The POWER Behind Your Designs

PPM 4Q04 Product Update

- TPS6023x, TPS6106x
- TPS62300, TPS65120, TPS65131
- bqSwitcher, bqHybrid, bqTinyIII
- TPS75003
- TPS712, Cap-Free LDOs
- TPS62000 vs TPS62020
- Cost Driven LDO/SVS
- LPDC Software

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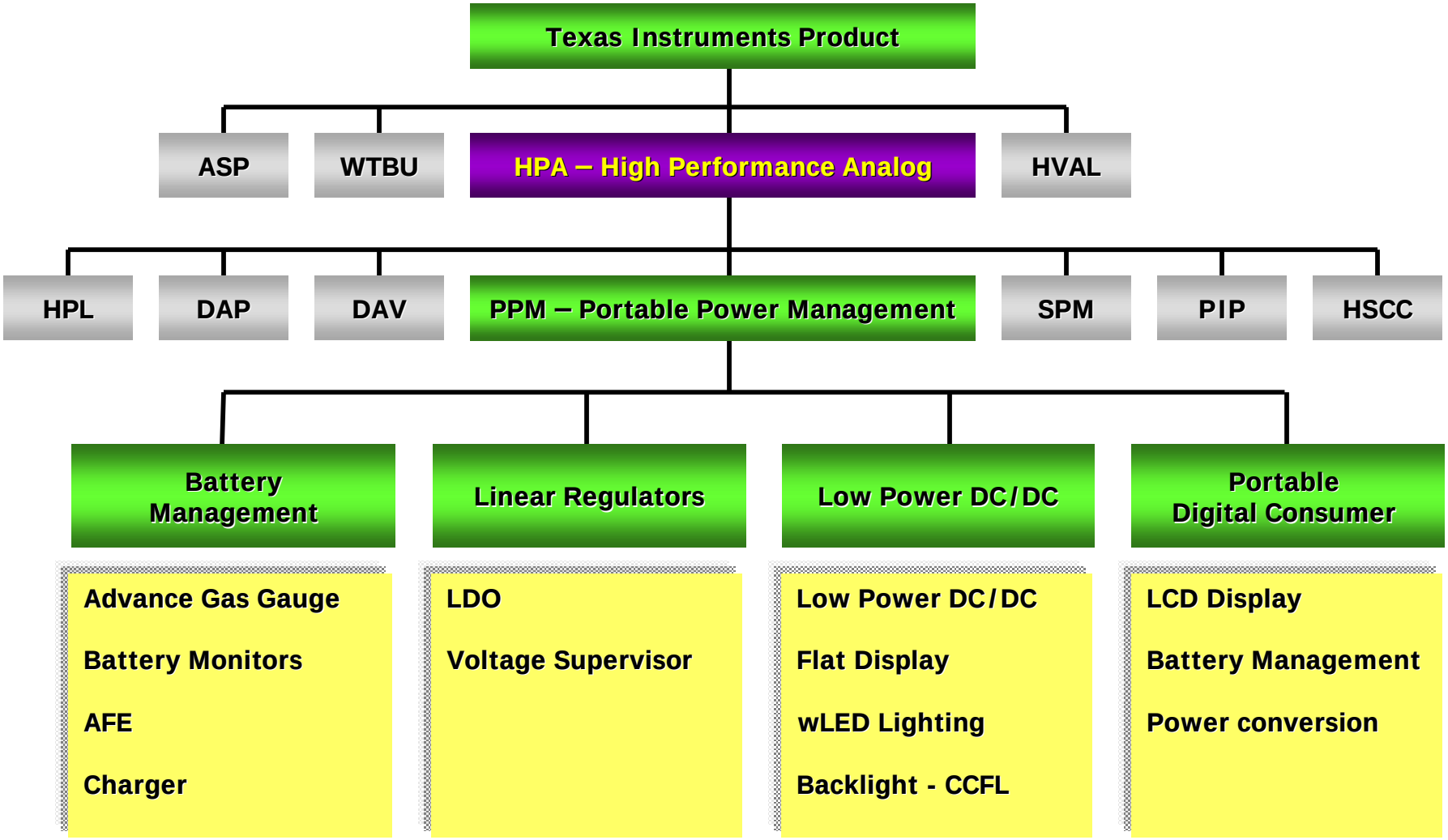
Dec 20, 2004

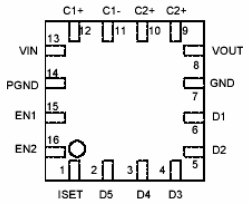
Organization Summary - Portable Power Management



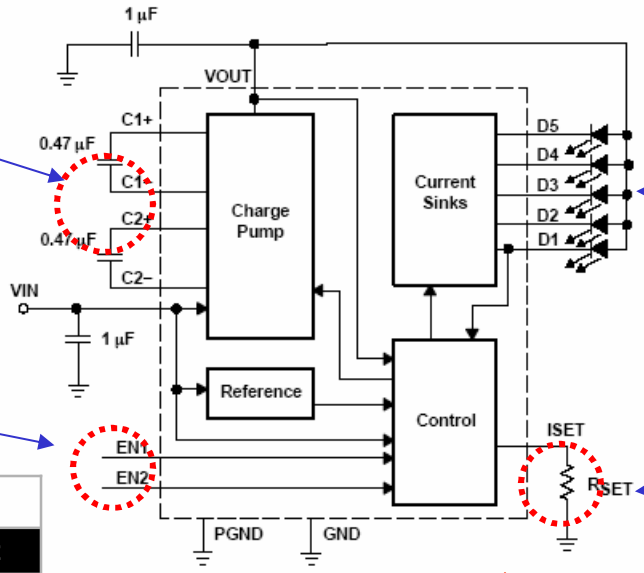
TPS60230/1 - White LED Charge Pump

p Features

- ü PWM dimmable
- ü Only 5 small external components
- ü 1MHz oscillator frequency
- ü output current source for each LED
- ü 60mA quiescent current
- ü Thermal shutdown
- ü 3x3QFN16 package



- High Efficiency by Fractional Conversion with 1x and 1.5x Modes
- 2.7V~6.5V Input Range
- LED Brightness control



TPS60230
- 5 wLEDs x 25mA/CH

TPS60231
- 3 wLEDs x 25mA/CH

- LED Current Setting

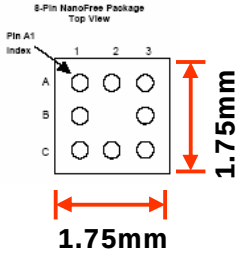
LED Current Adjustment

EN2	EN1	Mode : VISET	LED Current
0	0	SD	0
0	1	200mV	1/3
1	0	400mV	2/3
1	1	600mV	Full

