1 General

1.1 Purpose

This test report is to provide the detailed data for evaluating and verifying the PMP40001 which employs one Buck-Boost Controller ---- LM5175 combined with a USB C PD DFP Controllers ---- TPS25740 which can negotiate with the external USB C PD devices for 3 sets of output voltage (5/12/20V). The maximal output power is designed as 60W and valid input voltage is from 6V to 13.5V which is compatible with the 2S and 3S lithium battery pack.

1.2 Reference Documentation

Schematic: PMP40001_Sch.pdf
Gerber: PMP40001_GerberNCdrills.zip
Layer Plot: PMP40001_PCBlayers.pdf
Assembly Drawing: PMP40001_Assy.pdf
CAD File: PMP40001_CAD.zip
BOM: PMP40001_BOM.pdf

1.3 Test Equipment

Multi-meter (current): Fluke 287C
Multi-meter (voltage): Fluke 287C
DC Source: Chroma 62006P-100-25
E-Load: Chroma 63105A module
Oscilloscope: Tektronix DPO3054
Electrical Thermography: Fluke Ti9
**2 Performance Data and Waveform**

**2.1 Efficiency**

**2.1.1 Output voltage: 5V**

<table>
<thead>
<tr>
<th>Vin(V)</th>
<th>Iin(A)</th>
<th>Vo(V)</th>
<th>Io(A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.002</td>
<td>0.130</td>
<td>5.170</td>
<td>0.087</td>
<td>57.78%</td>
</tr>
<tr>
<td>5.985</td>
<td>0.484</td>
<td>5.164</td>
<td>0.493</td>
<td>87.90%</td>
</tr>
<tr>
<td>5.964</td>
<td>0.922</td>
<td>5.156</td>
<td>0.986</td>
<td>92.49%</td>
</tr>
<tr>
<td>5.940</td>
<td>1.370</td>
<td>5.146</td>
<td>1.496</td>
<td>94.62%</td>
</tr>
<tr>
<td>5.921</td>
<td>1.817</td>
<td>5.136</td>
<td>1.991</td>
<td>95.07%</td>
</tr>
<tr>
<td>5.907</td>
<td>2.268</td>
<td>5.128</td>
<td>2.485</td>
<td>95.12%</td>
</tr>
<tr>
<td>5.889</td>
<td>2.736</td>
<td>5.116</td>
<td>2.994</td>
<td>95.08%</td>
</tr>
<tr>
<td>9.002</td>
<td>0.079</td>
<td>5.174</td>
<td>0.088</td>
<td>64.09%</td>
</tr>
<tr>
<td>8.998</td>
<td>0.314</td>
<td>5.165</td>
<td>0.494</td>
<td>90.33%</td>
</tr>
<tr>
<td>8.993</td>
<td>0.607</td>
<td>5.155</td>
<td>0.987</td>
<td>93.27%</td>
</tr>
<tr>
<td>8.987</td>
<td>0.906</td>
<td>5.144</td>
<td>1.496</td>
<td>94.53%</td>
</tr>
<tr>
<td>8.981</td>
<td>1.198</td>
<td>5.135</td>
<td>1.991</td>
<td>95.04%</td>
</tr>
<tr>
<td>8.976</td>
<td>1.493</td>
<td>5.124</td>
<td>2.485</td>
<td>95.02%</td>
</tr>
<tr>
<td>8.970</td>
<td>1.798</td>
<td>5.114</td>
<td>2.995</td>
<td>94.97%</td>
</tr>
<tr>
<td>13.501</td>
<td>0.060</td>
<td>5.175</td>
<td>0.088</td>
<td>56.28%</td>
</tr>
<tr>
<td>13.498</td>
<td>0.216</td>
<td>5.168</td>
<td>0.494</td>
<td>87.57%</td>
</tr>
<tr>
<td>13.494</td>
<td>0.411</td>
<td>5.156</td>
<td>0.986</td>
<td>91.70%</td>
</tr>
<tr>
<td>13.491</td>
<td>0.615</td>
<td>5.145</td>
<td>1.495</td>
<td>92.72%</td>
</tr>
<tr>
<td>13.487</td>
<td>0.808</td>
<td>5.135</td>
<td>1.990</td>
<td>93.78%</td>
</tr>
<tr>
<td>13.484</td>
<td>1.005</td>
<td>5.124</td>
<td>2.485</td>
<td>93.97%</td>
</tr>
<tr>
<td>13.479</td>
<td>1.209</td>
<td>5.113</td>
<td>2.994</td>
<td>93.94%</td>
</tr>
</tbody>
</table>
2.1.2 Output voltage: 12V

