Flyback Switcher Chips With Built-In USB PD Controller Simplify Adapter Designs

Power Integrations' InnoSwitch3-PD family of ICs is being introduced as the industry's most highly integrated solution for USB Type-C, USB Power Delivery (PD), and USB Programmable Power Supply (PPS) adapters. Housed in a compact InSOP-24D, each InnoSwitch3-PD IC includes a USB-C and PD controller, a high-voltage PowiGaN switch, a multi-mode quasi-resonant flyback controller, secondary-side sensing, FluxLink isolated digital feedback and a synchronous-rectification driver, simplifying the design of adapters up to 100 W (Fig. 1). Table 1 lists the devices in the InnoSwitch3-PD family and their output power capabilities.

According to Power Integrations, InnoSwitch3-PD provides the only one-chip solution for USB-PD and enables a dramatic reduction in the overall component count (see Table 2). The company notes that the key benefit of this high level of integration is not so much size reduction, particularly when compared against an Innoswitch4 based solution which allows higher switching frequencies, as it is design simplification. As Aditya Kulkarni, senior product marketing engineer at Power Integrations, observed, "We make the design easier." This also allows some new customers to develop USB PD adapters without investing in software development, he added.

Nevertheless, the high-level of integration in InnoSwitch3-PD does enable a very high density design. Kulkarni said, "InnoSwitch3-PD ICs target designers seeking the ultimate in charger power density and ease of design. This requires the highest level of integration and maximum efficiency to limit self-heating. Our latest addition to the InnoSwitch3 family dramatically simplifies the development and manufacturing of compact, energy-efficient USB PD power supplies for smartphones, tablets, notebooks, and other devices that benefit from fast charging. InnoSwitch3-PD ICs reduce the BOM count to half that of conventional designs, reducing design time and simplifying high-volume manufacture for slim, ultra-compact OEM and aftermarket chargers."

The InnoSwitch3-PD contains a number of features that simplify USB-PD adapter design. The on-chip USB PD controller supports USB PD 3.0 + PPS & QC4 protocols and provides one-time programmable (OTP) memory. The integrated type-C controller is compliant with USB Type-C Rev. 1.3, includes a pull-up current-source for "sink" and cable detection, a VCONN supply for electronically marked cables, and overvoltage protection for CC1/CC2 (28 V). The IC also features a dedicated temperature sense pin for an NTC resistor, simplifying temperature sensing and implementation of overtemperature protection.

The company offers two reference designs demonstrating the highly integrated adapter solutions made possible by InnoSwitch3-PD chips. One of these is based on a new design report, RDR-838, which describes a 60-W USB PD 3.0 Power Supply with 3.3-V to 21-V PPS output using the InnoSwitch3-PD PowiGaN-powered INN3879C-H801 (see Fig. 2).

Featuring no-load power consumption as low as 14 mW, power supply designs using InnoSwitch3-PD ICs meet all global energy-efficiency regulations. The high efficiency of these devices ensures low heat dissipation, eliminating the need for bulky heatsinks. Power Integrations' FluxLink high-speed communications feedback link ensures fast, accurate secondary-side regulation.

InnoSwitch3-PD ICs are also fully protected, with input voltage monitoring, accurate brown-in/brown-out and overvoltage protection, and output overvoltage and undervoltage fault detection with independently configurable fault responses.

The InnoSwitch3-PD ICs are priced from $1.30 per unit in 10,000-unit quantities. For further information, contact a Power Integrations sales representative or one of the company's authorized worldwide distributors—Digi-Key, Farnell, Mouser and RS Components.