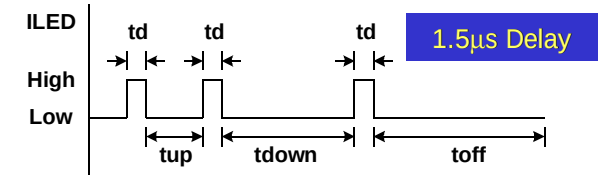
4C 1R Only

TPS61060 - Sync Boost wLED Driver

- **Features**
  - ü Synchronous Boost Topology
  - ü 1.2MHz Fixed Switching Frequency
  - ü Internal 5 bit DAC, 16.7mV/Step
  - ü CSP8, 3x3QFN8 Package
- **Single Wire I/F Dimming**
  - ü Save software effort
  - ü No PWM generated from GPIO
  - ü Minimize display interference

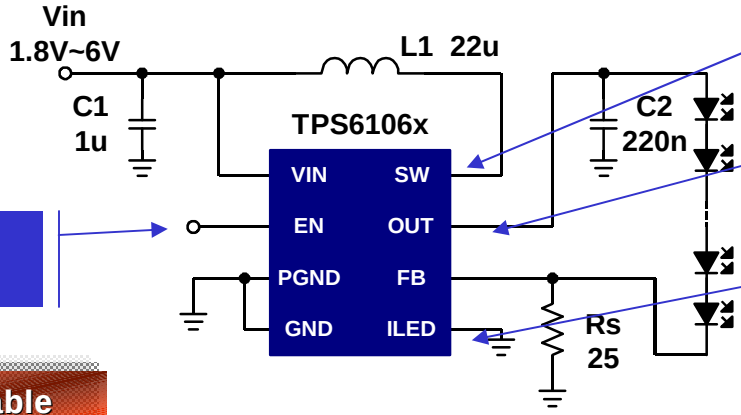


ILED Dimming



1 ≤ t ≤ 75µs	180 ≤ t ≤ 300µs	t ≥550µs
Increase	Decrease	SD

Part Number	OVP (min)
TPS61060	14.0V
TPS61061	18.0V
TPS61062	22.75V



- 1.2MHz PWM
- Synchronous Boost

- Internal OVP
- LED disconnect at Shutdown

- Enable pin
- Up to 1kHz PWM dimming

- High : 250mV Reference
- Low : 500mV Reference
- Digital Dimming
- 15.6mV/Step (32 Step)

DS Available

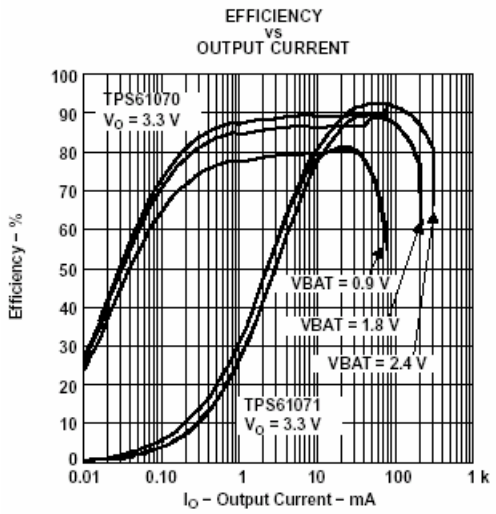
TPS61070 – Single Cell, Sync. Boost Converter

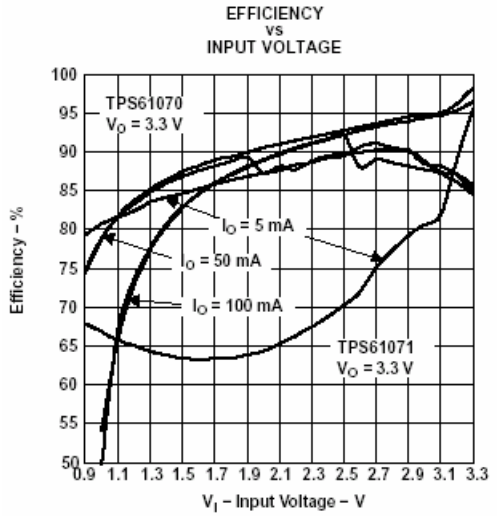
Features

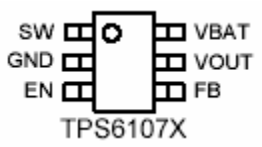
- Synchronous Boost Topology
- Load disconnect during shutdown
- 1.2MHz switching frequency
- TSOT23 package

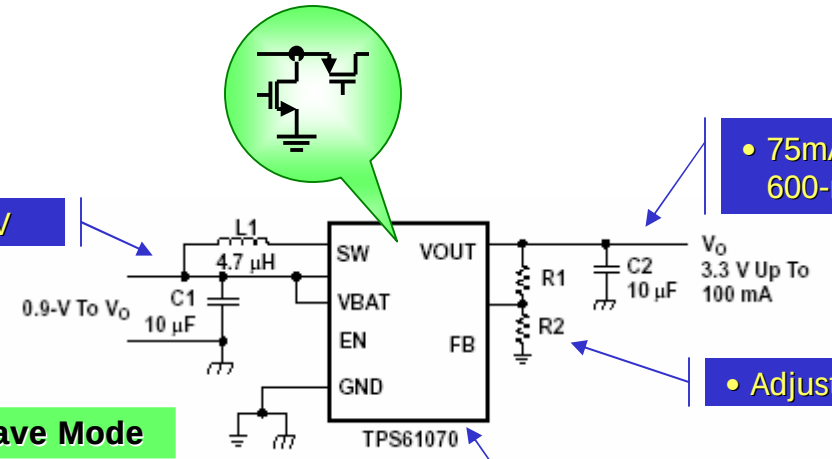
Focus

- Single Alkaline powered apps. Eg, MP3
- Backup up battery supply





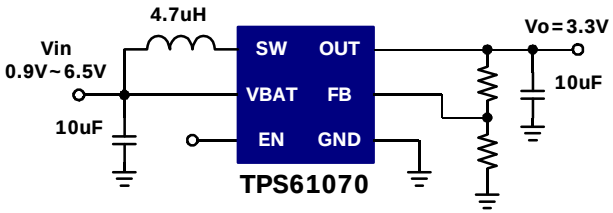


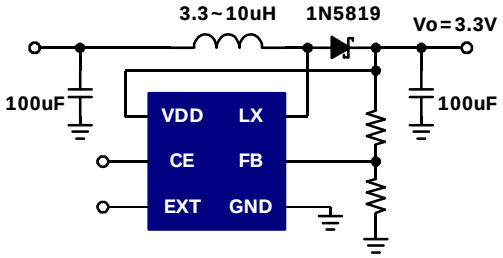


- 1V start up, down to 0.9V
- 75mA @ 3.3V Vout and 0.9V Vin, 600-mA switch current limit
- Adjustable, up to 5.5V
- 19µA Quiescent Current

