

More power in less space

Update on power management products

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As our world becomes increasingly reliant on technology, **the demand for power will only continue to increase.**

The demand for a **smaller footprint**

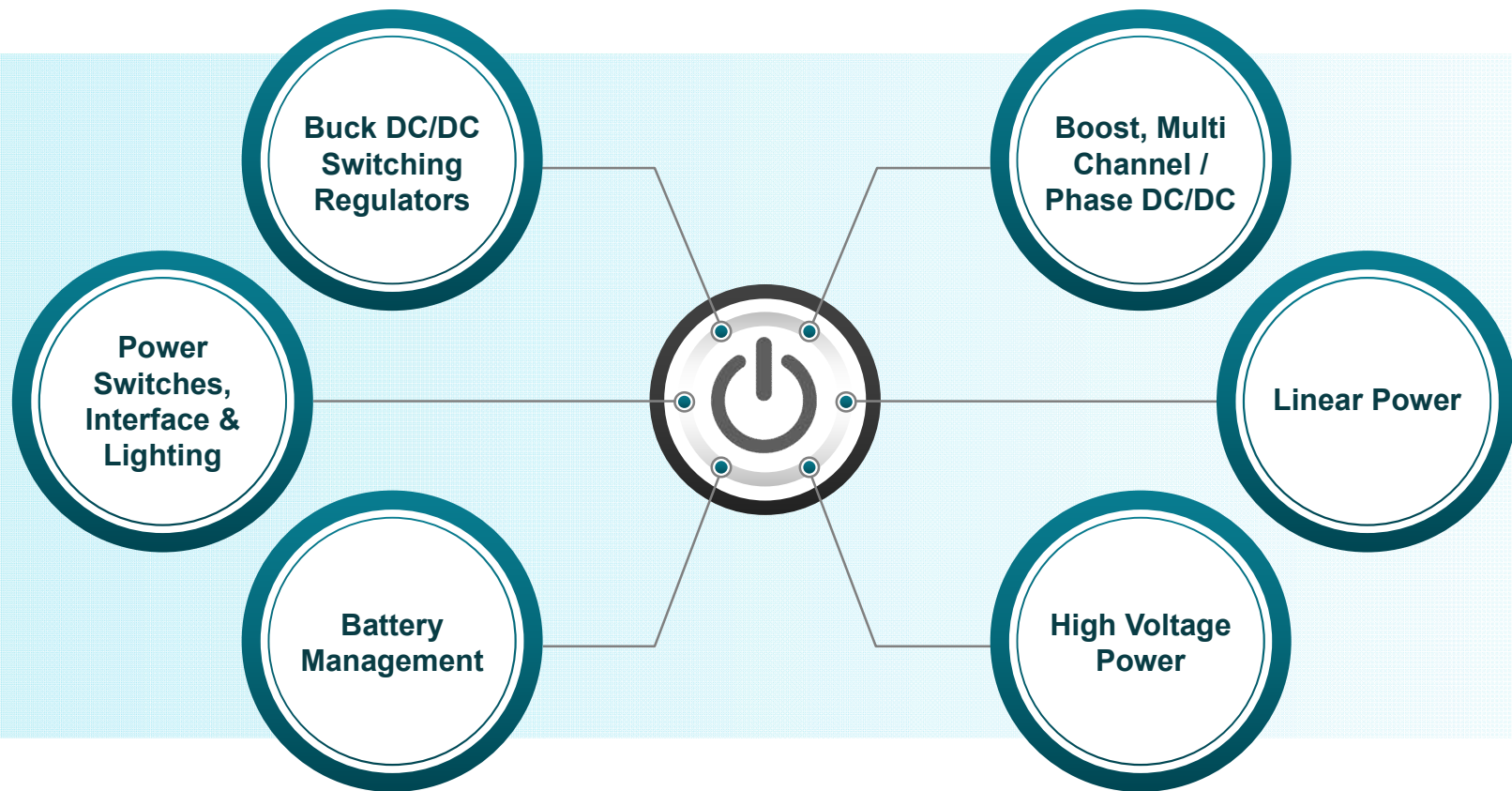
1

Power density – demand for more power in smaller and smaller footprints – will continue to be a top power trend for power designers.

