Power Management

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DC to DC Buck and Boost Regulators

Part Number	Type	Input Voltage Range	Output Voltage Range	I_{OUT}	I_{CC} Typ	Efficiency	Shutdown	Low Battery Indicator	Package	Comments
SP6639	Buck	6.0V to 7.5V	adj; 5.0V	100mA	10µA	91%	✔	✔	8L NSOIC	low voltage, high efficiency, buck converter; ideal for Lithium ion and 3 to 4 cell alkaline applications
SP6640	Buck	4.0V to 7.5V	adj; 3.3V	100mA	10µA	87%	✔	✔	8L NSOIC	low voltage, high efficiency, buck converter; ideal for Lithium ion and 3 to 4 cell alkaline applications
SP6641	Boost	0.9V to 4.5V	3.3V or 5.0V	A=200mA B=500mA	10µA	85%	✔		5L SOT-23	ultra low quiescent current; ideal for 1 cell lithium ion and 1-2 cell alkaline
SP6644	Boost	0.85V to 1.65V	adj; 3.3V 5.0V	90mA	50µA	92%	✔	✔	8L MSOP	programmable peak inductor current for optimal system design
SP6645	Boost	0.85V to 1.65V	adj; 3.3V 5.0V	180mA	50µA	88%	✔	✔; <2V	8L MSOP	high efficiency, high drive boost with shutdown and low battery; ideal for single or dual alkaline cell
SP6648	Boost	0.5V to 4.5V	adj; 2.5V to 5.0V	500mA	12µA	92%	✔	✔	10L MSOP	highest efficiency, highest drive boost regulator; ideal for 1 cell lithium ion and 1-2 cell alkaline
SP6650	Buck	2.7V to 6.5V	adj; 1.25V to V_{IN}	600mA	70µA	95%	✔	✔	10L MSOP	high efficiency buck regulator ideal for 1 cell lithium ion
SP6651	Buck	2.5V to 6.5V	adj; 1.25V to V_{IN}	800mA	15µA	95%	✔	✔	10L MSOP	ultra low quiescent current; high output current; ideal for 1 cell lithium ion
SP6653	Buck	3.5V to 7.5V	adj; 3.0V	100mA	10µA	85%	✔	✔	8L NSOIC	low voltage, high efficiency, buck converter; ideal for Lithium ion and 3 to 4 cell alkaline applications

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PWM/PFM Buck Controllers

Part Number	Type	Input Voltage Range	Output Voltage Range	I_{OUT}	I_{CC}	Frequency	Efficiency	Shutdown	Fault Protection	Package	Comments
SP6120	PFET or NFET	+3V to +7V	1.25V to V_{CC}	15A	950µA	200kHz to 600kHz	95%	✔	✔	16L TSSOP	fixed frequency, synchronous voltage mode controller
SP6121	PFET	+3V to +7V	1.25V to V_{CC}	15A	500µA	500kHz	95%	✔	✔	8L NSOIC	fixed frequency, synchronous voltage mode controller
SP6122	PFET	+3V to +7V	1.25V to V_{CC}	4A	300µA	300kHz	90%	✔	✔	8L µSOIC	minimum on-time, asynchronous
SP6123	NFET	+3V to +7V	0.8V to V_{CC}	15A	500µA	500kHz	95%	✔	✔	8L NSOIC	fixed frequency, synchronous voltage mode controller; sub 1 volt output
SP6124	NFET	+3V to +7V	0.8V to V_{CC}	4A	400µA	300kHz	90%	✔	✔	10L MSOP	asynchronous

Charge Pump Voltage Converters

Part Number	Input Voltage Range	Charge Pump Output	I_{CC}	Output Current	Shutdown	F_{OSC}	8L PDIP P	8L MSOP U	10L MSOP U	8L NSOIC N	5L SOT-23 K	6L SOT-23 K	Comments
SP682	+2.0V to 5.5V	-10V	60µA	10mA	✔	12 kHz	✔	✔		✔			low cost doubling voltage inverters from a single 5V supply; ideal for biasing and portable applications
SP6660	+1.5V to 4.25V	-1.5V to -4.25V or +3V to 8.5V	400µA	200mA		10kHz/ 80kHz	✔	✔		✔			inverts or doubles input supply voltage; high output current - 200mA
SP6661	+1.5V to 4.25V	-1.5V to -4.25V or +3V to 8.5V	3mA	200mA		120kHz/ 900kHz		✔		✔			inverts or doubles input supply voltage; high frequency oscillator allows 1µF ceramic capacitors
SP6828	+1.15V to 4.2V	-1.15 to -4.2V	20µA	25mA		12kHz					✔		inverts input supply voltage; ideal for +3.6V lithium ion battery applications
SP6829	+1.15V to 4.2V	-1.15 to -4.2V	40µA	25mA		35kHz					✔		inverts input supply voltage; ideal for +3.6V lithium ion battery applications
SP6830	+1.15V to 5.0V	-1.15V to -5.0V	50µA	25mA	✔	35kHz						✔	inverts input supply voltage; ideal for +3.6V lithium ion battery applications with shutdown
SP6831	+1.15V to 5.0V	-1.15V to -5.0V	165µA	25mA	✔	120kHz						✔	inverts input supply voltage; ideal for +3.6V lithium ion battery applications with shutdown
SP6832	+1.15V to 5.0V	-1.15V to -5.0V	700µA	25mA		500kHz					✔		inverts input supply voltage; ideal for +3.6V lithium ion battery applications small caps
SP6680	+2.7V to 6.5V	+5.4V to 6.0V	100µA	60mA	✔	8.198kHz; 32.768Hz; 262.144kH			✔				regulated output; input is direct connect to single cell lithium ion battery

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3.3V Microprocessor Supervisory ICs

Part Number	I_{CC}	Reset Threshold	Reset active	Separate Watchdog Output	Battery Backup Switching	Manual Reset Input	Reset Accuracy	PF Accuracy	8L PDIP	8L µSOIC	8L NSOIC
									P	U	N
SP690R	40µA	2.625V	low		✔		75mV	4%	✔		✔
SP690S	40µA	2.925V	low		✔		75mV	4%	✔		✔
SP690T	40µA	3.075V	low		✔		75mV	4%	✔		✔
SP706P	40µA	2.630V	high	✔		✔	75mV	4%	✔	✔	✔
SP706R	40µA	2.630V	low	✔		✔	75mV	4%	✔	✔	✔
SP706S	40µA	2.930V	low	✔		✔	75mV	4%	✔	✔	✔
SP706T	40µA	3.080V	low	✔		✔	75mV	4%	✔	✔	✔
SP708R	40µA	2.630V	low/h			✔	75mV	4%	✔	✔	✔
SP708S	40µA	2.930V	low/h			✔	75mV	4%	✔	✔	✔
SP708T	40µA	3.08V	low/h			✔	75mV	4%	✔	✔	✔
SP802R	40µA	2.625V	low		✔		60mV	2%	✔		✔
SP802S	40µA	2.925V	low		✔		60mV	2%	✔		✔
SP802T	40µA	3.075V	low		✔		60mV	2%	✔		✔
SP804R	40µA	2.625V	high		✔		60mV	2%	✔		✔
SP804S	40µA	2.925V	high		✔		60mV	2%	✔		✔
SP804T	40µA	3.075V	high		✔		60mV	2%	✔		✔
SP805R	40µA	2.625V	high		✔		75mV	4%	✔		✔
SP805S	40µA	2.925V	high		✔		75mV	4%	✔		✔
SP805T	40µA	3.075V	high		✔		75mV	4%	✔		✔

5.0V Microprocessor Supervisory ICs

Part Number	I_{CC}	Reset Threshold	Reset Active Output	Separate Watchdog Switching	Battery Backup Input	Manual Reset	Reset Accuracy	PF Accuracy	8L PDIP	16L PDIP	8L µSOIC	8L NSOIC	16L NSOIC	16L SOIC
									P	P	U	N	N	T
SP691A	60µA	4.65V	low/high	✔	✔			4%		✔			✔	✔
SP693A	60µA	4.40V	low/high	✔	✔			4%		✔			✔	✔
SP800L	60µA	4.65V	low/high	✔	✔			1%		✔			✔	✔
SP800M	60µA	4.40V	low/high	✔	✔			1%		✔			✔	✔
SP703	60µA	4.65V	low		✔	✔	125mV	4%	✔			✔		
SP704	60µA	4.40V	low		✔	✔	125mV	4%	✔			✔		
SP705	60µA	4.65V	low	✔		✔	125mV	4%	✔		✔	✔		
SP706	60µA	4.40V	low	✔		✔	125mV	4%	✔		✔	✔		
SP707	60µA	4.65V	low/high			✔	125mV	4%	✔		✔	✔		
SP708	60µA	4.40V	low/high			✔	125mV	4%	✔		✔	✔		
SP813L	60µA	4.65V	high	✔		✔	125mV	4%	✔		✔	✔		
SP813M	60µA	4.40V	high	✔		✔	125mV	4%	✔		✔	✔		
SP690A	60µA	4.65V	low		✔		125mV	4%	✔			✔		
SP692A	60µA	4.40V	low		✔		125mV	4%	✔			✔		
SP802L	60µA	4.65V	low		✔		75mV	2%	✔			✔		
SP802M	60µA	4.40V	low		✔		75mV	2%	✔			✔		
SP805L	60µA	4.65V	high		✔		125mV	4%	✔			✔		
SP805M	60µA	4.40V	high		✔		125mV	4%	✔			✔		
SP791	75µA	4.65V	low		✔		125mV	4%		✔			✔	

USB Power Control Switches

Part Number	Input Voltage Range	I_{CC}	I_{OUT} Per Channel	ENABLE Voltage	Error Flag	8L NSOIC	8L PDIP	Comments
SP2525-1	+3.0V to +5.5V	80µA	500mA	active high	yes	✔		single channel power control switch compliant to USB specifications
SP2525-2	+3.0V to +5.5V	80µA	500mA	active low	yes	✔		single channel power control switch compliant to USB specifications
SP2526-1	+3.0V to +6.0V	80µA	500mA	active high	yes	✔		dual channel power control switch compliant to USB specifications
SP2526-2	+3.0V to +6.0V	80µA	500mA	active low	yes	✔		dual channel power control switch compliant to USB specifications

Shunt Voltage Regulators and References

Device	IK (Min - Max) (mA)	VKA (V)	Accuracy (1%)	Reference Voltage (V_{REF})	2 Terminal	3 Terminal	I_{REF} (Max) (µA)	SOT-23 3 pin (M)	SOT-23 5 pin (M5)	SOT-89 3 pin (M1)	SOIC 8 pin (S)	TO-92 3 pin (N)
SPX431A	1-150	36	0.5%	2.5V		✔	4		✔	✔	✔	✔
SPX431B	1-150	36	1%	2.5V		✔	4		✔	✔	✔	✔
SPX431C	1-150	36	2%	2.5V		✔	4		✔	✔	✔	✔
SPX431L	1-100	20	0.5%,1, 2%	2.5V		✔	4	✔		✔	✔	✔
SPX1431	1-150	36	0.40%	2.5V		✔	1.9		✔	✔	✔	✔
SPX2431	1-100	20	0.5%,1%	2.5V		✔	4	✔				
SPX2431L	0.16-100	20	0.5%,1%	2.5V		✔	4	✔			✔	✔
SPX4040	0.16-15	N/A	0.5%, 1%	2.5V	✔		N/A	✔			✔	✔
SPX432	1-80	18	0.5%, 1%	1.24V		✔	6	✔			✔	✔
SPX4041	0.16-15	N/A	1%, 2%	1.24V	✔		N/A	✔			✔	✔
SPX1004-1.2	0.01-20	N/A	0.5%	1.235V	✔		N/A			✔	✔	✔
SPX1004-2.5	0.01-20	N/A	1%	2.5V	✔		N/A			✔	✔	✔
SPX385-1.2	0.01-20	N/A	1.3%, 2.4%	1.235V	✔		N/A			✔	✔	✔
SPX385-2.5	0.01-20	N/A	1%, 2%	2.5V	✔		N/A			✔	✔	✔

PNP Low Dropout Voltage Regulators

Device	MAX I_{OUT} (mA)	Operating Voltage Range (V)	V_{OUT} Accuracy	1.8V	2.0V	2.5V	2.8V	3.3V	3.5V	5.0V	Adj.	Enable	Error Flag	Dropout Voltage (mV) Typ	SOT-23 5 pin (M5)	SOT-89 3 pin (M1)	SOT-223 3 pin (M3)	SOIC 8 pin (S)	TO-92 3 pin (N)	TO-252 3 pin (R)	TO-220 3 pin (U)	TO-220 5 pin (U5)	TO-263 3 pin (T)	TO-263 5 pin (T5)
SPX116	100	2.5 - 14	3%					✔	✔					280		✔			✔					
SPX2931	100	6 - 26	2%, 3%					✔	✔					300		✔			✔					
LP2950	100	6 - 30	0.5%, 1%					✔		✔				380					✔					
LP2951	100	6 - 30	0.5%, 1%					✔		✔		✔	✔	380				✔						
SPX1121	150	6 - 30	1%					✔		✔				420			✔		✔					
SPX2930	150	6 - 26	3%					✔	✔					300		✔			✔		✔			
SPX2950	150	6 - 30	0.5%, 1%					✔		✔				450					✔					
SPX2951	150	6 - 30	0.5%, 1%					✔		✔		✔	✔	450				✔						
SPX5205	150	2.5 - 16	1%	✔	✔	✔	✔	✔		✔	✔	✔		210	✔									
SPX2954	250	6 - 30	0.5%, 1%					✔		✔		✔	✔	375			✔	✔	✔		✔		✔	
SPX2808	300	5 - 10	2%, 3%					✔	✔					300		✔	✔							
SPX1521	300	6 - 20	1%					✔		✔				420			✔			✔	✔		✔	
SPX2920	400	6 - 20	1%					✔		✔		✔	✔	375			✔	✔			✔		✔	
SPX1129	500	6 - 20	1%					✔		✔				420			✔			✔	✔		✔	
SPX2945	500	6 - 20	1%					✔		✔		✔	✔	350			✔	✔		✔	✔		✔	
SPX3819	500	2.5 - 16	1%			✔		✔		✔	✔	✔	✔	340	✔			✔						
SPX2940	1A	6 - 16	3%	✔		✔		✔		✔				390							✔		✔	
SPX2941	1A	6 - 16	3%								✔	✔		390								✔		✔
SPX3940	1A	4.3 - 16	1%, 2%	✔		✔		✔		✔				390			✔				✔		✔	
SPX29150	1.5A	2.5 - 16	1.5%	✔		✔		✔		✔				390							✔		✔	
SPX29151	1.5A	2.5 - 16	1.5%	✔		✔		✔		✔		✔	✔	390								✔		✔
SPX29152	1.5A	2.5 - 16	1.5%								✔	✔		390								✔		✔
SPX29153	1.5A	2.5 - 16	1.5%								✔		✔	390								✔		✔
SPX29300	3A	2.5 - 16	1%	✔		✔		✔		✔				550							✔		✔	
SPX29301	3A	2.5 - 16	1%	✔		✔		✔		✔		✔	✔	550								✔		✔
SPX29302	3A	2.5 - 16	1%								✔	✔		550								✔		✔
SPX29303	3A	2.5 - 16	1%								✔		✔	550								✔		✔

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NPN Low Dropout Voltage Regulators

