Welcome!
Texas Instruments New Product Update

- This webinar will be recorded and available at www.ti.com/npu
- Phone lines will be muted
- Please post questions in the chat or contact your sales person or field applications engineer

New Product Update:
Mid-Vin, high-current buck DC/DC switching regulators

Josh Frazor

October 22, 2020

Agenda

- How to achieve superior power density
- New product highlights
  - Highest efficiency 12V/6A buck converter in market --- **TPS543620**
  - Stackable power module with excellent transient performance--- **TPSM41615 / 25**
  - 12V/15A buck converter with remote sense and 2MHz Fsw --- **TPS542A52**
  - Stackable PMBus™ with telemetry converter family --- **TPS546D24A / B24A / A24A**
- Closing remarks & next webinar opportunity

Power Density – W/mm²

Faster Switching Frequencies

Increasing the DC/DC converter's switching frequency reduces Inductor area

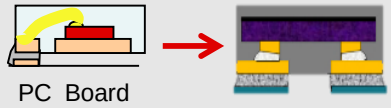
New devices are being designed to minimize switching losses and increase efficiency at higher Fsw

(Example – TPS543620 has only ~1% efficiency difference from 1MHz and 600kHz)

Smaller Advanced Packages

HotRod™

- Flip-chip on lead frame
- No wire bonds required
- Reduced parasitics
- Lower resistance



Stacked Clip-QFN

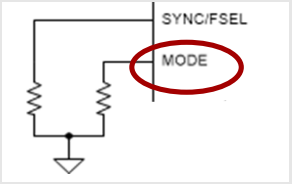
- 3D for highest power density & lowest Rds(on)
- Reduced parasitics
- Large single GND pad

Multifunction pin Capability

Achieve high power density with DC/DC converter packages using multiplexed pin Functionality

Mode pin example

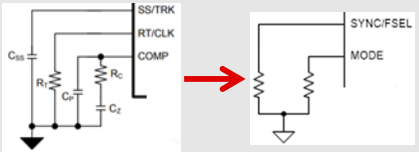
- Current limit
- Ramp setting for comp.
- Soft start time



Internal Compensation

Internally compensated Advanced Current Mode control, D-CAP3, etc.

- Fewer ext. components
- Easy design
- Less verification
- Limited L/C components



TPS543620

Samples/EVMs available now

4V-18V, 6A SWIFT™ Synchronous Step-Down Converter

Features

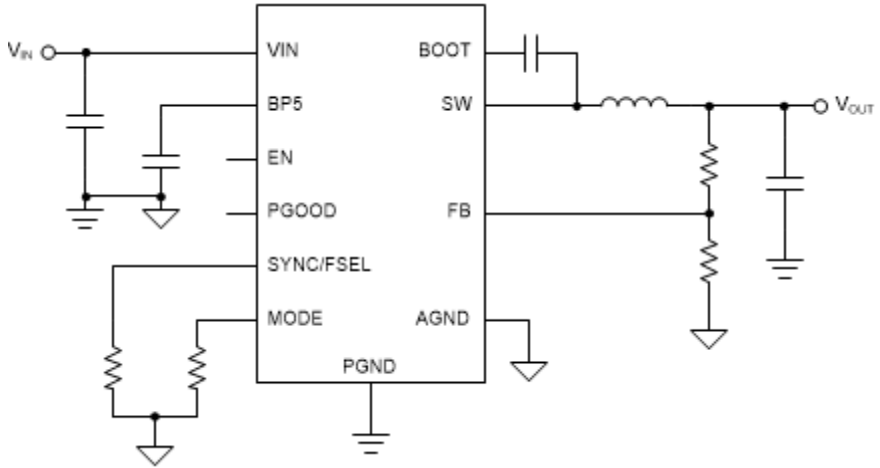
- Fixed Freq Internal Compensated ACM control
- 25/6.5mΩ Rdson
- Selectable Fsw: 500kHz, 750kHz, 1MHz, 1.5MHz, 2.2MHz
- Selectable SS (0.5ms, 1ms, 2ms, 4ms)
- Low min-on-time: 30ns
- Adjustable Current Limit (6A/3A)
- EN, PG, External Freq SYNC
- 0.5V, ±0.5% Voltage reference accuracy over temp
- Protections: OVP, OCP, UVP, UVLO, TSD
- 2.5x3.0mm HotRod™ package
- -40C to 150C junction temperature operation