2

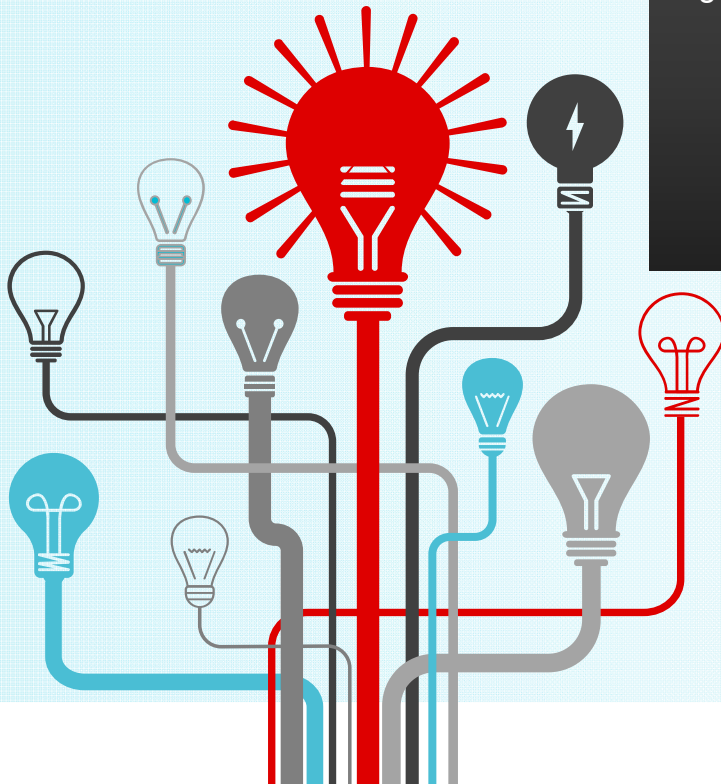
Integration of active and passive components into power systems to reliably achieve size reduction goals.

Power management products for your system



Solving power and energy-management challenges

“How can we make the next generation of wearables smaller, thinner and lighter while extending battery life?”



“How can power electronics enable higher levels of factory automation?”



“With 30KW of power per server rack in data centers today, how can we manage even more?”

