

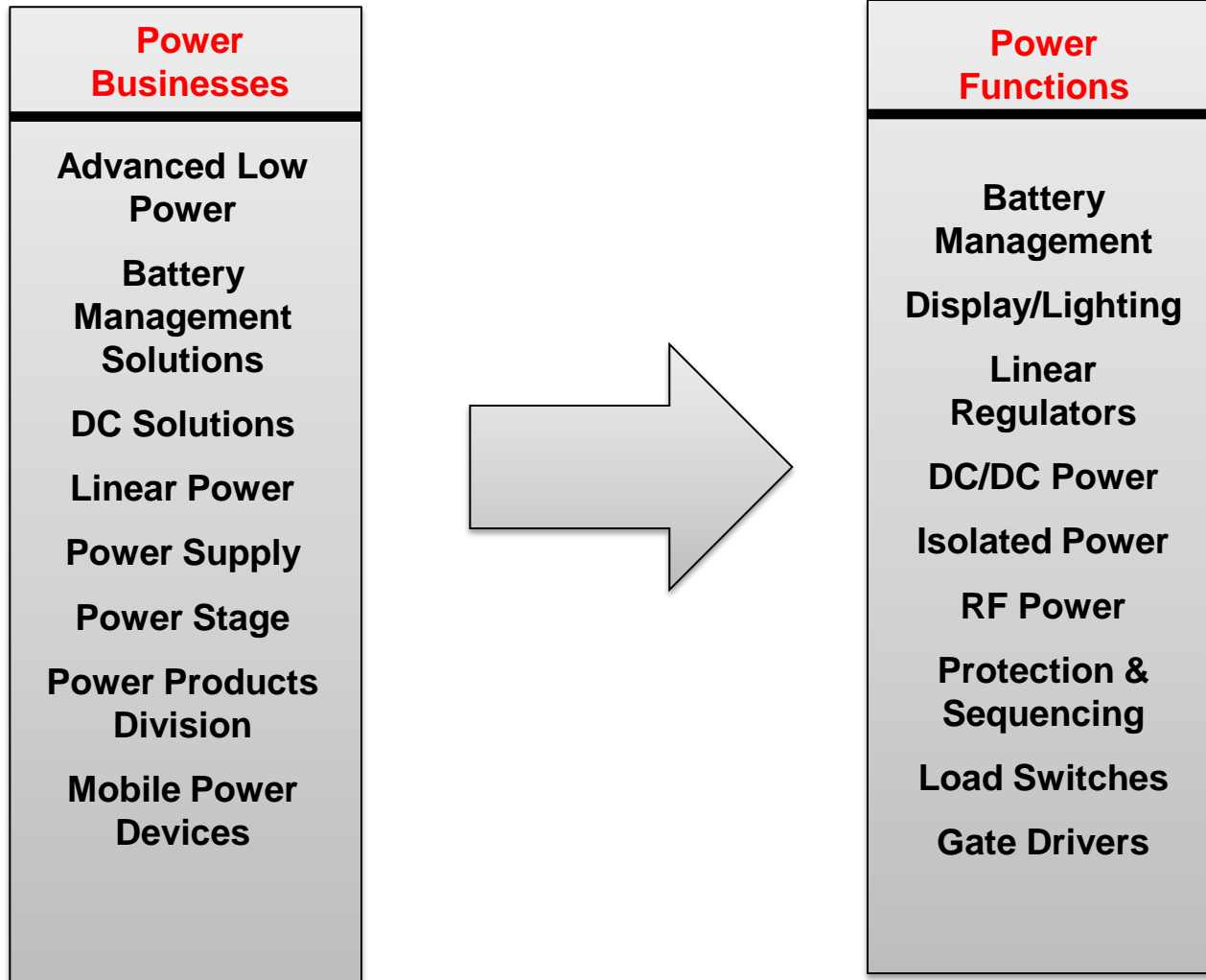
TI Power tech seminar for UIH

Van Yang

Analog FAE

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TI's Power Businesses' Functions



DC/DC Solutions *at a glance...*

<http://power.ti.com>

#1 in power management market share with 19.4%
53 new DC/DC power products introduced in 2012

Industrial & Automotive DC/DC

TPS43060
60V, Low Iq
Synchronous Boost
Controller

TPS55340
5A, 40V Low Iq
Boost DC/DC Converter

LM5017
100V/0.6A
HV Buck Converter

TPS54061
200mA, 60V
Synchronous Step-Down
DC/DC Converter

TPS84250
50V, 2.5A
Power Module

LM5575Q
75V/3A
Simple Switcher
HV Buck Converter

TPS54360
3.5A, 60V Step-Down
DC/DC Converter w/ Eco-Mode

TPS84259
40V, 2A Negative Output
Voltage Power Module

Computing DC/DC

TPS51285
Dual Synchronous Step-Down
Controller w/ ULQ Mode

TPS51206
2A Peak Sink/Source
DDR Termination Regulator
w/ VTTREF

TPS51362/3/7
22V Input, 8A/10A Step-Down
Converter w/ Integrated FET

Consumer DC/DC

TPS54325
4.5V-18VIN, 3A, Sync,
Step-Down D-CAP2™
Converter

TPS54494/5
4.5V-18VIN, Dual 4A+2A,
Synchronous, Step-Down,
D-CAP2™ Converter

TPS54331/2
3.5V-28VIN, 3A, Non-Sync,
Step-Down, Current-Mode
Converter w/ Eco-mode™

LMZ14203
42V/3A
Simple Switcher
Wide Vin Module

Power Stage [FET]

CSD16556Q5B
Extremely Low Resistance
25V NexFET N-Channel
Power MosFET

CSD86360Q5D
Synchronous
Buck NexFET™
Power Block

CSD18532Q5B
60V N-Channel
NexFET™ Power MOSFET

CSD97374Q4M
High Frequency
Synchronous Buck

Power Module



Battery Management *at a glance...*

#1 in power management market share with 19.4%
30 new battery management products introduced in 2012

<http://power.ti.com>

Single-Cell Chargers

BQ2404x

1A Charger, 30 V Input, w/ Support For
USB, HV Chemistry (4.35V), Status Indicator

Cost Competitive

BQ2425x

Industry's Smallest foot-print

2.0A Charger, USB2.0/3.0, BC1.2
I2C/Stand Alone, Power Path
Dynamic Pwr Mgmt

TPS62736/BQ25570

Nano-power Buck/Boost Charger,
330nA Iq, MPPT, >90% efficient at low currents

Extract uW to mW from ambient

BQ2407x

1.5A Charger, 28V input, w/ Power Path
USB Support, Dynamic Pwr Mgmt

Low Cost/High Performance

BQ2426x

Optimized Fast Charging

3.0A Charger, USB2.0/3.0, USB-OTG,
Power Path, I2C, Dynamic
Pwr Mgmt

Multi-Cell Chargers

BQ24190x

Industry First 4.5A 1S charger
Fully integrated w/ I2C

Charge Fast, Stay Cool

BQ24195/5L

**Industry First Single-Chip
Power Bank**

1S 2.5A/4.5A charger w/ I2C
D+D- w/5.1BV 1A/2.1A OTG

BQ246xx

1-6S chargers controller
Standalone for Li-ion, SuperCap, Solar

Cost competitive solution

BQ24133

High Integration 1-3S chargers
Standalone and simple design
94% efficiency, 2.5A/4A charging

BQ2417x

High Integration 1-3S chargers
Standalone and simple design
94% efficiency, 2.5A/4A charging

Single-Cell Gauges/Monitoring

BQ27421

WCSP ROM based

Low Cost Gauge

BQ27530

WCSP Flash based

**Charge Controller plus
Fuel Gauge**

BQ27425-G2

WCSP ROM based

Low Cost Fuel Gauge

BQ27541-G1

QFN Flash based

Pack Side Gauge

BQ27520-G4

WCSP Flash based

**Programmable
Fuel Gauge**



Multi-Cell Gauges/Monitoring

BQ34Z950

Impedance track + DQ + SMB
gauge for high cell Li-Ion, Li-Polymer
and Lead acid battery packs

1st DQ Soln w/ Impedance Track

BQ34Z1xx

Simple gas gauge for high cell
Li-Ion, Li-Polymer and Lead acid
Battery packs

Impedance Track Fuel Gauge

BQ2945xy

Over voltage protectors for 2S-3S
Li-Ion Batter Pack

Small 2x2 QFN pkg

BQ771z00

4S, 5S OVP Protector

BQ76925

Analog Front End for 3S-6S Li-Ion battery
With internal cell balancing

BQ76PL536A

Stackable Analog Front End,
Protection and Balancing for
Automotive

Advanced Low Power at a glance...

