flowMNPC 0

Features

- Three-level MNPC topology
- High reactive power capability
- Low inductive layout
- Improved LVRT capability
- Enhanced thermal performance

flow 0 12 mm housing

Target applications

- Industrial Drives
- Solar Inverters
- UPS

Types

- 10-FS12NMA080SH08-M260F98

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>Boost Switch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<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>
<td>$T_J = T_{Jmax}$</td>
<td>62</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak collector current</td>
<td>$I_{C,PK}$</td>
<td>limited by $T_{Jmax}$</td>
<td>320</td>
<td>A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>$P_{D}$</td>
<td>$T_J = T_{Jmax}$</td>
<td>101</td>
<td>W</td>
</tr>
<tr>
<td>Gate-emitter voltage</td>
<td>$V_{GES}$</td>
<td></td>
<td>±30</td>
<td>V</td>
</tr>
<tr>
<td>Short circuit ratings</td>
<td>$t_{SC}$</td>
<td>$V_{CE} = 15 , V$</td>
<td>2</td>
<td>$\mu s$</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>$T_{Jmax}$</td>
<td>$V_{CE} \leq 360 , V$</td>
<td>175</td>
<td>$^\circ C$</td>
</tr>
</tbody>
</table>
### 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>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Boost Diode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak repetitive reverse voltage</td>
<td>( V_{\text{RRM}} )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>Continuous (direct) forward current</td>
<td>( I_i )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>49</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak forward current</td>
<td>( I_{\text{PRM}} )</td>
<td>( I_i ) limited by ( T_{\text{max}} )</td>
<td>100</td>
<td>A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>( P_{\text{tot}} )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>87</td>
<td>W</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>( T_{\text{max}} )</td>
<td></td>
<td>175</td>
<td>(^\circ\text{C})</td>
</tr>
<tr>
<td><strong>Buck Switch</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collector-emitter voltage</td>
<td>( V_{\text{CES}} )</td>
<td></td>
<td>1200</td>
<td>V</td>
</tr>
<tr>
<td>Collector current</td>
<td>( I_C )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>77</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak collector current</td>
<td>( I_{\text{CRM}} )</td>
<td>( I_i ) limited by ( T_{\text{max}} )</td>
<td>240</td>
<td>A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>( P_{\text{tot}} )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>192</td>
<td>W</td>
</tr>
<tr>
<td>Gate-emitter voltage</td>
<td>( V_{\text{GES}} )</td>
<td>( V_{\text{GE}} = 15 , \text{V} ), ( V_{\text{cc}} = 800 , \text{V} ), ( T = 150 , ^\circ\text{C} )</td>
<td>±20</td>
<td>V</td>
</tr>
<tr>
<td>Short circuit ratings</td>
<td>( t_{\text{SC}} )</td>
<td></td>
<td>10</td>
<td>( \mu\text{s} )</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>( T_{\text{max}} )</td>
<td></td>
<td>175</td>
<td>(^\circ\text{C})</td>
</tr>
<tr>
<td><strong>Buck Diode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak repetitive reverse voltage</td>
<td>( V_{\text{RRM}} )</td>
<td></td>
<td>650</td>
<td>V</td>
</tr>
<tr>
<td>Continuous (direct) forward current</td>
<td>( I_i )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>58</td>
<td>A</td>
</tr>
<tr>
<td>Repetitive peak forward current</td>
<td>( I_{\text{PRM}} )</td>
<td>( I_i ) limited by ( T_{\text{max}} )</td>
<td>320</td>
<td>A</td>
</tr>
<tr>
<td>Total power dissipation</td>
<td>( P_{\text{tot}} )</td>
<td>( I_1 = T_{\text{max}} ), ( T = 80 , ^\circ\text{C} )</td>
<td>82</td>
<td>W</td>
</tr>
<tr>
<td>Maximum junction temperature</td>
<td>( T_{\text{max}} )</td>
<td></td>
<td>175</td>
<td>(^\circ\text{C})</td>
</tr>
</tbody>
</table>
Maximum Ratings

