PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Key Features
- Industry standard case dimensions
  50.8 x 25.4 x 11.9 mm (2 x 1 x 0.47 in)
- High Efficiency up to 91%
- 2250 Vdc input to output isolation
- Meets functional insulation and safety requirements according to IEC/UL 62368
- Complies with EN 45545-2 standard

General Characteristics
- Input under voltage shutdown
- Remote control
- Output over voltage protection
- Over temperature protection
- Output short-circuit protection
- Output voltage adjust function

Safety Approvals
Design for Environment
Meets requirements in high-temperature lead-free soldering processes.

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Ordering Information

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<th>Output</th>
</tr>
</thead>
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<tr>
<td>PKE 8410A PIP</td>
<td>3.3 V, 10 A / 33 W</td>
</tr>
<tr>
<td>PKE 8411A PIP</td>
<td>5 V, 8 A / 40 W</td>
</tr>
<tr>
<td>PKE 8413A PIP</td>
<td>12 V, 3.33 A / 40 W</td>
</tr>
<tr>
<td>PKE 8415A PIP</td>
<td>15 V, 2.67 A / 40 W</td>
</tr>
</tbody>
</table>

Product number and Packaging

<table>
<thead>
<tr>
<th>Options</th>
<th>PKE84XXXA n1n2n3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>n1</td>
</tr>
<tr>
<td>Remote Control logic</td>
<td>n2</td>
</tr>
<tr>
<td>Case Type</td>
<td>n3</td>
</tr>
</tbody>
</table>

Options Description

- n1: PI Through hole
- n2: P Positive
- n3: HS No heat sink

Example: a through hole mounted product with positive logic, no heat sink, tray packaging would be PKE 84XX PIP.

* Standard variant (i.e. no option selected).

General Information

Reliability

The failure rate ($\lambda$) and mean time between failures (MTBF$= 1/\lambda$) is calculated at max output power and an operating ambient temperature ($T_A$) of +40°C. Flex uses Telcordia SR-332 Issue 3 Method 1 to calculate the mean steady-state failure rate and standard deviation ($\sigma$).

Telcordia SR-332 Issue 3 also provides techniques to estimate the upper confidence levels of failure rates based on the mean and standard deviation.

<table>
<thead>
<tr>
<th>Mean steady-state failure rate, $\lambda$</th>
<th>Std. deviation, $\sigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>258.016nFailures/h</td>
<td>103.291nFailures/h</td>
</tr>
</tbody>
</table>

MTBF (mean value) for the PKE841XA series = 3.87Mh.
MTBF at 90% confidence level = 2.52Mh

Compatibility with RoHS requirements

The products are compatible with the relevant clauses and requirements of the RoHS directive 2011/65/EU and have a maximum concentration value of 0.1% by weight in homogeneous materials for lead, mercury, hexavalent chromium, PBB and PBDE and of 0.01% by weight in homogeneous materials for cadmium.

Exemptions in the RoHS directive utilized in Flex products are found in the Statement of Compliance document.

Flex fulfills and will continuously fulfill all its obligations under regulation (EC) No 1907/2006 concerning the registration, evaluation, authorization and restriction of chemicals (REACH) as they enter into force and is through product materials declarations preparing for the obligations to communicate information on substances in the products.

Quality Statement

The products are designed and manufactured in an industrial environment where quality systems and methods like ISO 9000, Six Sigma, and SPC are intensively in use to boost the continuous improvements strategy. Infant mortality or early failures in the products are screened out and they are subjected to an ATE-based final test. Conservative design rules, design reviews and product qualifications, plus the high competence of an engaged work force, contribute to the high quality of the products.

Warranty

Warranty period and conditions are defined in Flex General Terms and Conditions of Sale.

Limitation of Liability

Flex does not make any other warranties, expressed or implied including any warranty of merchantability or fitness for a particular purpose (including, but not limited to, use in life support applications, where malfunctions of product can cause injury to a person’s health or life).

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Safety Specification

General information
Flex Power DC/DC converters and DC/DC regulators are designed in accordance with the safety standards IEC 62368-1, EN 62368-1 and UL 62368-1 Audio/video, information and communication technology equipment - Part 1: Safety requirements

IEC/EN/UL 62368-1 contains requirements to prevent injury or damage due to the following hazards:

- Electrical shock
- Electrically-caused fire
- Injury caused by hazardous substances
- Mechanically-caused injury
- Skin burn
- Radiation-caused injury

On-board DC/DC converters, Power interface modules and DC/DC regulators are defined as component power supplies. As components they cannot comply with the provisions of any safety requirements without “conditions of acceptability”. Clearance between conductors and between conductive parts of the component power supply and conductors on the board in the final product must meet the applicable safety requirements. Certain conditions of acceptability apply for component power supplies with limited stand-off (see Mechanical Information for further information). It is the responsibility of the installer to ensure that the final product housing these components complies with the requirements of all applicable safety standards and regulations for the final product.

Component power supplies for general use shall comply with the requirements in IEC/EN/UL 62368-1. Product related standards, e.g. IEEE 802.3af Power over Ethernet, and ETS-300132-2 Power interface at the input to telecom equipment, operated by direct current (dc) are based on IEC/EN/UL 60950-1 with regards to safety.

Flex Power DC/DC converters, Power interface modules and DC/DC regulators are UL 62368-1 recognized and certified in accordance with EN 62368-1. The flammability rating for all construction parts of the products meet requirements for V-0 class material according to IEC 60695-11-10, Fire hazard testing, test flames – 50 W horizontal and vertical flame test methods.

Isolated DC/DC converters & Power interface modules
The product may provide basic or functional insulation between input and output according to IEC/EN/UL 62368-1 (see Safety Certificate), different conditions shall be met if the output of a basic or a functional insulated product shall be considered as ES1 energy source.

For basic insulated products (see Safety Certificate) the output is considered as ES1 energy source if one of the following conditions is met:

- The input source provides supplementary or double or reinforced insulation from the AC mains according to IEC/EN/UL 62368-1.
- The input source provides functional or basic insulation from the AC mains and the product's output is reliably connected to protective earth according to IEC/EN/UL 62368-1.

