MSP430 Ultra-Low-Power MCU Power Management Reference Guide

1Q 2006

Includes Suggested Texas Instruments Power Management Solutions for:
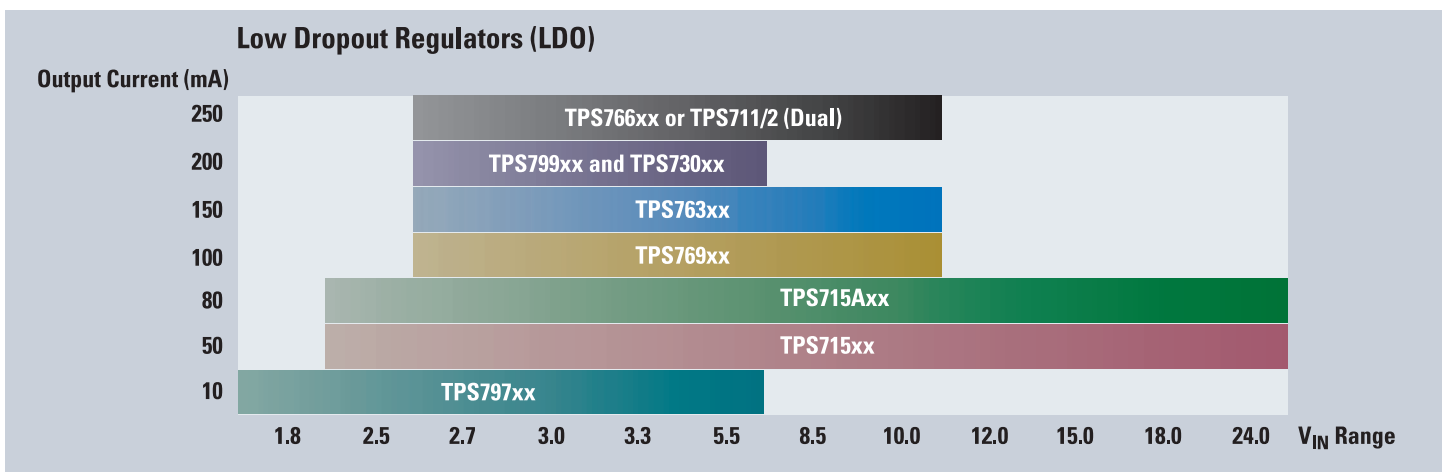- MSP430x1xx
- MSP430x2xx
- MSP430x4xx

→ **What's Inside**

→ **General MSP430 Power Selection Guides**

General LDO Power Selection Guide

Low Dropout Regulators (LDO)

Output Current (mA)

250		TPS766xx or TPS711/2 (Dual)									
200		TPS799xx and TPS730xx									
150		TPS763xx									
100		TPS769xx									
80			TPS715Axx								
50			TPS715xx								
10		TPS797xx									

1.8   2.5   2.7   3.0   3.3   5.5   8.5   10.0   12.0   15.0   18.0   24.0 V_{IN} Range

General Charge Pump Selection Guide

Capacitive Charge Pumps

Output Current (mA)

200		TPS6010x and TPS6012x							
150			TPS60101 and TPS6013x						
100		TPS6010x, 6012x, 6014x, 6020x, 6021x							
50		TPS6020x and TPS6021x							
30			REG710-x						
20	TPS6030x								

0.9   1.8   2.5   2.7   3.0   3.3   3.6   5.4   6.0   6.5   8.0 V_{IN} Range
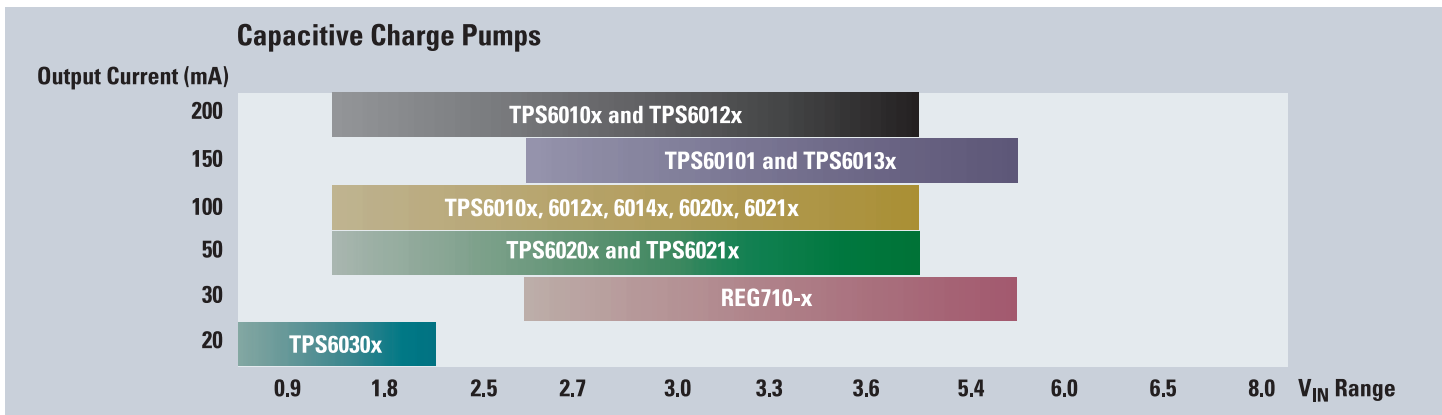
General Boost Converter Selection Guide