TPS61070	**Power Save Mode**
TPS61071	**PWM Mode Only**

Solution Comparison





	TPS61070	Competition	TPS61070 Advantage
Package	TSOT23-5	SOT23-6	--
Topology	Sync. Boost	Boost	Smaller start up inrush current
True Shutdown	Yes	No	High Eff & save ext Diode
Switching Frequency	1.2MHz	500kHz	Allow Smaller Inductor
Low Side Switch Rds (on)	0.54W ± 20%	1.1W	Reduce Conduction Loss Loss = $I^2 \times R \times D$
High Side Switch Rds(on)	0.66W ± 20%	0.4V (Schottky Diode)	Reduce Conduction Loss Loss = $I^2 \times R \times D$ or = $I \times VF$
Iq	VBAT/VO 1mA/30mA	75mA/550mA	Extend Battery Life
Input Cap	10mF	100mF	Smaller & Cheap
Output Cap	10mF	100mF	Smaller & Cheap

- USD$0.1~0.15 external component save
- Smaller solution size
- Higher efficiency

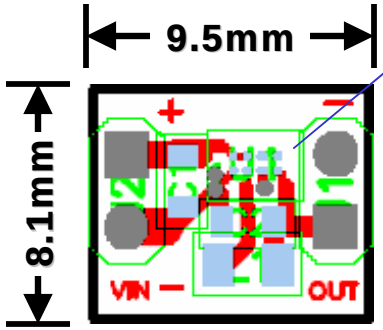
TPS62300 - 500mA Synchronous Step Down Converter

Features

- Sync. Buck Topology
- 3MHz Switching frequency
- 86µA Quiescent Current
- 2x1WCSP, 3x3QFN10 package

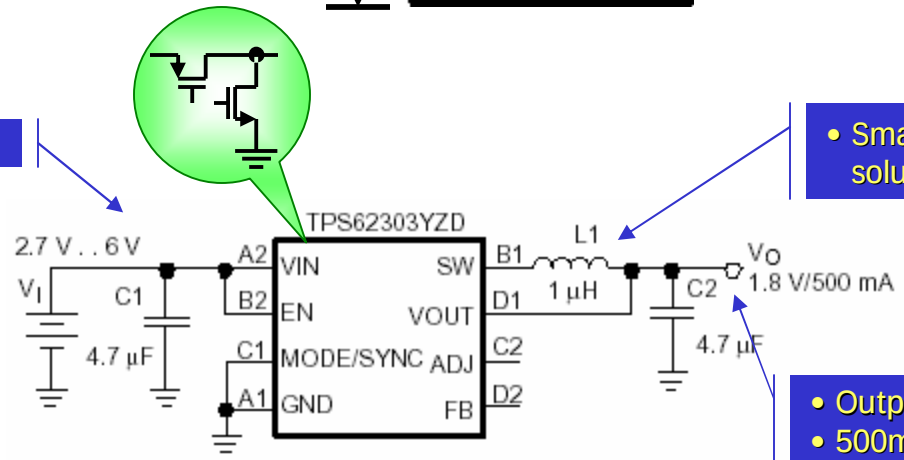
Focus

- Mobile Phone/Smartphone apps
- Small solution size apps



TPS62300 CSP EVM
- Cin = 4.7uF (0603)
- Cout = 4.7uF (0603)
- L = 1uH Taiyo Yuden CB2012

- 2.7V~6V Input Range



- Small Inductor for small solution size

- Output Down to 0.6V
- 500mA Output Current
- -0.5%/+1.3% DC accuracy

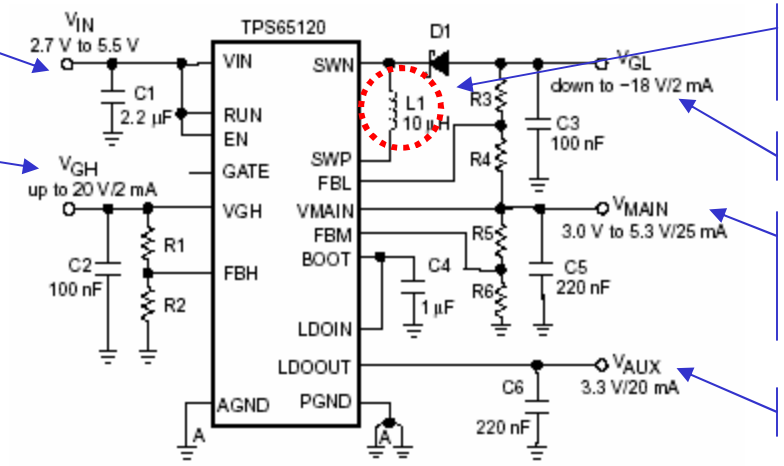
TPS65120 - SFF LCD Panel Bias w/ Inductor

Features

- 4 Channel output
- Internal/External Sequencing
- Ultra-Small External Components
- Internal Softstart
- Output Short Circuit Protected
- 1µA Shutdown Current
- Ultra-Thin 16-Pin QFN Package (3x3mm/0.8mm max height)

Device	LDO	Sequencing
TPS65120	3.3V	Vmain→VGL→VGH
TPS65121	2.5V	Vmain→VGL→VGH
TPS65122	1.8V	Vmain→VGL→VGH
TPS65123	No	Vmain→VGL→VGH
TPS65124	No	Programmable

- 2.7V~5.5V Input
- VGH : Up to 20V/2mA



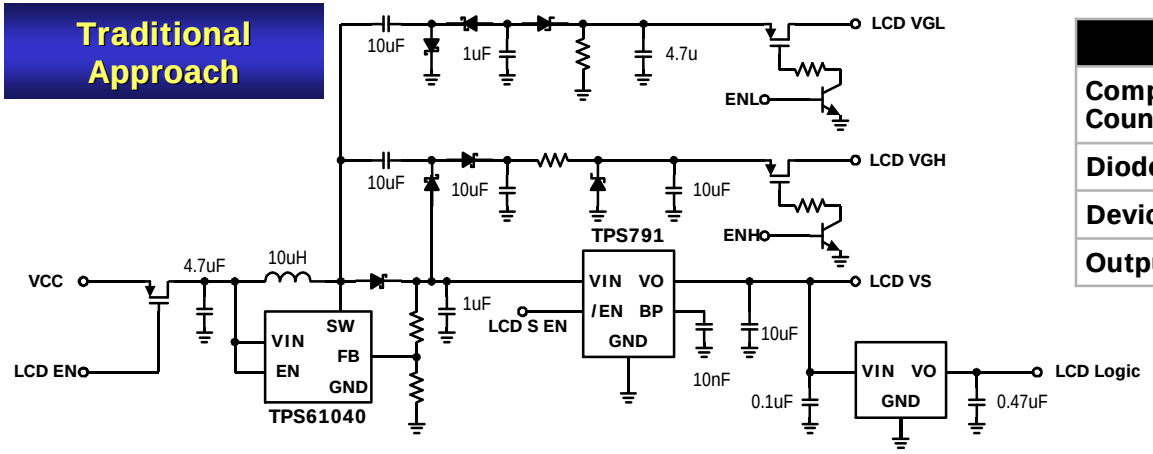
- Triple Output using One Tiny Inductor
- VGL : Down to -18V/2mA
- Vmain : 3.3V~5.3V/20mA
- LDO for post Regulation
- 85% Efficiency
- Aux LDO for Tcon/Logic

