**Goal**

Able to convert a low voltage into higher voltage, within a reduced volume, and with a high efficiency (from 92 to more than 98%), these step-up can advantageously replace conventional dc/dc converters (2) when input/output insulation is not required. Moreover, if your starting current is very high, our technique of elevation enables the switching – almost directly and immediately – from the source (battery) to the load, while a typical converter can collapse. Reinforced switch diode available on request.

**Examples:**
- To transform a 12V battery into a powerful stabilized generator 15V / 900W or 24V / 576W
- To power a vehicle with 24V/600W from the 10 to 20V of its fuel-cell
- To operate a solar pump at constant speed, under 24V/1.2kW, from 18 to 23V
- To stabilize, at 400V/2kW, a 370V generator whose voltage varies from 345V to 395V
- To overcome the high starting current of an engine (ex: Maxon 24V / 9.15A / 212A) from a 12V battery

**General presentation**

The active part of the regulator (i.e. not counting high-performance screw connectors for wires of section \( \leq 72 \text{mm}^2 \)) measures 64 x 64 mm, and is thus compatible with regular half-brick modules. Depending on the cooling method (dynamic or passive) chosen by the customer when ordering, the complete regulator shall have one of the 4 following shapes:

1. **Integrated dynamic cooling**
   - Case 1: equipped with a small built-in fan, fast racking-out for fan replacement directly by the user after 50,000 hours
   - (this case 1 is 4 times smaller than case 4, which is of the same power but cooled by natural convection)

2. **Independent passive dissipation**
   - Case 2: the user places the elevator’s thermal interface against a heat conducting wall whose thermal resistance is \( \leq 1.5^\circ/\text{W} \)

3. **Standard passive dissipation**
   - Case 3: case 2 equipped with a "112" dissipator can be mounted on DIN rail; enhanced cooling if the whole unit is screwed on a heat conducting wall
   - N.B.: the picture represents the regulator deeply embedded in its "112" dissipator

4. **Reinforced passive dissipation**
   - With "225" dissipator (2 times longer than "112", same section)

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(1) patent registration: 2012 ; trademark: 2014  
(2) see also our isolated dc/dc converters, from 15W to 2kW, and our analog signal converters
Electrical data
- Power output (P_out): from 500W up to 2.32kW with twelve product references
- Input voltage "V_in": ranging from 10V to 400V dc depending on the unit as seen on table 10
- Common input and output, occupying the 2 "-" connection terminals
- Output voltage “V_out”: ranging from de 15V to 400V (always higher than the maximum input voltage)
- Input currents: 95A max (unit 10V to 14V ➔ 15V / 900W)
- No-load current: ≤ 6W / V_in ; fan’s power on case Ω : ≈ 5W
- Minimum load current: zero to ≤100mA depending on the model
- Line-no-load regulation: better than 2%; dynamic answer < 5% / <50ms
- Efficiency at full load: 92% to > 98%, depending on the model
- Ripple: less than 1% of V_out; fixed switching frequency > 200kHz

Protection
- Limited overloads: as long as decreasing V_out remains ≥ V_in + 0.5V
- Abnormal overloads: please add a fuse or current-limiter on the output or input
- Under-voltage or sufficient input over-voltage: the regulator no longer elevates the input voltage
- Filters: input and output; shields: two parallel metallic plates
- Thermal protection: lowering of V_out to ≈ V_in - 0.5V (automatic reset)
- Vibrations, tropicalisation, IP63 to IP67 sealing, except the fan. Stainless steel for the high-performance wire-connectors
- Ohmic wire loss reduction, with connectors receiving sections up to 72mm²
- The dynamic dissipation model is equipped with a highly reliable fan (50,000 hours)

Thermal characteristics (see table 13 with curves to read losses depending on ambient temperature)
- All models can work with ambient temperature from -40°C up to +90°C at decreasing power (except the dynamic dissipation model: from -30°C to +70°C)
- Models 1, 2 and 3 can work at half-power when the temperature ≥ 60°C
- Storage temperature: -40°C to +100°C for models 2, 3 and 4
- Temperature coefficient: 2.10⁻⁴ / °C

Options on request
- Remote sensing: 2 miniature connection points
- Shifting of the input range: 3 connections (please contact us for further details)
- Other input and output voltages ≤ 400V
- Other output powers, below 2.32kW
- Inhibition of the "step-up" function: 2 connections
- Control of the current limitation on the "step-up" range
- Customizable colors and texts for cases
- Reinforced switch diode for very high starting current