#1 in power management market share with 19.4%
25 new battery management products introduced in 2012

<http://power.ti.com>

Display Power

TPS65150-Q1

4ch LCD bias

**Flexible LCD supply
for Automotive**

Integrated Vcom
Vs up to 15V (boost),
<1% accuracy
V_{GH} (with GVS) & V_{GL}

TPS65631

2 output AMOLED

**High efficiency
and accuracy**
300mA output

TPS65132

+/-5V SIMO

**Highly flexible &
Programmable**

>86% efficiency
80mA output current
CSP package

TPS65130

+/- 15V max Regulator

**Highly flexible
and efficient**

>85% efficiency
200mA output current

TPS61086

high A, 1ch boost

High current boost
up to 18.5V
2A switch

Low Power DC/DC Converters

TPS62130/40/50/60

Industrial

**General purpose DC/DC reg. 3A Low Vin buck
with 3 ext components**
1A-4A 17V in buck
with DCS control

TLV62090

Industrial

**High efficiency step down
conv in 3x3 mm QFN pkg**

TPS623870

Processor Power

Remote Sensing
8A dual phase buck with
DCS control

TPS81256

Wireless

Integrated Pwr Soln
3W fully integrated, low noise
boost in MicroSiP pkg

TPS63020/25

Wireless

Highly Efficient

4A buck-boost in QFN/WCSP
package

TPS650380

Processor Power

miniPMU
Triple multiphase buck,
up to 6.8A

Integrated Display Lighting Solutions

TPS61162/3

2-Ch WLED Driver

2ch for 4-6" Smartphones
2.7V ~ 6.5V input voltage range
Up to 38V output, 2x25mA
one-wire dimming & analog
dimming

TPS61176

6ch WLED - tablets

6ch for Single-Cell Battery Supply

Up to 38V output, 6 x 30mA
Mixed-mode Dimming

TPS61196

6ch WLED driver - TV

6ch 200mA 1-D dimming
Up to 120V output voltage
200mA continuous / 400mA pulse
independent PWM dimming

Advanced Portable Power

TPS65090

2-Ch WLED- smart phone

**Highly integrated soln
for single-cell Li-ion batt**
Up to 90% efficacy
2.7V-6.5V input voltage

TPS65070

For batt. powered proc.

**One IC for all power
functions**
5-ch Power mgmt IC with
3 Dc/DCs, 2 LDOs
in 6x6mm QFN

TPS65912x

PMU- Processor Power

**Highly integrated
PMUs**
4 bucks
10 LDOs
3 LED outputs

TPS650250

Pwr Mgt IC for Li-ion

Flexible and low cost PMU
3 DC/DC and 3 LDOs,
Fully adjustable

TPS65050

6-ch Power Mgmt IC

Highly efficient
6-ch Power mgmt IC
with 2 DC/DCs, 4 LDOs,
In 4x4 QFN

TPS65023

6-ch Power Mgmt IC

**General purpose
PMIC**
3 DC/DCs, 3 LDOs,
I2C interface and DVS

Linear Power at a glance...

<http://power.ti.com>

#1 in power management market share with 19.4%
23 new battery management products introduced in 2012

LDOs and Supervisors

TLV713xx

150-mA Low-Dropout Regulator
w/ Foldback Current Limit for
Portable devices

TPS709xx

150-mA, 30V, Ultra-Low IQ,
Wide Input Low-Dropout Regulator
w/ Reverse Current Protection

TPS7A4700

Low Noise, 1A High Voltage
Low-Dropout Regulator

Power Interface

TPS23753A

PoE Interface and Isolated Converter Controller
w/ Enhanced ESD Ride-Through

TPS23751/2/3A/6

PoE PD
with DC-DC Converter

TPS247x

3V-18V Converter
Hot Swap

TPS25910

3V-20V Protection
eFuse

LM(2)506x

Hot Swap/Monitoring
PMBus Monitoring

LM5050

High Voltage
ORing FET controller

WEBENCH® Design Center & PowerLab

www.ti.com/webench

ti.com/powerlab

WEBENCH® Design Tools Fast, Easy-To-Use Solutions

Power, lighting, sensors
FPGA & processor power

TINA-TI™

Circuit Simulator

Thousands of models for offline
simulation

Downloadable Models

PSpice, IBIS, and more

PowerLab™

Reference Design Library

Hundreds of advanced
power reference design examples

WEBENCH® Designer *My Designs*

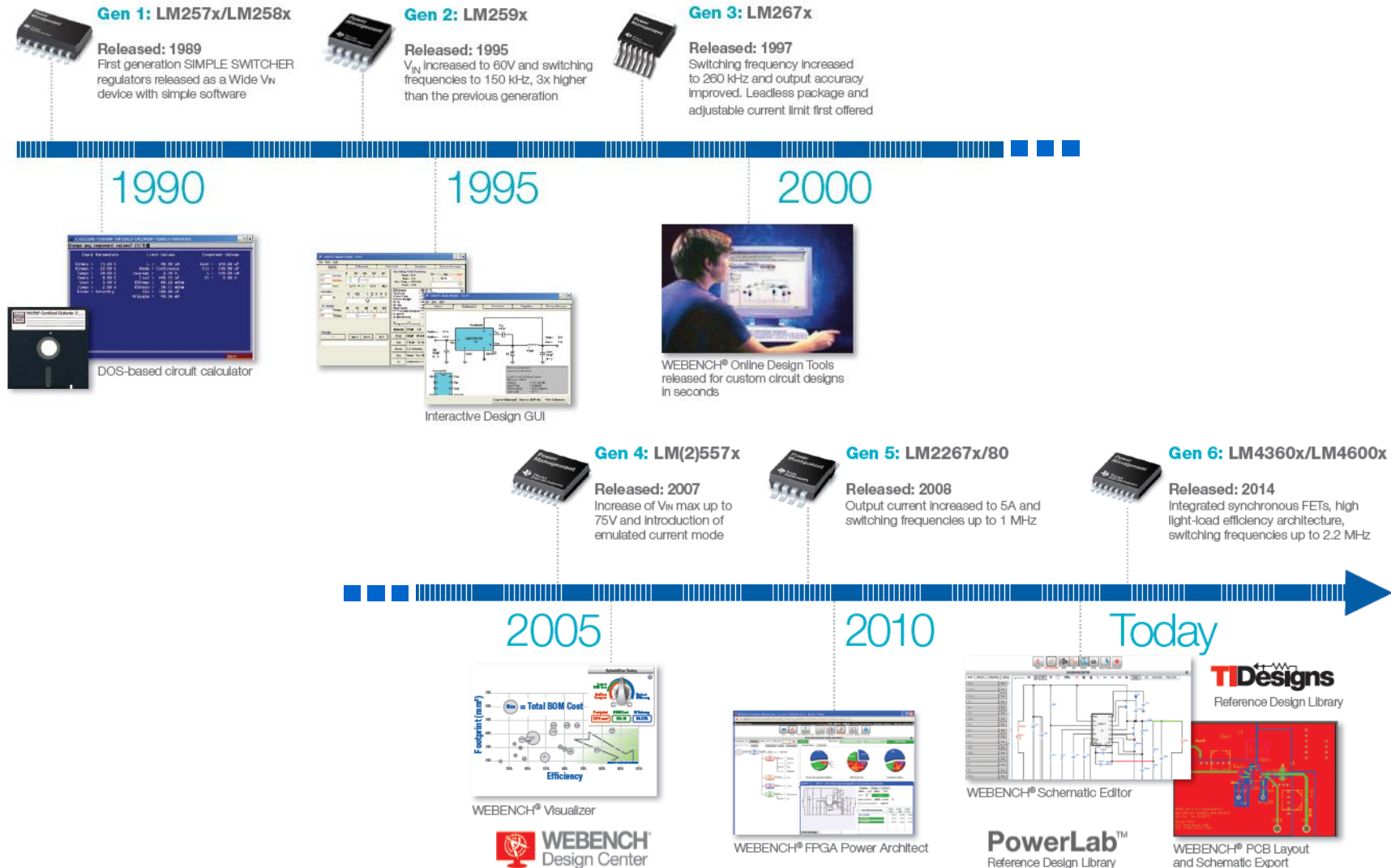
The screenshot shows the WEBENCH Designer interface with the 'Power' tab selected. It prompts the user to 'Enter your power supply requirements:'. There are radio buttons for 'DC' (selected) and 'AC'. Below, there are input fields for 'Vin' (Min 14.0 V, Max 22.0 V), 'Vout' (3.3 V), 'Iout' (2.0 A), and 'Ambient Temp' (30 °C). At the bottom, there are two red buttons: 'Power Architect' and 'Start Design'.

PowerLab™ Power Reference Designs Selection Tool

The screenshot shows the PowerLab Power Reference Designs Selection Tool interface. It has a 'Reset All Criteria' and 'Hide Criteria' link at the top left. Below, there are input fields for 'Input voltage range' (Min and Max in V), 'Output voltage' (V), 'Output current' (A), and 'Part or design number'. There are also checkboxes for 'Isolated/non-isolated' and 'Input type' (AC, DC). On the right, there is a list of 'Application(s)' and a 'Topology / Subtopology of devices associated' section with checkboxes for Boost, Buck Boost, Buck, Flyback, and Forward. A red button labeled 'Power for Processors' is visible in the bottom right.

