<tr>
<td>$Q_r$ (100%)</td>
<td>7,66 µC</td>
</tr>
<tr>
<td>$t_{Q_r}$</td>
<td>0,36 µs</td>
</tr>
</tbody>
</table>

| $P_{rec}$ (100%) | 22,46 kW |
| $E_{rec}$ (100%) | 0,83 mJ |
| $t_{E_{rec}}$ | 0,36 µs |

**Figure 9.** FWD
Turn-on Switching Waveforms & definition of $t_{E_{rec}}$ ($t_{E_{rec}} =$ integrating time for $E_{rec}$)
Boost Switching Characteristics

**Figure 1.** IGBT
Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at 25 °C
- \( V_{CE} = 150 \, V \)
- \( T_J = 125 \, ^\circ C \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, A \)

**Figure 2.** IGBT
Typical switching energy losses as a function of gate resistor

\[ E = f(R_g) \]

With an inductive load at 25 °C
- \( V_{CE} = 150 \, V \)
- \( T_J = 125 \, ^\circ C \)
- \( R_{goff} = 8 \, \Omega \)
- \( I_C = 150 \, A \)

**Figure 3.** FWD
Typical reverse recovery energy loss as a function of collector current

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

With an inductive load at 25 °C
- \( V_{CE} = 150 \, V \)
- \( T_J = 125 \, ^\circ C \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, A \)

**Figure 4.** FWD
Typical reverse recovery energy loss as a function of gate resistor

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

With an inductive load at 25 °C
- \( V_{CE} = 150 \, V \)
- \( T_J = 125 \, ^\circ C \)
- \( R_{goff} = 8 \, \Omega \)
- \( I_C = 150 \, A \)
Boost Switching Characteristics

**Figure 5.** IGBT

Typical switching times as a function of collector current

\[ t = f(I_C) \]

With an inductive load at

- \( T_J = 150 \, ^\circ C \)
- \( V_{CE} = 150 \, V \)
- \( V_G = \pm 15 \, V \)
- \( R_{gon} = 8 \, \Omega \)
- \( I_C = 150 \, A \)

**Figure 6.** IGBT

Typical switching times as a function of gate resistor

\[ t = f(R_g) \]

With an inductive load at

- \( T_J = 150 \, ^\circ C \)
- \( V_{CE} = 150 \, V \)
- \( V_G = \pm 15 \, V \)
- \( I_C = 150 \, A \)
- \( R_{goff} = 8 \, \Omega \)

**Figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

At

- \( V_{CE} = 150 \, V \), \( 25 \, ^\circ C \)
- \( V_G = \pm 15 \, V \), \( T_J = 125 \, ^\circ C \)
- \( R_{pm} = 8 \, \Omega \), \( 150 \, ^\circ C \)
- \( I_C = 150 \, A \)

**Figure 8.** FWD

Typical reverse recovery time as a function of IGBT turn off gate resistor

\[ t_{rr} = f(R_{goff}) \]

At

- \( V_{CE} = 150 \, V \), \( 25 \, ^\circ C \)
- \( V_G = \pm 15 \, V \), \( T_J = 125 \, ^\circ C \)
- \( I_C = 150 \, A \), \( 150 \, ^\circ C \)
Boost Switching Characteristics

Figure 9. FWD
Typical recovered charge as a function of collector current

\[ Q_r = f(I_C) \]

At
- \( V_{CE} = 150 \text{ V} \), \( T_J = 25 \text{ °C} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( R_{gon} = 8 \Omega \) 

Figure 10. FWD
Typical recovered charge as a function of IGBT turn-on gate resistor

\[ Q_r = f(R_{gon}) \]

At
- \( V_{CE} = 150 \text{ V} \), \( T_J = 25 \text{ °C} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( I_C = 150 \text{ A} \)

Figure 11. FWD
Typical peak reverse recovery current as a function of collector current

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

At
- \( V_{CE} = 150 \text{ V} \), \( T_J = 25 \text{ °C} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( R_{gon} = 8 \Omega \) 

Figure 12. FWD
Typical peak reverse recovery current as a function of IGBT turn-on gate resistor

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

At
- \( V_{CE} = 150 \text{ V} \), \( T_J = 25 \text{ °C} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( I_C = 150 \text{ A} \) 

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Boost Switching Characteristics

**Figure 13.** FWD

Typical rate of fall of forward and reverse recovery current as a function of collector current

\[
\frac{d i_{F}}{d t}, \frac{d i_{rr}}{d t} = f(I_C)
\]

**At**

\[V_{CE} = 150 \text{ V} \]
\[V_{GE} = \pm 15 \text{ V} \]
\[T_j = 125 ^\circ C \]
\[R_{gon} = 8 \text{ Ω} \]

**Figure 14.** FWD

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

\[
\frac{d i_{F}}{d t}, \frac{d i_{rr}}{d t} = f(R_{gon})
\]

**At**

\[V_{CE} = 150 \text{ V} \]
\[V_{GE} = \pm 15 \text{ V} \]
\[T_j = 125 ^\circ C \]
\[R_{gon} = 8 \text{ Ω} \]

**Figure 15.** IGBT

Reverse bias safe operating area

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

\[T_j = 175 ^\circ C \]
\[R_{ss} = 8 \text{ Ω} \]
\[R_{off} = 8 \text{ Ω} \]
Boost Switching Definitions

