### Features
- Mixed voltage NPC topology
- Reactive power capability
- Low inductance layout
- Common collector neutral connection

### Target Applications
- Solar Inverter
- UPS

### Types
- 10-FZ07NMA100SM-M265F58
- 10-PZ07NMA100SM-M265F58Y

### Maximum Ratings

#### Buck Switch

<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>Collector-emitter breakdown voltage</td>
<td>$V_{CE}$</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>DC collector current</td>
<td>$I_C$</td>
<td>$T_s = T_{max}$</td>
<td>79</td>
<td>A</td>
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<tr>
<td>Repetitive peak collector current</td>
<td>$I_{DSM}$</td>
<td>$T_s$ limited by $T_{max}$</td>
<td>300</td>
<td>A</td>
</tr>
<tr>
<td>Turn off safe operating area</td>
<td>$T_s$</td>
<td></td>
<td>300</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_s = T_{max}$</td>
<td>136</td>
<td>W</td>
</tr>
<tr>
<td>Gate-emitter peak voltage</td>
<td>$V_{GE}$</td>
<td></td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Maximum Junction Temperature</td>
<td>$T_{jmax}$</td>
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<td>175</td>
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#### Buck Diode

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<th>Unit</th>
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<tr>
<td>Peak Repetitive Reverse Voltage</td>
<td>$V_{RSM}$</td>
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<td>600</td>
<td>V</td>
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<tr>
<td>Mean forward current</td>
<td>$I_{FSD}$</td>
<td>$T_s = T_{max}$</td>
<td>50</td>
<td>A</td>
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<tr>
<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_s = T_{max}$</td>
<td>69</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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$T_s = 25 °C$, unless otherwise specified
### Maximum Ratings

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
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<tr>
<td>Collector-emitter breakdown voltage</td>
<td>$V_{CES}$</td>
<td>$T_j = T_{j\text{max}}$, $T_s = 80 , ^\circ C$</td>
<td>600</td>
<td>V</td>
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<tr>
<td>DC collector current</td>
<td>$I_{C}$</td>
<td>$r_s$ limited by $T_{j\text{max}}$</td>
<td>57</td>
<td>A</td>
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<tr>
<td>Repetitive peak collector current</td>
<td>$I_{CM}$</td>
<td>$T_j \leq 150 , ^\circ C$, $V_{CE} &lt; V_{CES}$</td>
<td>225</td>
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<tr>
<td>Turn off safe operating area</td>
<td>$T_j \leq 150 , ^\circ C$</td>
<td>$V_{CE} = 15 , V$</td>
<td>225</td>
<td>A</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P_{tot}$</td>
<td>$T_j = T_{j\text{max}}$, $T_s = 80 , ^\circ C$</td>
<td>82</td>
<td>W</td>
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<tr>
<td>Gate-emitter peak voltage</td>
<td>$V_{GE}$</td>
<td>$T_j = T_{j\text{max}}$, $V_{CE} = 15 , V$</td>
<td>±40</td>
<td>V</td>
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<tr>
<td>Short circuit ratings</td>
<td>$I_{SC}$</td>
<td>$T_j \leq 150 , ^\circ C$, $V_{CE} = 15 , V$</td>
<td>6</td>
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<td>Maximum Junction Temperature</td>
<td>$T_{j\text{max}}$</td>
<td></td>
<td>360</td>
<td>µs</td>
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</table>

### Boost Diode

| Peak Repetitive Reverse Voltage | $V_{BBM}$ | $T_j = T_{j\text{max}}$, $T_s = 80 \, ^\circ C$ | 650 | V |
| Mean forward current | $I_{FDM}$ | $T_j = T_{j\text{max}}$, $T_s = 80 \, ^\circ C$ | 47 | A |
| Surge (non-repetitive) forward current | $I_{FSM}$ | $T_s = 10 \, ms$ | 100 | A |
| Repetitive peak forward current | $I_{FPM}$ | $r_s$ limited by $T_{j\text{max}}$ | 100 | A |
| Power dissipation | $P_{tot}$ | $T_j = T_{j\text{max}}$, $T_s = 80 \, ^\circ C$ | 70 | W |
| Maximum Junction Temperature | $T_{j\text{max}}$ | | 175 | °C |

### Thermal Properties

| Storage temperature | $T_{stg}$ | | -40..+125 | °C |
| Operation temperature under switching condition | $T_{op}$ | | -40..+(T_{j\text{max}} - 25) | °C |