SIMPLE SWITCHER® Regulators

A Legacy of Ease-of-Use



Part Number Nomenclature

LM 4 VV II

- 4:** Synchronous Simple Switcher feature set
- Fully synchronous
 - Low quiescent current
 - Power Good
 - Precision Enable
 - Internal compensation

Max Operating Input Rail

36: 36V V_{in}

60: 60V V_{in}

Output Current

00: 500mA

01: 1A

02: 2A

03: 3A

Example: LM**43603**

- Synchronous family
- Max V_{in} : **36V**
- I_{out} : **3A**

LM557x Series

- Non-synchronous
- 6V to 75V input
- Up to 3A output
- TSSOP

LM2267x Series

- Non-synchronous
- 4.5V to 42V input
- Up to 5A output
- Internal comp
- PSOP, TO-263

LM4xxxx Series

- Synchronous
- 3.5V to 60V
- Up to 3A output
- Internal comp
- TSSOP
- Low I_Q
- 200kHz to 2.2MHz F_{sw}

Gen6 36V –LM43600/1/2/3

0.5A/1A/2A/3A SIMPLE SWITCHER® Synchronous Buck Regulators

Features

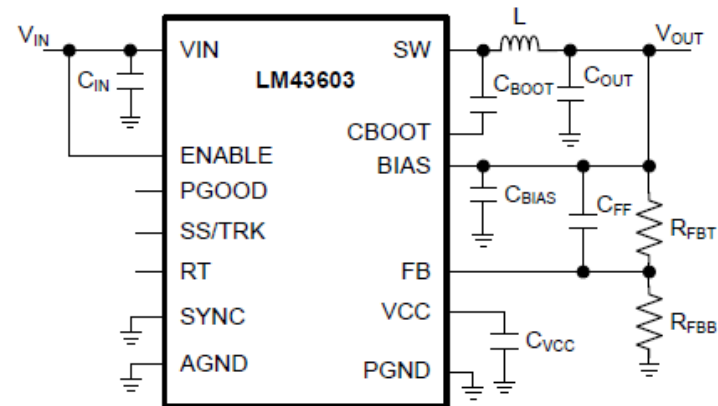
- Vin range 3.5V-36V
- Synchronous Peak Current Mode architecture
- Vout Range 1.0V to 28Vout
- Output current options: 0.5A/1A/2A/3A
- **Internal Compensation**
- **Low 27µA operating quiescent current**
- Precision Enable
- Default frequency of 500kHz, Adjustable or Synchronizable from **200kHz – 2.2MHz**
- Internal or adjustable Soft-Start/Tracking
- Power Good output
- Operating Junction Temperature: -40 to 125C
- HTSSOP16 package

Applications

- Industrial
- Sub-AM band Automotive
- Networking
- Computing

Benefits

- Wide Vin range to fit a variety of applications
- Improved efficiency compared to non-synchronous solutions
- **Scalable footprint simplifies design reuse**
- Minimized BOM count and solution size
- **>80% efficiency at 1mA output current (12V→3.3V, 500kHz)**
- Higher switching frequency allows smaller external filtering components
- Pin compatible with 60V 0.5A/1A/2A HTSSOP and 36V 0.5A/1A/2A HTSSOP



Gen6 60V – LM46000/01/2

0.5A/1A/2A SIMPLE SWITCHER® Synchronous Buck Regulators

Features

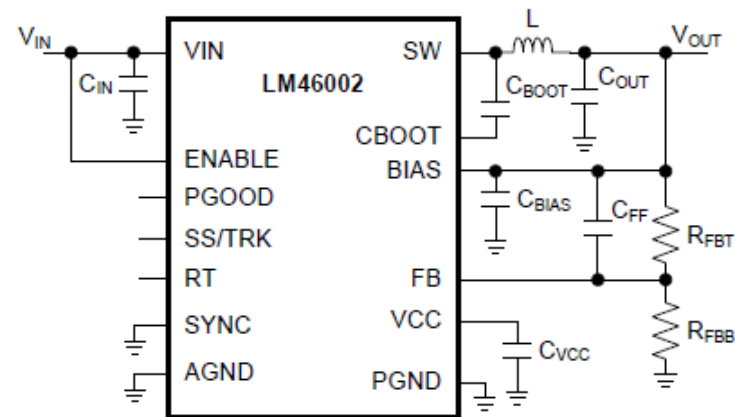
- Vin range 3.5V-60V
- Vout Range 1.0V to 28Vout
- Synchronous Peak Current Mode architecture
- Output current options: 0.5A/1A/2A
- **Low 27µA operating quiescent current**
- Precision Enable
- Default frequency of 500kHz, Adjustable or Synchronizable from **200kHz – 2.2MHz**
- Internal or adjustable Soft-Start/Tracking
- Power Good output
- **Internal Compensation**
- Operating Junction Temperature: -40 to 125C
- HTSSOP16 package

Applications

- Industrial
- Sub AM-band 12V and 24V Automotive
- Networking
- Computing

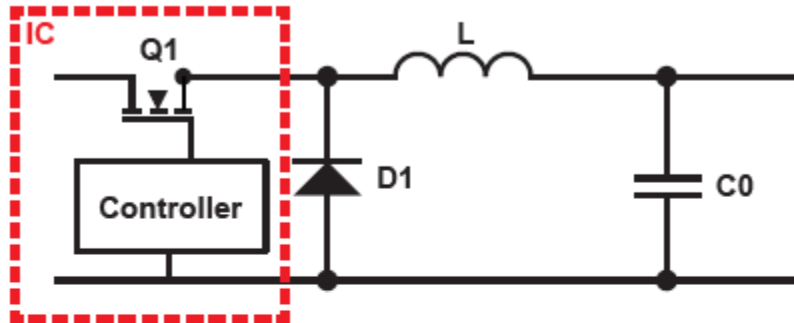
Benefits

- Transient protection for 12V, 24V, 36V, 48V input systems
- Improved efficiency compared to non-synchronous solutions
- **75% efficiency at 1mA output current (12V→3.3V)**
- Higher switching frequency allows smaller external filtering components
- Minimized BOM count and solution size
- **Scalable footprint simplifies design reuse**
- Pin compatible with 36V 0.5A/1A/2A/3A family

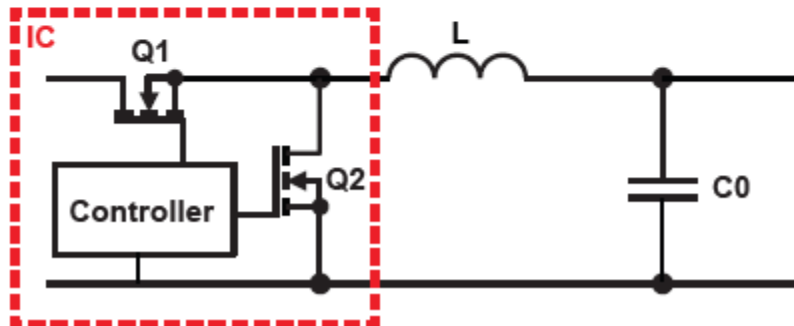


Advantages of a Synchronous Solution

Non-Synchronous



Synchronous



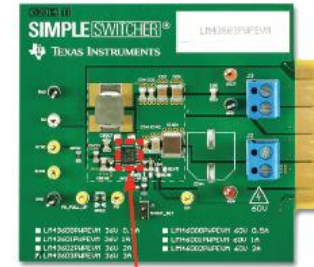
Smaller Solution Size

Typical Non-Synchronous EVM



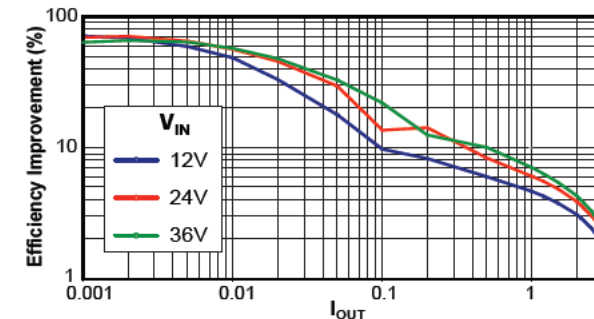
Total Regulator Area
(IC + Diode) = 95 mm²

LM43603 Synchronous EVM

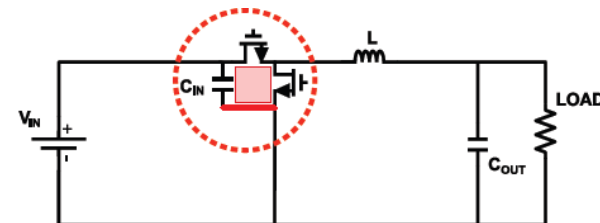


Total Regulator Area
(IC) = 32 mm²

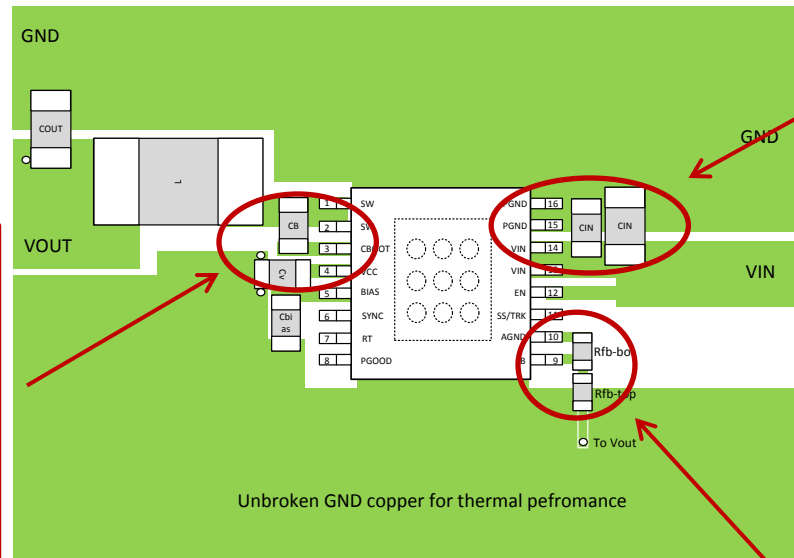
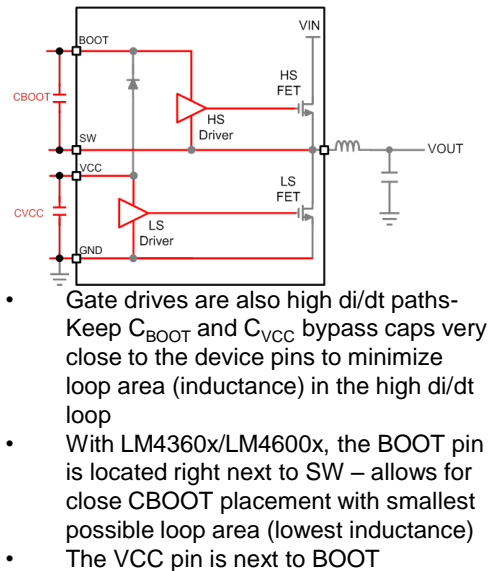
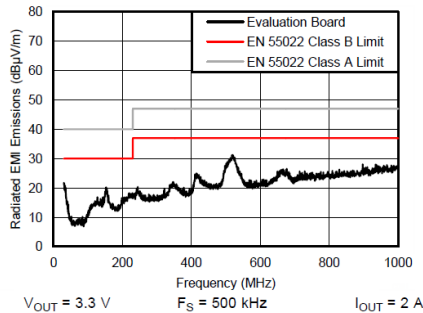
Improved Efficiency