Applications

- Base stations, Radio units, Small cells for Telecom
- Optical and Fiber networks
- Test & Measurement and Aerospace & Defense
- Medical and Healthcare

Benefits

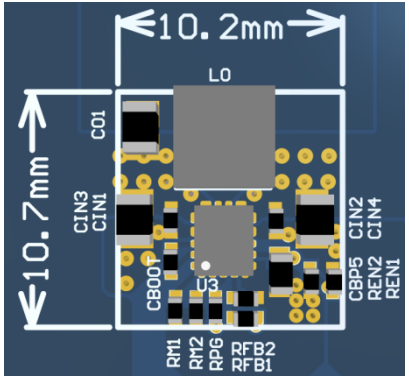
- **Highest efficiency 12V/6A converter in market**
- 6A in 125C Ta, no airflow @ 12V input, 3.3V output, 1MHz
- Small system footprint
- No external compensation -> less passive components
- TPS54620/TPS54824 higher power density upgrade!



Solution size improved over current gen device

TPS543620

- **Area = 109 mm², All components on top layer**
- Fsw=1MHz
- Inductor L: 0.56 µH, 7 mΩ, 4.1 x 4.1 x 2.1 mm (typ)
- https://katalog.we-online.com/pbs/datasheet/744383560056.pdf
- Cout=1x100uF, Cin=2x0.1uF+2x10uF
- Package Theta Ja~37°C/W