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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Condition</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Module Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Thermal Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Storage temperature</td>
<td>( T_{stg} )</td>
<td>-40...+125 °C</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td>Operation temperature under switching condition</td>
<td>( T_{op} )</td>
<td>-40…(( T_{jmax} ) - 25) °C</td>
<td></td>
<td>°C</td>
</tr>
<tr>
<td><strong>Isolation Properties</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Isolation voltage</td>
<td>( V_{isol} )</td>
<td>DC Test Voltage* ( t_p = 2 ) s</td>
<td>6000</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AC Voltage ( t_p = 1 ) min</td>
<td>2500</td>
<td>V</td>
</tr>
<tr>
<td>Creepage distance</td>
<td></td>
<td>min. 12,7 mm</td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>Clearance</td>
<td></td>
<td>8,72 mm</td>
<td></td>
<td>mm</td>
</tr>
<tr>
<td>Comparative Tracking Index</td>
<td>CTI</td>
<td>&gt; 200</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*100 % tested in production
## 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>V&lt;sub&gt;GE&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>V&lt;sub&gt;GS&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>V&lt;sub&gt;CE&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>V&lt;sub&gt;DS&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>V&lt;sub&gt;F&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>I&lt;sub&gt;C&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>I&lt;sub&gt;D&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>I&lt;sub&gt;F&lt;/sub&gt;</td>
<td></td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
<tr>
<td>T&lt;sub&gt;j&lt;/sub&gt;</td>
<td>°C</td>
<td></td>
<td>Min</td>
<td>Typ</td>
</tr>
</tbody>
</table>

### Boost Switch

**Static**

- **Gate-emitter threshold voltage**
  - \( V_{GE(th)} \)
  - Min: 5 V
  - Typ: 0.0571 V
  - Max: 25 V

- **Collector-emitter saturation voltage**
  - \( V_{CEsat} \)
  - Min: 15 V
  - Typ: 80 V
  - Max: 25 V

- **Collector-emitter cut-off current**
  - \( I_{CES} \)
  - Min: 0 mA
  - Typ: 650 mA
  - Max: 25 mA

- **Gate-emitter leakage current**
  - \( I_{GES} \)
  - Min: 30 nA
  - Typ: 0 nA
  - Max: 250 nA

- **Internal gate resistance**
  - \( r_g \)
  - None

- **Input capacitance**
  - \( C_{ins} \)
  - \( f = 1 \text{ Mhz} \)
  - Min: 0 pF
  - Typ: 30 pF
  - Max: 25 pF

- **Output capacitance**
  - \( C_{oes} \)
  - \( = 184 \text{ pF} \)

- **Reverse transfer capacitance**
  - \( C_{res} \)
  - Min: 79 pF

- **Gate charge**
  - \( Q_g \)
  - Min: 15 nC
  - Typ: 400 nC
  - Max: 80 nC

### Thermal

- **Thermal resistance junction to sink**
  - \( R_{th(j-s)} \)
  - \( \lambda \text{ paste} = 3.4 \text{ W/mK} \)
  - Min: 0.94 K/W

### Dynamic

- **Turn-on delay time**
  - \( t_{on} \)
  - Min: 5 nS
  - Typ: 58 nS
  - Max: 58 nS

- **Rise time**
  - \( t_r \)
  - Min: 5 nS
  - Typ: 6 nS

- **Turn-off delay time**
  - \( t_{off} \)
  - Min: 6 nS
  - Typ: 92 nS

- **Fall time**
  - \( t_f \)
  - Min: 15 nS
  - Typ: 54 nS

- **Turn-on energy (per pulse)**
  - \( E_{on} \)
  - \( Q_{RFF} = 5.6 \mu C \)
  - Min: 0.263 mWs
  - Typ: 0.368 mWs
  - Max: 0.420 mWs

- **Turn-off energy (per pulse)**
  - \( E_{off} \)
  - \( Q_{RFF} = 7.6 \mu C \)
  - Min: 0.758 mWs
  - Typ: 1.22 mWs
  - Max: 1.33 mWs