Step Up Converter

Output Current (mA)

Output Current (mA)	Device
300	TPS6102x/6112x
200	TPS61016
150	TPS61070 and TPS61071
100	TPS61013
50	TPS61041
30	TPS61042
20	TPS61045

V_{IN} Range: 0.8 0.9 1.8 2.5 2.7 3.0 3.3 3.6 5.4 6.0 6.5 8.0
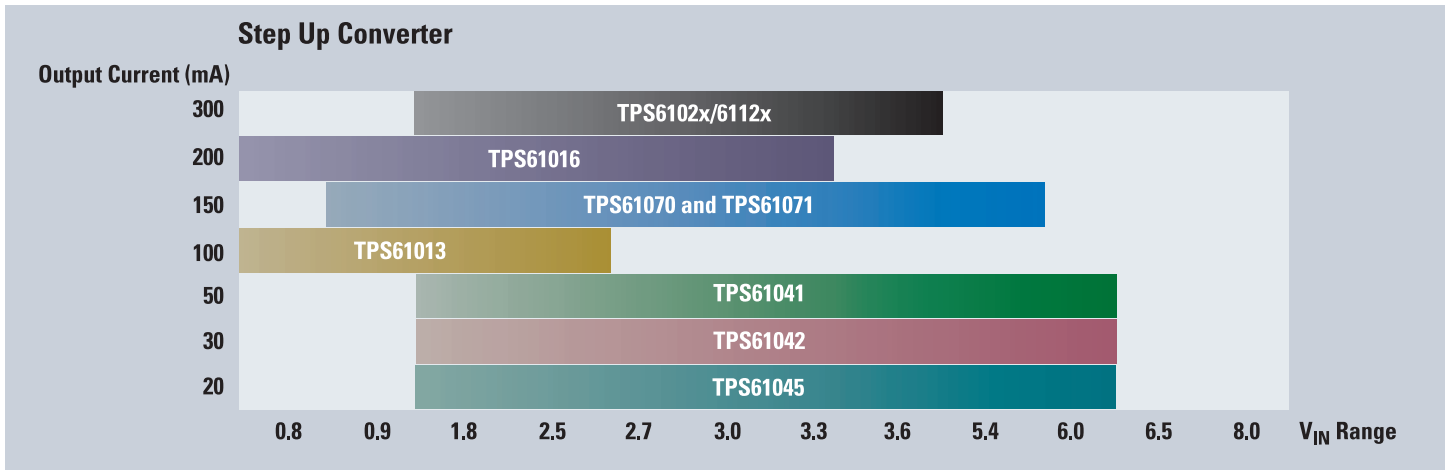
General Buck Converter Selection Guide

Step Down Converter

Output Current (mA)

Output Current (mA)	Device
500	TP62300/1/2/3/5/11/13/20/21
400	TPS62100/1/2/3
300	TPS62220/1/2/3/4/8/9
200	TPS62200/1/2/3/4/5/6/7/8
100	TPS6755