### Isolation Properties

| Isolation voltage | $r = 2 \, s$, DC Test Voltage* | 4000 | V |
| Creepage distance | Press-fit pins / Solder pins | min >12,7 | mm |
| Clearance | Press-fit pins / Solder pins | 9 / 9,15 | mm |
| Comparative Tracking Index | CTI | >200 |

*100% tested in production

$T_s = 25 \, ^\circ C$, unless otherwise specified
## 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><strong>Buck Switch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate emitter threshold voltage</td>
<td>( V_{GE(th)} )</td>
<td>( V_{GS} = V_{GE} )</td>
<td>0,0005</td>
<td>25</td>
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<tr>
<td>Collector-emitter saturation voltage</td>
<td>( V_{CEO} )</td>
<td>15</td>
<td>100</td>
<td>25</td>
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<tr>
<td>Collector-emitter cut-off current incl. Diode</td>
<td>( I_{CES} )</td>
<td>0</td>
<td>650</td>
<td>25</td>
</tr>
<tr>
<td>Gate-emitter leakage current</td>
<td>( I_{GE} )</td>
<td>20</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Integrated Gate resistor</td>
<td>( R_{pin} )</td>
<td>none</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on delay time</td>
<td>( t_{on} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
<td>015</td>
<td>150</td>
</tr>
<tr>
<td>Rise time</td>
<td>( t_{r} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>( t_{off} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Fall time</td>
<td>( t_{f} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>Turn-on energy loss</td>
<td>( E_{on} )</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Turn-off energy loss</td>
<td>( E_{off} )</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>Input capacitance</td>
<td>( C_{in} )</td>
<td>( f = 1 , \text{MHz} )</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Output capacitance</td>
<td>( C_{oss} )</td>
<td>( f = 1 , \text{MHz} )</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>Reverse transfer capacitance</td>
<td>( C_{ies} )</td>
<td>( f = 1 , \text{MHz} )</td>
<td>0</td>
<td>25</td>
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<tr>
<td>Gate charge</td>
<td>( Q_{G} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<td>520</td>
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<td>Thermal resistance junction to sink</td>
<td>( R_{th(j-s)} )</td>
<td>( λ_{paste} = 3,4 , \text{W/mK} )</td>
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<tr>
<td><strong>Buck Diode</strong></td>
<td></td>
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<tr>
<td>Diode forward voltage</td>
<td>( V_{F} )</td>
<td>60</td>
<td>25</td>
<td>1,80</td>
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<td>Reverse leakage current</td>
<td>( I_{rr} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<td>15</td>
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<tr>
<td>Peak reverse recovery current</td>
<td>( I_{RRM} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<td>15</td>
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<tr>
<td>Reverse recovery time</td>
<td>( t_{rr} )</td>
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<tr>
<td>Reverse recovered charge</td>
<td>( Q_{rec} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<td>( (\frac{dI}{dt})_{max} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<tr>
<td>Reverse recovered energy</td>
<td>( E_{rec} )</td>
<td>( R_{pin} = 4 , \Omega )</td>
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<td>15</td>
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<td>Thermal resistance junction to sink</td>
<td>( R_{th(j-s)} )</td>
<td>( λ_{paste} = 3,4 , \text{W/mK} )</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Gate emitter threshold voltage</td>
<td>$V_{GE}$</td>
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<td>0,0012</td>
<td>V</td>
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<tr>
<td>Collector-emitter saturation voltage</td>
<td>$V_{CE}$</td>
<td></td>
<td>15</td>
<td>V</td>
</tr>
<tr>
<td>Collector-emitter cut-off incl diode</td>
<td>$I_{CES}$</td>
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<td>mA</td>
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<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{G}$</td>
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<td>mA</td>
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<td>Integrated Gate resistor</td>
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17 Jan. 2019 / Revision 4
Buck
Buck Switch IGBT and Buck Diode FWD

**figure 1.**
**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

At

$t_f = 250 \ \mu s$

$T_j = 25 \ ^\circ C$

$V_{CE}$ from 5 V to 15 V in steps of 1 V

**figure 2.**
**IGBT**

Typical output characteristics

$I_C = f(V_{CE})$

At

$t_f = 250 \ \mu s$

$T_j = 125 \ ^\circ C$

$V_{CE}$ from 5 V to 15 V in steps of 1 V

**figure 3.**
**IGBT**

Typical transfer characteristics

$I_C = f(V_{GE})$

At

$V_{GE}$ from 5 V to 15 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

$V_{CE} = 10 \ \text{V}$

$T_j = 25/125 \ ^\circ C$

$t_f = 250 \ \mu s$
Buck
Buck Switch IGBT and Buck Diode FWD

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

\[ E = f(I_C) \]