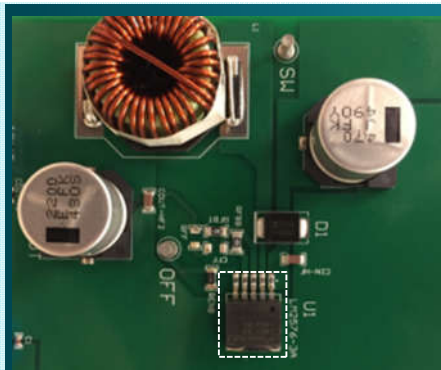




LMZM33606 and TPS62827

Wide V_{IN} converter power density evolution

$36V_{IN}$, $3A I_{OUT}$



50mm x 50mm

Non-Sync

52kHz

77% efficiency

1989



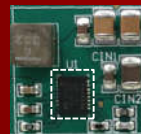
25mm x 20mm

Non-Sync

Up to 1MHz

84% efficiency

2008



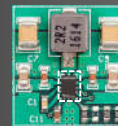
18mm x 17mm

Sync

Up to 2.1MHz

89% efficiency

2014



3A



6A

15mm x 16mm

Sync

Up to 2.1MHz

93% efficiency

Today

Low V_{IN} converter power density evolution

5.5V_{IN}, 4A I_{OUT}



15mm x 20mm

Sync

Up to 1MHz

60mW/mm²

2008



8mm x 12mm

Sync

Up to 1.4MHz

210mW/mm²

2014



5.2mm x 6.5mm

Sync

Up to 2.2MHz

470mW/mm²

Today

Low V_{IN} converter power density evolution

$5.5V_{IN}$, $4A I_{OUT}$



15mm x 20mm

Sync

Up to 1MHz

60mW/mm²

2008



8mm x 12mm

Sync

Up to 1.4MHz

210mW/mm²

2014



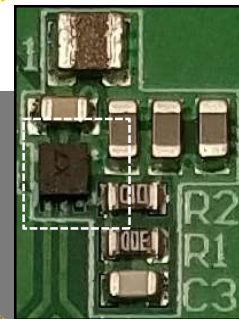
5.2mm x 6.5mm

Sync

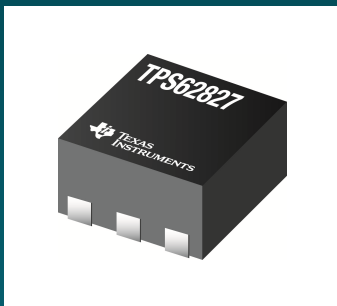
Up to 2.2MHz

470mW/mm²

Today

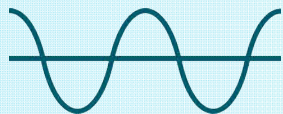


The need for higher power density



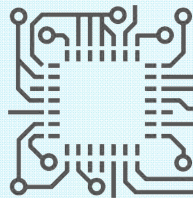
TI has introduced the LMZM33606 power module and the TPS62827 buck converter that meet tomorrow's demand for higher density, **today**.

Benefits of the **LMZM33606** power module



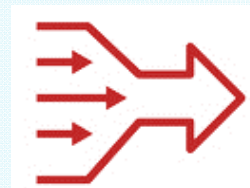
Exceeds industry EMI standards

Tight current loops reduce EMI.
Tested to EN55011 (CISPR11) Class-B
Radiated Emissions standard



High density

Tiny low thermal resistance QFN
package integrates high-frequency input
filter capacitor and a shielded inductor for
a complete solution in <250mm².



Simplifies design

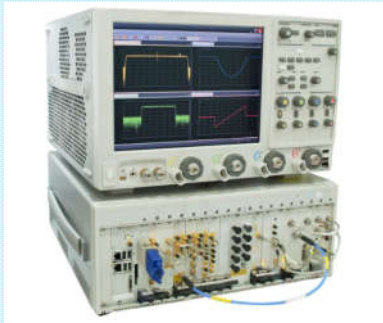
Create a power supply in the new
WEBENCH® power design environment
with only four external components.

View the LMZM33606 [datasheet](#)

LMZM33606: Markets and applications

The LMZM33606 provides robust thermal and EMI performance in a compact solution size for a wide range of DC/DC applications

Test and Measurement



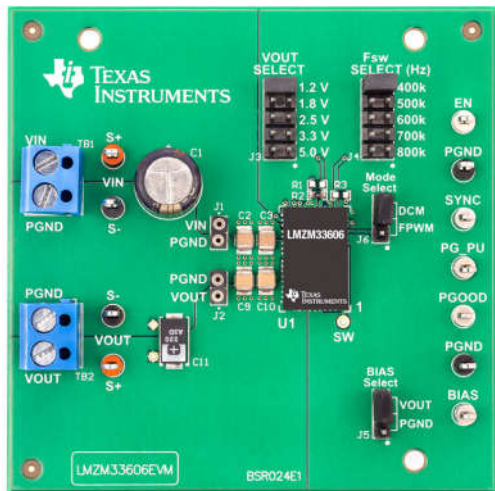
Medical & Imaging



Industrial and Factory Automation



Evaluate your design today



LMZM33606 power module evaluation board
available now: www.ti.com/tool/lmzm33606evm

- 3.5V to 36V input voltage range
- Up to 6A of output current
- 1V to 20V output voltage range

Available for US\$49.

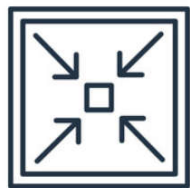
For basic evaluation instruction, read the [user guide](#).

Benefits of the **TPS62827** buck converter



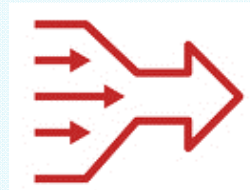
**Tight output voltage
accuracy**

DCS-Control topology and 1% Vout accuracy support processors and FPGAs at all operating conditions



**Shrinks
board size**

Tiny 1.5mm x 1.5mm QFN package provides a 34mm² complete solution size



Simplifies design

Scalable for design flexibility
Create a power supply in the new WEBENCH® power design environment with only three external components.

