**Features**

- Neutral-point-Clamped inverter
- Compact 12mm housing
- Low Inductance Layout

**Target Applications**

- UPS
- Motor Drive
- Solar inverters

**Types**

- 10-PY07NIB150SG-M136F38Y

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### Maximum Ratings

$T_j = 25 \, ^\circ C$, 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>Buck IGBT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>$V_{CE}$</td>
<td>$T_j = T_{jmax}$, $T_a = 80 , ^\circ C$</td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>DC collector current</td>
<td>$I_C$</td>
<td>$T_j = T_{jmax}$, $T_a = 80 , ^\circ C$</td>
<td>128</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak collector current</td>
<td>$I_{CRM}$</td>
<td>$T_j$ limited by $T_{jmax}$</td>
<td>450</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_j = T_{jmax}$, $T_a = 80 , ^\circ C$</td>
<td>279</td>
<td>W</td>
</tr>
<tr>
<td>Gate-emitter peak voltage</td>
<td>$V_{GE}$</td>
<td>$T_j = T_{jmax}$, $T_a = 80 , ^\circ C$</td>
<td>420</td>
<td>V</td>
</tr>
<tr>
<td>Short circuit ratings</td>
<td>$t_{p}$</td>
<td>$T_j \leq 150 , ^\circ C$</td>
<td>5</td>
<td>µs</td>
</tr>
<tr>
<td></td>
<td>$V_{RRM}$</td>
<td>$V_{GS} = 15 , V$</td>
<td>400</td>
<td>V</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
<td>$T_j$ limited by $T_{jmax}$</td>
<td>175</td>
<td>°C</td>
</tr>
</tbody>
</table>

| **Buck Diode**                     |        |                    |       |      |
| Peak Repetitive Reverse Voltage    | $V_{ASM}$ | $T_j = T_{jmax}$, $T_a = 80 \, ^\circ C$ | 650   | V    |
| DC forward current                 | $I_F$  | $T_j = T_{jmax}$, $T_a = 80 \, ^\circ C$ | 125   | A    |
| Diode surge non repetitive forward current | $I_{FSM}$ | $t_{p} = 10 \, ms$, sine half wave, $T_j = 100 \, ^\circ C$ | 1280  | A    |
| Power dissipation                  | $P_{tot}$ | $T_j = T_{jmax}$, $T_a = 80 \, ^\circ C$ | 241   | W    |
| Maximum Junction Temperature       | $T_{jmax}$ | $T_j$ limited by $T_{jmax}$ | 175   | °C   |
## Maximum Ratings

### Boost IGBT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collector-emitter breakdown voltage</td>
<td>$V_{CE}$</td>
<td>$T_i = T_{jmax}$, $T_s = 25 , ^\circ C$</td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>DC collector current</td>
<td>$I_{DC}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>173</td>
<td>A</td>
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<tr>
<td>Repetitive peak collector current</td>
<td>$I_{PCM}$</td>
<td>$T_s$ limited by $T_{jmax}$</td>
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<td>A</td>
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<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>324</td>
<td>W</td>
</tr>
<tr>
<td>Gate-emitter peak voltage</td>
<td>$V_{GE}$</td>
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<td>V</td>
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<tr>
<td>Short circuit ratings</td>
<td>$t_{PC}$</td>
<td>$T_s \leq 150 , ^\circ C$</td>
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<td>µs</td>
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<tr>
<td></td>
<td>$V_{DC}$</td>
<td>$V_{DC} = 15 , V$</td>
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### Boost Inverse Diode

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<th>Symbol</th>
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<tbody>
<tr>
<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{RSM}$</td>
<td></td>
<td>600</td>
<td>V</td>
</tr>
<tr>
<td>DC forward current</td>
<td>$I_{F}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>124</td>
<td>A</td>
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<tr>
<td>Repetitive peak forward current</td>
<td>$I_{FPM}$</td>
<td>$T_s$ limited by $T_{jmax}$</td>
<td>200</td>
<td>A</td>
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<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>204</td>
<td>W</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
<td></td>
<td>175</td>
<td>°C</td>
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### Boost Diode