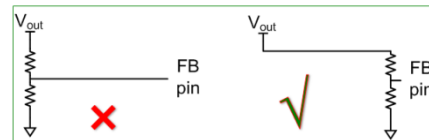
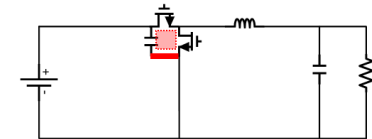
Better EMI Performance



Pin-Out Optimized for EMI Performance

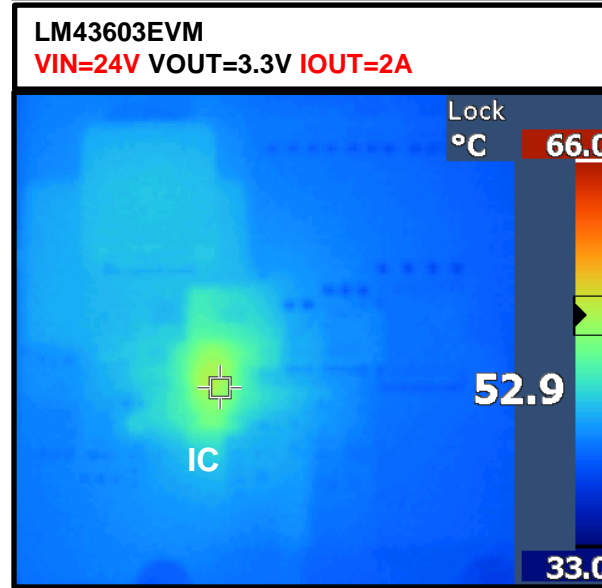
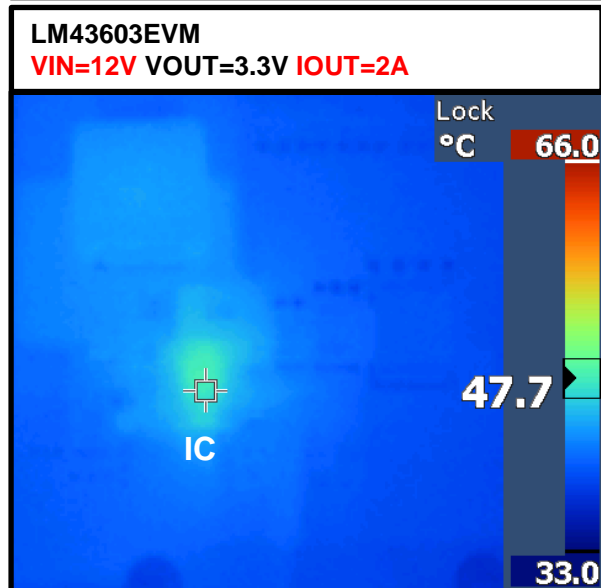
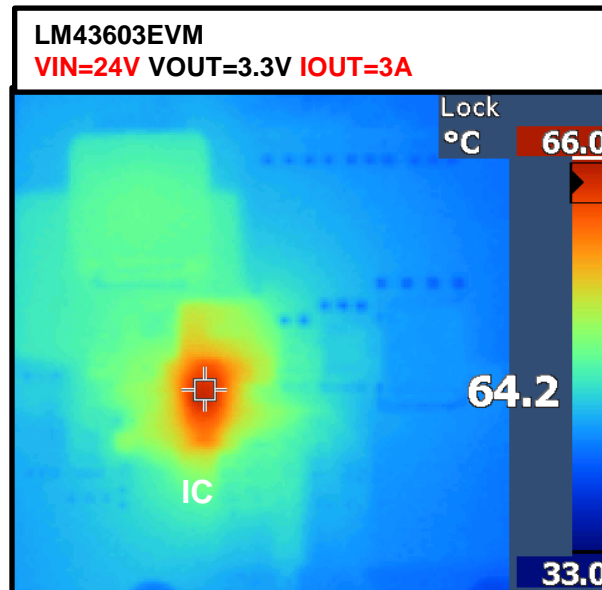
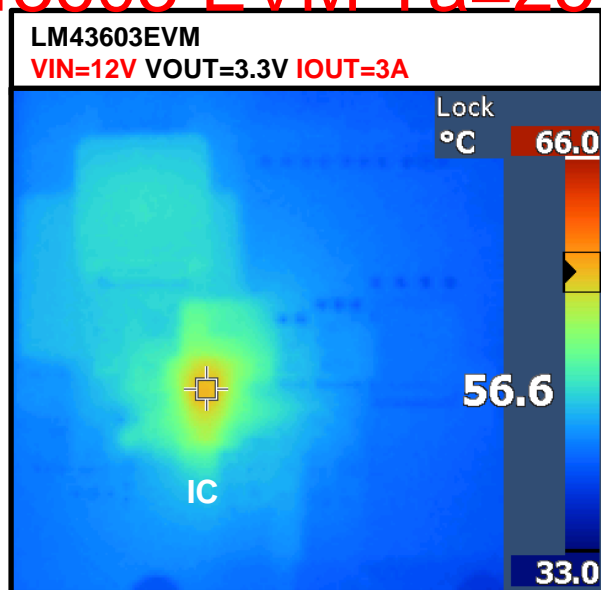


- The VIN and PGND location allows for the input cap to be placed as close as possible to the package.
- The SW pin is on the other side, so there is no need for the input cap to jump over the SW node.
- The loop area formed by the input cap, VIN, and PGND pins is minimized.



- Make long runs to low impedance nodes, short runs to high impedance nodes.
- Place output voltage divider close to the FB node (high impedance), farther from Vout (low impedance)
- With LM4360x/LM4600x, the FB Pin is in the corner, shielded by AGND and away from noise sources. This makes it easy to place the divider right next to the FB pin, keeping this node as small as possible.

