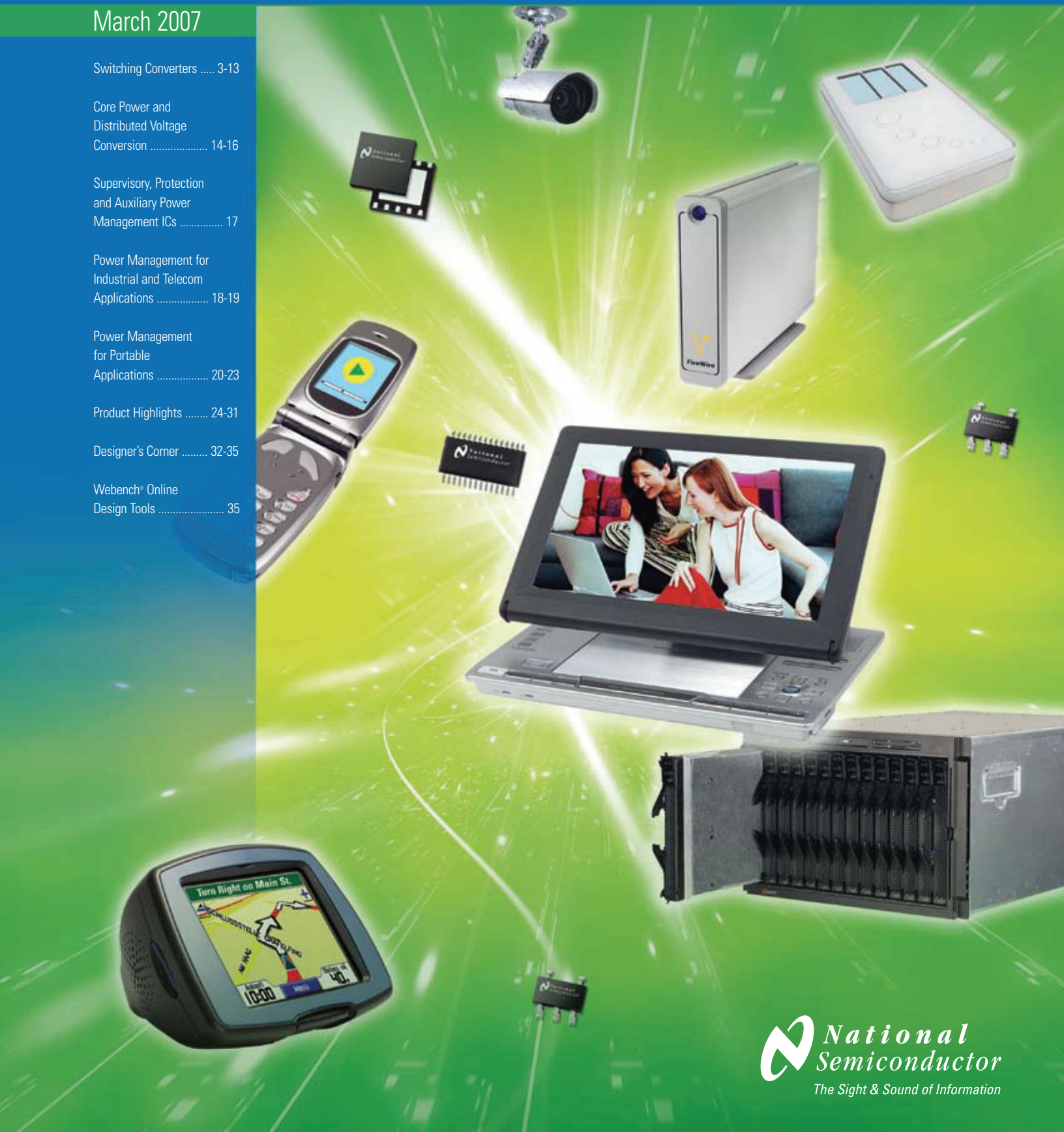
Power Products Selection Guide

March 2007



National Semiconductor

The Sight & Sound of Information

New Products

New

Part Number	Description	Page Number
Switching Capacitor Step-Down DC/DC Converter		
LM2771	Low-Ripple 250 mA switched capacitor step-down DC-DC converter	4
LM2772	Low-Ripple 150 mA switched capacitor step-down DC-DC converter	4
Dual Switching Regulators – Internal Switch		
LM3370	Dual synchronous step-down DC-DC converter with dynamic voltage scaling function through I^2C	4
LM26400	Dual 2A Syn buck regulator	4
Step-Down (Buck) Single Switching Regulators – Internal Switch		
LM2694	30V, 600 mA step-down switching regulator	6
LM2695	High voltage (30V, 1.25A) step down switching regulator	7
LM2696	3A, Constant on time buck regulator	8
LM2830/31/32	1A/1.5A/2A Load, step-down DC-DC regulator	6, 7
LM2853	3A 500 KHz SIMPLE SWITCHER®	8
LM3100	SIMPLE SWITCHER® synchronous 1.5A, 1 MHz buck regulator	7
LM3676	2 MHz 600 mA Step-Down DC-DC With Mode Control	6
LM5009	150 mA, 100V step-down switching regulator	5
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LM5575	75V, 1.5A step-down switching regulator, SIMPLE SWITCHER®	7
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LM25005	High voltage, 2.5A buck regulator	7
LM25007	High voltage, 0.5A step-down switching regulator	5
LM25574	42V, 0.5A step-down switching regulator, SIMPLE SWITCHER®	5
LM25575	42V, 1.5A step-down switching regulator, SIMPLE SWITCHER®	7
LM25576	42V, 3A step-down switching regulator, SIMPLE SWITCHER®	8
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Step-Up Switching Regulator – Internal Switch		
LM5001	High voltage (75V) switch with internal low side N-channel MOSFET	9
LM5002	High voltage (75V) switch with internal low side N-channel MOSFET (0.5A)	9
LM27313	1.6 MHz Boost regulator with internal 30V internal MOSFET in SOT23 package	9
LM2735X/Y	550 KHz/1.6 MHz step-up DC/DC regulator	9
Step-Up Switching Controller – External Switch		
LM5022	60V, Low Side controller for Boost and SEPIC	12
LM3430	40V, Boost controller for LED backlighting	12
Switching Controllers for Step-Down Non-Isolated Topologies – External Switch		
LM1771	Low voltage SOT-23 synchronous buck controller with precision enable and no external compensation	10
LM3489	Hysteretic PFET buck sleep mode controller with enable pin	10
LM25115A	42V, Secoudary side post regulator/DC-DC converter with voltage tracking	10
LM5115A	75V, Secoudary side post regulator/DC-DC converter with voltage tracking	10

Abbreviations
D = Die
W = Wafer

Abbreviations for Temperature Range
Com = Commercial (0°C to 70°C)
Ext = Extended commercial (0°C to 125°C typ)*
Ind = Industrial (-40°C to 125°C)
Mil = Military (-55°C to 125°C)

Abbreviations for Features
PG = Powergood
SS = Soft-start
SD = Shutdown
Sync R = Synchronous Rectification

New

Part Number	Description	Page Number
Low Dropout Linear Regulators (LDOs) – Positive Output		
LP38851/4/7	0.8A Dual Rail LDO with soft start and enable	14
LP38852/5/8	1.5A Dual Rail LDO with soft start and enable	14
LP38853/6/9	3A Dual Rail LDO with soft start and enable	14
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LM5072	Integrated PoE PD interface and DC-DC converter with aux input capability	19
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High Power LED Driver		
LM3402/HV	6-75V, 0.5A constant current back regulator	19
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LM3405	22V, 550 KHz/1.0 MHz 1A constant current back regulator	19
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LM5069	Positive high voltage hot-swap controller with latched fault and auto-retry options	19
Integrated Power Management Units (PMUs)		
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LP3910	Power management IC for hard driver based portable media players	21
LP3913	Power management IC for flash memory based portable media players	21
LP3917	CDMA Cellular phone power management unit	21
LP3955	CDMA Cellular phone power management system	21
LP3971	Power management unit for advanced application processors	21
LP3972	Power management unit with multi bit I^2C interface for advanced application processor	21
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Lighting Management Units (LMUs)		
LP3958	Lighting management unit for controlling 4+2 white LEDs for main and sub display and 3 sets of white LEDs for keypad	21
LP5526	Lighting management unit with high voltage boost converter with up to 150 mA serial flash LED driver	21
LP5527	Lighting management unit for camera flash and 4 LEDs with I^2C programmability	21
White LED Driver – Inductorless		
LM27965	Dual display white led driver with I2C interface	22
LM27966	White led driver with I^2C interface	22
Step-Down Switching Regulators for RF Power Amplifiers		
LM3207	650 mA Miniature, Adjustable, Step-Down DC-DC Converter for RF Power Amplifiers with Integrated Vref LDO	23
LM3208	650 mA Miniature, Adjustable, Step-Down DC-DC Converter for RF Power Amplifiers with Rdson Management	23
LM3280	Adjustable Step-Down DC-DC Converter and 3 LDOs for RF Power Management	23

Switching Converters

Inductorless Switching Regulators

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT}	I_{OUT} (mA)	Typ F_{SW} (kHz)	Typ I_q (µA)	Temp Range (°C)	Other Features/Comments	Packaging
LM2750	2.7	5.6	5.0 & Adj	120	1700	5000	-40 to 125	Excellent thermal properties	LLP-10, D, W
LM2751	2.8	5.5	4.5, 5	150	725	1000	-40 to 85	LED Driver	LLP-10
LM2760	2.0	4.4	3.3[2]	20	750	10	-40 to 100	Short circuit and thermal protection	SOT23-5
LM2770	2.7	5.5	1.2/1.5 & 1.2/1.57	250	700	55	-30 to 105	Soft-start, sleep-mode, pin-selectable voltage scaling	LLP-10
New LM2771	2.7	5.5	1.5	250	1100	45	-30 to 110	High output accuracy, low output ripple	LLP-10
New LM2772	2.5	5.5	1.2	150	1100	47	-30 to 110	High output accuracy, low output ripple	LLP-10
LM2787	2.7	5.5	Adjustable negative[1]	10	260	400	-40 to 110	Low noise, shutdown pin	micro SMD-8
LM2797	2.6	5.5	1.8[2]	120	500	35	-40 to 125	Fast turn-on time	MSOP-10
LM2798	2.6	5.5	1.5, 1.8, 2.0[2]	120	500	35	-40 to 125	Output-OK and battery-OK flags	MSOP-10
LM3354	2.5	5.5	1.8, 3.3, 4.1, 5.0[2]	90	1000	375	-40 to 120	Step-up/step-down multi-gain architecture	MSOP-10

[1] Adjustable output voltage range: -1.5V to -5.2V
[2] Custom output voltages possible in 100 mV increments. Contact National for more information.

Dual Switching Regulators – Internal Switch

Part Number	Description	V_{IN} Min	V_{IN} Max	Channel 1 Output	Channel 2 Output	F_{SW} (kHz)	Internal MOSFET R_{DSON} (Ω)	SS	Enable	Other Features/ Comments	Temp Range (°C)	Packaging
LM2716	One buck and one boost regulator on a single IC	4	20	3.3V at 1.2A (buck)	Adj (up to 20V) at 3.6A switch (boost)	300 to 600	0.12 boost, 0.16 buck	✓	✓	Individual enable and soft-start pins for each channel; external compensation	-40 to 125	TSSOP-24
LM2717	Dual buck	4	20	Fixed 3.3V and Adj at 1.6A	Adj at 1.8A	300 to 600	0.16	✓	✓	Two versions: Buck1 3.3V Fixed and Adj.	-40 to 125	TSSOP-24
New LM3370	Dual 600 mA buck I²C programmable	2.7	5.5	1V to 2V at 600 mA	1.8V to 3.3V at 600 mA	2000	PFET: 0.4; NFET: 0.25	✓	✓		-30 to 125	LLP-16
New LM26400	Dual buck	3	20	Adj at 2A	Adj at 2A	500	0.175	✓	✓	Individual enable & soft start pins for each channel; internal compensation	-40 to 125	TSSOP-16, LLP-16

Automatic Step-Up/Step-Down Inductorless Switching Regulators

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT}	I_{OUT} (mA)	Typ F_{SW} (kHz)	Typ I_q (µA)	Temp Range (°C)	Packaging
LM2760	2	4.4	3.3	20	750	10	-40 to 100	SOT23-5
LM3354	2.5	5.5	1.8, 3.3, 4.1, 5.0	90	1000	375	-40 to 120	MSOP-10

Step-Down (Buck) Single Switching Regulators[1] – Internal Switch

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT} Options (Adj Range)	F_{SW} (kHz)	SD	SS	Sync R	PG	Clock Sync	WEBENCH Simulation	Temp Range (°C)	Other Features/ Comments	Packaging
150 mA I_{OUT}													
New! LM5009	9	100	Adj (down to 2.5)	50 to 800	✓	—	—	—	—	✓	-40 to 125	Internal startup regulator for V_{IN} > 9V; internal 100V/0.5A N-MOSFET	MSOP-8, LLP-8
250 mA I_{OUT}													
LM2770	2.7	5.5	1.2, 1.5, 1.57	700	✓	✓	—	—	—	✓	-30 to 105	Inductorless converter; sleep power saving mode for I_{OUT} < 10 mA	LLP-10
New! LM2771	2.7	5.5	1.5	1100	✓	✓	—	—	—	—	-30 to 110	Low ripple and noise, inductorless converter	LLP-10
300/400 mA I_{OUT}													
LM2612	2.8	5.5	1.05, 1.3, 1.5, 1.8	500 to 1000	✓	✓	✓	—	✓	—	-25 to 85	Pin-selectable PWM and PFM modes, max I_q at S_D = 3 µA, 2% V_{OUT} accuracy	micro SMD-10
LM2614	2.8	5.5	Adj (1 to 3.6)	500 to 1000	✓	✓	✓	—	✓	—	-25 to 85	Pin-selectable PWM and PFM modes, max I_q at S_D = 3 µA, 2% V_{OUT} accuracy	micro SMD-10
LM2618	2.8	5.5	1.8, 1.83, 1.87, 1.92	500 to 1000	✓	✓	✓	—	✓	—	-25 to 85	Similar to LM2612 but with synchronous rectification in PFM mode	micro SMD-10
LM3670	2.5	5.5	1.2, 1.5, 1.6, 1.8, 1.875, 2.5, 3.3 and, Adj (0.7 to 2.5)	1000	✓	✓	✓	—	—	✓	-40 to 125	15 µA I_q, PWM/PFM modes, 100% duty cycle, only 3 external components, internal compensation, and soft-start, stable with ceramic caps	SOT23-5
New! LM3673	2.7	5.5	Adj (1.1 to 3.3)	2000	✓	✓	✓	—	—	✓	-30 to 85	16 µA I_q, PWM/PFM modes, 3 surface-mount components, 1 inductor and 2 ceramic caps	micro SMD-5
LM5008	9	100	Adj (down to 2.5)	50 to 800	✓[2]	—	—	—	—	✓	-40 to 125	Internal startup regulator for V_{IN} > 9V; internal 100V/0.5A N-MOSFET	MSOP-8, LLP-8
500 mA I_{OUT}													
LM2594HV	4.5	60	3.3, 5, 12, Adj (1.23 to 57)	150	✓	—	—	—	—	✓	-40 to 125	SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, D, W
LM2597HV	4.5	60	3.3, 5, 12, Adj (1.23 to 57)	150	✓	✓	—	✓	—	✓	-40 to 125	Error output delay, SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, D, W
LM2619	2.8	5.5	Adj (1.5 to 3.6)	500 to 1000	✓	✓	✓	—	✓	—	-25 to 85	Pin-selectable PWM and PFM modes, max I_q at SD = 3 µA, 2% V_{OUT} accuracy	TSSOP-14, micro SMD-10
LM2671	8	40	3.3, 5, 12, Adj (1.21 to 37)	260 to 400	✓	✓	—	—	✓	✓	-40 to 125	1.5% Output voltage accuracy, SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, LLP-16, D, W
LM2674	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	✓	—	—	—	—	✓	-40 to 125	1.5% Output voltage accuracy, SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, LLP-16, D, W
LM5007	9	75	Adj (down to 2.5)	50 to 800	✓[2]	—	—	—	—	✓	-40 to 125	Internal startup regulator for V_{IN} > 9V; internal 80V/0.7A N-MOSFET	MSOP-8, LLP-8
New! LM5574	6	75	Adj (down to 1.225)	50 to 500	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator 1.5% output voltage accuracy	TSSOP-16
New! LM25007	9	42	Adj (down to 2.5)	50 to 800	✓[2]	—	—	—	—	✓	-40 to 125	Internal startup regulator for V_{IN} > 9V; internal 42V/0.7A N-MOSFET	MSOP-8, LLP-8
New! LM25574	6	42	Adj (down to 1.225)	50 to 1000	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator 1.5% output voltage accuracy	TSSOP-16

[1] Most of these regulators can be used in additional topologies, such as inverting, buck-boost, or zeta.
[2] Part can be shutdown if R_{ON} pin is pulled to ground.

Step-Down (Buck) Single Switching Regulators[1] – Internal Switch (continued)

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT} Options (Adj Range)	F_{SW} (kHz)	SD	SS	Sync R	PG	Clock Sync	WEBENCH Simulation	Temp Range (°C)	Other Features/ Comments	Packaging
600 mA I_{OUT}													
New LM2694	8	30	Adj (down to 1.25)	1000	✓	✓	—	—	✓	—	-40 to 125	No compensation required, ultra-fast transient response, thermal shutdown, low standby current of 12 µA	eTSSOP-16
LM3671	2.7	5.5	1.2, 1.25, 1.375, 1.5, 1.6, 1.8, 1.875, 2.5, 2.8, 3.3, and Adj (1.1 to 3.3)	2000	✓	✓	✓	—	—	✓	-30 to 125	15 µA I_q, PWM/PFM modes, 100% duty cycle, only 3 external components, internal compensation, and soft-start, stable with ceramic caps	micro SMD-5, SOT23-5
New LM3674	2.7	5.5	1.2, 1.25, 1.375, 1.5, 1.6, 1.8, 1.875, 2.5, 2.8, 3.3, and Adj (1.1 to 3.3)	2000	✓	✓	✓	—	—	✓	-30 to 125	15 µA I_q, PWM only mode, 100%duty cycle, only 3 external components, internal compensation, and soft-start, stable with ceramic caps	micro SMD-5, SOT23-5
New LM3676	2.9	5.5	1.5, 1.8, 3.3, ADJ	2000	✓	✓	✓	—	—	✓	-30 to 125	16 µA Iq,Automatic PFM/PWM mode switching or Force PWM, 100% duty circle, only 3 components,internal compensation, and soft start, stable with ceramic capacitor	LLP-8
750 mA I_{OUT}													
LM2736	3.0	18	Adj (1.25 to 16)	550, 1600, 3000	✓	✓	—	—	—	✓	-40 to 125	Thermal shutdown, OVP, Internal compensation and soft-start	SOT23-6
1A I_{OUT}													
LM2590HV	4.5	60	3.3, 5, Adj (1.23 to 57)	150	✓	✓	—	✓	—	✓	-40 to 125	Error output delay, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, D, W
LM2591HV	4.5	60	3.3, 5, Adj (1.23 to 57)	150	✓	—	—	—	—	✓	-40 to 125	SIMPLE SWITCHER® regulator	TO263-7, TO220-7, D, W
LM2595	4.5	40	3.3, 5, 12, Adj (1.23 to 37)	150	✓	—	—	—	—	✓	-40 to 125	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W
LM2598	4.5	40	3.3, 5, 12, Adj (1.23 to 37)	150	✓	✓	—	✓	—	✓	-40 to 125	Error output delay, SIMPLE SWITCHER® regulator	TO263-5, TO220-5
LM2672	8	40	3.3, 5, 12, Adj (1.21 to 37)	260 to 400	✓	✓	—	—	✓	✓	-40 to 125	1.5% Output voltage accuracy, SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, LLP-16, D, W
LM2675	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	✓	—	—	—	—	✓	-40 to 125	1.5% Output voltage accuracy, SIMPLE SWITCHER® regulator	SOIC-8, DIP-8, LLP-16, D, W
LM2734	3	20	0.8 to 18	550,1600, 3000	✓	✓	—	—	—	✓	-40 to 125	Thermal shutdown, OVP, internal compensation, 30 nA shutdown current, pulse-by-pulse C_L	SOT23-6, LLP-6
New LM2830	3	5.5	Adj (0.6 to 4.5)	1600, 3000	✓	Internal	—	—	—	✓	-40 to 125	Internal compensation	SOT23-5, LLP-6
LM5010A	6	75	Adj (down to 2.5)	50 to 800	✓	✓	—	—	—	✓	-40 to 125	No compensation required; ultra-fast transient response; thermal shutdown	eTSSOP-14, LLP-10
LM25010	6	42	Adj (down to 2.5)	50 to 1000	✓	✓	—	—	—	✓	-40 to 125	Ultra-fast transient response; thermal shutdown	TSSOP-14, LLP-10

See page 5 for footnotes.