View the TPS62827 [datasheet](#)

TPS62827: Markets and applications

The TPS62827 provides robust thermal and EMI performance in a compact solution size for a wide range of DC/DC applications

Data Storage



Building Automation



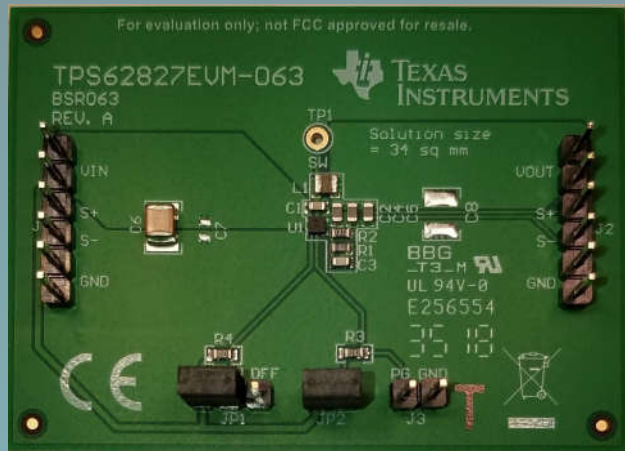
Portable Electronics



Communication Equipment



Evaluate your design today



TPS62827 power module evaluation board
available now: www.ti.com/tool/tps62827evm-063

- 2.4V to 5.5V input voltage range
- Up to 4A of output current
- 0.6-V to 4V output voltage range
- 34 mm² total BOM size

Available for US\$49.

For basic evaluation instruction, read the [user guide](#).



LMG341x family

LMG341x family: 1 MHz frequency shrinks magnetics

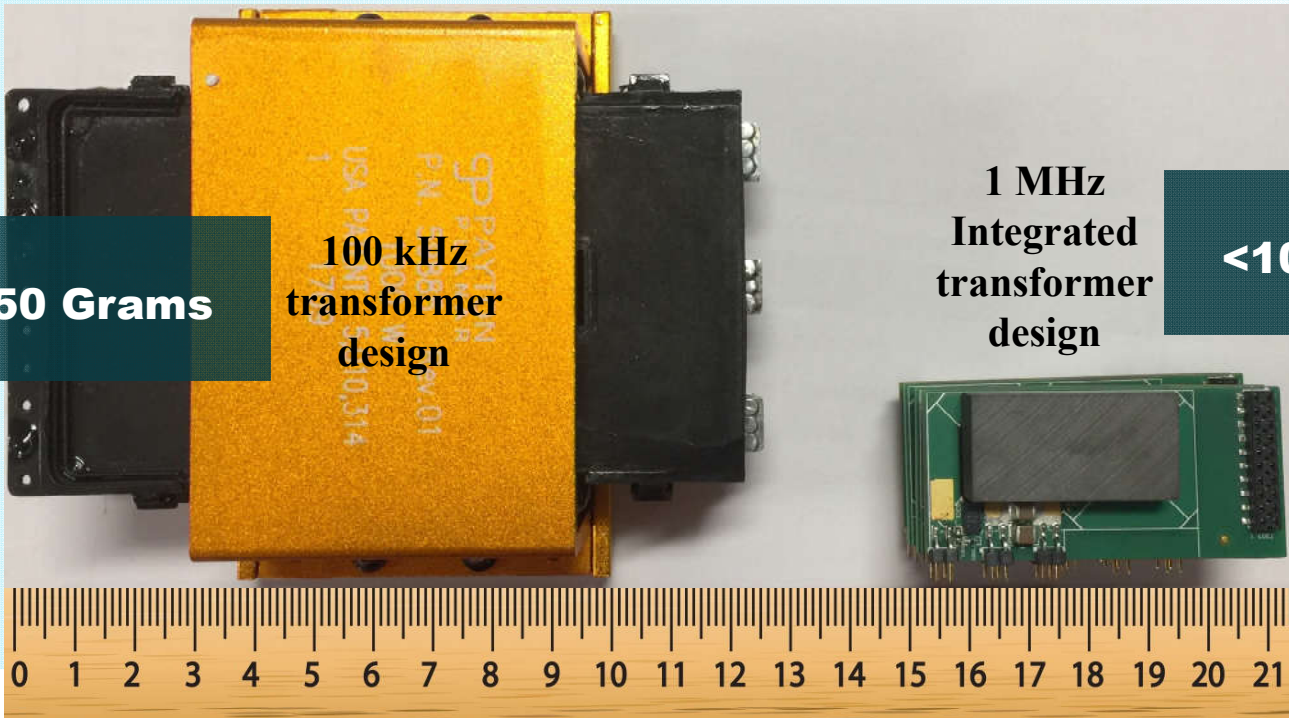
Compared with a 100kHz silicon design, the GaN design is **6X** smaller