LM43603 EVM $T_a=25^{\circ}\text{C}$

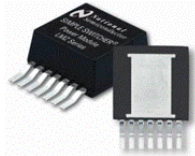


TI's SIMPLE SWITCHER® Power Module

Most Comprehensive Power Module Portfolio

Leaded LMZ1/LMZ2 Modules

- Wide VIN up to 10A
- Leaded PMOD Packaging



Nano Modules

- 5V/12V up to 2A module
- 3.5mm x 3.5mm DFN

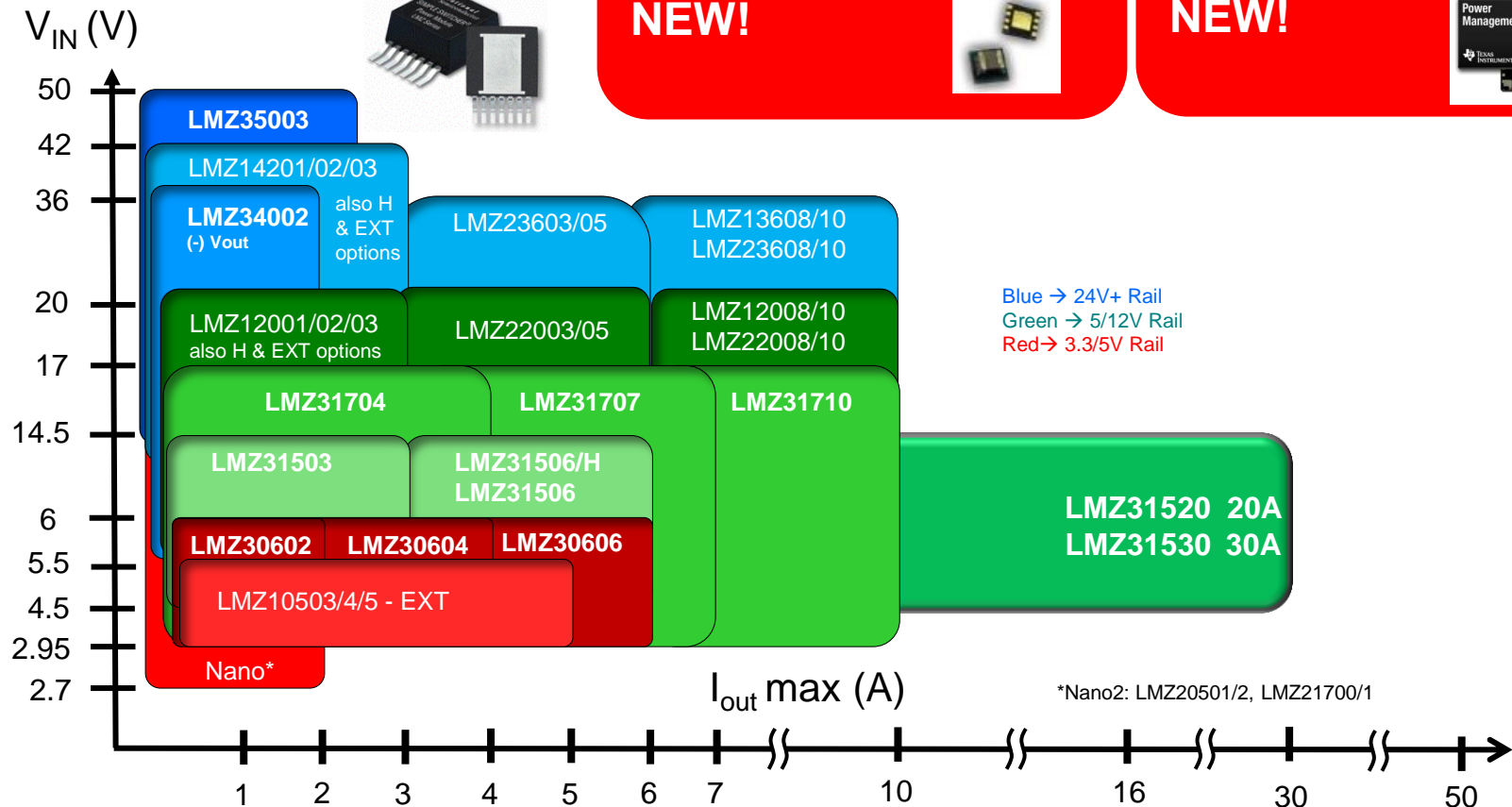
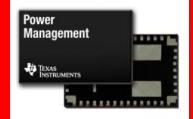
NEW!



LMZ3 Modules

- High Power Density 12V, up to 30A
- Small Low-Profile QFN Package

NEW!



Leaded & QFN Modules

LMZ **A** **BB** **CC** **H** **EXT**

Z: Power Modules

1: 1st Series
2: 2nd Series
3: 3rd Series

Max Operating
Input Rail

05: 5.5V Vin
20: 20V Vin
36: 36V Vin
42: 42V Vin

Output
Current

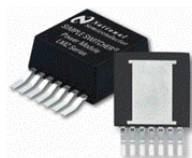
01: 1A
02: 2A
...
10: 10A

EXT: Extended
Temp

H: High Output Voltage

Example: LM**Z****2****36****10**

- LM**Z2**-series
- Max Vin: **36V**
- Iout: **10A**



LMZ1-Series

- Leaded
- Precision Enable
- Soft Start

LMZ2-Series

- Leaded
- Precision Enable
- Soft Start
- Frequency Sync
- Current Sharing

LMZ3-Series

- QFN
- Precision Enable
- Soft Start/Tracking
- Frequency Sync
- PGood
- Current Sharing*

*LMZ31710 & LMZ31506

Nano Modules

LMZ A BB CC

Z: Power Modules

1: 1st Series
2: 2nd Series

Max Operating
Input Rail
05: 5.5V Vin
17: 17V Vin

Output Current
00: 500-650mA
01: 1A
02: 2A

Example: LM**Z10501**

- LM**Z1**-series
- Max Vin: **5.5V**
- I_{out}: **1A**



LMZ1-Series

- Precision Enable
- Soft Start

LMZ2-Series

- Precision Enable
- Soft Start
- Ecomode
- PGOOD



Device Qualification

High Quality Devices

**Individual Components
& Final Product Qual
tested**

**Happy to discuss any
test in greater detail if
interested**

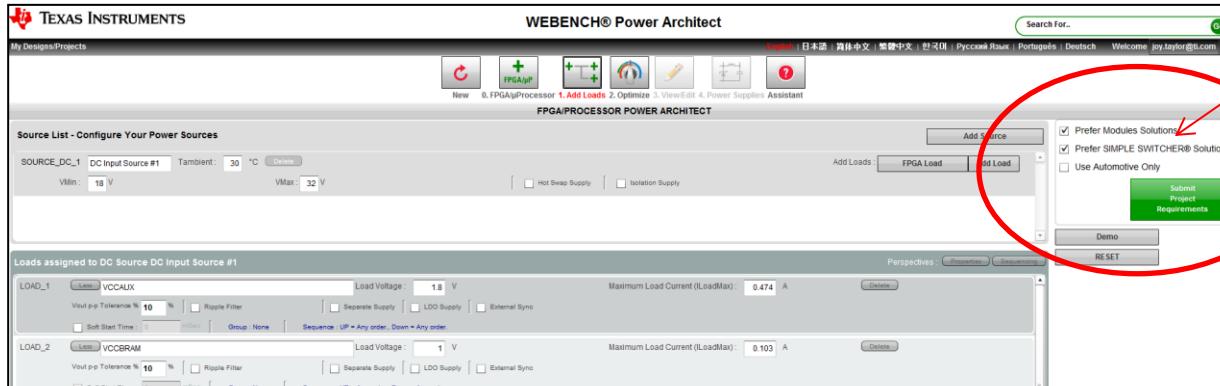
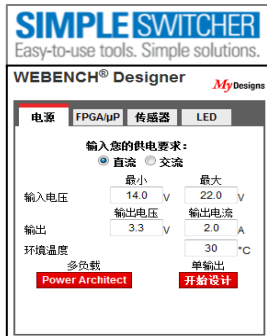
LMZ3 follow standard QFN soldering guidelines and are rated at MSL 3 as per JEDEC (parts don't need to be baked before soldering, providing the parts are used within 168 hours of the package being opened)

LMZ31506H Qualification Summary

Test Type	Condition/Duration	Qty (Lots/Pieces)	Results
Moisture Sensitivity	(Level 3 @ 260C peak +/-0C)	27	Pass
**Temp cycling -65C/150C	-65C/+150C (500, 1000* Cyc)	3/77	Pass
**Unbiased HAST	110C/85%RH/17.7 psia (96, 264* hrs)	3/77	Pass
**Biased Temp. Humidity	85C/85%RH (500, 1000 Hrs)	1/77	Pass
BLR - Temp Cycle, -40/125C	-40/125C (1200) cycles)	1/42	Pass
**High Temp. Storage Bake	150C (500 Hrs)	1/75	Pass
**High Temp. Storage Bake	170C (168, 420hrs)	2/77	Pass
**Steady-State Life Test	125C (500, 1000 Hrs)	2/77	Pass
**Power Cycling	15 Minute Duty Cycle 1000 Hours	3/40	Pass
Vibration	MIL-STD-883D, METHOD 2007.2 - Pass 20g	1/9	Pass
Mechanical Shock	MIL-STD-883D, METHOD 2002.3 - pass 1500g	1/3	Pass
Flammability	Method A - UL94-0	3/5	Pass
Solderability	Steam age, 8 hours	3/22	Pass
Salt Atmosphere	24Hours	3/22	Pass
ESD HBM	+/-100V	1/3	Pass
ESD MM	+/-100V	1/3	Pass
ESD CDM	+/-500V	1/3	Pass
Radiated Emissions	Pass - Class B EN55022 Regulations	1/3	Pass
Conducted Emissions	Data Provided, Passed Class B EN55022	1/3	Pass