Step-Down (Buck) Single Switching Regulators[1] – Internal Switch (continued)

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT} Options (Adj Range)	F_{SW} (kHz)	SD	SS	Sync R	PG	Clock Sync	WEBENCH Simulation	Temp Range (°C)	Other Features/ Comments	Packaging
1.25A I_{OUT}													
New LM2695	8	30	Adj (down to 1.25)	1000	✓	✓	—	—	✓	—	-40 to 125	No compensation required, ultra-fast transient response, thermal shutdown, low standby current of 12 µA	eTSSOP-14, LLP-10
1.5A I_{OUT}													
LM2831	3	5.5	Adj (0.6 to 4.5)	550, 1600, 3000	✓	Internal	—	—	—	✓	-40 to 125	Internal compensation	SOT23-5, LLP-6
New LM3100	4.5	36	Adj (down to 0.8)	Adj (up to 1 MHz)	✓	✓	✓	—	—	✓	-40 to 125	SIMPLE SWITCHER® synchronous 1 MHz regulator	eTSSOP-20
New LM5575	6	75	Adj (down to 1.225)	5 to 500	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator 1.5% output voltage accuracy	eTSSOP-16
New LM25575	6	42	Adj (down to 1.225)	5 to 1000	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator 1.5% output voltage accuracy	eTSSOP-16
New LM26001	4	38	Adj (down to 1.24)	Adj (150-500)	✓	✓	—	✓	✓	✓	-40 to 125	<40 µA I_q in sleep-mode, 10 µA Iq in shutdown mode, 3V min input voltage	eTSSOP-16
New LM26001B	4	18	Adj (down to 1.24)	150-500	✓	✓	—	✓	✓	✓	-40 to 125	<40 µA Iq in sleep-mode, 10 µA in shutdown, 3V min input voltage, 2% reference accuracy	eTSSOP-16
2A I_{OUT}													
LM2592HV	4.5	60	3.3, 5, Adj (1.23 to 57)	150	✓	—	—	—	—	✓	-40 to 125	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W
LM2593HV	4.5	60	3.3, 5, Adj (1.23 to 57)	150	✓	✓	—	✓	—	—	-40 to 125	Error output delay, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, D, W
New LM2832	3	5.5	Adj (0.6 to 4.5V)	550, 1600, 3000	✓	Internal	—	—	—	✓	-40 to 125	Internal compensation	LLP-6, eMSOP-8
LM2852	2.9	5.5	3.0, 3.3, 2.5, 1.8, 1.5, 1.2, 1, 0.8	500, 1500	✓	✓	✓	—	—	✓	-40 to 125	Thermal shutdown, internal compensation, low standby current, C_L, factory set	eTSSOP-14
2.5A I_{OUT}													
LM5005	7	75	Adj (1.225 to 63)	50 to 500	✓	✓	—	—	✓	✓	-40 to 125	1.5% Feedback voltage accuracy, emulated current mode, thermal protection	eTSSOP-20
New LM25005	7	42	Adj (1.225 to 37)	50 to 500	✓	✓	—	—	✓	✓	-40 to 125	1.5% Feedback voltage accuracy, emulated current mode, thermal protection	eTSSOP-20

See page 5 for footnotes.

Step-Down (Buck) Single Switching Regulators[1] – Internal Switch (continued)

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT} Options (Adj Range)	F_{SW} (kHz)	SD	SS	Sync R	PG	Clock Sync	WEBENCH Simulation	Temp Range (°C)	Other Features/ Comments	Packaging
3A I_{OUT}													
LM2670	8	40	3.3, 5, 12, Adj (1.21 to 37)	260 to 400	✓	—	—	—	✓	✓	-40 to 125	2% Output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14, D, W
LM2673	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	—	✓	—	—	—	✓	-40 to 125	Prog. current limit, 2% output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14
LM2676	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	✓	—	—	—	—	✓	-40 to 125	2% Output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14, D, W
New LM2696	4.5	24	Adj (down to 1.25)	100 to 500	✓	✓	—	✓	—	✓	-40 to 125	No compensation required, ultra-fast transient response, thermal shutdown, low standby current of 12 µA	eTSSOP-16
New LM2853	3	5.5	0.8, 1.0, 1.2, 1.5, 1.8, 2.5, 3.0, 3.3	550	✓	✓	✓	—	—	✓	-40 to 125	Voltage mode control with internal compensation, low standby current of 12 µA	eTSSOP-14
New LM5576	6	75	Adj (from 1.225)	50 to 500	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator, 1.5% output voltage accuracy	eTSSOP-20
New LM25576	6	42	Adj (from 1.225)	50 to 1000	✓	✓	—	—	✓	✓	-40 to 125	COT, SIMPLE SWITCHER® Regulator, 1.5% output voltage accuracy	eTSSOP-20
5A I_{OUT}													
LM2677	8	40	3.3, 5, 12, Adj (1.21 to 37)	260 to 400	✓	—	—	—	✓	✓	-40 to 125	2% Output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14
LM2678	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	✓	—	—	—	—	✓	-40 to 125	2% Output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14
LM2679	8	40	3.3, 5, 12, Adj (1.21 to 37)	260	—	✓	—	—	—	✓	-40 to 125	Prog. current limit, 2% output voltage accuracy, SIMPLE SWITCHER® regulator	TO263-7, TO220-7, LLP-14

See page 5 for footnotes.

Step-Up (Boost/Flyback/SEPIC) Switching Regulators – Internal Switch

Part Number	V_{IN} Min	V_{IN} Max	V_{OUT} Options Adj (Max)	Switch Current (mA)	F_{SW} (kHz)	Enable Pin	SS	Clock Sync	WEBENCH Simulation	Temp Range	Other Features/ Comments	Packaging
LM2750	2.7	5.6	5.0 and Adj (3.8 to 5.2)	120 I_{OUT}	1700	✓	—	—	—	Ind	Inductorless regulated boost converter	LLP-10, D, W
LM2751	2.8	5.5	4.5, 5	150 (4.5V) & 80 (5V)	725/300/ 37/9.5	✓	—	—	✓	-40 to 85	LED driver	LLP-10
LM2753	3	5.5	5	400	725	✓	—	—	✓	-40 to 85	Flash-LED driver	LLP-10
LM3501	2.7	7	Adj (up to 16, 21)	400 or 670	1000	✓	—	—	—	Ind	Synchronous rectification, no external Schottky diode required	micro SMD-8
New! LM5002	3	75	Adj	500	Prog. to 1.5 MHz (max.)	✓	—	✓	—	-40 to 125	75V internal switch + LDO, external compensation Thermal Shutdown	SO-8, LLP-8
New! LM27313	2.7	14	Adj (5.0 to 28.0)	800	1.6 MHz	✓	—	—	—	-40 to 125	Current Mode PWM controller Internal compensation	SOT23-5
LM2733X/Y	2.7	14	Adj (up to 40)	1000	1600, 600	✓	—	—	—	Ind	Current-mode PWM converter	SOT23-5
New! LM5001	3	75	Adj	1000	Prog. to 1.5 MHz (max.)	✓	—	—	—	-40 to 125	75V internal switch + LDO, external compensation Thermal Shutdown	SO-8, LLP-8
LM2698	2	12	Adj (up to 18)	1350	600, 1250	✓	—	—	—	Ind	2.5% output voltage accuracy	MSOP-8
LM2731X/Y	2.7	14	Adj (up to 21)	1500	1600, 600	✓	—	—	—	Ind	Current-mode PWM converter	SOT23-5
LM2622	2	12	Adj (up to 17.5)	1650	600, 1300	✓	—	—	—	Ind	PWM converter	MSOP-8, D, W
LM3310	2.5	7	Adj (up to 20)	2000	660, 1280	—	✓	—	✓	Ind	1 Ch, 1 op amp, 1 GPM	LLP-24
LM3311	2.5	7	Adj (up to 20)	2000, LDO = 350	660, 1280	—	✓	—	✓	Ind	1 Ch+LDO, 1 op amp, 1 GPM	LLP-24
LM5000	3.1	40	Adj (up to 80)	2000	300, 600, 700, 1250	✓	✓	—	✓	Ind	80V internal switch, thermal shutdown	TSSOP-16, LLP-14
New! LM2735X/Y	2.7	5.5	Adj (4.0 to 24.0)	2450	1.6 MHz/ 550 kHz	✓	✓ (internal)	—	✓	-40 to 125	Current Mode PWM controller internal Soft-start	SOT23-5, LLP-6
LM2700	2.2	12	Adj (up to 17.5)	3600	600, 1250	✓	—	—	—	Ind	PWM converter	TSSOP-14, LLP-14
LM3224	2.7	7	Adj (up to 17)	2600	615, 1250	✓	✓	—	—	Ind	External comp, ceramic caps	MSOP-8
LM2585	4	40	3.3, 5, 12, Adj (up to 60)	3000	100	—	✓	—	✓	Ind	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W
LM2586	4	40	3.3, 5, 12, Adj (up to 60)	3000	100 to 200	✓	✓	✓	✓	Ind	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W
LM2587	4	40	3.3, 5, 12, Adj (up to 60)	5000	100	—	✓	—	✓	Ind	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W
LM2588	4	40	3.3, 5, 12, Adj (up to 60)	5000	100 to 200	✓	✓	✓	✓	Ind	SIMPLE SWITCHER® regulator	TO263-5, TO220-5, D, W

Fixed-Gain Inductorless Switched Capacitor Converters – Charge Pumps

Part Number	Function	V_{IN} Min	V_{IN} Max	Typ R_{OUT} (Ω)	Min I_{OUT} (mA)	Typ F_{SW} (kHz)	Temp Range (°C)	Other Features/ Comments	Packaging
Doublers and Inverters									
LM2780	Inverts input voltage, ultra-low voltage ripple	1.8	5.5	8	50 (typ)	12	-40 to 90	Two flying caps for low output ripple	micro SMD-8
LM2781	Inverts input voltage, ultra-low voltage ripple	1.8	5.5	8	50 (typ)	210	-40 to 90	Two flying caps for low output ripple, small solution	micro SMD-8

Switching Converters

Switching Controllers for Step-Down Non-Isolated Topologies[1] – External Switch

Part Number	V_{IN}[2] Min	V_{IN}[2] Max	V_{OUT} Options (Adj Range)	V_{OUT} Accuracy (%)	I_{OUT}[3] (A)	F_{SW} (kHz)	Mode	SD	SS	Sync R	PG
Single Switching Controllers											
LM1770	2.8	5	Down to 0.8	2	4	300 to 1400	COT	✓	✓	—	—
New LM1771	2.8	5	Down to 0.8	2	4	300 to 1400	COT	✓	✓	—	—
LM3477/77A	2.95	35	Down to 1.3	1.5	6	500	Current	✓	✓	—	—
LM27241	5.5	28[6]	Down to 0.6	1.5	16	200 to 500	Voltage	✓	✓	✓	✓
LM2727	2.2	16[6]	Down to 0.6	1.5	20	50 to 2000	Voltage	✓	✓	✓	✓
LM2737	2.2	16[6]	Down to 0.6	1.5	20	50 to 2000	Voltage	✓	✓	✓	✓
LM2742	1	16[6]	Down to 0.6	1.5	20	50 to 2000	Voltage	✓	✓	✓	✓
LM2743	1	16[9]	Down to 0.6	2	25	50 to 2000	Voltage	✓	✓	✓	✓
LM2744	1	16[9]	Down to 0.5[10]	0.5[10]	25	50 to 2000	Voltage	✓	✓	✓	✓
LM2745	1	14	0.6 to 0.8 V_{IN}	1.5	25	1000	Voltage	✓	✓	✓	✓
LM2746	1	14	0.6 to 0.8 V_{IN}	1	25	1000	Voltage	✓	✓	✓	✓
LM2747	1	14	0.6 to 0.8 V_{IN}	1	25	1000	Voltage	✓	✓	✓	✓
LM2748	1	14	0.6 to 0.8 V_{IN}	1.5	25	1000	Voltage	✓	✓	✓	✓
LM3075	4.5	36	Down to 1.3V	2	20	200, 300	Current	✓	✓	✓	✓
LM3475	2.7	10	0.8 to 10	1.5	5	1400	Hysteretic	✓	✓	—	—
LM3485	4.5	35	Down to 1.27	2	4	DC to 1400	Hysteretic	✓[4]	—	—	—
New LM3489	4.5	35	Down to 1.27	2	4	DC to 1400	Hysteretic	✓[4]	✓	—	—
LM3495	2.8	18	0.6 to 5.5	1	10	200 to 1500	Emulated Peak Current	✓	✓	✓	—
LM3743	3	5.5	Down to 0.8	1.75	20	300 to 1000	Voltage	✓	✓	✓	—
LM5115	4.5	75[12]	0.75 to 12	1.7	20	100 to 1000	Voltage/current injection	✓	✓	✓	—
New LM5115A	4.5	75	0.75 to 12	1.7	20	100 to 1000	Voltage mode/ Valley current mode	✓	✓	✓	—
LM25115	4.5	42	0.75 to 12	1.7	20	100 to 1000	Voltage/current injection	✓	✓	✓	—
New LM25115A	4.5	42	0.75 to 12	1.7	20	100 to 1000	Voltage mode/ Valley current mode	✓	✓	✓	—
Dual Switching Controllers											
LM2647	5.5	28[6]	0.6 to 5	1.5	25[11]	200, 500	Voltage with V_{IN} feedforward	✓	✓	✓	✓
LM2657	4.5	28[6]	Down to 0.6	1.5	25[11]	200, 500	Voltage with V_{IN} feedforward	✓	✓	✓	✓
LM5642	4.5	36	1.3 to 32.5	1.5	20[11]	150 to 250	Current	✓	✓	✓	—

[1] Many of these controllers can be used to drive additional topologies, such as inverting buck-boost, zeta, or synchronous flyback.
[2] IC V_{CC} range = application V_{IN} range unless otherwise noted.
[3] Achievable output current using these switching controllers depends on different factors, such as the external transistors (MOSFETs) used, airflow, package, etc. Typically, achievable output currents with good system efficiency can range from less than 1A to the values shown under "I_{OUT}" in the table above. These calculations are made using standard SMT and no airflow. Larger currents, many times 150% to 200% of the table above "I_{OUT}" values can be achieved if having air flow and/or other adequate heat dissipation techniques.
[4] Part can be shut down if FB pin is pulled above 1.3V.
[5] Unique FB architecture composed of a voltage-follower amplifier and a comparator with both inverting and non-inverting inputs available to the user.

Lossless I_{SENSE}	Clock Sync	Total # of Regulators	Temp Range (°C)	Other Features/Comments	Packaging
—	—	1	-40 to 125	No compensation required	SOT23-5
—	—	1	-40 to 125	Precision enable, no compensation required	SOT23-5
—	—	1	-40 to 125	Hysteretic threshold at 36% or 12% (A version) of programmed current limit; V_{OUT} OVP	MSOP-8
✓	—	1	-5 to 125	Selectable pulse-skip mode for high light load efficiency	TSSOP-20
✓	—	1	-40 to 125	0.6V Internal voltage reference; UVLO, UVP	TSSOP-14
✓	—	1	-40 to 125	0.6V Internal voltage reference	TSSOP-14
✓	—	1	-40 to 125	4.2V UVLO, TRI-STATE® output during SD, 40 ns minimum on time	TSSOP-14
✓	—	1	-40 to 125	2.7V UVLO, TRI-STATE output during SD, tracking, precision SD threshold	TSSOP-14
✓	—	1	-40 to 125	External V_{REF} version of LM2743 for ultra-high accuracy; tracking, sequencing.	TSSOP-14
✓	✓	1	-40 to 125	Start into pre-bias loads, 40 ns Min_ON time	TSSOP-14
✓	—	1	-40 to 125	Start into pre-bias loads, 40 ns Min_ON time and high accuracy VFB	TSSOP-14
✓	✓	1	-40 to 125	Start into pre-bias loads, 40 ns Min_ON time and high accuracy VFB, optional frequency synchronize range 250 kHz to 1 MHz	TSSOP-14
✓	—	1	-40 to 125	Start into pre-bias loads, 40 ns Min_ON time	TSSOP-14
✓	—	1	-40 to 125	User-selectable FPWM and SKIP modes, positive and negative current limit, UVLO, OVP	TSSOP-20
✓	—	1	-40 to 125	Fast transient response, high efficiency, wide V_{IN} range, and 100 duty cycle capable	SOT23-5
✓	—	1	-40 to 125	No compensation required. Current limit; P-FET controller	MSOP-8
✓	—	1	-40 to 125	No compensation required. Current limit; P-FET controller	MSOP-8
✓	✓	1	-40 to 125	Power supply tracking, pre-biased startup, skip mode at light load	TSSOP-16
✓	—	1	-40 to 125	Power supply tracking, pre-biased startup	MSOP-10
✓	✓	1	-40 to 125	Voltage mode/current injection simpifies loop compensation	TSSOP-16, LLP-16
✓	✓	1	-40 to 125	Operates from ac or dc input, power-up & power-down tracking	TSSOP-16
✓	✓	1	-40 to 125	42V Version of LM5115	TSSOP-16, LLP-16
✓	✓	1	-40 to 125	42V Version of LM5115A	TSSOP-16
✓	—	2	-5 to 125	PWM/SKIP and FPWM modes; soft shutdown, line feedforward, 180 out-of-phase	TSSOP-28, LLP-28
✓	—	2	-40 to 125	Same as LM2647 with lower V_{IN} and auto-recover from faults	TSSOP-28
✓	✓	2	-40 to 125	180 Out-of-phase channels; individual soft-start allows sequencing	TSSOP-28

[6] IC V_{CC} = 4.5V to 5.5V at 2 mA
[7] Application input voltage dependent upon the MOSFET driver ICs used. 4.xxV to 5.xxV is only the IC's V_{CC} range.
[8] Through the external MOSFET drivers used.
[9] IC V_{CC} = 3.0V to 6.0V at 2 mA
[10] Dependant upon the external voltage reference utilized.
[11] Per channel. Twice this current may be obtained for dual controllers when the channels are paralleled.
[12] IC V_{CC} = 4.5V to 30V

Switching Converters

Step-Up (Boost/Flyback/SEPIC) Switching Controllers – External Switch

Part Number	V_{IN} Min	V_{IN} Max	Output Voltage	F_{SW} (kHz)	SD	SS	Sync R	Clock Sync
New LM3430	6	40	Adj	100 to 2 MHz	—	✓	✓	✓
LM3478	2.95	40	Adj	100 to 1000	✓	✓	—	—
LM3488	2.95	40	Adj	100 to 1000	✓	✓	—	✓
LM5020	8	100	Adj	50 to 1000	✓*	✓	—	✓
LM5021	8	30	Adj	50 to 1000	✓*	✓	—	✓
New LM5022	6	60	Adj	100 to 2 MHz	—	✓	—	✓

*The controller will enter a low-power state if the SS pin is below the shutdown threshold of 0.45V.