DS Available

TPS65120 Benefit

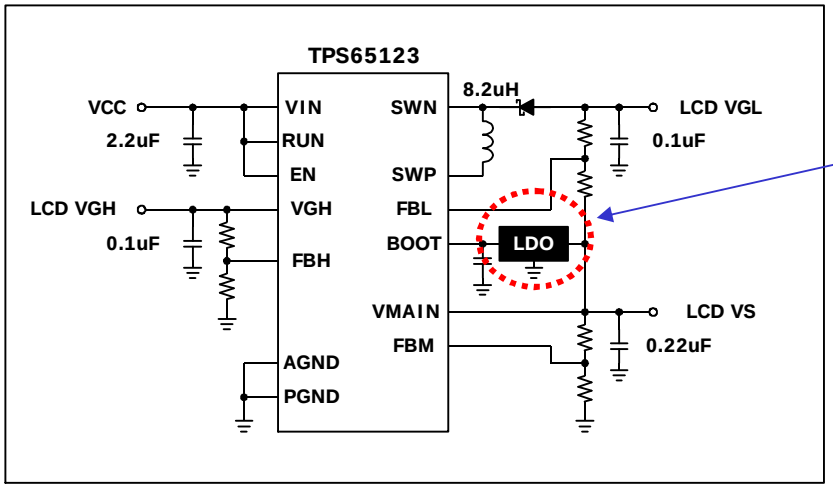
Most Compacted LCD Bias Solution in the Market

Traditional Approach



	Discrete	TPS65120
Component Count	31	14
Diode / FET	7 / 5	1 / 0
Device	3	1
Output Cap	Big	Small

For Imain >25mA



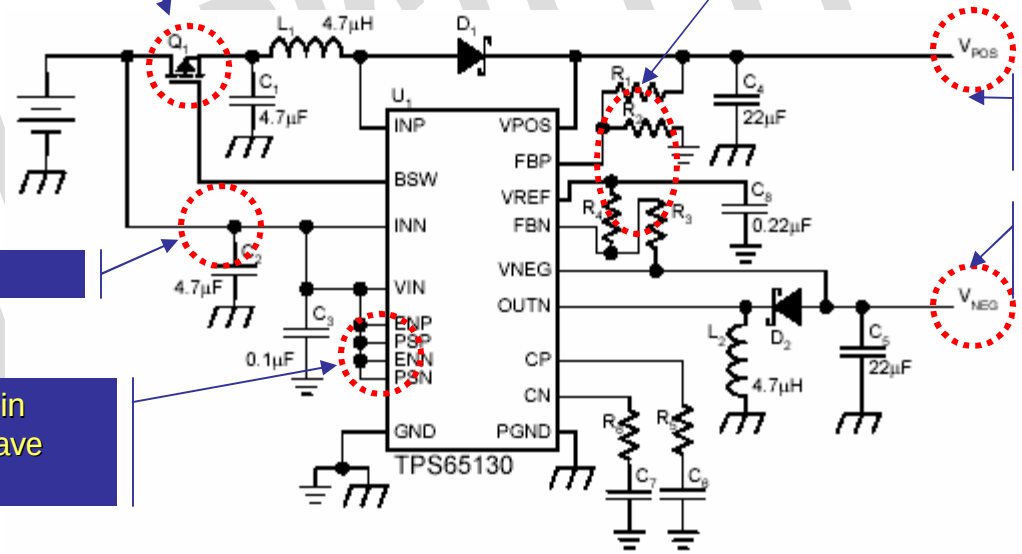
- External LDO for Output current >25mA
- TPS715, SC70, 50mA

TPS65130/1 - Dual Channel OLED/CCD Power Supply

Features

- ü 1.5MHz Fixed Frequency PWM Operation
- ü Iswitch : TPS65130/31 : 800mA/1950mA
- ü 50㎃ Quiescent Current
- ü 1μA Shutdown Current
- ü Thermal Shutdown
- ü 4x4mm2 QFN16 Package

- External MOSFET Control for True Shutdown
- Adjustable Output
- VPOS : 16V/250mA (30)
- Up to 89% Efficiency
- VNEG : -12V/250mA (30)
- Up to 83% Efficiency
- 2.7V~5.5V Input
- Individual Enable Pin
- Individual Power Save Mode Control



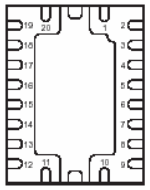
DS Available

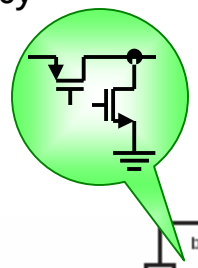
bqSwitcher – bq24100, Switching Li+ /Li-Poly Charger

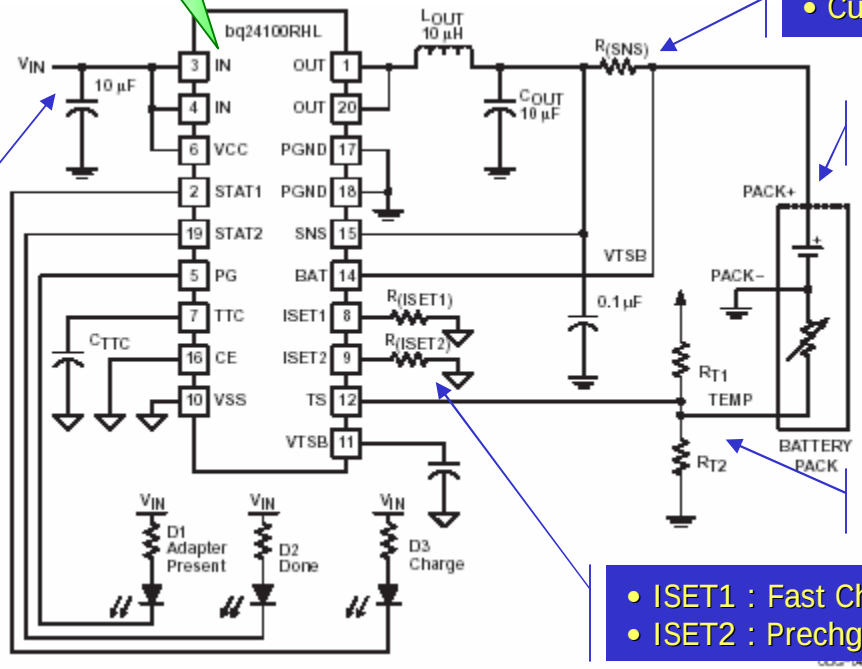
Features

- Sync. Buck Switching Charger
- Support 1/2/3 cells in series
- 1.1MHz Switching frequency
- Sleep Current <86µA
- 3.5x4.5 QFN20 package
- >90% Efficiency