For functional insulated products (see Safety Certificate) the output is considered as ES1 energy source if one of the following conditions is met:

- The input source provides double or reinforced insulation from the AC mains according to IEC/EN/UL 62368-1.
- The input source provides basic or supplementary insulation from the AC mains and the product's output is reliably connected to protective earth according to IEC/EN/UL 62368-1.
- The input source is reliably connected to protective earth and provides basic or supplementary insulation according to IEC/EN/UL 62368-1 and the maximum input source voltage is 60 Vdc.

Galvanic isolation between input and output is verified in an electric strength test and the isolation voltage (V iso) meets the voltage strength requirement for basic insulation according to IEC/EN/UL 62368-1.

It is recommended to use a slow blow fuse at the input of each DC/DC converter. If an input filter is used in the circuit the fuse should be placed in front of the input filter. In the rare event of a component problem that imposes a short circuit on the input source, this fuse will provide the following functions:

- Isolate the fault from the input power source so as not to affect the operation of other parts of the system
- Protect the distribution wiring from excessive current and power loss thus preventing hazardous overheating
Absolute Maximum Ratings

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>T_{θH} Operating Temperature (see Thermal Consideration section)</td>
<td>-40</td>
<td>+115</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>T_{θS} Storage temperature</td>
<td>-55</td>
<td>+125</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>V_{i} Input voltage</td>
<td>9</td>
<td>75</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>V_{iso} Isolation voltage (input to output)</td>
<td>9</td>
<td>75</td>
<td>Vdc</td>
<td></td>
</tr>
<tr>
<td>V_{iso} Isolation voltage (input to case)</td>
<td>3000</td>
<td>Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V_{iso} Isolation voltage (output to case)</td>
<td>2000</td>
<td>Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V_{tr} Input voltage transient (Tp 1s)</td>
<td>1500</td>
<td>Vdc</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V_{RC} Remote Control pin voltage</td>
<td>+0.3</td>
<td>+10</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those indicated in the Electrical Specification section of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

Fundamental Circuit Diagram
## Electrical Specification

### 3.3 V, 10 A / 33 W

Typical values given at: \( T_{Pi} = +25^\circ C, V_i = 48 \text{ V} \), unless otherwise specified under Conditions.
At least 330μF E-Cap be added in the input terminal for stabilize input voltage source. (680μF E-Cap be added in the output terminal for stabilize)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conditions</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_i )</td>
<td>Input voltage range</td>
<td>9</td>
<td>75</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( V_{\text{toff}} )</td>
<td>Turn-off input voltage</td>
<td>Decreasing input voltage</td>
<td>7.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( V_{\text{ton}} )</td>
<td>Turn-on input voltage</td>
<td>Increasing input voltage</td>
<td>8.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>OVP</td>
<td>Input Over voltage protection</td>
<td>77.5</td>
<td>80</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>( C_i )</td>
<td>Internal input capacitance</td>
<td>12</td>
<td>μF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( P_o )</td>
<td>Output power</td>
<td>0</td>
<td>33</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>( \eta )</td>
<td>Efficiency</td>
<td>50% of max ( I_o ), ( V_i = 12 \text{ V} )</td>
<td>89</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>max ( I_o ), ( V_i = 12 \text{ V} )</td>
<td>85</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50% of max ( I_o ), ( V_i = 24 \text{ V} )</td>
<td>89</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>max ( I_o ), ( V_i = 24 \text{ V} )</td>
<td>87</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>50% of max ( I_o ), ( V_i = 48 \text{ V} )</td>
<td>87</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>max ( I_o ), ( V_i = 48 \text{ V} )</td>
<td>87</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>( P_d )</td>
<td>Power Dissipation</td>
<td>max ( I_o )</td>
<td>8.3</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>( P_i )</td>
<td>Input idling power</td>
<td>( I_o = 0 \text{ A}, V_i = 48 \text{ V} )</td>
<td>0.42</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>( f_s )</td>
<td>Switching frequency</td>
<td>0-100 % of max ( I_o )</td>
<td>198</td>
<td>220</td>
<td>242</td>
</tr>
<tr>
<td>( V_{oi} )</td>
<td>Output voltage initial setting and accuracy</td>
<td>( T_{Pi} = +25^\circ C, V_i = 48 \text{ V}, I_o = 10 \text{ A} )</td>
<td>3.267</td>
<td>3.3</td>
<td>3.333</td>
</tr>
<tr>
<td>( V_o )</td>
<td>Output adjust range</td>
<td>2.97</td>
<td>3.63</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Output voltage tolerance band</td>
<td>0-100 % of max ( I_o )</td>
<td>3.201</td>
<td>3.399</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Idling voltage</td>
<td>( I_o = 0 \text{ A} )</td>
<td>3.201</td>
<td>3.399</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td>Line regulation</td>
<td>max ( I_o )</td>
<td>-33</td>
<td>33</td>
<td>mV</td>
</tr>
<tr>
<td></td>
<td>Load regulation</td>
<td>( V_i = 48 \text{ V}, 0-100 % of max ( I_o )</td>
<td>-33</td>
<td>33</td>
<td>mV</td>
</tr>
<tr>
<td>( V_{tr} )</td>
<td>Load transient voltage deviation</td>
<td>( V_i = 48 \text{ V}, \text{ Load step 50-75-50% of max } I_o ), ( \text{di/dt} = 1 \text{ A/μs} )</td>
<td>±200</td>
<td>mV</td>
<td></td>
</tr>
<tr>
<td>( t_o )</td>
<td>Load transient recovery time</td>
<td>( \text{di/dt} = 1 \text{ A/μs} )</td>
<td>500</td>
<td>μs</td>
<td></td>
</tr>
<tr>
<td>( t_r )</td>
<td>Ramp-up time (from 10–90% of ( V_o ))</td>
<td>10-100% of max ( I_o ), ( T_{Pi} = 25^\circ C, V_i = 48 \text{ V} )</td>
<td>20</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>( t_s )</td>
<td>Start-up time (from ( V ) connection to 90% of ( V_o ))</td>
<td>24</td>
<td>ms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( t_v )</td>
<td>( V ) shut-down fall time (from ( V ) off to 10% of ( V_o ))</td>
<td>max ( I_o )</td>
<td>200</td>
<td>us</td>
<td></td>
</tr>
<tr>
<td>( t_{RC} )</td>
<td>RC start-up time</td>
<td>max ( I_o )</td>
<td>12</td>
<td>ms</td>
<td></td>
</tr>
<tr>
<td>( I_o )</td>
<td>Output current</td>
<td></td>
<td>10</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>( I_{lim} )</td>
<td>Current limit threshold</td>
<td>( T_{Pi} &lt; \text{ max } T_{Pi} )</td>
<td>12.5</td>
<td>20</td>
<td>A</td>
</tr>
<tr>
<td>( I_{sc} )</td>
<td>Short circuit current</td>
<td>( T_{Pi} = 25^\circ C )</td>
<td>0.32</td>
<td>A</td>
<td></td>
</tr>
<tr>
<td>( C_{out} )</td>
<td>Recommended Capacitive Load</td>
<td>( T_{Pi} = 25^\circ C )</td>
<td>680</td>
<td>5000</td>
<td>μF</td>
</tr>
<tr>
<td>( V_{\text{Osc}} )</td>
<td>Output ripple &amp; noise</td>
<td>See ripple &amp; noise section, ( V_o ), max ( I_o ), see Note 1</td>
<td>20</td>
<td>40</td>
<td>mVp-p</td>
</tr>
<tr>
<td>OVP</td>
<td>Over voltage protection</td>
<td>( T_{Pi} = +25^\circ C, V_i = 48 \text{ V}, 10-100% of max ( I_o )</td>
<td>4.3</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