<table>
<thead>
<tr>
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<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
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<tbody>
<tr>
<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{RSM}$</td>
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<td>650</td>
<td>V</td>
</tr>
<tr>
<td>DC forward current</td>
<td>$I_{F}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>120</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak forward current</td>
<td>$I_{FPM}$</td>
<td>$T_s$ limited by $T_{jmax}$</td>
<td>200</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_i = T_{jmax}$, $T_s = 80 , ^\circ C$</td>
<td>203</td>
<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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### Thermal Properties

<table>
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<th>Unit</th>
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<tbody>
<tr>
<td>Storage temperature</td>
<td>$T_{stg}$</td>
<td></td>
<td>-40...+125</td>
<td>°C</td>
</tr>
<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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### Isolation Properties

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
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</thead>
<tbody>
<tr>
<td>Isolation voltage</td>
<td>$V_i$</td>
<td>$t = 2 , s$</td>
<td>4000</td>
<td>V</td>
</tr>
<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>min 12,7</td>
<td>mm</td>
</tr>
<tr>
<td>Comparative Tracking Index</td>
<td>CTI</td>
<td></td>
<td>&gt; 200</td>
<td></td>
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</table>
## Characteristic Values

### Buck IGBT

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate-emitter threshold voltage</td>
<td>$V_{GE(th)}$</td>
<td>$V_{CE}$ $V_{GS}$</td>
<td>$25$</td>
<td>$0.0024$</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>$V_{CE}$</td>
<td>$V_{GS}$</td>
<td>$15$</td>
<td>$1.38$</td>
</tr>
<tr>
<td>Collector-emitter cut-off incl. Diode</td>
<td>$I_{DS}$</td>
<td>$V_{CE}$</td>
<td>$150$</td>
<td>$1.94$</td>
</tr>
<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{GS}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$2.23$</td>
</tr>
<tr>
<td>Integrated Gate resistor</td>
<td>$R_{gint}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$0.39$</td>
</tr>
<tr>
<td>Turn-on delay time</td>
<td>$t_{on}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$149$</td>
</tr>
<tr>
<td>Rise time</td>
<td>$t_{r}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$34$</td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>$t_{off}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$219$</td>
</tr>
<tr>
<td>Fall time</td>
<td>$t_{f}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$18$</td>
</tr>
<tr>
<td>Turn-on energy loss</td>
<td>$E_{on}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$1.53$</td>
</tr>
<tr>
<td>Turn-off energy loss</td>
<td>$E_{off}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$1.99$</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{in}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$9240$</td>
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<tr>
<td>Output capacitance</td>
<td>$C_{oss}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$480$</td>
</tr>
<tr>
<td>Gate charge</td>
<td>$Q_{G}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$274$</td>
</tr>
<tr>
<td>Gate charge</td>
<td>$Q_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$940$</td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{th(j-s)}$</td>
<td>phase-change material</td>
<td>$0.34$</td>
<td>K/W</td>
</tr>
<tr>
<td>Buck Diode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Diode forward voltage</td>
<td>$V_{F}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$1.07$</td>
</tr>
<tr>
<td>Reverse leakage current</td>
<td>$I_{L}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$160$</td>
</tr>
<tr>
<td>Peak reverse recovery current</td>
<td>$I_{RMS}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$160$</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>$t_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$1.57$</td>
</tr>
<tr>
<td>Reverse recovered charge</td>
<td>$Q_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$97$</td>
</tr>
<tr>
<td>Peak rate of fall of recovery</td>
<td>$(dI_{LRMS}/dt)_{max}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$10$</td>
</tr>
<tr>
<td>Reverse recovered energy</td>
<td>$E_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$3093$</td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{th(j-s)}$</td>
<td>phase-change material</td>
<td>$0.39$</td>
<td>K/W</td>
</tr>
</tbody>
</table>