With an inductive load at
- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω
- \( R_{goff} = 4 \) Ω

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

\[ E = f(R_G) \]

With an inductive load at
- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( I_C = 50 \) A

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

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

With an inductive load at
- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

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

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

With an inductive load at
- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( I_C = 50 \) A
**Buck**

**Buck Switch IGBT and Buck Diode FWD**

**figure 9.**  
Typical switching times as a function of collector current  
$t = f(I_C)$

With an inductive load at  
$T_j = 125 \, ^\circ C$  
$V_{CE} = 150 \, V$  
$V_{GE} = \pm 15 \, V$  
$R_{gon} = 4 \, \Omega$  
$R_{goff} = 4 \, \Omega$

**figure 11.**  
Typical reverse recovery time as a function of collector current  
$t_{rr} = f(I_C)$

At  
$T_j = 25/125 \, ^\circ C$  
$V_{CE} = 150 \, V$  
$V_{GE} = \pm 15 \, V$  
$R_{gon} = 4 \, \Omega$  

**figure 10.**  
Typical switching times as a function of gate resistor  
$t = f(R_g)$

With an inductive load at  
$T_j = 125 \, ^\circ C$  
$V_{CE} = 150 \, V$  
$V_{GE} = \pm 15 \, V$  
$I_C = 50 \, A$

**figure 12.**  
Typical reverse recovery time as a function of IGBT turn on gate resistor  
$t_{rr} = f(R_{gon})$

At  
$T_j = 25/125 \, ^\circ C$  
$V_s = 150 \, V$  
$I_f = 50 \, A$  
$V_{GE} = \pm 15 \, V$
Buck

Buck Switch IGBT and Buck Diode FWD

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

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

At
- \( T_j = 25/125 \, ^\circ C \)
- \( V_{CE} = 150 \, V \)
- \( V_{GE} = \pm 15 \, V \)
- \( R_{gon} = 4 \, \Omega \)

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

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

At
- \( T_j = 25/125 \, ^\circ C \)
- \( V_s = 150 \, V \)
- \( I_f = 50 \, A \)
- \( V_{GE} = \pm 15 \, V \)

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

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

At
- \( T_j = 25/125 \, ^\circ C \)
- \( V_{CE} = 150 \, V \)
- \( V_{GE} = \pm 15 \, V \)
- \( I_f = 50 \, A \)
- \( V_{GE} = \pm 15 \, V \)

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

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

At
- \( T_j = 25/125 \, ^\circ C \)
- \( V_s = 150 \, V \)
- \( I_f = 50 \, A \)
- \( V_{GE} = \pm 15 \, V \)
Typical rate of fall of forward and reverse recovery current as a function of collector current

\[ \frac{dI_0}{dt}, \frac{dI_{rec}}{dt} = f(I_c) \]

At
\[ T_j = \frac{25}{125} \; ^\circ C \]
\[ V_{CE} = 150 \; V \]
\[ V_{GE} = \pm 15 \; V \]
\[ R_{gon} = 4 \; \Omega \]

IGBT transient thermal impedance as a function of pulse width

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

At
\[ D = \frac{t_p}{T} \]
\[ R_{th(j-s)} = 0,70 \; K/W \]

IGBT thermal model values

<table>
<thead>
<tr>
<th>( R ; (K/W) )</th>
<th>( \tau_a ; (s) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>6,67E-02</td>
<td>1,43E+00</td>
</tr>
<tr>
<td>1,15E-01</td>
<td>2,44E-01</td>
</tr>
<tr>
<td>2,87E-01</td>
<td>6,53E-02</td>
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<tr>
<td>1,30E-01</td>
<td>1,67E-02</td>
</tr>
<tr>
<td>5,73E-02</td>
<td>4,56E-03</td>
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</table>

FWD thermal model values

<table>
<thead>
<tr>
<th>( R ; (K/W) )</th>
<th>( \tau_a ; (s) )</th>
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</thead>
<tbody>
<tr>
<td>8,15E-02</td>
<td>3,99E+00</td>
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<td>2,02E-01</td>
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<td>9,74E-02</td>
<td>5,31E-03</td>
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</tbody>
</table>
Buck

