NXP integrated power train PIP212-12M application

70-A POL converter with over 93% efficiency using integrated power train PIP212-12M

This compact, highly efficient design, which combines NXP integrated power trains with a PWM controller from Intersil, uses industry-standard construction and operating conditions to deliver an output current of up to 70 amps and an efficiency of over 93%.

Key features

- Output current up to 70 amps
- Efficiency above 93%
- Input from 3.3 to 16 volts
- Output voltage from 0.8 to 6 volts
- Switching frequency up to 1 MHz
- Automatic dead-time reduction
- Power-ready signal flag
- Selectable output voltage
- Components used:
  - NXP integrated power train PIP212-12M
  - Intersil PWM controller ISL6558

This point-of-load (POL) converter is an optimal solution for powering advanced microprocessors, high-current DSPs, DDR memory systems, and ASIC devices. It uses two NXP integrated power trains in a dual-phase configuration and a PWM controller from Intersil.

With adequate airflow, the POL converter provides continuous output currents up to 70 A with an efficiency of over 93%. It is implemented in a four-layer board and measures 7.6 x 7.6 cm.

The POL converter uses two PIP12-12M devices to create a dual-phase synchronous buck converter. High integration means the PIP212-12M can be used to create buck regulators capable of up to 35 A per phase and frequencies up to 1 MHz per phase, with greater power densities than are possible with discretes or other integrated solutions.

Each PIP212-12M device consists of a high-side (control FET), a low-side (synchronous FET), and a FET driver, and is housed in a single surface-mount package with integrated heat sink. Large pad areas connected to the package thermal pads are used to dissipate the heat generated by each PIP212-12M.

For superior efficiency, the PIP212-12M device includes high-performance MOSFETs and a customized driver. The driver monitors and actively eliminates switching dead time without allowing the devices to go into cross conduction.

The PIP212-12M is easy to modify for specific requirements without additional circuitry. The feature set includes functionality for sequencing, an onboard regulator that

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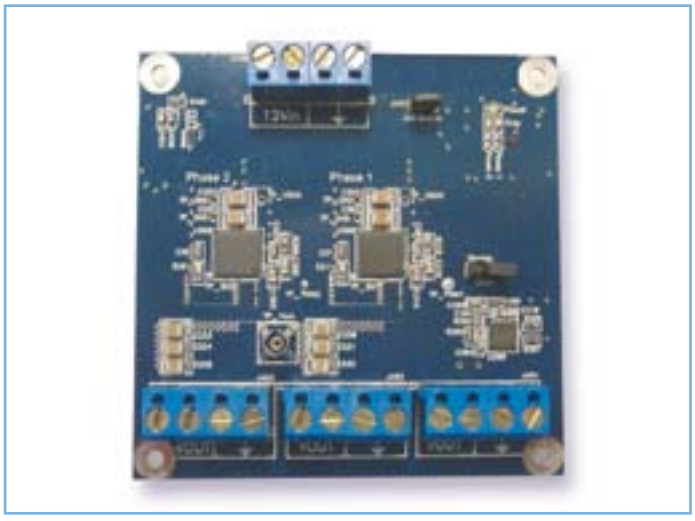
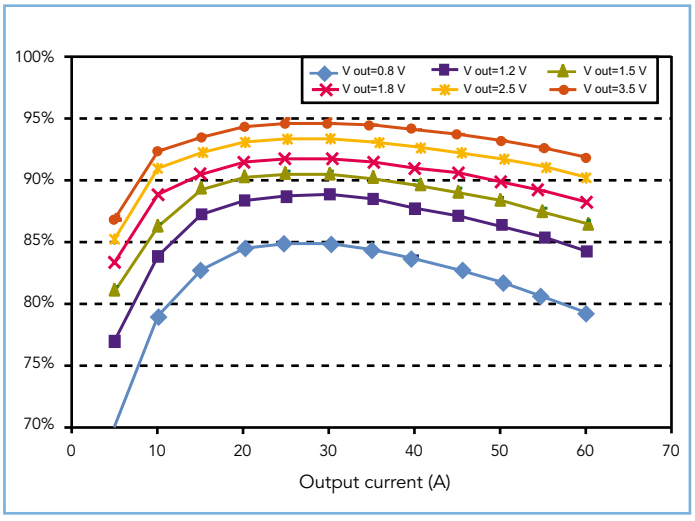
provides 5-V power in 12-V-only applications, and a Vo sense feature that lets the PWM sense current in mulit-phase, current-sharing designs.

The integrated design allows the PIP212-12M to be used as the building block of buck regulators capable of up to 35 A per phase and frequencies of up to 1 MHz per phase with greater power densities than are possible with discretes or other integrated solutions.

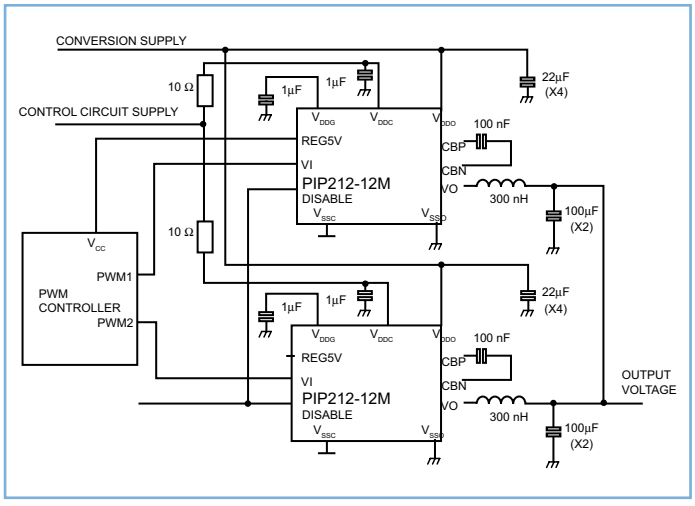
The efficiency diagram is plotted for a range of output voltages. The input voltage on each sweep is 12 V, and the switching frequency is 500 kHz. The maximum current swept is the level that produces FET case temperatures of 90 °C. Airflow is 1.0 m/s (200 LFM). With greater airflow, higher currents can be achieved.



Implemented in a four-layer PC board, the 70-A POL converter measures 7.6 x 7.6 cm



Efficiency in the 70-A POL converter is over 90%



Block diagram of the 70-A POL converter

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