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Tiny, Quad-Output Regulators Need No External Inductors Or Capacitors

At the recent APEC 2022, Empower Semiconductor announced the EP71xx series of digitally configurable, quad-output stepdown converters, which are said to combine the industry's highest current density and efficiency, the fastest dynamic voltage scaling (DVS) and transient response, and extensive fault protection. As with previous members of Empower's IVR (integrated voltage regulator) family, the new regulators provide complete voltage regulation and protection functionality without the need for external discrete components.

The EP71xx series delivers up to 12 A of continuous current with up to four voltage regulators in a single FcCSP package that measures just 5 mm x 7 mm and only 0.7 mm in height. The IVRs operate from a single 3.3-V input and generate output voltages that are programmable from 0.5 V to 2.5 V. Output voltage set-point accuracy is ±1.0%. Built-in fault protection and warning capabilities cover OVLO, UVLO, OVP, OCP and short-circuits. A block diagram is shown in Fig. 1 and a list of features is given in the table.

The company previously introduced the EP70xx series of IVRs, which were designed to operate from a 1.8-V input and produce programmable outputs from 0.5 to 1.25 V on three outputs with a total current of up to 10 A continuous. (see "Voltage Regulator ICs Take Monolithic Integration To Another Level," How2Power Today, July 2020)

Target applications for the series will include optical transceivers, active cables, memory modules and storage devices, networking equipment such as GPON and Photonic Service Switches, PoL power for CPUs, GPUs, accelerators and AI processors and 5G systems.

Empower's IVRs are high-performance power management chips designed to provide efficiency, size, and cost benefits to energy-hungry, data-intensive, electronics applications by replacing traditional power management integrated circuits (PMICs) with a single tiny IC. IVRs monolithically integrate the voltage regulator semiconductor and all the necessary discrete components into a single space-saving device.

Maximum efficiencies can be achieved, minimizing losses across the widest possible range of operating conditions. Ultra-fast transient response supports regulation through a load step and the programmable 'ExpressV' DVS-on-demand is capable of up to 6 mV/ns (Fig. 2). According to the vendor, this feature is more than 1000x faster than other competing technologies and enables rapid, lossless, processor state changes that can significantly reduce processor power.

Commenting on the launch of the new IVR series, Mukund Krishna, Empower's senior product marketing manager states: "Conventional power management solutions do not offer the power density, simplicity and flexibility demanded by rapidly evolving data-intensive applications. With the addition of the new quad-output devices to our IVR family, we are giving system designers the opportunity to reduce PCB power management area and components by ten times or more, drive down system power losses by as much as 50%, and greatly simplify system design."

The EP71XX devices pack a full suite of telemetry functionality to report voltage, current and die-temperature, and continue to feature programmable soft-start and DVS ramp rates via the digital interface. Enhancements to the EP71xx include advanced features such as user-programmable power-up/power-down sequencing (see Fig. 3), user-configurable logic levels and programmable GPIOs to enable customized system functionality. All configurations and diagnostics are available through a standard I^2C interface (see the table again). For more information, see the website.