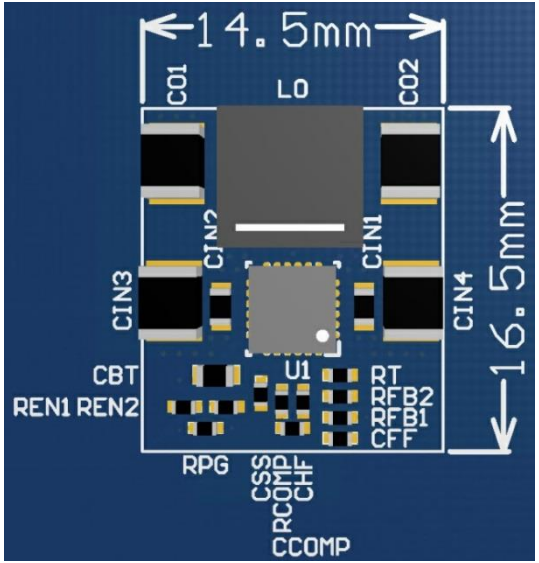


-55% reduction

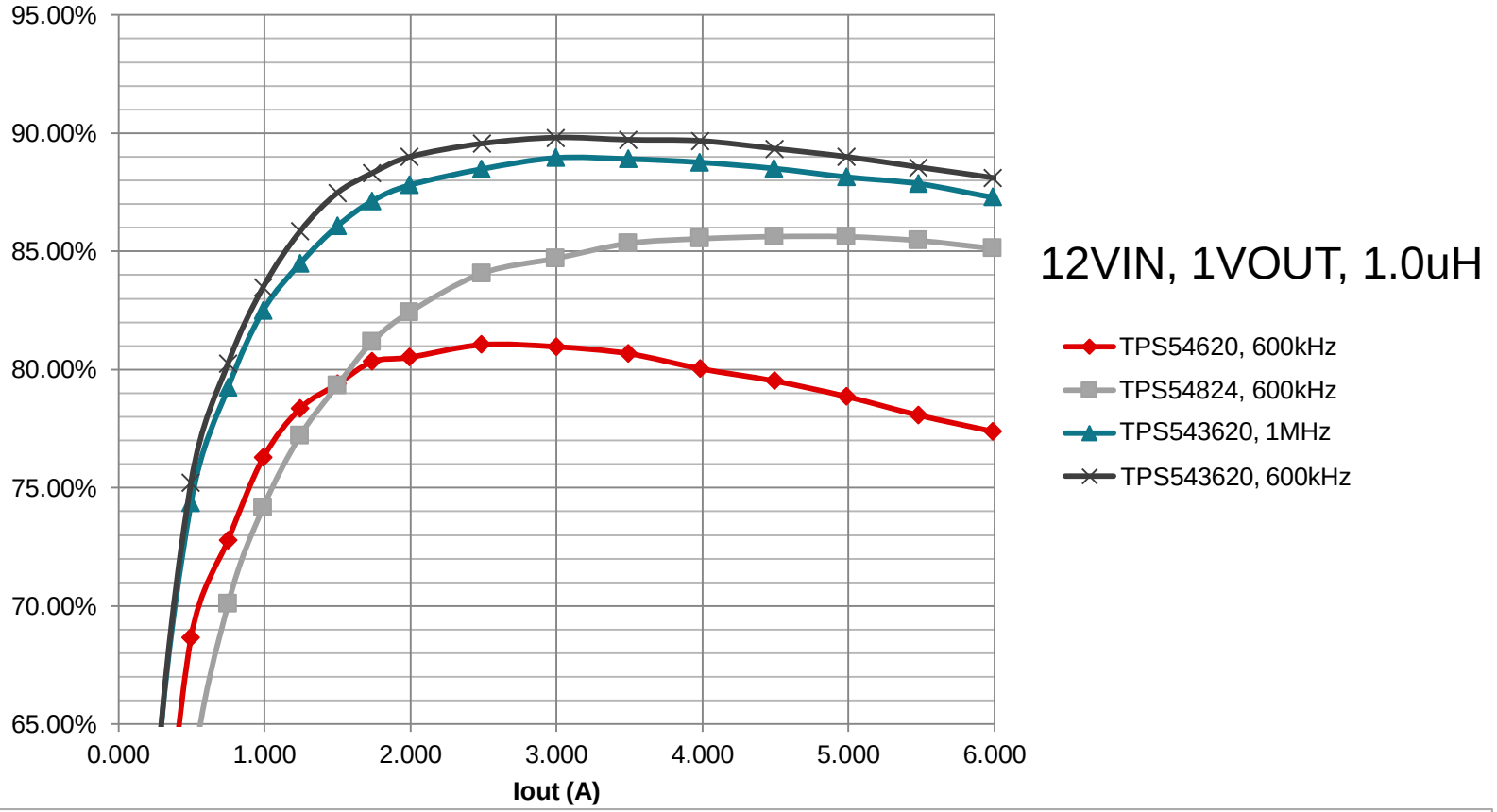
- Faster frequency
- No loop compensation
- Smaller package
- Mode pin functionality

TPS54824

- **Area = 240 mm², All components on top layer**
- Fsw=600kHz
- Inductor L: 1.2 µH, 6.4 mΩ, 6.45 x 6.65 x 3.0 mm (typ)
- http://katalog.we-online.com/pbs/datasheet/74439344012.pdf
- Cout=2x100uF, Cin=2x 22uF Cin=2x0.1uF+2x10uF
- Package Theta Ja~23°C/W



TPS543620 vs current gen efficiency



TPSM41615/25

Samples/EVMs available now

4V-16V, 15A/25A Stackable power module with excellent transient performance

Features

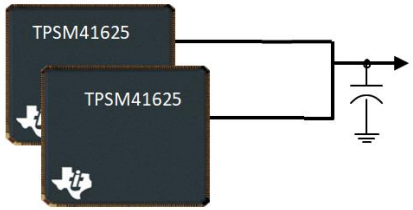
- Output Voltage Range 0.6V to 7V
- +/- 0.5% Vref (0C to 125C Tj)
- Current sharing up to 50A
- FPWM with Fsync In/Out from 300kHz to 1MHz
- Advanced Current Mode architecture with API and BB
- Fully differential remote voltage sense
- Power Dense 11 x 16 x 4.2mm package footprint
- Pin out engineered for low EMI
- -40C to 125C max recommended operating temperature

