Description
This reference design automatically provides a back-up voltage during a power interruption. It manages the charging of supercaps and provides reverse blocking protection. The maximum supercap charging current and voltage can be adjusted. When the input voltage fails a buck-boost converter (TPS63802) takes over and generates a constant backup voltage. The supercap capacitance and voltage define the energy which is available for the backup. The PMP30693 provides a stable backup output of 3.7 V at 300 mA for more than 100 s until the output voltage drops.
1.1 *Thermal Images*

The images below show the infrared images taken from the FlexCam

1.1.1 *Supercap Charge; no input current limit (R7 = 0, R5 not populated)*

MAIN Voltage = 3.6V  
SYS Current = 1A  

![Thermal Image 1](image1)

<table>
<thead>
<tr>
<th>Name</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diode D2</td>
<td>31.2°C</td>
</tr>
<tr>
<td>Diode D1</td>
<td>46.0°C</td>
</tr>
<tr>
<td>Controller U4</td>
<td>43.3°C</td>
</tr>
<tr>
<td>Inductor L1</td>
<td>36.2°C</td>
</tr>
<tr>
<td>Ideal Diode U1</td>
<td>37.2°C</td>
</tr>
</tbody>
</table>

1714 Vin=3.6V SC CHARGE (no current limit)  
Il=1A

1.1.2 *Supercap Charge; Input current limit Variant 1 (R7 = 68mohm, R5 = 0, R14 = R15 = R16 = 30.1ohm); Maximal charge current: 100mA, maximal precharge current = 300mA*

MAIN Voltage = 3.6V  
SYS Current = 1A  

![Thermal Image 2](image2)

<table>
<thead>
<tr>
<th>Name</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller U4</td>
<td>29.5°C</td>
</tr>
<tr>
<td>Inductor L1</td>
<td>30.0°C</td>
</tr>
<tr>
<td>Ideal Diode U1</td>
<td>35.4°C</td>
</tr>
</tbody>
</table>

1711_Vin=3.6V SC CHARGE 1 (300mA100mA)  
Il=1A
1.1.3 Supercap Discharge (Backup Mode)

SYS Current = 1A

<table>
<thead>
<tr>
<th>Name</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controller U4</td>
<td>58.1°C</td>
</tr>
<tr>
<td>Ideal Diode U5</td>
<td>36.9°C</td>
</tr>
</tbody>
</table>

1713 Vin=0V SC DISCHARGE (Backup)

Iload=1A.is2
2 Waveforms

2.1 Supercap Charging

2.1.1 Supercap Charge; no input current limit (R7 = 0, R5 not populated)

MAIN Voltage = 3.3V
SYS Current = 0A

MAIN Voltage = 3.6V
SYS Current = 0A
MAIN Voltage = 3.6V
SYS Current = 1A

MAIN Voltage = 5.4V
SYS Current = 0A
2.1.2 Supercap Charge; Input current limit Variant 1 (R7 = 68mohm, R5 = 0, R14 = R15 = R16 = 30.1ohm); Maximal charge current: 100mA, maximal precharge current = 300mA

MAIN Voltage = 3.3V
SYS Current = 0A

MAIN Voltage = 3.6V
SYS Current = 0A
2.1.3 **Supercap Charge; Input current limit Variant 2** (R7 = 130mohm, R5 = 0, R13 = R14 = R15 = DNP, R16=49.9ohm); Maximal charge current: 50mA, maximal precharge current = 50mA

MAIN Voltage = 3.6V
SYS Current = 0A
2.2 Voltage Drop input vs. output

2.2.1 Supercap Charge; no input current limit (R7 = 0, R5 not populated)
MAIN Voltage = 3.6V
SYS Current = 1A
2.3 Supercap recharge cycle

2.3.1 no input current limit (R7 = 0, R5 not populated)

A supercap discharge resistor $R_{\text{discharge}}$ was assembled for this measurement. The resistor was connected between the supercap voltage ($V_{\text{SC}}$ (2x)) and ground. It forces a discharge of the supercaps.

- MAIN Voltage = 3.6V
- SYS Current = 0A
- $R_{\text{discharge}}$ = 100ohm
2.4 **Supercap balancing**

2.4.1 **no input current limit (R7 = 0, R5 not populated)**

C1 = voltage across capacitors C25+C17
C2 = voltage across capacitor C25

MAIN Voltage = 3.2V
SYS Current = 0A

MAIN Voltage = 3.6V
SYS Current = 0A
MAIN Voltage = 5.4V
SYS Current = 0A
2.5 Supercap discharge time (Backup Mode)

SYS Current = 1A

SYS Current = 0.3A
SYS Current = load profile:

![Graph showing SYS Current load profile]
2.6 Output Voltage Ripple

2.6.1 Backup Mode (Supercap discharge)

SYS Current = 1A
2.7 Load Transient Response

Load Profile:

2.7.1 Buck Backup Mode (Supercap Discharge)
2.7.2 Boost Backup Mode (Supercap Discharge)