



## DC-to-DC converter powertrain PIP2xx series

# Absolute performance and efficiency for buck converters

The PIP212, PIP213 and PIP214 deliver industry-leading DC/DC converter performance. A fully integrated and optimized powertrain solution, they help cut costs, reduce size and simplify the design of low output voltage, high current and high frequency DC/DC converters. The high system efficiencies are particularly suited for powering high-end processors and peripheral ICs in communications and computing systems.

### Key features / benefits

- ▶ Input conversion range from 3.3 to 16 V
- ▶ Output voltages from 0.8 to 6 V
- ▶ Capable of up to 35 A maximum output current
- ▶ Operating frequency up to 1 MHz
- ▶ Peak system efficiency up to 95% at 500 kHz
- ▶ Compatible with single- and multi-phase PWM controllers
- ▶ Low-profile surface mounted package (8 x 8 x 0.85 mm)
- ▶ Automatic deadtime reduction for maximum efficiency
- ▶ Internal low voltage drop bootstrap switch
- ▶ Efficient gate drive (internal 6.5 V regulator)
- ▶ Internal thermal shutdown
- ▶ Power sequencing function
- ▶ Auxiliary 5 V output
- ▶ Intel DrMOS specification compatible

### Key applications

- ▶ High-current / low output voltage point-of-load DC/DC converters
- ▶ High-frequency POL DC/DC converters
- ▶ Small form-factor voltage regulator modules (VRMs)

Our PIP212, PIP213 and PIP214 are fully optimized power building blocks for high-frequency, high-current synchronous buck DC/DC conversion applications. These highly integrated solutions are compatible with industry-standard PWM controllers and eliminate many of the design issues associated with synchronous buck converters.

The control MOSFET, synchronous rectifier MOSFET and parallel Schottky diode, MOSFET driver, and bootstrap diode can be replaced by a single PIP212, PIP213 or PIP214. This significantly lowers component count leading to a simpler PCB layout, smaller designs and higher power densities. So you can squeeze more functionality into your products.

As a truly integrated solution, the PIP212, PIP213 or PIP214 allow for optimization of individual components and greatly reduce the parasitics associated with conventional discrete solutions. This results in both increased power density and greater system efficiency at higher operating frequencies.

These parts also deliver excellent efficiency for switching frequencies up to 1 MHz, allowing for a considerable reduction in the number of input and output capacitors required.

## Packed PIP2xx series with power and features

The PIP2xx series include many additional functions such as an internal low voltage drop bootstrap switch, over-temperature protection, power sequencing functions, 6.5 V sync FET gate driver for optimal performance, and a synchronized 5 V source to power an external PWM controller.

It also provides automatic deadtime reduction (the delay between switching off one MOSFET and switching on the other). By continuously monitoring the conduction of the body diode of the synchronous rectifier MOSFET, they can adjust the deadtime. This helps reduce power losses as well as protecting against cross-conduction (or shoot-through).

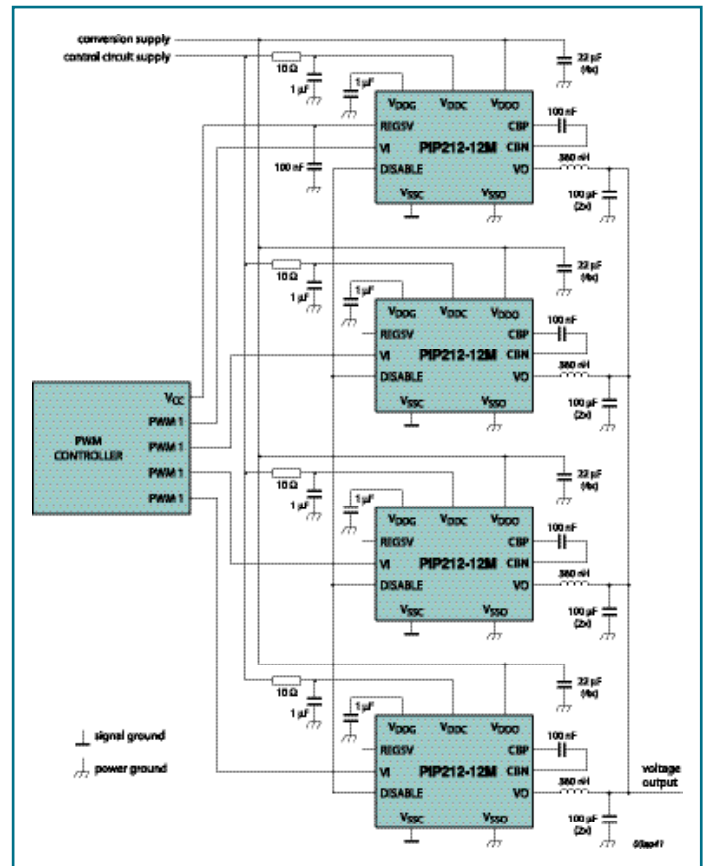
## Outline performance

Type	V <sub>in</sub> (V)	V <sub>out</sub> (V)	f <sub>in</sub> (kHz)	I <sub>out(avg)</sub> (A)	Efficiency (%)
PIP212	12	1,5	500	30	90% at 15A
PIP212	12	3,3	500	30	94% at 15A
PIP213	12	1,5	500	20	88% at 10A
PIP213	12	3,3	500	20	91% at 10A
PIP214	12	1,5	500	35	91% at 15A
PIP214	12	3,3	500	35	95% at 15A

A typical four-phase buck converter is shown on the right. This system uses four PIP212 devices to deliver a continuous 120 A output at an operating frequency of 500 kHz. The effective ripple frequency is therefore raised to 2 MHz.

Using the PIP212, PIP213 or PIP214 in a multiphase VRM converter minimizes the number of additional components required. All that needs to be added is a PIP212, PIP213 or PIP214, controller IC, an external inductor, input and output capacitors, two decoupling capacitors and a bootstrap capacitor. The external PWM controller IC can be powered by the internal 5 V output regulator.

## Outline performance



A typical 4-phase buck converter using the PIP212-12M to deliver a continuous output current of 120 A at an operating frequency of 500 kHz