Mechanical presentation: 4 configurations (see 2 + 11 and the 4 pictures below)
- Case 1 250cm³ / 380g / 96 x 64 x thickness 61 mm; equipped with an integrated dynamic cooling
- Case 2 100cm³ / 290g / 92 x 64 x thickness 40 mm; alone (without dissipator); screwal on a functional dissipating wall or on one of the two available dissipators (length 112.6mm or 225.2mm)
- Case 3 500cm³ / 700g / 112.6 x 120 x thickness 47 mm; case 2 deeply embedded in the short dissipator; with clip on the back for DIN rail Ω (or with lateral side clip upon request)
- Case 4 1000cm³ / 1150g / 225.2 x 120 x thickness 47 mm; case 2 deeply embedded in the long dissipator; with clip on the back for DIN rail Ω (or with lateral side clip upon request)

Mechanical specifications
- Connections through large high-performance connectors enabling wire sections up to 72mm²
- Fan (MTBF 50,000 h) included in case 1 "250cm³": easily dismountable
- All cases can be fixed on a wall with two screws (center distances: 85/90/48.2 x 50.8mm)
- High volume saving if the user already has a thermally dissipating functional wall

Standards and specifications
- Marking CE/UL 60950-1 / EN 60950-1 / IEC 60950-1 / RoHS / 55022A if optional external filter
- Flammability: horizontal test for electrical applications, according to UL 94 HB standard
- MTBF (case at 50°C): passive dissipation models >120,000 hours / dynamic version with fan: 50,000 hours
- Worldwide manufacturers for active parts. Patent, assembling and final controls: ELECDAN Converter
Maximum ambient temperature for the 4 models, depending on losses. Result from graphic display or lineal equation.

Admissible losses depending on the ambient temperature $T°$:
- $30°C \leq T° \leq 70°C; P(W) = 90W - T° / thermal resistance$
- $50°C \leq T° \leq 90°C; P(W) = 90W - T° / 1°C / W$
- $50°C \leq T° \leq 90°C; P(W) = 90W - T° / 1°C / W$
- $50°C \leq T° \leq 90°C; P(W) = 90W - T° / 1°C / W$

Step-Up Voltage Regulator 500W to 2.32kW and main SKU

<table>
<thead>
<tr>
<th>No.</th>
<th>Input voltage (V)</th>
<th>Output Voltage (V)</th>
<th>Current (A)</th>
<th>Power rating (W)</th>
<th>Efficiency</th>
<th>Max. loss (W)</th>
<th>SKU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10 to 14</td>
<td>15</td>
<td>60</td>
<td>900</td>
<td>&gt; 0.95</td>
<td>40</td>
<td>SUR-1014-1560....</td>
</tr>
<tr>
<td>2</td>
<td>24</td>
<td>576</td>
<td></td>
<td></td>
<td>&gt; 0.94</td>
<td>40</td>
<td>SUR-1014-2424....</td>
</tr>
<tr>
<td>3</td>
<td>28</td>
<td>500</td>
<td></td>
<td></td>
<td>&gt; 0.92</td>
<td>40</td>
<td>SUR-1014-2818....</td>
</tr>
<tr>
<td>4</td>
<td>24</td>
<td>600</td>
<td></td>
<td></td>
<td>&gt; 0.94</td>
<td>38</td>
<td>SUR-1020-2425....</td>
</tr>
<tr>
<td>5</td>
<td>28</td>
<td>500</td>
<td></td>
<td></td>
<td>&gt; 0.92</td>
<td>40</td>
<td>SUR-1020-2818....</td>
</tr>
<tr>
<td>6</td>
<td>24</td>
<td>500</td>
<td></td>
<td></td>
<td>&gt; 0.96</td>
<td>40</td>
<td>SUR-1823-2450....</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>700</td>
<td></td>
<td></td>
<td>&gt; 0.95</td>
<td>32</td>
<td>SUR-1823-2825....</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>1200</td>
<td></td>
<td></td>
<td>&gt; 0.94</td>
<td>40</td>
<td>SUR-2028-3620....</td>
</tr>
<tr>
<td>8a</td>
<td>20 to 28</td>
<td>60</td>
<td>12.5</td>
<td>600</td>
<td>&gt; 0.95</td>
<td>32</td>
<td>SUR-2028-48-12.5....</td>
</tr>
<tr>
<td>9</td>
<td>56</td>
<td>700</td>
<td></td>
<td></td>
<td>&gt; 0.95</td>
<td>32</td>
<td>SUR-3646-56-12.5....</td>
</tr>
<tr>
<td>10</td>
<td>56</td>
<td>40</td>
<td>2320</td>
<td></td>
<td>&gt; 0.98</td>
<td>30</td>
<td>SUR-4556-5840....</td>
</tr>
<tr>
<td>10a</td>
<td>46</td>
<td>50</td>
<td>3000</td>
<td></td>
<td>0.99</td>
<td>31</td>
<td>SUR-4652-6050....</td>
</tr>
<tr>
<td>11</td>
<td>72</td>
<td>1200</td>
<td></td>
<td></td>
<td>&gt; 0.97</td>
<td>40</td>
<td>SUR-5469-7218....</td>
</tr>
<tr>
<td>11a</td>
<td>72</td>
<td>1000</td>
<td></td>
<td></td>
<td>&gt; 0.97</td>
<td>31</td>
<td>SUR-4056-7214....</td>
</tr>
<tr>
<td>12</td>
<td>400</td>
<td>5</td>
<td>2000</td>
<td></td>
<td>&gt; 0.98</td>
<td>36</td>
<td>SUR-345395-4005....</td>
</tr>
</tbody>
</table>