Note 1: Measured with 0.1μF ceramic Cap. and 10μF tantalum(or EE) Cap. cross to output.
PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Note 2: PKE 8410A PIP  Power Derating Curve
(Output Power VS Input Voltage)
**Typical Characteristics**

**3.3 V, 10 A / 33 W**

**Efficiency**

*Load vs. Efficiency*

Efficiency vs. load current and input voltage at +25°C.

**Power Dissipation**

*Load vs. Power Dissipation*

Dissipated power vs. load current and input voltage at +25°C.

**Output Current Derating (Vin=48V)**

Available load current vs. ambient air temperature and airflow at V=48 V. See Thermal Consideration section.

**Current Limit Characteristics**

Output voltage vs. load current at I_o > max I_o at +25°C.

**Output Current Derating (Vin=9V)**

Available load current vs. ambient air temperature and airflow at V=9 V. See Thermal Consideration section.

**Output Current Derating (Vin=48V) with heat sink**

Available load current vs. ambient air temperature and airflow at V=48 V. See Thermal Consideration section.
Typical Characteristics

3.3 V, 10 A / 33 W

Start-up

Start-up enabled by connecting \( V_i \) at:
\( T_{\text{in}} = +25^\circ\text{C}, \ V_i = 9 \text{ V}, \ 10 \text{ A resistive load.} \)

Top trace: output voltage (2 V/div.).
Bottom trace: input voltage (5 V/div.).
Time scale: (50 ms/div.).

Output Ripple & Noise

Output voltage ripple at:
\( T_{\text{in}} = +25^\circ\text{C}, \ V_i = 48 \text{ V}, \ 10 \text{ A resistive load.} \)

Trace: output voltage (20 mV/div.).
Time scale: (5 µs/div.).

Output Voltage Adjust (TRIM UP/TRIM DOWN)

The resistor value for an adjusted output voltage is calculated by using the following equations:

Output Voltage Adjust, Increase:
\[ R_{\text{ADJ\_UP}} = \left( \frac{1.9528}{\Delta} - 12 \right) \text{k}\Omega \]

Output Voltage Adjust, Decrease:
\[ R_{\text{ADJ\_DOWN}} = \left( \frac{1.8627}{\Delta} - 15.815 \right) \text{k}\Omega \]

Example:

To trim up the 3.3V model by 8% to 3.56V the required external resistor is:
\[ R_{\text{ADJ\_UP}} = \left( \frac{1.9528}{0.08} - 12 \right) = 12.41 \text{ k}\Omega \]

Example:

To trim down the 3.3V model by 7% to 3.07V the required external resistor is:
\[ R_{\text{ADJ\_DOWN}} = \left( \frac{1.8627}{0.07} - 15.815 \right) = 10.79 \text{ k}\Omega \]
Electrical Specification

