Enpirion® Power Application Note #102
Startup and Shutdown Sequencing
With EN2340/60/90/F0Q1 Family
Synchronous Buck with Integrated Inductor

Application Information

SINGLE INPUT SUPPLY OPERATION (PVIN ONLY)

Figure 1a. Typical Single Input Supply Schematic – With ENABLE Toggle

Figure 1b. Startup/Shutdown with ENABLE Toggle

Figure 2a. Typical Single Input Supply – With PVIN to ENABLE to GND Resister Divider

Figure 2b. Startup/Shutdown with PVIN/ENABLE/GND Resister Divider

Soft Start Time ≈ 2ms
with \( C_{ss} = 47 \text{nF} \)
Delay from ENABLE rising edge to soft start begin ~ 1ms

Soft Shutdown Time ≈ 1.3ms
with \( C_{ss} = 47 \text{nF} \)
PVIN is powered off
PVIN slew rate limitations as per datasheet

PVIN – Recommended to be ramped down after the Vout soft-shutdown occurs

PVIN is powered off
PVIN slew rate limitations as per datasheet

PVIN is powered off
Description

Single Input Supply Sequencing

A typical schematic for single input supply operation is shown in Figure 1a and 2a. The EN23xxQI family is designed to be powered by either a single input supply (PVIN) or two separate supplies (PVIN and AVIN). The EN23xxQI family has an internal linear regulator that converts PVIN to 3.3V. The output of the linear regulator is provided on the AVINO pin once the device is enabled. AVINO should be connected to AVIN on the EN23xxQI device. In addition, a resistor ($R_{VB}=4.75\,\text{k}\Omega$) should be connected from VDDB to AVIN. In single supply applications, ENABLE cannot be asserted before PVIN. See Figure 1a and Figure 1b for a recommended startup and shutdown sequencing in single supply mode. If no external enable signal is available, a resistor divider (see Figure 2a) from PVIN to ENABLE and then to ground can be used to enable and disable the device at a programmed PVIN voltage level. The lower resistor (4.02k) can be adjusted to set startup and shutdown at a specific PVIN voltage level. See ENABLE and DISABLE thresholds in the Electrical Characteristics table of the datasheet.

Application Information

DUAL INPUT SUPPLY OPERATION (PVIN AND AVIN)

**Figure 3a.** Typical Dual Input Supply Schematic – With ENABLE Toggle

**Figure 3b.** AVIN Before PVIN with ENABLE Toggle

**Figure 4a.** Typical Dual Input Supply Schematic –

**Figure 4b.** PVIN Before AVIN with ENABLE Toggle
Description

Dual Input Supply Sequencing
A typical schematic for dual input supply operation is shown in Figures 3a/4a/5a. For dual input supply applications, the sequencing of the two input supplies, PVIN and AVIN, is very important. There are several common acceptable turn-on sequences for the device. AVIN can always come up before PVIN. If PVIN comes up before AVIN, then ENABLE must be toggled last, after AVIN is asserted. Do not turn off AVIN before PVIN and ENABLE during shutdown. Doing so will disable the internal controller while there may still be energy in the system. The device will not soft-shutdown properly and damage may occur. See Figures 3b/4b/5b for recommended startup and shutdown sequencing examples.

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