Benefits

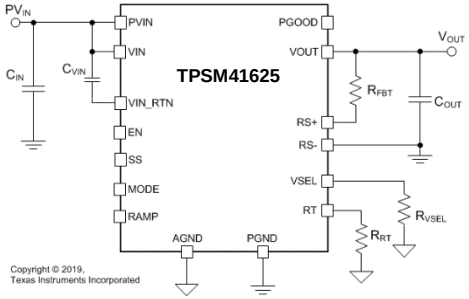
- High design flexibility with Wide VOUT capability
- Fixed frequency, out-of-phase sync out when stacking
- Sync wide enough to support single clock architectures
- Outstanding load transient response (4% deviation for 50% transient at 40A/µs slew). **Require fewer output capacitors**
- Outstanding load regulation (100µV deviation 0 to 25A)
- Low profile to maintain clearance from heatsinking

Applications

- Industrial: Test & Measurement, Healthcare
- Telecommunication & Networking Equipment
- Enterprise Storage and Video Broadcasting
- ASIC, FPGA and DSP Attach



Single – 15A/25A
Stackable 30A/50A



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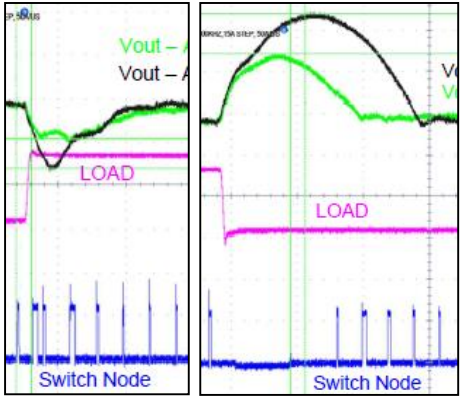
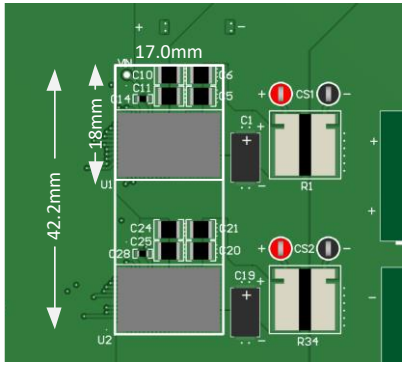
TPSM41625 Advantages



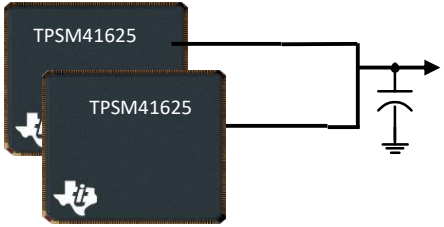
Fast Transient Response

- Async pulse injection (API) reduces Vout undershoot
- Body Braking reduces Vout overshoot
- Reduce capacitance to meet total ΔVout while saving space & cost
- Can be enabled or disabled



2x TPSM41625
Stacked 50A
717.4mm^2(=42.2x17mm)

TPSM41625
Single 25A
306mm^2(=18x17mm)



High-Current Stackable

- Advanced Current Mode (ACM) control
- Parallel 2 devices for 50A
- Connect Vshare, Ishare and Sync pins for 180˚out-of-phase switching

