

PFC And Hybrid-Flyback IC Drives Performance In GaN-Based USB-C Adapters

[Infineon Technologies'](#) XDP digital power XDPS2221 is a highly-integrated combo controller IC for USB-PD that supports high-power designs in wide input and output voltage applications of up to 28-V output voltage. The device integrates an ac-dc power factor correction (PFC) controller with a dc-dc hybrid flyback controller (HFB), also known as an asymmetrical half-bridge (AHB), in one single package. Through the harmonized operation of the two stages, regulatory requirements can easily be met, says the company. A proposed architecture based on the controller supporting USB-PD EPR is shown in Fig. 1.

In addition, the further integration of all gate drivers and a 600-V high-voltage start-up cell for the initial IC voltage supply and the certified active X-capacitor discharge enable a low external bill of materials (BOM) and component count (Fig. 2). Based on a novel zero-voltage switching (ZVS) HFB topology in conjunction with GaN-based devices, it brings class-leading efficiency across various line/load conditions, according to the vendor. Thanks to these features and inherent topology advantages, such as zero voltage switching and resonant energy transfer for transformer size reduction, system designs using XDPS2221 can achieve very high power densities.

Moreover, the combo IC features a synchronous PFC and HFB burst-mode operation for the lowest possible no-load input standby power performance. The quasi-resonant multimode PFC stage is enhanced with automatic PFC enable/disable functionality and adaptive PFC bus voltage control to maximize average and light load efficiency. Optionally, the integrated PFC function can also be disabled, to support the use case with any kind of external PFC Controller.

The hybrid flyback stage uses peak current control for robust regulation and fast dynamic load response. To ensure ZVS operation under all conditions, the hybrid flyback features ZVS pulse insertion, including body diode cross-conduction prevention in discontinuous conduction mode. Additionally, XDPS2221 also provides easy-to-configure parameters via a graphical user interface to optimize system performance.

The XDP digital power XDPS2221 combo controller for PFC-boost and dc-dc HFB is available in a DSO-14 package and can be ordered now. For more information, see the XDPS2221 [page](#). For example performance results see the [application note](#) "Engineering report XDP 140W USB-PD reference board with PFC + hybrid flyback combo IC XDPS2221". On [Digi-Key](#), unit pricing for XDPS2221 is listed at \$2.85 in quantities of 1000.

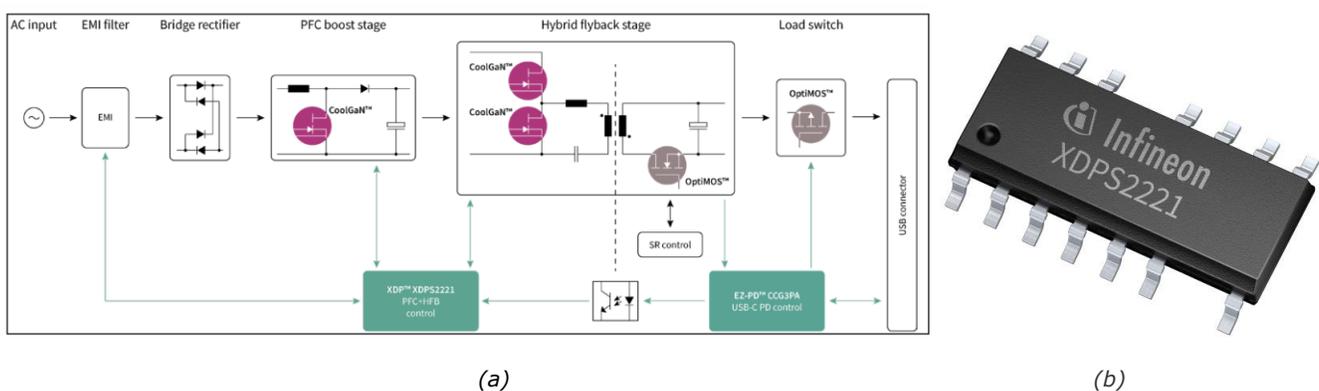


Fig. 1. The XDPS2221 PWM controller is a highly integrated device combining a multimode ac-dc PFC controller and a multimode dc-dc hybrid-flyback controller. A proposed converter power architecture employing the XDPS2221 for USB-PD EPR (a) and the controller's 14-pin DG-PSO package (b) are shown here.