---

Copyright Vincotech
### Characteristic Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boost Diode</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fStatic</td>
<td>$f_{\text{Static}}$</td>
<td>Forward voltage</td>
<td>$V_F$</td>
<td>50 25 125 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reverse leakage current</td>
<td>$I_R$</td>
<td>1200 25</td>
</tr>
<tr>
<td>Thermal</td>
<td></td>
<td>Thermal resistance junction to sink</td>
<td>$R_{\text{hs}}$ = 3.4 W/mK (PSX)</td>
<td></td>
</tr>
<tr>
<td>Dynamic</td>
<td></td>
<td>Peak recovery current</td>
<td>$I_{\text{RMS}}$</td>
<td>25 125 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reverse recovery time</td>
<td>$t_{rr}$</td>
<td>25 125 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Recovered charge</td>
<td>$Q_i$</td>
<td>25 125 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reverse recovered energy</td>
<td>$E_{\text{rec}}$</td>
<td>25 125 150</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peak rate of fall of recovery current</td>
<td>$(dI/dt)_{\text{Max}}$</td>
<td>25 125 150</td>
</tr>
</tbody>
</table>
### 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>Static</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate-emitter threshold voltage</td>
<td>$V_{GE(th)}$</td>
<td>$V_{CE} = 0$</td>
<td>0,003</td>
<td>25</td>
</tr>
<tr>
<td>Collector-emitter saturation voltage</td>
<td>$V_{CE\text{sat}}$</td>
<td></td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>Collector-emitter cut-off current</td>
<td>$I_{\text{ces}}$</td>
<td></td>
<td>0</td>
<td>1200</td>
</tr>
<tr>
<td>Gate-emitter leakage current</td>
<td>$I_{\text{ges}}$</td>
<td></td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Internal gate resistance</td>
<td>$r_g$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input capacitance</td>
<td>$C_{\text{in}}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Output capacitance</td>
<td>$C_{\text{out}}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reverse transfer capacitance</td>
<td>$C_{\text{res}}$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gate charge</td>
<td>$Q_t$</td>
<td></td>
<td>15</td>
<td>960</td>
</tr>
<tr>
<td>Thermal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{\text{j-s}}$</td>
<td>$\lambda_{\text{paste}} = 3,4$ W/mK (PSX)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dynamic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on delay time</td>
<td>$t_{\text{d(on)}}$</td>
<td>$R_{\text{on}} = 4$ Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rise time</td>
<td>$t_r$</td>
<td>$R_{\text{on}} = 4$ Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-off delay time</td>
<td>$t_{\text{d(off)}}$</td>
<td>$R_{\text{off}} = 4$ Ω</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall time</td>
<td>$t_f$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-on energy (per pulse)</td>
<td>$E_{\text{on}}$</td>
<td>$\Delta_{\text{PNO}} = 2$ μC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Turn-off energy (per pulse)</td>
<td>$E_{\text{off}}$</td>
<td>$\Delta_{\text{PNO}} = 3,6$ μC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## 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 Diode</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Static</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forward voltage</td>
<td>$V_i$</td>
<td>80</td>
<td>25</td>
<td>125</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1,55</td>
<td>1,62</td>
</tr>
<tr>
<td>Reverse leakage current</td>
<td>$I_r$</td>
<td>650</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td><strong>Thermal</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermal resistance junction to sink</td>
<td>$R_{th(j-s)}$</td>
<td>(PSX)</td>
<td>1,15</td>
<td>K/W</td>
</tr>
<tr>
<td><strong>Dynamic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak recovery current</td>
<td>$I_{RM}$</td>
<td>±15</td>
<td>350</td>
<td>82</td>
</tr>
<tr>
<td>Reverse recovery time</td>
<td>$t_{rr}$</td>
<td></td>
<td>25</td>
<td>42</td>
</tr>
<tr>
<td>Recovered charge</td>
<td>$Q_r$</td>
<td></td>
<td>25</td>
<td>2,04</td>
</tr>
<tr>
<td>Reverse recovered energy</td>
<td>$E_{rec}$</td>
<td></td>
<td>25</td>
<td>0,314</td>
</tr>
<tr>
<td>Peak rate of fall of recovery current</td>
<td>$(di/dt)_{MAX}$</td>
<td></td>
<td>25</td>
<td>6568</td>
</tr>
<tr>
<td><strong>Thermistor</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated resistance</td>
<td>$R$</td>
<td>25</td>
<td>22</td>
<td>kΩ</td>
</tr>
<tr>
<td>Deviation of $R_{diss}$</td>
<td>$\Delta R$</td>
<td>100</td>
<td>-5</td>
<td>5</td>
</tr>
<tr>
<td>Power dissipation</td>
<td>$P$</td>
<td>25</td>
<td>5</td>
<td>mW</td>
</tr>
<tr>
<td>Power dissipation constant</td>
<td></td>
<td>25</td>
<td>1,5</td>
<td>mW/K</td>
</tr>
<tr>
<td>B-value</td>
<td>$R_{B(25)}$</td>
<td>Tol. ±1 %</td>
<td>25</td>
<td>3962</td>
</tr>
<tr>
<td>B-value</td>
<td>$R_{B(125)}$</td>
<td>Tol. ±1 %</td>
<td>25</td>
<td>4000</td>
</tr>
<tr>
<td>Vincotech NTC Reference</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Vincotech datasheet 17 Jul. 2019 / Revision 1
Boost Switch Characteristics

**Figure 1.** Typical output characteristics

$I_C = f(V_{CE})$

**Figure 2.** Typical output characteristics

$I_C = f(V_{CE})$

**Figure 3.** Typical transfer characteristics

$I_C = f(V_{GE})$

**Figure 4.** Transient thermal impedance as function of pulse duration

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

---

$t_p = 250 \mu s$

$V_{CE} = 15 V$

$T_j: 25^\circ C$

$125^\circ C$

$150^\circ C$

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

$t_p = 100 \mu s$

$V_{CE} = 10 V$

$25^\circ C$

$125^\circ C$

$150^\circ C$

---

$R_{th(j-s)} = 0.94 \text{ K/W}$

IGBT thermal model values

$R$ (K/W) $\tau$ (s)