TPS542A52

Samples/EVMs available now

4V-16V, 15A Synchronous SWIFT™ Buck Converter with Differential Remote Sense

Features

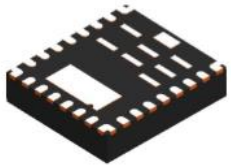
- Output voltage range 0.5V to 5.5V
- Differential remote sense with +/- 0.5% Vout accuracy
- Pin-strapping for Fsw, SS, Mode, Current limit selection
- Fixed frequency voltage mode with internal compensation
- 8 selectable switching frequencies from 400kHz to 2MHz
- Low Iq shutdown mode: <20µA, IC disabled, no switching
- FCCM/Eco-Mode selectable
- Pre-biased monotonic start-up
- Output voltage overshoot reduction
- EN, UVLO, PGOOD, SYNC
- 4x4.5mm QFN HR package

Applications

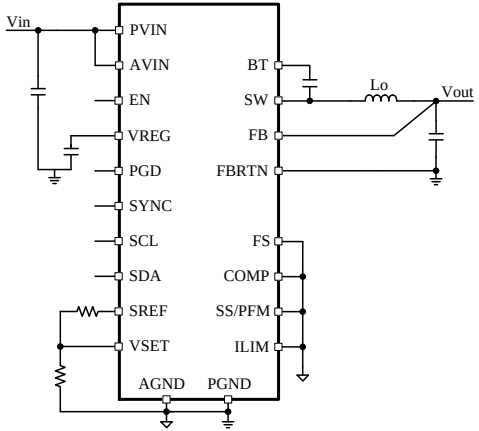
- Wireless Infrastructure: AAU / RRU / BBU
- Wired Networking Switches & Routers
- Test and Measurement, Medical Imaging
- Aerospace & Defense

Benefits

- +/- 0.5Vout regulation accuracy.
- Reduced system cost and complexity with selectable options of internal compensation.
- Meet Ta 95°C up to 14A, 105°C up to 12A for Communications Applications with no airflow



4mm x 4.5mm GQFN



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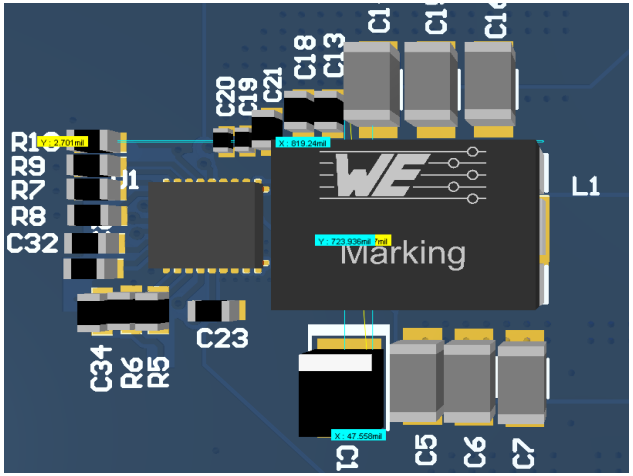
TPS542A52 Solution Size

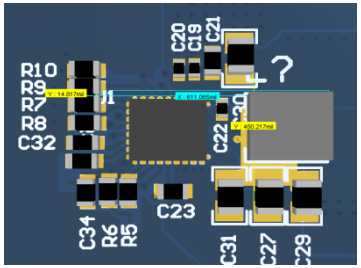
1MHz



Area: 380mm^2 (18x21mm)

Included traces & vias, being conservative

2MHz



Area: 180mm^2 (11.5x15.5mm)

1.Use Tj = 150^{0}C and small Ton (10ns capability) to push for >2MHz while meeting Ta = 105^{0}C

2.Small inductor size: 5x5mm or 7x7mm

3.Less Cout

4.180mm^2 (11.5x15.5mm)

TPS546D24A / B24A / A24A

Samples/EVMs available now: 40A, 20A, 10A

2.95V to 18V Input, 4xStack 40A/20A/10A, SWIFT™ Synchronous Buck Converter with PMBus™