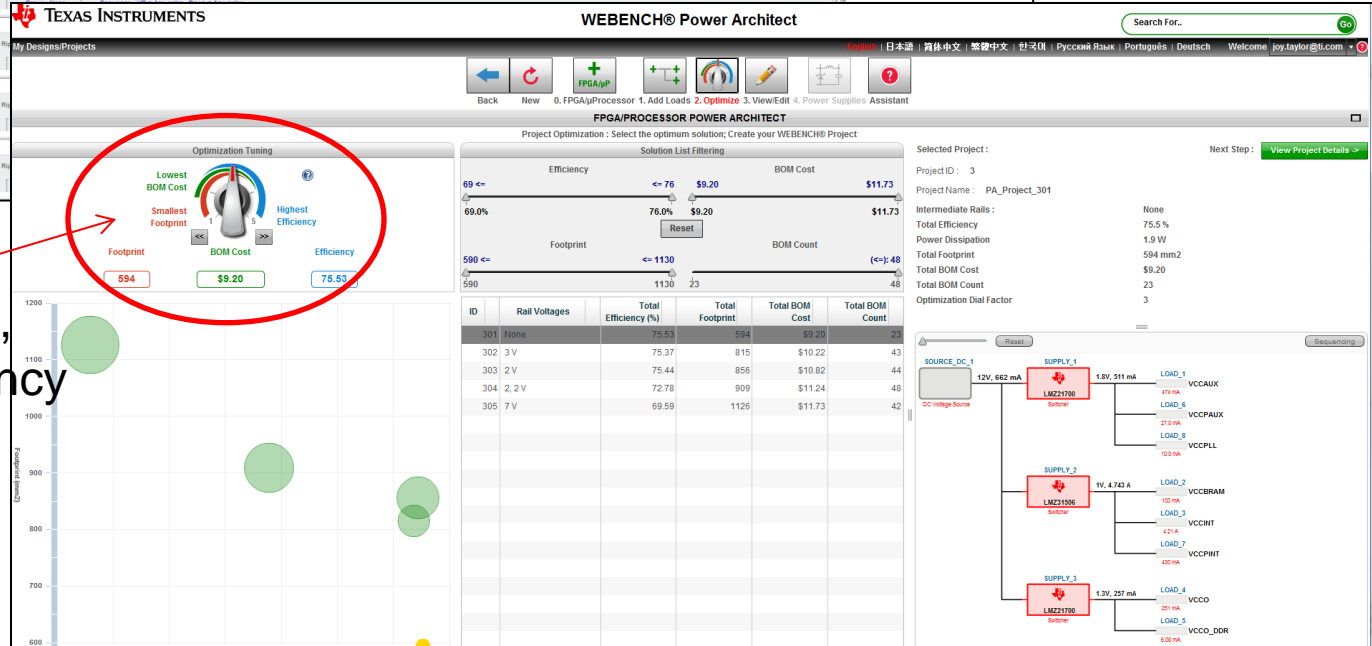
** - MSL 3 Preconditioning

Tools: WEBENCH® FPGA Architect



Can Select Power Module Solutions for Ease of Use Designs

Can optimize designs for cost, size, and efficiency



Tools: FPGA Power Supply Design

Detail Report with Complete BOM, Electrical Performance



WEBENCH® Power Architect

Project Report

Project: 6807010 - PA_Project_0 (modified from 0)
Created: 2013-07-23 15:15:30.062
Optimize project opFactor=5

Project Summary	
1. Total System Efficiency	85.319 %
2. Total System BOM Count	32.0
3. Total System Footprint	830.0 mm2
4. Total System BOM Cost	\$13.11
5. Total System Power Dissipation	375.6 mW

→ Launch WEBENCH Power Architect.

Power Supplies

#	Name	NSID	Description	Vout	Iout	Efficiency	Foot-print	Cost	Design	Page
1.	SUPPLY_1	LMZ10500	Switcher: 650mA SIMPLE SWITCHER Nano Module	1.8 V	0.176 A	88%	76	\$1.43	155	4
2.	SUPPLY_2	LMZ30802	Switcher: 2A Synchronous Buck Module	1 V	1.175 A	88.3%	327	\$5.25	156	6
3.	SUPPLY_3	LMZ12001	Switcher: 1A SIMPLE SWITCHER Power Module	1.5 V	0.386 A	89.2%	328	\$4.75	157	8
4.	SUPPLY_4	LMZ10500	Switcher: 650mA SIMPLE SWITCHER Nano Module	2.5 V	0.070 A	88.1%	76	\$1.43	159	12
5.	SUPPLY_5	LP5907-1.8	LDO: Ultra low noise with no bypass capacitor	1.8 V	0.070 A	65.3%	25	\$0.25	158	10

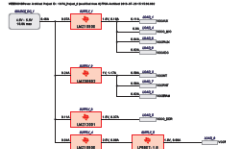
Power Loads

#	Name	VLoad	Iload	Description
1.	VCCDAUX	1.8 V	0.109 A	VoutRipple=10%
2.	VCCO_MIO	1.8 V	0.005 A	VoutRipple=10%
3.	VCCPAUX	1.8 V	0.037 A	VoutRipple=10%
4.	VCCDDO	1.8 V	0.025 A	VoutRipple=10%
5.	VCCINT	1 V	0.586 A	VoutRipple=10%
6.	VCCPINT	1 V	0.565 A	VoutRipple=10%
7.	VCCBRAM	1 V	0.024 A	VoutRipple=10%
8.	VCCO_DDR	1.5 V	0.366 A	VoutRipple=10%
9.	VCCPLL	1.8 V	0.078 A	Requires a separate supply

FPGAs, Processors

#	Manufacturer	Part Number	Name	Series	Description
1.	Xilinx	XC7Z020-2CLG400C	FPGA_1	Zynq-7000	PPGA Xilinx Zynq-7000 XC7Z020-2CLG400C

http://www.xilinx.com/support/documentation/data_sheets/ds187-XC7Z020-XC7Z020-Data-Sheet.pdf



WEBENCH® Design Report

Design: 680701056 LMZ30802RGR

LMZ30802RGR 4.5V-5.5V to 1.0V @ 1.175A

VinMin = 4.5V
VinMax = 5.5V
Vout = 1.0V
Iout = 1.18A

Device = LMZ30802RGR
Topology = Buck
Created = 7/23/13 3:15:19 PM
BOM Cost = \$5.25
Total Pd = 0.16W
Footprint = 327.0mm2
BOM Count = 7

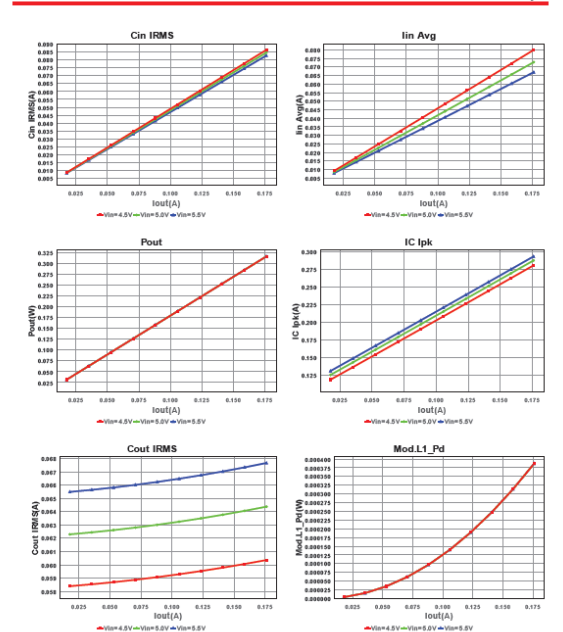
Electrical BOM

#	Name	Manufacturer	Part Number	Properties	Qty	Price	Footprint
1.	Cin	Panasonic	EEF-U0K101R Series= UD	Cap= 100.0 µF ESR= 18.0 mOhm VDC= 8.0 V IRMS= 2.5 A	1	\$0.83	CAPSMT_6_UD 58mm2
2.	Cin1	TDK	C4532SR1A476M Series= XSR	Cap= 47.0 µF ESR= 1.7 mOhm VDC= 10.0 V IRMS= 3.8 A	1	\$0.63	1812 38mm2
3.	Cout	Nippon Chemi-Con	APXER40ARA151ME81G Series= PXE	Cap= 150.0 µF ESR= 22.0 mOhm VDC= 4.0 V IRMS= 2.61 A	1	\$0.61	CAPSMT_62_E81 53mm2
4.	Cout1	TDK	C3216XSR0J476M Series= XSR	Cap= 47.0 µF ESR= 2.0 mOhm VDC= 6.3 V IRMS= 4.1 A	1	\$0.21	1206 19mm2
5.	Res1	Vishay-Dale	CRCW04025K62FKED Series= CRCW_s3	Res= 5.62 kOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	D402 8mm2
6.	RI	Vishay-Dale	CRCW04021M21FKED Series= CRCW_s3	Res= 1.21 MOhm Power= 63.0 mW Tolerance= 1.0%	1	\$0.01	D402 8mm2
7.	U1	Texas Instruments	LMZ30802RGR	Switcher	1	\$2.95	BQFN-39 143mm2

Operating Values

#	Name	Value	Category	Description
1.	Cin IRMS	464.347 mA	Current	Input capacitor RMS ripple current
2.	Cout IRMS	387.093 mA	Current	Output capacitor RMS ripple current
3.	IC IpK	1.845 A	Current	Peak switch current in IC
4.	Iin Avg	241.88 mA	Current	Average input current
5.	M1 Ims	517.12 mA	Current	Q Iavg
6.	BOM Count	7	General	Total Design BOM count
7.	FootPrint	327.0 mm2	General	Total Foot Print Area of BOM components
8.	Frequency	650.0 kHz	General	Switching frequency
9.	IC Tolerance	10.0 mV	General	IC Feedback Tolerance
10.	M Vds Act	26.245 mV	General	Voltage drop across the MosFET
11.	Mode	CCM	General	Conduction Mode
12.	Pout	1.175 W	General	Total output power