PWM Controllers for Isolated Topologies – Medium and High Power

Part Number	Description	Mode	Topologies	V_{IN} (Max)	F_{SW} (kHz)	Sync	UVLO	I-Limit
LM5020	Single ended	Current	Flyback, forward, buck, or boost	100	50 to 1000	Up	✓	Cycle-cycle
LM5021	AC-DC controller	Current	Flyback, forward	30	50 to 500	Up	—	Cycle-cycle & hiccup
LM5025/A/B	Active clamp	Voltage/feedfwd	Forward active clamp	105	100 to 1000	Up & down	✓	Cycle-cycle & hiccup
LM5026	Active clamp	Current	Forward active clamp	105	100 to 1000	Input/output	✓	Cycle-cycle & hiccup
LM5030	Alternating outputs	Current	Push-pull, half-, or full-bridge	100	50 to 1000	Up	—	Cycle-cycle & hiccup
LM5032	Dual interleaved	Current	Flyback, forward	105	100 to 1000	Up	✓	Cycle-cycle & hiccup
LM5033	Alternating outputs	Voltage	Push-pull, half-, or full-bridge	100	50 to 1000	Up	—	Hiccup
LM5034	Dual interleaved active clamp	Current	Forward active clamp	105	100 to 1000	Up	✓	Cycle-cycle & hiccup
LM5035	Half-bridge controller and gate driver	Voltage	Half-bridge	100	100 to 1000	Up	✓	Cycle-cycle & hiccup
LM5041/A	Buck-fed cascade alternating outputs	Current	Current or voltage fed push-pull, bridge	100	50 to 1000	Up	✓	Cycle-cycle & hiccup
LM5115	Secondary-side post regulator	Voltage/current-injection	Synchronous secondary-side post regulator	75	100 to 1000	Up	—	Cycle-cycle
New LM5115A	Secondary-side post regulator	Voltage mode/ valley current mode	Synchronous secondary-side post regulator	75	100 to 1000	✓	—	Cycle-cycle
LM25115	Secondary-side post regulator	Voltage/current-injection	Synchronous secondary-side post regulator	42	100 to 1000	Up	—	Cycle-cycle
New LM25115A	Secondary-side post regulator	Voltage mode/ valley current mode	Synchronous secondary-side post regulator	42	100 to 1000	✓	—	Cycle-cycle

High-Speed MOSFET Drivers

Part Number	V_{IN} Max (MOSFET)	V_{DD} Range	Peak Gate Drive Sink/ Source Typ Current (A)	Input Type	Min Pulse Width (ns)	Rise/Fall Time Typ (ns)	Bottom/Top Driver Turn On or Off Propagation Delay Time (ns)
High-Voltage, Half-Bridge Gate Drivers for Synchronous Buck and Bridge Topologies (Low-Side and High-Side FET Drivers)							
LM5100A	100	9 to 14	3.0/3.0	Dual, independent	50	8	20/20
LM5100B	100	9 to 14	2.0/2.0	Dual, independent	50	8/8	20/20
LM5100C	100	9 to 14	1.0/1.0	Dual, independent	50	8/8	20/20
LM5101	100	7.5 to 14	1.8/1.6	Dual, independent	50	10/10[1]	25/25
LM5101A	100	9 to 14	3.0/3.0	Dual, independent	50	8	25/25
LM5101B	100	9 to 14	2.0/2.0	Dual, independent	50	8/8	25/25
LM5101C	100	9 to 14	1.0/1.0	Dual, independent	50	8/8	25/25
LM5102	100	7.5 to 14	1.8/1.6	Dual, independent	50	10/10[1]	35/35
LM5104	100	7.5 to 14	1.8/1.6	Single PWM	50	10/10[1]	35/35
LM5105	100	7.5 to 14	1.8/1.6	Single PWM	50	15	25/25
LM5106	100	7.5 to 14	1.8/1.2	Single PWM	50	22/15	26/26
LM5107	100	7.5 to 14	1.4/1.3	Dual, independent	50	15	28/28
LM5109B	90	7.5 to 14	1.0/1.0	Dual, independent	50	20	30/30

Part Number	Type	IC V_{CC} Range	Peak Gate Drive Sink/ Source Typ Current (A)	Input Type	Output Gate Driver Type[3]	Rise/Fall Time Typ (ns)[4]	Turn On/Turn Off Typ Propagation Delay Time (ns)
High-Current, Low-Side Gate Drivers for Low-Side FET Topologies (Such as Forward, Push-Pull)							
LM5110-1	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5110-2	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5110-3	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5111-1	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5111-2	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5111-3	Dual	3.5 to 14	5.0/3.0	Dual, independent	Compound	14/12	25/25
LM5112	Single	3.5 to 14	7.0/3.0	Inverting, non-inverting	Compound	14/12	25/25

[1] At 1 nF load.
[2] The ability to hold MOSFET gates off with a negative VGS voltage reduces losses when driving low threshold voltage MOSFETs.
[3] Compound output driver stages include MOS and bipolar transistors operating in parallel, leveraging the unique advantages of both, while reducing drive current variation with voltage and temperature.
[4] At 2 nF load.

WEBENCH Simulation	Temp Range (˚C)	Other Features/Comments	Packaging
—	40 to 125	>90% duty cycle, slope compensation; Programmable UVLO, LED backlighting (companion with LM3432)	LLP-12
✓	-40 to 125		MSOP-8
✓	-40 to 125		MSOP-8
—	-40 to 125	80% and 50% duty cycle limit (LM5020-1 and LM5020-2 respectively); programmable UVLO; slope compensation	MSOP-10, LLP-10
—	-40 to 125	80% and 50% duty cycle limit (LM5021-1 and LM5021-2 respectively); programmable UVLO; slope compensation	MSOP-8, MDIP-8
—	-40 to 125	<90% duty cycle, slope compensation, programmable UVLO	MSOP-10

	Gate Drivers (A)	V_{CC}	V_{REF}	FB Ref	Temp Range (˚C)	Other Features/Comments	Packaging
	1	7.7	—	1.25V + 2%	-40 to 125	80% and 50% duty cycle limit (LM5020-1 and LM5020-2 respectively)	MSOP-10, LLP-10
	0.7	8.5	—	—	-40 to 125	Low start-up current; cycle skipping; hiccup current limit	MSOP-8, MDIP-8
	3/1	7.6	5	—	-40 to 125	See datasheets for unique features of LM5025A, LM5025B	TSSOP-16, LLP-16
	3/1	7.6	5	—	-40 to 125	High bandwidth opto interface; programmable maximum duty cycle	TSSOP-16, LLP-16
	1.5	7.7	—	1.25V + 2%	-40 to 125	Slope compensation, direct opto-coupler interface	MSOP-10, LLP-10
	2.5	7.7	—	—	-40 to 125	Controls dual or single interleaved converter	TSSOP-16, LLP-16
	1.5	9.6	2.5	—	-40 to 125	Intermediate bus converter controller	MSOP-10, LLP-10
	2.5/0.25	7.7	—	—	-40 to 125	Controls dual or single interleaved converter	TSSOP-20
	2.0	7.7	5	—	-40 to 125	SyncFET driver, high bandwidth opto interface, thermal sensor/OVP comparator	TSSOP-20, LLP-24
	1.5	9	5	0.75V + 2%	-40 to 125	Programmable deadtime, overlap timing	TSSOP-16, LLP-16
	2.5	7	—	0.75V ± 1.7%	-40 to 125	Operates from ac or dc input	TSSOP-16, LLP-16
	2.5	7	—	0.75V ± 1.7%	-40 to 125	Operates from ac or dc input, power-up & power-down tracking	TSSOP-16
	2.5	7	—	0.75V ± 1.7%	-40 to 125	42V Version of LM5115	TSSOP-16, LLP-16
	2.5	7	—	0.75V ± 1.7%	-40 to 125	42V Version of LM5115A	TSSOP-16

UVLO	Low Gate Enable Pin	Chip Enable Pin	Internal Bootstrap Diode	Temp Range (˚C)	Other Features/Comments	Packaging
✓	—	—	✓	-40 to 125	CMOS input threshold, HIP2100 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	CMOS input threshold, HIP2100 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	CMOS input threshold, HIP2100 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	TTL input thresholds inputs	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	TTL input threshold, HIP2101 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	TTL input threshold, HIP2101 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	TTL input threshold, HIP2101 compatible	SOIC-8, LLP-10
✓	—	—	✓	-40 to 125	Independently programmable delay (rising edge)	MSOP-10, LLP-10
✓	—	—	✓	-40 to 125	Adaptive deadtime with additional programmable delay	SOIC-8, LLP-10
✓	—	✓	✓	-40 to 125	TTL input threshold, programmable dead time	LLP-10
✓	—	✓	—	-40 to 125	TTL input threshold, programmable dead time	MSOP-10, LLP-10
✓	—	—	✓	-40 to 125	TTL input threshold, ISL6700 compatible	SOIC-8, LLP-8
✓	—	✓	—	-40 to 125	TTL input threshold	SOIC-8, LLP-8

UVLO	Negative Drive Capability[2]	Enable Pin	Temp Range (˚C)	Other Features/Comments	Packaging
✓	✓	✓	-40 to 125	Non-inverting outputs	SOIC-8, LLP-10
✓	✓	✓	-40 to 125	Inverting outputs	SOIC-8, LLP-10
✓	✓	✓	-40 to 125	One inverting, one non-inverting output	SOIC-8, LLP-10
✓	—	—	-40 to 125	Non-inverting outputs	SOIC-8
✓	—	—	-40 to 125	Inverting outputs	SOIC-8
✓	—	—	-40 to 125	One inverting, one non-inverting output	SOIC-8
✓	✓	—	-40 to 125	Inverting and non-inverting input for the single driver	LLP-6

Low Dropout Linear Regulators (LDOs) – Positive Output

Output Current	Part Number	V_{OUT} 1.2	1.5	1.8	2.5	2.8	3.0	3.3	5.0	Adj	Other Available Voltages[9]	V_{IN} Min	Max	$V_{DROPOUT}$[6] (max)	V_{OUT} Tolerance[8] (%)
100 mA	LP5900	—	✓	✓	✓	✓	✓	✓	—	—	2, 2.2, 2.7	2.5	5.5	0.15	2
150 mA	LP3984	—	✓	✓	—	—	—	—	—	—	2.0, 2.9, 3.1	2.5	6	0.12F	2F
	LP3987	—	—	—	✓	✓	✓	—	—	—	2.6, 2.85	2.7	6	0.1F	3F
	LP3988	—	—	—	✓	—	✓	✓	—	—	1.85, 2.6, 2.85	2.5	6	0.15F	3.5F
	LP3990	✓	✓	✓	✓	✓	—	✓	—	—	0.8, 1.35	2.0	6	0.12 (typ)	4F
	LP3995	—	✓	✓	✓	✓	✓	✓	—	—	1.6, 1.9, 2.1	2.5	6	0.1F	5F
	LP3999	—	✓	✓	✓	✓	✓	✓	—	—	1.6, 1.7, 1.875, 1.9, 2.0, 2.1, 2.2, 2.4, 2.6	2.5	6	0.1F	5F
	LP5951	—	✓	✓	✓	✓	✓	✓	—	—	1.3, 2.0	1.8	5.5	0.2	3.5
	LM9076	—	—	—	—	—	—	✓	✓	—	3.3	2.1	52	0.4	2
250 mA	LP3997	—	—	—	—	—	—	✓	—	—	—	2	6	0.4	3F
300 mA New	LP3991	✓	✓	—	—	✓	—	—	—	—	1.3	1.65	3.6	300 mV	1
New	LP3996	—	✓	—	✓	✓	✓	✓	—	—	0.8, 1.5	2	6	210 mV	1.5
New	LP5952	—	✓	—	✓	✓	✓	✓	—	—	0.8, 1.5	—	—	—	1.5
New	LP5996	✓	✓	✓	—	—	—	—	—	—	0.7, 1.3, 1.4, 1.6, 2.0	0.7	4.5	130 mV	—
500 mA	LP38691	—	—	✓	✓	—	—	✓	✓	1.25 to 9		2.5	10	0.25	2
	LP38693	—	—	✓	✓	—	—	✓	✓	1.25 to 9		2.5	10	0.25	2
800 mA	LP3871	—	—	✓	✓	—	—	✓	✓	—	—	2.5	7	0.3	1.5
	LP3874	✓[1]	—	✓	✓	—	—	✓	✓	1.215 to 5	—	2.5	7	0.3	1.5
	LP3878	—	—	—	—	—	—	—	—	1.0 to 5.5	—	2.5	16	0.475	1
	LP3879	✓	—	—	—	—	—	—	—	—	—	2.5	6	—	1.0 or 1.2
	LP3881	✓	✓	✓	—	—	—	—	—	—	—	1.3[2]	5.5	0.12	1.5
	LP3891	✓	✓	✓	—	—	—	—	—	—	—	1.6[2]	5.5	0.3	1.5
	LP38841	✓	✓	—	—	—	—	—	—	0.56 to 1.5	0.8V	1.05	5.5	0.075	1.5

Low Dropout Linear Regulators (LDOs) – Positive Output (continued)

Output Current	Part Number	V_{OUT} 0.8	1.2	1.5	1.8	2.5	2.8	3.0	3.3	5.0	Adj	Other Available Voltages[9]	V_{IN} Min	Max	$V_{DROPOUT}$[6] (Max)
800 mA New	LP38851	—	—	—	—	—	—	—	—	—	0.8 to 1.8	—	3.0	5.5	0.24 (typ.)
New	LP38854	✓	✓	—	—	—	—	—	—	—	—	—	3.0	5.5	0.24 (typ.)
New	LP38857	✓	✓	—	—	—	—	—	—	—	—	—	3.0	5.5	0.24 (typ.)
1A	LP38690	—	—	—	✓	✓	—	—	✓	✓	1.25 to 9	—	2.5	10	0.45
	LP38692	—	—	—	✓	✓	—	—	✓	✓	1.25 to 9	—	2.5	10	0.45
1.5A	LP3852	—	—	—	✓	—	—	✓	✓		—	—	2.5	7	0.28
	LP3855	—	✓[1]	—	✓	✓	—	—	✓	✓	1.215 to 5	—	2.5	7	0.28
	LP3872	—	—	—	✓	✓	—	—	✓	✓	—	—	2.5	7	0.45
	LP3875	—	✓[1]	—	✓	✓	—	—	✓	✓	1.215 to 5	—	2.5	7	0.45
	LP3882	—	✓	✓	✓	—	—	—	—	—	—	—	1.5[2]	5.5	0.17
	LP3892	—	✓	✓	✓	—	—	—	—	—	—	—	1.7[2]	5.5	0.32
	LP38842	—	✓	✓	—	—	—	—	—	—	0.56 to 1.5V	0.8	1.12	5.5	0.115
New	LP38852	—	—	—	—	—	—	—	—	—	0.8 to 1.8	—	3.0	5.5	0.18
New	LP38855	✓	✓	—	—	—	—	—	—	—	—	—	3.0	5.5	0.18
New	LP38858	✓	✓	—	—	—	—	—	—	—	—	—	3.0	5.5	0.18
3A	LP3853	—	—	—	✓	✓	—	—	✓	✓	—	—	2.5	7	0.45
	LP3856	—	✓[1]	—	✓	✓	—	—	✓	✓	1.215 to 5	—	2.5	7	0.45
	LP3873	—	—	—	✓	✓	—	—	✓	✓	—	—	2.5	7	1.0
	LP3876	—	✓[1]	—	✓	✓	—	—	✓	✓	1.215 to 5	—	2.5	7	1.0
	LP3883	—	✓	✓	✓	—	—	—	—	—	—	—	1.6[2]	5.5	0.27
	LP3893	—	✓	✓	✓	—	—	—	—	—	—	—	2.2[2]	5.5	0.65
	LP38843	—	✓	✓	—	—	—	—	—	—	—	0.8	1.3	5.5	0.21
New	LP38853	—	—	—	—	—	—	—	—	—	0.8 to 1.8	—	3	5.5	0.45
New	LP38856	✓	✓	—	—	—	—	—	—	—	—	—	3	5.5	0.45
New	LP38859	✓	✓	—	—	—	—	—	—	—	—	—	3	5.5	0.45

[1] Use Adj version for 1.21V fixed output
[2] Dual-rail, V_{BIAS} supply = 4.5V to 6V
[3] F denotes value for full temp range and T denotes typical value, otherwise values are maximum at 25°C (typically quiescent current is given for minimum load)
[4] Quasi LDO
[5] Those regulators not originally designed to be used with ceramic output caps can still be stable using ceramic capacitors if C_{OUT} is connected in series with a small resistor to simulate the needed ESR

I_q max[3] (mA)	SS	Error Flag	POR	Ceramic Caps Stable[5]	Temp Range	Other Features/ Comments	Packaging
0.05	✓	—	—	✓	Ind	No bypass capacitor. 6.5 μV_{RMS}, 75 dB PSRR at 1 kHz, $C_{IN} = C_{OUT} = 0.47\ \mu F$	micro SMD-4, LLP-6
0.125F	✓	—	—	—	Ind	Low noise, tantalum output capacitor	micro SMD-4, SOT23-5, D, W
0.12F	✓	—	—	✓	Ind	Sleep mode control	micro SMD-5
0.12F	✓	✓	—	✓	Ind	Power-good flag output	micro SMD-5, SOT23-5, D, W
0.08	✓	—	—	✓	Ind	Supports 1 µF C_{OUT}	micro SMD-4, SOT23-5, LLP-6
0.15F	✓	—	—	✓	Ind	Low noise, fast turn-on time, optimal for analog and RF loads	micro SMD-5, LLP-6
0.15F	✓	—	—	✓	Ind	Active shutdown; low noise, fast turn-on, optimal for A and RF	micro SMD-5
0.29	—	—	—	✓	Ind	Micropower	SOT23-5
0.025	✓	✓	✓	—	Ind	Reverse polarity protection of -15V, transient protection of +60V	TO263-5, MSOP-8
0.1F	✓	✓	✓	✓	Ind	Delay pin to set POR delay time using a capacitor	MSOP-8
120 µA	—	—	—	✓	-40 to 125	Low V_{IN}	mirco SMD-4
35 µA	—	—	✓	✓	-40 to 125	Dual output	LLP-10
35 µA	—	—	—	✓	-40 to 125	Dual output	LLP-10
11 µA	—	—	—	✓	-40 to 125	Low V_{IN}	micro SMD-5
0.100F	—	—	—	✓	Ind	Stable with 1 µF ceramic capacitors, Low I_q	TO252-3, LLP-6
0.100F	✓	—	—	✓	Ind	Stable with 1 µF ceramic capacitors, Low I_q	SOT223-5, LLP-6
9	✓	✓	—	—	Ind		SOT223-5, TO263-5, TO220-5
9	✓	—	—	—	Ind	Sense pin	SOT223-5, TO263-5, TO220-5
5.5	✓	—	—	✓	Ind	Low noise	PSOP-8, LLP-8
15	✓	—	—	—	-40 to 85	Sub-bandgap	PSOP-8, LLP-8
7	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
7	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO220-5, TO263-5
30	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5, PSOP-8

V_{OUT} Tolerance[8] (%)	I_q max[3] (mA)	SS	SD	Error Flag	POR	Ceramic Caps Stable[5]	Temp Range	Other Features/ Comments	Packaging
3	8 (typ.)	✓	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5, PSOP-8
3	8 (typ.)	—	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
3	8 (typ.)	✓	—	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
2.50	0.100F	—	—	—	—	✓	Ind	Stable with 1 µF ceramic capacitors, Low I_q	TO252-3, LLP-6
2.50	0.100F	—	✓	—	—	✓	Ind	Stable with 1 µF ceramic capacitors, Low I_q	SOT223-5, LLP-6
1.5	9	—	✓	✓	—	✓	Ind		SOT223-5, TO263-5, TO220-5
1.5	9	—	✓	—	—	✓	Ind	Sense pin	SOT223-5, TO263-5, TO220-5
1.5	9	—	✓	✓	—	—	Ind		SOT223-5, TO263-5, TO220-5
1.5	9	—	✓	—	—	—	Ind	Sense pin	SOT223-5, TO263-5, TO220-5
1.5	7	—	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO220-5, TO263-5
1.5	7	—	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO220-5, TO263-5
1.5	30	—	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5, PSOP-8
3	14	✓	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5, PSOP-8
3	14	—	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
3	14	✓	—	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
1.5	9	—	✓	✓	—	✓	Ind		TO220-5, TO263-5
1.5	9	—	✓	—	—	✓	Ind	Sense pin	TO220-5, TO263-5
1.5	9	—	✓	✓	—	—	Ind		TO220-5, TO263-5
1.5	9	—	✓	—	—	—	Ind	Sense pin	TO220-5, TO263-5
1.5	7	—	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO220-5, TO263-5
1.5	7	—	✓	—	—	—	Ind	Ideal for low V_{IN} conversion	TO220-5, TO263-5
1.5	30	—	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion, shutdown current 30 nA	TO263-5, TO220-5
3	14	✓	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5,PSOP-8
3	14	—	✓	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5
3	14	✓	—	—	—	✓	Ind	Ideal for low V_{IN} conversion	TO263-5, TO220-5