### Gate Driver

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{GS}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$274$</td>
</tr>
<tr>
<td>Reverse leakage current</td>
<td>$I_{L}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$160$</td>
</tr>
<tr>
<td>Peak reverse recovery current</td>
<td>$I_{RMS}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$160$</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>$t_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$1.57$</td>
</tr>
<tr>
<td>Reverse recovered charge</td>
<td>$Q_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$97$</td>
</tr>
<tr>
<td>Peak rate of fall of recovery</td>
<td>$(dI_{LRMS}/dt)_{max}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$10$</td>
</tr>
<tr>
<td>Reverse recovered energy</td>
<td>$E_{R}$</td>
<td>$V_{GS}$</td>
<td>$25$</td>
<td>$3093$</td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{th(j-s)}$</td>
<td>phase-change material</td>
<td>$0.39$</td>
<td>K/W</td>
</tr>
</tbody>
</table>
## Characteristic Values

<table>
<thead>
<tr>
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<th>Value</th>
<th>Unit</th>
</tr>
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<tbody>
<tr>
<td><strong>Boost IGBT</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate emitter threshold voltage</td>
<td>( V_{\text{th}} )</td>
<td></td>
<td>0,0024</td>
<td>V</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>( V_{\text{CEsat}} )</td>
<td></td>
<td>25</td>
<td>5, 6, 5</td>
</tr>
<tr>
<td>Collector-emitter cut-off voltage</td>
<td>( V_{\text{CE}} )</td>
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<td>1,05, 1,15, 1,85</td>
</tr>
<tr>
<td>Collector-emitter cut-off incl diode</td>
<td>( V_{\text{CEO}} )</td>
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<td>0, 0076</td>
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<tr>
<td>Gate-emitter leakage current</td>
<td>( I_{\text{GO}} )</td>
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<td>25</td>
<td>1200</td>
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<tr>
<td>Integrated Gate resistor</td>
<td>( R_{\text{gint}} )</td>
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<td>25</td>
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</tr>
<tr>
<td>Turn-on delay time</td>
<td>( t_{\text{f(on)}} )</td>
<td></td>
<td>25</td>
<td>149</td>
</tr>
<tr>
<td>Rise time</td>
<td>( t_{\text{r}} )</td>
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<td>31, 36</td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>( t_{\text{f(off)}} )</td>
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<tr>
<td>Fall time</td>
<td>( t_{\text{f}} )</td>
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<tr>
<td>Turn-on energy loss</td>
<td>( E_{\text{on}} )</td>
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<td>Turn-off energy loss</td>
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<td>4,26, 5,95</td>
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<td>Input capacitance</td>
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<td>Output capacitance</td>
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<td>Reverse transfer capacitance</td>
<td>( C_{\text{rs}} )</td>
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<tr>
<td>Gate charge</td>
<td>( Q_{\text{g}} )</td>
<td></td>
<td>25</td>
<td>940</td>
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<tr>
<td>Thermal resistance junction to sink</td>
<td>( R_{\theta(j-s)} )</td>
<td></td>
<td>25</td>
<td>phase-change material ( \Delta T = 3,4 ) W/mK</td>
</tr>
<tr>
<td><strong>Boost Inverse Diode</strong></td>
<td></td>
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</tr>
<tr>
<td>Diode forward voltage</td>
<td>( V_{\text{F}} )</td>
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<td>25, 150</td>
<td>1,20, 1,77, 1,54, 1,90</td>
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<tr>
<td>Thermal resistance junction to sink</td>
<td>( R_{\theta(j-s)} )</td>
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<td>25</td>
<td>phase-change material ( \Delta T = 3,4 ) W/mK</td>
</tr>
<tr>
<td><strong>Boost Diode</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Diode forward voltage</td>
<td>( V_{\text{F}} )</td>
<td></td>
<td>25, 150</td>
<td>1,2, 1,77, 1,57, 1,9</td>
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<tr>
<td>Reverse leakage current</td>
<td>( I_{\text{Rm}} )</td>
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<td>25, 150</td>
<td>48, 48</td>
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<tr>
<td>Peak reverse recovery current</td>
<td>( I_{\text{MRR}} )</td>
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<td>25, 150</td>
<td>82, 114</td>
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<tr>
<td>Reverse recovery time</td>
<td>( t_{\text{r}} )</td>
<td></td>
<td>25, 150</td>
<td>233, 290</td>
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<tr>
<td>Reverse recovered charge</td>
<td>( Q_{\text{m}} )</td>
<td></td>
<td>25, 150</td>
<td>6, 13</td>
</tr>
<tr>
<td>Peak rate of fall of recovery current</td>
<td>( \left</td>
<td>\frac{di_{\text{f}}}{dt} \right</td>
<td>_{\text{max}} )</td>
<td></td>
</tr>
<tr>
<td>Reverse recovery energy</td>
<td>( E_{\text{m}} )</td>
<td></td>
<td>25, 150</td>
<td>1,65, 3,68</td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>( R_{\theta(j-s)} )</td>
<td></td>
<td>25</td>
<td>phase-change material ( \Delta T = 3,4 ) W/mK</td>
</tr>
<tr>
<td><strong>Thermistor</strong></td>
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<tr>
<td>Rated resistance</td>
<td>( R )</td>
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<tr>
<td>Deviation of ( R_{\text{min}} )</td>
<td>( \Delta R_{\text{min}} )</td>
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<td>-4,5, 4,5</td>
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<tr>
<td>Power dissipation</td>
<td>( P )</td>
<td></td>
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</tr>
<tr>
<td>Power dissipation constant</td>
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<td>3,5</td>
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<td>B-value</td>
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<tr>
<td>B-value</td>
<td>( B_{\text{Bmax}} )</td>
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<td>Vincotech NTC Reference</td>
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**Vincotech NTC Reference**