V_{IN} Range: 2.5 2.7 3.0 3.3 5.0 5.5 6.0 9.0 12.0
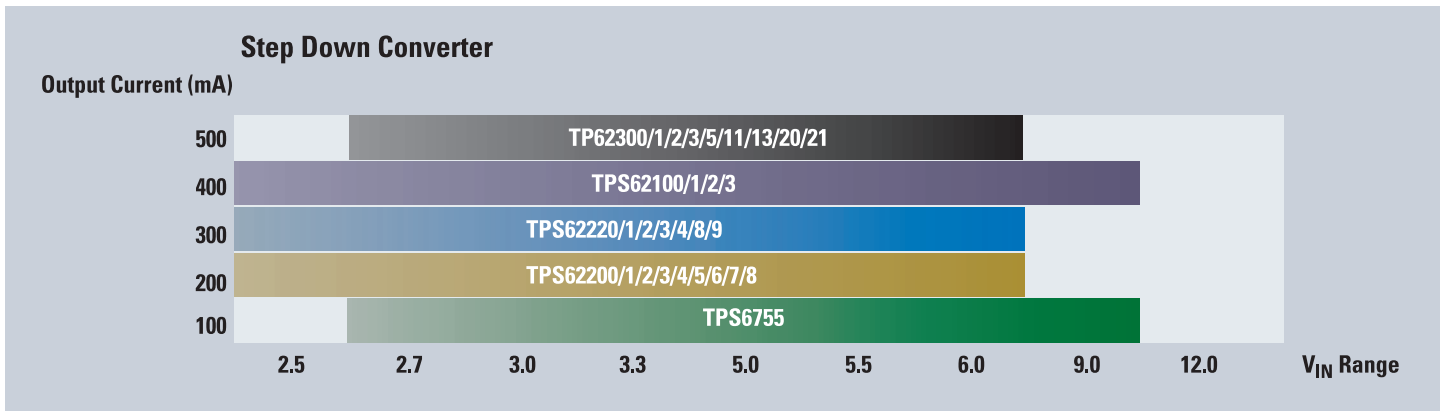
General SVS Power Selection Guide

Single
- TL7700
- TL7770xx
- TL7757/9
- TL77xxA/B
- TLC77xx
- TPS3803*
- TPS3809*
- UCx543
- UCx544