6.31E-02 2.59E+00

1.02E-01 4.41E-01

4.73E-01 8.37E-02

1.96E-01 2.52E-02

6.91E-02 4.70E-03

3.59E-02 4.42E-04
Boost Switch Characteristics

**Gate voltage vs gate charge**

$$V_{GE} = f(Q_G)$$

**Safe operating area**

$$I_C = f(V_{CE})$$

- $I_C = 80$ A
- $D = \text{single pulse}$
- $T_j = 25$ °C
- $V_{GE} = \pm 15$ V
- $T_i = T_{j max}$

---

**Figure 5.**

- $I_C$ vs $Q_G$
- $V_{CE}$ = 400 V

**Figure 6.**

- $I_C$ vs $V_{GE}$
- $V_{GE}$ = 0 to 1000 V
- $V_{CE}$ = 0 to 1000 V
- $100\mu s$ to $100 ms$
- $10 ms$ to $100 ms$
- $1 ms$ to $100 ms$
- $100 ms$ to $1000 ms$
- $1000 ms$
Boost Diode Characteristics

**figure 1.** Typical forward characteristics

$I_F = f(V_F)$

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

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

$t_p = 250 \mu s$

$T_j: 25 \, ^\circ C$

$125 \, ^\circ C$

$150 \, ^\circ C$

$R_{th(j-s)} = 1.09 \, K/W$

FWD thermal model values

<table>
<thead>
<tr>
<th>$R$ (K/W)</th>
<th>$\tau$ (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.05E-02</td>
<td>7.09E+00</td>
</tr>
<tr>
<td>8.82E-02</td>
<td>9.93E-01</td>
</tr>
<tr>
<td>2.80E-01</td>
<td>1.18E-01</td>
</tr>
<tr>
<td>4.48E-01</td>
<td>3.26E-02</td>
</tr>
<tr>
<td>1.45E-01</td>
<td>5.44E-03</td>
</tr>
<tr>
<td>9.23E-02</td>
<td>5.22E-04</td>
</tr>
</tbody>
</table>
Buck Switch Characteristics

**Figure 1.** Typical output characteristics

- $I_C = f(V_{CE})$
- $t_p = 250 \mu s$
- $V_{CE} = 15 \text{ V}$
- $T_j = 125^\circ \text{C}$
- $T_j = 150^\circ \text{C}$
- $V_{CE}$ from 7 V to 17 V in steps of 1 V

**Figure 2.** Typical output characteristics

- $I_C = f(V_{CE})$
- $t_p = 250 \mu s$
- $V_{CE} = 15 \text{ V}$
- $T_j = 125^\circ \text{C}$
- $T_j = 150^\circ \text{C}$
- $V_{CE}$ from 7 V to 17 V in steps of 1 V

**Figure 3.** Typical transfer characteristics

- $I_C = f(V_{GE})$
- $t_p = 100 \mu s$
- $V_{CE} = 10 \text{ V}$
- $T_j = 125^\circ \text{C}$
- $T_j = 150^\circ \text{C}$

**Figure 4.** Transient thermal impedance as function of pulse duration

- $Z_{th(j-s)} = f(t_p)$
- $D = \frac{t_p}{\tau}$
- $R_{th(j-s)} = 0.50 \text{ K/W}$

**IGBT thermal model values**

<table>
<thead>
<tr>
<th>$R$ (K/W)</th>
<th>$\tau$ (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.04E-02</td>
<td>2.14E+00</td>
</tr>
<tr>
<td>7.93E-02</td>
<td>4.50E-01</td>
</tr>
<tr>
<td>2.54E-01</td>
<td>9.48E-02</td>
</tr>
<tr>
<td>6.61E-02</td>
<td>3.38E-02</td>
</tr>
<tr>
<td>2.51E-02</td>
<td>5.63E-03</td>
</tr>
<tr>
<td>1.59E-02</td>
<td>6.08E-04</td>
</tr>
</tbody>
</table>
Buck Switch Characteristics

**Figure 5.** IGBT
Gate voltage vs gate charge

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

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

\[ I_C = 80 \, A \]

**Figure 6.** IGBT
Safe operating area

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

\[ V_{CE} \leq 600 \, V \]

**Figure 7.** IGBT
Short circuit duration as a function of \( V_{GE} \)

\[ t_{SPC} = f(V_{GE}) \]

**Figure 8.** IGBT
Typical short circuit current as a function of \( V_{GE} \)

\[ I_{SC} = f(V_{GE}) \]
Buck Diode Characteristics

Typical forward characteristics

\[ I_F = f(V_F) \]

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

\[ t_p = 250 \text{ } \mu\text{s} \]

\[ D = \frac{t_p}{T} \]