Device	MAX I_{OUT} (mA)	Operating Voltage Range (V)	V_{OUT} Accuracy	2.5V	2.85V	3.0V	3.3V	5.0V	Adj.	Dropout Voltage (V) Typ	SOT-223 3 pin (M3)	TO-252 3 pin (R)	TO-220 3 pin (U)	TO-220 5 pin (U5)	TO-263 3 pin (T)	TO-263 5 pin (T5)
SPX1202	600	4.5 - 12	1%	✔		✔	✔		✔	1.05	✔	✔	✔		✔	
SPX1117	800	4.25 - 15	1%	✔	✔	✔	✔		✔	1.1	✔	✔	✔		✔	
SPX2810	1.0A	2.75 - 10	1%, 2%	✔		✔	✔		✔	1.1	✔	✔	✔		✔	
SPX1583	1.5A	V_{IN}=1.75-5.5 V_{CTL}=2.5-12	2%	✔			✔		✔	0.560				✔		✔
SPX2815	1.5A	2.75 - 7	1%,2%	✔			✔	✔	✔	1.1		✔	✔		✔	
SPX1582	3.0A	V_{IN}=1.75-5.5 V_{CTL}=2.5-12	2%	✔			✔		✔	0.560				✔		✔
SPX1587	3.0A	2.75 - 10	1%, 2%	✔			✔	✔	✔	1.1		✔	✔		✔	
SPX1581	5.0A	V_{IN}=1.75-5.5 V_{CTL}=2.5-12	2%	✔			✔		✔	0.560				✔		✔
SPX1585	5.0A	2.75 - 10	1%, 2%	✔			✔	✔	✔	1.1			✔		✔	
SPX1580	7.0A	V_{IN}=1.75-5.5 V_{CTL}=2.5-12	2%	✔			✔		✔	0.640				✔		✔
SPX1584	8.0A	2.75 - 7	1%, 2%				✔	✔	✔	1.1			✔			

CMOS Low Dropout Voltage Regulators

Device	MAX I_{OUT} (mA)	Operating Voltage Range (V)	V_{OUT} Accuracy	2.5V	2.7V	2.85V	3.0V	3.3V	5.0V	Adj.	Enable	Error Flag	Dropout Voltage (mV) Typ	SOT-23 5 pin (M5)	SOT-23 6 pin (M6)	SC-70 4 pin (C4)	SC-70 5 pin (C5)
SP6213	100	2.7 - 7	2%	✔	✔	✔	✔	✔	✔	✔	✔	✔	150			✔	✔
SP6200	100	2.7 - 7	2%	✔	✔	✔	✔	✔	✔	✔	✔	✔	100		✔		
SP6201	200	2.7 - 7	2%	✔	✔	✔	✔	✔	✔	✔	✔	✔	250		✔		
SP6203	300	2.7 - 7	2%	✔	✔	✔	✔	✔	✔	✔	✔	✔	300	✔	✔		
SP6205	500	2.7 - 7	2%	✔	✔	✔	✔	✔	✔	✔	✔	✔	400	✔	✔		

Dual Low Dropout Voltage Regulators

Device	MAX I_{OUT} (mA)	Operating Voltage Range (V)	V_{OUT} Accuracy	2.5V	2.7V	2.85V	3.0V	3.3V	5.0V	Adj.	Enable	Error Flag	Dropout Voltage (mV) Typ	6L MLP	8L NSOIC	Comments
SP6231	500	0 - 6	2%					✔			✔			✔	✔	500mA CMOS LDO with auxiliary 6L MLP voltage input

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Power Management Evaluation Boards and Kits

Evaluation Boards

Part Number	Description	Type	Order Number
SP2526	SP2526 Evaluation Board	Evaluation Board	SP2526EB
SP6120	SP6120 Evaluation Board & Manual	Evaluation Kit	SP6120EB
SP6121	SP6121 Evaluation Board & Manual	Evaluation Kit	SP6121EB
SP6122	SP6122 Evaluation Board & Manual	Evaluation Kit	SP6122UEB
SP6231	SP6231 Evaluation Board & Manual	Evaluation Kit	SP6231EB
SP6639/40/53	SP6639/40/53Evaluation Board & Manual	Evaluation Kit	SP6639/40/53NEB
SP6641A	Evaluation Board & Manual	Evaluation Kit	SP6641AKEB
SP6641B	Evaluation Board & Manual	Evaluation Kit	SP6641BKEB
SP6650	SP6650 Evaluation Board	Evaluation Board	SP6650EB
SP6660	SP6660 Evaluation Board	Evaluation Board	SP6660EB
SP6661	SP6661 Evaluation Board	Evaluation Board	SP6661EB
SP691A	SP691A Evaluation Board	Evaluation Board	SP691AEB
SP693A	SP693A Evaluation Board	Evaluation Board	SP693AEB
SP791	SP791 Evaluation Board	Evaluation Board	SP791EB

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Evaluation Kits

Part Number	Description	Type	Order Number
SP791	SP791 Evaluation Kit (includes Evaluation Board, Samples and Documentation)	Evaluation Kit	SP791EK

100 mA Low Dropout Voltage Regulators

features

- **Guaranteed 100mA Output Current**
- **5.0V and 3.3V Versions @ 100mA Output**
- **Very Low Quiescent Current**
- **Low Dropout Voltage: 380mV at 100mA**
- **Extremely Tight Load and Line Regulation**
- **Very Low Temperature Coefficient**
- **Current & Thermal Limiting**
- **Need Only 1µF for Stability**
- **LP2951 versions only**
  - Error Flag Warns of Output Dropout
  - Logic-Controlled Electronic Shutdown
  - Output Programmable From 1.24 to 29V
- **Offered in TO-92 (LP2950) & SOIC (LP2951)**

applications

- **Battery Powered Systems**
- **Cordless Telephones**
- **Radio Control Systems**
- **Portable/Palm Top/Notebook Computers**
- **Portable Consumer Equipment**
- **Portable Instrumentation**
- **SMPS Post-Regulator**
- **Voltage Reference**
- **Automotive Electronics**

description

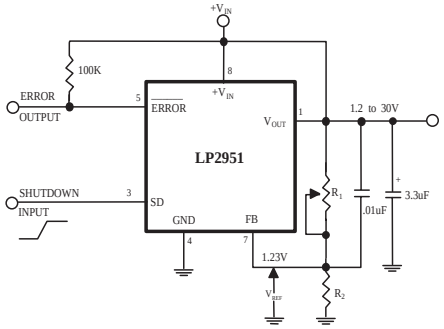
The LP2950 and LP2951 are low power voltage regulators. These devices are an excellent choice for use in battery-powered applications such as cordless telephones, radio control systems, and portable computers. The LP2950 and LP2951 feature low quiescent current and low dropout voltage (typ. 50mV at light load and 380 mV at 100mA). This includes a tight initial tolerance of 0.5% (typ.), extremely good load and line regulation (0.05% typ.), and very low output temperature coefficient, making the LP2950/LP2951 useful as a low-power voltage reference.

The error flag output feature is used as a power-on reset for warning of a low output voltage, due to a falling input voltage. The logic-compatible shutdown feature enables the regulator to be switched ON and OFF. The LP2950 is offered in a 3-pin TO-92 package compatible with other 5V, 3.0V & 3.3V regulators. The LP2951 is available in an 8-lead SOIC package.

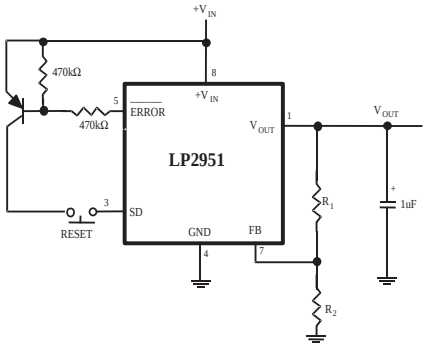
P

typical application circuits

Adjustable Regulator

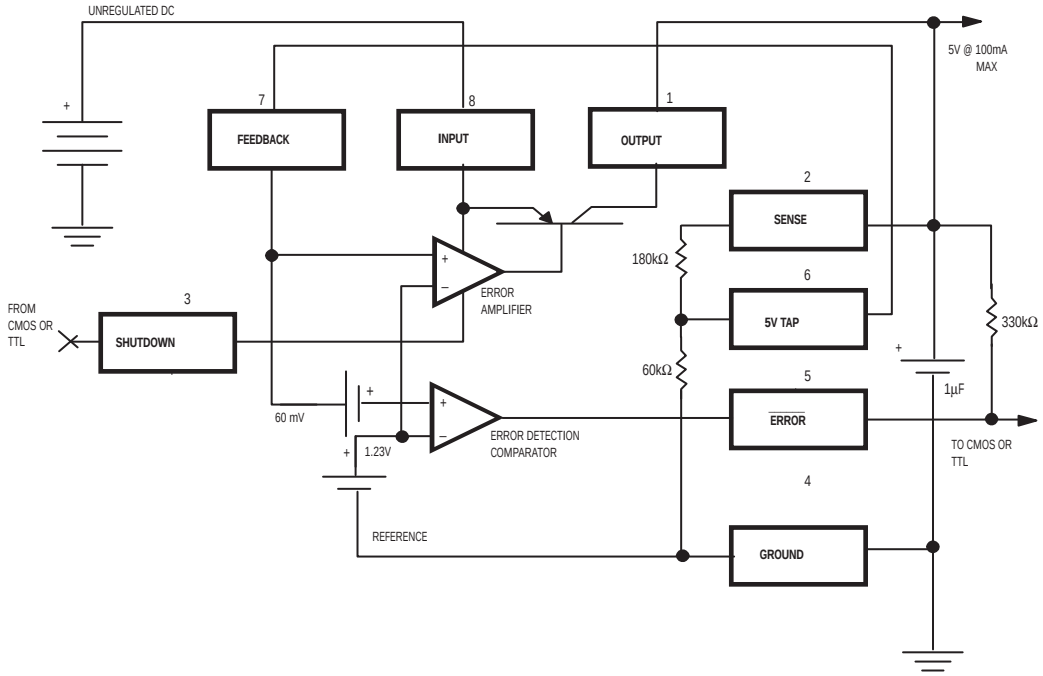


Latch Off When Error Flag Occurs



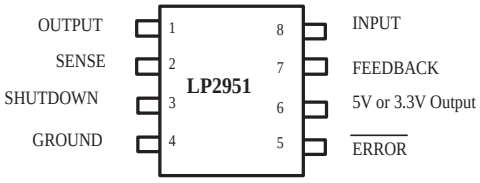
LP2950/LP2951

block diagram



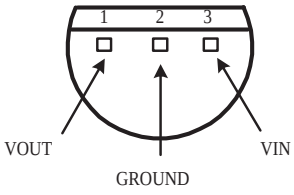
packages

8-Pin Surface Mount (S)



Top View

TO-92 (N)



Bottom View

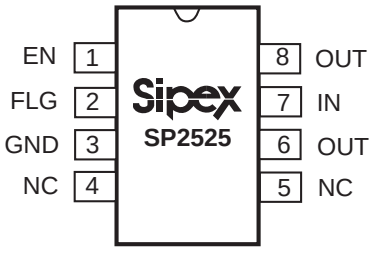
ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number.	Precision	Output Voltage	Packages
LP2950ACN-3.3	0.5%	3.3V	3 lead TO-92
LP2950ACN-5.0	0.5%	5.0V	3 lead TO-92
LP2950CN-3.3	1%	3.3V	3 lead TO-92
LP2950CN-5.0	1%	5.0V	3 lead TO-92
LP2951ACS-3.3	0.5%	3.3V	8 Lead SOIC
LP2951ACS-5.0	0.5%	5.0V	8 Lead SOIC
LP2951CS-3.3	1%	3.3V	8 Lead SOIC
LP2951CS-5.0	1%	5.0V	8 Lead SOIC

+3.0V to +5.5V USB Power Control Switch

features

- **Compliant to USB Specifications**
- **+3.0V to +5.5V Input Voltage Range**
- **Open Drain Error Flag Output**
- **2.7V Undervoltage Lockout**
- **500mA Minimum Continuous Load Current**
- **1.25A Short Circuit Current Limit**
- **140mΩ Maximum On-Resistance**
- **80µA On-State Supply Current**
- **1µA Shutdown Current**
- **Thermal Shutdown**
- **1ms Soft-Start Power Up**
- **Active-High Version**
  - SP2525-1
- **Active-Low Version**
  - SP2525-2

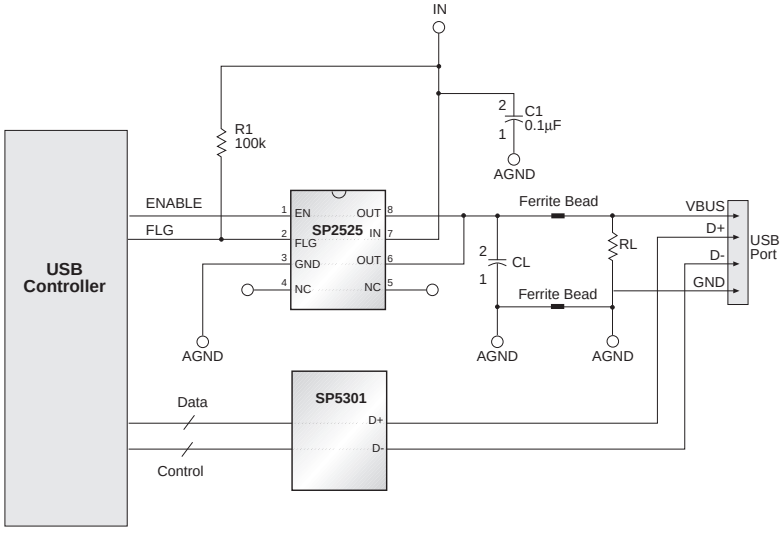


description

The SP2525 device is a single +3.0V to +5.5V USB supervisory power control switch ideal for self-powered and bus-powered Universal Serial Bus (USB) applications. The SP2525 device has low on-resistance (80mΩ typical) and can supply 500mA minimum. The fault currents are limited to 2.0A typical and the flag output pin is available to indicate fault conditions to the USB controller. The 1ms soft start of the SP2525 device will eliminate any momentary voltage drop on the upstream port that may occur when the switch is enabled in bus-powered applications. The thermal shutdown feature will prevent permanent damage to the SP2525 device when subjected to excessive current loads. The under voltage lockout feature will ensure that the SP2525 device will remain off unless there is a valid input voltage present.