Buck Switch IGBT and Buck Diode FWD

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

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

At
\[ T_j = 175 \degree C \]

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

\[ I_C = f(T_s) \]

At
\[ T_j = 175 \degree C \]
\[ V_{GE} = 15 \, \text{V} \]

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

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

At
\[ T_j = 175 \degree C \]

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

\[ I_F = f(T_s) \]

At
\[ T_j = 175 \degree C \]
Buck

Buck Switch IGBT and Buck Diode FWD

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

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

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

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

**figure 27.**
Reverse bias safe operating area

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

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

**At**
- \( I_C = 100 \text{ A} \)
- \( V_{CE} = 130 \text{ V} \)
- \( V_{CE} = 520 \text{ V} \)

**At**
- \( T_j = 125 \degree C \)
- \( R_{gon} = 4 \Omega \)
- \( R_{goff} = 4 \Omega \)

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**Boost**

**Boost Switch IGBT and Boost Diode FWD**

**figure 1.** IGBT

*Typical output characteristics*

$I_C = f(V_{CE})$

**figure 2.** IGBT

*Typical output characteristics*

$I_C = f(V_{CE})$

At

$t_P = 250 \ \mu s$

$T_J = 25 \ ^\circ C$

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

**figure 3.** IGBT

*Typical transfer characteristics*

$I_C = f(V_{GE})$

**figure 4.** FWD

*Typical diode forward current as a function of forward voltage*

$I_F = f(V_F)$

At

$T_J = 25/125 \ ^\circ C$

$t_P = 250 \ \mu s$

$V_{CE} = 10 \ \text{V}$
**Boost**

Boost Switch IGBT and Boost Diode FWD

**figure 5.**

**IGBT**

Typical switching energy losses as a function of collector current

\[ E = f(I_C) \]

With an inductive load at

- \( T_J = 25 \text{/} 125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω
- \( I_C = 50 \) A

**figure 6.**

**IGBT**

Typical switching energy losses as a function of gate resistor

\[ E = f(R_G) \]

With an inductive load at

- \( T_J = 25 \text{/} 125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( I_C = 50 \) 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

- \( T_J = 25 \text{/} 125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

**figure 8.**

**FWD**

Typical reverse recovery energy loss as a function of gate resistor

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

With an inductive load at

- \( T_J = 25 \text{/} 125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( I_C = 50 \) A
Boost Switch IGBT and Boost Diode FWD

**Figure 9.** IGBT

Typical switching times as a function of collector current

\[ t = f(I_C) \]

With an inductive load at

- \( T_j = 125 \ ^{\circ}C \)
- \( V_{CE} = 150 \ V \)
- \( V_{GE} = \pm 15 \ V \)
- \( R_{gon} = 4 \ \Omega \)
- \( I_C = 50 \ A \)

**Figure 10.** IGBT

Typical switching times as a function of gate resistor

\[ t = f(R_G) \]

With an inductive load at

- \( T_j = 125 \ ^{\circ}C \)
- \( V_{CE} = 150 \ V \)
- \( V_{GE} = \pm 15 \ V \)
- \( I_C = 50 \ A \)

**Figure 11.** FWD

Typical reverse recovery time as a function of collector current

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

At

- \( T_j = 25/125 \ ^{\circ}C \)
- \( V_{CE} = 150 \ V \)
- \( V_{GE} = \pm 15 \ V \)
- \( R_{gon} = 4 \ \Omega \)

**Figure 12.** FWD

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

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

At

- \( T_j = 25/125 \ ^{\circ}C \)
- \( V_a = 150 \ V \)
- \( I_f = 50 \ A \)
- \( V_{GE} = \pm 15 \ V \)
Boost

Boost Switch IGBT and Boost Diode FWD

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

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

At

- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

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

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

At

- \( T_j = 25/125 \) °C
- \( V_R = 150 \) V
- \( I_F = 50 \) A
- \( V_{GE} = \pm 15 \) V

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

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

At

- \( T_j = 25/125 \) °C
- \( V_{CE} = 150 \) V
- \( V_{GE} = \pm 15 \) V
- \( R_{gon} = 4 \) Ω

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

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

At

- \( T_j = 25/125 \) °C
- \( V_R = 150 \) V
- \( I_F = 50 \) A
- \( V_{GE} = \pm 15 \) V
Boost Switch IGBT and Boost Diode FWD