**5 V, 8 A / 40 W**

Typical values given at: \( T_{Pl} = +25^\circ C, V_i = 48 \text{ V} \), max \( I_o \), unless otherwise specified under Conditions. At least 330uF E-Cap be added in the input terminal for stabilize input voltage source.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conditions</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_i ) Input voltage range</td>
<td></td>
<td>9</td>
<td>75</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{tuff} ) Turn-off input voltage</td>
<td>Decreasing input voltage</td>
<td>7.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_{ton} ) Turn-on input voltage</td>
<td>Increasing input voltage</td>
<td>8.5</td>
<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>OVP Input Over voltage protection</td>
<td></td>
<td>77.5</td>
<td>80</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( C_i ) Internal input capacitance</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td>( \mu F )</td>
</tr>
<tr>
<td>( P_O ) Output power Note2</td>
<td></td>
<td>0</td>
<td>40</td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>( \eta ) Efficiency</td>
<td>50% of max ( I_o ), ( V_i = 12 \text{ V} )</td>
<td>87</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>max ( I_o ), ( V_i = 12 \text{ V} )</td>
<td>85</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>50% of max ( I_o ), ( V_i = 24 \text{ V} )</td>
<td>89</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>max ( I_o ), ( V_i = 24 \text{ V} )</td>
<td>89</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>50% of max ( I_o ), ( V_i = 48 \text{ V} )</td>
<td>86</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td></td>
<td>max ( I_o ), ( V_i = 48 \text{ V} )</td>
<td>88</td>
<td></td>
<td></td>
<td>%</td>
</tr>
<tr>
<td>( P_d ) Power Dissipation</td>
<td>max ( I_o )</td>
<td>11.1</td>
<td></td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>( P_i ) Input idling power</td>
<td>( I_o = 0 \text{ A}, V_i = 48 \text{ V} )</td>
<td>0.38</td>
<td></td>
<td></td>
<td>W</td>
</tr>
<tr>
<td>( f_s ) Switching frequency</td>
<td>0-100 % of max ( I_o )</td>
<td>198</td>
<td>220</td>
<td>242</td>
<td>kHz</td>
</tr>
<tr>
<td>( V_{oi} ) Output voltage initial setting and accuracy</td>
<td>( T_{Pl} = +25^\circ C, V_i = 48 \text{ V}, I_o = 8 \text{ A} )</td>
<td>4.95</td>
<td>5</td>
<td>5.05</td>
<td>V</td>
</tr>
<tr>
<td>( V_o ) Output adjust range</td>
<td></td>
<td>4.5</td>
<td>5.5</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( V_o ) Output voltage tolerance band</td>
<td>0-100 % of max ( I_o )</td>
<td>4.85</td>
<td>5.15</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_d ) Idling voltage</td>
<td>( I_o = 0 \text{ A} )</td>
<td>4.85</td>
<td>5.15</td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>( I_l ) Line regulation max ( I_o )</td>
<td></td>
<td>-50</td>
<td>50</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>( I_l ) Load regulation ( V_i = 48 \text{ V}, 0-100 % \text{ of max } I_o )</td>
<td>-50</td>
<td>50</td>
<td>mV</td>
<td></td>
<td></td>
</tr>
<tr>
<td>( V_{tr} ) Load transient voltage deviation</td>
<td>( V_i = 48 \text{ V}, \text{Load step } 50-75-50% \text{ of max } I_o, \text{di/dt} = 1 \text{ A/\mu s} )</td>
<td>±200</td>
<td></td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>( t_{tr} ) Load transient recovery time</td>
<td></td>
<td>500</td>
<td></td>
<td></td>
<td>( \mu s )</td>
</tr>
<tr>
<td>( t_{r} ) Ramp-up time (from 10-90% of ( V_o ) )</td>
<td>10-100% of max ( I_o ), ( T_{Pl} = 25^\circ C, V_i = 48 \text{ V} )</td>
<td>20</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>( t_{s} ) Start-up time (from ( V_o ) connection to 90% of ( V_o ) )</td>
<td></td>
<td>24</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>( t_{v} ) ( V_o ) shut-down fall time (from ( V_o ) off to 10% of ( V_o ) )</td>
<td>max ( I_o )</td>
<td>200</td>
<td></td>
<td></td>
<td>us</td>
</tr>
<tr>
<td>( t_{RC} ) RC start-up time max ( I_o )</td>
<td></td>
<td>12</td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>( I_o ) Output current</td>
<td></td>
<td>8</td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>( I_{lim} ) Current limit threshold</td>
<td>( T_{Pl} &lt; \text{max } T_{Pl} )</td>
<td>14.5</td>
<td>17</td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>( I_{sc} ) Short circuit current</td>
<td>( T_{Pl} = 25^\circ C )</td>
<td>0.32</td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>( \text{Cout} ) Recommended Capacitive Load</td>
<td>( T_{Pl} = 25^\circ C )</td>
<td>3000</td>
<td></td>
<td></td>
<td>( \mu F )</td>
</tr>
<tr>
<td>( V_{om} ) Output ripple &amp; noise</td>
<td>See ripple &amp; noise section, ( V_o ), max ( I_o ), see Note 1</td>
<td>20</td>
<td>40</td>
<td></td>
<td>mVp-p</td>
</tr>
<tr>
<td>OVP Over voltage protection</td>
<td>( T_{Pl} = +25^\circ C, V_i = 48 \text{ V}, 10-100% \text{ of max } I_o )</td>
<td>6.2</td>
<td></td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Note 1: Measured with 0.1uF ceramic Cap. and 10uF tantalum(or EE) Cap. cross to output.
PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Note 2: PKE 8411A PIP Power Derating Curve
(Output Power VS Input Voltage)
Typical Characteristics
5 V, 8 A / 40 W

Efficiency

Load vs. Efficiency

Efficiency vs. load current and input voltage at +25°C.

Power Dissipation

Load vs. Power Dissipation

Dissipated power vs. load current and input voltage at +25°C.

Output Current Derating (Vin=48V)

Available load current vs. ambient air temperature and airflow at Vin=48 V. See Thermal Consideration section.

Current Limit Characteristics

Output voltage vs. load current at Io > max Io at +25°C.

Output Current Derating (Vin=9V)

Available load current vs. ambient air temperature and airflow at Vin=9 V. See Thermal Consideration section.

Output Current Derating (Vin=48V) with heat sink

Available load current vs. ambient air temperature and airflow at Vin=48 V. See Thermal Consideration section.
Technical Specification

PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Typical Characteristics

5 V, 8 A / 40 W

Start-up enabled by connecting V_i at:
TP1 = +25°C, V_i = 9 V,
I_o = 8 A resistive load.

Top trace: output voltage (2 V/div.),
Bottom trace: input voltage (5 V/div.),
Time scale: (100 ms/div.).

Output Voltage Adjust (TRIM UP/TRIM DOWN)

The resistor value for an adjusted output voltage is calculated by using the following equations:

Output Voltage Adjust, Increase:

\[ R_{\text{ADI\_UP}} = \left( \frac{1.5}{\Delta} - 10 \right) \text{k}\Omega \]

Output Voltage Adjust, Decrease:

\[ R_{\text{ADI\_DOWN}} = \left( \frac{1.5}{\Delta} - 13 \right) \text{k}\Omega \]

Example:

To trim up the 5.0V model by 8% to 5.4V the required external resistor is:

\[ R_{\text{ADI\_UP}} = \left( \frac{1.5}{0.08} - 10 \right) = 8.75 \text{ k}\Omega \]

Example:

To trim down the 5.0V model by 7% to 4.65V the required external resistor is:

\[ R_{\text{ADI\_DOWN}} = \left( \frac{1.5}{0.07} - 13 \right) = 8.43 \text{ k}\Omega \]
## Electrical Specification

### PKE 8413A PIP

12 V, 3.33 A / 40 W

Typical values given at: $T_{PI} = +25^\circ\text{C}$, $V_i = 48$ V, $\text{max } I_o$, unless otherwise specified under Conditions.

At least 220 μF E-Cap be added in the input terminal for stabilize input voltage source.