P

typical application circuit



ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP2525-1EN	-40°C to +85°C	8-pin NSOIC
SP2525-2EN	-40°C to +85°C	8-pin NSOIC

SP2525

block diagram

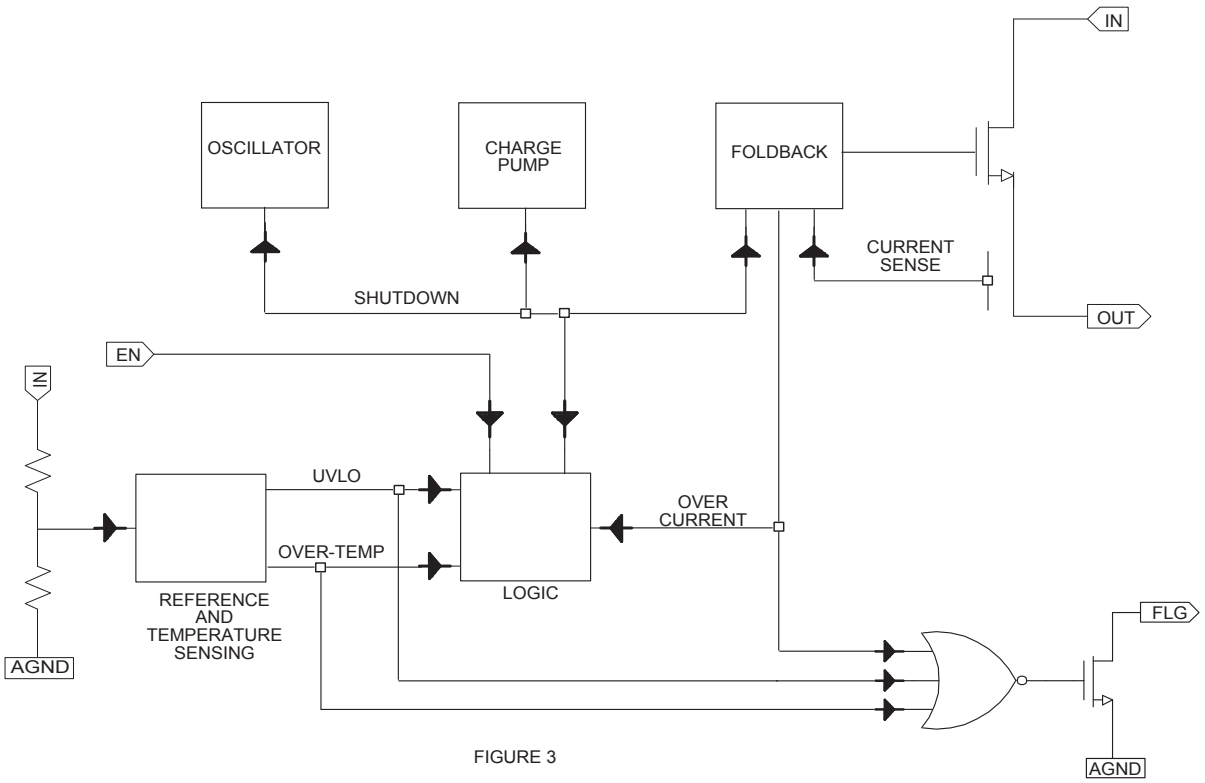


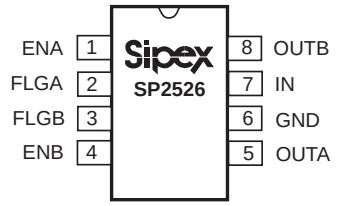
FIGURE 3

pin number	name	description
1	EN	Enable Input Active High for the SP2525-1 and Active Low for the SP2525-2.
2	FLG	Fault Flag Output —Active-low, open-drain output. Indicates over-current, UVLO and Thermal Shutdown.
3	GND	Ground Reference —Supply return.
4	NC	No Connection.
5	NC	No Connection.
6, 8	OUT	Switch Output Connect Out Pins Together
7	IN	Supply Voltage (Input)

+3.0V to +5.5V USB Power Control Switch

features

- **Compliant to USB Specifications**
- **+3.0V to +5.5V Input Voltage Range**
- **Two Independent Power Switches**
- **Two Error Flag Outputs, Open Drain**
- **2.7V Undervoltage Lockout**
- **500mA Minimum Continuous Load Current Per Switch**
- **1.25A Short Circuit Current Limit**
- **140mΩ Maximum On-Resistance**
- **80µA On-State Supply Current**
- **1µA Shutdown Current**
- **Output Can Be Forced Higher Than Input (Off-State)**
- **Thermal Shutdown**
- **1ms Soft-Start Power Up**
- **Active-High Version -** SP2526-1
- **Active-Low Version -** SP2526-2

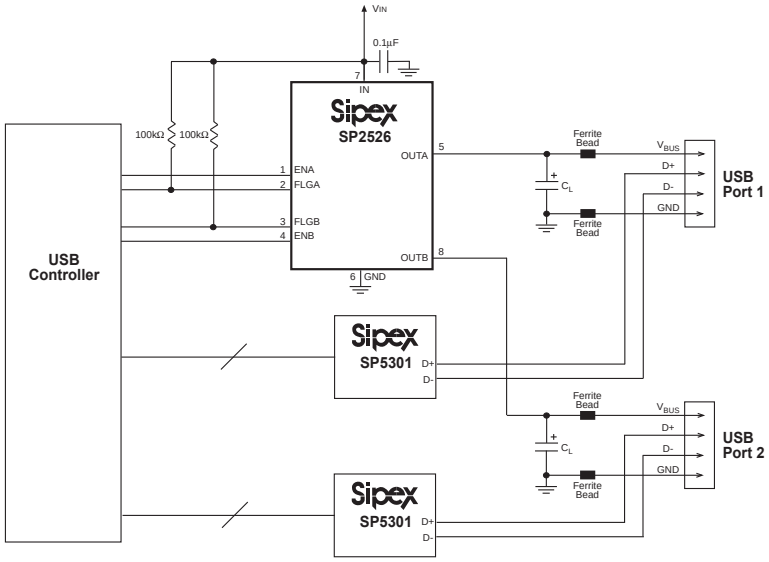


description

The SP2526 device is a dual +3.0V to +5.5V USB supervisory power control switch ideal for self-powered and bus-powered Universal Serial Bus (USB) applications. Each switch has low on-resistance (80mΩ typical) and can supply 500mA minimum. The fault currents are limited to 2.0A typical and the flag output pin for each switch is available to indicate fault conditions to the USB controller. The 1ms soft start will eliminate any momentary voltage droop on the upstream port that may occur when the switch is enabled in bus-powered applications. The thermal shutdown feature will prevent damage to the device when subjected to excessive current loads. The undervoltage lockout feature will ensure that the device will remain off unless there is a valid input voltage present.

P

typical application circuit

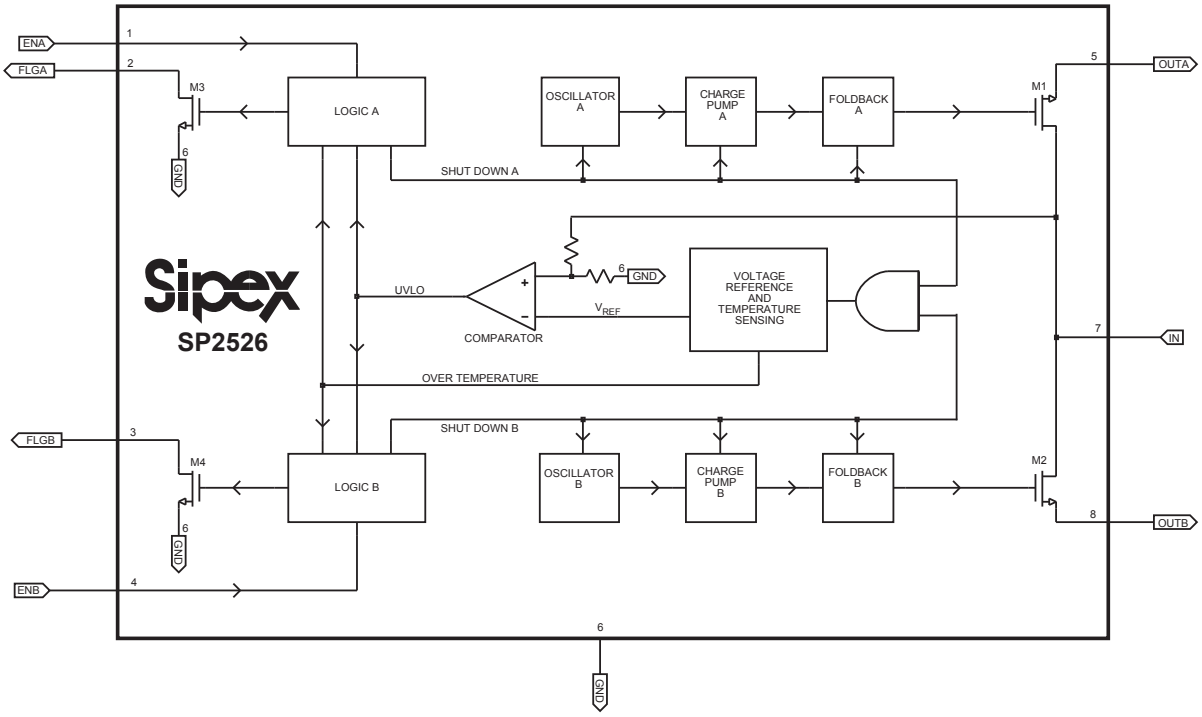


ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP2526-1EN	-40°C to +85°C	8-pin NSOIC
SP2526-2EN	-40°C to +85°C	8-pin NSOIC

SP2526

block diagram



pin number	name	description
1	ENA	Enable Input for MOSFET Switch A. This input pin is active high for the SP2526-1 and active low for the SP2526-2.
2	FLGA	Fault Flag Output for Switch Channel A. This open drain output pin pulls low to indicate overcurrent, undervoltage lockout, and thermal shutdown conditions.
3	FLGB	Fault Flag Output for Switch Channel B. This open drain output pin pulls low to indicate overcurrent, undervoltage lockout, and thermal shutdown conditions.
4	ENB	Enable Input for MOSFET Switch B. This input pin is active high for the SP2526-1 and active low for the SP2526-2.
5	OUTA	Output for MOSFET Switch Channel A. This is the output pin of the MOSFET source of channel A, typically connected to the switched side of the load.
6	GND	Ground reference. Supply return.
7	IN	Supply Input. This input pin is connected to the MOSFET drain of both switches. Connect +3.0V to +5.5V to this input pin. The voltage at this input pin also supplies the internal circuitry.
8	OUTB	Output for MOSFET Switch Channel B. This is the output pin of the MOSFET source of channel B, typically connected to the switched side of the load.

SP6120

Low Voltage, AnyFET™, Synchronous, Buck Controller

Ideal for 5A to 15A, High Performance, DC-DC Power Converters

features

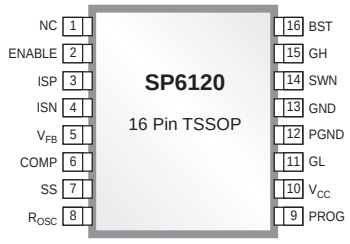
- **AnyFET™ Technology: Capable of Switching either PFET or NFET High Side Switch**
- **Optimized for Single Supply, 3.3V or 5.0V Bus Applications**
- **Output Adjustable Down to 1.25V**
- **Optimized for Output Current up to 15A**
- **High Efficiency: 95% Possible**
- **Resistor Programmable Frequency**
- **Selectable Discontinuous or Continuous Conduction Mode for Use in Battery or Bus Applications**
- **Fast Transient Response**
- **Accurate 1% Reference Over Line, Load and Temperature**
- **Accurate 10% Frequency**
- **Accurate, Rail to Rail, 43mV, 20% Over-Current Sensing**
- **Resistor Programmable Output Voltage**
- **Capacitor Programmable Soft Start**
- **Hiccup Over-Current Protection**
- **16-Pin TSSOP, Small Size**

applications

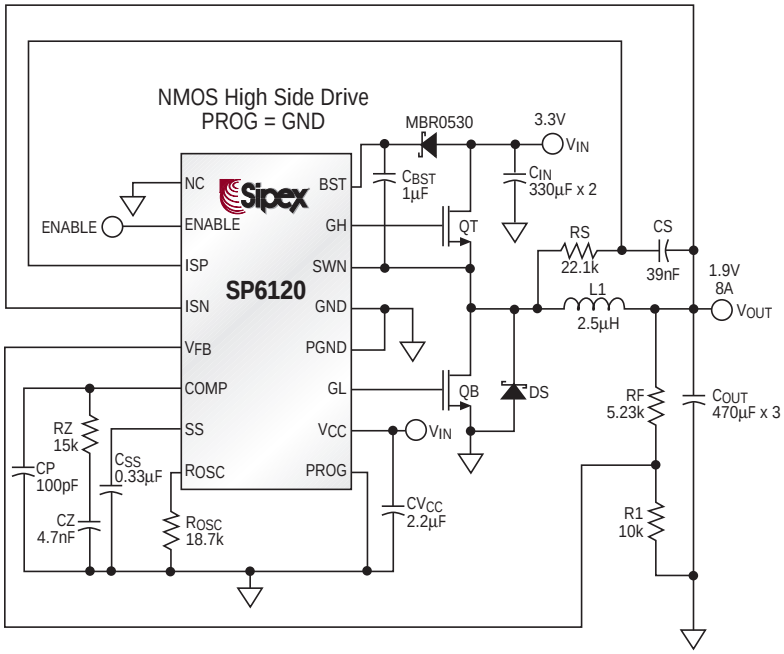
- **DSP**
- **Microprocessor Core**
- **I/O & Logic**
- **Industrial Control**
- **Distributed Power**
- **Low Voltage Power**

description

The SP6120 is a fixed frequency, voltage mode, synchronous PWM controller designed to work from a single 5V or 3.3V input supply. Sipex's unique "AnyFET™" Technology allows the SP6120 to be used for resolving a multitude of price/performance trade-offs. It is separated from the PWM controller market by being the first controller to offer precision, speed, flexibility, protection and efficiency over a wide range of operating conditions.



NMOS application circuit



QT, QB = FAIRCHILD FDS6690A
QT1 = FAIRCHILD FDS6375 (PMOS Only)
L1 = PANASONIC ETQP6F2R5SFA

DS = STMICROELECTRONICS STPS2L25U
C_{IN} = SANYO 6TPB330M
C_{OUT} = SANYO 4TPB470M

SP6120

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC} 7V
BST 13.2V
BST-SWN 7V
SWN . . . . . .-1V to 7V
GH . . . . . .-0.3V to BST +0.3V
GH-SWN 7V
All Other Pins . . . . . .-0.3V to V_{CC} +0.3V
Peak Output Current < 10µs
GH, GL 2A
Operating Temperature Range SP6120C
0°C to +70°C SP6120E
-40°C to +85°C
Junction Temperature, TJ . . . . . .+125°C
Storage Temperature Range . . . . . .-65˚C to +150˚C
Power Dissipation
Lead Temperature (soldering 10 sec) . . . . . .+300˚C
ESD Rating . . . . . .2kV HBM

electrical specifications

Unless otherwise specified: 3.0V < V_{CC} <5.5V, 3.0V < BST < 13.2, R_{OSC} = 18.7kΩ, C_{COMP} = 0.1µF, C_{SS} = 0.1µF, ENABLE = 3V, CGH = CGL = 3.3nF, V_{FB} = 1.25V, ISP = ISN = 1.25V, SWN = GND = PGND = 0V, -40°C < T_A <85°C (Note 1)

P

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
QUIESCENT CURRENT					
V_{CC} Supply Current	No Switching	-	0.95	1.8	mA
V_{CC} Supply Current (Disabled)	ENABLE = 0V	-	5	20	µA
BST Supply Current	No Switching	-	1	20	µA
ERROR AMPLIFIER					
Error Amplifier Transconductance			600		µS
COMP Sink Current	V_{FB} = 1.35V, COMP = 0.5V, No Faults	15	35	65	µA
COMP Source Current	V_{FB} = 1.15V, COMP = 1.6V	15	35	65	µA
COMP Output Impedence			3		MOhm
V_{FB} Input Bias Current		-	60	100	nA
REFERENCE					
Error Amplifier Reference	Trimmed with Error Amp in Unity Gain	1.238	1.250	1.262	V
V_{FB} 3% Low Comparator			|-3|		%VREF
V_{FB} 3% High Comparator			3		%VREF
OSCILLATOR & DELAY PATH					
Oscillator Frequency		270	300	330	kHz
Oscillator Frequency #2	R_{OSC} = 10.2kOhm	450	500	550	kHz
Duty Ratio	Loop In Control -100% DC possible		95		%

electrical specifications

Unless otherwise specified: 3.0V < V_{CC} <5.5V, 3.0V < BST < 13.2, R_{OSC} = 18.7kΩ, C_{COMP} = 0.1µF, C_{SS} = 0.1µF, ENABLE = 3V, CGH = CGL = 3.3nF, V_{FB} = 1.25V, ISP = ISN = 1.25V, SWN = GND = PGND = 0V, -40°C < T_A <85°C (Note 1)

PARAMETER	CONDITIONS	MIN	TYP	MAX	UNITS
OSCILLATOR & DELAY PATH: continued					
R_{OSC} Voltage	Information Only - Moves with Oscillator Trim		0.65		V
Minimum GH Pulse Width	V_{CC} > 4.5V, Ramp up COMP Voltage > 0.6V until GH starts switching		120		ns
SOFTSTART					
SS Charge Current	V_{SS} = 1.5V	25	50	70	µA
SS Discharge Current	V_{SS} = 1.5V	2	5	7	µA
COMP Discharge Current	V_{COMP} = 0.5V, Fault Initiated	200	500	-	µA
COMP Clamp Voltage	V_{FB} < 1.0V, V_{SS} = 2.5V	2.1	2.4	2.8	V
SS Ok Threshold		1.8	2.0	2.2	V
SS Fault Reset		0.2	0.25	0.3	V
SS Clamp Voltage		2.1	2.4	2.8	V
OVER CURRENT & ZERO CURRENT COMPARATORS					
Over Current Comparator Threshold Voltage	Rail to Rail Common Mode Input	32	43	54	mV
ISN, ISP Input Bias Current		-	60	250	nA
Zero Current Comparator Threshold	VISP - VISN		2		mV
ENABLE/UVLO					
V_{CC} Start Threshold		2.75	2.85	2.95	V
V_{CC} Stop Threshold		2.65	2.75	2.9	V
V_{CC} Hysteresis			100		mV
Enable Threshold		0.65	1.1	1.45	V
Enable Pin Source Current		0.6	4	9	µA
GATE DRIVER					
GH Rise Time	V_{CC} > 4.5V	-	40	110	ns
GH Fall Time	V_{CC} > 4.5V	-	40	110	ns
GL Rise Time	V_{CC} > 4.5V	-	40	110	ns
GL Fall Time	V_{CC} > 4.5V	-	40	110	ns
GH to GL Non-Overlap Time	V_{CC} > 4.5V		60		ns
GL to GH Non-Overlap Time	V_{CC} > 4.5V		60		ns

Note 1: Specifications to -40°C are guaranteed by design, characterization and correlation with statistical process control.