WEBENCH® Power Architect Project

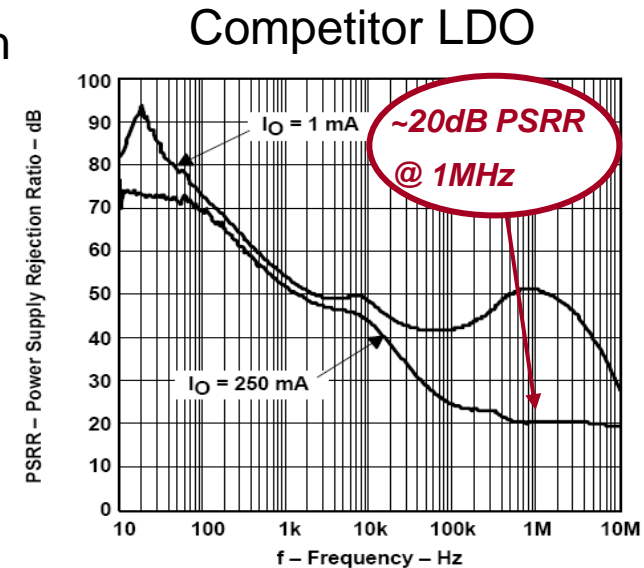
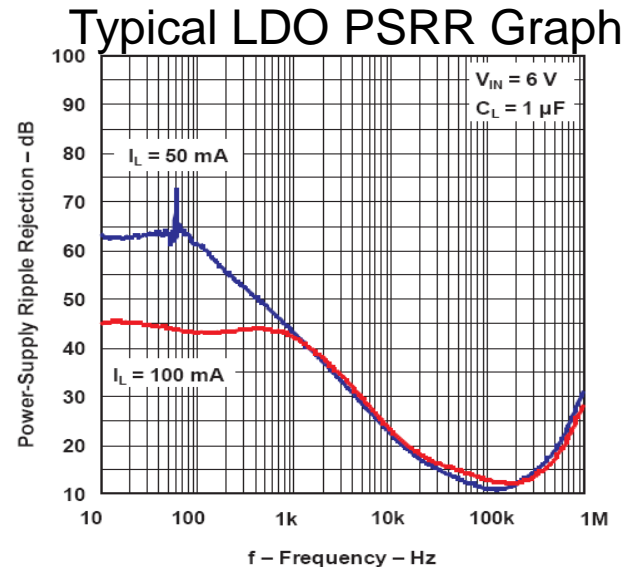
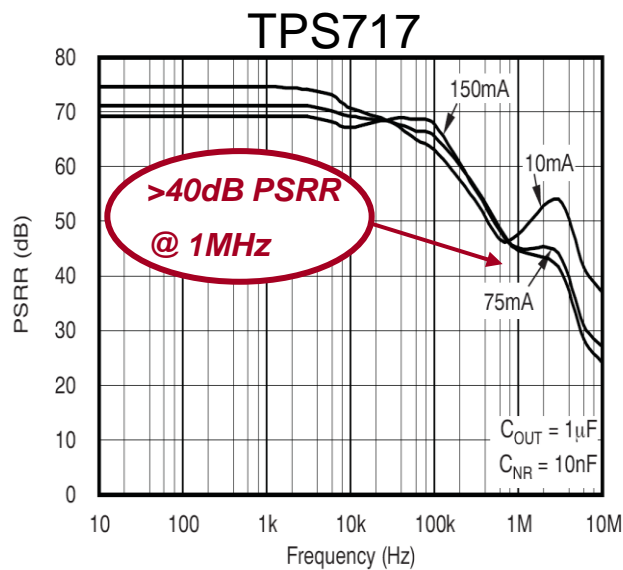




Advantages of Quiet Supply

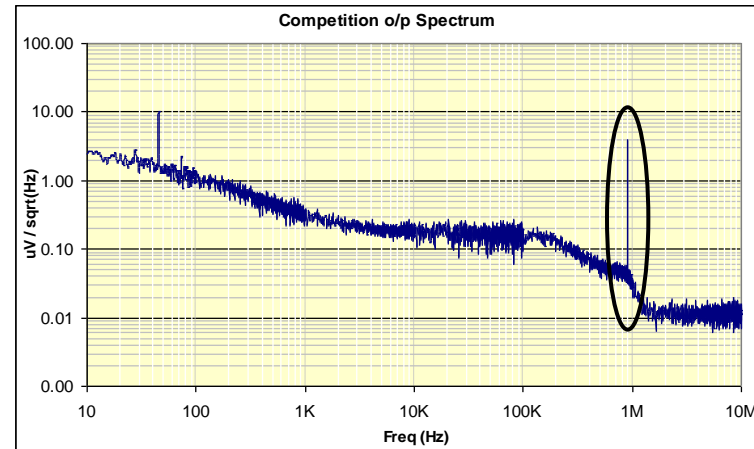
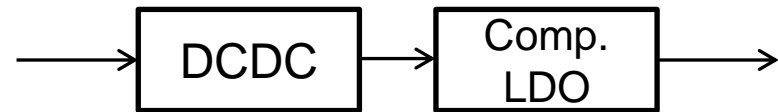
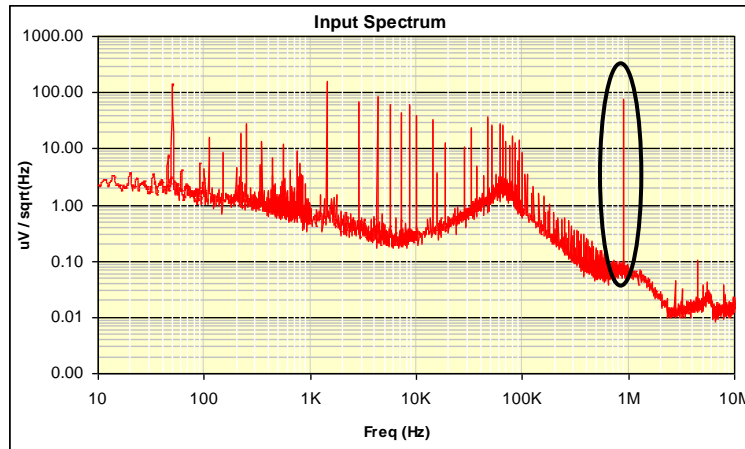
PSRR – Power Supply Rejection Ratio

- Measurement of power supply's ability to reject/filter noise on the input bus
- Historically, LDOs have had poor high frequency PSRR performance
- Today, TI has LDOs with PSRR > 40dB @ 5MHz



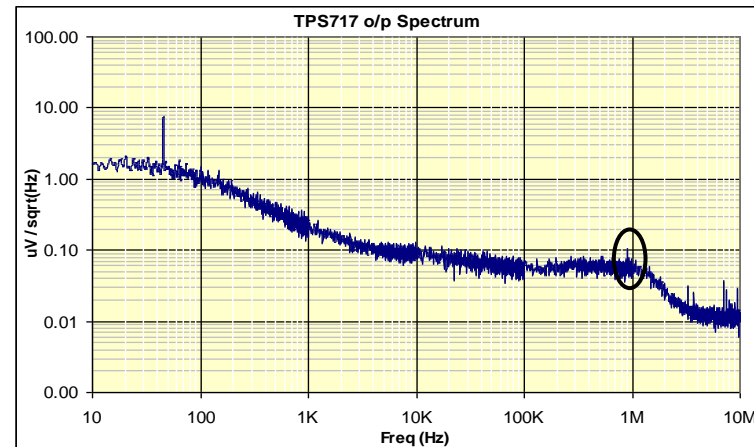
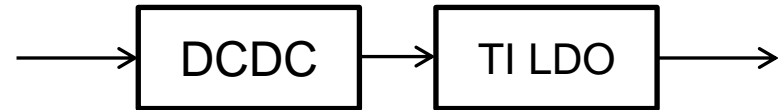
- Most LDOs have high PSRR at lower frequencies
- **Having high PSRR over a large bandwidth is what distinguishes performance LDOs**