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conditions</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_i$</td>
<td>Input voltage range</td>
<td>9</td>
<td>75</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{off}}$</td>
<td>Turn-off input voltage</td>
<td>Decreasing input voltage</td>
<td>7.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$V_{\text{on}}$</td>
<td>Turn-on input voltage</td>
<td>Increasing input voltage</td>
<td>8.5</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>OVP</td>
<td>Input Over voltage protection</td>
<td>77.5</td>
<td>80</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>$C_i$</td>
<td>Internal input capacitance</td>
<td>12</td>
<td>μF</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$P_O$</td>
<td>Output power</td>
<td>0</td>
<td>40</td>
<td>W</td>
<td></td>
</tr>
</tbody>
</table>

### Efficiency

- 50% of max $I_o$, $V_i = 12$ V
- max $I_o$, $V_i = 12$ V
- 50% of max $I_o$, $V_i = 24$ V
- max $I_o$, $V_i = 24$ V
- 50% of max $I_o$, $V_i = 48$ V
- max $I_o$, $V_i = 48$ V

### Power Dissipation

- $P_d$: max $I_o$ 4 W
- $P_k$: Input idling power $I_o = 0$ A, $V_i = 48$ V 0.5 W

### Switching Frequency

- $f_s$: 0-100 % of max $I_o$ 198 kHz to 242 kHz

### Output Voltage Initial Setting and Accuracy

- $V_{Oi}$: $T_{PI} = +25^\circ\text{C}$, $V_i = 48$ V, $I_o = 3.33$ A

### Output Adjust Range

- $V_O$: $T_{PI} = +25^\circ\text{C}$, $V_i = 48$ V

### Idling Voltage

- $I_i$: $I_o = 0$ A

### Load Regulation

- $V_l$: $V_i = 48$ V, 0-100 % of max $I_o$ -120 mV to 120 mV

### Line Regulation

- $I_l$: $V_i = 48$ V

### Line Regulation

- $I_k$: $V_i = 48$ V, Load step 50-75-50% of max $I_o$ di/dt = 1 A/μs

### Ramp-up Time

- $I_{r1}$: (from 10-90% of $V_o$) 10-100% of max $I_o$, $T_{PI} = 25^\circ\text{C}$, $V_i = 48$ V

### Start-up Time

- $I_s$: (from $V_i$ connection to 90% of $V_o$) 20 ms

### V_i shut-down fall time

- $I_v$: (from $V_i$ off to 90% of $V_o$) max $I_o$ 200 μs

### RC start-up time

- $I_{rs}$: max $I_o$ 12 ms

### Output Current

- $I_O$: 0 A

### Current Limit Threshold

- $I_{lim}$: $T_{PI} < \text{max } T_{PI}$ 4 A

### Short circuit current

- $I_{sc}$: $T_{PI} = 25^\circ\text{C}$ 0.32 A

### Recommended Capacitive Load

- $C_{out}$: $T_{PI} = 25^\circ\text{C}$ 0 μF to 1500 μF

### Output Ripple & Noise

- $V_{OAC}$: See ripple & noise section, $V_{OAC}$, max $I_o$, see Note 1 20 mVp-p

### Over voltage protection

- $OVP$: $T_{PI} = +25^\circ\text{C}$, $V_i = 48$ V, 10-100% of max $I_o$ 15 V

Note 1: Measured with 0.1uF ceramic Cap. and 10uF tantalum(or EE) Cap. cross to output.
Note 2: PKE 8413A PIP Power Derating Curve
(Output Power VS Input Voltage)
Typical Characteristics
12 V, 3.33 A / 40 W

Efficiency

Efficiency vs. load current and input voltage at +25°C.

Power Dissipation

Dissipated power vs. load current and input voltage at +25°C.

Output Current Derating (Vin=48V)

Available load current vs. ambient air temperature and airflow at Vin=48 V. See Thermal Consideration section.

Current Limit Characteristics

Output voltage vs. load current at I_o > max I_o at +25°C.

Output Current Derating (Vin=9V)

Available load current vs. ambient air temperature and airflow at Vin=9 V. See Thermal Consideration section.

Output Current Derating (Vin=24V)

Available load current vs. ambient air temperature and airflow at Vin=24 V. See Thermal Consideration section.
Typical Characteristics
12 V, 3.33 A / 40 W

**Start-up**

Start-up enabled by connecting V_i at:
- T_{in} = +25°C, V_i = 48 V,
- I_o = 3.33 A resistive load.

Top trace: output voltage (5 V/div.).
Bottom trace: input voltage (20 V/div.).
Time scale: (200 ms/div.).

**Output Ripple & Noise**

Output voltage ripple at:
- T_{in} = +25°C, V_i = 48 V,
- I_o = 3.33 A resistive load.

Trace: output voltage (20 mV/div.).
Time scale: (5 µs/div.).

**Output Load Transient Response**

Output voltage response to load current step-change (1.66→2.49→1.66 A) at:
- T_{in} = +25°C, V_i = 48 V.

Top trace: output voltage (500 mV/div.).
Bottom trace: load current (1 A/div.).
Time scale: (2 ms/div.).

**Output Voltage Adjust (TRIM UP/TRIM DOWN)**

The resistor value for an adjusted output voltage is calculated by using the following equations:

**Output Voltage Adjust, Increase:**

\[
R_{\text{ADJ\_UP}} = \left(\frac{3.5998}{\Delta} - 24\right) \text{k}\Omega
\]

**Output Voltage Adjust, Decrease:**

\[
R_{\text{ADJ\_DOWN}} = \left(\frac{3.5796}{\Delta} - 31.179\right) \text{k}\Omega
\]

**Example:**

To trim up the 12V model by 8% to 12.96V the required external resistor is:

\[
R_{\text{ADJ\_UP}} = \left(\frac{3.5998}{0.08} - 24\right) = 21 \text{ k}\Omega
\]

**Example:**

To trim down the 12V model by 7% to 11.16V the required external resistor is:

\[
R_{\text{ADJ\_DOWN}} = \left(\frac{3.5796}{0.07} - 31.179\right) = 19.96 \text{ k}\Omega
\]

**Output Voltage=12V**

PKE 8413A PIP
## Electrical Specification

**PKE 8415A PIP**

15 V, 2.67 A / 40 W

Typical values given at: $T_{PI} = +25^\circ C$, $V_I = 48$ V, max $I_O$, unless otherwise specified under Conditions.

At least 330μF E-Cap be added in the input terminal for stabilize input voltage source.