>650 Grams

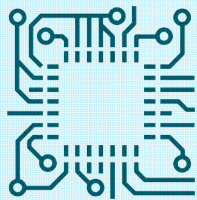
**100 kHz
transformer
design**

**1 MHz
Integrated
transformer
design**

<100 Grams

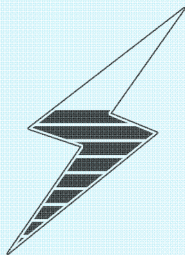


Benefits of the **LMG341x GaN** power stage



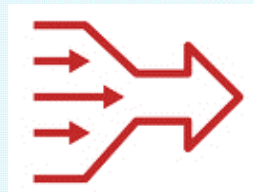
Maximum power density and efficiency

GaN power stage enables **double power density** and **80% lower losses** than silicon MOSFET with high-speed, MHz switching frequency



Devices for every power level

Fully integrated driver, FET and protection in **50 mΩ, 70 mΩ** and **expanding portfolio** offer a single-chip solution for applications ranging from sub-100 W to 10 kW



Simplifies design

Comprehensive portfolio of designs for AC-DC, isolated DC-DC and inverter topologies enables ease of design and **faster time to market**



System reliability

Backed by **20 million device reliability hours** and features built-in intelligence for over-temperature, over-current and under voltage lockout protection

View the LMG3410R070 [datasheet](#)

GaN powers applications ranging from Watts to Kilowatts

Personal electronics



Motor drives and robotics



Grid infrastructure



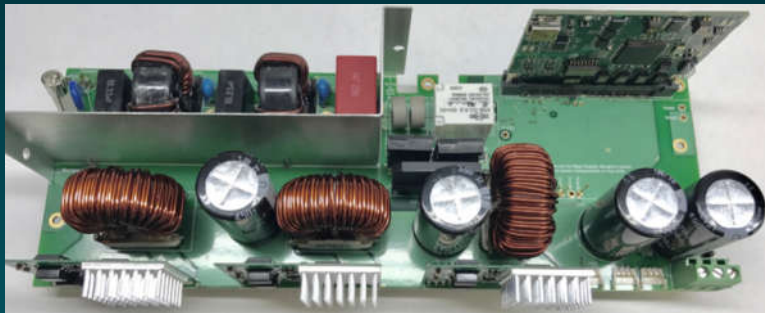
Watts



Kilowatts

At any power level, the **LMG341x family of devices** enable smaller, more efficient and higher-performing designs in a variety of applications.

Maximized efficiency + power density for industrial and telecom designs



The **Interleaved CCM Totem Pole Bridgeless Power Factor Correction (PFC) Reference Design** implements adaptive dead-time and phase shedding methods for improved efficiency (98.75% at peak) and less than 2% Total Harmonic Distortion (THD). The design features an in-built frequency response analyzer (SFRA) for verification and design of control loops.