FWD thermal model values

<table>
<thead>
<tr>
<th>R (K/W)</th>
<th>( \tau ) (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5,84E-02</td>
<td>5,35E-01</td>
</tr>
<tr>
<td>1,14E-01</td>
<td>2,04E-02</td>
</tr>
<tr>
<td>5,44E-01</td>
<td>4,10E-03</td>
</tr>
<tr>
<td>9,87E-02</td>
<td>3,19E-04</td>
</tr>
</tbody>
</table>

Thermistor Characteristics

Typical NTC characteristic as a function of temperature

\[ R = f(T) \]

NTC-typical temperature characteristic

<table>
<thead>
<tr>
<th>R (Ω)</th>
<th>25</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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

\[ V_{CE} = 350 \text{ V} \]
\[ V_{GE} = \pm 15 \text{ V} \]
\[ R_{gon} = 4 \Omega \]
\[ T_j = 25, 125, 150 \text{ °C} \]

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

\[ E = f(R_{g}) \]

With an inductive load at

\[ V_{CE} = 350 \text{ V} \]
\[ V_{GE} = \pm 15 \text{ V} \]
\[ I_c = 55 \text{ A} \]
\[ T_j = 25, 125, 150 \text{ °C} \]

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

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

With an inductive load at

\[ V_{CE} = 350 \text{ V} \]
\[ V_{GE} = \pm 15 \text{ V} \]
\[ R_{gon} = 4 \Omega \]
\[ T_j = 25, 125, 150 \text{ °C} \]

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

\[ E_{rec} = f(R_{g}) \]

With an inductive load at

\[ V_{CE} = 350 \text{ V} \]
\[ V_{GE} = \pm 15 \text{ V} \]
\[ I_c = 55 \text{ A} \]
\[ T_j = 25, 125, 150 \text{ °C} \]
Boost Switching Characteristics

**Figure 5.** IGBT

Typical switching times as a function of collector current

\[ t = f(I_C) \]

With an inductive load at

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

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

\[ I_C = 55 \, A \]

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

**Figure 6.** IGBT

Typical switching times as a function of gate resistor

\[ t = f(R_g) \]

With an inductive load at

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

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

\[ I_C = 55 \, A \]

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

**Figure 7.** FWD

Typical reverse recovery time as a function of collector current

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

With an inductive load at

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

\[ V_{CE} = 150 \, V \]

\[ I_C = 15 \, A \]

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

**Figure 8.** FWD

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

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

With an inductive load at

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

\[ V_{CE} = 150 \, V \]

\[ I_C = 15 \, A \]
Boost Switching Characteristics

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

\[ Q_r = f(I_C) \]

With an inductive load at
\[ V_{CI} = 350 \text{ V} \]
\[ V_{CI} = \pm15 \text{ V} \]
\[ R_{gon} = 4 \text{ } \Omega \]

\[ T_j = 25 \text{ } ^\circ \text{C} \]
\[ T_j = 125 \text{ } ^\circ \text{C} \]

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

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

With an inductive load at
\[ V_{CI} = 350 \text{ V} \]
\[ V_{CI} = \pm15 \text{ V} \]
\[ I_g = 55 \text{ A} \]

\[ T_j = 25 \text{ } ^\circ \text{C} \]
\[ T_j = 125 \text{ } ^\circ \text{C} \]

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

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

With an inductive load at
\[ V_{CI} = 350 \text{ V} \]
\[ V_{CI} = \pm15 \text{ V} \]
\[ R_{gon} = 4 \text{ } \Omega \]

\[ T_j = 25 \text{ } ^\circ \text{C} \]
\[ T_j = 125 \text{ } ^\circ \text{C} \]

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

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

With an inductive load at
\[ V_{CI} = 350 \text{ V} \]
\[ V_{CI} = \pm15 \text{ V} \]
\[ I_g = 55 \text{ A} \]

\[ T_j = 25 \text{ } ^\circ \text{C} \]
\[ T_j = 125 \text{ } ^\circ \text{C} \]
Boost Switching Characteristics

**Figure 13.**
Typical rate of fall of forward and reverse recovery current as a function of collector current $\frac{di_F}{dt}$, $\frac{di_{rr}}{dt} = f(I_C)$.

<table>
<thead>
<tr>
<th>$V_{CE}$</th>
<th>$I_C$</th>
<th>$T_j$</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 V</td>
<td>55 A</td>
<td>25 °C</td>
</tr>
<tr>
<td>±15 V</td>
<td>4 Ω</td>
<td>125 °C</td>
</tr>
<tr>
<td>±15 V</td>
<td>4 Ω</td>
<td>150 °C</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>$R_{gon}$</th>
<th>$R_{goff}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 Ω</td>
<td>4 Ω</td>
</tr>
</tbody>
</table>

With an inductive load at $V_{CE} = 350$ V, $T_j = 125$ °C.