SP6120

pin number	name	description
1	NC	No Connection
2	ENABLE	TTL compatible input with internal 4µA pullup. Floating or V_{ENABLE}> 1.5V will enable the part, V_{ENABLE} < 0.65V disables part.
3	ISP	Current Sense Positive Input: Rail to Rail Input for Over-Current Detection, 43mV threshold with 10µs (typ) response time.
4	ISN	Current Sense Negative Input: Rail to Rail input for Over-Current Detection.
5	V_{FB}	Feedback Voltage Pin: Inverting input of the error amplifier and serves as the output voltage feedback point for the buck converter. The output voltage is sensed and can be adjusted through an external resistor divider.
6	COMP	Error Amplifier Compensation Pin: A lead lag network is typically connected to this pin to compensate the feedback loop. This pin is clamped by the SS voltage and is limited to 2.7V maximum.
7	SS	Soft Start Programming Pin: This pin sources 40µA on start-up. A 0.01µF to 1µF capacitor on this pin is typically enough capacitance to soft start a power supply. In addition, hiccup mode timing is controlled by this pin through the 4µA discharge current. The SS voltage is clamped to 2.7V maximum.
8	R_{OSC}	Frequency Programming Pin: A resistor to ground is used to program frequency. Typical values - 18700Ω, 300kHz; 11500Ω, 500kHz.
9	PROG	Programming Pin:PROG = GND; MODE = NFET/CONTINUOUS PROG = 68kΩ to GND; MODE = NFET/DISCONTINUOUS PROG = V_{CC}; MODE = PFET/CONTINUOUS PROG = 68kΩ to V_{CC}; MODE = PFET/DISCONTINUOUS
10	V_{CC}	I.C. Supply Pin: ESD structures also hooked to this pin.
11	GL	Synchronous FET Driver: 1nF/20ns typical drive capability.
12	PGND	Power Ground Pin: Used for Power Stage. Connect Directly to GND at I.C. pins for optimal performance.
13	GND	Ground Pin: Main ground pin for I.C.
14	SWN	Switch Node Reference: High side MOSFET driver reference. Can also be tied to GND for low voltage applications.
15	GH	HIgh Side MOSFET Driver: Can be NFET or PFET depending on Program Mode. 1nF/20ns typical drive capability. Maximum voltage rating is referenced to SWN.
16	BST	High Side Driver Supply Pin.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Temperature Range		
0°C to +70°C	–40°C to +85°C	Package Type
SP6120CY	SP6120EY	16-Pin TSSOP

Low Voltage, 8 Pin, Synchronous, Buck Controller

Ideal for 5A to 15A, Small Footprint, DC-DC Power Converters

features

- **Optimized for Single Input Voltage - 3.3V to 5.0V Bus Applications**
- **Output Adjustable Down to 1.25V**
- **Optimized for Output Current Up to 15A**
- **High Efficiency: 95% possible**
- **Accurate, 500kHz Fixed Frequency Operation**
- **High Side PMOS Switch Negates Need for External Charge Pump**
- **Fast Transient Response**
- **Internal, 0.4 V/ms, Soft Start Circuit**
- **Precision 1% Reference**
- **Resistor Programmable Output Voltage**
- **Lossless Adjustable Current Limit with High Side $R_{DS(ON)}$ Sensing**
- **0% to 100% Duty Cycle Range**
- **Output Over Voltage Protection**
- **Hiccup Mode Current Limit Protection**
- **8 Pin SO Narrow Package**

applications

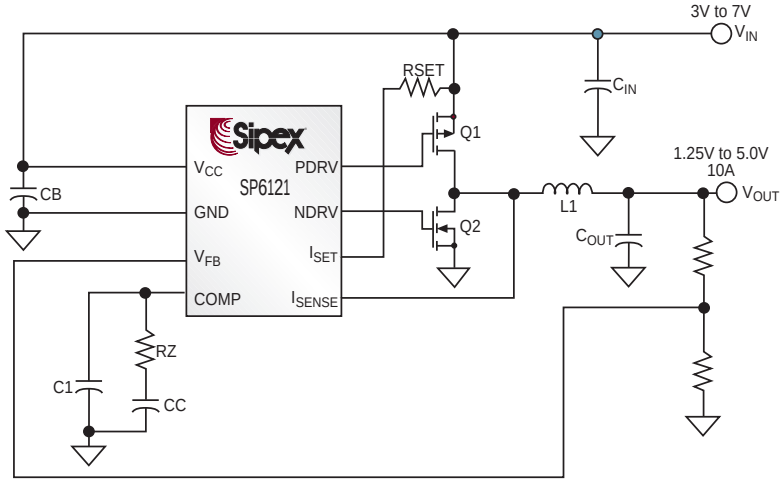
- **Supply Bias for**
  - Digital Set Top Box
  - Microprocessor Core
  - I/O & Logic
- **Video Cards**
- **Board Level Supply in Distributed Power Systems**

description

The SP6121 is a fixed frequency, voltage mode, synchronous PWM controller designed to work from a single 5V or 3.3V input supply, providing excellent AC and DC regulation for high efficiency power conversion. The operating frequency is internally set at 500kHz, permitting the use of small, surface mount inductors and capacitors. Requiring only few external components, the SP6121 packaged in an 8-pin SOIC, is especially suited for low voltage applications where cost, small size and high efficiency are critical. With its low voltage capability and inherent 100% duty cycle operation, the SP6121 allows low dropout operation in the event of a low input supply voltage condition.

P

typical application circuit



SP6121

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC} 7V
All other pins . . . . . .-0.3V to V_{CC}+0.3V
Peak Output Current < 10us
PDRV, NDRV 2A
Storage Temperature . . . . . .65°C to 150°C
Lead Temperature (Soldering, 10 sec) . . . . . .300°C
ESD Rating . . . . . .2kV HBM

electrical specifications

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, C_{COMP} = 22nF, C_{PDRV} = C_{NDRV} = 3.3nF, V_{FB} = 1.25V, I_{SET} = I_{SENSE} = V_{CC}, GND = 0V

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
QUIESCENT CURRENT					
V_{CC} Supply Current	-	0.5	1.0	mA	No Switching
V_{CC} Supply Current (Disabled)	-	25	60	µA	COMP = 0V
ERROR AMPLIFIER					
Error Amplifier Transconductance		600		uS	
COMP Sink Current	15	35	65	µA	V_{FB} =1.35V, COMP = 0.8V, No Faults
COMP Source Current	15	35	65	µA	V_{FB} =1.15V, COMP = 1.8V
COMP Output Impedance		3		MΩ	
V_{FB} Input Bias Current		100		nA	
Error Amplifier Reference					
Initial Accuracy	1.238	1.250	1.262	V	Trimmed with Error Amplifier in Unity Gain
Error Amplifier Reference over Line, Load and Temperature	1.225	1.250	1.275	V	
OSCILLATOR & DELAY PATH					
Internal Oscillator Frequency	440	500	560	kHz	
Maximum Duty Cycle	100	-	-	%	COMP = 2V
Minimum Duty Cycle	-	-	0	%	COMP = 0.8V
Minimum PDRV Pulse Width		100		ns	V_{CC} > 4.5V, Ramp up COMP voltage until PDRV starts switching
CURRENT LIMIT					
Internal Current Limit Threshold	125	160	195	mV	VI_{SET} - VI_{SENSE}, T_A = 25°C
I_{SET} Sink Current	25	30	35	µA	VI_{SET} =5V, T_A = 25°C
Current Limit Threshold and I_{SET} Temperature Coefficient		0.33		%/C	
Current Limit Time Constant		15		µs	
I_{SENSE} Input Bias Current	-	-	100	nA	

electrical specifications

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, C_{COMP} = 22nF, C_{PDRV} = C_{NDRV} = 3.3nF, V_{FB} = 1.25V, I_{SET} = I_{SENSE} = V_{CC}, GND = 0V

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
SOFT START, SHUTDOWN, UVLO					
Internal Soft Start Skew Rate		0.4		V/ms	Measured at COMP pin on the transition from shutdown
Internal Soft Start Delay Time		1.5		ms	COMP charging to PDRV switching
COMP Discharge Current	150	300		µA	COMP=0.5V, Fault Initiated
COMP Clamp Voltage	0.6	0.7	0.8	V	VFB=1.3V
COMP Clamp Current		100		µA	COMP=0.5V, VFB =1.15V
Shutdown Threshold Voltage	0.2	0.3	0.4	V	Measured at COMP Pin
Shutdown Input Pull-up Current		5		µA	COMP=0.2V, Measured at COMP pin
V_{CC} Start Threshold	2.75	2.85	2.95	V	
V_{CC} Stop Threshold	2.65	2.75	2.85	V	
V_{CC} Hysteresis	-	100	-	mV	
GATE DRIVERS					
PDRV Rise Time	-	40	110	ns	V_{CC} >4.5V
PDRV Fall Time	-	40	110	ns	V_{CC} >4.5V
NDRV Rise Time	-	40	110	ns	V_{CC} >4.5V
PDRV Fall Time	-	40	110	ns	V_{CC} >4.5V
PDRV to NDRV Non-Overlap Time		80		ns	V_{CC} >4.5V
NDRV to PDRV Non-Overlap Time		50		ns	V_{CC} >4.5V

SP6121

pin number	name	description
1	V_{CC}	Positive input supply for the control circuitry and gate drivers. Properly bypass this pin to GND with a low ESL/ESR ceramic capacitor.
2	GND	Ground pin. Both power and control circuitry of the IC is referenced to this pin.
3	V_{FB}	Feedback Voltage Pin. It is the inverting input of the error amplifier and serves as the output voltage feedback point for the buck converter. The output voltage is sensed and can be adjusted through an external resistor divider.
4	COMP	Output of the Error Amplifier. It is internally connected to the non-inverting input of the PWM comparator. A lead-lag network is typically connected to the COMP pin to compensate the feedback loop in order to optimize the dynamic performance of the voltage mode control loop. Sleep mode can be invoked by pulling the COMP pin below 0.2V with an external open-drain or open-collector transistor. Supply current is reduced to 25µA (typical) in shutdown. An internal 5µA pull-up ensures start-up.
5	I_{SENSE}	Current Limit Sense pin. Connect this pin to the switching node at the junction between the two external power MOSFET transistors. This pin monitors the voltage dropped across the R_{DSON} of the high side P-channel MOSFET while it is conducting. When this drop exceeds the sum of the voltage programmed through the I_{SET} pin plus the internal 160mV threshold, the overcurrent comparator sets the fault latch and terminates the output pulses. The controller stops switching and goes through a hiccup sequence. This prevents excessive power dissipation in the external power MOSFETs during an overload condition. An internal delay circuit prevents that very short and mild overload conditions, that could occur during a load transient, activate the current limit circuit. To disable the current limit circuit connect I_{SENSE} to V_{CC}.
6	I_{SET}	Current Limit Threshold pin. An external resistor connected between this pin and the source of the high side P-channel MOSFET adds to the internal current limit threshold of 160mV. If a current limit threshold in excess of 160mV is required, the external programming resistor can properly be chosen based on the internal 30µA pull down current available on the ISET pin. Both this 30µA current source and the 160mV built-in current limit threshold have a positive temperature coefficient to provide first order correction for the temperature coefficient of the external P-channel MOSFET's R_{DSON}.
7	NDRV	High current driver output for the low side MOSFET switch. It is always low if PDRV is low or during a fault.
8	PDRV	High current driver output for the high side MOSFET switch. It is always high if NDRV is high or during a fault.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6121CN	0°C to 70°C	8 Pin NSOIC
SP6121CN/TR	0°C to 70°C	(tape and reel) 8 Pin NSOIC

Low Voltage, Micro 8, PFET, Buck Controller

Ideal for 1A to 4A, Small Footprint, DC-DC Power Converters

features

- **Optimized for Single Supply, 3.V or 5.0V Bus Applications**
- **Output Adjustable Down to 1.25V**
- **Optimized for Output Current Up to 4A**
- **High Efficiency, 90% Possible**
- **20ns/1nF PFET Output Driver**
- **Fast Transient Response**
- **Open Drain Fault Output Pin**
- **Internal, 2ms, Soft Start Circuit**
- **Accurate 1.25V, 1.5% Reference**
- **Loss-less Adjustable Current Limit with High side $R_{DS(ON)}$ Sensing**
- **Hiccup or Lock-up Fault Modes**
- **Low 5µA Sleep Mode Quiescent Current**
- **Low 300µA Protected Mode Quiescent Current**
- **Ultra Low, 150µA Unprotected Mode Quiescent Current**
- **Output Over Voltage Protection**
- **Small Micro 8 Package**

applications

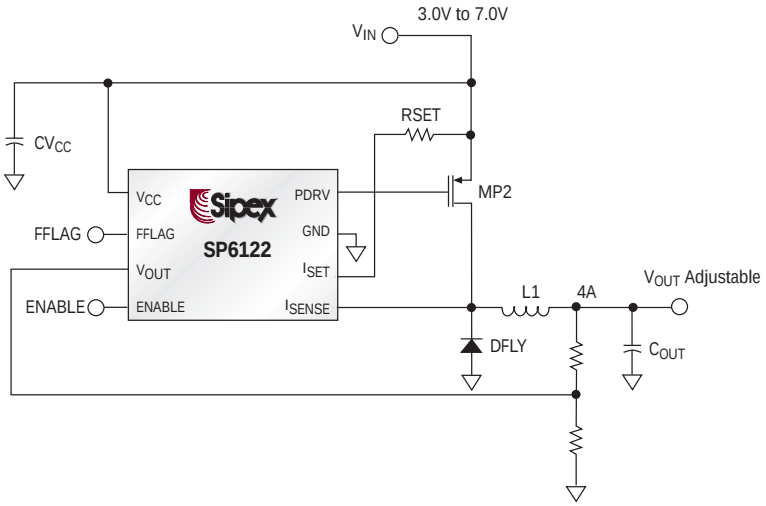
- **Video Cards**
- **High Power Portable**
- **Microcontrollers**
- **I/O and Logic**
- **Industrial Control**
- **Distributed Power**
- **Low Voltage Power**

description

The SP6122 is a PWM/PFM minimum on-time controller designed to work from a single 5V or 3.3V input supply. It is engineered specifically for size and minimum components count, simplifying the transition from a linear regulator to a switcher solution. However, unlike other "micro" parts, the SP6122 has an array of value added features like optional hiccup mode, over current protection, TTL enable, "jitter and frequency stabilization" and a fault flag pull down pin. Combined with reference and driver specifications usually found on more expensive integrated circuits, the SP6122 delivers great performance and value in a micro 8 package.