**Datasheet**

**21 Jul. 2016 / Revision 2**

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**Buck**

**figure 1.** IGBT

Typical output characteristics

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

At

- \( t_p = 350 \ \mu s \)
- \( T_j = 25 \ ^\circ C \)
- \( V_{CE} \) from 7 V to 17 V in steps of 1 V

**figure 2.** IGBT

Typical output characteristics

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

At

- \( t_p = 350 \ \mu s \)
- \( T_j = 150 \ ^\circ C \)
- \( V_{CE} \) from 7 V to 17 V in steps of 1 V

**figure 3.** IGBT

Typical transfer characteristics

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

At

- \( t_p = 350 \ \mu s \)
- \( V_{GE} \) from 7 V to 17 V in steps of 1 V

**figure 4.** FWD

Typical diode forward current as a function of forward voltage

\[ I_F = f(V_F) \]

At

- \( t_p = 350 \ \mu s \)
- \( T_j = 25\ ^\circ C \)
- \( T_j = T_{jmax} - 25\ ^\circ C \)
**Buck**

**Figure 5.**
Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ \text{C} \]
\[ V_{CE} = 350 \, \text{V} \]
\[ V_{GE} = \pm 15 \, \text{V} \]
\[ R_{gon} = 4 \, \Omega \]
\[ I_C = 150 \, \text{A} \]

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

\[ E = f(R_G) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ \text{C} \]
\[ V_{CE} = 350 \, \text{V} \]
\[ V_{GE} = \pm 15 \, \text{V} \]
\[ I_C = 150 \, \text{A} \]

**Figure 7.**
Typical reverse recovery energy loss as a function of collector current

\[ E_{\text{REC}} = f(I_C) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ \text{C} \]
\[ V_{CE} = 350 \, \text{V} \]
\[ V_{GE} = \pm 15 \, \text{V} \]
\[ R_{gon} = 4 \, \Omega \]

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

\[ E_{\text{REC}} = f(R_G) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ \text{C} \]
\[ V_{CE} = 350 \, \text{V} \]
\[ V_{GE} = \pm 15 \, \text{V} \]
\[ R_{gon} = 4 \, \Omega \]
\[ I_C = 150 \, \text{A} \]
**Buck**

**figure 9.** IGBT

Typical switching times as a function of collector current

\[ t = f(I_C) \]

- With an inductive load at
  - \( T_J = 150 \) °C
  - \( V_{CE} = 350 \) V
  - \( V_{GE} = \pm 15 \) V
  - \( R_{gon} = 4 \) Ω
  - \( R_{goff} = 4 \) Ω

**figure 10.** IGBT

Typical switching times as a function of gate resistor

\[ t = f(R_G) \]