**Figure 14.**
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn-on gate resistor $\frac{di_F}{dt}$, $\frac{di_{rr}}{dt} = f(R_{gon})$.

<table>
<thead>
<tr>
<th>$V_{CE}$</th>
<th>$I_C$</th>
<th>$T_j$</th>
</tr>
</thead>
<tbody>
<tr>
<td>350 V</td>
<td>55 A</td>
<td>25 °C</td>
</tr>
<tr>
<td>±15 V</td>
<td>4 Ω</td>
<td>125 °C</td>
</tr>
<tr>
<td>±15 V</td>
<td>4 Ω</td>
<td>150 °C</td>
</tr>
</tbody>
</table>

**Figure 15.**
IGBT Reverse bias safe operating area $I_C = f(V_{CE})$.

<table>
<thead>
<tr>
<th>$V_{CE}$</th>
<th>$I_C$</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 V</td>
<td>0 A</td>
</tr>
<tr>
<td>100 V</td>
<td>180 A</td>
</tr>
<tr>
<td>200 V</td>
<td>160 A</td>
</tr>
<tr>
<td>300 V</td>
<td>140 A</td>
</tr>
<tr>
<td>400 V</td>
<td>120 A</td>
</tr>
<tr>
<td>500 V</td>
<td>100 A</td>
</tr>
<tr>
<td>600 V</td>
<td>80 A</td>
</tr>
<tr>
<td>700 V</td>
<td>60 A</td>
</tr>
</tbody>
</table>

With an inductive load at $V_{CE} = 350$ V, $T_j = 125$ °C.

Copyright Vincotech
Boost Switching Definitions

General conditions

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_i$</td>
<td>125 °C</td>
</tr>
<tr>
<td>$R_{gs}$</td>
<td>4 Ω</td>
</tr>
<tr>
<td>$R_{ds}$</td>
<td>4 Ω</td>
</tr>
</tbody>
</table>

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

- $V_{CE}(0\%)$ = -15 V
- $V_{CE}(100\%)$ = 15 V
- $I_C(100\%)$ = 55 A
- $t_{doff}$ = 89 ns

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

- $V_{CE}(0\%)$ = -15 V
- $V_{CE}(100\%)$ = 15 V
- $I_C(100\%)$ = 55 A
- $t_{don}$ = 58 ns

Figure 3. Turn-off Switching Waveforms & definition of $t_f$.

- $V_{CE}(0\%)$ = -15 V
- $V_{CE}(100\%)$ = 15 V
- $I_C(100\%)$ = 55 A
- $t_f$ = 44 ns

Figure 4. Turn-on Switching Waveforms & definition of $t_r$.

- $V_{CE}(0\%)$ = -15 V
- $V_{CE}(100\%)$ = 15 V
- $I_C(100\%)$ = 55 A
- $t_r$ = 5 ns
Boost Switching Characteristics

**Figure 5.** FWD

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

- \( V_F \) (100%) = 350 V
- \( I_F \) (100%) = 55 A
- \( I_{\text{RMS(100%)}} \) = 149 A
- \( t_{rr} \) = 112 ns

**Figure 6.** FWD

Turn-on Switching Waveforms & definition of \( t_{Qr} \) (Integrating time for \( Q_r \))

- \( I_F \) (100%) = 55 A
- \( Q_r \) (100%) = 0 µC
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

- \( V_C = 350 \text{ V} \)
- \( V_I = \pm 15 \text{ V} \)
- \( R_g = 4 \text{ Ω} \)

25 °C

125 °C

150 °C

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

\[ E = f(R_g) \]

With an inductive load at

- \( V_C = 350 \text{ V} \)
- \( V_I = \pm 15 \text{ V} \)
- \( I_C = 55 \text{ A} \)

25 °C

125 °C

150 °C

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

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

With an inductive load at

- \( V_C = 350 \text{ V} \)
- \( V_I = \pm 15 \text{ V} \)
- \( R_g = 4 \text{ Ω} \)

25 °C

125 °C

150 °C

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

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

With an inductive load at

- \( V_C = 350 \text{ V} \)
- \( V_I = \pm 15 \text{ V} \)
- \( I_C = 55 \text{ A} \)

25 °C

125 °C

150 °C

---

Copyright Vincotech
Buck Switching Characteristics

**Figure 5.** IGBT

Typical switching times as a function of collector current

$t = \frac{1}{f}$

With an inductive load at:

- $T_j = 150 \, ^\circ C$
- $V_{CE} = 350 \, V$
- $V_{GS} = 4 \, V$
- $R_{on} = 4 \, \Omega$

