ABSTRACT
This application note describes how to configure the TPS22960 load switch as a dual switch in parallel configuration. Connecting in this manner allows the switch twice the current handling capability while decreasing switch on resistance by factor of 2. This is accomplished without affecting the controlled turn-on functionality.

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Dual Load Switch Configuration

The TPS22960 load switch device is available in a dual-switch 8-pin SOT (DCN) package. Therefore, the second switch option is readily available and easy to connect.

The device pinout and a description are shown in Table 1.

### Table 1. TPS22960 Pinout

<table>
<thead>
<tr>
<th>NO.</th>
<th>NAME</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>V(_{IN1})</td>
<td>Switch 1 input; bypass this input with a ceramic capacitor to GND</td>
</tr>
<tr>
<td>2</td>
<td>ON1</td>
<td>Switch 1 control input, active high. Do not leave floating.</td>
</tr>
<tr>
<td>3</td>
<td>ON2</td>
<td>Switch 2 control input, active high. Do not leave floating.</td>
</tr>
<tr>
<td>4</td>
<td>V(_{IN2})</td>
<td>Switch 2 input; bypass this input with a ceramic capacitor to GND</td>
</tr>
<tr>
<td>5</td>
<td>V(_{OUT2})</td>
<td>Switch 2 output</td>
</tr>
<tr>
<td>6</td>
<td>GND</td>
<td>Ground</td>
</tr>
<tr>
<td>7</td>
<td>SR</td>
<td>Slew rate control pin. SR = GND translates into a 75-(\mu)s rise time; SR = high translates into a 660-(\mu)s rise time.</td>
</tr>
<tr>
<td>8</td>
<td>V(_{OUT1})</td>
<td>Switch 1 output</td>
</tr>
</tbody>
</table>

To connect the switch in parallel configuration, make the following device connections shown in Figure 1:

- \(V_{IN1}\) to \(V_{IN2}\)
- ON1 to ON2
- \(V_{OUT1}\) to \(V_{OUT2}\)
- GND to circuit ground
- SR, ON1, and ON2 driven by GPIOs

![Figure 1. TPS22960 Load Switch Parallel Connections](image-url)
The difference in switch on resistance from a single switch configuration to dual switch configuration is shown in Table 2.

### Table 2. TPS22960 $r_{on}$ Single and Dual Configuration

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Configuration</th>
<th>$V_{OUT}$ (V)</th>
<th>$V_{drop}$ Across SW (V)</th>
<th>Calculated $r_{on}$ ($V_{drop}/I_{OUT}$) (mΩ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$r_{on}$, on state resistance SW1</td>
<td>$V_{IN} = 5.5$ V, $I_{OUT} = 200$ mA</td>
<td>Single switch</td>
<td>5.382</td>
<td>0.08926</td>
<td>446.3</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 3.3$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>3.169</td>
<td>0.1088</td>
<td>544</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 2.5$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>2.345</td>
<td>0.1270</td>
<td>635</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.8$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.607</td>
<td>0.1751</td>
<td>875.5</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.62$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.388</td>
<td>0.2039</td>
<td>1019.5</td>
</tr>
<tr>
<td>$r_{on}$, on state resistance SW2</td>
<td>$V_{IN} = 5.5$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>5.388</td>
<td>0.0824</td>
<td>412</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 3.3$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>3.169</td>
<td>0.1023</td>
<td>511.5</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 2.5$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>2.349</td>
<td>0.1266</td>
<td>633</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.8$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.601</td>
<td>0.1717</td>
<td>858.5</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.62$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.392</td>
<td>0.2015</td>
<td>1007.5</td>
</tr>
<tr>
<td>$r_{on}$, on state resistance</td>
<td>$V_{IN} = 5.5$ V, $I_{OUT} = 200$ mA</td>
<td>Dual parallel switch</td>
<td>5.429</td>
<td>0.04156</td>
<td>207.8</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 3.3$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>3.216</td>
<td>0.0545</td>
<td>272.5</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 2.5$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>2.414</td>
<td>0.06157</td>
<td>307.8</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.8$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.690</td>
<td>0.08273</td>
<td>413.6</td>
</tr>
<tr>
<td></td>
<td>$V_{IN} = 1.62$ V, $I_{OUT} = 200$ mA</td>
<td></td>
<td>1.5008</td>
<td>0.09242</td>
<td>462.1</td>
</tr>
</tbody>
</table>

Switch on resistance characteristics are shown in Figure 2, with a continuous output current of 200 mA.

![Figure 2. Switch ON Resistance vs Input Voltage, 200-mA Continuous Output Current](image-url)
The dual switch configuration is able to operate with a continuous current of 1 A. Figure 3 shows the switch on resistance at high continuous current operation.

![Graph: Switch ON Resistance vs Input Voltage, High Output Current](image)

**Figure 3.** Switch ON Resistance vs Input Voltage, High Output Current

The following scope plots (see Figure 4 through Figure 7) show the switch output slew rate of the single switch and dual switch configurations. No significant change is seen in the output waveform while exercising the controlled output control.

![Scope Plot: V_out Slew Rate, Single Switch Configuration, SR = Low](image)

**Figure 4.** $V_{out}$ Slew Rate, Single Switch Configuration, SR = Low
Figure 5. $V_{\text{OUT}}$ Slew Rate, Single Switch Configuration, $SR = \text{High}$

Figure 6. $V_{\text{OUT}}$ Slew Rate, Dual Switch Configuration, $SR = \text{Low}$
Fig. 7 shows a typical layout scheme. The VIN and VOUT pins of the switch can carry significant current, so traces to these pins should be of suitable length and width to minimize voltage drop to the load. Locate CIN and COUT bypass capacitors close to the VIN and VOUT pins.
2 References

1. TPS22960 data sheet (SLVS914)
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