### Characteristics

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Conditions</th>
<th>min</th>
<th>typ</th>
<th>max</th>
<th>Unit</th>
</tr>
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<tr>
<td>$V_I$</td>
<td>Input voltage range</td>
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<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{off}$</td>
<td>Turn-off input voltage</td>
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<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{on}$</td>
<td>Turn-on input voltage</td>
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<td></td>
<td></td>
<td>V</td>
</tr>
<tr>
<td>OVP</td>
<td>Input Over voltage protection</td>
<td></td>
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<td></td>
<td>V</td>
</tr>
<tr>
<td>$C_I$</td>
<td>Internal input capacitance</td>
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<td>μF</td>
</tr>
<tr>
<td>$P_O$</td>
<td>Output power</td>
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<td></td>
<td>W</td>
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<td>$\eta$</td>
<td>Efficiency</td>
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<td></td>
<td>%</td>
</tr>
<tr>
<td>$P_d$</td>
<td>Power Dissipation</td>
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<td></td>
<td>W</td>
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<td>$P_k$</td>
<td>Input idling power</td>
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<td></td>
<td>W</td>
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<td>$I_s$</td>
<td>Switching frequency</td>
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<td>kHz</td>
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<td>$V_{oI}$</td>
<td>Output voltage initial setting and accuracy</td>
<td>$T_{PI} = +25^\circ C$, $V_I = 48$ V, $I_O = 2.67$ A</td>
<td>14.85</td>
<td>15</td>
<td>15.15</td>
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<td>$V_o$</td>
<td>Output adjust range</td>
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<td></td>
<td>V</td>
</tr>
<tr>
<td>$V_{oI}$</td>
<td>Output voltage tolerance band</td>
<td>0-100 % of max $I_O$</td>
<td>14.55</td>
<td>15.45</td>
<td>V</td>
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<tr>
<td>Idling voltage</td>
<td>$I_o = 0$ A</td>
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<td></td>
<td>V</td>
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<tr>
<td>Line regulation</td>
<td>$V_I = 48$ V, 0-100 % of max $I_O$</td>
<td>-150</td>
<td>150</td>
<td></td>
<td>mV</td>
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<tr>
<td>Load regulation</td>
<td>$V_I = 48$ V, 0-100 % of max $I_O$</td>
<td>-150</td>
<td>150</td>
<td></td>
<td>mV</td>
</tr>
<tr>
<td>$V_{tr}$</td>
<td>Load transient voltage deviation</td>
<td>$V_I = 48$ V, Load step 50-75-50% of max $I_O$, $dl/dt = 1$ A/μs</td>
<td>±200</td>
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<td>mV</td>
</tr>
<tr>
<td>$t_o$</td>
<td>Load transient recovery time</td>
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<td></td>
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<td>μs</td>
</tr>
<tr>
<td>$t_r$</td>
<td>Ramp-up time (from 10–90% of $V_o$)</td>
<td>10-100% of max $I_O$, $T_{PI} = 25^\circ C$, $V_I = 48$ V</td>
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</tr>
<tr>
<td>$t_s$</td>
<td>Start-up time (from $V_I$ connection to 90% of $V_o$)</td>
<td></td>
<td></td>
<td></td>
<td>ms</td>
</tr>
<tr>
<td>$t_v$</td>
<td>$V_I$ shut-down fall time (from $V_I$ off to 10% of $V_o$)</td>
<td>max $I_O$</td>
<td></td>
<td>200</td>
<td></td>
</tr>
<tr>
<td>$t_{RC}$</td>
<td>RC start-up time</td>
<td>max $I_O$</td>
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<td></td>
<td>ms</td>
</tr>
<tr>
<td>$I_O$</td>
<td>Output current</td>
<td></td>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>$I_{lim}$</td>
<td>Current limit threshold</td>
<td>$T_{PI} &lt; max T_{PI}$</td>
<td>4.2</td>
<td>5.34</td>
<td>A</td>
</tr>
<tr>
<td>$I_{sc}$</td>
<td>Short circuit current</td>
<td>$T_{PI} = 25^\circ C$</td>
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<td>0.32</td>
<td>A</td>
</tr>
<tr>
<td>$C_{out}$</td>
<td>Recommended Capacitive Load</td>
<td>$T_{PI} = 25^\circ C$</td>
<td></td>
<td>1000</td>
<td>μF</td>
</tr>
<tr>
<td>$V_{oac}$</td>
<td>Output ripple &amp; noise</td>
<td>See ripple &amp; noise section, $V_{oI}$, max $I_O$, see Note 1</td>
<td>40</td>
<td>80</td>
<td>mVp-p</td>
</tr>
<tr>
<td>OVP</td>
<td>Over voltage protection</td>
<td>$T_{PI} = +25^\circ C$, $V_I = 48$ V, 10-100% of max $I_O$</td>
<td>18</td>
<td></td>
<td>V</td>
</tr>
</tbody>
</table>

Note 1: Measured with 0.1uF ceramic Cap. and 10uF tantalum(or EE) Cap. cross to output.
Note 2: PKE 8415A PIP Power Derating Curve
(Output Power VS Input Voltage)
PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Typical Characteristics
15 V, 2.67 A / 40 W

Efficiency

Load vs. Efficiency

Efficiency vs. load current and input voltage at +25°C.

Power Dissipation

Load vs. Power Dissipation

Dissipated power vs. load current and input voltage at +25°C.

Output Current Derating (Vin=48V)

Available load current vs. ambient air temperature and airflow at V=48 V. See Thermal Consideration section.

Current Limit Characteristics

Output voltage vs. load current at I_o > max I_o at +25°C.

Output Current Derating (Vin=9V)

Available load current vs. ambient air temperature and airflow at V=9 V. See Thermal Consideration section.

Output Current Derating (Vin=48V) with heat sink

Available load current vs. ambient air temperature and airflow at V=48 V. See Thermal Consideration section.
Typical Characteristics

15 V, 2.67 A / 40 W

Start-up

- Top trace: output voltage (10 V/div.).
- Bottom trace: input voltage (5 V/div.).
- Time scale: (50 ms/div.).

Start-up enabled by connecting \( V_i \) at:
TP1 = +25°C, \( V_i = 9 \) V, \( I_o = 2.67 \) A resistive load.