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.998</td>
<td>0.175</td>
<td>12.089</td>
<td>0.087</td>
<td>66.95%</td>
</tr>
<tr>
<td>8.986</td>
<td>0.725</td>
<td>12.079</td>
<td>0.493</td>
<td>91.42%</td>
</tr>
<tr>
<td>8.971</td>
<td>1.404</td>
<td>12.068</td>
<td>0.986</td>
<td>94.50%</td>
</tr>
<tr>
<td>8.956</td>
<td>2.105</td>
<td>12.056</td>
<td>1.496</td>
<td>95.69%</td>
</tr>
<tr>
<td>8.941</td>
<td>2.788</td>
<td>12.045</td>
<td>1.991</td>
<td>96.22%</td>
</tr>
<tr>
<td>8.926</td>
<td>3.476</td>
<td>12.034</td>
<td>2.485</td>
<td>96.39%</td>
</tr>
<tr>
<td>8.910</td>
<td>4.189</td>
<td>12.021</td>
<td>2.994</td>
<td>96.44%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.497</td>
<td>0.139</td>
<td>12.080</td>
<td>0.087</td>
<td>65.91%</td>
</tr>
<tr>
<td>11.487</td>
<td>0.569</td>
<td>12.070</td>
<td>0.493</td>
<td>91.06%</td>
</tr>
<tr>
<td>11.476</td>
<td>1.097</td>
<td>12.059</td>
<td>0.986</td>
<td>94.52%</td>
</tr>
<tr>
<td>11.464</td>
<td>1.641</td>
<td>12.046</td>
<td>1.495</td>
<td>95.75%</td>
</tr>
<tr>
<td>11.453</td>
<td>2.171</td>
<td>12.035</td>
<td>1.990</td>
<td>96.34%</td>
</tr>
<tr>
<td>11.441</td>
<td>2.703</td>
<td>12.025</td>
<td>2.485</td>
<td>96.64%</td>
</tr>
<tr>
<td>11.429</td>
<td>3.253</td>
<td>12.015</td>
<td>2.994</td>
<td>96.77%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.497</td>
<td>0.127</td>
<td>12.071</td>
<td>0.087</td>
<td>61.41%</td>
</tr>
<tr>
<td>13.489</td>
<td>0.490</td>
<td>12.063</td>
<td>0.493</td>
<td>89.99%</td>
</tr>
<tr>
<td>13.479</td>
<td>0.938</td>
<td>12.054</td>
<td>0.986</td>
<td>94.03%</td>
</tr>
<tr>
<td>13.469</td>
<td>1.403</td>
<td>12.043</td>
<td>1.495</td>
<td>95.29%</td>
</tr>
<tr>
<td>13.460</td>
<td>1.852</td>
<td>12.030</td>
<td>1.990</td>
<td>96.05%</td>
</tr>
<tr>
<td>13.449</td>
<td>2.304</td>
<td>12.020</td>
<td>2.485</td>
<td>96.43%</td>
</tr>
<tr>
<td>13.439</td>
<td>2.769</td>
<td>12.008</td>
<td>2.994</td>
<td>96.63%</td>
</tr>
</tbody>
</table>
2.1.3 Output voltage: 20V