Features

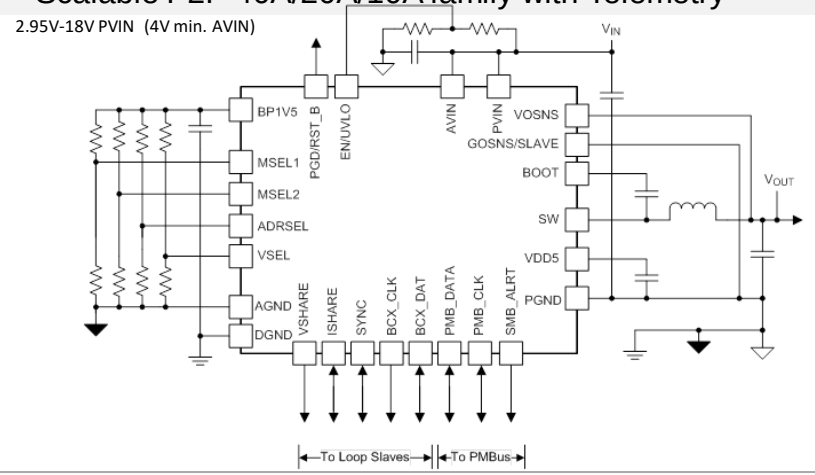
- Integrated 5.0mΩ/1.6mΩ High & Low Side MOSFETs
- Fixed Frequency Internally Compensated Average Current Mode Control with external CLK SYNC
- 2x, 3x, 4x Stackable with a Single Address per Output
- Extensive PMBus Command Set with V, I, & T Telemetry
- 0.6V to 5.5V Output with <1% Error: -40°C to 150°C Tj
- 0.2V to 5.5V Output via PMBus
- Differential Remote Sensing
- AVS and Margining Capabilities through PMBus
- MSEL pins to Pin-Strap in Stand-alone Analog Mode
- 275kHz – 1.5MHz; 225kHz – 1.5MHz thru PMBus
- 5mm x 7mm x 1.5mm QFN Package

Applications

- Active Antenna System, Remote Radio & Baseband Unit
- Automated Test Equipment, Medical Scanner, Radar
- Aerospace and defense radar

Benefits

- >90% efficiency 12VIN, 1Vout, 500kHz from 6-12A (B24A)
- >90% efficiency 12VIN, 1Vout, 500kHz from 15-25A (D24A)
- Fast Load and Line Transient with Fewer Components
- System Characterization and Health Monitoring, +/-10% Iout, +/-2% Vout & +/-5°C Internal Die Temperature
- Powers Low Voltage Processors or 3.3V & 5V Bus Rails
- Fsw, SS, OCP, & Vout Selectable without PMBus
- Scalable P2P 40A/20A/10A family with Telemetry



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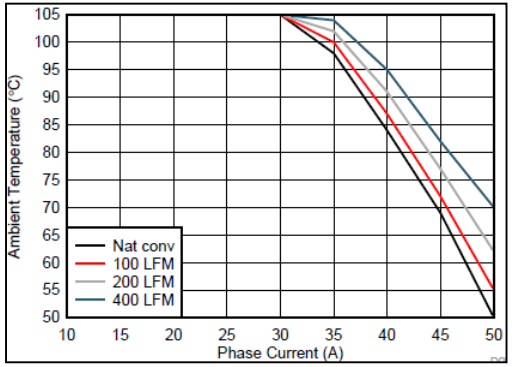
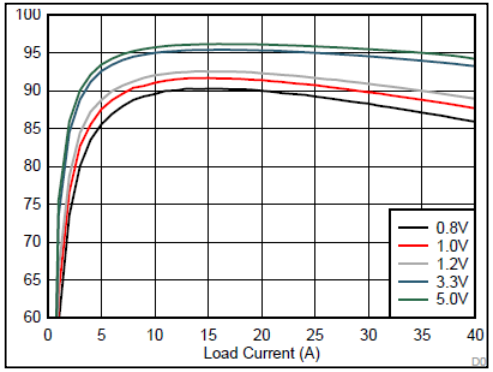
TPS546D24A / B24A / A24A advantages