Device	Li cell	Apps
bq24100	4.2V	Standalone
bq24103	4.2V or 8.4V	Standalone
bq24105	Ext prog.	Standalone
bq24108	4.2V	Standalone
bq24113	1 or 2 cells	System Control
bq24115	Ext prog.	System Control







- 3.5V~16V Input Range
- Max 20V Rating

- Current Sense Resistor
- Up to 2A Charge Current
- Battery Temperature Sense
- ISET1 : Fast Charge
- ISET2 : Prechg/Taper current

DS Available

Focus

- Single Li+, Ichg > 1A
- 2 Li+ Battery Pack
- Single Li+, High Vin

bqHybrid – bq25010, Charger + DCDC

Features

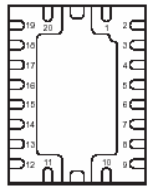
- Single cell Li+/Poly application
- 1.1MHz Switching frequency for DCDC
- PowerSave Mode
- 5µA sleep current
- 3.5x4.5 QFN20 package
- >95% Efficiency

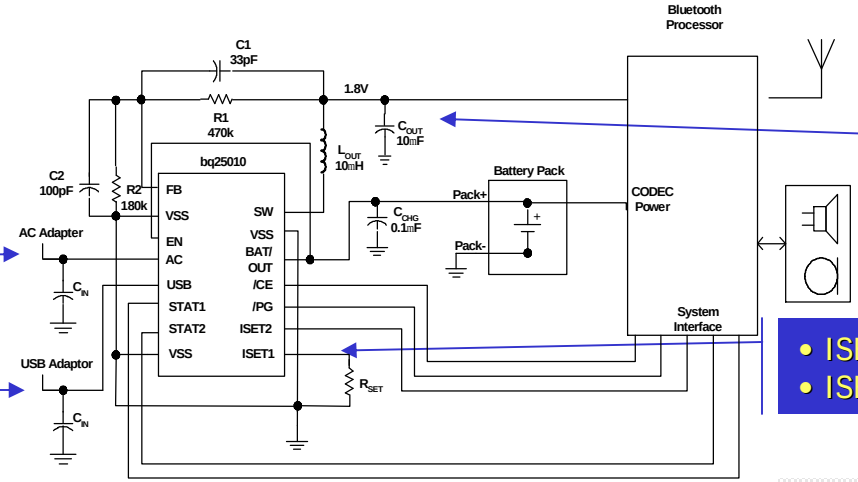
Focus

- Bluetooth Headset
- MP3/Media player
- Mobilephone

bqHybrid = **bqTiny II** + **TPS62xxx (150mA)**

Device	DCDC Vo
bq25010	Adj
bq25011	3.3V
bq25012	1.8V





- Charge from Adaptor
- 4.5V~6.5V Input Range
- Ichg : 500mA max

- Charge from USB
- 4.35V~6.5V Input Range
- Ichg : 100/500mA

- Output Voltage down to 0.8V
- Io : 150mA max

- ISET1 : Adpt/Prechg/Taper Current
- ISET2 : USB Chg selection

DS **MP Jan05**

bqTiny III – bq24030, Charger w/ DPPM

Features

- Li+ Charger with Dynamic Power Path Management (DPPM)
- 3.5x4.5 QFN20 package

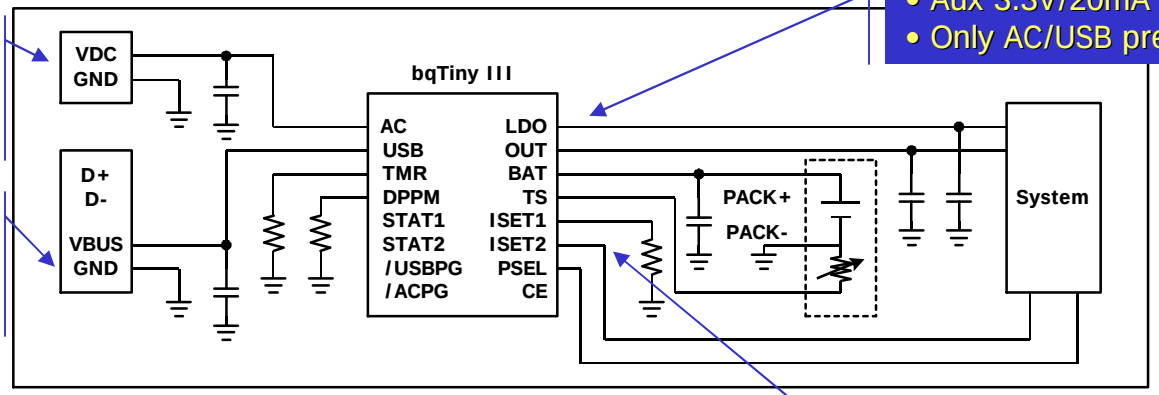
Focus

- Smartphone
- MP3/Media player

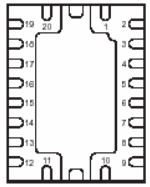
Device	CHG Reg Voltage	Option
bq24030	4.2V	AC input regulated above 6V
bq24032	4.2V	AC input regulated above 4.4V
bq24035	4.2V	AC input cut off above 6V