[6] Dropout voltage is given for full load. F denotes value for full temperature range, and T denotes typical value; otherwise values are maximum at 25°C

[7] Denotes products with fixed output voltages that also provide adjustment control of the output voltage

[8] F denotes value for full temp range

[9] Please contact National for additional voltage options

Dual and Multiple LDO Devices

Part Number	Type	I_{OUT} (mA)	V_{OUT} Accuracy[1]	Available Voltages[2]	$V_{DROPOUT}$[3] (Max)	V_{IN}		I_q max[4] (mA)	SD Control	Error Flag	POR	Ceramic Caps Stable[5]	Temp Range (˚C)	Other Features/ Comments	Packag-ing
						Min	Max								
LP2966	Dual	150, 150	1%	1.8/1.8, 1.8/3.0, 1.8/3.3, 2.5/2.5, 2.8/2.8, 2.8/3.0, 3.0/3.0, 3.3/2.5, 3.3/3.3, 3.3/3.6, 3.6/3.6, 5.0/5.0	0.19	2.7	7	0.45	✓	✓	—	—	-40 to 125		MSOP-8
LP2967	Dual	150, 150	1%	1.8/2.5, 1.8/3.3, 2.5/2.8, 2.5/3.3, 2.6/2.6, 2.8/2.8, 2.8/3.3	0.22	2.1	16	0.34	✓	—	—	✓	-40 to 125	Low noise	MSOP-8, micro SMD-8, D, W
LP3986	Dual	150, 150	3%F	1.8/2.5, 1.8/2.8, 2.5/2.5, 2.5/2.8, 2.6/2.6, 2.8/2.8, 2.85/2.85, 2.9/2.9, 3.0/2.8, 3.0/3.0, 3.1/3.1, 3.1/3.3, 3.3/3.3	0.1F	2.7	6	0.2F	✓	—	—	✓	-40 to 125		micro SMD-8
LM2984/ 84C	Triple	500, 100, 7.5	3%F	5.0 (3x)	0.8	—	26	50	✓	✓	✓	—	-40 to 125	µP Watchdog and supervisor. Reverse voltage and transient protection. Ideal for automotive use.	TO220-11

[1] F denotes value for full temp range
[2] Please contact National for additional voltage options
[3] Dropout voltage is given for full load. F denotes value for full temperature range, and T denotes typical value; otherwise values are maximum at 25˚C
[4] F denotes value for full temp range and T denotes typical value, otherwise values are maximum at 25˚C (typically quiescent current is given for minimum load)
[5] Those regulators not originally designed to be used with ceramic output caps can still be stable using ceramic capacitors if COUT is connected in series with a small resistor to simulate the needed ESR

Supervisory, Protection and Auxiliary Power Management ICs

Voltage References[1]

Part Number	Type	Voltages (V)	Accuracy (%)	TEMPCO (ppm/°C)	$V_{DROPOUT}$	I_Q/I_{OUT} Current	Packaging
LM4120	Series	1.8, 2.048, 2.5, 3.0, 3.3, 4.096, 5	0.2, 0.5	50	210 mV at 5 mA	250 µA/±5 mA	SOT23-5, D, W
LM4125	Series	2.0, 2.5, 4.1	0.2, 0.5	50	120 mV at 1 mA	160 µA/5 mA	SOT23-5
New LM4128	Series	1.8, 2.048, 2.5, 3.0, 3.3, 4.096	0.1, 0.2, 0.5, 1.0	75, 100	400 mV at 10 mA	100 µA/10 mA	SOT23-5
New LM4132	Series	1.8, 2.048, 2.5, 3.0, 3.3, 4.096	0.05, 0.1, 0.2, 0.4, 0.5	10, 20, 30	400 mV at 10 mA	100 µA/20 mA	SOT23-5
LM4140	Series	0.5[2], 0.6[2], 0.7[2], 0.75[2], 0.8[2], 0.9[2], 1.0, 1.25, 2.0, 2.5, 4.1, 4.5[2]	0.1	3, 6, 10	160 mV at 8 mA	230 µA/8 mA	SOIC-8

[1] For an extensive list of voltage reference parts, please visit our website at power.national.com
[2] These and other voltages available upon request. Contact your National sales office for more information.

Power Supply Supervisory ICs

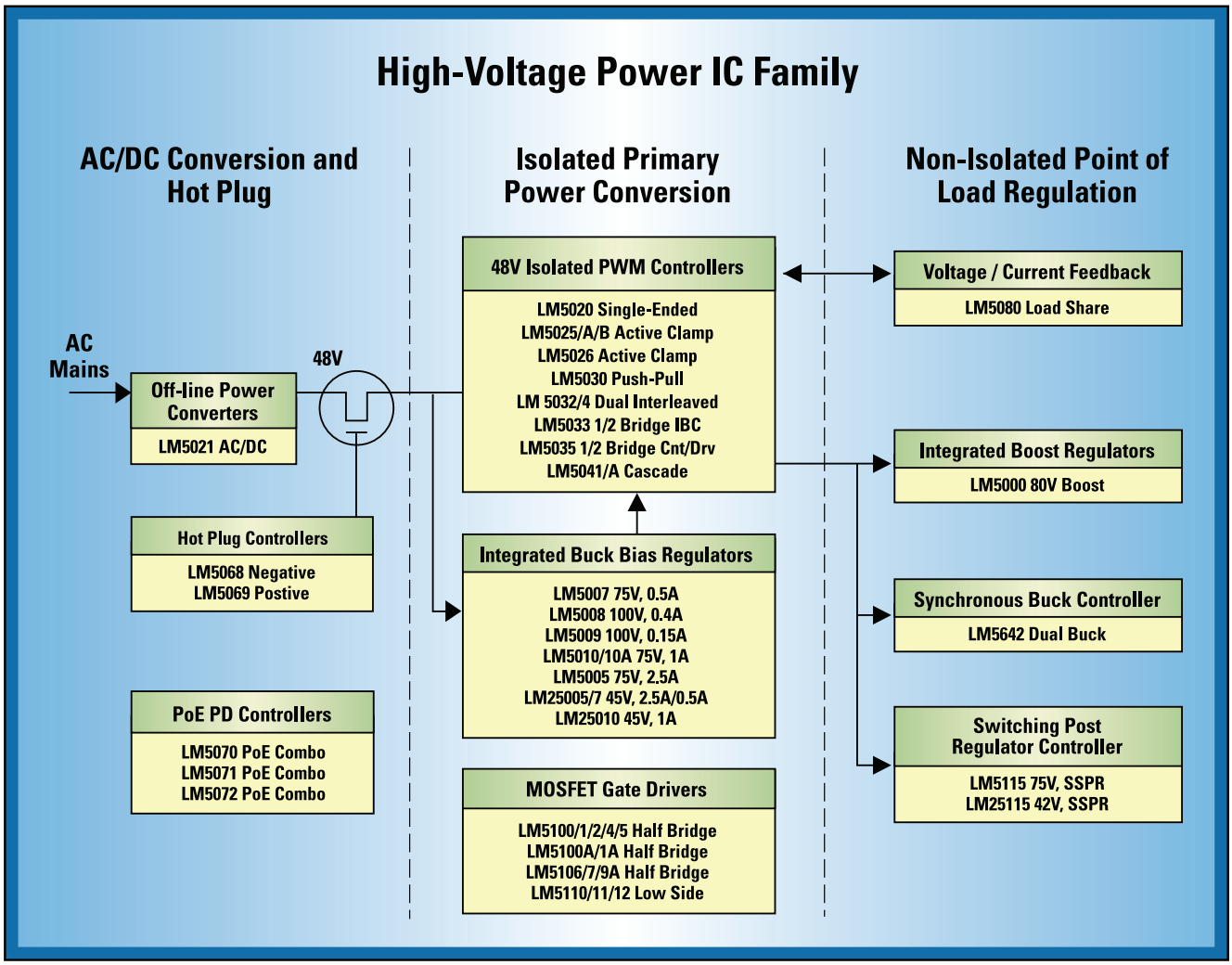
Part Number	Reset timeout Period Customer-Specified	Watchdog Timeout Period Customer-Specified	Separate Watchdog Output	Manual Reset	Power Fall Comparator	Low Line Output	Output Type	Package
LM3700[1,2]	Yes					✓	Push Pull -L/H	micro SMD-9
LM3702[1,2]	Yes			✓		✓	Push Pull -L/H	micro SMD-9
LM3706/07[1,2]	Yes	Yes				✓	Push Pull -L/H	micro SMD-9
LM3708/09[1,2]	Yes	Yes		✓		✓	Push Pull -L/H	micro SMD-9
LM3710/11[1,2]	Yes	Yes		✓	✓	✓	Push Pull -L/H	micro SMD-9, MSOP-10
LM3712/13[1,2]	Yes	Yes	✓	✓	✓	✓	Push Pull -L/H	micro SMD-9
LM3722[1,3]	No			✓	✓		Push Pull -L	SOT23-5
LM3723[1,3]	No			✓	✓		Push Pull -H	SOT23-5
LM3724[1,3]	No			✓	✓		Open Drain	SOT23-5

[1] a. Reset Assertion Down to 1V Vcc
b. Customer Reset Threshold Voltages: For Other Voltages Between 2.2V and 5.0V in 10 mV Increments, Contact National Semiconductor Corporation
[2] a. ±0.5% Reset Accuracy
b. Standard Reset Threshold Voltage: 3.08V
[3] Standard Reset Threshold Voltage: 4.63V, 3.08V and 2.32V
[4] Standard Reset Threshold Voltage: 2.83/2.93-3.08/4.0/4.38/4.63V
[5] PCI Local Bus Power Supervisor (5V and 3.3V)
[6] Standard Reset Threshold Voltage: Factory Programmable 2.4V to 5V

Sequencers

Product ID	Timing Options (ms)	# of Regulators Able to Sequence	Input Min Voltage	Input Max Voltage	Power-Up	Power-Down	Enable	Other Features/Comments	Package
New LM3880	10, 30, 60, 120	3	2.7	5.5	Y	Y	Yes	Custom timing options available along with customer power-down sequences	SOT23-5

Power Management for Industrial and Telecom Applications



Load Share Controllers

Part Number	V_{CC} Range	Share Methods				Temp Range (°C)	Packaging
		Remote Sense –	Remote Sense +	Trim	Feedback		
LM5080	3 to 14	✓	✓	✓	✓	-40 to 125	MSOP-8

Hot-Swap Solutions

Telecom Hot-Swap Controllers

Part Number	V_{IN} Range	Fault Latch/ Retry	PG	Current Limit Methods			UV	OV	Temp Range (°C)	Packaging
				In-Rush Current	Active Limiting	Fast Comparator				
LM5068-1	-10 to -90	Latch-off	Active high	Active/SS	✓	✓	✓	✓	-40 to 105	MSOP-8
LM5068-2	-10 to -90	Auto-retry	Active high	Active/SS	✓	✓	✓	✓	-40 to 105	MSOP-8
LM5068-3	-10 to -90	Latch-off	Active low	Active/SS	✓	✓	✓	✓	-40 to 105	MSOP-8
LM5068-4	-10 to -90	Auto-retry	Active low	Active/SS	✓	✓	✓	✓	-40 to 105	MSOP-8

High Power LED Drivers

Part Number	Input Voltage Range (V)	Output Voltage (V)	Total LED Current (mA)	Number of LEDs in Series	Switching Frequency (KHz)	Topology	PWM Dimming	Key Features	Package
New! LM3402/02HV	6 to 42 / 6 to 75	Adjustable	525	1 to 9/15	Adjustable up to 1 MHz	Buck	Yes	200 mV feedback voltage. Fast PWM dimming	MSOP-8
New! LM3404/04HV*	6 to 42 / 6 to 75	Adjustable	1000	1 to 9/15	Adjustable up to 1 MHz	Buck	Yes	200 mV feedback voltage. Fast PWM dimming	SOIC-8
New! LM3405	min 4/max 22	Adjustable	1A	1 to 4	550/1600	Buck	Yes	200 mV Feedback, Fast PWM dimming, External compensation, Thin package	SOT23-6, MSOP-8

*Preliminary information

Power-over-Ethernet (PoE) Solutions

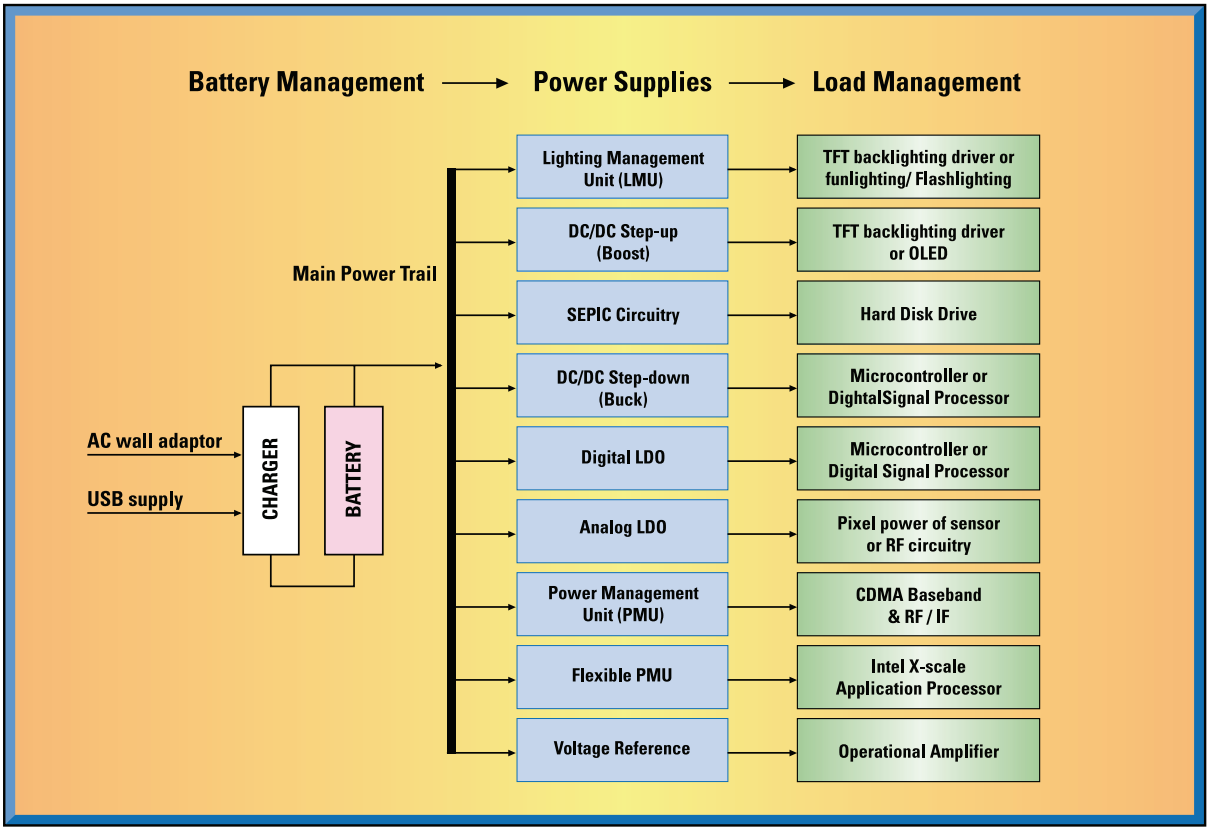
Part Number	Description	V_{IN} Range	F_{SW}	Typ Current Draw w/AUX Winding (µA)	Reference Accuracy (%)	Reference Designs and Eval Boards	Other Features/Comments	Temp Range (°C)	Packaging
LM5070	Integrated PoE single-chip solution: PD interface and DC-DC converter	1.5 to 75*	50 kHz to 1 MHz	700	±2.0	Two available: highest efficiency and simplest implementation	Includes all LM5020 features plus an 80V, 400 mA line connection switch and associated control and sequencing for a fully IEEE 802.3af compliant PD interface	-40 to 125	TSSOP-16, LLP-16
LM5071	Integrated PoE single-chip solution: PD interface and DC-DC converter	1.5 to 75*	50 kHz to 1 MHz	700	±2.0	Two available: single and dual outputs	All features of the LM5070 plus auxiliary power interface	-40 to 125	TSSOP-16
New! LM5072	Integrated PoE single-chip solution: PD interface and DC-DC converter	1.5 to 70	50 kHz to 1 MHz	700	±2.0	One available: single	All features of the LM5071 but 2x power level of 802.3af compliant PD device	-40 to 125	eTSSOP-16
New! LM5073	Power Over Ethernet PD Interface with Aux Support	1.5 to 70	—	—	—	One available	Line Over Voltage Protection 100V, 0.6 ohm Hot Swap MOSFET Complementary Open Drain Outputs for controlling a DC/DC converter	-40 to 125	eTSSOP-14

* 1.5V to 12V = the part is in signature mode 12V to 22V = the part is in classification mode >22V = the DC-DC converter is operational (UVLO release)

Industrial and Telecom High-Voltage (80V/100V) Solutions

Part Number	Description	Eval Board	WEBENCH Enabled
Integrated Switching Regulators			
LM5000	Wide 3.1V to 40V input, 2A switch PWM boost or flyback	✓	✓
LM5005	Ultra-wide input voltage range 2.5A buck regulator	✓	✓
LM5007	9V to 75V input, 500 mA step-down with fast transient response	✓	✓
LM5008	9V to 100V input, 350 mA step-down with fast transient response	✓	✓
New! LM5009	150 mA, 100V step-down switching regulator	✓	✓
LM5010A	6V to 75V input, 1A step-down with fast transient response	✓	✓
Switching Regulator PWM Controllers			
LM5020	Single-ended 100V current-mode controller	✓	—
LM5021	AC-DC current mode PWM controller	✓	✓
LM5025/A/B	Active-clamp voltage-mode 100V controller with feed-forward and 3A gate driver	✓	—
LM5026	Active-clamp current-mode 100V controller with 3A gate driver	✓	—
LM5030	100V Push-pull current-mode PWM controller with synchronization	✓	—
LM5032	High voltage dual interleaved current mode controller	—	—
LM5033	100V Push-pull voltage-mode IBC PWM controller with synchronization	✓	—
LM5034	High voltage dual interleaved current mode controller with active clamp	✓	—
LM5035	PWM controller with integrated half-bridge and syncFET drivers	✓	—
LM5041/A	100V input cascaded PWM controller	✓	—
LM5115	Secondary side post regulator controller	✓	—
New! LM25115	Secondary side post regulator controller	—	—
MOSFET Drivers			
LM5100/1/2/4	Dual FET drivers for 100V synchronous buck and bridge topologies	—	—
LM5105/07/09	100V Half-bridge power MOSFET drivers	—	—
LM5106	100V Half-bridge gate driver with programmable dead-time	—	—
LM5110/11/12	Single and dual high-current drivers	✓	—
Hot-Swap Controller			
LM5068	-48V Hot-swap controller with latched fault and auto-retry options	✓	—
New! LM5069	Positive high voltage hot-swap cortroller with latched fault and auto-retry options	—	—
Load Share Controller			
LM5080	Modular current-sharing controller	—	—