Advantages of Quiet Supply

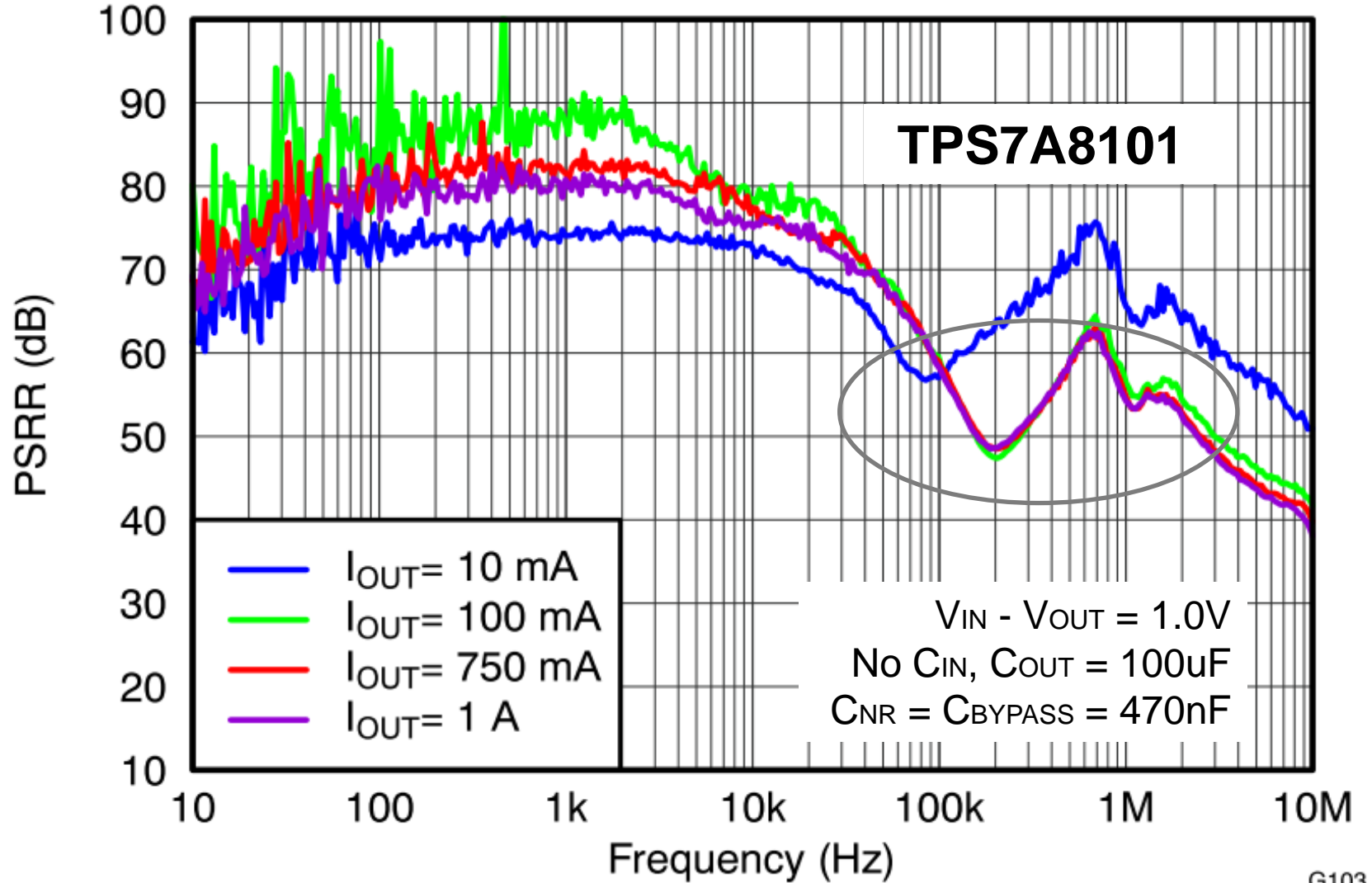


- **Switching frequency spike (~1MHz)**

- Not attenuated by competition's LDO
- Attenuated by TPS717
- May show up at output of RF VCO which after mixing will affect the PA performance
- May fold back into audio band and create noise in audio application



Advantages of Quiet Supply



G103



Advantages of Quiet Supply

Output Noise Density

Random Noise due to statistical effects in conduction

- Split into two types:
 - Thermal and Bipolar Shot Noise
 - Flicker Noise

Having low output noise density ensures that the LDO is not affecting the rail

- You could just use opt for a *normal* LDO and try to filter its noise *BUT*:
 - A large filter is required to filter out low frequency noise
 - Your solution gets larger and more expensive

TPS7A4700 Noise Spectrum Density

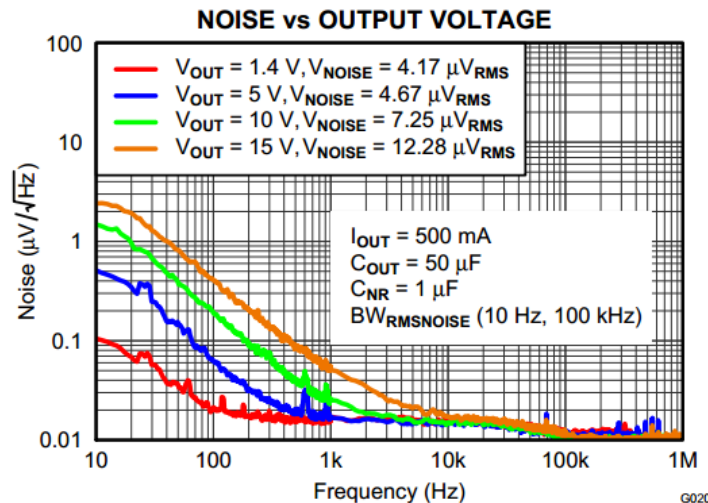
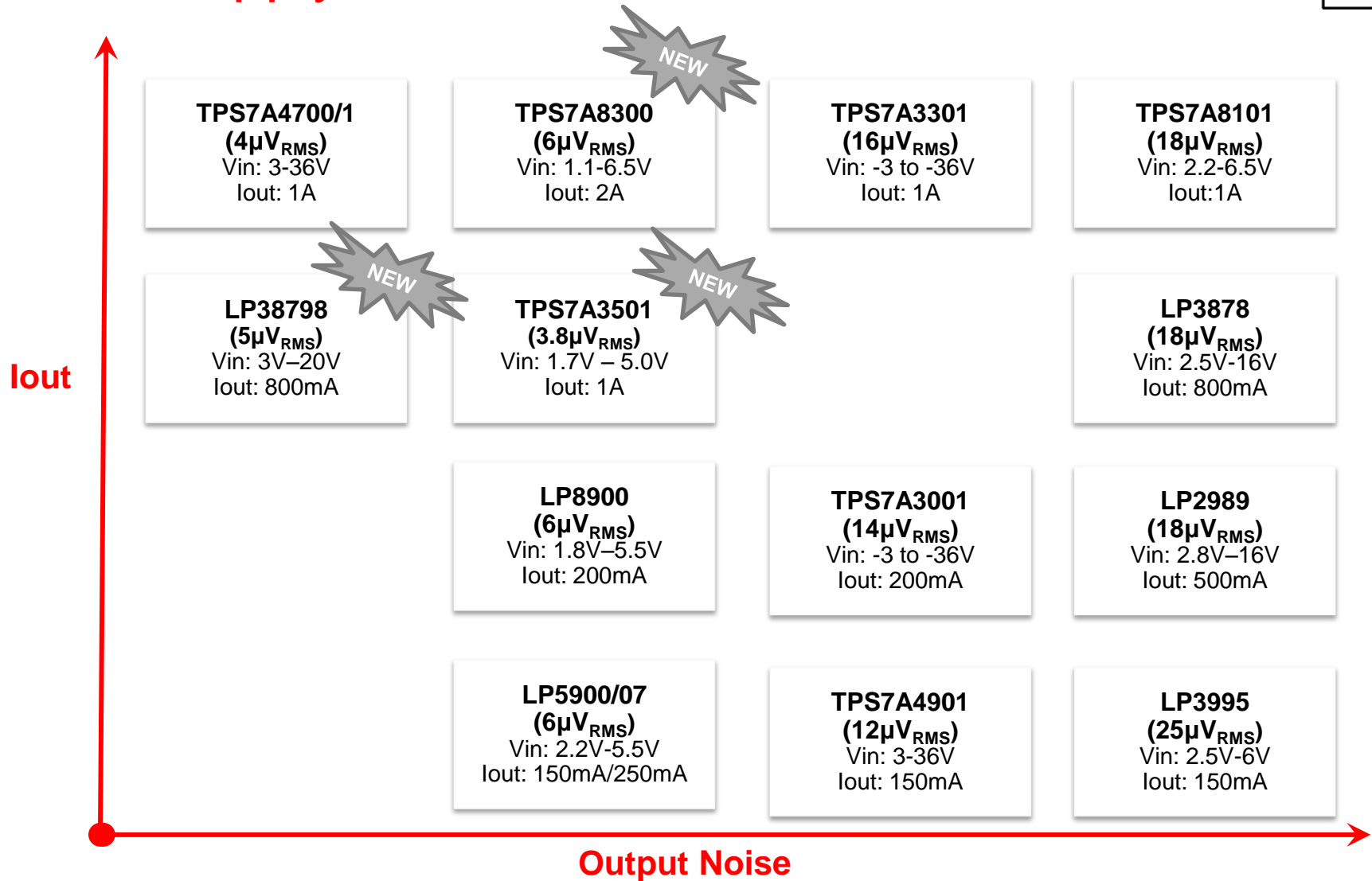


Figure 1.

Quiet Supply LDO Solutions



Quiet Supply LDO Solutions Table



	TPS7A83	TPS7A47	TPS7A33	LP38798	LP2989	LP5900/7	LP8900	TPS7A30	TPS7A49	TPS7A35
I _{OUT} (A)	2	1	1	0.8	0.5	0.15/0.25	0.2	0.2	0.15	1
V _{IN} (V)	1.1-6.5	3-36	-3 to -36	3-20	2.8-16	2.5-5.5	1.8-5.5	-3 to -36	3-36	1.4 - 5
V _{OUT} (V)	0.8-5	1.4-34	-1.18 to -33	1.2-11.8	2.5-5	1.5-3.3 (fixed)	1.2-3.6 (fixed)	-1.18 to -33	1.2-33	1.2 – 4.5
V _{OUT} Accuracy (%)	+/-1	+/-1	+/-1	+/-1	+/-0.75	+/-2	+/-1	+/-1.5	+/-1.5	+/- 30mV
Dropout (mV)	125 @ 2A	307 @ 1A	307 @	200 @ 800mA	310 @ 500 mA	80/120 @ 150/200mA	110 @ 200mA	215 @ 100mA	260 @ 100mA	200 – 500
Output Noise	6uVrms	4uVrms	16uVrms	5uVrms	18uVrms	6.5/10 uVrms	6uVrms	14uVrms	12.7uVrms	3.8uVrms
PSRR @ 100kHz (dB)	43	60	64	60	60	60	45	55	53	40
Package (bold: smallest)	20-SON	20-SON	20-SON 7-TO-220	12-SON	8SOIC 8VSSOP 8WSN	4-DSBGA 6-SON 4-SON 5SOT-23	6-DSBGA	8MSOP-PowerPAD	8MSOP-PowerPAD	6-SON
Solution size	5x5mm + 4 caps + 1 resistor	5x5mm + 3 caps	5x5mm + 3 caps	4x4mm + 3 caps + 2 resistors	3x3.8mm + 3 caps + 1 resistor	0.65x0.65mm + 2 caps	1.5x1.1mm + 3 caps	3x5mm + 4 caps + 2 resistors	3x5mm + 4 caps + 2 resistors	2x2mm + 3 caps + 1 resistor

Thank You

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