- Charge from Adaptor
- 4.5V~6.5V Input Range
- Ichg : 500mA max

- Charge from USB
- 4.35v~6.5V Input Range
- Ichg : 100/500mA



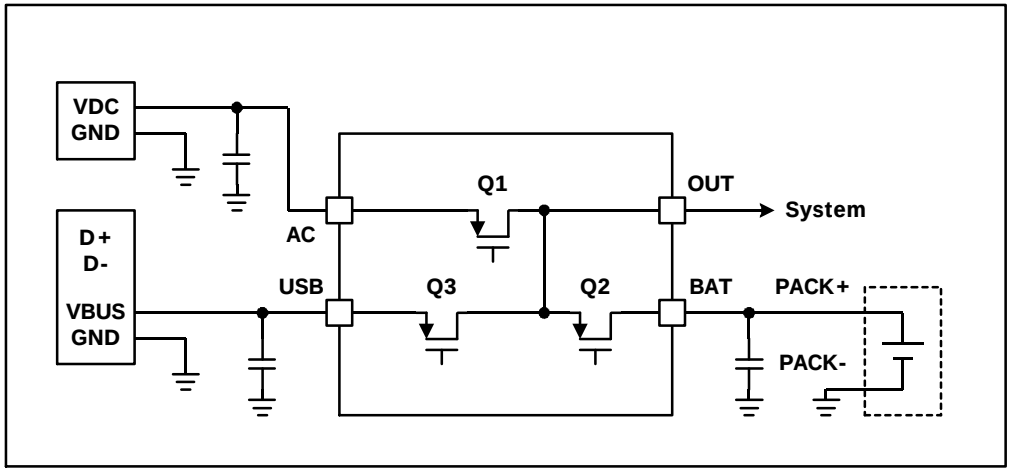
- Aux 3.3V/20mA LDO output
- Only AC/USB present

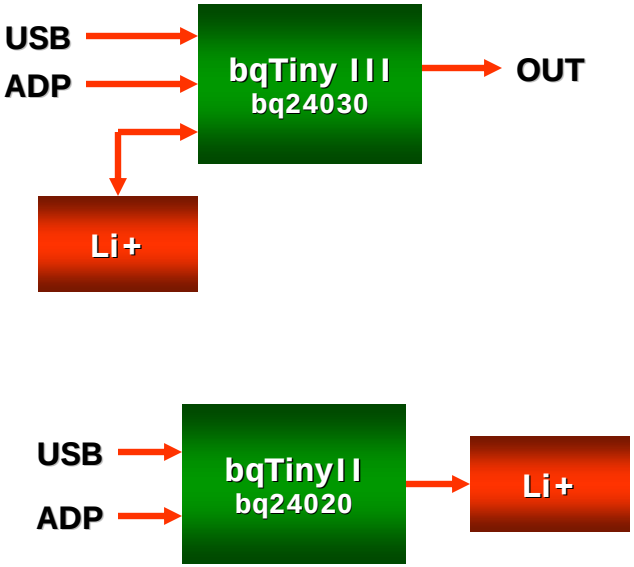


- ISET1 : Adpt/Prechg/Taper Current
- ISET2 : USB Chg selection

DS Available

bqTiny III – Dynamic Power Path Management



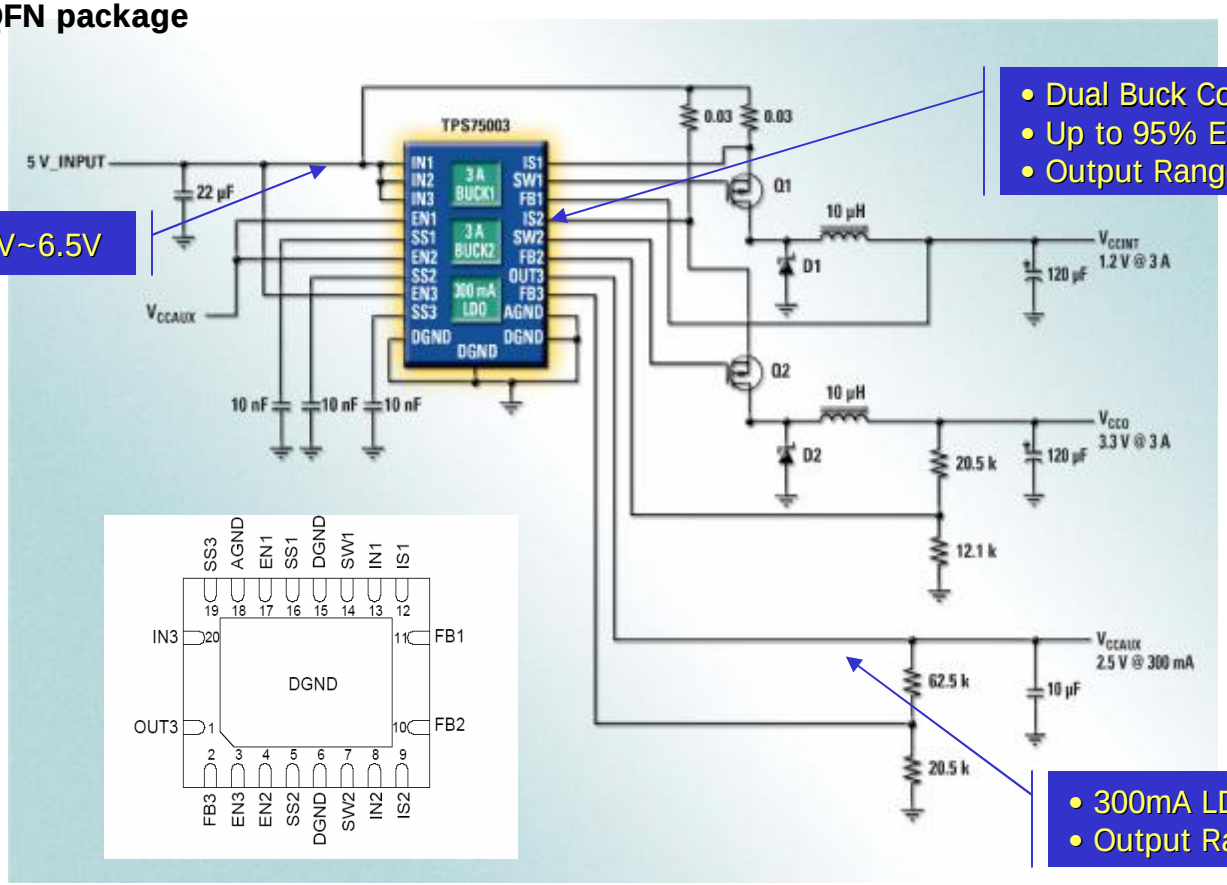


Scenario	VOUT	Charge Control	DPPM
AC (PSEL=High)	- Q1 full ON as AC < Vreg - Q1 as a LDO as AC > Vreg	- Via Q2 - Charge rate by ISET1 setting	- Reduce Q2 charge current as VOUT < V_{DPPM} - V_{DPPM} =I_{DPPM} x R_{DPPM}
USB (PSEL=Low)	- Q3 on, Q1 off	- Via Q2 - Charge rate by ISET2 setting	- Reduce Q2 charge current as VOUT < V_{DPPM} - V_{DPPM} =I_{DPPM} x R_{DPPM}
Battery (/xPG=Off)	- Powered by Battery via Q2 - Q1 & Q3 off (SLEEP Mode)	- Charge circuit turned off	- Disable