Power Management for Portable Applications



DDR Memory Solutions – Memory Supply Plus Memory Termination

Memory Supply (V_{DD}/V_{DDQ}) Regulators

Part Number	V_{IN} Range (P_{VIN})	I_{OUT} (A)	V_{OUT} (Min)	F_{SW}	IC V_{CC}	SD	Lossless I_{SENSE}	PG	Temp Range (°C)	Other Features/ Comments	Packaging
LM2727	2.2 to 16	0.5 to 20 cont.	0.6	50 kHz to 2 MHz	4.5 to 5.5	✓	✓	✓	-40 to 125	Suspend to disk shutdown; UVP and OVP latch-off	TSSOP-14
LM2737	2.2 to 16	0.5 to 20 cont.	0.6	50 kHz to 2 MHz	4.5 to 5.5	✓	✓	✓	-40 to 125	Suspend to disk shutdown	TSSOP-14
LM2745	1 to 14	0.5 to 20 cont.	0.6	50 kHz to 1 MHz	3.0 to 6.0	✓	✓	✓	-40 to 125	Monotonic start-up, synchronization	TSSOP-14
LM27241	5.5 to 28	0.5 to 20 cont.	0.6	200 kHz to 500 kHz	4.5 to 5.5	✓	✓	✓	-5 to 125	Pulse-skip mode for high light load efficiency	TSSOP-20

Memory Termination (V_{TT}) and Reference (V_{REF}) Regulators

Part Number	V_{IN} Range (P_{VIN})	Sink/Source (A)	Standards	F_{SW}	External Components	Split Rails*	SD	V_{REF} Out	Thermal Protection	Temp Range (°C)	Other Features/ Comments	Packaging
Linear												
LP2995	2.2 to 5.5	3 peak, 1.5 cont.	DDR	—	3	—	—	✓	—	0 to 125		SOIC-8, LLP-16, PSOP-8
LP2996	1.5 to 5.5	3 peak, 1.5 cont.	DDR and DDR-II	—	3	✓	✓	✓	✓	0 to 125	Suspend to RAM shutdown	SOIC-8, LLP-16, PSOP-8
LP2997	1.5 to 5.5	1.5 peak, 0.5 cont.	DDR-II	—	3	✓	✓	✓	✓	0 to 125	Suspend to RAM shutdown	SOIC-8, PSOP-8
Switching												
LM2744	1 to 16	0.5 to 25 cont.	DDR and DDR-II	50 kHz to 2 MHz	✓	✓	✓	—	—	-40 to 125	Suspend to RAM shutdown, low 4 mV offset	TSSOP-14

*Independent power and analog rails

Integrated Power Management Units (PMUs)

Part Number	Description/ Key Functions	Output Voltage Range (V)	I_{OUT} (mA)	Output Accuracy	$V_{DROPOUT}$	Temp Range (˚C)	Packaging
New LM3370	Dual 600 mA buck I²C programmable	Stepdown 1: 1V to 2V; Stepdown 2: 2.3V to 3.3V	600	3%	—	-30 to 125	LLP-16
New LP3905	Dual 600 mA buck, dual LDO	1 to 3.3	600	3%	80 mV	-40 to 125	LLP-14
New LP3906	Dual 1.5A buck, dual 300 mA LDO I²C programmable	Stepdown 1: 0.8V to 2V; Stepdown 2: 1V to 3.5V LDOs: 1V to 3.5V Buck 2: 1V to 3.5V	1500 (Stepdown) 300 mA (LDO)	3%	25 mV typ @ 50 mA	-40 to 125	LLP-24
New LP3910	Power management IC for hard driver based portable media player	DC/DC Buck: 0.8 to 3.3 DC/DC Buck/Boost: 1.8 to 3.3 LDO: 1.2 to 3.3	LDO: 150 mA, Buck 600 mA, Buck/Boost 1000 mA	3%	100 mV @ 150 mA	-40 to 125	LLP-48
New LP3913	Power management IC for Flash based portable media player	LDO: 1.2 to 3.3 DC/DC Buck: 0.8 to 3.3	LDO: 150 mA, Buck 1,2: 600 mA, Buck 3: 500 mA	3%	100 mV @ 150 mA	-40 to 125	LLP-48
New LP3917	CDMA PMU with 2 inductive bucks, 9 LDOs, 2 comparators, 1 high speed serial interface and USB transceiver	LDO: 1.5 to 3.3 Stepdown: 1.0 to 2.5V, Ext Res Adj Stepdown 2: 1.8V fixed	1 at 80, 5 at 150, 3 at 300 LDO 800, 600 Stepdown	3%	170 mV (typ)	-40 to 125	micro SMD xt-49
LP3941A	Charger with battery backup, 11x linear regulators, I²C-compatible interface, 2x comparators, 3x LED drivers and control, charging, and communications	1.5 to 3.3	50 to 200	2% Typ	150 mV at full load	-40 to 125	LLP-48
New LP3955	CDMA PMU with linear battery charger, 1 inductive buck, 8 LDOs and USB transceiver	LDO: 1.5 to 3.1 (programmable) Stepdown: Ext Res Adj	1 at 80, 5 at 150, 2 at 300 LDO 600 Stepdown	3% Buck, 2% LDO, 1% Charger	200 mV	-40 to 125	LLP-40
New LP3971	Power management unit for application processors, 3 buck with Dynamic Voltage Management (DVM), 6 LDOs, back up battery charger, 2 GPIOs, and I²C-compatible interface	LDOs: 1.0 to 3.3 Stepdowns: 0.8 to 3.3V	150, 300, 400 (LDO) 1500 (Stepdown)	3%	250 mV	-40 to 125	LLP-40
New LP3972	Power management unit for application processors, 3 buck with Dynamic Voltage Management (DVM), 6 LDO, back up battery charger, 2 GPIO, and enhanced I²C interface	LDO: 0.85 to 3.3 DC/DC Buck: 0.725 to 3.3	150 mA, 300 mA, 400 mA (LDO); 1500 mA (DC/DC Buck)	3%	375 mV @ 10 mA	-40 to 125	LLP-40
LP5550	PowerWise® PMU, 1 buck, 3 LDOs	LDO1: 0.7 to 2.2, LDO2: 1.5 to 3.3 LDO3: 0.6 to 1.35 Stepdown 1: 0.6 to 1.2V	50, 100, 250 (LDO) 300 (Stepdown)	3%	260 mV	-40 to 125	LLP-16
New LP5551	PowerWise™ Technology Compliant Energy Management Unit	LDO: 0.6 to 3.3 DC/DC Buck: 0.6 to 1.2	LDO: 50 to 250 mA, DC/DC Buck: 300 mA	3%	65 mV @ 125 mA	-40 to 125	LLP-36

Lighting Management Unit (LMUs)

Part Number	Description	Input Voltage Range (V)	Drive Current for All	Current for Flash Mode	Current Matching	Key Functions	Package
LM4970	Audio Synchronized Color LED Driver	2.7-5.5	42 mA	NA	NA	Audio Synchronized	LLP-14
LP3931	LMU for Controlling 2 Sets of RGB LED Drivers	2.65-2.9	NA	6 Outputs, Each Up to 120 mA	NA	A Flash Function for Photo Taken in Camera-enabled Cell Phone	LLP-24
LP3933	LMU for Controlling 4+2 x White LEDs and 2 x RGB Fun-light LEDs	2.65-2.9	Max. White-LED Current - 25 mA Per LED Output	6 RGB-outputs, Each up to 75 mA	White LED 2%, RGB with External Ballast	Boost Switching Regulator, 6x White LEDs, 2x RGB, SPI Interface	CSP-32
LP3936	LMU for Controlling 4+2 x White LEDs and 1x RGB Fun-light LEDs	3-6	Max. White-LED Current - 25 mA Per LED Output	3 RGB-outputs, Each Up to 75 mA	White LED 2%, RGB with External Ballast	Boost Switching Regulator, 6x White LEDs, 1x RGB, Ambient Light Sensor with Averaging, 1²C/Microwire/SPI Interface	CSP-32
LP3950	LMU with Audio Synchronization for 2 Sets of RBG Drivers	2.7-2.9	300 mA	300 mA	NA	Synchronize to Audio Inputs with Programmable Pattern to Drive RGB	CSP-32
LP3954	Advanced LMU for Main and Sub-display, Funlighting, Flashlighting and Audio Synchronization	3-5.5	700 mA	300 mA	NA	Advanced LMU for Dual Display Portable Electronics	micro SMD-36 (3 mm x 3 mm x 0.6 mm)
New LP3958	LMU with High Voltage Boost Converter for Serial Main & Sub-display Backlight and Keypad LEDs	3.3-5.0	70 mA	NA	NA	All-in-one for Dual Display Devices with Keypads	micro SMD-25 (2.54 mm x 2.54 mm x 0.6 mm)
New LP5526	LMU with High Voltage Boost Converter and Serial Flash LED Driver (Up to 150 mA)	3.3-5.0	150 mA	150 mA	NA	Dedicated Flash Function	micro SMD-25 (2.54 mm x 2.54 mm x 0.6 mm)
New LP5527	LMU for camera flash and 4 LEDs with I²C programmability	3.0-5.5	Up to 1A	400 mA	1%	LED connectivity test, audio synchronization	micro SMD-30

White-LED Drivers – Inductive

Part Number	V_{IN} Range	Number of LEDs	V_{OUT} (Max)	Sw Peak Current (Typ)	F_{SW}	Ambient Temp Range (°C)	Comments	Packaging
LM2731	2.7 to 14	More than 10	Adj (up to 20)	1.5A	600 kHz/1.6 MHz	-40 to 125[1]		SOT23-5
LM2733	2.7 to 14	More than 10	Adj (up to 40)	1A	600 kHz/1.6 MHz	-40 to 125[1]		SOT23-5
LM3224	2.7 to 7.0	1	20	2.45A	615 kHz/1.25 MHz	-40 to 125[1]	Flat panel display power, high current LED driver	MSOP-8
LM3500	2.7 to 7.0	Up to 5	16, 21	400, 670 mA	1 MHz	-40 to 85		micro SMD-8
LM3501	2.7 to 7.0	Up to 5	16, 21	400, 670 mA	1 MHz	-40 to 85	Analog input dimming	micro SMD-8
LM3502	2.5 to 5.5	Up to 10	16, 25, 35, 44	400, 600, 750 mA	1 MHz	-40 to 85	Dual display control	micro SMD-10, LLP-16
LM3503	2.5 to 5.5	Up to 10	16, 25, 35, 44	400, 600, 750 mA	1 MHz	-40 to 85	Dual display control, analog dimming	micro SMD-10, LLP-16
LM3519	2.7 to 5.5	Up to 4	18.9	750 mA	2 MHz to 8 MHz	-40 to 85	Up to 30 kHz PWM dimming control	SOT23-6
LM3520	2.7 to 5.5	1 String and 1 OLED	22.2	700 mA	1 MHz	-40 to 85	4 to 5 LEDs plus OLED subdisplay	LLP-14
LM3551	2.7 to 5.5	1 to 4	11	2.1A	1.25 MHz	-40 to 85	Flash LED driver, timeout protection, active low enable	LLP-14
LM3552	2.7 to 5.5	1 to 4	11	2.1A	1.25 MHz	-40 to 85	Flash LED driver, timeout protection, active high enable	LLP-14
LM3557	2.7 to 7.5	Up to 5	22	0.8A	1.25 MHz	-40 to 85	5-LED string	LLP-8

[1] Junction temperature

White-LED Drivers – Inductorless

Part Number	V_{IN} Min	V_{IN} Max	Number of Individual Outputs	Typ I_{LED} (mA)	Typ F_{SW} (kHz)	EN Pin	I_{LED} Adj	PWM Brightness Control	Analog Brightness Control	Ambient Temp Range	Other Features/ Comments	Packaging
LM2750	2.7	5.6	1	120	1700	✓	—	✓[1]	—	-40 to 85	Constant voltage source for multi-LEDs in parallel; low noise	LLP-10, D, W
LM2751	2.8	5.5	1 Voltage regulated	80, 150	9.5, 37, 300, 725	✓	—	—	✓	-40 to 85	1.5 x and x 2 gains	LLP-10
LM2753	3.0	5.5	1 Voltage regulated	250	725	✓	✓	—	✓	-40 to 85	Flash LED driver, 250 mA continuous load, 400 mA pulsed load	LLP-10
LM27951	3.0	5.5	4 Current regulated	30	750	✓	✓	—	—	-40 to 85	Common cathode current source topology, 0.2% LED current matching	LLP-14
LM27952	3.0	5.5	4 Current regulated	30	750	✓	✓	—	✓	-40 to 85	Common anode current sink topology, 0.2% LED current matching	LLP-14
New LM27965	2.7	5.5	9	20	1270	—	✓	No But I²C	—	-30 to 85	Dual display whit LED Driver with I²C compatible interface	LLP-24
New LM27966	2.7	5.5	6	20	20	—	✓	No But I²C	—	-30 to 85	White LED driver with I²C compatible interface	LLP-24
LM3570	2.7	5.5	4	20	500	✓	✓	✓	—	-40 to 85	3 constant current outputs plus regulated constant voltage output (4.35V) for driving additional LEDs	LLP-14
LM3590	6.0	12.6	1[2]	20	—	✓	✓	✓[1]	—	-40 to 85		SOT23-5
LM3595	3.0	5.5	4	25	—	✓	✓	—	✓	-40 to 85		LLP-10

[1] Through the EN pin
[2] Supports up to 3 white LEDs connected in series

TFT-LCD Power Solutions for Notebook PCs, Monitors and Television

Part Number	V_{IN} Range	V_{OUT} (Max)	Boost Switch Peak Current (A)	F_{SW}	SS	Integrated Features	Temp Range (°C)	Packaging
LM2622	2.0 to 12	17.5	1.65	600 kHz, 1.3 MHz	—	—	-40 to 125	MSOP-8
LM2700	2.2 to 12	17.5	3.6	600 kHz, 1.25 MHz	—	—	-40 to 125	TSSOP-14, LLP-14
LM2716	4.0 to 20	3.3, 20	Fixed buck: 1.2A, Adj boost: 3.6A	300 to 600 kHz	✓	3.3V Output fixed buck and adjustable boost	-40 to 125	TSSOP-24
LM2717	4.0 to 20	3.3, 20	Buck 1: 1.6A Buck 2: 1.8A	300 to 600 kHz	✓	Buck 1: 3.3V and Adj Buck 2: Adj	-40 to 125	TSSOP-24
LM3224	2.7 to 7.0	20	2.45	615 kHz, 1.25 MHz	✓	—	-40 to 125	MSOP-8
LM3310	2.5 to 7.0	20	2.6	660 kHz, 1.28 MHz	✓	1 Op amp, 1 GPM	-40 to 125	LLP-24
LM3311	2.5 to 7.0	20	2.6, LDO = 350 mA	660 kHz, 1.28 MHz	✓	LDO, 1 Op amp, 1 GPM	-40 to 125	LLP-24

Battery Charging Solutions

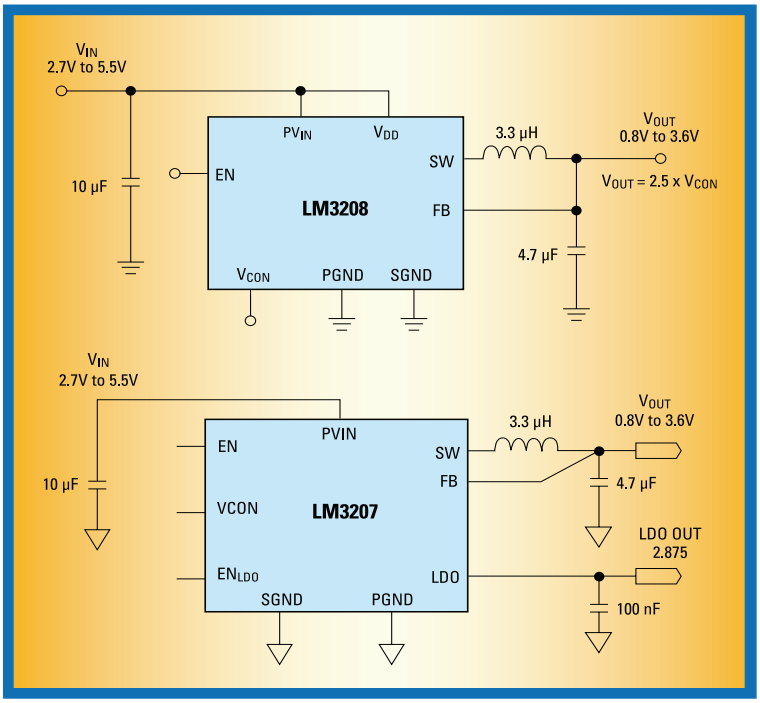
Part Number	Description	Input Range (V)	Functions	Features	Operating Temp Range	Package
LM3658	USB/AC Adaptor Charger	4.5 to 6.0	Charge from either USB or AC Wall Adaptor, Additional Option B with LDO Mode	Integrated Power FETs with Thermal Regulator, Additional Option A with 10 Hours Timer	Com	LLP-10 (3 mm x 3 mm)
LP3947	AC Wall Adaptor/USB Charger	4.30 to 6.0	100 mA to 750 mA Charge Current Mode in Charger Mode, 100 mA/500 mA in USB Charge Mode	Battery Temperature Sensing, Charge Status Indicator, Current Sensing Operational Amplifier	Com	LLP-14

Step-Down Switching Regulators for RF Power Amplifiers

Part Number	Description	V_{IN} Min	V_{IN} Max	V_{OUT}	I_{OUT} (mA)	F_{SW} (kHz)	Bypass Modes	SD	SS	Sync R	Eval Board	Temp Grade	Packaging
LM3200	Dynamically adjustable output voltages, 2.2 µH inductor, low V_{OUT} ripple, low noise and excellent PSRR	2.7	5.5	Adj (0.8 to 3.6V)	500	2000	Forced and automatic	✓	—	✓	✓	-25 to 125	micro SMD-10
LM3202	Miniature, adjustable, step-down DC-DC converter with bypass mode for RF power amplifiers	2.7	5.5	Adj (1.3 to 3.16)	650	2000	None	✓	✓	✓	✓	-30 to 125	micro SMD-8
LM3203	Miniature, adjustable, step-down DC-DC converter with bypass mode for RF power amplifiers	2.7	5.5	Adj (0.8 to 3.6)	500	2000	Forced	✓	50 µs enable	✓	✓	-30 to 125	micro SMD-10
LM3204	Miniature, adjustable, step-down DC-DC converter with bypass mode for RF power amplifiers	2.7	5.5	Adj (0.8 to 3.6)	300/500	2000	Forced and automatic	✓	50 µs enable	✓	✓	-30 to 125	micro SMD-10
New LM3207	650 mA Miniature, Adjustable, Step-Down DC-DC Converter for RF Power Amplifiers with Integrated Vref LDO	2.7	5.5	Adj (0.8 to 3.6)	650	2000	—	✓	✓	✓	✓	-30 to 125	micro SMD-9
New LM3208	650 mA Miniature, Adjustable, Step-Down DC-DC Converter for RF Power Amplifiers with Rdson management	2.7	5.5	Adj (0.8 to 3.6)	650	2000	—	✓	✓	✓	✓	-30 to 125	micro SMD-8
New LM3280	Adjustable Step-Down DC-DC Converter and 3 LDOs for RF Power Management	2.7	5.5	Adj (0.8 to 3.6)	300 in PWM mode, 500 in bypass mode	2000	✓	✓	✓	✓	✓	-30 to 125	micro SMD-16

Product Highlights

LM3207/8
650 mA Miniature, Adjustable, Step-Down DC-DC Converter for RF Power Amplifiers