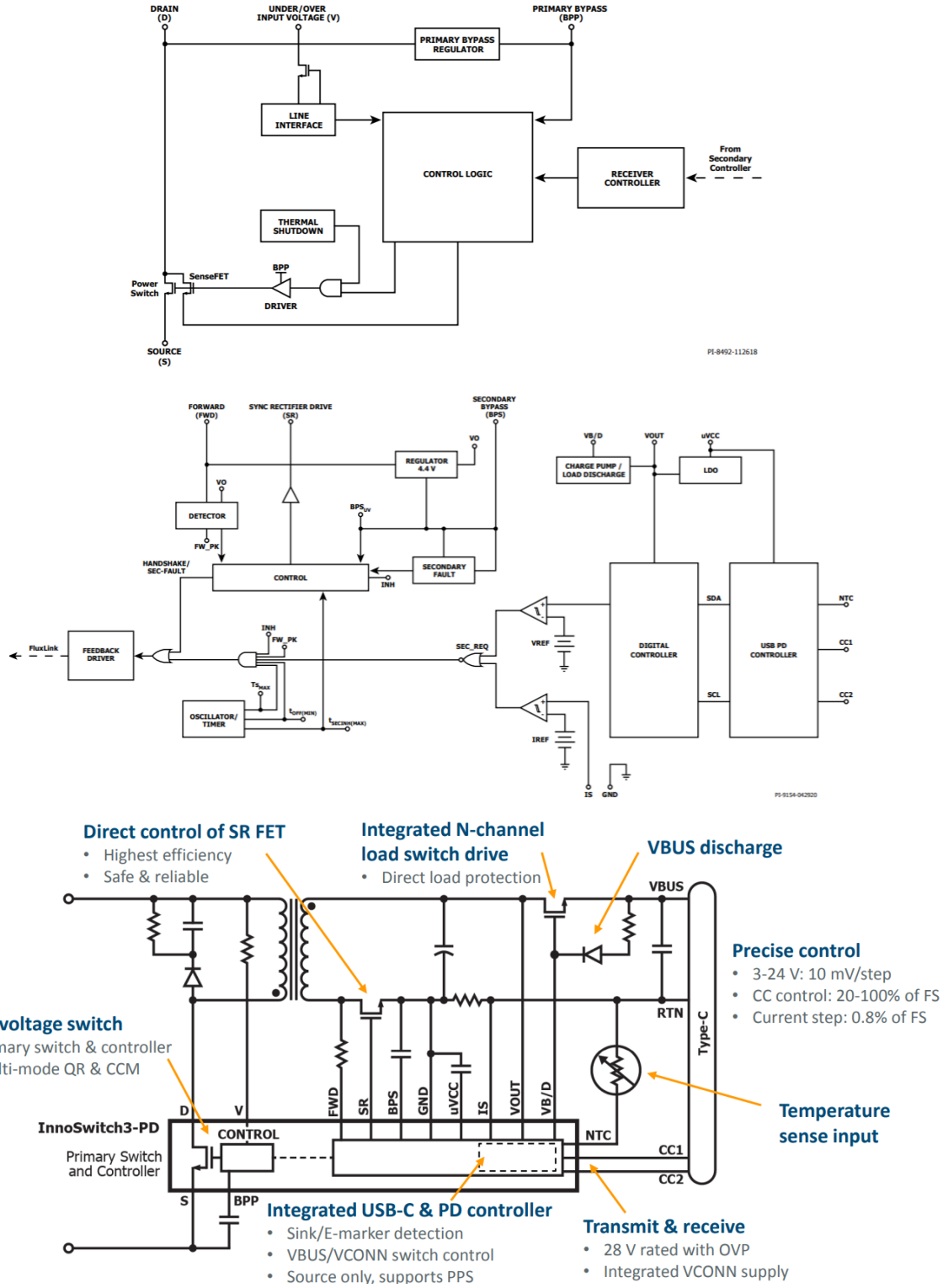

Fig. 1. The InnoSwitch3-PD IC is an offline QR flyback switcher IC with integrated USB Type-C and USB-PD controller, high-voltage switch, synchronous rectification and FluxLink feedback, leading to a highly integrated solution for USB PD and USB PPS adapters. (Also see Table 2.) The top two block diagrams depict the key functions within the InnoSwitch3-PD IC. The bottom diagram shows a simplified application diagram with some key chip features called out.

Table 1. InnoSwitch3-PD models and their output power capabilities. As with other InnoSwitch families, the lower-power models use a silicon primary-side power switch, while the higher-power models employ a GaN (PowiGaN) primary-side power switch.

Part Number	Power Switch Voltage Rating (V)	Typical Maximum Output Power (W)			
		230 VAC ±15%		85-264 VAC	
		Adapter	Open Frame	Adapter	Open Frame
INN3865C	650	25	30	22	25
INN3866C	650	35	40	27	36
INN3867C	650	45	50	40	45
INN3878C	750	70	75	55	65
INN3879C	750	80	85	65	75
INN3870C	750	90	100	75	85

Table 2. Comparison of 60-W USB-PD adapter design solutions (Power Train + USB-PD interface) available from Power Integrations and two other chip makers. According to Power Integrations, InnoSwitch3-PD uses dramatically fewer parts than the best conventional solutions.

Solution Type	Control ICs Used	Primary Side	Secondary Side	USB-PD Interface	Total Components
Competitor 1	3-Chip Solution	71	10	37	118
Competitor 2	4-Chip Solution	87	15	22	124
InnoSwitch4-CZ ClampZero™	INN4075C + CPZ1062M + USB Controller	40	15	24	79
InnoSwitch3-PD	INN3879C	35	16	9	60

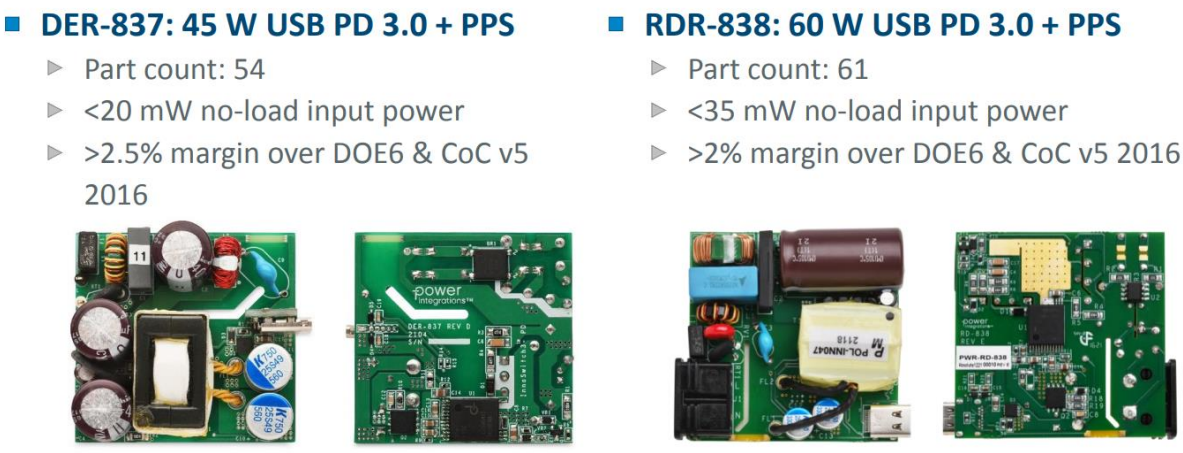

Fig. 2. Power Integrations offers two reference designs that demonstrate the highly integrated USB PD 3.0 + PPS adapter solutions enabled by the InnoSwitch3-PD ICs.