P

typical application circuit



SP6122

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC} 7V
All other pins . . . . . .-0.3V to V_CC+0.3V
Peak Output Current < 10µs
PDRV 2A
Storage Temperature . . . . . .-65°C to 150°C
Power Dissipation
Lead Temperature (Soldering, 10 sec) . . . . . .300°C
ESD Rating . . . . . .2kV HBM

electrical specifications

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, C_{PDRV} = 1nF, V_{ENABLE} = V_{CC}, V_{FFLAG} = V_{CC}, I_{SET} = I_{SENSE} = V_{CC}, GND = 0V

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
QUIESCENT CURRENT					
V_{CC} Supply Current, OVC Enabled	-	300	400	µA	No Switching, ISET = ISENSE = V_{CC}
V_{CC} Supply Current, OVC Disabled	-	250	-	µA	No Switching, ISET = ISENSE = 0
V_{CC} Supply Current, OVC Disabled, Ultra Low IQ	-	150	-	µA	No Switching, ISET = 0, ISENSE=V_{CC}
V_{CC} Supply Current, Sleep Mode	-	5	15	µA	Enable=0
REFERENCE 1.25V					
Output Voltage, Initial Accuracy	VR*0.985	VR	VR*1.015	V	VR = Factory Set Voltage, see Note
Output Voltage, Over Line, Load and Temperature	VR*0.980	VR	VR*1.020	V	VR = Factory Set Voltage, see Note
PFM Reference Comparator Hysteresis	-	5	-	mV	Internal Hysteresis at Feedback Terminal
OSCILLATOR 300kHz					
Oscillator Frequency	F*0.7	F	F*1.3	kHz	
Minimum Pulse Width during Startup (Blanking Time)	-	200	-	ns	
SOFT START					
Soft Start Ramp Time	-	2	-	ms	V_{OUT} = VR – 30mV, Measure time from ENABLE = 1V to PDRV Low
Soft Start Voltage when PDRV Switches	-	250	-	mV	Measure VSoft Start when PDRV goes Low. (internal)

electrical specifications: continued

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, C_{PDRV} = 1nF, V_{ENABLE} = V_{CC}, V_{FFLAG} = V_{CC}, I_{SET} = I_{SENSE} = V_{CC}, GND = 0V

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
RDS OVER CURRENT COMPARATOR					
Over Current Comparator Threshold Voltage	130	150	180	mV	$V(I_{SET})$ - $V(I_{SENSE})$ 25°C only
Threshold Voltage Temperature Coefficient	-	3300	-	ppm/°C	
I_{SET} Sink Current	18	23	28	µA	Current into I_{SET} 25°C only
I_{SET} Current Temperature Coefficient	-	4000	-	ppm/°C	
I_{SENSE} Input Bias Current	-	-	100	nA	
I_{SET}, I_{SENSE} Common Mode Input Range	2.0	-	V_{CC}	V	
Over Current Peak Detection Time Constant	-	10	-	µs	
ENABLE INPUT & FFLAG OUTPUT					
ENABLE Threshold	-	1.1	-	V	
ENABLE Pin Source Current	2	5	10	µA	
FFLAG Sink Current	3	7.5		mA	V(FFLAG) = 1V
GATE DRIVER					
PDRV Rise Time		20	75	ns	0.5V to 4.5V
PDRV Fall Time		20	75	ns	4.5V to 0.5V

P

SP6122

pin number	name	description
1	V_{CC}	Main Supply Pin: Decouple close to pin.
2	FFLAG	Fault Flag Pull-down Pin: Sinks current during a fault condition. Can be hooked up to ENABLE to initiate Hiccup Timing.
3	V_{OUT}	For fixed 1.5V version, this voltage is divided internally and compared to a 1.5%, 1.25V reference at the PFM comparator. For the adjustable version, this pin is directly connected to the PFM comparator.
4	ENABLE	Enable Input: Floating this pin or pulling above 1.1V enables the part. Pulling this pin to less than 0.65V will disable the part. If FFLAG is hooked to ENABLE, a capacitor on ENABLE will control hiccup timing.
5	I_{SENSE}	Negative Input to the Over Current Amplifier/Comparator: This input is subtracted from the I_{SET} input and gained by a factor of 3.3. The output of this amplifier is compared with a 0.5V threshold, yielding a 150mV threshold. This threshold has a 3300 ppm/°C temperature coefficient. If the subtraction exceeds 150mV, charge is pumped into a capacitor until the capacitor hits V_CC/2. At this time, the over current fault is activated. If I_{SET} = 0V and I_{SENSE} = V_{CC}, the part enters an unprotected, 150µA quiescent current mode.
6	I_{SET}	Positive Input to the Over Current Amplifier: 23µA flows into the I_{SET} pin if it is pulled through a resistor to V_{IN}. This current has a 4000ppm/°C temperature coefficient and can be used via external resistor to raise the overcurrent trip point from 150mV to some higher value. If I_{SET} = 0V and I_{SENS}E = 0V, the part enters an unprotected, 250µA quiescent current mode.
7	GND	Power and Analog Ground: Hook directly to output ground.
8	PDRV	Drive for PFET High Side Switch: 1nF/20ns Output Driver.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6122ACU	0°C to 70°C	8 Pin µSOIC
SP6122ACU-1.5	0°C to 70°C	8 Pin µSOIC

Low Voltage, 8 Pin, NFET, Synchronous, Buck Controller

Ideal for 5A to 15A, Small Footprint, DC-DC Power Converters

features

- **Dual N-Channel MOSFET Synchronous Driver**
- **Optimized for Single Supply, 3.3V or 5.0V Bus Applications**
- **Optimized for Output Current up to 15A**
- **Output Adjustable Down to 0.8V**
- **High Efficiency: 95% Possible**
- **Accurate 500kHz Fixed Frequency Operation**
- **Fast Transient Response**
- **Internal, 5ms, Soft Start Circuit**
- **Resistor Programmable Output Voltage**
- **Loss-less Current Limit with High Side Rds-on Sensing**
- **Hiccup Mode Current Limit Protection**
- **8-Pin SO Narrow Package**

applications

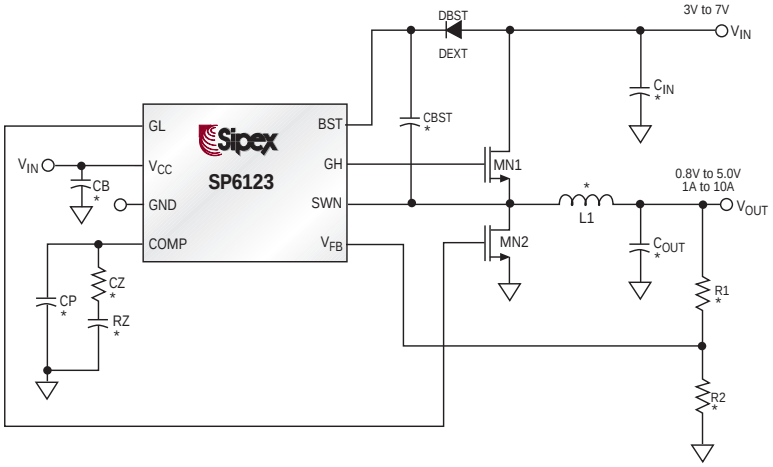
- **Video Cards**
- **Digital Set Top Boxes**
- **DSP**
- **Microprocessor Core**
- **I/O & Logic**
- **Industrial Control**
- **Distributed Power**
- **Low Voltage Power**

description

The SP6123 is a fixed frequency, voltage mode, synchronous PWM controller designed to work from a single 5V or 3.3V input supply, providing excellent AC and DC regulation for high efficiency power conversion. Requiring only few external components, the SP6123 packaged in an 8-pin SOIC, is especially suited for low voltage applications where cost, small size and high efficiency are critical. The operating frequency is internally set to 500kHz, allowing small inductor values and minimizing PC board space. The SP6123 drives an all N-channel synchronous power MOSFET stage for improved efficiency and includes an accurate 0.8V reference for low output voltage applications.

P

typical application circuit



SP6123

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC} 7V
BST 13.2V
BST-SWN 7V
All other pins . . . . . .-0.3V to V_{CC} + 0.3V

Peak Output Current < 10us
GH,GL 2A

Storage Temperature . . . . . .65 °C to 150°C
Power Dissipation
Lead Temperature (Soldering, 10 sec) . . . . . .300°C
ESD Rating . . . . . .2kV HBM

electrical specifications

Unless otherwise specified: -40°C < T_A < 85°C, 3.0V < V_{CC} < 5.5V, C_{COMP} = 0.1µF, CGH = CGL = 3.3nF, V_{FB} = 0.8V, SWN = GND = 0V

P

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
QUIESCENT CURRENT					
V_{CC} Supply Current	-	0.5	1.0	mA	No Switching
V_{CC} Supply Current (Disabled)	-	30	60	µA	COMP= 0V
ERROR AMPLIFIER					
Error Amplifier Transconductance		0.6		mS	
COMP Sink Current	20	35	60	µA	V_{FB}=0.9V, COMP=0.9V, No Faults
COMP Source Current	20	35	60	µA	V_{FB}=0.7V, COMP=2V
COMP Output Impedance		3		MΩ	
V_{FB} Input Bias Current	-	-	100	nA	
Error Amplifier Reference	0.788	0.8	0.812	V	Trimmed with Error Amp in Unity Gain
OSCILLATOR & DELAY PATH					
Internal Oscillator Frequency	450	500	550	kHz	
Maximum Duty Cycle		95		%	
Minimum Duty Cycle	-	-	0	%	Comp=0.7V
Minimum GH Pulse Width		100		ns	V_{CC}>4.5V, Ramp up COMP voltage until GH starts switching
CURRENT LIMIT					
Internal Current Limit Threshold	185	250	340	mV	V_{CC}-VSWN
Current Limit Threshold Temperature Coefficient		0.4		%/C	
Current Limit Time Constant		15		us	

electrical specifications: continued

Unless otherwise specified: -40°C < T_A < 85°C, 3.0V < V_{CC} < 5.5V, C_{COMP} = 0.1µF, CGH = CGL = 3.3nF, V_{FB} = 0.8V, SWN = GND = 0V

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
SOFT START, SHUTDOWN, UVLO					
Internal Soft Start Slew Rate		0.3		V/ms	Measured at COMP pin on the transition from shutdown
Internal Soft Start Delay Time		0.8		ms	COMP charging to GH switching
COMP Discharge Current	200	-	-	µA	COMP=0.5V, Fault Initiated
COMP Pull-up Voltage	0.6	0.7	0.8	V	V_{FB}=0.9V
COMP Pull-up Current	10	15	28	µA	COMP=0.5V, V_{FB}=0.9V
Shutdown Threshold Voltage	0.3	0.35	0.4	V	Measured at COMP Pin
Shutdown Input Pull-up Current		5		µA	COMP=0.2V, Measured at COMP pin
V_{CC} Start Threshold	2.63	2.8	2.95	V	
V_{CC} Stop Threshold	2.47	2.7	2.9	V	
V_{CC} Hysteresis	-	100	-	mV	
GATE DRIVERS					
GH Rise Time	-	40	100	ns	V_{CC}>4.5V
GH Fall Time	-	40	100	ns	V_{CC}>4.5V
GL Rise Time	-	40	100	ns	V_{CC}>4.5V
GL Fall Time	-	40	100	ns	V_{CC}>4.5V
GH to GL Non-Overlap Time		60		ns	V_{CC}>4.5V
GH to GL Non-Overlap Time		60		ns	V_{CC}>4.5V

SP6123

pin number	name	description
1	GL	High current driver output for the low side MOSFET switch. It is always low if GH is high. GL swings from GND to V_{CC}
2	V_{CC}	Positive input supply for the control circuitry and the low side gate driver. Properly bypass this pin to GND with a low ESL/ESR ceramic capacitor.
3	GND	Ground pin. Both power and control circuitry of the IC is referenced to this pin.
4	COMP	Output of the Error Amplifier. It is internally connected to the non-inverting input of the PWM comparator. A lead-lag network is typically connected to the COMP pin to compensate the feedback loop in order to optimize the dynamic performance of the voltage mode control loop. Sleep mode can be invoked by pulling the COMP pin below 0.3V with an external open-drain or open-collector transistor. Supply current is reduced to 30µA (typical) in shutdown. An internal 5µA pull-up ensures start-up.
5	V_{FB}	Feedback Voltage Pin. It is the inverting input of the Error Amplifier and serves as the output voltage feedback point for the Buck converter. The output voltage is sensed and can be adjusted through an external resistor divider.
6	SWN	Lower supply rail for the GH high-side gate driver. It also connects to the Current Limit comparator. Connect this pin to the switching node at the junction between the two external power MOSFET transistors. This pin monitors the voltage dropped across the R_{DSON} of the high side N-channel MOSFET while it is conducting. When this drop exceeds the internal 250mV threshold, the overcurrent comparator sets the fault latch and terminates the output pulses. The controller stops switching and goes through a hiccup sequence. This prevents excessive power dissipation in the external power MOSFETS during an overload condition. An internal delay circuit prevents that very short and mild overload conditions, that could occur during a load transient, activate the current limit circuit.
7	GH	High current driver output for the high side MOSFET switch. It is always low if GL is high or during a fault. GH swings from SWN to BST.
8	BST	High side driver supply pin. Connect BST to the external boost diode and capacitor as shown in the Application Schematic of page 1.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6123CN	0°C to 70°C	8 Pin NSOIC

Low Voltage, Micro 10, NFET Buck Controller

Ideal for 1A to 5A, Small Footprint, DC-DC Power Converters

features

- **N-Channel High Side MOSFET Driver**
- **Optimized for Single Supply, 3.3V or 5.0V Bus Applications**
- **Output Adjustable Down to 0.8V**
- **Optimized for Output Current up to 5A**
- **High Efficiency: 90% Possible**
- **20ns/1nF NFET Output Driver**
- **Fast Transient Response**
- **Open Drain Fault Output Pin**
- **Internal, 2ms Soft Start Circuit**
- **Adjustable Output Voltage**
- **Adjustable On-Time**
- **Loss-less Adjustable Current Limit with High side R_{DSON} Sensing**
- **Hiccup or Lock-up Fault Modes**
- **Low 5µA Sleep Mode Quiescent Current**
- **Low 400µA Quiescent Current**
- **2.5 V UVLO**
- **Output Over Voltage Protection**
- **Small Micro 10 Package**

applications

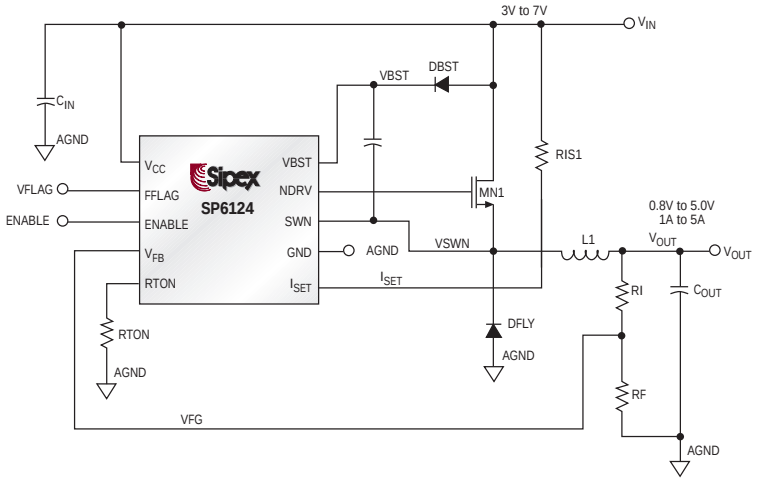
- **Video Cards**
- **High Power Portable**
- **Microcontrollers**
- **I/O & Logic**
- **Industrial Control**
- **Distributed Power**
- **Low Voltage Power**

description

The SP6124 is a PWM/PFM minimum on-time controller designed to work from a single 5 V or 3.3 V input supply. It is engineered specifically for size and minimum components count, simplifying the transition from a linear regulator to a switcher solution. However, unlike other “micro” parts, the SP6124 has an array of value added features like 0.8V reference, UVLO, optional hiccup mode, over current protection, TTL enable and a fault flag pull down pin. Combined with reference and driver specifications usually found on more expensive integrated circuits, the SP6124 delivers great performance and value in a micro 10 package.