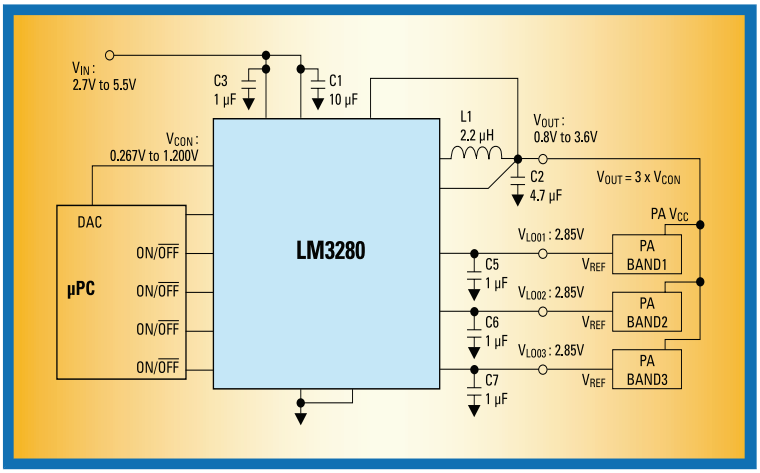
Features

- 2 MHz (typ.) PWM Switching Frequency
- Operates from a single Li-Ion cell (2.7V to 5.5V)
- Variable Output Voltage (0.8V to 3.6V)
- 650 mA Maximum load capability
- Fast Output Voltage Transient (0.8V to 3.4V in 25 µs typ.) (LM3208)
- High Efficiency (95% Typ at 3.9 V_{IN}, 3.4 V_{OUT} at 400 mA) from internal synchronous rectification (LM3207)
- High Efficiency (95% Typ at 3.9 V_{IN}, 3.4 V_{OUT} at 400 mA) (LM3208)
- Integrated 2.875V Vref LDO (LM3207)
- Regulated LDO Output up to 10 mA max (LM3207)
- Fast 3 uS Vref LDO On/Off Time (LM3207)
- 9-pin micro SMD Package (LM3207)
- 8-pin micro SMD Package (LM3208)
- Current Overload Protection
- Thermal Overload Protection

Applications

- Cellular Phones
- Hand-Held Radios
- RF PC Cards
- Battery Powered RF Devices

LM3280
Adjustable Step-Down DC-DC Converter and 3 LDOs for RF Power Management



Features

- 2 MHz (typ.) PWM Switching Frequency
- Operates from a single Li-Ion cell (2.7V to 5.5V)
- Adjustable Output Voltage (0.8V to 3.6V) DC-DC
- High-efficiency synchronous buck converter
- 300 mA Maximum load capability (PWM mode)
- 500 mA Maximum load capability (Bypass mode)
- PWM, Forced and Automatic Bypass Mode
- 3 Low-dropout and fast transient response LDOs
- 16-pin micro SMD Package
- Current Overload Protection
- Thermal Overload Protection

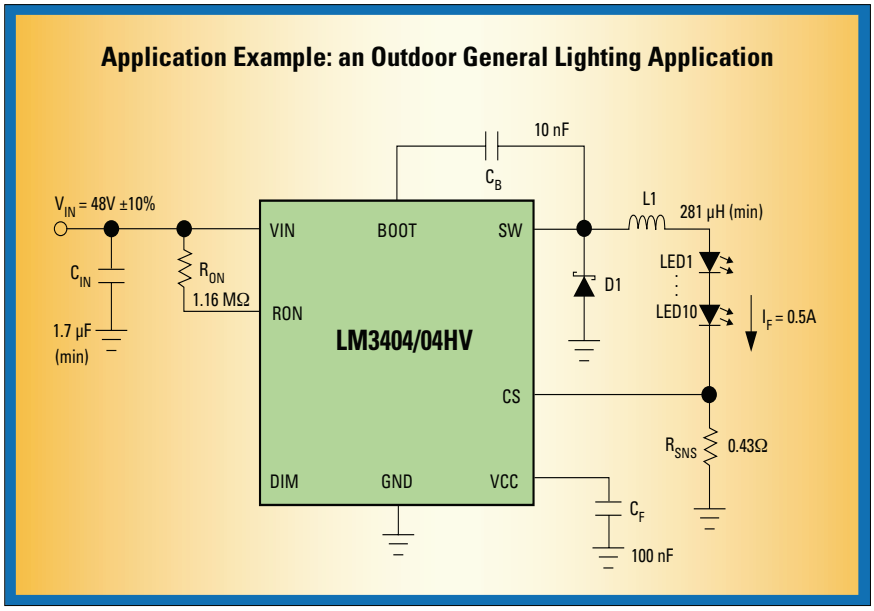
Applications

- Cellular Phones
- Hand-Held Radios
- Battery Powered RF Devices

LM3404/04HV
1.0A Constant Current Buck Regulator for Driving High Power LEDs

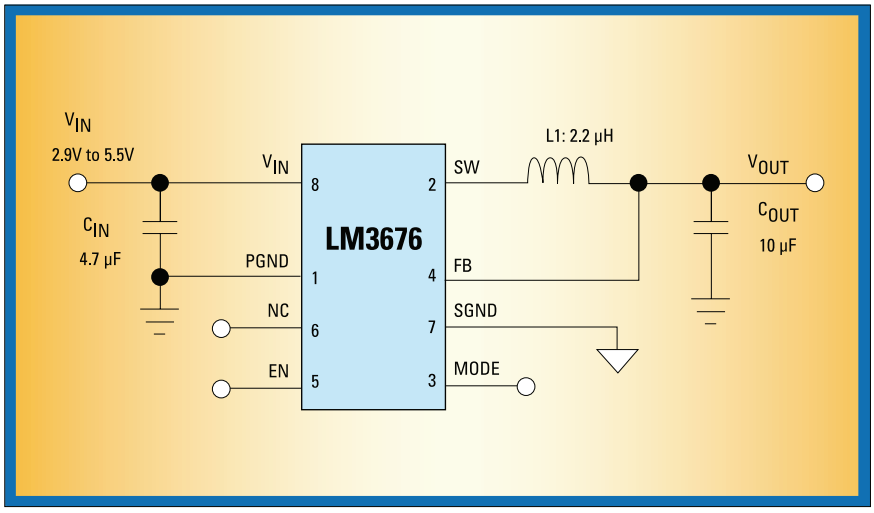
Features
- Integrated 1.0A MOSFET
- V_{IN} Range 6V to 42V (LM3404)
- V_{IN} Range 6V to 75V (LM3404HV)
- 1.2A Output Current Over Temperature
- Cycle-by-Cycle Current Limit
- No Control Loop Compensation Required
- Separate PWM Dimming and Low Power Shutdown
- Supports All-ceramic Output Capacitors and Capacitor-less Outputs
- Thermal Shutdown Protection
- SO-8 Package

Applications
- LED Driver
- Constant Current Source
- Automotive Lighting
- General Illumination
- Industrial Lighting



LM3676
2 MHz, 600 mA Step-Down DC-DC Converter with Mode Control

Features
- 16 µA typical quiescent current
- 600 mA maximum load capability
- 2 MHz PWM fixed switching frequency (typ)
- Automatic PFM/PWM mode switching or Forced PWM mode
- Available in fixed output voltages and adjustable version
- 8-Lead non-pullback LLP package
- Internal synchronous rectification for high efficiency
- Internal soft start
- 0.01 µA typical shutdown current
- Operates from a single Li-Ion cell battery
- Only three tiny surface-mount external components required (one inductor, two ceramic capacitors)
- Current overload and Thermal shutdown protection



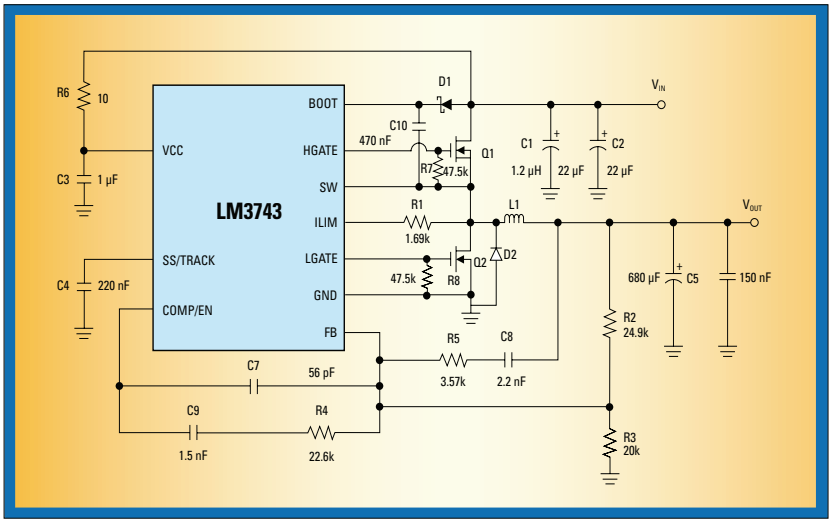
Applications
- Mobile Phones
- PDAs
- MP3 Players
- W-LAN
- Portable Instruments
- Digital Still Cameras
- Portable Hard Disk Drives

Product Highlights

LM3743
N-Channel FET Synchronous Buck Controller for Low Output Voltages

Features

- Input Voltage from 3.0V to 5.5V
- Output Voltage Adjustable Down to 0.8V
- Reference Accuracy: ±1.75%, Over Full Temperature and Input Voltage Range

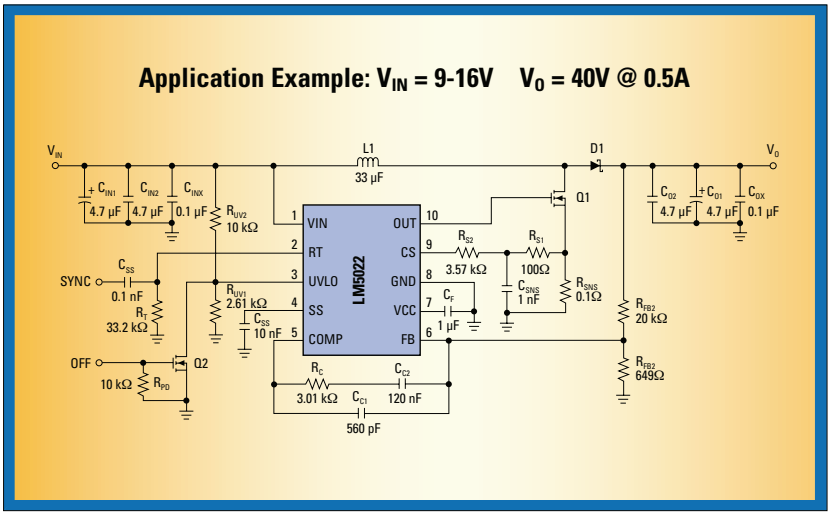


- Low-side Sensing Programmable Current Limit
- Fixed High-side Sensing for Supplemental Short-circuit Protection
- Undervoltage Protection
- Hiccup Mode Protection Eliminates Thermal Runaway During Fault Conditions
- Externally Programmable Soft-start with Tracking Capability
- Switching Frequency Options of 1 MHz or 300 kHz
- Pre-bias Start-up Capability
- MSOP-10 Package

Applications

- ASIC/FPGA/DSP Core Power
- Broadband Communications
- Multi-media Set Top Boxes
- Networking Equipment
- Printers/Scanners
- Servers
- Low Voltage Distributed Power

LM5022
60V Low Side Controller for Boost and SEPIC



Features

- Internal 60V Startup Regulator
- 1A Peak MOSFET Gate Driver
- V_{IN} Range 6V to 60V
- Duty Cycle Limit of 90%
- Programmable UVLO with Hysteresis
- Cycle-by-Cycle Current Limit
- External Synchronizable (AC-coupled)
- Single Resistor Oscillator Frequency Set
- Slope Compensation
- Adjustable Soft-start
- MSOP-10 Package

Applications

- Boost Converter
- SEPIC Converter

LM5576
75V, 3A Step-Down Switching Regulator

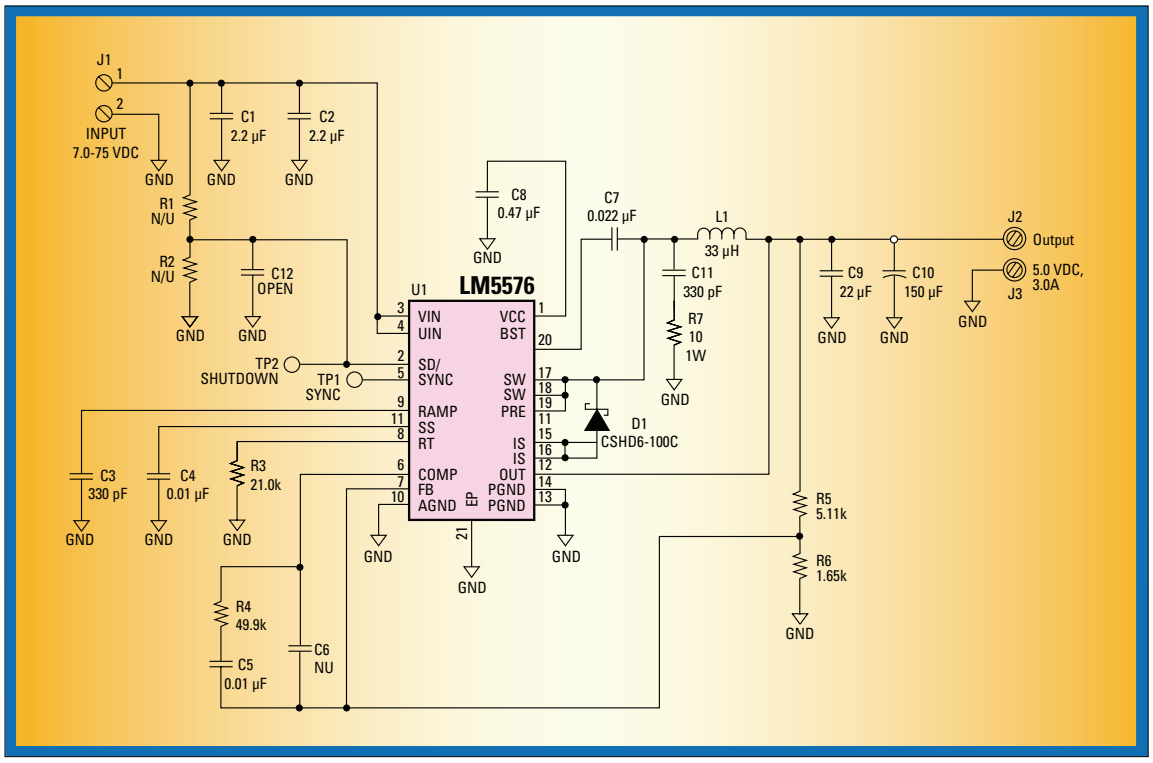
Features

- Integrated 75V, 170 mΩ N-channel MOSFET
- Ultra-wide Input Voltage Range from 6V to 75V
- Internal Bias Regulator
- Adjustable Output Voltage from 1.225V
- 1.5% Feedback Reference Accuracy
- Current Mode Control with Emulated Inductor Current Ramp
- Single Resistor Oscillator Frequency Setting
- Oscillator Synchronization Input
- Programmable Soft-start
- Shutdown/Standby Input
- Wide Bandwidth Error Amplifier
- Thermal Shutdown

Package

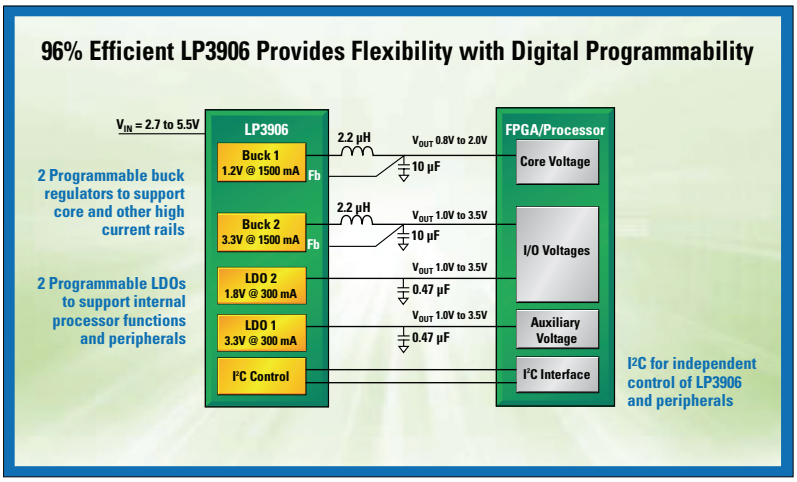
- TSSOP-20EP (Exposed Pad)

Application Example: Input: 7-75V Output: 5V/3A



Product Highlights

LP3906
Dual High-Current Step-Down DC/DC and Dual Linear Regulator with I²C Compatible Interface



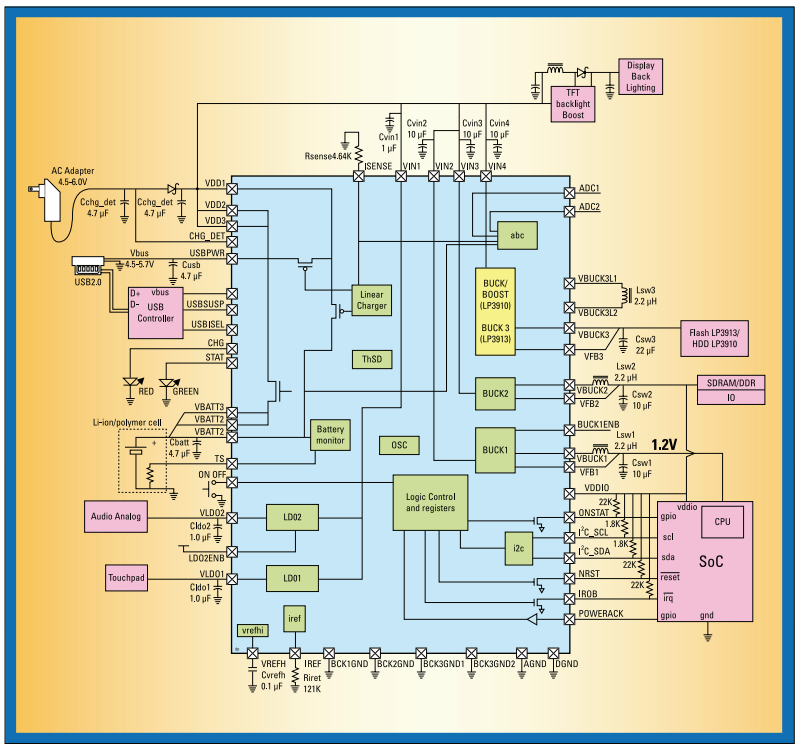
Features

- Compatible with advanced applications processors and FPGAs
- 2 LDOs for powering Internal processor functions and I/Os
- High speed serial interface for independent control of device functions and settings
- Precision internal reference
- Thermal overload protection
- Current overload protection
- 24-lead 5 × 4 × 0.8 mm LLP package
- Software Programmable Regulators

Applications

- FPGA, DSP Core Power
- Applications Processors
- Peripheral I/O Power

LP3910/13
Power Management IC for Hard Drive Based Portable Media Players



Features

- 2 low-dropout regulators – LDO1 is used for general purpose applications, LDO2 is used for low-noise analog applications. Both LDOs have programmable output voltages
- Green and Red LED charger status drivers
- 4-channel 8-bit dual slope a/d converter
- Wide load range Buck-Boost DC/DC converter (LP3910)
- 2 High-efficiency DVS Buck converters (LP3910)
- 3 High-efficiency DVS Buck converters (LP3913)
- 400 kHz I²C compatible interface
- Linear constant-current/constant-voltage charger for single cell lithium-ion batteries
- USB and Adapter charging
- System power supply management
- 6 x 6 x 0.8 mm 48 LLP package
- Voltage and thermal supervisory circuits
- Continuous battery voltage monitoring
- Interrupt Request output with 8 sources
- LP3913 is pin for pin and software compatible with the LP3910 Hard Drive based PMIC

Applications

- Portable Gaming Devices
- Portable Navigation Systems
- Hard Drive-based MP3 Players (LP3910)
- Flash-based Portable Media Players (LP3913)