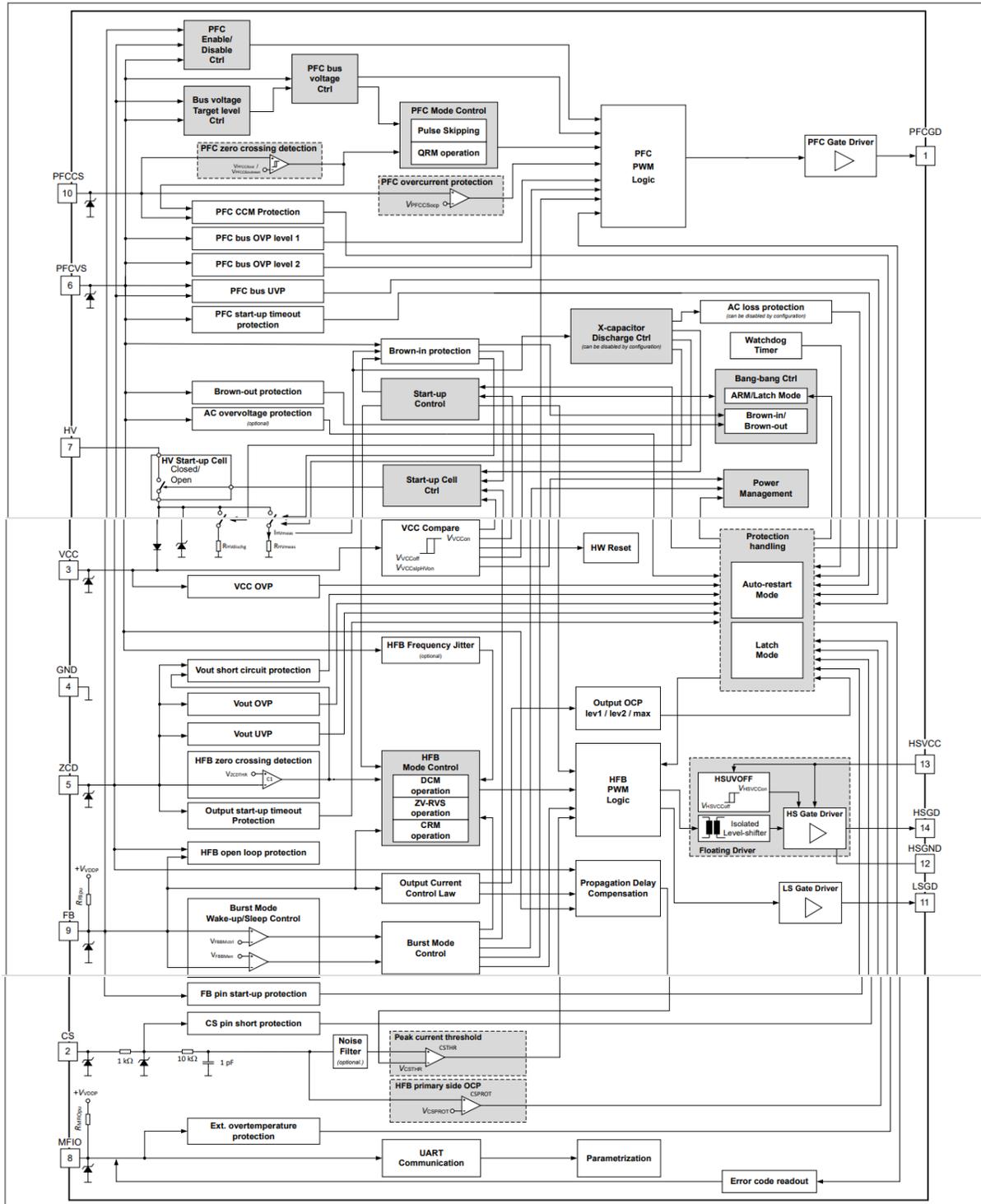


Fig. 2. Internal block diagram of the XDPS2221. The controller is integrated with a high-side driver coupled with a coreless transformer and a low-side driver driving the high- and the low-side switches of the HFB stage, as well as a driver for the PFC switch. It enables a simple system structure out of the traditional flyback topology, but comes with the performance of a resonant half-bridge converter. The integrated, multi-mode PFC controller utilizes a quasi-resonant switching scheme, which operates in critical conduction mode and ensures high efficiency across different line input and load conditions. In addition, a 600-V start-up cell and integrated x-cap discharge features offer BOM savings. A comprehensive suite of protection functions enables reliable operation under all operating conditions.