P

typical application circuit



SP6124

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{CC},VBST 7V
All other pins . . . . . .-0.3V to V_{CC} + 0.3V

Peak Output Current < 10µs
NDRV 2A

Storage Temperature . . . . . .-65°C to 150°C

Power Dissipation
Lead Temperature (Soldering, 10 sec) . . . . . .300°C
ESD Rating . . . . . .2kV HBM

electrical specifications

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, CNDRV = 1nF, V_{ENABLE} = V_{CC}, V_{FFLAG} = V_{CC}, I_{SET} = SWN = V_{CC}, GND = 0V, RTON = 32500

P

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
QUIESCENT CURRENT					
V_{CC} Supply Current, OVC Enabled	-	400	500	µA	No Switching, ISET=ISENSE=V_{CC}
V_{CC} Supply Current, OVC Disabled	-	350		µA	No Switching, ISET=0
V_{CC} Supply Current, Sleep Mode	-	5	10	µA	Enable=0
REFERENCE					
Reference Voltage	0.784	0.8	.816	V	
PWM/PFM Reference Comparator Hysteresis	3	5	9	mV	
OSCILLATOR					
On Time		1.1		us	RTON=27k, V_{CC}=3.3
Trailing Edge Reset Blanking Time		200		ns	
SOFT START					
Soft Start Ramp Time		2		ms	RTON=27k, V_{CC}=5
Soft Start Voltage when NDRV Switches		250		mV	Measure $V_{SOFTSTART}$ when PDRV goes low. (internal)

electrical specifications

Unless otherwise specified: 0°C < T_A < 70°C, 3.0V < V_{CC} < 5.5V, CNDRV = 1nF, V_{ENABLE} = V_{CC}, V_{FFLAG} = V_{CC}, I_{SET} = SWN = V_{CC}, GND = 0V, RTON = 32500

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
RDS OVER CURRENT COMPARATOR					
Over Current Comparator Threshold Voltage		150		mV	$V(I_{SET})$-V(SWN) 25°C Only
I_{SET} Sink Current		30		µA	Current into I_{SET} 25°C Only
I_{SET} Current & Threshold Voltage Temperature Coefficient		3300		ppm/°C	
I_{SENSE} Input Bias Current			100	nA	
I_{SET}, SWN Common Mode Input Range	2.0		V_{CC}	V	
Over Current Peak Detection Time Constant	10			us	
ENABLE/UVLO & FFLAG OUTPUT					
V_{CC} Start Threshold	2.8	2.9	3.0	V	
V_{CC} Stop Threshold	2.7	2.8	2.9	V	
V_{CC} Hysteresis	75	100	125	mV	
ENABLE Threshold	0.65	1.0	1.2	V	
ENABLE Pin Source Current	0.6	4	8	µA	
FFLAG Sink Current		10		mA	V(FFLAG)=1V, V_{CC}=5
GATE DRIVER					
NDRV Rise Time		20	75	ns	0.5V to 4.5V
NDRV Fall Time		20	75	ns	4.5V to 0.5V

P

SP6124

pin number	name	description
1	V_{CC}	Main Supply Pin: Decouple close to pin.
2	FFLAG	Fault Flag Pull-down Pin: Sinks current during a fault condition. Can be hooked up to ENABLE to initiate Hiccup Timing.
3	ENABLE	Enable Input: Floating this pin or pulling above 1.2V enables the part. Pulling this pin to less than 0.65V will disable the part. If FFLAG is hooked to ENABLE, a capacitor on ENABLE will control hiccup timing.
4	V_{FB}	Regulated Feedback Voltage: This voltage is compared to a 1.5%, 0.8V reference at the PWM/PFM comparator.
5	RTON	On Time Programming Pin: The voltage on this pin sets the on-time by the relation – T_{ON} = V(RTON)*(V_{CC}*300kHz). Because this pin also sources 20µA, the on-time can be programmed via a resistor to ground.
6	I_{SET}	Positive Input to the Over Current Amplifier: 30µA flows into the I_{SET} pin if it is pulled through a resistor to V_{IN}. This current has a 3300 ppm/°C temp. coefficient. and can be used via external resistor to raise the overcurrent trip point from 150mV to some higher value. If I_{SET}=0V, the part enters an unprotected, 350µA quiescent current mode.
7	GND	Power and Analog Ground: Hook directly to output ground.
8	SWN	Source of External NFET & Negative Input to the Over Current Amplifier/Comparator: This input is subtracted from the ISET input and gained by a factor of 3.3. The output of this amplifier is compared with a 0.5V threshold, yielding a 150mV threshold. This threshold has a 3300 ppm/°C temperature coefficient. If the subtraction exceeds 150mV, charge is pumped into a capacitor until the capacitor hits V_{CC}/2. At this time, the over current fault is activated. This pin is also the ground return for the NFET driver circuitry. Care must be take on the layout to ensure a tight connection between this pin and the source of the external NFET.
9	NDRV	Drive for NFET High Side Switch: 1nF/20ns Output Driver.
10	VBST	Supply for the NFET Driver Circuitry: Typically this pin forms the output of a voltage doubler for enhancing the NFET.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6124CU	0°C to 70°C	10 Pin MSOP

Micropower, 100mA and 200mA CMOS LDO Regulators

features

- **Guaranteed 100mA Output, SP6200**
- **Guaranteed 200mA Output, SP6201**
- **Fixed Outputs**
  2.5V, 2.7V, 2.85V, 3.0V, 3.3V, 5V
- **Adjustable Output Available**
- **Low Dropout Voltage, 160mV @ 100mA**
- **High Output Voltage Accuracy, 2%**
- **Ultra Low Shutdown Current, 1µA Max**
- **Ultra Low GND Current**
  - 200µA @ 200mA Load
  - 28µA @ 100µA Load
- **Fast Transient Response**
- **78dB PSRR @ 100Hz**
- **40dB PSRR @ 400kHz**
- **Extremely Tight Load and Line Regulation**
- **Very Low Temperature Coefficient**
- **Current and Thermal Limiting**
- **$\overline{\text{RESET}}$ Output (V_{OUT} good)**
- **Logic-Controlled Electronic Enable**
- **Unconditionally stable with 1µF Ceramic**
- **5 Pin SOT-23 Package**

applications

- **Cellular Telephones**
- **Laptop, Notebooks and Palmtop Computers**
- **Battery-Powered Equipment**
- **Consumer/ Personal Electronics**
- **SMPS Post-Regulator**
- **DC-to-DC Modules**
- **Medical Devices**
- **Data Cable**
- **Pagers**

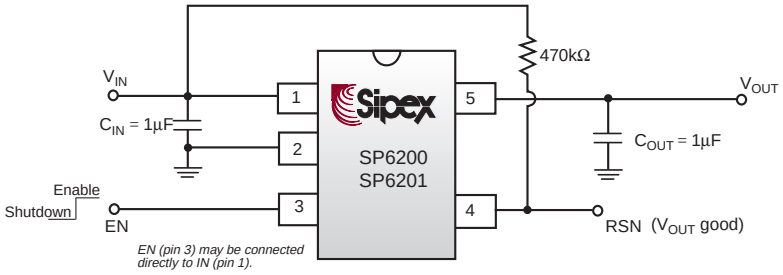
description

The SP6200 and SP6201 are CMOS LDOs designed to meet a broad range of applications that require accuracy, speed and ease of use. These LDOs offer extremely low quiescent current which only increases slightly under load, thus providing advantages in ground current performance over bipolar LDOs. The LDOs handle an extremely wide load range and guarantee stability with a 1µF ceramic output capacitor. They have excellent low frequency PSRR, not found in other CMOS LDOs and thus offer exceptional Line Regulation. High frequency PSRR is better than 40dB up to 400kHz. Load Regulation is excellent and temperature stability is comparable to bipolar LDOs. An enable feature is provided on all versions.

The SP6200/6201 is available in fixed and adjustable output voltage versions in a small SOT-23-5 package. A V_{OUT} good indicator is provided on all fixed output versions.

P

typical application circuit



SP6200/6201

pin number	name	description
1	IN	Supply Input
2	GND	Ground
3	EN	Enable/Shutdown (Input): CMOS or TTL compatible input. Logic high = enable, logic low = shutdown
4	$\overline{\text{RESET}}$	Open drain indicating that V_{OUT} is good
4	ADJ	Adjustable (Input): Adjustable regulator feedback input. Connect resistor voltage divider.
5	OUT	Regulator Output

P

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Top Mark	Temperature Range	Package Type
SP6200EM5-2.5	E25	-40˚C to +125˚C	SOT-23-5
SP6200EM5-2.7	E27	-40˚C to +125˚C	SOT-23-5
SP6200EM5-2.85	E285	-40˚C to +125˚C	SOT-23-5
SP6200EM5-3.0	E30	-40˚C to +125˚C	SOT-23-5
SP6200EM5-3.3	E33	-40˚C to +125˚C	SOT-23-5
SP6200EM5-5.0	E50	-40˚C to +125˚C	SOT-23-5
SP6200EM5-ADJ	EAdj	-40˚C to +125˚C	SOT-23-5
SP6201EM5-2.5	F25	-40˚C to +125˚C	SOT-23-5
SP6201EM5-2.7	F27	-40˚C to +125˚C	SOT-23-5
SP6201EM5-2.85	F285	-40˚C to +125˚C	SOT-23-5
SP6201EM5-3.0	F30	-40˚C to +125˚C	SOT-23-5
SP6201EM5-3.3	F33	-40˚C to +125˚C	SOT-23-5
SP6201EM5-5.0	F50	-40˚C to +125˚C	SOT-23-5
SP6201EM5ADJ	FAdj	-40˚C to +125˚C	SOT-23-5

300/500mA CMOS LDO Regulators

features

- Guaranteed 300mA Output Current, SP6203
- Guaranteed 500mA Output Current, SP6205
- Fixed Output Voltages: 2.7V, 2.85V, 3.0V, 3.3V, 5V
- Adjustable Output Available
- 2% Output Voltage Accuracy
- Very Low Dropout Voltage, 300mV at 500mA
- Ultra Low Quiescent Current (40µA)
- Current Limiting and Thermal Shutdown
- Fast Transient Response
- Low Temperature Coefficient
- Power-Saving Shutdown Mode
- Reverse Battery Protection
- Bypass Capacitor for Low-Noise Output
- Stable with No Load Using 1µF Ceramic
- Industry Standard 5 Lead and 6 Lead SOT-23 Packages

applications

- Cellular/GSM Phones
- Laptops / Palmtop Computers
- Pagers
- Medical Devices
- Wideband CDMA Cellular Handsets

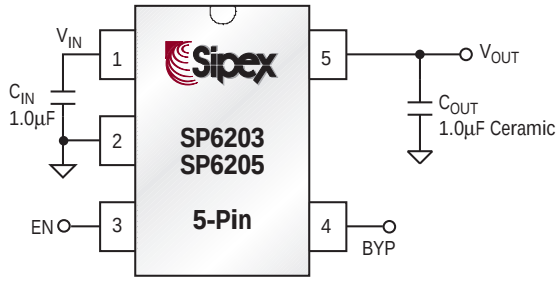
description

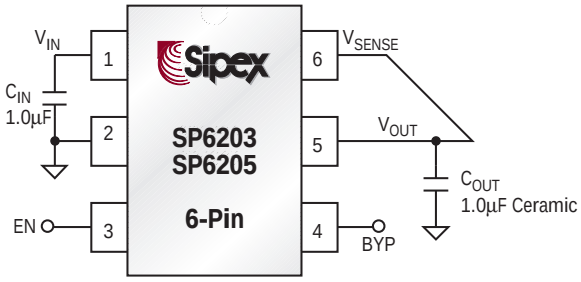
The SP6203/6205 is an efficient linear voltage regulator with ultra low dropout voltage, ground current and quiescent current. Applications for these devices include battery-powered equipment such as portable and wireless products. Regulator ground current increases only slightly in dropout, further prolonging battery life. Also, the enable/shutdown control function contributes to save power and thus prolong battery life. Both devices are well protected with current limit, over-temperature shutdown and reverse battery protection. In addition, noise performance is further enhanced by means of an external bypass capacitor.

Both devices are available in fixed and adjustable output voltage versions in small SOT-23-5 & SOT-23-6 packages.