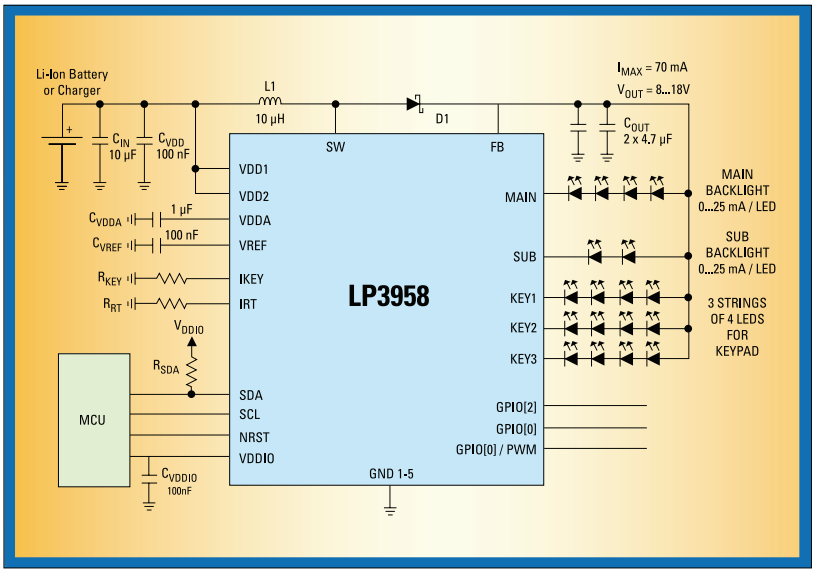
LP3958
Lighting Management Unit with High Voltage Boost Converter

Features

- High efficiency boost converter with programmable output voltage
- 2 individual drivers for serial display backlight LEDs
- 3 drivers for serial keypad LEDs
- Automatic dimming controller
- Stand alone serial keypad LEDs controller
- 3 general purpose IO pins
- 25-bump micro SMD Package: (2.54 x 2.54 x 0.6 mm)

Applications

- Cellular Phones and PDAs
- MP3 Players
- Digital Cameras



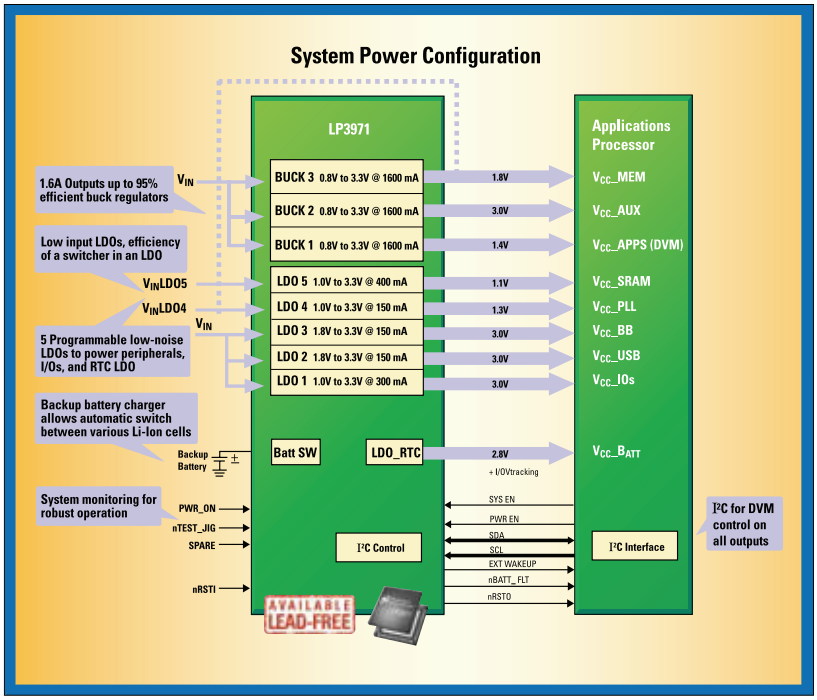
LP3971/72
Power Management Unit for Advanced Applications Processors

Features

- Compatible with advanced applications processors requiring DVM (Dynamic Voltage Management)
- Three buck regulators for powering high current processor functions or I/O's
- 6 LDO's for powering RTC, peripherals, and I/O's
- Backup battery charger with automatic switch for lithiummanganese coin cell batteries and Super capacitors
- I²C compatible high speed serial interface
- Software control of regulator functions and settings
- Precision internal reference
- Thermal overload protection
- Current overload protection
- Tiny 40-pin 5 x 5 mm LLP package

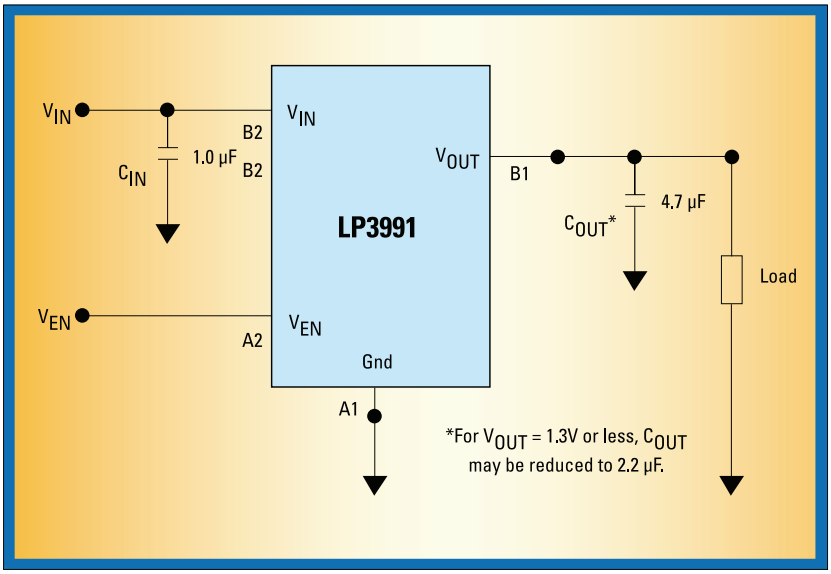
Applications

- PDA Phones
- Smart Phones
- Personal Media Players
- Digital Cameras
- Application Processors
  - – Intel Xscale
  - – Freescale
  - – Samsung



Product Highlights

LP3991
300 mA Linear Voltage Regulator for Digital Applications



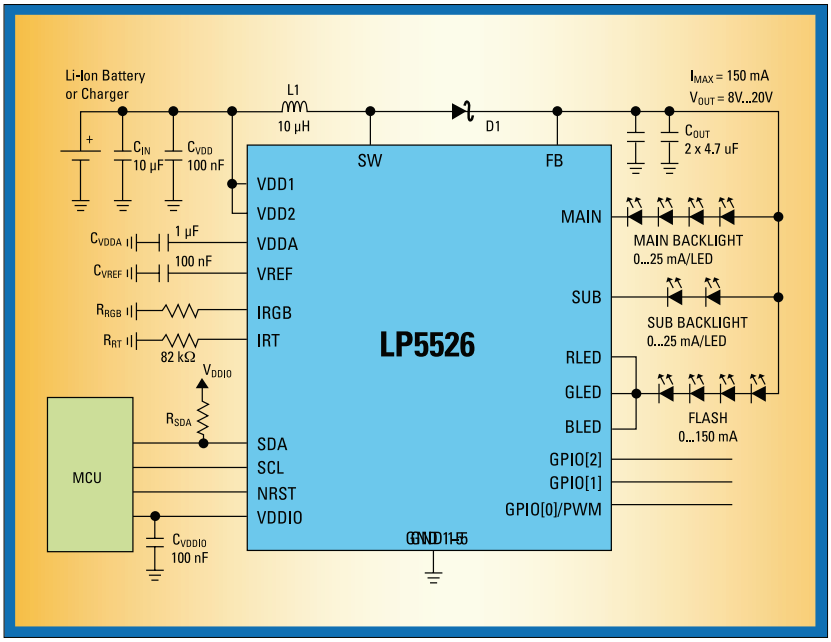
Features

- Operation from 1.65V to 3.6V Input
- 1% accuracy at room temperature
- Output Voltage from 1.2V to 2.8V
- 125 mV Dropout at 300mA load
- 50 µA Quiescent Current at 1 mA Load
- Inrush Current controlled to 600 mA
- PSRR 65 dB at 1kHz
- 100 µs Start-Up time for 1.5V V_{OUT}
- Stable with Ceramic Capacitors as small as 0402
- Thermal-Overload and Short-Circuit Protection
- 4 pin micro SMD (0.963 x 1.446 mm)

Applications

- Post DC/DC Regulator
- Battery Operated Devices
- Hand-Held Information Appliances

LP5526
Lighting Management Unit with High Voltage Boost Converter with up to 150 mA Serial FLASH LED Driver



Features

- High efficiency boost converter with programmable output voltage up to 20V
- 2 individual drivers for serial display backlight LEDs
- Automatic dimming controller
- Stand alone RGB controller
- Dedicated flash function
- Safety function to avoid prolonged flash
- 3 general purpose IO pins
- 25-bump micro SMD Package: (2.54 x 2.54 x 0.6 mm)

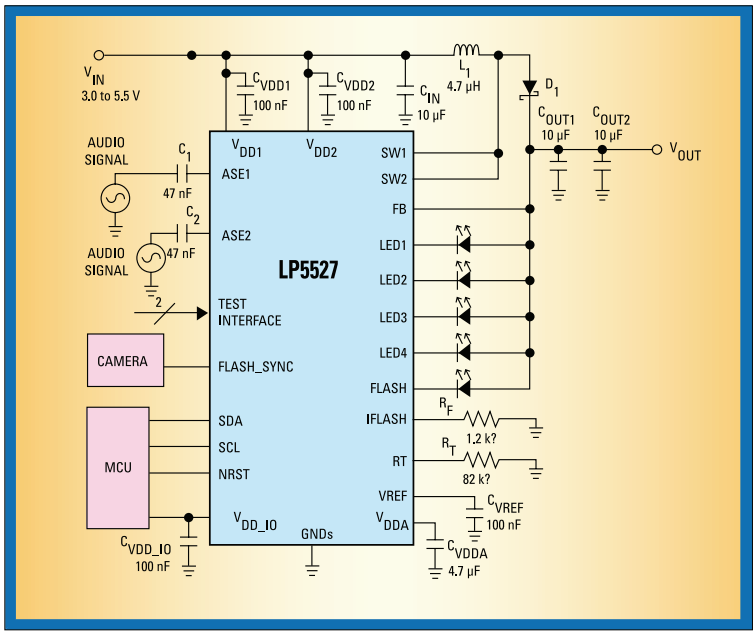
Applications

- Cellular Phones and PDAs
- MP3 Players
- Digital Cameras

LP5527
Tiny LED Driver for Camera Flash and 4 LEDs with I²C Programmability, Connectivity Test and Audio Synchronization

Features
- High current boost DC-DC converter (up to 1A output current)
- Programmable boost output voltage
- 400 mA flash LED constant current driver with low tolerance and a safety circuit
- Synchronization pin for the flash timing
- Two single-ended audio inputs with gain control
- Four constant current 15 mA LED drivers with 8-bit programmable brightness control
- Audio synchronization feature
- I²C compatible control interface
- Built-in LED connectivity test to maximize manufacturing yield
- Small micro SMD-30 package (2.5 x 3.0 x 0.6 mm)

Applications
- Camera FLASH
- Funlight and backlight driving in battery powered devices



LP5952
350 mA Dual Rail Linear Regulator

Features
- Excellent load transient response: ±15 mV typical
- Excellent line transient response: ±1 mV typical
- $0.7V \leq V_{IN} \leq 4.5V$
- $2.5V \leq V_{BATT} \leq 5.5V$
- $0.5V \leq V_{OUT} \leq 2.0V$
- For I_{LOAD} = 350 mA:
  $V_{BATT} \geq V_{OUT(NOM)}$ + 1.5V or 2.5V whichever is higher
- For I_{LOAD} = 150 mA:
  $V_{BATT} \geq V_{OUT(NOM)}$ + 1.3V or 2.5V whichever is higher
- 50 µA typical quiescent current from V_{BATT}
- 10 µA typical quiescent current from V_{IN}
- 0.1 µA typical quiescent current in shutdown
- Guaranteed 350 mA output current
- Noise voltage = 100 μV_{RMS} typical
- Operates from a single Li-Ion cell or 3 cell NiMH/NiCd batteries
- Only one or two tiny surface-mount external components required depending on application
- Small 5 bump micro SMD package, lead free
- Thermal-overload and short-circuit protection
- -40°C to +125°C junction temperature range

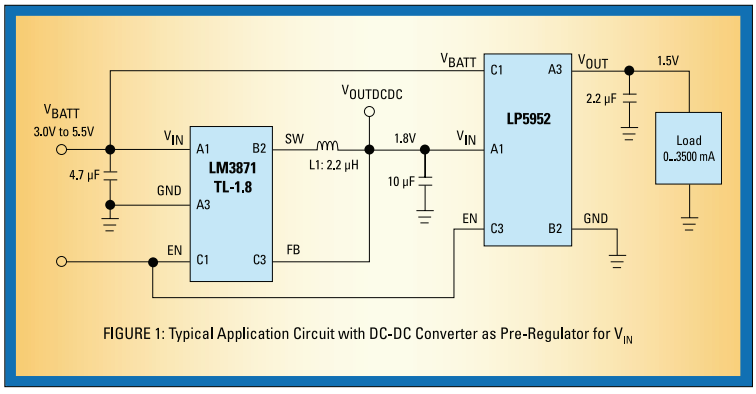
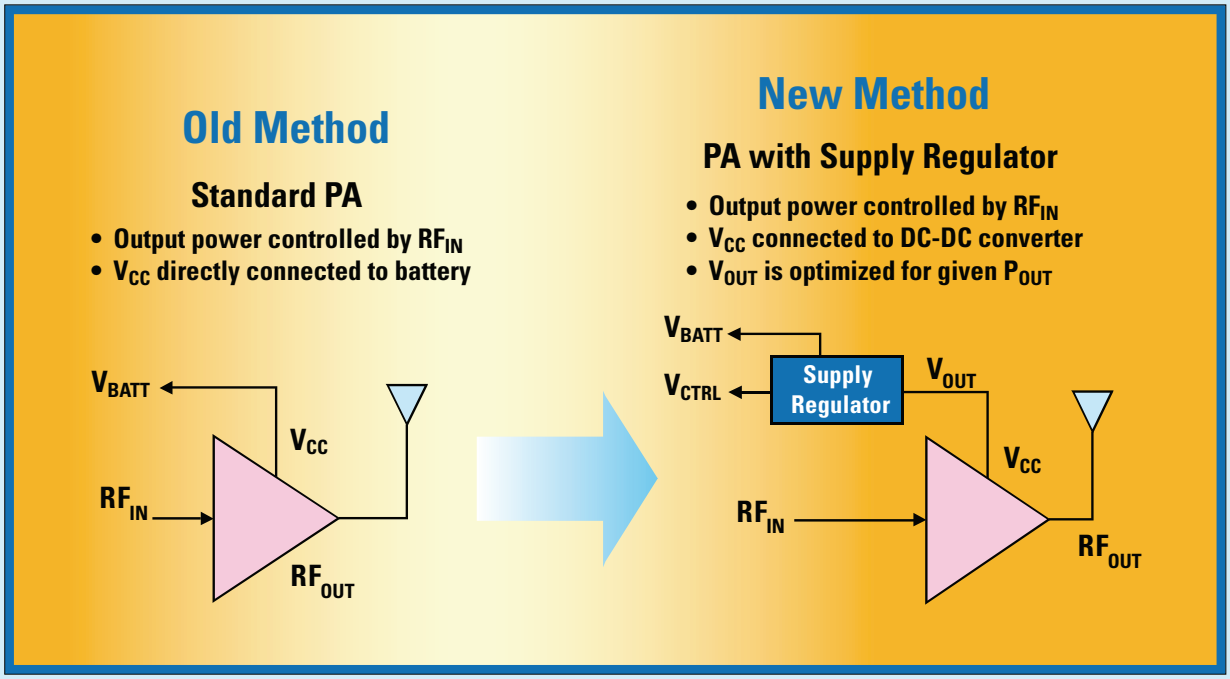


FIGURE 1: Typical Application Circuit with DC-DC Converter as Pre-Regulator for V_{IN}

Applications
- Mobile Phones
- Hand-Held Radios
- Personal Digital Assistants
- Palm-Top PCs
- Portable Instruments
- Battery Powered Devices

Optimizing RF Power Amplifier System Efficiency Using DC-DC Converters

— By Mathew Jacob, Applications Engineering Manager



RF power amplifiers used in CDMA/WCDMA cellular standards have been traditionally powered directly from the battery. This makes system implementation easy but the requirement for linear power amplifiers in such standards have intrinsic inefficiencies throughout the transmit power spectrum.

Cellular standards have been evolving with transmission speeds that started from 14.4 kbps in CDMA-1 to 2 Mbps in CDMA2000/WCDMA. Apart from this, cellular providers have increased the services bundled with the 3G phones in order to increase the average revenue per subscriber. At the same time, the talk time and battery life is expected to be improved with the same or slightly higher capacity batteries. This makes system design challenging. System designers have to be very cautious and perform a power survey of each and every component on the phone board. The RF Power Amplifier (RF PA) powered directly from the battery is a major concern from the power budget perspective.

The modulation schemes used in CDMA and WCDMA result in an amplitude-modulated signal that exhibits a non-constant amplitude envelope. In order to preserve signal integrity and further spectral re-growth, a linear power amplifier is necessary. However, power efficiency is traded off because power amplifiers operate efficiently when operated in gain compression. To meet the required linearity, the operating transmit power is backed off from the power amplifier's compression point that causes an overall reduction in efficiency. When the handset is operating in transmit mode, the RF power section consumes up to 65% of the overall power budget as a result of the PA's intrinsic inefficiencies.

For this reason, linear PAs are ideal candidates to be powered with a magnetic buck converter which will dramatically increase efficiency of the system.

Power-Added Efficiency (PAE) is a key performance metric of a power amplifier.

$$PAE\ (\%) = (P_{OUT} - P_{IN})/Pdc$$

The key in using a DC-DC converter (PA supply regulator) is to reduce the Pdc factor in the denominator. When the PA is connected directly to the battery, Pdc = Vbatt*Ibatt and, whenit is powered

by a PA supply regulator, Pdc = Vo*Io. Now itcan be seen that for increasing the PAE we have to have a low Vo and Io compared to Vbatt and Ibatt. This is achieved by lowering the output voltage of the PA supply regulator at lower transmitted RF power levels. This in turn reduces Io (current drawn by the PA) and results in a much lower input current drawn from the battery due to the inherent high efficiency of the DC-DC converter.

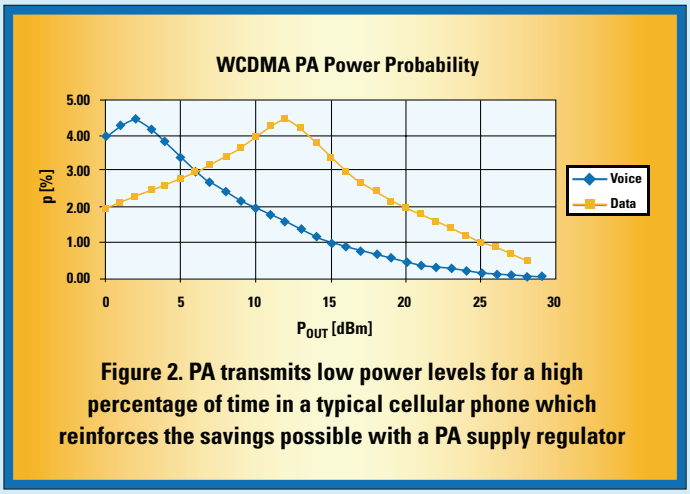


Figure 2. PA transmits low power levels for a high percentage of time in a typical cellular phone which reinforces the savings possible with a PA supply regulator

It is important to consider the power probability profile (see ***Figure 2***) for the modulation methods to really understand the impact of savings in powering a PA with a supply regulator. The profiles are different for urban and rural regions.

As shown in ***Figure 3***, the output voltage of the DC-DC converter has to be varied as the transmitted power levels are changed to maintain the Adjacent Channel Power/leakage Ratio (ACPR/ACLR) specifications. The savings in battery current can be as high as 50 mA in the 0 dBm to 20 dBm power levels. ***Figure 2*** shows that the PA is operating in this band of power levels for a majority of its time.