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.097</td>
<td>0.312</td>
<td>20.123</td>
<td>0.086</td>
<td>61.19%</td>
</tr>
<tr>
<td>9.080</td>
<td>1.214</td>
<td>20.114</td>
<td>0.492</td>
<td>89.81%</td>
</tr>
<tr>
<td>9.059</td>
<td>2.357</td>
<td>20.096</td>
<td>0.984</td>
<td>92.65%</td>
</tr>
<tr>
<td>9.034</td>
<td>3.520</td>
<td>20.084</td>
<td>1.493</td>
<td>94.26%</td>
</tr>
<tr>
<td>9.013</td>
<td>4.662</td>
<td>20.068</td>
<td>1.986</td>
<td>94.83%</td>
</tr>
<tr>
<td>8.991</td>
<td>5.816</td>
<td>20.054</td>
<td>2.480</td>
<td>95.10%</td>
</tr>
<tr>
<td>8.968</td>
<td>7.016</td>
<td>20.039</td>
<td>2.988</td>
<td>95.16%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.497</td>
<td>0.244</td>
<td>20.144</td>
<td>0.086</td>
<td>61.97%</td>
</tr>
<tr>
<td>11.484</td>
<td>0.956</td>
<td>20.105</td>
<td>0.491</td>
<td>89.97%</td>
</tr>
<tr>
<td>11.467</td>
<td>1.851</td>
<td>20.086</td>
<td>0.985</td>
<td>93.24%</td>
</tr>
<tr>
<td>11.450</td>
<td>2.765</td>
<td>20.074</td>
<td>1.493</td>
<td>94.69%</td>
</tr>
<tr>
<td>11.433</td>
<td>3.652</td>
<td>20.059</td>
<td>1.987</td>
<td>95.44%</td>
</tr>
<tr>
<td>11.416</td>
<td>4.547</td>
<td>20.046</td>
<td>2.481</td>
<td>95.80%</td>
</tr>
<tr>
<td>11.399</td>
<td>5.474</td>
<td>20.031</td>
<td>2.990</td>
<td>95.98%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vin (V)</th>
<th>Iin (A)</th>
<th>Vo (V)</th>
<th>Io (A)</th>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.498</td>
<td>0.203</td>
<td>20.109</td>
<td>0.086</td>
<td>63.33%</td>
</tr>
<tr>
<td>13.487</td>
<td>0.809</td>
<td>20.100</td>
<td>0.491</td>
<td>90.51%</td>
</tr>
<tr>
<td>13.472</td>
<td>1.558</td>
<td>20.083</td>
<td>0.984</td>
<td>94.19%</td>
</tr>
<tr>
<td>13.457</td>
<td>2.343</td>
<td>20.069</td>
<td>1.494</td>
<td>95.12%</td>
</tr>
<tr>
<td>13.443</td>
<td>3.094</td>
<td>20.056</td>
<td>1.988</td>
<td>95.84%</td>
</tr>
<tr>
<td>13.428</td>
<td>3.850</td>
<td>20.043</td>
<td>2.481</td>
<td>96.17%</td>
</tr>
<tr>
<td>13.413</td>
<td>4.630</td>
<td>20.028</td>
<td>2.990</td>
<td>96.42%</td>
</tr>
</tbody>
</table>

![20Vo Efficiency Graph](image)

2.2 Standby Current
<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>TEST CONDITION</th>
<th>MIN</th>
<th>TYP</th>
<th>MAX</th>
<th>UNIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>$I_{STD}$</td>
<td>Standby current Vin=6V, output port unattached</td>
<td>26.7</td>
<td>TYP</td>
<td>37.6</td>
<td>uA</td>
</tr>
<tr>
<td></td>
<td>Standby current Vin=9V, output port unattached</td>
<td>37.6</td>
<td>53.7</td>
<td>37.6</td>
<td>uA</td>
</tr>
<tr>
<td></td>
<td>Standby current Vin=13.5V, output port unattached</td>
<td>53.7</td>
<td>53.7</td>
<td>53.7</td>
<td>uA</td>
</tr>
</tbody>
</table>

2.2 Port Attach and Detach

Apply a type C PD UFP at the output port and remove it after 10s.