Watchdog
- TPS3813
- UCCx946

Reset Active High
- TPS3124
- TPS3824

Manual Reset
- TPS3801
- TPS3808
- TPS3836
- TPS3838

Backup Battery Switch
- bq2205
- TPS3606
- TPS3617
- TPS3619

Chip Enable Gate
- TPS3600
- TPS3610
- TPS3613

Reset Active High
- TPS3125
- TPS3126
- TPS3825
- TPS3837*

Watchdog
- TPS3123
- TPS3128
- TPS3820
- TPS3823
- TPS3828

Power-Fail
- TPS3103

*For low-cost solutions, start here

Dual
- TL7770-xx
- TL3805*
- TPS3806

Manual Reset
- TPS3106

Watchdog, Power Fail
- TPS3306-xx

Reset Active High, Power Fail
- TPS3707

Watchdog
- TPS3110

Power Fail
- TPS3705

Reset Active High
- TPS3305-xx

Triple
- TPS3510
- TPS3511
- TPS3513
- TPS3514

Manual Reset, Active High Reset
- TPS3307-xx

Quad
- UCx903

Supervisory Circuits (Voltage Supervisors) Family of Products

MSP430 Product Selection Guide

## Including the Power Requirements and SVS Parameters

Part Number	MSP430 Family	Type of Program Memory	Program Memory (kB)	RAM (Bytes)	I/O Pins	Flash Programming Voltage (V)	Operating Voltage (V)	Integrated SVS
x1xx Family								
MSP430F1101A	FLASH/ROM No LCD	Flash	1	128	14	2.7 - 3.6	1.8 - 3.6	—
MSP430C1101	FLASH/ROM No LCD	ROM	1	128	14	N/A	1.8 - 3.6	—
MSP430F1111A	FLASH/ROM No LCD	Flash	2	128	14	2.7 - 3.6	1.8 - 3.6	—
MSP430C1111	FLASH/ROM No LCD	ROM	2	128	14	N/A	1.8 - 3.6	—
MSP430E112	FLASH/ROM No LCD	UV-EPROM	4	256	14	2.7 - 3.6	1.8 - 3.6	—
MSP430P112	FLASH/ROM No LCD	OTP	4	256	14	2.7 - 3.6	1.8 - 3.6	—
MSP430F1121A	FLASH/ROM No LCD	Flash	4	256	14	2.7 - 3.6	1.8 - 3.6	—
MSP430C1121	FLASH/ROM No LCD	ROM	4	256	14	N/A	1.8 - 3.6	—
MSP430F1122	FLASH/ROM No LCD	Flash	4	256	14	2.7 - 3.6	1.8 - 3.6	—
MSP430F1132	FLASH/ROM No LCD	Flash	8	256	14	2.7 - 3.6	1.8 - 3.6	—
MSP430F122	FLASH/ROM No LCD	Flash	4	256	22	2.7 - 3.6	1.8 - 3.6	—
MSP430F123	FLASH/ROM No LCD	Flash	8	256	22	2.7 - 3.6	1.8 - 3.6	—
MSP430F1222	FLASH/ROM No LCD	Flash	4	256	22	2.7 - 3.6	1.8 - 3.6	—
MSP430F1232	FLASH/ROM No LCD	Flash	8	256	22	2.7 - 3.6	1.8 - 3.6	—
MSP430F133	FLASH/ROM No LCD	Flash	8	256	48	2.7 - 3.6	1.8 - 3.6	—
MSP430C1331	FLASH/ROM No LCD	ROM	8	256	48	N/A	1.8 - 3.6	—
MSP430F135	FLASH/ROM No LCD	Flash	16	512	48	2.7 - 3.6	1.8 - 3.6	—
MSP430C1351	FLASH/ROM No LCD	ROM	16	512	48	N/A	1.8 - 3.6	—
MSP430F147	FLASH/ROM No LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F1471	FLASH/ROM No LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F148	FLASH/ROM No LCD	Flash	48	2048	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F1481	FLASH/ROM No LCD	Flash	48	2048	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F149	FLASH/ROM No LCD	Flash	60	2048	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F1491	FLASH/ROM No LCD	Flash	60	2048	48	2.7 - 3.6	1.8 - 3.6	—
MSP430F155	FLASH/ROM No LCD	Flash	16	512	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F156	FLASH/ROM No LCD	Flash	24	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F157	FLASH/ROM No LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F167	FLASH/ROM No LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F168	FLASH/ROM No LCD	Flash	48	2048	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F169	FLASH/ROM No LCD	Flash	60	2048	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F1610	FLASH/ROM No LCD	Flash	32	5120	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F1611	FLASH/ROM No LCD	Flash	48	10240	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F1612	FLASH/ROM No LCD	Flash	55	5120	48	2.7 - 3.6	1.8 - 3.6	Yes
x2xx Family								
MSP430F2101	FLASH No LCD	Flash	1	128	16	2.2 - 3.6	1.8 - 3.6	—
MSP430F2111	FLASH No LCD	Flash	2	128	16	2.2 - 3.6	1.8 - 3.6	—
MSP430F2121	FLASH No LCD	Flash	4	256	16	2.2 - 3.6	1.8 - 3.6	—
MSP430F2131	FLASH No LCD	Flash	8	256	16	2.2 - 3.6	1.8 - 3.6	—
MSP430F2001	FLASH No LCD	Flash	1	128	10	2.2 - 3.6	1.8 - 3.6	—
MSP430F2002	FLASH No LCD	Flash	1	128	10	2.2 - 3.6	1.8 - 3.6	—
MSP430F2003	FLASH No LCD	Flash	1	128	10	2.2 - 3.6	1.8 - 3.6	—
MSP430F2011	FLASH No LCD	Flash	2	128	10	2.2 - 3.6	1.8 - 3.6	—
MSP430F2012	FLASH No LCD	Flash	2	128	10	2.2 - 3.6	1.8 - 3.6	—
MSP430F2013	FLASH No LCD	Flash	2	128	10	2.2 - 3.6	1.8 - 3.6	—

Including the Power Requirements and SVS Parameters

Part Number	MSP430 Family	Type of Program Memory	Program Memory (kB)	RAM (Bytes)	I/O Pins	Flash Programming Voltage (V)	Operating Voltage (V)	Integrated SVS
x4xx Family								
MSP430F412	FLASH/ROM LCD	Flash	4	256	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430C412	FLASH/ROM LCD	ROM	4	256	48	N/A	1.8 - 3.6	Yes
MSP430F413	FLASH/ROM LCD	Flash	8	256	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430C413	FLASH/ROM LCD	ROM	8	256	48	N/A	1.8 - 3.6	Yes
MSP430F415	FLASH/ROM LCD	Flash	16	512	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F417	FLASH/ROM LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FW423	FLASH/ROM LCD	Flash	8	256	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FW425	FLASH/ROM LCD	Flash	16	512	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FW427	FLASH/ROM LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F4250	FLASH/ROM LCD	Flash	16	256	32	2.7 - 3.6	1.8 - 3.6	—
MSP430F4260	FLASH/ROM LCD	Flash	24	256	32	2.7 - 3.6	1.8 - 3.6	—
MSP430F4270	FLASH/ROM LCD	Flash	32	256	32	2.7 - 3.6	1.8 - 3.6	—
MSP430F423	FLASH/ROM LCD	Flash	8	256	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F425	FLASH/ROM LCD	Flash	16	512	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F427	FLASH/ROM LCD	Flash	32	1024	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FE423	FLASH/ROM LCD	Flash	8	256	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FE425	FLASH/ROM LCD	Flash	16	512	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FE427	FLASH/ROM LCD	Flash	32	1024	14	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F435	FLASH/ROM LCD	Flash	16	512	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F436	FLASH/ROM LCD	Flash	24	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F437	FLASH/ROM LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FG437	FLASH/ROM LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FG438	FLASH/ROM LCD	Flash	48	2048	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430FG439	FLASH/ROM LCD	Flash	60	2048	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F447	FLASH/ROM LCD	Flash	32	1024	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F448	FLASH/ROM LCD	Flash	48	2048	48	2.7 - 3.6	1.8 - 3.6	Yes
MSP430F449	FLASH/ROM LCD	Flash	60	2048	48	2.7 - 3.6	1.8 - 3.6	Yes