Triple Supply for Xilinx Spartan™-3 FPGAs TPS75003

p Features

- ü Independent Soft-Start for All 3 Power Supplies
- ü Independent Enable for Each Supply for Flexible Sequencing
- ü LDO Stable with Small Ceramic Output Capacitor
- ü 4.5x3.5QFN package



- Dual Buck Controller
- Up to 95% Efficiency
- Output Range : 1.2V~6.5V

- Input Range 2.2V~6.5V

- 300mA LDO
- Output Range : 1.2V~6.5V

DS

MP Mar05

Dual RF LDOs - TPS711/12/13

Preview

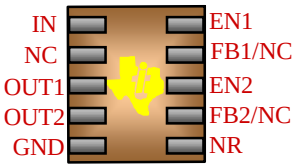
Features

- **Input Voltage Range: 2.7V to 5.5V**
- **Output Voltages**
  - **Fixed : 1.8V~4.7V**
  - **Adjustable : 1.2V~5V**
- **Rated Output Current: 250mA per LDO**
- **Stable With Ceramic Output Capacitor**
- **38mV Dropout at 100mA**
- **73dB PSRR @ 10 kHz**
- **15㎷RMS Output Noise**
- **2% Accuracy Over Load/Line/Temp**
- **Chip Scale and QFN Packages**

Focus

- Mobile Phone
- CMOS sensor module
- RF application

Chip Scale



QFN-10

DS

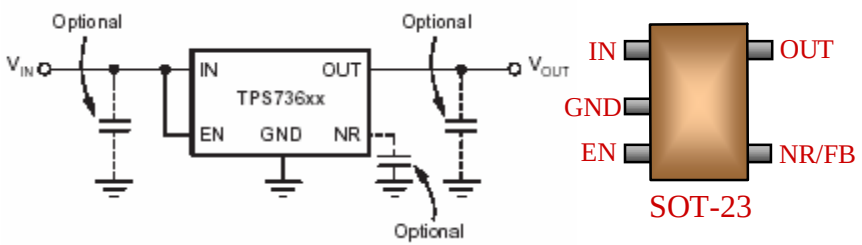
TPS712 : MP Jan05
TPS711 : ES Feb05

Device	IOUT	VDO@ 250mA	EN	SVS	Package
TPS712/11	250 mA	95 mV	Yes	No	QFN/WCSP
TPS713	250 mA	95 mV	Yes	Yes	QFN

Cap-Free LDOs with Reverse Current Blocking

Features

- Input Voltage 1.7V to 5.5V
- Output Voltages: 1.5V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V and Adjustable (1.20V to 5.5V)
- 1% Accuracy Over Load/Line/Temp
- No output Cap Needed for Stability
- 30μVRMS Output Noise, 100Hz to 100KHz
- 80dB PSRR @ 1kHz
- Reverse Leakage Protection
- Guaranteed Min/Max Current Limit
- SOT23, SOT223



Device	IOUT	VDO	NR	Package
TPS731	150 mA	30 mV	Y	SOT23
TPS732	250 mA	40 mV	Y	SOT23 SOT223
TPS736	400 mA	75 mV	Y	SOT23 SOT223

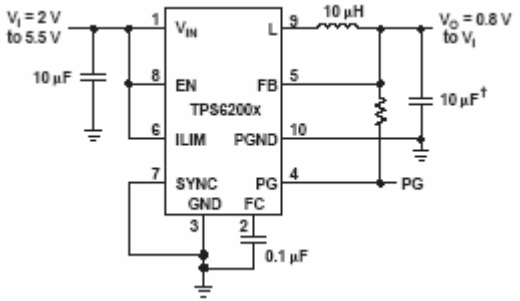
Features

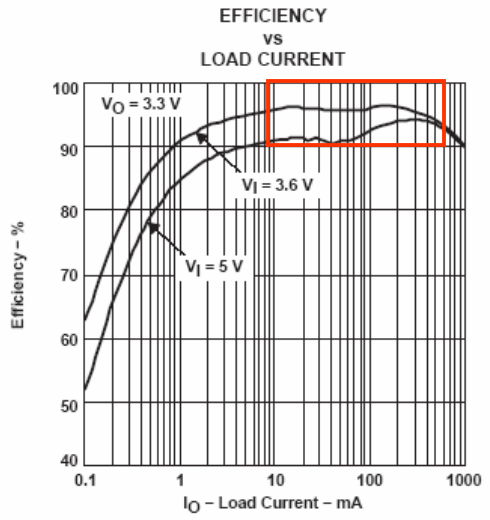
Preview

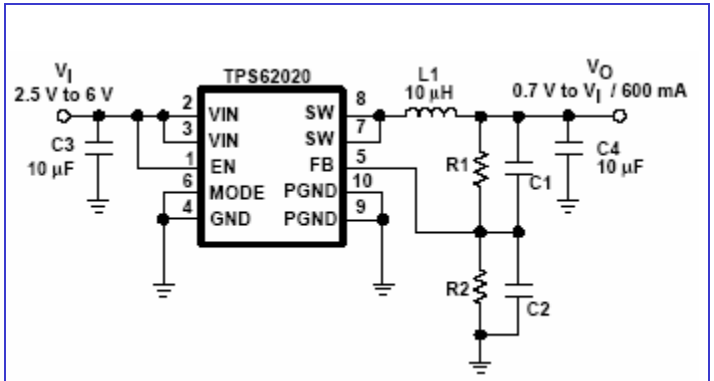
- Input Voltage 1.8V to 10V
- Output Voltages: 1.5V, 1.8V, 2.5V, 3.0V, 3.3V, 5.0V and Adjustable (1.2V to 10V)
- No Output Cap Needed for Stability
- 30μVRMS Output Noise, 100Hz to 100KHz
- 60dB PSRR @ 1kHz
- Reverse Leakage Protection
- 2% Accuracy Over Load/Line/Temp
- SOT223, DDPAK

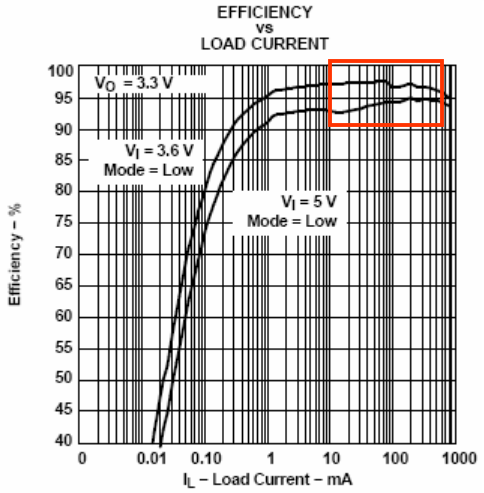
Device	IOUT	VDO	NR	Package
TPS733	500 mA	125 mV	Y	SOT223 DDPAK
TPS734	1.0 A	250 mV	y	SOT223 DDPAK
TPS735	1.5 A	500 mV	Y	SOT223 DDPAK