SOA performance

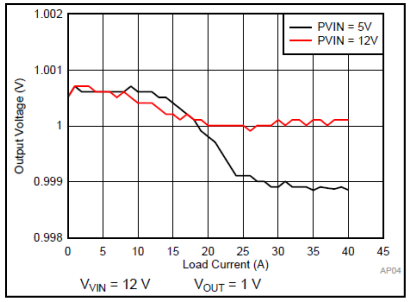
- 12V to 1V @ 325kHz
- L=300nH
- 40A @ 83°C no airflow
- 4 layer, 2 oz. copper

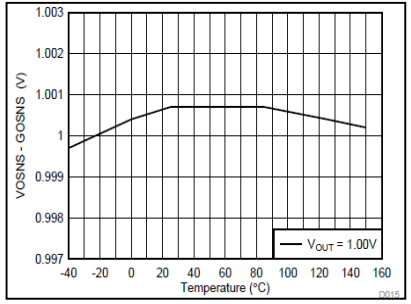


High efficiency

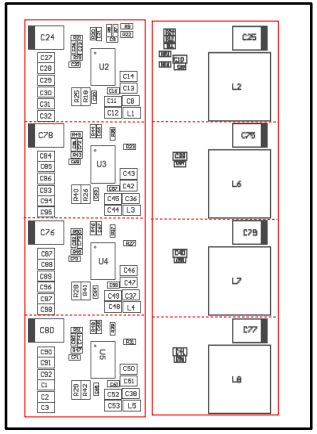
- 88% at 1V/40A
- 92% peak at 1V/15A
- 12Vin @ 325kHz
- L = 300nH

High Vout accuracy over load and temp





Sub mV resolution available with PMBus



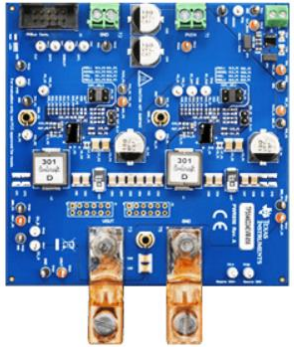
Small-size and stackable

- 160A, 4Φ in 4” x 1” double sided design PMP21814; 12V → 0.9V
- 4 devices addressed as 1 output via PMBus
- Modular board layout to support 1, 2, 3 and 4Φ designs
- Each 40-A phase occupies less than 1”x1” footprint

TPS546D24A / B24A / B24A collateral

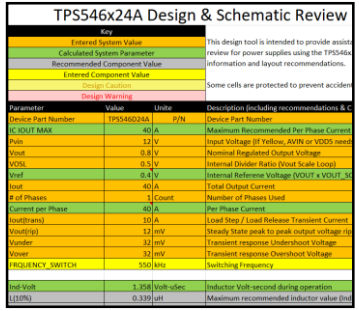
TPS546D24AEVM-2PH

- 2-Φ stackable design provides up to 80A
- Configured at 5-12Vin, 0.8Vout, and 500kHz
- Configurable to evaluate only one channel
- Supports Digital Fusion GUI



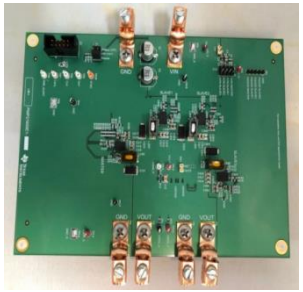
Software Tools

- Compensation and pin-strap resistor selection spreadsheet <download>
- Digital Fusion Power Designer GUI <download>
- Average and Transient P-SPICE Models <download>



TI-Design PMP21814

- 4-Φ stackable design provides up to 160A
- 12Vin, 0.8Vout, and 650kHz
- 0.11% Vout accuracy
- Includes BOM, test report, Gerber file & schematic
- Click here to view



Application notes

- Powering the TPS546D24A from a Single 3.3 V Input Power Supply <view>
- Achieving Better than 1% *Output Voltage* Accuracy with TPS546D24A <view>
- DC/DC Converter Solutions for Hardware Accelerators in Data Center Applications <view>

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