- With an inductive load at
  - \( T_J = 150 \) °C
  - \( V_{CE} = 350 \) V
  - \( V_{GE} = \pm 15 \) V
  - \( I_C = 150 \) A

**figure 11.** FWD

Typical reverse recovery time as a function of collector current

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

**figure 12.** FWD

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

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

At

- \( T_J = 25/150 \) °C
- \( V_{CE} = 350 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

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**Figure 13.** Typical reverse recovery charge as a function of collector current

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

- At
  - \( T_J = 25/150 \, ^\circ C \)
  - \( V_{CE} = 350 \, V \)
  - \( V_{GE} = \pm 15 \, V \)
  - \( R_{gon} = 4 \, \Omega \)

**Figure 14.** Typical reverse recovery charge as a function of IGBT turn on gate resistor

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

- At
  - \( T_J = 25/150 \, ^\circ C \)
  - \( V_R = 350 \, V \)
  - \( I_F = 150 \, A \)
  - \( V_{GE} = \pm 15 \, V \)

**Figure 15.** Typical reverse recovery current as a function of collector current

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

**Figure 16.** Typical reverse recovery current as a function of IGBT turn on gate resistor

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

- At
  - \( T_J = 25/150 \, ^\circ C \)
  - \( V_{CE} = 350 \, V \)
  - \( V_{GE} = \pm 15 \, V \)
  - \( I_F = 150 \, A \)
  - \( V_{GE} = \pm 15 \, V \)
figure 17. Typical rate of fall of forward and reverse recovery current as a function of collector current
\[ \frac{dI}{dt}, \frac{dI_{rec}}{dt} = f(I_c) \]

At
- \( T_j = 25/150 \) °C
- \( V_{CE} = 350 \) V
- \( V_{GE} = \pm 15 \) 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
\[ \frac{dI}{dt}, \frac{dI_{rec}}{dt} = f(R_{gon}) \]

At
- \( T_j = 25/150 \) °C
- \( V_s = 350 \) V
- \( I_f = 150 \) A
- \( V_{GE} = \pm 15 \) V

figure 19. IGBT transient thermal impedance as a function of pulse width
\[ Z_{th(j-s)}(K/W) = f(t_p) \]

At
- \( D = t_p / T \)
- \( R_{th(j-s)} = 0.34 \) K/W

IGBT thermal model values
- \( R \) (K/W) \( \tau \) (s)
  - 4,43E-02 3,55E+00
  - 6,46E-02 8,58E-01
  - 1,01E-01 1,36E-01
  - 9,03E-02 4,30E-02
  - 2,31E-02 4,39E-03
  - 1,76E-02 6,24E-04

figure 20. FWD transient thermal impedance as a function of pulse width
\[ Z_{th(j-s)}(K/W) = f(t_p) \]

At
- \( D = t_p / T \)
- \( R_{th(j-s)} = 0.39 \) K/W

FWD thermal model values
- \( R \) (K/W) \( \tau \) (s)
  - 4,62E-02 3,80E+00
  - 6,71E-02 9,22E-01
  - 5,38E-02 2,23E-01
  - 1,26E-01 5,05E-02
  - 3,49E-02 1,17E-02
  - 3,03E-02 2,42E-03

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**Figure 21.** IGBT
Power dissipation as a function of heatsink temperature

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

At

\[ T_j = 175 \degree C \]

**Figure 22.** IGBT
Collector current as a function of heatsink temperature

\[ I_C = f(T_s) \]

At

\[ T_j = 175 \degree C \]

**Figure 23.** FWD
Power dissipation as a function of heatsink temperature

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

At

\[ T_j = 175 \degree C \]

**Figure 24.** FWD
Forward current as a function of heatsink temperature

\[ I_F = f(T_s) \]

At

\[ T_j = 175 \degree C \]

\[ V_{\text{ge}} = 15 \text{ V} \]
Buck

**figure 25.** IGBT
Safe operating area as a function of collector-emitter voltage

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

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

At
- \( D = \) single pulse
- \( T_s = 80 \) °C
- \( V_{GE} = \pm 15 \) V
- \( T_j = T_{j\text{max}} \) °C