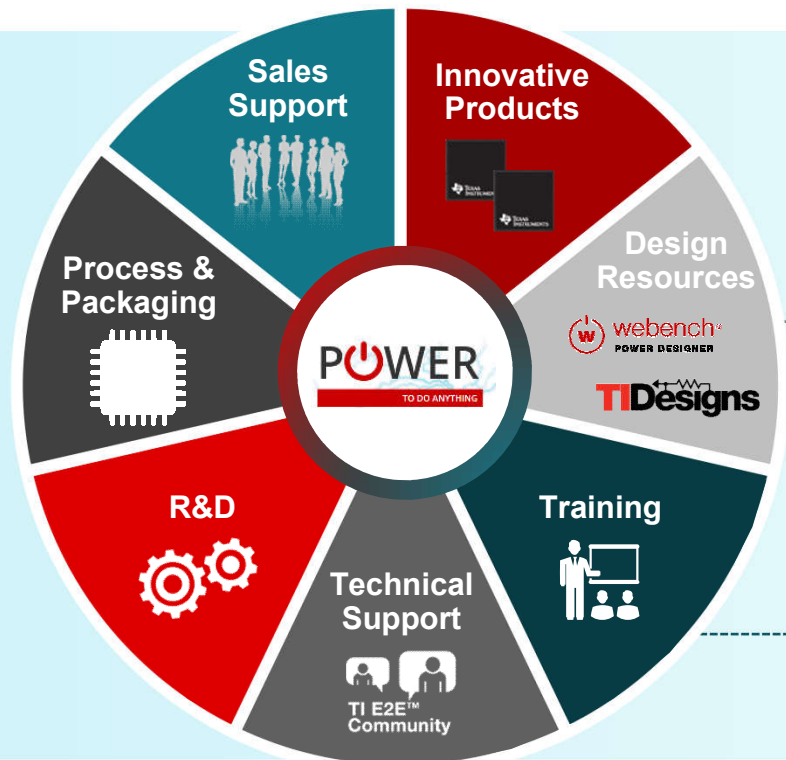
- [TIDM-1007 and tools folder](#)
- [Design guide](#)



The **Highly Efficient, 1.6kW High Density GaN Based 1MHz CrM Totem-pole PFC Converter Reference Design** is a high density (165 x 84 x 40 mm) design that achieves 98.7% efficiency at full load and 230-V AC input for many space constrained applications such as server, telecom, and industrial power supplies.

- [TIDA-00961 and tools folder](#)
- [Design guide](#)

Complete ecosystem for power design



Ti.com/power



Select, customize,
simulate, export.

The new **WEBENCH®**
Power Designer is here
to work for you.



Now available in
Simplified Chinese:
“Fundamentals of Power
Supply Design” book from
TI and Robert Mammano,
father of the first
fully-integrated
PWM controller

Additional resources

LMZM33606

- [How to Create a Programmable Output Inverting Buck-Boost Regulator](#) (blog)
- [Power Modules for Lab Instrumentation](#) (pdf)
- [Practical Thermal Design With DC/DC Power Modules](#) (application note)
- [Inverting Application for the LMZM33606](#) (application note)

TPS62827

- [Designing with Leadless QFN and SON Packages](#) (application note)
- [DCS-Control Topology For a Seamless Transition Into Power-save](#) (Analog Applications Journal)
- [Performing Accurate PFM Mode Efficiency Measurements](#) (application note)

LMG341x family

- [Half the space, double the power: How gallium nitride is revolutionizing robotics, renewable energy, telecom and more](#) (blog)
- [Overcurrent protection in high-density power designs](#) (application note)
- [Thermal considerations for designing a GaN power stage](#) (application note)
- [High voltage half bridge design guide for LMG3410 smart GaN FET](#) (application note)



Thank you!

POWER
TO DO ANYTHING

Back up

LMZM33604/6

High Efficiency 36V Input 6A Module in Compact 10x16x4mm QFN Package



Features

- 3.5 to 36V Input Voltage Range
- 4A and 6A Output Current Options
- Adjustable 1.0 to 18V Vout
- 10 x 16 x 4.0mm QFN Package
- FPWM with Frequency Sync from 200KHz to 1.2MHz
- -40°C to 105°C Operating Temp Range (125°C Junction)
- Tested to CISPR11/EN55011, Class B Radiated EMI
- PG, Pre-Biased Start Up and Prog UVLO

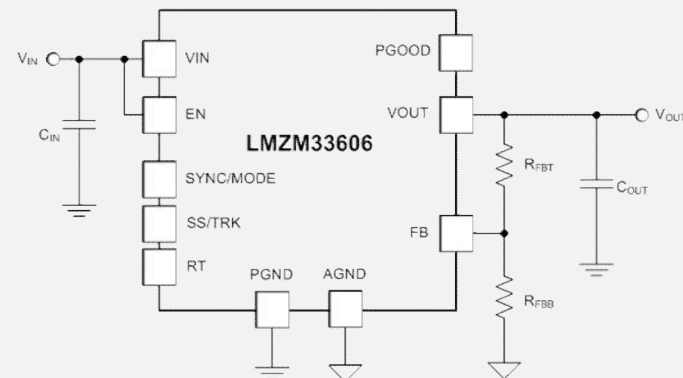
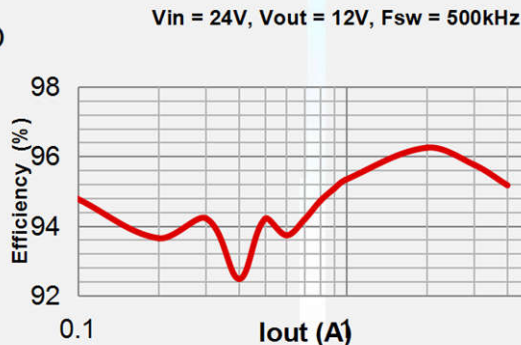