TPS62000 vs TPS62020





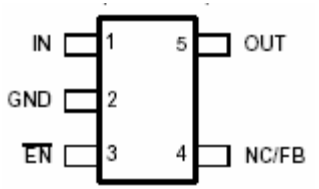




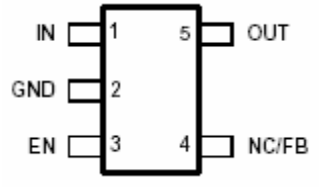
	TPS62000	TPS62020
Package	3x5 MSOP10 2.25x1.75 CSP12	3x5 MSOP10 3x3 QFN10
Output Current	600mA	600mA
Vin	2V~5.5V	2.5V~6V
Vout	0.8V ~Vin	0.7V~6V
Switching Frequency	750kHz	1.25MHz
P-FET Rds (on) @Vin=3.6V	0.28W (Typ)	0.115W
N-FET Rds(on) @Vin=3.6V	0.28W (Typ)	0.085V
Iq (Typ/Max)	50mA/75mA	18mA/35mA

Cost Driven LDO & SVS

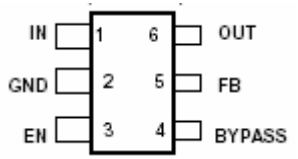
- **TPS769 : 100mA/SOT23**
  - Output : 1.2V/1.5V/1.8V/2.5V/2.7V/2.8V/3V/3.3V/5V/ADJ
  - Iq : 17㎂
- **TPS763 : 150mA/SOT23**
  - Fixed : 1.6V/1.8V/2.5V/2.7V/2.8V/3V/3.3V/3.8V/5V/ADJ
  - Iq : 85㎂
- **TPS730 : 200mA/SOT23(Preview)**
  - TPS793 Low cost version
- **TPS3801 : SC70 SVS**
  - Voltage : 1.8V/2.5V/2.7V/3V/3.3V/5V/ADJ
  - Manual Reset (except TPS3801-01, ADJ version)
  - 200ms Delay Time
- **TPS3809 : SOT23**
  - Voltage : 2.5V/3V/3.3V/5V
  - 200ms Delay Time



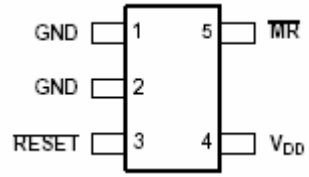
TPS769



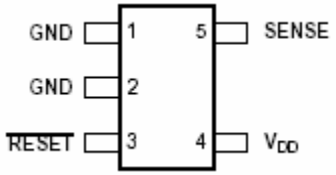
TPS763



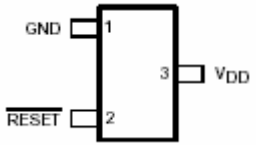
TPS730



TPS3801-xx

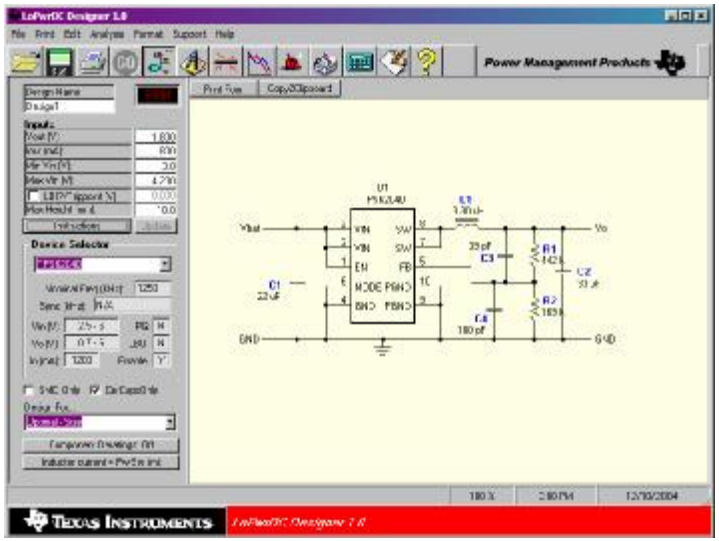


TPS3801-01

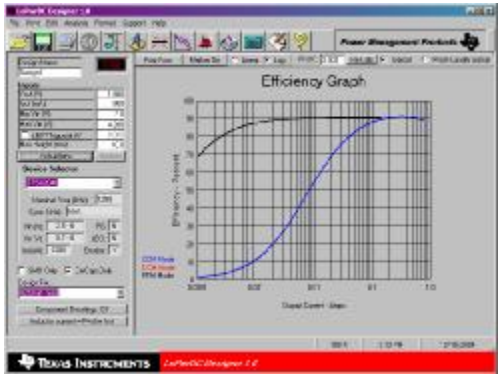


TPS3809-xx

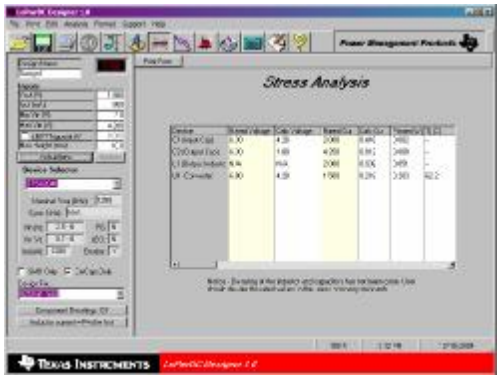
Low Power DC/DC Software – TPS62K series



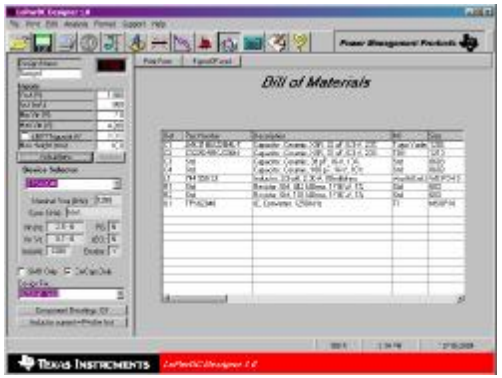
Electrical Analysis



Efficiency



Component Stress



BOM List

- In "power.ti.com"
  - Design Resources ® Development Tools
  - DCDC Conversion ® Application Software
  - Low Power DC/DC Designer Software

http://focus.ti.com/docs/toolsw/folders/print/tps62k-sw.html

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