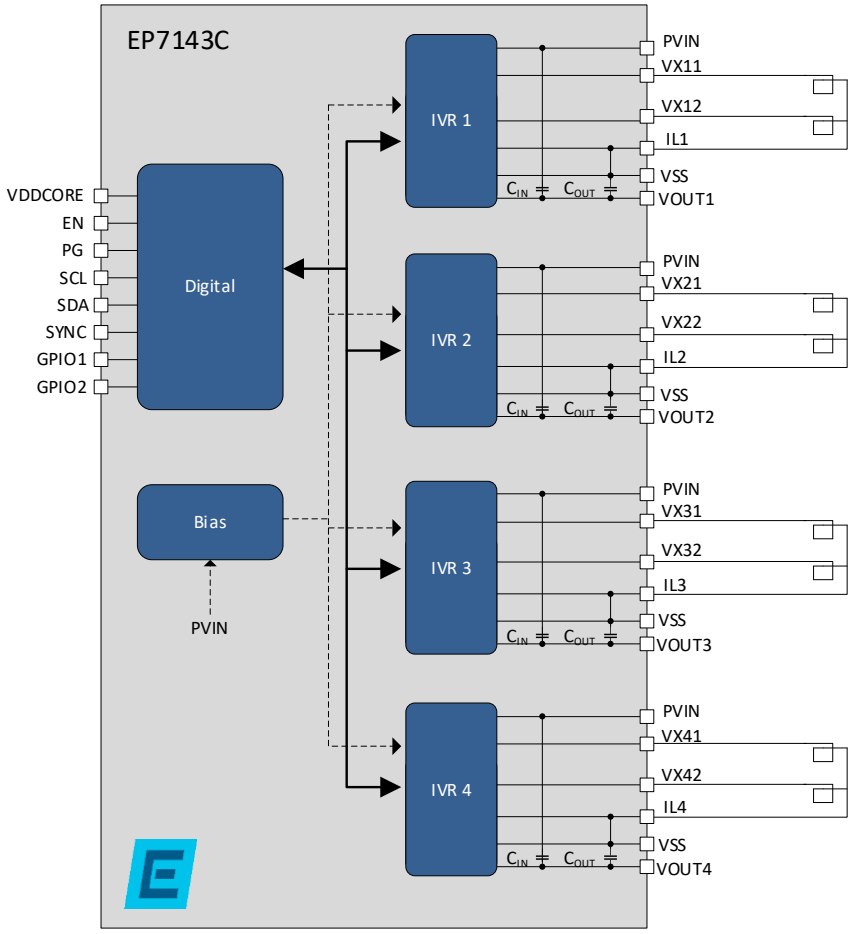

Fig. 1. The EPC7134 is a member of the EP71xx series of 3.3-V input, digitally configurable, quad-output stepdown converters, also referred to as IVRs. Said to offer the industry's highest power density, these devices integrate up to four integrated voltage regulators with total current output up to 12 A in a 5-mm x 7-mm x 0.7-mm chipscale package. These devices provide extensive fault protection without external discrete components.

Table. Features of the EP71xx series IVRs.

- Up to four integrated voltage regulators (IVRs) with total current up to 12 A
- V_{in} = 3.3 V ± 10%
- No external discrete inductors or capacitors required
- Programmable output voltage: 0.5 V to 2.5 V
- Output voltage set point accuracy: ± 1.0% over PVT
- Ultra-fast transient response: < 20-mV dip on full load in a 500-ns step
- Programmable fast dynamic voltage scaling: ± 6 mV/ns
- DVS On-Demand through user-programmable GPIO
- User-defined GPIO functions: DVS, PG, I^2C alert and overcurrent warning
- Flexibility to support a wide range of digital interface logic levels (1.2 to 3.3 V)
- Extensive fault protection: OVLO, UVLO, OVP, PG, current limiting & short-circuit protection
- Telemetry: accurate current (± 8%), voltage (± 1.5%) and temperature (± 4C) reporting
- Adjustable, fast soft-start with low inrush current
- Built-in programmable power sequencing (including multiple devices)
- Synchronization option to external clock
- I^2C interface to coordinate sequencing, telemetry, DVS/AVS and diagnostics
- Offered in 5-mm x 7-mm FcCSP, and in die form