P

typical application circuits





SP6203/6205

pin number		name	description
SOT-23-5	SOT-23-6		
1	1	V_{IN}	Power Supply Input
2	2	GND	Ground Terminal
3	3	EN	Enable/Shutdown (Logic high = enable, logic low = shutdown)
4 (fixed)	4 (fixed)	BYP	Reference bypass input for ultra-quiet operation. Connecting a 5nF capacitor to this input further reduces output noise.
4 (adj.)	4 (adj.)	ADJ	Adjust (Input) : Adjustable regulator feedback input. Connect to a resistive voltage-divider network.
5	5	V_{OUT}	Regulator Output Voltage
-	6	V_{SENSE}	Sensing pad to set the output voltage (through metal option)

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6203EM5-3.0	-40°C to +125°C	SOT-23-5
SP6205EM5-3.0	-40°C to +125°C	SOT-23-5
SP6203EM6-3.0	-40°C to +125°C	SOT-23-6
SP6205EM6-3.0	-40°C to +125°C	SOT-23-6

100mA CMOS LDO Regulator

features

- Guaranteed 100 mA Output
- Fixed Outputs: 2.7V, 2.85V, 3.0V, 3.3V, 5V
- 2.5% Output Voltage Accuracy
- Low Dropout Voltage, 200 mV at 100mA
- Low Quiescent Current, 65µA
- Low Ground Current, 135µA @ IL = 100 mA
- Short-Circuit Current Limit
- Thermal Shutdown
- Good Load and Line Regulation
- Fast Transient Response
- Low Temperature Coefficient
- Stable with No Load Using 0.47µF and 1µF Ceramic
- Industry Standard SC-70 Packages
- Pin – Compatible Replacement for MIC5213

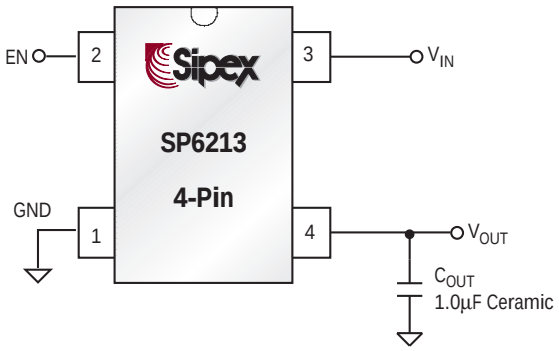
applications

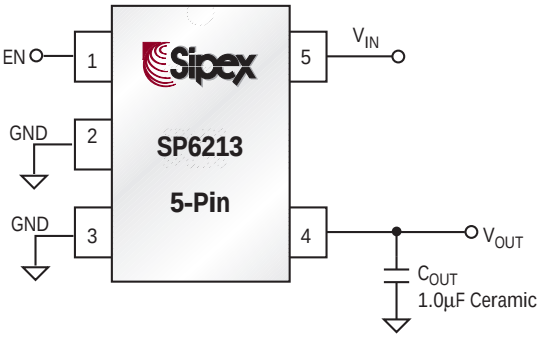
- Cellular Phones
- Digital Cordless Phones
- Laptops, Notebook and Palmtop Computers
- Battery-Powered Equipment
- Medical Devices
- High Efficiency Linear Power Supplies
- Wideband CDMA Handsets

description

The SP6213 is a CMOS linear voltage regulator with low dropout voltage, ground current and quiescent current. It is designed specifically for hand-held, battery-powered devices. The SP6213 includes an enable/shutdown control pin and comes in industry standard SC-70 packages. Regulator ground current increases only slightly in dropout, to further prolonging battery life.

typical application circuits





SP6213

pin number		name	description
4-pin	5-pin		
1	2,3	GND	Ground Connection
2	1	EN	Enable/Shutdown (Logic high = enable, logic low = shutdown)
3	5	V_{IN}	Supply Input
4	4	V_{OUT}	Regulator Output

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6213EC4-3.0	-40°C to +125°C	SC-70-4
SP6213EC5-3.0	-40°C to +125°C	SC-70-5

500mA, 3.3V Linear Regulator with Auxiliary Backup

features

- **3.3V ±2% Output Voltage**
- **400mA Quiescent Current @500mA out**
- **Fast Transient Response**
- **Current Limit Protection**
- **Thermal Shutdown with Hysteresis**
- **Auxiliary Supply Control**
- **"Glitch Free" Transition Between Two Supplies**
- **Internal 0.2W PFET switch**
- **Sense input for accurate 3.3V where you need it.**
- **Available in 8 Pin NSOIC and Thermally Enhanced Tiny 6 Pin MLP**

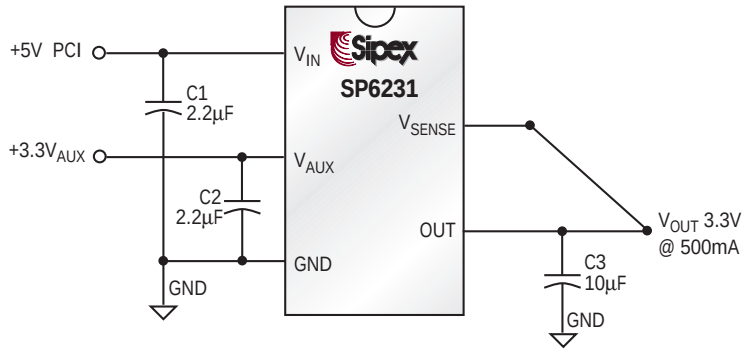
applications

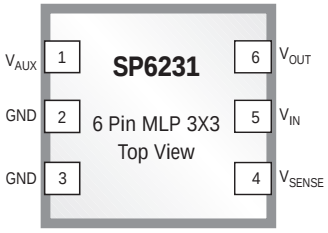
- **USB peripherals**
- **NIC cards**
- **PCMCIA/PCI cards**
- **Desktop computers**
- **Dual power systems**

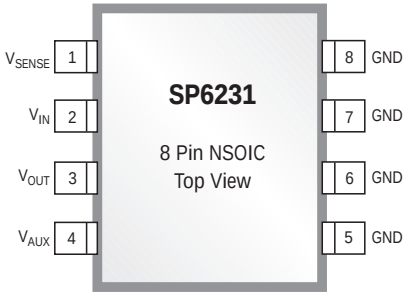
description

The SP6231 is a 500mA, 3.3V LDO with an integrated auxiliary voltage input switch. During normal operation the SP6231 acts as a standard LDO with an output voltage of 3.3V (±2% accuracy) while delivering up to 500mA. When the 5V input drops below 4.4V, the 3.3V VAUX input is switched to the output through an internal PFET, maintaining a constant "glitch free" output voltage.

typical application circuit







SP6231

pin number		name	description
8-pin NSOIC	6-pin MLP		
1	4	V_{SENSE}	Output Sense Pin for accurate 3.3V where you need it.
2	5	V_{IN}	Main 5V input.
3	6	V_{OUT}	3.3V output either from regulating the 5V in or from the VAUX
4	1	V_{AUX}	3.3V auxiliary backup supply that is switched in through an internal PMOS when VIN drops below 4.4V typically.
5,6,7,8 (fused)	2,3	GND	Ground pins.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6231ER-3.3	-40°C to +125°C	6 Pin MLP
SP6231EN-3.3	-40°C to +125°C	8 Pin NSOIC

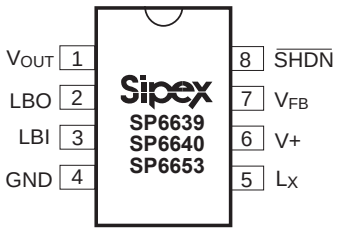
5V/ 3.3V/ 3V Adjustable, High Efficiency, Low IQ, Step-Down DC-DC Converter

features

- **Wide Input Range, 3.2V to 11.5V**
- **Fixed/Adjustable Output Voltage**
  - 5V (SP6639)
  - 3.3V (SP6640)
  - 3.0V (SP6653)
- **100mA Output Current**
- **High Efficiency, 94% Possible**
- **Ultra Low 10µA Quiescent Current**
- **Low Current Shutdown Mode**
- **Low Battery Detector**
- **Preset or Adjustable Output Voltage**
- **Low EMI Inductor Damping**
- **8 Pin SO Narrow Package**
- **Pin-to-Pin Compatible with MAX639, MAX640, MAX653**

applications

- **Cellular Phones**
- **Laptop Computers**
- **Distributed Power Systems**
- **5V to 3.3V Conversion**
- **Lithium-Ion Systems**
- **3 to 4 Alkaline Systems**



description

The SP6639/40/53 step-down switching regulators provide high efficiency over a wide range of input voltage, output voltage and output current. Duty cycle modulation is used to achieve efficiencies over 90% for input voltages from 3.2V to 11.5V. It features a no load quiescent current of only 10µA. The circuit contains a 1Ω internal power MOSFET reducing the external component count to only one inductor, a schottky diode and the usual input and output capacitors. The internal oscillator is shut down when the circuit is in regulation to reduce power consumption. Internal inductor damping significantly reduces EMI.

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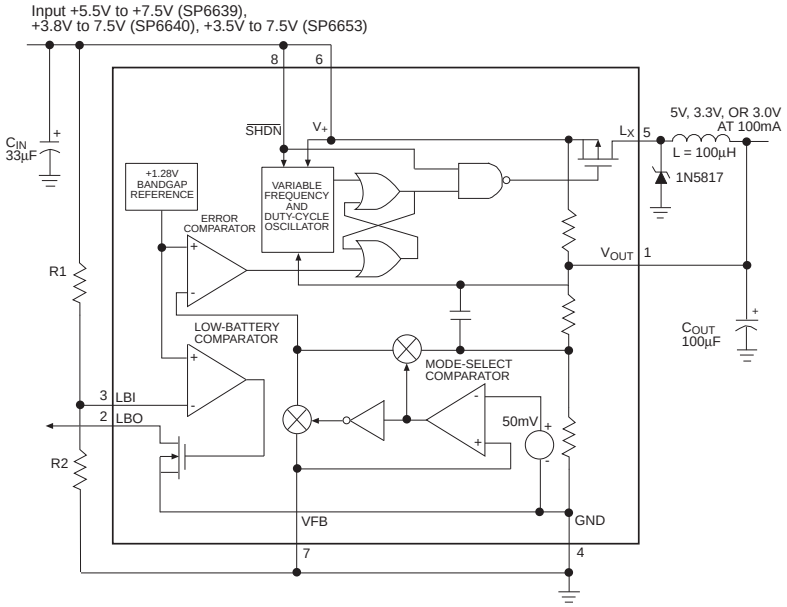
block diagram



SP6639/SP6640/SP6653

absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability and cause permanent damage to the device.

V+ 12V
LX . . . . . .(V+ - 12V) to (V+ +0.3V)
LBI, LBO, V_{FB}, SHDN, V_{OUT} . . . .-0.3V to (V+ +0.3V)
LX Output Current (Note 1) 1A
LBO Output Current 10mA
Continuous Power Dissipation (TA = +70°C)
Plastic DIP
(derate 9.09mW/°C above +70°C) 727mW
SO Narrow
(derate 5.88mW/°C above +70°C) 471mW

Operating Temperature Ranges
SP6639 . . . . . .0°C to +70°C
Storage Temperature . . . . . .-65°C to +160°C
Lead Temperature (soldering sec) . . . . . .+300°C

electrical specifications

(V+ = 6V for the SP6639, V+ = 5V for the SP6640/6653, I_{LOAD} = 0mA, $T_A = T_{MIN}$ to T_{MAX}, typical values are at T_A = 25°C, circuit of figure 3 unless otherwise noted.)

PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNITS
DC CHARACTERISTICS						
Supply Voltage			3.2	4.0	11.5	V
Supply Current	SHDN = V+, no load			10	20	µA
Output Voltage (Note 2)	SP6639, V+ = 5.2V to 11.5V, 0mA < I_{OUT} < 100mA		4.80	5.00	5.20	V
	SP6640, V+ = 3.5V to 11.5V, 0mA < I_{OUT} < 100mA		3.17	3.30	3.43	
	SP6653, V+ = 3.2V to 11.5V, 0mA < I_{OUT} < 100mA		2.88	3.00	3.12	
Dropout Voltage	I_{OUT} = 100mA, L = 100µH			0.1	0.2	V
Efficiency	SP6639	I_{OUT} = 100mA, L = 100µH		91		%
		I_{OUT} = 25mA, L = 470µH		94		
	SP6640	I_{OUT} = 100mA, L = 100µH		87		
		I_{OUT} = 25mA, L = 470µH		91		
	SP6653	I_{OUT} = 100mA, L = 100µH		85		
		I_{OUT} = 25mA, L = 470µH		89		
Switch On-Time	SP6639	V+ = 6V, V_{OUT} = 5V	40.5	47.0	52.0	µs
	SP6640	V+ = 4V, V_{OUT} = 3.3V	57.0	62.9	72.0	
	SP6653	V+ = 4V, V_{OUT} = 3V	40.5	45.4	50.0	
	SP66XX K_{ON}	Note 3	40.5	47.0	52.0	µsV
Switch Off-Time	SP6639	V+ = 6V, V_{OUT} = 5V	9.0	11.0	13.6	µs
	SP6640	V+ = 4V, V_{OUT} = 3.3V	13.5	16.7	20.5	
	SP6653	V+ = 4V, V_{OUT} = 3V	15.0	18.3	22.0	
	SP66XX K_{OFF}	Note 4	45.0	55.0	68.0	µsV

electrical specifications: continued

(V+ = 6V for the SP6639, V+ = 5V for the SP6640/6653, I_{LOAD} = 0mA, $T_A = T_{MIN}$ to T_{MAX}, typical values are at T_A = 25°C, circuit of figure 3 unless otherwise noted.)

PARAMETER	CONDITIONS		MIN.	TYP.	MAX.	UNITS
LX Switch On-Resistance	V+ 6V, T_A = +25°C, SP6639/40/53			0.8	1.5	Ω
	V+ 6V, $T_A = T_{MIN}$ to T_{MAX}, SP6639				2.5	
	V+ 4V, $T_A = T_{MIN}$ to T_{MAX}, SP6640/53				2.8	
LX Switch Leakage	V+ = 7.5V, V_{LX} = 0V	T_A = +25°C		0.003	1.0	µA
		$T_A = T_{MIN}$ to T_{MAX}			30.0	
VFB Bias Current	VFB = 2V			4.0	15.0	nA
VFB Dual-Mode Trip Point				50		mV
VFB Threshold			1.26	1.28	1.30	V
LBI Bias Current	V_{LBI} = 2V			2	10	nA
LBI Threshold			1.26	1.28	1.30	V
LBO Sink Current	V_{LBO} = 0.4V	SP6639	0.8	2.5		mA
		SP6640/SP6653	0.4	1.2		
LBO Leakage Current	VLBO = 7.5V			0.001	0.1	µA
LBO Delay	50mV overdrive			25		µs
$\overline{SHDN}$ Threshold			0.80	1.15	2.00	V
$\overline{SHDN}$ Pull-Up Current	SHDN = 0V		0.10	0.20	0.40	µA

Note 1. Peak Inductor current must be limited to 600mA by using an inductor of 100µH or greater.

Note 2. Output guaranteed by correlation to measurements of device parameters (i.e. switch on-resistance, on-times, off-times, and output voltage trip points).

Note 3. $K_{ON} = t_{ON}* (V+ - V_{OUT})$. For the SP6639 V+ = 6V to 7.5V, V_{OUT} = 3V to 5V; for the SP6640 V+ = 4V to 7.5V, V_{OUT} = 3.3V; for the SP6653 V+ = 4V to 7.5V, Vout = 3V.

Note 4. $K_{OFF} = T_{OFF} * V_{OUT}$. For the SP6639 V+ = 6V to 7.5V, V_{OUT} = 3V to 5V; for the SP6640 V+ = 4V to 7.5V, V_{OUT} = 3.3V; for the SP6653 V+ = 4V to 7.5V, Vout = 3V.