**figure 26.** IGBT
Gate voltage vs Gate charge

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

At
- \( I_C = 150 \) A
figure 1. IGBT
Typical output characteristics
$I_C = f(V_{CE})$

At $t_p = 350 \mu s$
$T_J = 25 ^\circ C$
$V_{CE}$ from 7 V to 17 V in steps of 1 V

figure 2. IGBT
Typical output characteristics
$I_C = f(V_{CE})$

At $t_p = 350 \mu s$
$T_J = 150 ^\circ C$
$V_{CE}$ from 7 V to 17 V in steps of 1 V

figure 3. IGBT
Typical transfer characteristics
$I_C = f(V_{GE})$

At $t_p = 350 \mu s$
$V_{CE} = 10 V$

figure 4. FWD
Typical diode forward current as a function of forward voltage
$I_F = f(V_F)$

At $t_p = 350 \mu s$
**Boost**

**Figure 5.** IGBT
Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ C \]

\[ V_{CE} = 350 \, V \]

\[ V_{GE} = \pm 15 \, V \]

\[ R_{gon} = 4 \, \Omega \]

\[ I_C = 150 \, A \]

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

\[ E = f(R_G) \]

With an inductive load at

\[ T_J = 25/150 \, ^\circ C \]

\[ V_{CE} = 350 \, V \]

\[ V_{GE} = \pm 15 \, V \]

\[ I_C = 150 \, A \]

**Figure 7.** FWD
Typical reverse recovery energy loss as a function of collector current

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

With an inductive load at

\[ T_J = 25/150 \, ^\circ C \]

\[ V_{CE} = 350 \, V \]

\[ V_{GE} = \pm 15 \, V \]

\[ R_{gon} = 4 \, \Omega \]

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

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

With an inductive load at

\[ T_J = 25/150 \, ^\circ C \]

\[ V_{CE} = 350 \, V \]

\[ V_{GE} = \pm 15 \, V \]

\[ I_C = 150 \, A \]
Boost

**Figure 9. IGBT**

Typical switching times as a function of collector current

\[ t = f(I_C) \]

With an inductive load at
- \( T_j = 150 \) °C
- \( V_{CE} = 350 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω
- \( R_{goff} = 4 \) Ω

**Figure 10. IGBT**

Typical switching times as a function of gate resistor

\[ t = f(R_g) \]

With an inductive load at
- \( T_j = 150 \) °C
- \( V_{CE} = 350 \) V
- \( V_{GE} = \pm 15 \) V
- \( I_c = 150 \) A

**Figure 11. FWD**

Typical reverse recovery time as a function of collector current

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

At
- \( T_j = 25/150 \) °C
- \( V_{CE} = 350 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

**Figure 12. FWD**

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

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

At
- \( T_j = 25/150 \) °C
- \( V_{BE} = 350 \) V
- \( I_f = 150 \) A
- \( V_{CE} = \pm 15 \) V
Boost

**figure 13.**
Typical reverse recovery charge as a function of collector current

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

**figure 14.**
Typical reverse recovery charge as a function of IGBT turn on gate resistor

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

At

\[ T_j = 25/150 \ ^\circ C \]

\[ V_{CE} = 350 \ V \]

\[ V_{GE} = \pm 15 \ V \]

\[ R_{gon} = 4 \ \Omega \]

**figure 15.**
Typical reverse recovery current as a function of collector current

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

**figure 16.**
Typical reverse recovery current as a function of IGBT turn on gate resistor

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

At

\[ T_j = 25/150 \ ^\circ C \]

\[ V_{CE} = 350 \ V \]

\[ V_{GE} = \pm 15 \ V \]

\[ R_{gon} = 4 \ \Omega \]
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 $T_j = 25/150 \, ^\circ C$

- $V_{CE} = 350 \, V$
- $V_{GE} = \pm 15 \, V$
- $R_{gon} = 4 \, \Omega$

IGBT transient thermal impedance as a function of pulse width

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

At $D = 0.5$

- $R_{th(j-s)} = 0.29 \, K/W$
- $R_{th(j-s)} = 0.47 \, K/W$

IGBT thermal model values

- K (K/W) - Tau (s)
  - $4.40E-02$ - $2.95E+00$
  - $5.08E-02$ - $7.93E-01$
  - $7.83E-02$ - $1.41E-01$
  - $8.59E-02$ - $4.33E-02$
  - $2.00E-02$ - $3.83E-03$
  - $1.46E-02$ - $5.99E-04$