**Figure 6.** IGBT

Typical switching times as a function of gate resistor

$t = \frac{1}{f}$

With an inductive load at:

- $T_j = 150 \, ^\circ C$
- $V_{CE} = 350 \, V$
- $V_{GS} = 4 \, V$
- $I_{on} = 55 \, A$

**Figure 7.** FWD

Typical reverse recovery time as a function of collector current

$t_{rr} = \frac{1}{f}$

With an inductive load at:

- $T_j = 25 \, ^\circ C$
- $V_{CE} = 350 \, V$
- $V_{GS} = 4 \, V$
- $I_{on} = 55 \, A$

**Figure 8.** FWD

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

$t_{rr} = \frac{1}{f}$

With an inductive load at:

- $T_j = 25 \, ^\circ C$
- $V_{CE} = 350 \, V$
- $V_{GS} = 4 \, V$
- $I_{on} = 55 \, A$
Buck Switching Characteristics

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

\[ Q_r = f(I_C) \]

With an inductive load at:
- \( V_{CE} = 350 \text{ V} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( R_{gon} = 4 \text{ \( \Omega \)} \)

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

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

With an inductive load at:
- \( V_{CE} = 350 \text{ V} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( I_g = 55 \text{ A} \)

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

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

With an inductive load at:
- \( V_{CE} = 350 \text{ V} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( R_{gon} = 4 \text{ \( \Omega \)} \)

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

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

With an inductive load at:
- \( V_{CE} = 350 \text{ V} \)
- \( V_{GE} = \pm 15 \text{ V} \)
- \( I_g = 55 \text{ A} \)
Buck Switching Characteristics

**Figure 13.** FWD
Typical rate of fall of forward and reverse recovery current as a function of collector current
\( \frac{dI_F}{dt}, \frac{dI_{rr}}{dt} = f(I_C) \)

With an inductive load at
- \( V_C = 350 \) V
- \( T_J = 125 \) °C
- \( V_C = \pm 15 \) V
- \( T_J = 150 \) °C
- \( R_{gon} = 4 \) Ω

**Figure 14.** FWD
Typical rate of fall of forward and reverse recovery current as a function of IGBT turn-on gate resistor
\( \frac{dI_F}{dt}, \frac{dI_{rr}}{dt} = f(R_{gon}) \)

With an inductive load at
- \( V_C = 350 \) V
- \( T_J = 125 \) °C
- \( V_C = \pm 15 \) V
- \( T_J = 150 \) °C
- \( I_C = 55 \) A

**Figure 15.** IGBT
Reverse bias safe operating area
\( I_C = f(V_{CE}) \)

At
- \( T_J = 125 \) °C
- \( R_{gas} = 4 \) Ω
- \( R_{psh} = 4 \) Ω
Buck Switching Definitions

General conditions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$T_t$</td>
<td>125 °C</td>
</tr>
<tr>
<td>$R_{Gon}$</td>
<td>4 Ω</td>
</tr>
<tr>
<td>$R_{Goff}$</td>
<td>4 Ω</td>
</tr>
</tbody>
</table>

**Figure 1.** IGBT

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

- $V_{CE}(0\%) = -15 \text{ V}$
- $V_{CE}(100\%) = 15 \text{ V}$
- $I_{C}(100\%) = 55 \text{ A}$
- $t_{doff} = 235 \text{ ns}$

**Figure 2.** IGBT

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

- $V_{CE}(0\%) = -15 \text{ V}$
- $V_{CE}(100\%) = 15 \text{ V}$
- $I_{C}(100\%) = 55 \text{ A}$
- $t_{don} = 78 \text{ ns}$

**Figure 3.** IGBT

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

- $V_{CE}(10\%) = 350 \text{ V}$
- $I_{C}(10\%) = 55 \text{ A}$
- $t_{f} = 89 \text{ ns}$

**Figure 4.** IGBT

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

- $V_{CE}(10\%) = 350 \text{ V}$
- $I_{C}(10\%) = 55 \text{ A}$
- $t_{r} = 15 \text{ ns}$
Buck Switching Characteristics

**Figure 5.** FWD

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

- $V_F$ (100%) = 350 V
- $I_F$ (100%) = 55 A
- $I_RRM$ (10%) = 84 A
- $I_RRM$ (90%) = 84 A
- $I_RRM$ (100%) = 84 A
- $t_{rr}$ = 109 ns

**Figure 6.** FWD

Turn-on Switching Waveforms & definition of $t_{Qr}$ (Integrating time for $Q_r$)