**Figure 17.**
Typical rate of fall of forward and reverse recovery current as a function of collector current:
\[ \frac{dI}{dt}, \frac{dI_{rec}}{dt} = f(I_C) \]

**Figure 18.**
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn on gate resistor:
\[ \frac{dI}{dt}, \frac{dI_{rec}}{dt} = f(R_{gon}) \]

**Figure 19.**
IGBT transient thermal impedance as a function of pulse width:
\[ Z_{th(j-s)} = f(t_p) \]

**Figure 20.**
FWD transient thermal impedance as a function of pulse width:
\[ Z_{th(j-s)} = f(t_p) \]

**Table:** IGBT thermal model values

<table>
<thead>
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<th>R (K/W)</th>
<th>Tau (s)</th>
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<td>5,72E-02</td>
<td>3,97E-04</td>
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**Table:** FWD thermal model values

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<td>1,02E-01</td>
<td>6,56E-04</td>
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</tbody>
</table>
Boost
Boost Switch IGBT and Boost Diode FWD

**figure 21.**
Power dissipation as a function of heatsink temperature
\[ P_{\text{tot}} = f(T_s) \]

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

**figure 22.**
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.**
Power dissipation as a function of heatsink temperature
\[ P_{\text{tot}} = f(T_s) \]

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

**figure 24.**
Forward current as a function of heatsink temperature
\[ I_F = f(T_s) \]

At
\[ T_j = 175 \, ^\circ C \]
figure 1. Thermistor
Typical NTC characteristic as a function of temperature
$R_T = f(T)$
Buck Switching Definitions

General conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
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</tr>
<tr>
<td>( R_{on} )</td>
<td>4 Ω</td>
</tr>
<tr>
<td>( R_{off} )</td>
<td>4 Ω</td>
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</table>

**Turn-off Switching Waveforms & definition of \( t_{doff} \), \( t_{Eoff} \)**

\( t_{doff} = \text{integrating time for } E_{off} \)

**Turn-on Switching Waveforms & definition of \( t_{don} \), \( t_{Eon} \)**

\( t_{don} = \text{integrating time for } E_{on} \)

---

**Figure 1.**

- \( V_{CE} (0\%) = -15 \) V
- \( V_{CE} (100\%) = 15 \) V
- \( I_C (100\%) = 50 \) A
- \( t_{doff} = 0,094 \) µs
- \( t_{Eoff} = 0,171 \) µs

**Figure 2.**

- \( V_{CE} (0\%) = -15 \) V
- \( V_{CE} (100\%) = 15 \) V
- \( I_C (100\%) = 50 \) A
- \( t_{don} = 0,071 \) µs
- \( t_{Eon} = 0,151 \) µs

---

**Figure 3.**

- \( V_C (100\%) = 150 \) V
- \( I_C (100\%) = 50 \) A
- \( t_f = 0,022 \) µs

**Figure 4.**

- \( V_C (100\%) = 150 \) V
- \( I_C (100\%) = 50 \) A
- \( t_r = 0,021 \) µs
**Buck Switching Definitions**

**figure 5.** IGBT

**Turn-off Switching Waveforms & definition of \( t_{E_{off}} \)**

\[
P_{E_{off}} (100\%) = 7.49 \text{ kW}
\]

\[
E_{E_{off}} (100\%) = 0.32 \text{ mJ}
\]

\[
t_{E_{off}} = 0.171 \mu s
\]

**figure 6.** IGBT

**Turn-on Switching Waveforms & definition of \( t_{E_{on}} \)**

\[
P_{E_{on}} (100\%) = 7.49 \text{ kW}
\]

\[
E_{E_{on}} (100\%) = 0.27 \text{ mJ}
\]

\[
t_{E_{on}} = 0.151 \mu s
\]

**figure 7.** IGBT

**Turn-off Switching Waveforms & definition of \( t_{rr} \)**

\[
V_{d} (100\%) = 150 \text{ V}
\]

\[
i_{d} (100\%) = 50 \text{ A}
\]

\[
i_{rr} (100\%) = -59 \text{ A}
\]

\[
t_{rr} = 0.113 \mu s
\]
Buck Switching Definitions

**Figure 8.** Turn-on Switching Waveforms & definition of $\tau_{\text{Qrr}}$
($\tau_{\text{Qrr}}$ = integrating time for $\text{Q}_{\text{rr}}$)