FWD transient thermal impedance as a function of pulse width

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

At $D = 0.5$

- $R_{th(j-s)} = 0.29 \, K/W$
- $R_{th(j-s)} = 0.47 \, K/W$

FWD thermal model values

- K (K/W) - Tau (s)
  - $4.73E-02$ - $4.12E+00$
  - $6.76E-02$ - $9.18E-01$
  - $1.01E-01$ - $1.37E-01$
  - $1.41E-01$ - $3.83E-02$
  - $6.28E-02$ - $8.98E-03$
  - $4.92E-02$ - $1.99E-03$
Boost

**figure 21. IGBT**
Power dissipation as a function of heatsink temperature

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

At
\[ T_j = 175 \, ^\circ C \]

**figure 22. IGBT**
Collector current as a function of heatsink temperature

\[ I_C = f(T_s) \]

At
\[ T_j = 175 \, ^\circ C \]
\[ V_{GE} = 15 \, V \]

**figure 23. FWD**
Power dissipation as a function of heatsink temperature

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

At
\[ T_j = 175 \, ^\circ C \]

**figure 24. FWD**
Forward current as a function of heatsink temperature

\[ I_F = f(T_s) \]

At
\[ T_j = 175 \, ^\circ C \]
Boost Inv. Diode

**figure 25.** Boost Inverse Diode

Typical diode forward current as a function of forward voltage

$I_F = f(V_F)$

![Graph showing typical diode forward current](image1)

At

$t_p = 250 \mu s$

**figure 26.** Boost Inverse Diode

Diode transient thermal impedance as a function of pulse width

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

![Graph showing diode transient thermal impedance](image2)

At

$D = t_p / T$

$R_{th(j-s)} = 0.46 \ K/W$

**figure 27.** Boost Inverse Diode

Power dissipation as a function of heatsink temperature

$P_{tot} = f(T_s)$

![Graph showing power dissipation](image3)

At

$T_j = 175 ^\circ C$

**figure 28.** Boost Inverse Diode

Forward current as a function of heatsink temperature

$I_F = f(T_s)$

![Graph showing forward current](image4)

At

$T_j = 175 ^\circ C$
Figure 1. Thermistor

Typical NTC characteristic as a function of temperature

\[ R = f(T) \]
Switching Definitions BUCK

General conditions

\[ T_J = 150 \, ^\circ \text{C} \]
\[ R_{\text{on}} = 4 \, \Omega \]
\[ R_{\text{off}} = 4 \, \Omega \]

**figure 1.** IGBT
Turn-off Switching Waveforms & definition of \( t_{\text{doff}} \) \( t_{\text{Eoff}} \)
\[
(t_{\text{Eoff}} = \text{integrating time for } E_{\text{off}})

\[
V_{\text{CE}} (0\%) = -15 \, \text{V}
\]
\[
V_{\text{CE}} (100\%) = 15 \, \text{V}
\]
\[
V_C (100\%) = 700 \, \text{V}
\]
\[
I_C (100\%) = 150 \, \text{A}
\]
\[
t_{\text{doff}} = 0,22 \, \mu\text{s}
\]
\[
t_{\text{Eoff}} = 0,31 \, \mu\text{s}
\]

**figure 2.** IGBT
Turn-on Switching Waveforms & definition of \( t_{\text{don}} \) \( t_{\text{Eon}} \)
\[
(t_{\text{Eon}} = \text{integrating time for } E_{\text{on}})

\[
V_{\text{CE}} (0\%) = -15 \, \text{V}
\]
\[
V_{\text{CE}} (100\%) = 15 \, \text{V}
\]
\[
V_C (100\%) = 700 \, \text{V}
\]
\[
I_C (100\%) = 150 \, \text{A}
\]
\[
t_{\text{don}} = 0,15 \, \mu\text{s}
\]
\[
t_{\text{Eon}} = 0,25 \, \mu\text{s}
\]