Output Voltage Adjust (TRIM UP/TRIM DOWN)

The resistor value for an adjusted output voltage is calculated by using the following equations:

Output Voltage Adjust, Increase:

\[
R_{\text{ADJ\_UP}} = \left( \frac{4.4993}{\Delta} - 30 \right) \text{k}\Omega
\]

Output Voltage Adjust, Decrease:

\[
R_{\text{ADJ\_DOWN}} = \left( \frac{4.6}{\Delta} - 39.099 \right) \text{k}\Omega
\]

Example:

To trim up the 15V model by 8% to 16.2V the required external resistor is:

\[
R_{\text{ADJ\_UP}} = \left( \frac{4.4993}{0.08} - 30 \right) = 26.24 \text{ k}\Omega
\]

Example:

To trim down the 15V model by 7% to 13.95V the required external resistor is:

\[
R_{\text{ADJ\_DOWN}} = \left( \frac{4.6}{0.07} - 39.099 \right) = 26.62 \text{ k}\Omega
\]
EMC Specification
Conducted EMI measured according to EN55032, CISPR 32 and FCC part 15J (see test set-up). See Design Note 009 for further information. The fundamental switching frequency is 220 kHz for PKE 8413A PIP (40W/12V) at $V_i = 48$ V and max $I_o$.

Conducted EMI Input terminal value (typ)

![EMI without filter](image1)

Optional external filter for class B
Suggested external input filter in order to meet class B in EN 55032, CISPR 32 and FCC part 15J.

Filter components:
- CY1: 100 pF
- CY2: 2.2 nF
- CY7, CY8: 1 nF (Y-CAP.)
- C01, C02: 330 uF (EE-CAP.)
- L1: 10 mH (CM CHOKE)
- NC: CY3, CY4, CY5, CY6

![Test set-up](image2)

Layout recommendations
The radiated EMI performance of the product will depend on the PWB layout and ground layer design. It is also important to consider the stand-off of the product. If a ground layer is used, it should be connected to the output of the product and the equipment ground or chassis.

A ground layer will increase the stray capacitance in the PWB and improve the high frequency EMC performance.

Output ripple and noise
Output ripple and noise measured according to figure below. See Design Note 022 for detailed information.

![Output ripple and noise test setup](image3)
Operating information

Input Voltage
The input voltage range is 9 to 75 Vdc. At input voltages exceeding 80 V, the power loss will be higher than at normal input voltage and $T_{P1}$ must be limited to absolute max +115°C. The absolute maximum continuous input voltage is 80 Vdc.

Short duration transient disturbances can occur on the DC distribution and input of the product when a short circuit fault occurs on the equipment side of a protective device (fuse or circuit breaker). The voltage level, duration and energy of the disturbance are dependent on the particular DC distribution network characteristics and can be sufficient to damage the product unless measures are taken to suppress or absorb this energy. The transient voltage can be limited by capacitors and other energy absorbing devices like zener diodes connected across the positive and negative input conductors at a number of strategic points in the distribution network. The end-user must secure that the transient voltage will not exceed the value stated in the Absolute maximum ratings. ETSI TR 100 283 examines the parameters of DC distribution networks and provides guidelines for controlling the transient and reduce its harmful effect.

Turn-off Input Voltage
The products monitor the input voltage and will turn on and turn off at predetermined levels. The minimum hysteresis between turn on and turn off input voltage is 1.7 V.

Remote Control (RC)
The products are fitted with a remote control function referenced to the primary negative input connection (-In), with negative and positive logic options available. The RC function allows the product to be turned on/off by an external device like a semiconductor or mechanical switch. The RC pin has an internal pull up resistor to +In.

External decoupling capacitors are recommended value that could be used without any additional analysis is found in the Electrical specification. The ESR of the capacitors is a very important parameter. Stable operation is guaranteed with a verified ESR value of >5 mΩ across the output connections. For further information please contact your local Flex representative.

Input Voltage
The input voltage range is 9 to 75 Vdc. At input voltages exceeding 80 V, the power loss will be higher than at normal input voltage and $T_{P1}$ must be limited to absolute max +115°C. The absolute maximum continuous input voltage is 80 Vdc.

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Input and Output Impedance
The impedance of both the input source and the load will interact with the impedance of the product. It is important that the input source has low characteristic impedance. The products are designed for stable operation without external capacitors connected to the input or output. The performance in some applications can be enhanced by addition of external capacitance as described under External Decoupling Capacitors.

If the input voltage source contains significant inductance, the addition of a 220 µF capacitor across the input of the product will ensure stable operation. The capacitor is not required when powering the product from an input source with an inductance below 10 µH. The minimum required capacitance value depends on the output power and the input voltage. The higher output power the higher input capacitance is needed. Approximately doubled capacitance value is required for a 24 V input voltage source compared to a 48 V input voltage source.

External Decoupling Capacitors
When powering loads with significant dynamic current requirements, the voltage regulation at the point of load can be improved by addition of decoupling capacitors at the load. The most effective technique is to locate low ESR ceramic and electrolytic capacitors as close to the load as possible, using several parallel capacitors to lower the effective ESR. The ceramic capacitors will handle high-frequency dynamic load changes while the electrolytic capacitors are used to handle low frequency dynamic load changes. It is equally important to use low resistance and low inductance PWB layouts and cabling.

External decoupling capacitors will become part of the product's control loop. The control loop is optimized for a wide range of external capacitance and the maximum recommended value that could be used without any additional analysis is found in the Electrical specification. The ESR of the capacitors is a very important parameter. Stable operation is guaranteed with a verified ESR value of >5 mΩ across the output connections. For further information please contact your local Flex representative.
Output Voltage Adjust (V_{adj})
The products have an Output Voltage Adjust pin (V_{adj}). This pin can be used to adjust the output voltage above or below Output voltage initial setting. When increasing the output voltage, the voltage at the output pins (including any remote sense compensation) must be kept below the threshold of the over voltage protection, (OVP) to prevent the product from shutting down. At increased output voltages the maximum power rating of the product remains the same, and the max output current must be decreased correspondingly. To increase the voltage the resistor should be connected between the V_{adj} pin and +Out pin. The resistor value of the Output voltage adjust function is according to information given under the Output section for the respective product. To decrease the output voltage, the resistor should be connected between the V_{adj} pin and –Out pin.

Over Temperature Protection (OTP)
The products are protected from thermal overload by an internal over temperature shutdown circuit. When \( T_{P1} \) as defined in thermal consideration section exceeds 115°C the product will shut down. The product will make continuous attempts to start up (non-latching mode) and resume normal operation automatically after removal of the over voltage condition.