Benefits

- Designed for 24V, 12V and 5V Bus Systems
- Low design effort – highly integrated, small solution
- Fixed Freq + Sync to reduce system noise
- Wide Temperature range allows wide SOA performance

Applications

- Automated Test and Measurement
- Medical & Imaging
- Industrial and Motor Control



TPS62827/6/5

2A, 3A, 4A Buck Converter family with 1% Output Accuracy in 1.5x1.5mm QFN

Features

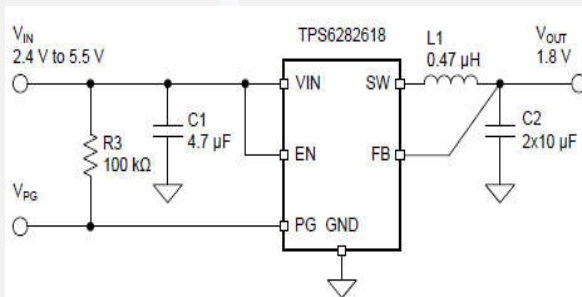
- 2.4V to 5.5V Input Voltage Range
- Low RDS(ON) Switches 26mΩ / 25mΩ
- 4uA quiescent current
- 1% output voltage accuracy (over full temperature range)
- DCS-Control™ Topology for fast transients at low noise
- Automatic Power Save Mode for Light Load Efficiency
- Switching Frequency 2.2MHz
- 1.5mm x 1.5mm QFN HotRod™

Applications

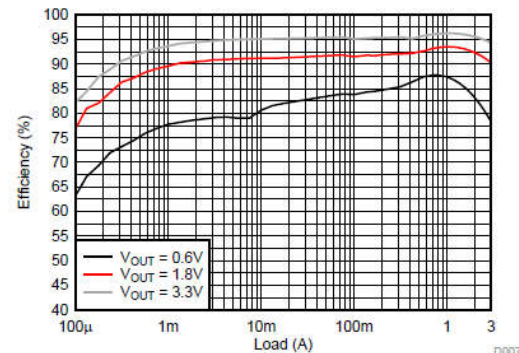
- General Purpose Point of Load (POL) Supply
- Solid State Drive (SSD)
- Surveillance Cameras, Video Door Bells
- Portable Electronics
- Optical Modules

Benefits

- Scalable 2, 3, 4A p2p compatible buck converter family supports highest design flexibility and re-use
- Low quiescent current & low RDSON delivers highest efficiency at light & full loads; extending battery run time
- Achieves tight output voltage accuracy requirements of low Vin processors & FPGAs at all operating conditions
- High switching frequency & high power density reduce BOM size & cost



TPS62826 Efficiency at $V_{IN} = 5V$



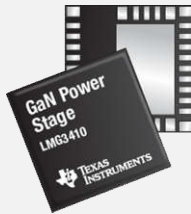
LMG3410R070

Integrated 600-V GaN FET power stage in compact 8x8mm split-pad QFN package



Features

- 70-m Ω typical $R_{DS(ON)}$ at 25°C
- 20-ns typical propagation delay
- High edge-rate tolerance
- Integrated temperature protection and UVLO
- Externally-adjustable drive strength for switching
- Performance and EMI control: supports 30 to 100 V/ns
- Targeted towards high-speed operation: up to 1-MHz steady-state operation



Applications

- Watts to Kilowatts solution for every application:
 - Personal electronics
 - Motor drives and robotics
 - Grid infrastructure

Benefits

- Integrated direct gate driver with zero common source inductance
- Built-in 5V LDO to power external Isolator
- Integrated bias supply – only +12V unregulated supply needed
- High speed over current protection with <100ns response time