**figure 3.** IGBT
Turn-off Switching Waveforms & definition of \( t_i \)

\[
V_C (100\%) = 700 \, \text{V}
\]
\[
I_C (100\%) = 150 \, \text{A}
\]
\[
t_i = 0,03 \, \mu\text{s}
\]

**figure 4.** IGBT
Turn-on Switching Waveforms & definition of \( t_f \)

\[
V_C (100\%) = 700 \, \text{V}
\]
\[
I_C (100\%) = 150 \, \text{A}
\]
\[
t_f = 0,03 \, \mu\text{s}
\]
Switching Definitions BUCK

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

- $P_{\text{off}} (100\%) = 105 \text{ kW}$
- $E_{\text{off}} (100\%) = 2.68 \text{ mJ}$
- $t_{\text{Eoff}} = 0.31 \text{ µs}$

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

- $P_{\text{on}} (100\%) = 105 \text{ kW}$
- $E_{\text{on}} (100\%) = 2.45 \text{ mJ}$
- $t_{\text{Eon}} = 0.25 \text{ µs}$

**figure 8.** FWD
Turn-off Switching Waveforms & definition of $t_{\text{rr}}$

- $V_d (100\%) = 700 \text{ V}$
- $I_d (100\%) = 150 \text{ A}$
- $I_{\text{SRM}} (100\%) = -157 \text{ A}$
- $t_{\text{rr}} = 0.10 \text{ µs}$
Switching Definitions BUCK

**Figure 9.** Turn-on Switching Waveforms & definition of $t_{Qrr}$

$\tau_{Qrr} = \text{integrating time for } Q_{rr}$

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

Q_{rr} (100\%) = 9.91 \mu\text{C}

$t_{Qrr} = 0.19 \mu\text{s}$

---

**Figure 10.** Turn-on Switching Waveforms & definition of $t_{Erec}$

$\tau_{Erec} = \text{integrating time for } E_{rec}$

$P_{rec} (100\%) = 105.00 \text{ kW}

E_{rec} (100\%) = 2.07 \text{ mJ}

$t_{Erec} = 0.19 \mu\text{s}$
### Ordering Code and Marking - Outline - Pinout

#### Pin table

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<td>OUT</td>
</tr>
<tr>
<td>37</td>
<td>52,2</td>
<td>28,2</td>
<td>OUT</td>
</tr>
</tbody>
</table>

### Ordering Code & Marking

<table>
<thead>
<tr>
<th>Version</th>
<th>Ordering Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>with thermal paste 12mm housing with Press-fit pins</td>
<td>10-PY07NIB150SG-M136F38Y/-3/</td>
</tr>
</tbody>
</table>

#### Outline

![Outline Diagram](image-url)
Ordering Code and Marking - Outline - Pinout

<table>
<thead>
<tr>
<th>ID</th>
<th>Component</th>
<th>Voltage</th>
<th>Current</th>
<th>Function</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1,T4,T5,T8</td>
<td>IGBT</td>
<td>650 V</td>
<td>75 A</td>
<td>Buck IGBT</td>
<td></td>
</tr>
<tr>
<td>D9,D10,D11,D12, D13,D14,D15,D16</td>
<td>PWD</td>
<td>650 V</td>
<td>40 A</td>
<td>Buck Diode</td>
<td></td>
</tr>
<tr>
<td>T2,T3,T6,T7</td>
<td>IGBT</td>
<td>600 V</td>
<td>75 A</td>
<td>Boost IGBT</td>
<td></td>
</tr>
<tr>
<td>D1,D4,D5,D8</td>
<td>PWD</td>
<td>650 V</td>
<td>50 A</td>
<td>Boost Diode</td>
<td></td>
</tr>
<tr>
<td>D2,D3,D6,D7</td>
<td>PWD</td>
<td>600 V</td>
<td>50 A</td>
<td>Boost Inverse Diode</td>
<td></td>
</tr>
<tr>
<td>NTC</td>
<td>Thermistor</td>
<td></td>
<td></td>
<td>Thermistor</td>
<td></td>
</tr>
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