- $I_d$ (100%) = 50 A
- $Q_{\text{rr}}$ (100%) = 3,10 µC
- $\tau_{\text{Qrr}}$ = 0,227 µs

**Figure 9.** Turn-on Switching Waveforms & definition of $\tau_{\text{Erec}}$
($\tau_{\text{Erec}}$ = integrating time for $E_{\text{rec}}$)

- $P_{\text{rec}}$ (100%) = 7,49 kW
- $E_{\text{rec}}$ (100%) = 0,31 mJ
- $\tau_{\text{Erec}}$ = 0,227 µs
Measurement circuits

Figure 10.
Buck stage switching measurement circuit
Boost Switching Definitions

**General conditions**

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<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
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<td>( R_{Gon} )</td>
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<td>( R_{Goff} )</td>
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**Turn-off Switching Waveforms & definition of \( t_{doff} \), \( t_{Eoff} \)**

\( t_{doff} \) = integrating time for \( E_{off} \)

\( t_{Eoff} \) = \( V_{CE} \) (0%) = -15 V
\( V_{CE} \) (100%) = 15 V
\( I_C \) (100%) = 50 A
\( t_{doff} \) = 0,156 µs
\( t_{Eoff} \) = 0,676 µs

**Turn-on Switching Waveforms & definition of \( t_{don} \), \( t_{Eon} \)**

\( t_{don} \) = integrating time for \( E_{on} \)

\( t_{Eon} \) = \( V_{CE} \) (0%) = -15 V
\( V_{CE} \) (100%) = 15 V
\( I_C \) (100%) = 50 A
\( t_{don} \) = 0,094 µs
\( t_{Eon} \) = 0,217 µs

**Boost Switching Definitions**

**General conditions**

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<tr>
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<td>( 100 )</td>
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**Turn-off Switching Waveforms & definition of \( t_f \)**

\( V_{CE} \) (0%) = -15 V
\( V_{CE} \) (100%) = 15 V
\( I_C \) (100%) = 50 A
\( t_f \) = 0,097 µs

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

\( V_{CE} \) (0%) = -15 V
\( V_{CE} \) (100%) = 15 V
\( I_C \) (100%) = 50 A
\( t_r \) = 0,017 µs
Boost Switching Definitions

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

- $P_{\text{off}}$ (100%) = 7.56 kW
- $E_{\text{off}}$ (100%) = 0.95 mJ
- $t_{\text{Eoff}}$ = 0.676 µs

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

- $P_{\text{on}}$ (100%) = 7.56 kW
- $E_{\text{on}}$ (100%) = 0.25 mJ
- $t_{\text{Eon}}$ = 0.217 µs

**figure 7.** IGBT
Turn-off Switching Waveforms & definition of $t_{\text{rr}}$

- $V_{\text{d}}$ (100%) = 150 V
- $I_{\text{d}}$ (100%) = 50 A
- $I_{\text{rrM}}$ (100%) = -43 A
- $t_{\text{rr}}$ = 0.290 µs
Boost Switching Definitions

**Figure 8.** Turn-on Switching Waveforms & definition of $t_{Qrr}$

$(t_{Qrr} = \text{integrating time for } Q_{rr})$

- $I_d (100\%) = 50$ A
- $Q_{rr} (100\%) = 4.21$ µC
- $t_{Qrr} = 1.00$ µs

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

$(t_{Erec} = \text{integrating time for } E_{rec})$

- $P_{rec} (100\%) = 7.56$ kW
- $E_{rec} (100\%) = 0.52$ mJ
- $t_{Erec} = 1.00$ µs

---

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Measurement circuits

**Figure 10.**
Boost stage switching measurement circuit
## Ordering Code & Marking

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<th>Version</th>
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## Outline

**Solder pins**

**Press-fit pins**

**Tolerance of pinpositions**: ±0.5mm at the end of pins

**Dimension of coordinate axis is only offset without tolerance**
**Datasheet**

**Boost Switch**

**Boost Diode**

**Thermistor**

**Pinout**

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**Handling instruction**

Handling instructions for flow 0 packages see vincotech.com website.

**Package data**

Package data for flow 0 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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<th>Date:</th>
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<td>Correct NTC coordinates</td>
<td>27</td>
</tr>
</tbody>
</table>

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As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in labelling can be reasonably expected to result in significant injury to the user.

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.