Definition of product operating temperature
The product operating temperatures is used to monitor the temperature of the product, and proper thermal conditions can be verified by measuring the temperature at positions P1. The temperature at this position \( (T_{P1}) \) should not exceed the maximum temperatures in the table below. Temperature above maximum \( T_{P1} \), measured at the reference point P1 are not allowed and may cause permanent damage.

<table>
<thead>
<tr>
<th>Pin</th>
<th>Designation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>On/Off Control</td>
<td>Remote control</td>
</tr>
<tr>
<td>2</td>
<td>-Input</td>
<td>Negative input</td>
</tr>
<tr>
<td>3</td>
<td>+Input</td>
<td>Positive input</td>
</tr>
<tr>
<td>4</td>
<td>+Out</td>
<td>Positive output</td>
</tr>
<tr>
<td>5</td>
<td>-Out</td>
<td>Negative output</td>
</tr>
<tr>
<td>6</td>
<td>Trim</td>
<td>Output voltage adjust</td>
</tr>
</tbody>
</table>

Over Voltage Protection (OVP)
The products have output over voltage protection that will shut down the product in over voltage conditions. The product will make continuous attempts to start up (non-latching mode) and resume normal operation automatically after removal of the over voltage condition.

Over Current Protection (OCP)
The products include current limiting circuitry for protection at continuous overload. The output voltage will decrease towards zero for output currents in excess of max output current (max \( I_{O} \)). The product will resume normal operation after removal of the overload. The load distribution should be designed for the maximum output short circuit current specified.
Thermal Consideration

General
The products are designed to operate in different thermal environments and sufficient cooling must be provided to ensure reliable operation.

For products mounted on a PWB without a heat sink attached, cooling is achieved mainly by conduction, from the pins to the host board, and convection, which is dependent on the airflow across the product. Increased airflow enhances the cooling of the product. The Output Current Derating graph found in the Output section for each model provides the available output current vs. ambient air temperature and air velocity at $V_I = 48$ V.

The product is tested on a 107 x 45 mm, 70 µm (2 oz), 1-layer test board in a wind box with 370 x 220 mm.

Product can be selected with heat-sink version, available to add operating temperature range. For customer different requirement (customer added different size heat-sink), the option is product attached with Thermal glue tape so that customer can attach different size heat-sink by themselves.

The heat-sink assembly drawing:
Mechanical Information

PIN CONNECTIONS

<table>
<thead>
<tr>
<th>PIN NUMBER</th>
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</tr>
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<tr>
<td>1</td>
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<td>5</td>
<td>-Output</td>
</tr>
<tr>
<td>6</td>
<td>Trim</td>
</tr>
</tbody>
</table>

Notes:
1. All dimensions in inches (mm)
2. Tolerance .xx =±0.04" .xxx=±0.020"
PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Soldering Information - Hole Mounting
The hole mounted product is intended for plated through hole mounting by wave or manual soldering. The pin temperature is specified to maximum to 270°C for maximum 10 seconds.

A maximum preheat rate of 4°C/s and maximum preheat temperature of 150°C is suggested. When soldering by hand, care should be taken to avoid direct contact between the hot soldering iron tip and the pins for more than a few seconds in order to prevent overheating.

A no-clean flux is recommended to avoid entrapment of cleaning fluids in cavities inside the product or between the product and the host board. The cleaning residues may affect long time reliability and isolation voltage.

Delivery Package Information
The products are delivered in antistatic clamshell trays

<table>
<thead>
<tr>
<th>Tray Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material</td>
</tr>
<tr>
<td>Surface resistance</td>
</tr>
<tr>
<td>Bakeability</td>
</tr>
<tr>
<td>Tray thickness</td>
</tr>
<tr>
<td>Box capacity</td>
</tr>
<tr>
<td>Tray weight</td>
</tr>
</tbody>
</table>
PKE 8000A series Direct Converters
Input 9-75 V, Output up to 10 A / 40 W

Package

1. Q'ty: 6*3=18 Pcs/Tray
   18*9=162 Pcs
2. Carton size: 290X260X239mm ±6mm
3. Single weight: 32g
4. N.W.: 5.2Kgs
5. G.W.: 7.2Kgs
## Product Qualification Specification

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Standards/Reference</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>External visual inspection</td>
<td>IPC-A-610</td>
<td></td>
</tr>
</tbody>
</table>
| Change of temperature (Temperature cycling) | IEC 60068-2-14 Na           | Temperature range: -55°C to 105°C
Number of cycles: 20
Dwell/transfer time: 30 min/3 min
| Cold (in operation)      | IEC 60068-2-1 Ad            | Temperature $T_A$: -45°C
Duration: 72 h                                             |
| Damp heat                | IEC 60068-2-30              | Temperature $T_A$, Humidity: 45°C, 95% RH
Duration: 72 hours                                             |
| Dry heat                 | IEC 60068-2-2 Bd            | Temperature: 125°C
Duration: 1000 h                                               |
| Electrostatic discharge susceptibility | IEC 61340-3-1, JESD 22-A114 | Human body model (HBM), Class 2, 2000 V                                 |
| Immersion in cleaning solvents | IEC 60068-2-45 XA, method 2 | Water, Glycol ether (Isopropyl alcohol): 55°C, 35°C (35°C)             |
| Mechanical shock         | IEC 60068-2-27 Ea           | Peak acceleration: 200 g
Duration: 6 ms                                                   |
| Moisture reflow sensitivity | J-STD-020E                   | Level 1 (SnPb-eutectic), Level 3 (Pb Free): 225°C, 260°C               |
| Operational life test    | MIL-STD-202G, method 108A   | Duration: 1000 h                                                        |
| Resistance to soldering heat | IEC 60068-2-20 Tb, method 1A | Solder temperature: 270°C
Duration: 10-13 s                                                  |
| Robustness of terminations | IEC 60068-2-21 Test Ua1     | Through hole mount products
All leads                                                           |
| Solderability            | IEC 60068-2-20 test Ta ¹    | Preconditioning Temperature, SnPb Eutectic Temperature, Pb-free: 235°C, 245°C |
| Vibration, broad band random | IEC 61373                   | Frequency: 5 to 150 Hz
RMS acceleration: 5 grms
Duration: 5 hrs in each direction                                  |

Notes

¹ Only for products intended for wave soldering (plated through hole products)