Other voltages, currents, powers, presentations: upon request
Example: 12 to 16V => 24V / 5A / 1400W / efficiency: 0.84 / loss: 90W / brick size

Physical characteristics of the 4 cases and last digit for SKU

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Cooling</th>
<th>Dimensions (mm)</th>
<th>Volume without connectors (cm³)</th>
<th>Weight (g)</th>
<th>Thermal resistance</th>
<th>Back mounting</th>
<th>SKU</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dynamic</td>
<td>96</td>
<td>64</td>
<td>250</td>
<td>380</td>
<td>1°C / W</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Independent passive</td>
<td>92</td>
<td>64</td>
<td>40</td>
<td>100</td>
<td>290</td>
<td>6°C / W</td>
</tr>
<tr>
<td>3</td>
<td>Standard passive</td>
<td>112.6</td>
<td>120</td>
<td>47</td>
<td>500</td>
<td>700</td>
<td>1.5°C / W</td>
</tr>
<tr>
<td>4</td>
<td>Reinforced passive</td>
<td>225.2</td>
<td>120</td>
<td>47</td>
<td>1000</td>
<td>1150</td>
<td>1°C / W</td>
</tr>
</tbody>
</table>

High-performance wire-connectors (bridge contact) for sections ≤ 72 mm²

Graphical determination of max. possible ambient temperature ($T°$)
- Please see on table 10 the order number (1 to 12) of the unit and note the corresponding maximum loss from column 4.
- Then check the thermal curve at 13 for the selected case number (1 to 4) as on table 11.
- The loss $P(W)$ is proportional to the output power from zero to the maximum value: $P(W) = \text{max. loss} \times \text{output power} / \text{power rating}$
- We read the max. possible ambient temperature from the intersection of the horizontal "loss" with the curve.

Examples:
1/ The step-up model "10 à 14V → 15V / 60A / 900W" has a maximum loss of 40W. At half-power (loss 20W), for case Φ, the max. ambient temperature should be: 70°C. At one power (loss 10W), the maximum ambient temperature should be: 80°C.
2/ For model No. 10 (58V / 60A / 2320W) with case Φ, max. ambient temperature: $60°C$ at full power (loss 30W) or $70°C$ at $2/3$ power (loss 20W).

Complete SKU Step-Up Regulator

<table>
<thead>
<tr>
<th>Function + Case type</th>
<th>Dissipator alone</th>
<th>Matching Clip</th>
</tr>
</thead>
<tbody>
<tr>
<td>table 10 + table 11</td>
<td>&quot;112&quot; or &quot;225&quot;</td>
<td>C112 C225 C37</td>
</tr>
</tbody>
</table>

Example of SKU for a dynamic cooling case:
No. 1 table 10 + No. 1 table 11 → SKU: SUR-1014-1560-1
Possible pairings from case 2 of any Step-Up Voltage Regulator

Thermal resistances (1.5 and 1°C/W) can be decreased by half, by adding a symmetrical dissipator (112S or 228S) back to back; linked through 4.5 diameter and M4. Mounting clip embedded in the symmetrical dissipator.

Accessories upon request

<table>
<thead>
<tr>
<th>Clip C 37</th>
<th>112</th>
</tr>
</thead>
<tbody>
<tr>
<td>dissipator 112</td>
<td>225</td>
</tr>
<tr>
<td>dissipator 225</td>
<td></td>
</tr>
<tr>
<td>dissipator 112S</td>
<td></td>
</tr>
<tr>
<td>dissipator 228S</td>
<td></td>
</tr>
<tr>
<td>Clip C</td>
<td>112</td>
</tr>
<tr>
<td></td>
<td>225</td>
</tr>
</tbody>
</table>

Embedding

special, optional, mountable on the lateral sides (thickness 37mm) of the dissipators: fixing with 2 symmetrical M3 (central distance 50mm)

thermal resistance < 1.5°C/W

4 inserts M3 on base plate (center distances: 50.8 x 48.2mm) for customer’s frame

thermally dissipating wall