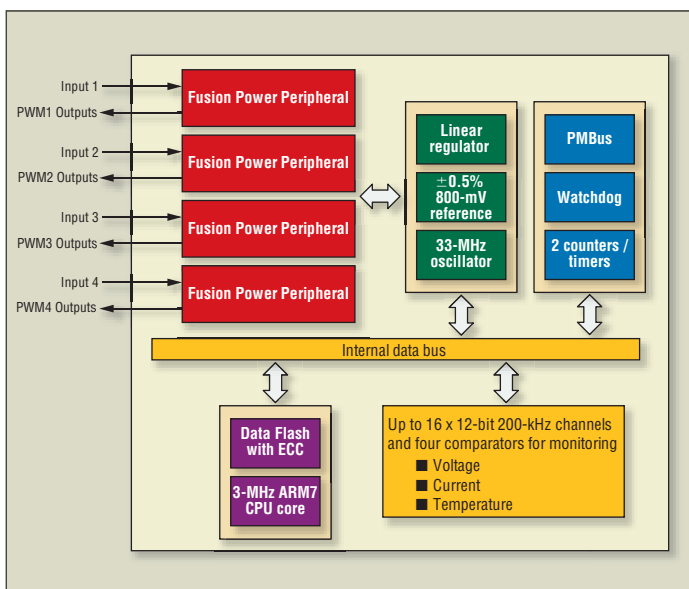


Digital Power Controllers Add Phases and Outputs

By David Morrison, Editor, *Power Electronics Technology*

Digital power control has been touted as a means of making controllers more configurable and adaptable to diverse power system requirements. That idea might suggest digital power controllers could be developed as one-size-fits-all solutions. However, recent product introductions would tend to dispel that illusion as semiconductor vendors continue to build out their digital controller IC portfolios with parts that tend to complement, rather than supplant earlier components. This trend is exemplified by the new controller ICs from Texas Instruments (TI; www.ti.com/digitalpower) and Primarion (www.primarion.com), which expand the options for implementing multiple supply rails and multiphase outputs. These chips target power-supply applications in computing and communications, as well as industrial and test and measurement equipment.

Launched in early May 2007, TI's UCD9240 is the newest member of the Fusion family of digital power controllers. This four-output multiphase controller can digitally manage up to four independent digital control loops and up to eight phases. This device builds on the company's experience in developing the UCD911x series of synchronous, single- or dual-phase controllers developed to manage a single supply rail. The UCD9240 also adds new features and improved performance for certain on-chip functions.



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But despite these expanded capabilities, power system designers may opt to combine the UCD9240 with the UCD911x and other Fusion devices to complete a design that includes multiple voltage rails and/or multiple stages of power conversion. A common example of the latter requirement is where a 48-V rail is stepped down to 12 V with an isolated bus converter and then to lower voltages with nonisolated point-of-load converters (POLs).

One of the key benefits of the '9240 is a phase management feature that enables it to perform phase shedding to optimize efficiency over the load range. And in doing so, the UCD9240 can automatically optimize the loop response for the operating condition (i.e., the load current or number of phases). At the same time, loop response can be tailored to achieve acceptable transient response over the load range.

To illustrate the usefulness of load shedding, the vendor cites an example where a four-phase controller switching at 500 kHz steps down a 10-V rail to 1 V for loads ranging from 2 A to 20 A. At the low end of the load range, the shift from four-phase to single-phase operation can improve efficiency by 30% in this example.

The UCD9240 implements digital pulse width modulators (PWMs) with 250-ps resolution, and is fully configurable by the Power+ Designer graphical user interface (GUI) for monitoring, control and management of point-of-load power conversion. GUI configuration allows a designer to manage the power supply's voltage and current thresholds and response, soft-start, margining, sequencing, tracking, phase management, loop response, fan control and many other features. The chip incorporates the Fusion Power Peripheral, which performs full-digital loop control while supporting switching frequencies of up to 2 MHz and up to 100 PMBus commands (see the **figure**).

