Application Brief

Multiphase Operation of LM5171

Key Concepts of Multiphase Operation

Multiphase operation, often called interleaving, uses multiple parallel converters to share the high load current. Multiphase operation provides benefits like ripple cancellation, reduced component size and easier thermal management.

To achieve multiphase operation, phase interleaving and current sharing must be considered.

See 6.3.18 Multiphase Configurations (SYNCO, OPT) in the LM5171-Q1 datasheet to achieve phase interleaving.

Current sharing is achieved by connecting ISET1 and ISET2 (ISETx) pins together as shown in Figure 1. Usually, the ISETx comes from the voltage loop error amplifiers output (ERRHV or ERRLV) of the primary LM5171. As shown in Figure 1, two diodes create an *OR* connection between ERRHV and ERRLV. The following resistor divider is selected based on the required maximum ISETx voltage. The average inductor current is limited when the maximum ISETx voltage is limited. The resistor divider provides an additional overcurrent limit. The voltage loop error amplifiers (ERRHV or ERRLV) of the secondary LM5171s are not used.

With average current mode control, the average current of each phase tracks the ISETx voltage. The same average current is expected across all phases, regardless of differences in inductance, input voltage or output voltage.

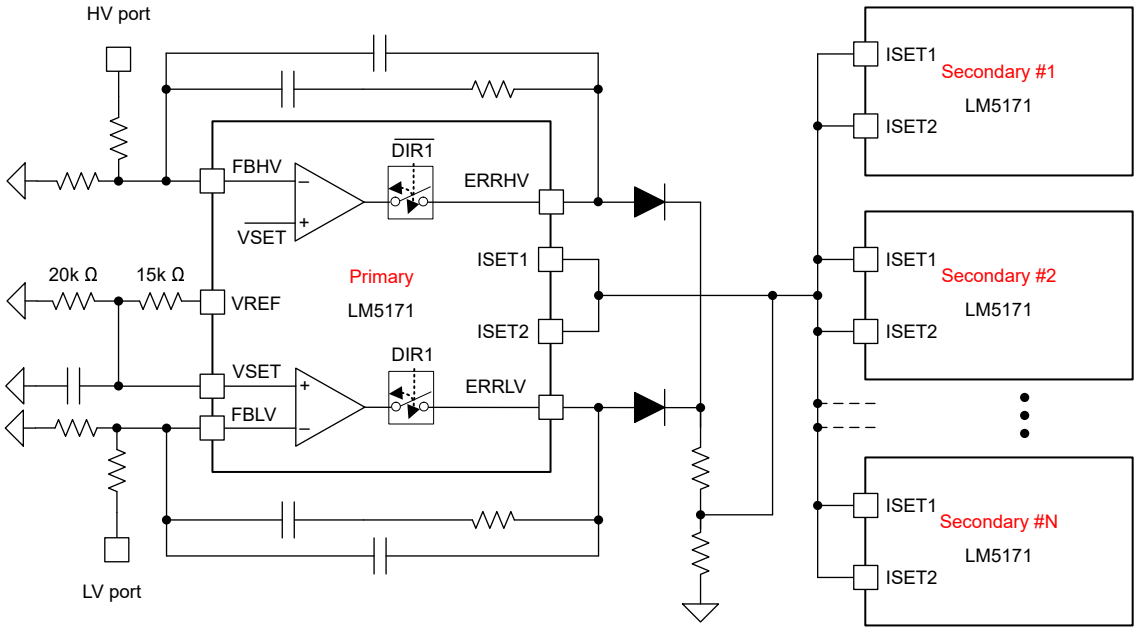

Figure 1. Multiphase Operation of LM5171

A Four-Phase Operation Example

Figure 2 shows a four-phase operation example. The key notes are as follows:

- Connect Primary SYNCO to Secondary SYNCI.
- Connect OPT pins of both LM5171s to VDD. The interleave angle between the two phases of each LM5171 are programmed to 180°. The SYNCI and SYNCO are phase shifted by 90°.
- Connect Primary ISETx to voltage loop error amplifiers output (ERRHV or ERRLV). Connect secondary ISETx to Primary ISETx.
- Terminate the unused error amplifiers pins of the secondary LM5171.