General conditions

- \( T_j \) = 125 °C
- \( R_{gon} \) = 8 Ω
- \( R_{goff} \) = 8 Ω

Figure 1. IGBT

Turn-off Switching Waveforms & definition of \( t_{don}, t_{Eoff} \) (integrating time for \( E_{off} \))

- \( V_{CE}(0\%) = -15 \) V
- \( V_{CE}(100\%) = 15 \) V
- \( I_C(100\%) = 149 \) A
- \( t_{don} = 0.128 \) µs
- \( t_{Eoff} = 0.252 \) µs

Figure 2. IGBT

Turn-on Switching Waveforms & definition of \( t_{f}, t_{Eon} \) (integrating time for \( E_{on} \))

- \( V_{CE}(0\%) = 15 \) V
- \( V_{CE}(100\%) = 15 \) V
- \( I_C(100\%) = 149 \) A
- \( t_{f} = 0.148 \) µs
- \( t_{Eon} = 0.387 \) µs

Figure 3. IGBT

Turn-on Switching Waveforms & definition of \( t_r \)

- \( V_{CE}(100\%) = 15 \) V
- \( I_C(100\%) = 149 \) A
- \( t_r = 0.034 \) µs
- \( t_f = 0.060 \) µs

Figure 4. IGBT

Turn-off Switching Waveforms & definition of \( I_C \)

- \( V_{CE}(100\%) = 15 \) V
- \( I_C(100\%) = 149 \) A
- \( t_f = 0.034 \) µs
- \( t_r = 0.060 \) µs

Vincotech
Boost Switching Characteristics

**Figure 5.** IGBT
Turn-off Switching Waveforms & definition of $t_{Eoff}$

<table>
<thead>
<tr>
<th>$P_{off}$ (100%)</th>
<th>22.41 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{off}$ (100%)</td>
<td>1.26 mJ</td>
</tr>
<tr>
<td>$t_{Eoff}$</td>
<td>0.25 µs</td>
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</tbody>
</table>

**Figure 6.** IGBT
Turn-on Switching Waveforms & definition of $t_{Eon}$

<table>
<thead>
<tr>
<th>$P_{on}$ (100%)</th>
<th>22.41 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>$E_{on}$ (100%)</td>
<td>0.94 mJ</td>
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<tr>
<td>$t_{Eon}$</td>
<td>0.39 µs</td>
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</table>

**Figure 7.** FWD
Turn-off Switching Waveforms & definition of $t_{rr}$

<table>
<thead>
<tr>
<th>$V_F$ (100%)</th>
<th>150 V</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_F$ (100%)</td>
<td>149 A</td>
</tr>
<tr>
<td>$I_{on}(100%)$</td>
<td>-80 A</td>
</tr>
<tr>
<td>$t_{rr}$</td>
<td>0.197 µs</td>
</tr>
</tbody>
</table>
Boost Switching Characteristics

Figure 8. FWD
Turn-on Switching Waveforms & definition of \( i_Q \) \( (t_Q = \text{integrating time for } Q) \)

- \( i_L \) (100%) = 149 A
- \( Q_r \) (100%) = 7.61 \( \mu \)C
- \( t_Q \) = 0.39 \( \mu \)s

Figure 9. FWD
Turn-on Switching Waveforms & definition of \( i_{\text{FWD}} \) \( (t_{\text{FWD}} = \text{integrating time for } E_{\text{rec}}) \)

- \( P_{\text{rec}} \) (100%) = 22.41 kW
- \( E_{\text{rec}} \) (100%) = 0.75 mJ
- \( t_{\text{FWD}} \) = 0.39 \( \mu \)s
## Ordering Code & Marking

<table>
<thead>
<tr>
<th>Text</th>
<th>Name</th>
<th>Date code</th>
<th>UL &amp; VIN</th>
<th>Lot</th>
<th>Serial</th>
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### Datamatrix

- **Type & Ver**: TTTTTTW
- **Lot**: LLLLL
- **Serial**: SSSS
- **Date code**: WWYY

## Pin Table

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### Outline

- **Ordering Code**: 10-FY07NMB150S5-LE75F08
- **Revision**: 1
- **Date**: 19 Sep. 2017

*Vincotech*

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19 Sep. 2017 / Revision 1
### Identification

<table>
<thead>
<tr>
<th>ID</th>
<th>Component</th>
<th>Voltage</th>
<th>Current</th>
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<th>Comment</th>
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<tbody>
<tr>
<td>T11, T12, T15, T16</td>
<td>IGBT</td>
<td>650 V</td>
<td>150 A</td>
<td>Buck Switch</td>
<td>Parallel devices with separate control. Values apply to complete device.</td>
</tr>
<tr>
<td>D11, D12, D15, D16</td>
<td>FWD</td>
<td>650 V</td>
<td>150 A</td>
<td>Buck Diode</td>
<td>Parallel devices. Values apply to complete device.</td>
</tr>
<tr>
<td>T13, T14, T17, T18</td>
<td>IGBT</td>
<td>650 V</td>
<td>150 A</td>
<td>Boost Switch</td>
<td>Parallel devices with separate control. Values apply to complete device.</td>
</tr>
<tr>
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<td>150 A</td>
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<td>Parallel devices. Values apply to complete device.</td>
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</tbody>
</table>

## Handling instruction

Handling instructions for flow 1 packages see vincotech.com website.

## Package data

Package data for flow 1 packages see vincotech.com website.

## UL recognition and file number

This device is certified according to UL 1557 standard, UL file number E192116. For more information see vincotech.com website.

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.