TPS715xx/Axx Low-Power LDO

Typical Device Specifications

Device	I_{OUT}	V_{DO}	I_Q	Package
TPS715	50 mA	415 mV	3.2 µA	SC70
TPS715A	80 mA	664 mV	3.2 µA	3x3 QFN

TPS715A
3x3 QFN

Pb-Free
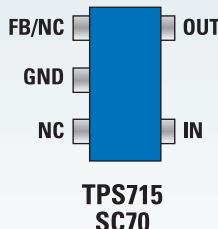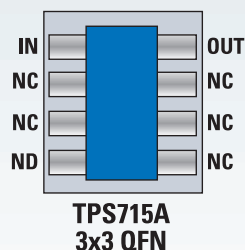
TPS715
SC70

Typical Application
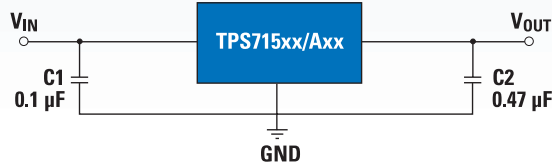
▶ **Features:**
- – TPS715xx/Axx V_{IN}: 2.5 V to 24 V
- – TPS715xx fixed V_{OUT}: 2.5 V, 3.0 V, 3.3 V, 5.0 V
- – TPS715xx/Axx fixed V_{OUT}: 3.3 V
- – TPS715xx/Axx adj V_{OUT}: 2.5 V to 15 V
- – Stable with ceramic output capacitor
- – 4% accuracy over load/line/temp
- – Ultra low I_Q: 3.2 µA

▶ **Applications:**
- – MSP430 microcontroller designs
- – Handsets
- – PDAs
- – Battery-powered applications

▶ **Evaluation Boards:**
- – TPS715xx/AxxEVM-065

▶ **1-ku Pricing:**
- – TPS715xx/Axx: $0.44
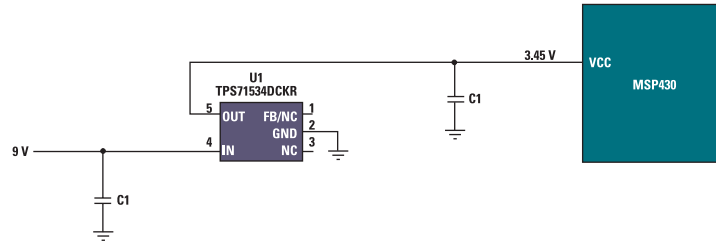- – TPS715xx: $0.34

www.ti.com/sc/device/TPS71501

↪ *Featured Products*

50-mA LDO from a 9-V Battery
TPS715345

Get samples, datasheets, and app reports at: **www.ti.com/sc/device/TPS715345**

Key Features
- TPS715345DCK 50-mA LDO with 24 V_{IN} in SC70 package
- Ultra-low 3.2 μA of I_Q
- Uses a .47 μF capacitor on the output
- Dropout voltage at 50 mA is 415 mV
- Also see TPS715AxxDCK for 80-mA solutions