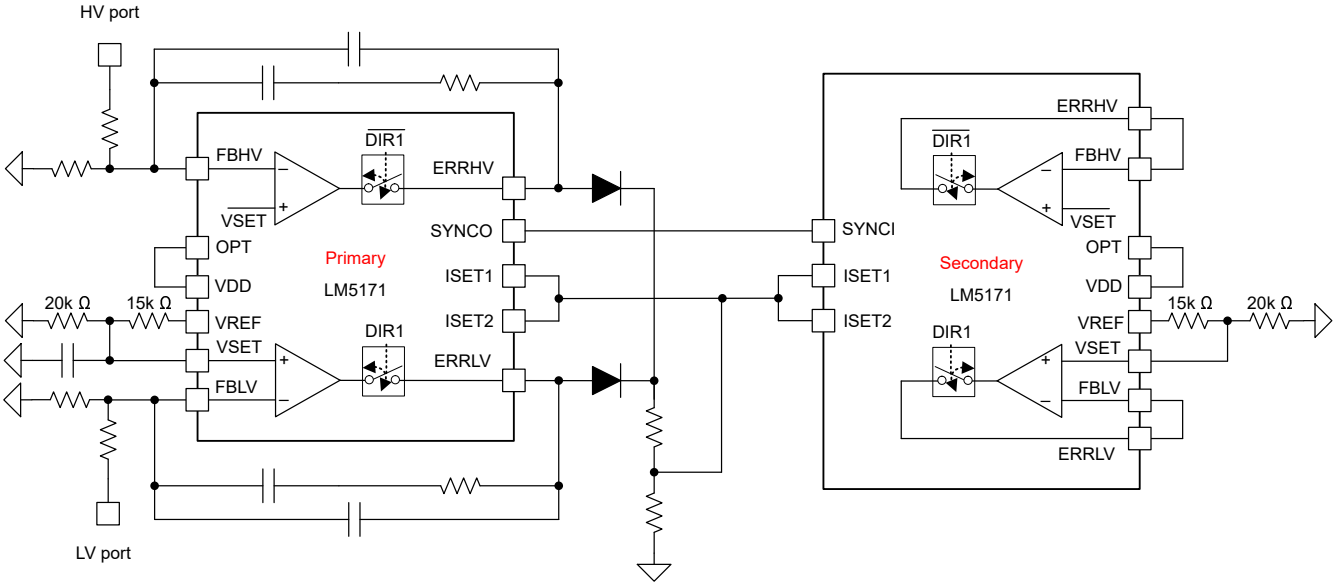

Figure 2. Four-Phase Operation of LM5171

A Three-Phase Operation Example

Figure 3 shows a three-phase operation example. The key notes are as follows:

- Connect Primary SYNCO to Secondary SYNCI.
- Connect OPT pin of primary LM5171 to AGND. The interleave angle between the two phases of Primary LM5171 is programmed to 240°. The SYNCI and SYNCO of the Primary LM5171 are phase shifted by 120°.
- Connect Primary ISETx to voltage loop error amplifiers output (ERRHV or ERRLV). Connect secondary ISET1 to Primary ISETx.
- Terminate the unused error amplifiers and Channel-2 pins of the secondary LM5171.

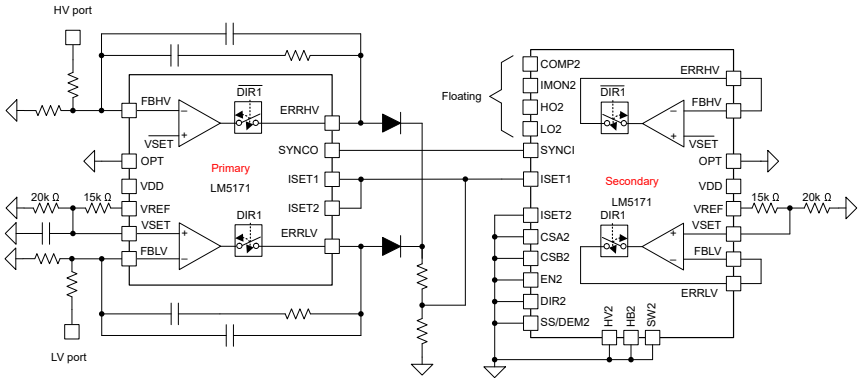

Figure 3. Three-Phase Operation of LM5171

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