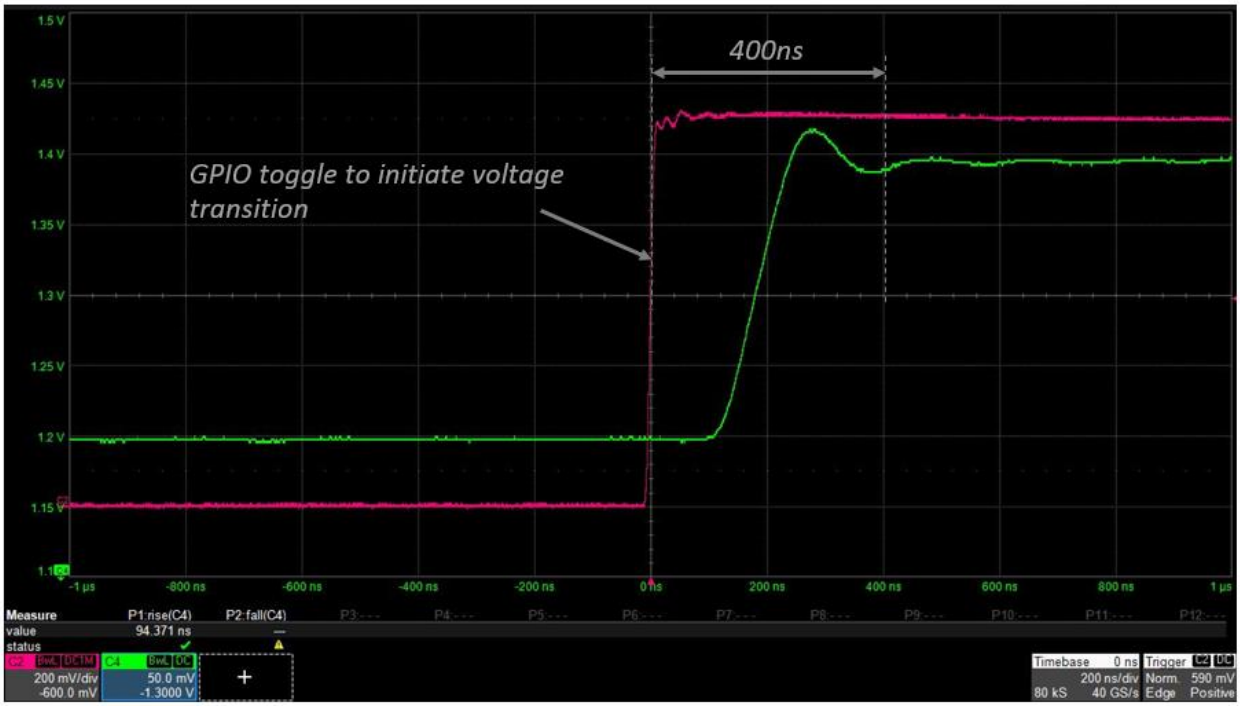

Fig. 2. DVS on-demand initiates and completes an entire voltage transition in ~400 ns.

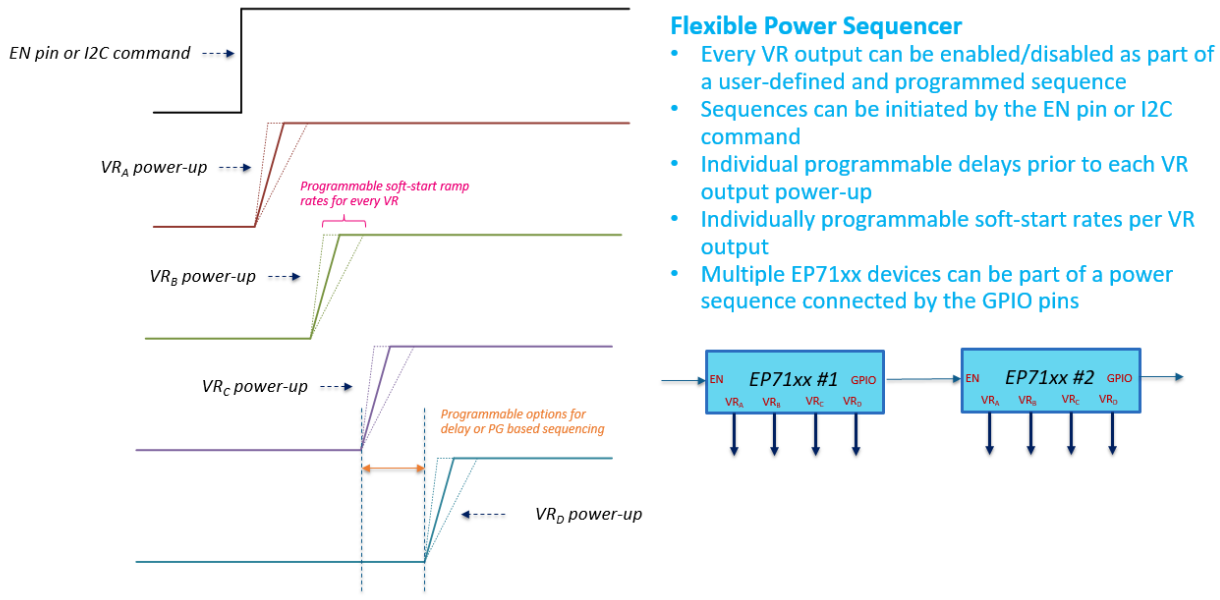

Fig. 3. The IVRs feature built-in power sequencing.