SP6639/SP6640/SP6653

pin number	name	description
1	V_{OUT}	Sense input for regulated-output operation. Internally connected to an on-chip voltage divider and to the variable duty-cycle, on demand oscillator. It must be connected to the external regulated output.
2	LBO	Low-Battery Output. An open-drain N-channel MOSFET sinks current when the voltage at LBI drops below 1.28V.
3	LBI	Low Battery Input. When the voltage at LBI drops below 1.28V, LBO sinks current.
4	GND	Ground.
5	L_X	Drain of a PMOS power switch that has its source connected to V+. L_X drives the external inductor, which provides current to the load.
6	V+	Positive Supply-Voltage Input. Should not exceed 9V.
7	V_{FB}	Dual-Mode Feedback Pin. When V_{FB} is grounded, the internal voltage divider sets the output to 5V (SP6639), 3.3V (SP6640), or 3V (SP6653). For adjustable operation, connect V_{FB} to an external voltage divider.
8	$\overline{SHDN}$	Shutdown Input- active low. When pulled below 0.8V, the L_X power switch stays off, shutting down the regulator. When the shutdown input is above 2V, the regulator stays on. Tie $\overline{SHDN}$ to V+ if shutdown mode is not used.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6639CN	0˚C to +70˚C	8-Pin NSOIC
SP6640CN	0˚C to +70˚C	8-Pin NSOIC
SP6653CN	0˚C to +70˚C	8-Pin NSOIC

Ultra Low Quiescent Current, High Efficiency Boost DC-DC Regulator

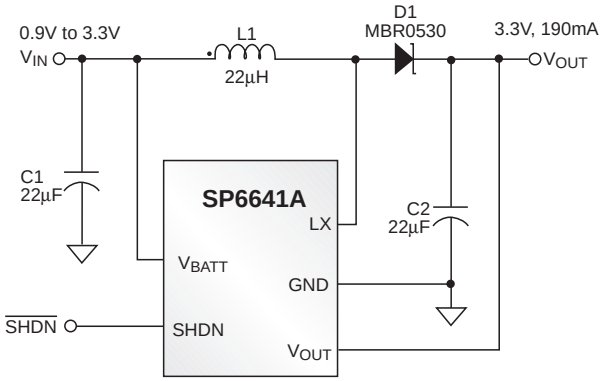
features

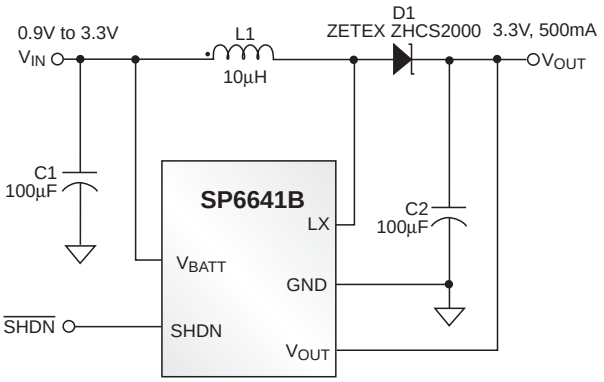
- **10µA, Ultra Low Quiescent Current**
- **Wide Input Voltage Range: 0.9V to 4.5V**
- **85% Efficiency**
- **90mA I_{OUT} at 1.3V Input, 1AA (SP6641A)**
- **500mA, I_{OUT} at 2.6V Input, 2AA (SP6641B)**
- **Fixed 3.3V or 5.0V Output Voltage**
- **0.3Ω NFET R_{DSon}**
- **Only 4 External Components Required**
- **Startup Voltage Guaranteed at 0.9V**
- **0.33A Inductor Current Limit (SP6641A)**
- **1A Inductor Current Limit (SP6641B)**
- **Logic Shutdown Control**
- **Tiny 5-Pin SOT-23 Package**

description

The SP6641 is an ultra-low quiescent current, high efficiency, DC-DC boost converter designed for single and dual cell alkaline, or Li-ion battery applications found in medical monitors, PDA's, MP3 players, and other handheld portable devices. The SP6641 features a 10µA quiescent current, a 0.3Ω N-channel charging switch, 0.9V input startup, and a 0.33A or 1.0A inductor current limiting feature. It is offered in a 5 pin SOT-23 package and provides an extremely small power supply footprint optimized for portable applications. The SP6641 is preset to 3.3V and can be controlled by a 1nA active LOW shutdown pin.

typical application circuits





absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

LX, V_{OUT}, SHDN, V_{BATT} to GND pin . . .-0.3 to 6.0V
LX Current 1.5A
Reverse V_{BATT} Current 220mA
Storage Temperature . . . . . .-65°C to 150°C
Operating Temperature . . . . . .-40°C to +85°C
Lead Temperature (Soldering, 10 sec) . . . . .300 °C

electrical specifications

V_{BATT} = V_{SHDN} = 1.3V, I_{LOAD} = 0mA, -40°C <T_A < +85°C, V_{OUT} = +3.3V, typical values at 27°C unless otherwise noted.

PARAMETER	MIN	TYP	MAX	UNITS	CONDITIONS
Input Voltage Operating Range, V_{BATT}	0.5		4.5	V	after startup
Start-up Voltage, V_{BATT}		0.85 1.00	0.90	V V	R_{LOAD} = 3kΩ, T_A = 27°C R_{LOAD} = 3kΩ, -40°C <T_A < +85°C
Output Voltage, V_{OUT}	3.16	3.30	3.44	V	3.3V V_{OUT} preset
Quiescent Current into V_{OUT}, $I_{Q(OUT)}$		10	15	mA	V_{OUT} = 3.5V
Quiescent Current into V_{BATT}, I_{QB}		20	500	nA	V_{OUT} = 3.5V
Shutdown Current into V_{OUT}, I_{SHDN}		1	500	nA	V_{SHDN} = 0V
Shutdown Current into V_{BATT}, I_{SHDN}		5	100	nA	V_{SHDN} = 0V
Efficiency (SP6641A)		79 85		% %	V_{BATT} =1.3V, I_{OUT} =60mA V_{BATT} =2.6V, I_{OUT} =120mA
Efficiency (SP6641B)		72 85		% %	V_{BATT} =1.3V, I_{OUT} =100mA V_{BATT} =2.6V, I_{OUT} =400mA
Inductor Current Limit (SP6641A)	280	330	380	mA	
Inductor Current Limit (SP6641B)	850	1000	1150	mA	
Output Current (SP6641A)		90 190		mA mA	V_{BATT} =1.3V V_{BATT} =2.6V
Output Current (SP6641B)		200 500		mA mA	V_{BATT} =1.3V V_{BATT} =2.6V
Minimum Off-Time Constant, K_{OFF}		1.50		V*µs	$T_{OFF} \geq K_{OFF} / (V_{OUT} - V_{IN})$
NMOS Switch Resistance		0.3	0.75	Ω	Inmos=100mA
SHDN Input Voltage Vil Vih	 80		20	% %	% of V_{BATT} % of V_{BATT}
SHDN Input Current		1	100	nA	

pin number	name	description
1	LX	Inductor switching node. Connect one terminal of the inductor to the positive terminal of the battery. Connect the second terminal of the inductor to this pin. The inductor charging current flows into LX, through the internal charging N-channel FET, and out through the GND pin.
2	GND	Ground pin. The internal regulator bias currents and the inductor charging current flows out of this pin.
3	V_{OUT}	Output voltage sense pin, internal regulator voltage supply, and minimum off-time one shot input. Kelvin connect this pin to the positive terminal of the output capacitor.
4	SHDN	Shutdown. Tie this pin to V_{BATT} for normal operation. Tie this pin the ground to disable all circuitry inside the chip. In shutdown mode, the output voltage will float at a diode drop below the battery potential.
5	V_{BATT}	Battery voltage pin. The startup circuitry runs off of this pin. The regulating circuitry also uses this voltage to control the minimum off-time. $T_{OFF} \geq K_{OFF} / (V_{OUT} - V_{IN})$.

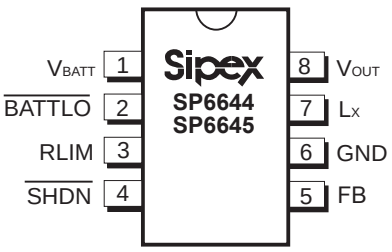
ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6641AEK-3.3	-40°C to 85°C	5-Pin SOT-23
SP6641AEK-3.3/TR	-40°C to 85°C	(Tape & Reel) 5-Pin SOT-23
SP6641BEK-3.3	-40°C to 85°C	5-Pin SOT-23
SP6641BEK-3.3/TR	-40°C to 85°C	(Tape & Reel) 5-Pin SOT-23

Single/Dual Alkaline Cell, High Efficiency Boost DC-DC Regulator

features

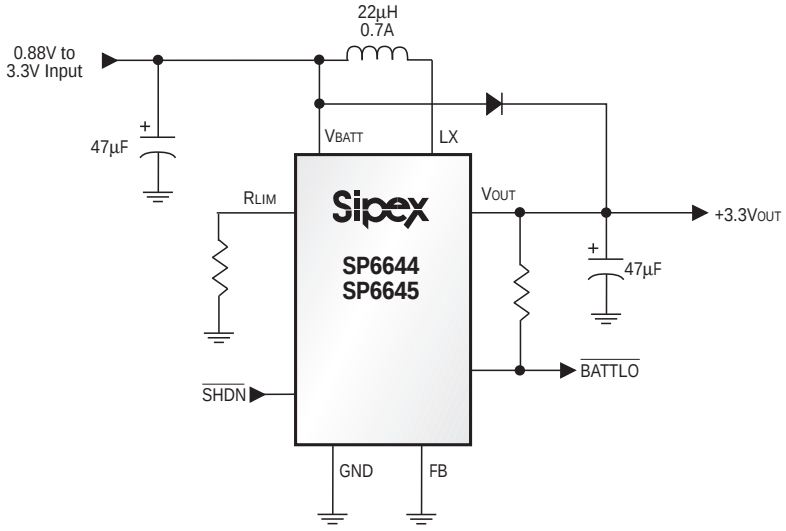
- **Flexibility to Optimize Inductor Type with Programmable Peak Current Control**
- **Optimized for 1AA (SP6644) and 2AA (SP6645) Batteries**
- **Output Fixed 3.3V or Adjustable from 5.5V Down to 2.0V**
- **90mA Output Current at 1.3V Input (1AA)**
- **190mA Output Current at 2.6V Input (2AA)**
- **High Efficiency, 92% Possible**
- **0.88V Guaranteed Start-Up**
- **1.6µA Quiescent Supply Current at V_{BATT}**
- **Reverse Battery Protection**
- **Internal Synchronous Rectifier**
- **5nA Logic Controlled Shutdown Current from V_{BATT}**
- **Low-Battery Detection Active LOW Output**
- **No External FETs**
- **Small Micro 8 Package**



description

The SP6644/6645 devices are high-efficiency, low-power step-up DC-DC converters ideal for single or dual alkaline cell applications such as pagers, remote controls, pointing devices, medical monitors, and other low-power portable end products. Designers can control the SP6644 device with a 1nA active LOW shutdown input. The SP6644 device features an active low output for batteries below +1.0V. The SP6645 device features an active low output for batteries below +2.0V. Both devices contain a 0.8Ω synchronous rectifier, a 0.5Ω N-channel MOSFET power switch, an internal voltage reference, circuitry for pulse-frequency-modulation, and an under voltage comparator. The output voltage for the SP6644/6645 devices is preset to +3.3V + 4% or can be adjusted from +2V to +5.5V by manipulating two external resistors.

typical application circuit



absolute maximum ratings

These are stress ratings only and functional operation of the device at these ratings or any other above those indicated in the operation sections of the specifications below is not implied. Exposure to absolute maximum rating conditions for extended periods of time may affect reliability.

V_{BATT} to GND . . . . . .-0.3 to 6.0V
V_{OUT} to GND . . . . . .-0.3 to 6.0V
LX, SHDN, FB, BATTLO, to GND . . . . . .-0.3 to 6.0V
Reverse battery current, T_A = +25˚C 220mA
(NOTE 1)
V_{BATT} forward current 0.5A
V_{OUT}, LX current 1A
Storage Temperature Range . . . . . .-65˚C to +165˚C
Lead Temperature (soldering 10s) . . . . . .+300˚C
Operating Temperature . . . . . .-40˚C to +85˚C

Power Dissipation Per Package
8-pin µSOIC
(derate 4.85mW/°C above +70°C) 390mW

CAUTION:
ESD (ElectroStatic Discharge) sensitive device. Permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. Personnel should be properly grounded prior to handling this device. The protective foam should be discharged to the destination socket before devices are removed.

electrical specifications

V_{BATT} = V_{SHDN} = 1.3V, I_{LOAD} = 0mA, FB = GND, T_A = -40°C to +85°C, and typical values are at T_A = +25°C unless otherwise noted.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Minimum Operating Input Voltage, $V_{BATT(MIN)}$		0.3		V	R_L = 3kΩ
Maximum Operating Input Voltage, $V_{BATT(MAX)}$			3.3	V	
Start-Up Input Voltage, V_{BATT}	0.88	0.82		V	R_L = 3kΩ,T_{AMB} = +25°C
Start-Up Input Voltage, V_{BATT}, Temperature Coefficient		-1		mV/°C	
$\overline{SHDN}$ Input Voltage V_{IL} V_{IH}	 80		20	%	 % of V_{BATT} % of V_{BATT}
$\overline{SHDN}$ Input Current		1	100	nA	
FB Input Current		1	10	nA	V_{FB} =1.3V
FB Set Voltage, V_{FB}	1.215	1.262	1.309	V	external feedback
$\overline{BATTLO}$ Trip Voltage	0.96 1.92	1.00 2.00	1.04 2.08	V	SP6644, V_{OUT} = 3.3V, hysteresis =2% SP6645, V_{OUT} = 3.3V, hysteresis =2%
Output Voltage, V_{OUT}	3.16	3.30	3.44	V	V_{FB}<0.1V
Output Voltage Range	2.0		5.5	V	external feedback
Output Current		190		mA	V_{BATT} = 2.6V, R_{LIM} = 2.5k, See Fig. 11
N-Channel On-Resistance		0.5	1.0	Ω	V_{OUT} = 3.3V
P-Channel On-Resistance		0.8	1.6	Ω	V_{OUT} = 3.3V

electrical specifications: continued

V_{BATT} = V_{SHDN} = 1.3V, I_{LOAD} = 0mA, FB = GND, T_A = -40°C to +85°C, and typical values are at T_A = +25°C unless otherwise noted.

PARAMETER	MIN.	TYP.	MAX.	UNITS	CONDITIONS
Quiescent Current into V_{OUT}, I_{QOUT}		50	80	µA	V_{OUT} = 3.5V
Quiescent Current into V_{BATT}, I_{QBATT}		1.6	3.0	µA	V_{BATT} = 1.0V
Shutdown Current into V_{OUT}, $I_{SHDNOUT}$		0.001	0.5	µA	V_{OUT} = 3.5V
Shutdown Current into V_{BATT}, $I_{SHDNBATT}$		0.005	0.1	µA	V_{BATT} = 1.0V
Low Output Voltage for $\overline{BATTLO}$, V_{OL}			0.4	V	V_{BATT} = 0.9V,V_{OUT} = +3.3V,I_{SINK} =1mA
Leakage Current for $\overline{BATTLO}$			1	µA	V_{BATT} = 1.3V,$V_{\overline{BATTLO}}$ = 3.5V
Efficiency		89		%	I_{LOAD} = 150mA,V_{BATT} = 2.6V
Inductor Peak Current, I_{PEAK}	245	275	305	mA	R_{LIM} = 5kΩ, NOTE 4
Inductor Range	22		330	µH	
R_{LIM} Range	2.5		9.3	kΩ	

NOTE 1: The reverse battery current is measured from the Typical Operating Circuit's input terminal to GND when the battery is connected backward. A reverse current of 220mA will not exceed package dissipation limits but, if left for an extended time (more than 10 minutes), may degrade performance.

NOTE 2: Specifications to -40°C are guaranteed by design, not production tested.

NOTE 3: Inductor Peak Current where I_{PEAK} = 1400/R_{LIM}.

pin number	name	description
1	V_{BATT}	Battery Supply. This pin ties to the sensor input of the $\overline{BATTLO}$ comparator.
2	$\overline{BATTLO}$	Open-Drain Battery Low Output. When the voltage drops below 1V for the SP6644 or 2V for the SP6645, $\overline{BATTLO}$ sinks current.
3	R_{LIM}	Resistor Programmable Inductor Peak Current. Connecting a resistor from this pin to ground programs the inductor peak current where I_{PEAK} = 1400/R_{LIM}.
4	$\overline{SHDN}$	Active-LOW Shutdown Input. Connect to V_{BATT} for normal operation.
5	FB	Feedback Input. Input for adjustable-output operation. Connect this input pin to an external resistor voltage divider between V_{OUT} and GND. Connect to GND for fixed-output operation.
6	GND	Connect to the lowest circuit potential, typically ground.
7	L_X	Coil. An inductor is connected from V_{BATT} to the N-Channel MOSFET switch drain and the P-Channel synchronous-rectifier drain through this pin.
8	V_{OUT}	Power Output. Feedback input for fixed 3.3V operation and IC power input. Connect filter capacitor close to V_{OUT}.

ordering information - *Please consult the factory for pricing and availability on a Tape-On-Reel option.*

Part Number	Temperature Range	Package Type
SP6644EU	-40°C to +85°C	8-Pin µSOIC
SP6645EU	-40°C to +85°C	8-Pin µSOIC