### 50-mA Charge Pump from Dual Alkaline Battery in Series
TPS60212

Get samples, datasheets and EVMs at: **www.ti.com/sc/device/TPS60212**

Key Features
- TPS60212DGS 50-mA charge pump with 3.6 V_{IN} in MSOP package
- 35 μA of I_Q in normal mode and 2 μA of I_Q in SNOOZE mode
- Normal mode provides 3.3 V at 4% over line, load and temp
- Snooze mode provides 3.3 V at 6% over line, load and temp
- Low-battery warning (LBI/LBO) option at 1.18 V
- Also see TPS60210 or TPS60211 for 100-mA solutions

power.ti.com
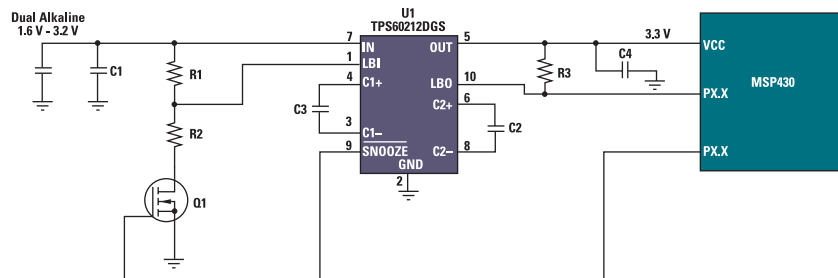
10-mA LDO with Discrete SVS from a Single Li-Ion Battery
TPS79730

Get samples, datasheets, EVMs and app reports at: **www.ti.com/sc/device/TPS79730**

Key Features

- TPS79730DCK 10-mA LDO with 5.5 V_{IN} in SC70 package
- Ultra-low 1.2 µA of I_Q
- Uses a .47-µF capacitor on the output
- Dropout voltage at 10 mA is 105 mV
- TPS3803 single reset supervisor (SVS) monitors the 3.0-V supply
- TPS3803 has an I_Q of 2 µA
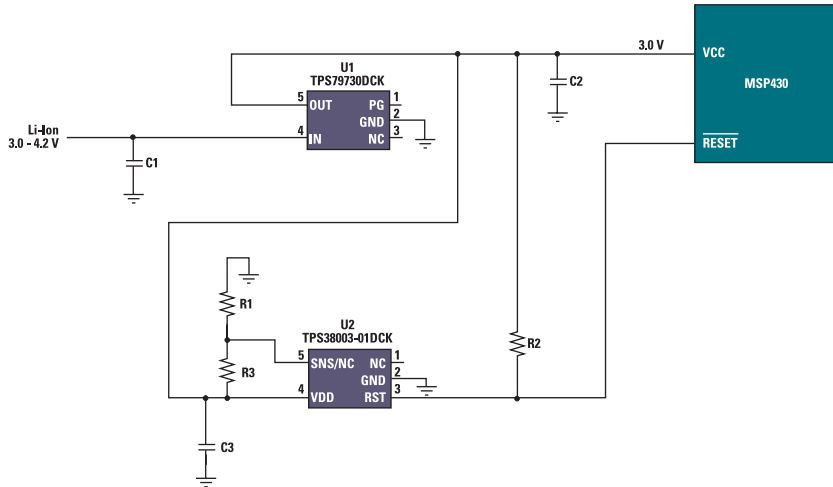
High V_{IN} DC/DC Converter Solution in QFN Package
TPS62111

Get samples, datasheets and EVMs at: **www.ti.com/sc/device/TPS62111**

Key Features

- High-efficiency synchronous step-down converter with up to 95% efficiency
- 3.1-V to 17-V operating input voltage range
- Adjustable output voltage range from 1.2 V to 16 V
- Fixed output voltage options available in 3.3 V and 5 V
- High-efficiency over a wide-load current range due to PFM/PWM operation mode
- 100% maximum duty cycle for lowest dropout
- Low 20-µA quiescent current (typical)
- Overtemperature and overcurrent protected

power.ti.com
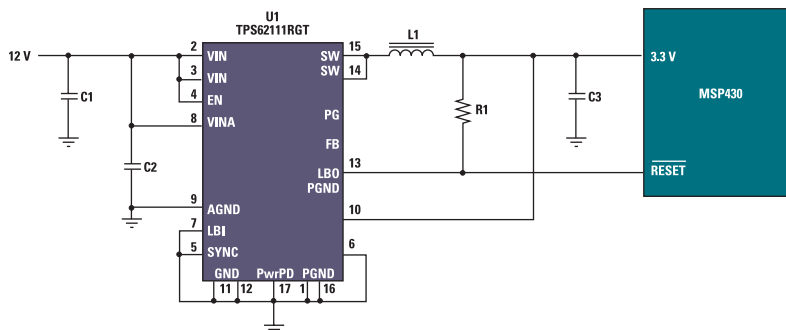
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