- $I_F$ (100%) = 55 A
- $Q_r$ (100%) = 0 μC
**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>
</tr>
</thead>
<tbody>
<tr>
<td>without thermal paste 12 mm housing with solder pins</td>
<td>10-FS12NMA080SH08-M260F98</td>
<td>WWYY</td>
<td>UL VIN</td>
<td>LLLLL</td>
<td>SSSSS</td>
</tr>
<tr>
<td>with thermal paste 12 mm housing with solder pins</td>
<td>10-FS12NMA080SH08-M260F98-/3/</td>
<td>WWYY</td>
<td>UL VIN</td>
<td>LLLLL</td>
<td>SSSSS</td>
</tr>
</tbody>
</table>

**Pin table**

<table>
<thead>
<tr>
<th>Pin</th>
<th>X</th>
<th>Y</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>33.6</td>
<td>0</td>
<td>S2</td>
</tr>
<tr>
<td>2</td>
<td>30.8</td>
<td>0</td>
<td>G2</td>
</tr>
<tr>
<td>3</td>
<td>22</td>
<td>0</td>
<td>-DC</td>
</tr>
<tr>
<td>4</td>
<td>19.2</td>
<td>0</td>
<td>-DC</td>
</tr>
<tr>
<td>5</td>
<td>10.1</td>
<td>0</td>
<td>GND</td>
</tr>
<tr>
<td>6</td>
<td>2.8</td>
<td>0</td>
<td>S4</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>0</td>
<td>G4</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>7.1</td>
<td>Line</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>9.9</td>
<td>Line</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>12.7</td>
<td>Line</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>15.5</td>
<td>Line</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>22.6</td>
<td>G3</td>
</tr>
<tr>
<td>13</td>
<td>2.8</td>
<td>22.6</td>
<td>S3</td>
</tr>
<tr>
<td>14</td>
<td>10.1</td>
<td>22.6</td>
<td>GND</td>
</tr>
<tr>
<td>15</td>
<td>19.2</td>
<td>22.6</td>
<td>+DC</td>
</tr>
<tr>
<td>16</td>
<td>22</td>
<td>22.6</td>
<td>+DC</td>
</tr>
<tr>
<td>17</td>
<td>30.8</td>
<td>22.6</td>
<td>G1</td>
</tr>
<tr>
<td>18</td>
<td>33.6</td>
<td>22.6</td>
<td>S1</td>
</tr>
<tr>
<td>19</td>
<td>33.6</td>
<td>14.8</td>
<td>NTC1</td>
</tr>
<tr>
<td>20</td>
<td>33.6</td>
<td>8.2</td>
<td>NTC2</td>
</tr>
<tr>
<td>21</td>
<td></td>
<td></td>
<td>Not assembled</td>
</tr>
<tr>
<td>22</td>
<td></td>
<td></td>
<td>Not assembled</td>
</tr>
</tbody>
</table>

**Outline**

- Tolerance of dimensions: ±0.5mm at the end of pins.
- Dimension of coordinate axis is only referred without tolerance.

---

**Copyright Vincotech**

17 Jul. 2019 / Revision 1
### Identification

<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>T3, T4</td>
<td>IGBT</td>
<td>650 V</td>
<td>80 A</td>
<td>Boost Switch</td>
<td></td>
</tr>
<tr>
<td>D1, D2</td>
<td>FWD</td>
<td>1200 V</td>
<td>50 A</td>
<td>Boost Diode</td>
<td></td>
</tr>
<tr>
<td>T1, T2</td>
<td>IGBT</td>
<td>1200 V</td>
<td>80 A</td>
<td>Buck Switch</td>
<td></td>
</tr>
<tr>
<td>D4, D3</td>
<td>FWD</td>
<td>650 V</td>
<td>80 A</td>
<td>Buck Diode</td>
<td></td>
</tr>
<tr>
<td>NTC</td>
<td>Thermistor</td>
<td></td>
<td></td>
<td>Thermistor</td>
<td></td>
</tr>
</tbody>
</table>
**Packaging instruction**

<table>
<thead>
<tr>
<th>Standard packaging quantity (SPQ)</th>
<th>&gt;SPQ</th>
<th>Standard</th>
<th>&lt;SPQ</th>
<th>Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>135</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.

**DISCLAIMER**

The information, specifications, procedures, methods and recommendations herein (together “information”) are presented by Vincotech to reader in good faith, are believed to be accurate and reliable, but may well be incomplete and/or not applicable to all conditions or situations that may exist or occur. Vincotech reserves the right to make any changes without further notice to any products to improve reliability, function or design. No representation, guarantee or warranty is made to reader as to the accuracy, reliability or completeness of said information or that the application or use of any of the same will avoid hazards, accidents, losses, damages or injury of any kind to persons or property or that the same will not infringe third parties rights or give desired results. It is reader’s sole responsibility to test and determine the suitability of the information and the product for reader’s intended use.

**LIFE SUPPORT POLICY**

Vincotech products are not authorised for use as critical components in life support devices or systems without the express written approval of Vincotech.

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.