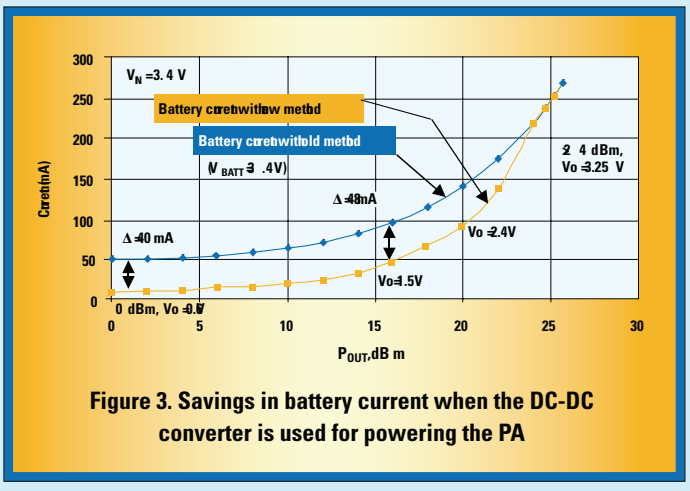


Figure 3. Savings in battery current when the DC-DC converter is used for powering the PA

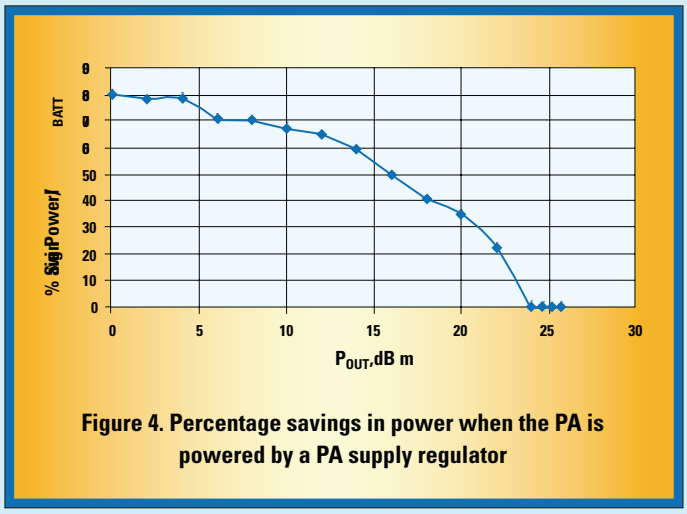


Figure 4. Percentage savings in power when the PA is powered by a PA supply regulator

So why do we have to change the voltage of the DC-DC converter as the transmitted power level is increased? The answer is that this change is needed to maintain the ACPR ratios. ACPR/ACLR is used to characterize the distortion of power amplifiers and other subsystems for their tendency to cause interference with neighboring radio channels or systems.

It is specified as the ratio of the Power-Spectral Density (PSD) of the main channel to the PSD measured at several offset frequencies.

In ***Figure 5*** it can be seen that if the supply voltage to the PA is not increased as Pout is increased, the ACLR specifications cannot be met. The system-level specification (3 GPP) for WCDMA is -34 dBc and, in order to preserve sufficient margin caused by temperature and device variances, the ACLR value of -38 dBc is used.

Key Requirements of Buck Converters for Powering RF Power Amplifiers

Buck converters that power RF PAs have specialized functions and are quite different from buck converters that power digital core processors. These differences arise in operating characteristics and parameters such as switching FET ON-resistances, current limit, transient response, modes of operation such as PFM/PWM, startup time, quiescent current, and dropout behavior. The following examples illustrate these differences:

- High efficiency over wide output voltage and load range
  Example: LM3205 has efficiency of 96% at V_{IN} = 4.2V, Vo = 3.4V, Io = 400 mA (high RF power) and 87% at V_{IN} = 3.9V, Vo = 1.5V, Io = 100 mA (low RF power).

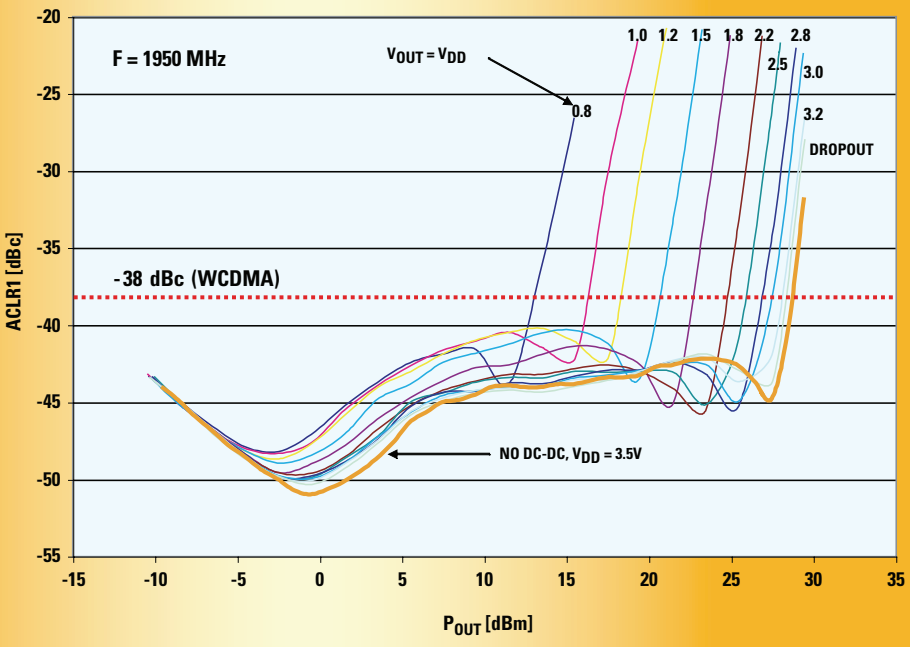


Figure 5. How ACLR is affected with respect to supply voltage to the PA and P_{OUT}

- Dynamic output voltage adjustment
  Example: In LM3205 the output voltage can be adjusted between 0.8V to 3.6V using a Vcon pin. The voltage gain from Vcon to Vo is 2.5.
- 30 µs Output slew rate and settling (50 µs window in beginning of every 667 µs transmit cycle in which the Vcon adjustments must be completed) In WCDMA architecture, transmit power is adjusted by ±1 dB in every 667 µs as requested by the basestation.
- Low dropout and low ripple near 100% duty cycle
  Example: Low R_{DSON} PFET 140 mΩ (LM3205) or BypassFET (LM3204) gives low dropout voltage and pulse-skipping schemes gives low ripple near 100% duty cycle.
- Low duty cycle operation for low output voltages
  Example: Minimum on time, 50 ns facilitates 10% duty cycle operation for output voltages of 0.8V and lower depending on the V_{IN} range.
- High switching frequency
  Example: 2 MHz switching frequency helps the use of smaller sized external components and meet spectral emission requirements.
- Fast turn on time to meet time mask for transmit ON/OFF
  Example: LM3203 has turn-on time of 50 µs for Vo = 3.4V from EN = low to high.

100% Duty Cycle vs Bypass Mode

When the buck converter is operating at 100% duty cycle the dropout voltage is

$$\text{Dropout Voltage} = (R_{ON,P} + R_L) \bullet Io,$$

where $R_{ON,P}$ is the R_{DSON} of the PFET and R_L is the inductor DCR. For a PA supply regulator that has a bypass FET the dropout voltage in bypass mode is,

$$\text{Dropout Voltage} = (R_{ON,BYP}) \bullet Io,$$

where $R_{ON,BYP}$ is the R_{DSON} of the bypass FET. The bypass FET can be turned on automatically or manually. As shown, the key advantage in having a bypass mode is lower dropout voltages; which translates to longer talk times and lowering the low battery shutdown point for the phone. The alternative is to use low DCR inductors and a low R_{DSON} PFET.

Example Application Circuits

In this example, the baseband will have a lookup table scheme where it sets the output voltage depending on the output power levels required. In this case, the power detector is part of a closed loop and sets the output voltage.

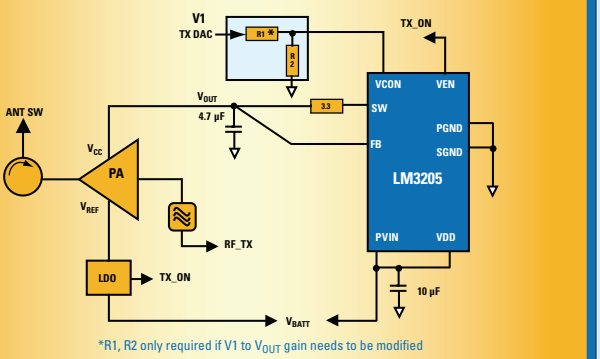


Figure 6. Baseband Controls Vo Directly

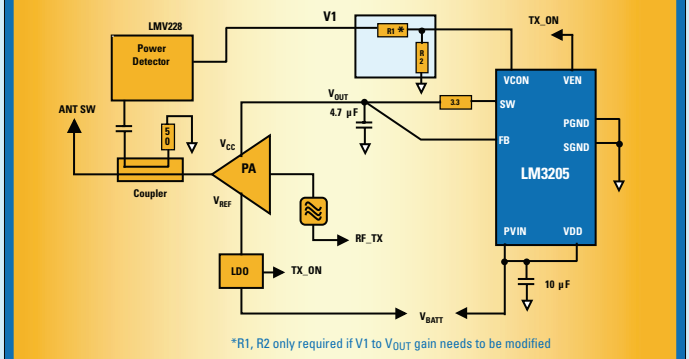


Figure 7. Using a Power Detector to Set Vo

Conclusion

DC-DC converters enhance the RF PA system efficiency in portable communication devices and support the addition of more features or functions by improving battery life.

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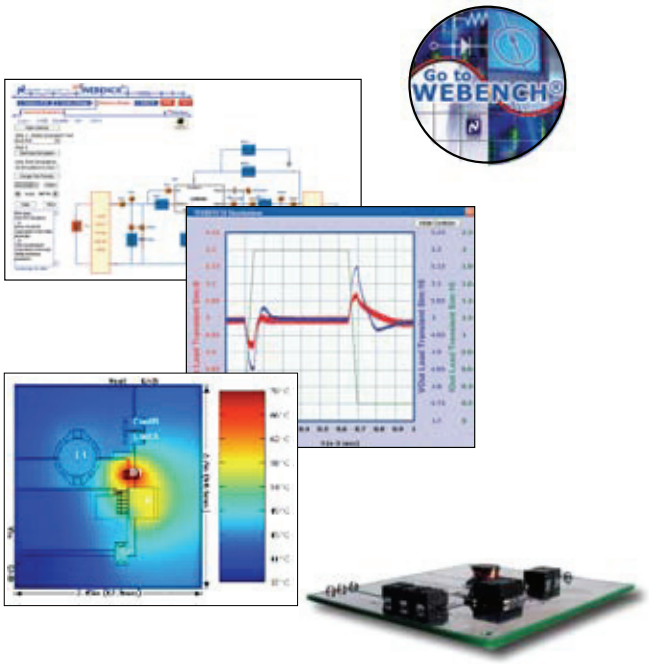

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PRC/HONG KONG

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eddy.li@arrowasia.com

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Fuzhou
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Ningbo
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irene.shan@arrowasia.com

Shanghai
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Shenyang
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paul.zhang@aitgroup.com.cn

Hong Kong
T: 2402-9032 F: 2402-9805
amy.leung@aitgroup.com.cn

Shanghai
T: 021-5298-9845 F: 021-5298-9849
kent.sun@aitgroup.com.cn

Shenzhen
T: 0755-8831-3199 F: 0755-8831-2399
may.he@aitgroup.com.cn

Suzhou
T: 0512-6841-1476 F: 0512-6841-1477
jeff.zeng@aitgroup.com.cn

Xiamen
T: 0592-3116-124 F: 0592-3116-127
may.he@aitgroup.com.cn

Avnet Sunrise Ltd.
www.sunrise.avnet.com
Beijing
T: 010-8206-2488 F: 010-8206-2427
avnetsunrise@avnet.com

Changsha
T: 0731-441-1732 F: 0731-441-2732
sandy.pang@avnet.com

Chengdu
T: 028-8652-8191 F: 028-8652-8300
sandy.pang@avnet.com

Chongqing
T: 023-6879-1501 F: 023-6879-1502
sandy.pang@avnet.com

Dalian
T: 0411-8792-2610 F: 0411-8792-2621

Guangzhou
T: 020-2283-8300 F: 020-2283-8309
snowfer.jiang@avnet.com

Fuzhou
T: 0591-773-7851 F: 0591-773-7194
snowfer.jiang@avnet.com

Hangzhou
T: 0571-8580-0906 F: 0571-8580-0919
sandy.pang@avnet.com

Hong Kong
T: 2176-5388 F: 2790-2182
carmen.liu@avnet.com

Nanjing
T: 025-8689-0220 F: 025-8689-0280
sandy.pang@avnet.com

Ningbo
T: 0574-8771-4702 F: 0574-8771-4712
sandy.pang@avnet.com

Qingdao
T: 0532-8575-7675 F: 0532-8571-0557
sandy.pang@avnet.com

Shanghai
T: 021-5206-2288 F: 021-5206-2299
sandy.pang@avnet.com

Shenzhen
T: 0755-8378-1886 F: 0755-8378-3656
snowfer.jiang@avnet.com

Suzhou
T: 0512-6522-2535 F: 0512-6522-2536

Tianjin
T: 022-2361-2796 F: 022-2361-5217
sandy.pang@avnet.com

Wuhan
T: 027-8732-2548 F: 027-8732-2651
snowfer.jiang@avnet.com

Xiamen
T: 0592-516-3621 F: 0592-516-3620
sandy.pang@avnet.com

Xian
T: 029-8831-0052 F: 029-8831-0390
sandy.pang@avnet.com

Zhengzhou
T: 0371-6677-0029 F: 0371-6677-0106
sandy.pang@avnet.com

Zhuhai
T: 0756-8125-011 F: 0756-8125-013

China Electronic Appliance Shenzhen Co., Ltd.
www.ceacsz.com.cn
Beijing
T: 010-6827-4230 F: 010-6823-3875
bjoffice@ceacsz.com.cn

Chengdu
T: 028-8525-2279 F: 028-8525-2319
cdoffice@ceacsz.com.cn

Hong Kong
T: 2302-4018 F: 2375-8378
hkoffice@ceacsz.com.cn

Shanghai
T: 021-6249-7036 F: 021-6249-6092
shoffice@ceacsz.com.cn

Shenzhen
T: 0755-8361-6195 F: 0755-8335-0876
szoffice@ceacsz.com.cn

Wuhan
T: 027-8769-0007 F: 027-8769-0006
whoffice@ceacsz.com.cn

Xiamen
T: 0592-516-7066 F: 0592-516-7065
xmoffice@ceacsz.com.cn

Xian
T: 029-8827-6283 F: 029-8827-6152
xaoffice@ceacsz.com.cn

Future Electronics
www.future.ca
Beijing
T: 010-6418-2335 F: 010-6418-2290
jian.fang@futureelectronics.com

Chengdu
T: 028-8545-4789 F: 028-8543-2616
charles.qi@futureelectronics.com

Guangzhou
T: 020-8364-9939 F: 020-8364-9329
jim.cai@futureelectronics.com

Hong Kong
T: 2420-6238 F: 2423-0767
jonathan@futureelectronics.com

Nanjing
T: 025-8471-0047 F: 025-8471-7972
kevin.xu@futureelectronics.com

Qingdao
T: 0532-502-6235 F: 0532-502-6015
howard.gao@futureelectronics.com

Shanghai
T: 021-6341-0077 F: 021-6341-0170
charlie.zhu@futureelectronics.com

Shenzhen
T: 0755-8366-9286 F: 0755-8366-9280
jack.wan@futureelectronics.com

Tianjin
T: 022-5819-5650 F: 022-5819-5750
li-min.ma@futureelectronics.com

Xiamen
T: 0592-239-8230 F: 0592-239-8236
hong-en.zhang@futureelectronics.com

Kei Kong Electronics Ltd.
www.keikong.com
Beijing
T: 010-8837-7016 F: 010-6835-8255
kkbj@keikongbj.com

Guangzhou
T: 020-2222-1773 F: 020-2222-1783
yuliang@keikong.com

Hong Kong
T: 2715-0738 F: 2715-1337
gigi@keikong.com

Nanjing
T: 025-8470-2292 F: 025-8471-8031
laura@keikongnj.com

Shanghai
T: 021-6354-1141 F: 021-6353-6038
bill.ye@kkongsh.com

Shenzhen
T: 0755-8328-1338 F: 0755-8328-1001
yen@keikong.com

Xiamen
T: 0592-3806-901 F: 0592-3806-909

RSL Microelectronics Co. Ltd.
www.rslgroup.com.cn
Beijing
T: 010-6435-1203 F: 010-6435-8904
enquiry@rslgroup.com.hk

Shanghai
T: 021-6440-0083 F: 021-6440-0084
wu.bing@rdl.com.hk

Shenzhen
T: 0755-8826-2633 F: 0755-8826-2655
candy@rdl.com.hk

Xiamen
T: 0592-296-1601 F: 0592-296-1605
jiang.wei@rdl.com.hk

RSL Electronics Co. Ltd.
www.rslgroup.com.cn
Hong Kong
T: 2333-0099 F: 2773-9900
andyngan@rslgroup.com.hk

Aeco Technology Co. Ltd.
www.aecotech.com.tw
Beijing
T: 010-6642-2960 F: 010-6642-2963
johnson_huang@aecotech.com.cn

Chengdu
T: 028-8667-3414 F: 028-8667-3419
johnson_huang@aecotech.com.cn

Hong Kong
T: 2304-4023 F: 2304-0065
lilian_lai@aecotech.com.hk

Shanghai
T: 021-6235-0331 F: 021-6235-0348
william_qu@aecotech.com.cn

Shenzhen
T: 0755-2518-1524 F: 0755-2518-1517
joey_chen@aecotech.com.tw

Suzhou
T: 0512-6515-9771 F: 0512-6515-9488
cindy_ji@aecotech.com.cn

Xian
T: 029-8831-1214 F: 029-8831-1215
johnson_huang@aecotech.com.cn

SINGAPORE

Arrow Electronics (S) Pte. Ltd.
www.arrowasia.com
T: 6559-8388 F: 6559-8288
rayson.ho@arrowasia.com

Avnet Asia Pte. Ltd.
www.avnet.com
T: 6580-6000 F: 6580-6200
haiteck.bay@avnet.com

Future Electronics
www.future.ca
T: 6479-1300 F: 6479-3151
seong-huat.loke@futureelectronics.com

TAIWAN

Arrow Electronics Taiwan Ltd.
www.arrowasia.com
T: 02-2698-2888 F: 02-2698-2900
chris.lee@arrowasia.com

Asian Information Technology Inc.
www.aitinc.com.tw
T: 02-8797-6866 F: 02-8797-6877
stephen.sun@aitinc.com.tw

Avnet Asia Pte. Ltd.
www.avnet.com
T: 02-2655-8688 F: 02-2655-8666
cy.lee@avnet.com

Techmosa International Inc.
www.techmosa.com.tw
T: 02-8226-7698 F: 02-2225-8960
tony_tung@techmosa.com.tw

Aeco Technology Co. Ltd.
www.aecotech.com.tw
T: 02-2555-9676 F: 02-2559-5939
peter_chen@aecotech.com.tw

THAILAND

Arrow Electronics (Thailand) Ltd.
www.arrowasia.com
T: 02-694-2332 F: 02-694-2331
colin.chin@arrowasia.com

Avnet Technology (Thailand) Co. Ltd.
www.avnet.com
T: 02-645-3678 F: 02-645-3681
natee.pinkaew@avnet.com

Future Electronics
www.future.ca
T: 02-361-8400 F: 02-361-8433
nitipon.tingpalpong@futureelectronics.com

For complete product information and technical assistance, please visit our website at
www.national.com
or email:
ap.support@nsc.com

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