Vin=6V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

Vin=6V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

Vin=9V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

Vin=9V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div
Vin=13.5V and Attach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

Vin=9V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=11.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=13.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=13.5V and Detach the 5V UFP
CH1: VBUS 2V/Div
CH2: CC 2V/Div

Vin=9V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=11.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=13.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div
Vin=9V and Attach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=9V and Detach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=11.5V and Attach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=11.5V and Detach the 20V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=13.5V and Attach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

Vin=13.5V and Detach the 12V UFP
CH1: VBUS 5V/Div
CH2: CC 2V/Div

2.3 Output Voltage Ripple

2.3.1 Output Voltage: 5V
2.3.2 Output Voltage: 12V
Vin=9V and No Load
CH1: VBUS (AC Coupled) 20mV/Div

Vin=9V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

Vin=11.5V and No Load
CH1: VBUS (AC Coupled) 20mV/Div

Vin=11.5V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

Vin=13.5V and No Load
CH1: VBUS (AC Coupled) 20mV/Div

Vin=13.5V and Full Load
CH1: VBUS (AC Coupled) 20mV/Div

2.3.3 Output Voltage: 20V
2.4 Dynamic Performance

2.3.1 Output Voltage: 5V

0→25% Load Step @150mA/us
Vin=6V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=6V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=9V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=9V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

25%↔50% Load Step @150mA/us
Vin=6V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=6V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

50%↔75% Load Step @150mA/us
Vin=6V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=6V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

75%↔100% Load Step @150mA/us
2.3.2 Output Voltage: 12V

0→25% Load Step @150mA/us
Vin=9V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=9V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=11.5V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=11.5V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 0 to 25% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 0 Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

25%↔50% Load Step @150mA/us
Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

50%↔75% Load Step @150mA/us
Vin=9V and Load switching from 50% to 75% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=9V and Load switching from 75% to 50% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=11.5V and Load switching from 50% to 75% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=11.5V and Load switching from 75% to 50% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 75% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

Vin=13.5V and Load switching from 75% to 50% Load  
CH1: VBUS (AC Coupled) 100mV/Div  
CH4: Io 1A/Div

75%↔100% Load Step @150mA/us
Vin=9V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 75% to 100% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 100% to 75% Load
CH1: VBUS (AC Coupled) 100mV/Div
CH4: Io 1A/Div

2.3.3 Output Voltage: 20V

0↔25% Load Step @150mA/us
Vin=9V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 0 to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 0 Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

25%↔50% Load Step @150mA/us
Vin=9V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 25% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 25% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

50%↔75% Load Step @150mA/us
Vin=9V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=9V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=11.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 50% to 75% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

Vin=13.5V and Load switching from 75% to 50% Load
CH1: VBUS (AC Coupled) 200mV/Div
CH4: Io 1A/Div

75%↔100% Load Step @150mA/us
Vin=9V and Load switching from 75% to 100% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

Vin=11.5V and Load switching from 75% to 100% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

Vin=13.5V and Load switching from 75% to 100% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

Vin=9V and Load switching from 100% to 75% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

Vin=11.5V and Load switching from 100% to 75% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

Vin=13.5V and Load switching from 100% to 75% Load  
CH1: VBUS (AC Coupled) 200mV/Div  
CH4: Io 1A/Div  

2.5 Bode Plot  
2.5.1 Output Voltage: 5V
Vin=6V and Io=3A
Fc=8.28KHz; Phase Margin=50.6°; Gain Margin=29.6dB

Vin=9V and Io=3A
Fc=10.0KHz; Phase Margin=57.9°; Gain Margin=30.1dB
Vin=13.5V and Io=3A
Fc=10.65KHz; Phase Margin=61.4°; Gain Margin=30dB

2.5.2 Output Voltage: 12V

Vin=9V and Io=3A
Fc=8.28KHz; Phase Margin=58.2°; Gain Margin=19.4dB
Vin=11.5V and Io=3A
Fc=9.26KHz; Phase Margin=54.9°; Gain Margin=20.5dB

Vin=13.5V and Io=3A
Fc=10.0KHz; Phase Margin=58.2°; Gain Margin=28.2dB

2.5.3 Output Voltage: 20V
Vin=9V and Io=3A
Fc=4.6kHz; Phase Margin=56.3°; Gain Margin=21.8dB

Vin=11.5V and Io=3A
Fc=6.26KHz; Phase Margin=58.9°; Gain Margin=23.2dB
Vin=13.5V and Io=3A
Fc=7.56KHz; Phase Margin=61.9°; Gain Margin=23.2dB

2.6 Thermal Performance

The board is applied a 9V DC voltage and output 20V/3A load to the output port. Run about 10min for warming up.
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