One enhancement in the UCD9240 is the addition of a linear regulator, which works with an external pass transistor, to power up the controller. Other improvements concern elements of the Fusion Power Peripherals, which consist of a differential input, an analog conditioning block, an error converter, a digital compensation filter and PWM outputs.

The error converter now features improved resolution that translates into better output-voltage resolution (1 mV versus 2.5 mV on older parts). In addition, the filter has added poles and zeros (three poles, three zeros), providing greater control over loop response. The controller also implements error correction code for data stored in Flash memory. The Flash memory also has been made more

durable and now allows 100,000 write-erase cycles.

To complement its UCD9K family of controllers, TI has also introduced two PowerTrain plug-in power modules that further simplify the dc-dc converter design. The PTD08A010W and PTD08A020W 10-A and 20-A PowerTrain modules integrate the inductor, FETs and UCD7230 driver with current sensing and short-circuit protection.

Samples of the UCD9240 are available in a 64-pin QFN with pricing at \$5.95 each in quantities of 1000. Volume production is expected in the third quarter of 2007.

Last month, Primarion expanded its Di-POL family of fully programmable digital power conversion and power management ICs by adding a dual-output, dual-phase device. The PX7522 is configured to regulate two independent outputs, or two phases in a single-output mode. At the same time, the chip provides the various monitoring and control functions associated with other members of the DiPOL family.

When operated in single-loop operation, the part will support either one or two phases with the ability to current share and synchronize frequency with the two other controllers in the DiPOL family. Those devices include the PX7510 single-phase controller and the PX7520 single-output, dual-phase controller. With the introduction of the PX7522, users

will have the option of mixing and matching the different controller chips to create multiple voltage rails. But, designers also have the option of using the '7522 in place of the other controllers wherever a single rail is needed.

Though many features are similar across the three parts, the new chip differs from the '7520 in that the '7522 contains two independent feedback loops rather than one. Among the chip's key features are its support for both DCR and $R_{DS(on)}$ current sensing and the ability to produce outputs ranging from 0.5 V to 8 V.

Other functions include compatibility with both tristate and non-tristate FET drivers; real-time current, temperature and input-voltage sense telemetry; extensive fault protection and reporting with user-configurable fault behavior; active voltage positioning; and sequencing, margining and tracking of the output voltage.

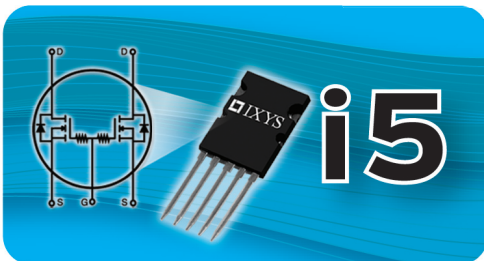
Configurations for the PX7522 are loaded, edited and saved to on-chip nonvolatile memory over the device's I²C serial interface using Primarion's GUI. The controller supports more than 60 PMBus commands. The chip is packaged in a 36-lead, 6-mm × 6-mm QFN.

Now sampling with top-tier customers, Primarion's PX7522 will be available for general sampling in the third quarter of 2007.

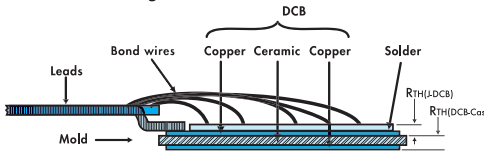
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- Paralleling capabilities

Part Number	Voltage (V)	$I_D(\text{die})$ $T_c=25^\circ\text{C}$ (A)	$I_D(\text{device})$ $T_c=25^\circ\text{C}$ (A)	$R_{DS(on)}$ (mOhms)	Q_g Typ (nC)	t_{rr} Typ (ns)	R_{thJC}^* Max (°C/W)	V_f Diode (V)
IXTL2x240N055T	55	2x240	2x140	4.4	170	30	1.0	1
IXTL2x220N075T	75	2x220	2x120	5.5	165	50	1.0	1
IXTL2x200N085T	85	2x200	2x112	6.0	152	55	1.0	1
IXTL2x180N10T	100	2x180	2x100	7.4	151	60	1.0	1

Note: Specifications are per die. * Thermal impedance with isolation

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