When to use Output Voltage Scaling

$$V_{OUT} = \frac{V_{DAC}}{K_{DIVIDER}}$$

- Controller supports up to 2.5V Natively (10mV DAC table)
- VOUT_SCALE_LOOP can be 1.0 or 8/9.
- When the VSP/VSN Resistor divider ratio matches VOUT_SCALE_LOOP, telemetry and OV/UV will not need external scaling.
- To achieve higher than ~2.8V, set the resistor divider to a larger ratio (not necessarily matching VOUT_SCALE_LOOP).
  – Output voltage telemetry will be scaled accordingly.
  – OVP/UVP thresholds will be scaled accordingly (controller senses VSP/VSN pins)
  – Switching Frequency may need scaling if the divider ratio is large. A low frequency control loop adjusts the on-times to maintain constant switching frequency, however its dynamic range is limited.

Using Vcore Controllers above VID table max Vout

5.3.28 Output Voltage Scaling

In some applications, it may be necessary to use an external resistor divider in the output voltage feedback to the controller, for example to reach an output voltage higher than that supported natively by the VID table. In this case, connect a resistor divider between the VSP and VSN pins of the channel, as shown in Figure 5-62. Where scaling is necessary, choose R_{VSP1} = 100 Ω, and scale R_{VSP2} accordingly.

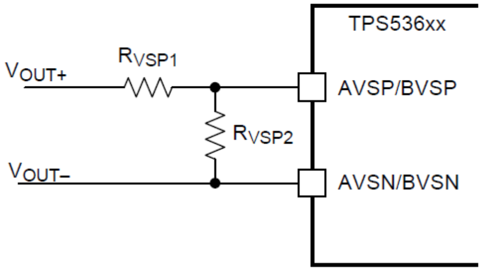

Figure 5-62. Output Voltage Scaling

The resistor divider ratio, defined in Equation 4 as K_{SCALE} determines the ratio of the actual output voltage, to the commanded output voltage. In Equation 5, V_{DAC} refers to the commanded output voltage, either via VOUT_COMMAND, or via the SVID interface.

$$K_{scale} = \frac{R_{VSP1} + R_{VSP2}}{R_{VSP2}} \quad (4)$$

$$V_{OUT} = V_{DAC} \times K_{scale} \quad (5)$$

Using Vcore Controllers above VID table max Vout

Note that the internal telemetry system measures the output voltage at the VSP/VSN pins of the controller. When using external output voltage scaling, the output voltage telemetry will report the sensed voltage by the controller, which must be re-scaled by K_{SCALE}, in order to accurately represent the true output voltage. This is shown in Equation 6 and Equation 7

$$\mathrm{READ\_VOUT} = \frac{V_{OUT}}{K_{scale}} \tag{6}$$

$$\mathrm{READ\_VOUT(corrected)} = \mathrm{READ\_VOUT} \times K_{scale} \tag{7}$$

Example: Output Voltage Scaling with KSCALE = 2.0

In order to achieve an output voltage of 3.3 V for Channel A, the user must apply external output voltage scaling. Follow these steps to apply external output voltage scaling

- Select $R_{VSP1} = R_{VSP2}$ according to Equation 4.
- Select VDAC = 1.650 V, by selecting 10-mV DAC mode and select the commanded output voltage to 1.650 V, via VOUT_COMMAND or the SVID interface.

In this case, the actual output voltage is 3.30 V: (K_3 × 1.65 V) = (2.0 × 1.65 V) = 3.30 V

READ_VOUT and MFR_SPECIFIC_04 must be multiplied by K_3 = 2.0 to reflect the true output voltage.