High Efficiency   Low Voltage Step-up DC/DC Converter

GENERATION DESCRIPTION

The SX1301 is a compact, high efficiency, and low voltage step-up DC/DC converter with an Adaptive Current Mode PWM control loop. It comprises of an error amplifier, a ramp generator, a PWM comparator, a switch pass element and the driver. It provides stable and high efficient operation over a wide range of load currents without external compensation. The below 1V start-up input voltage makes SX1301 suitable for single battery cell applications. The built-in power transistor is able to provide up to 300mA output current while working under Li-Battery Supply. Besides, it provides extra pin to drive external power devices (NMOS or NPN) in case higher output current is needed. The output voltage is set with two external resistors. The 500KHz high switching rate reduces the size of external components. Besides, the 14μA low quiescent current together with high efficiency maintains long battery lifetime.
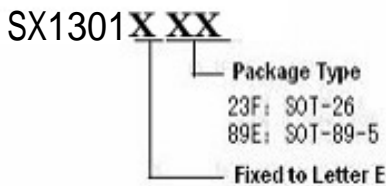
FEATURES

- Low Quiescent (Switch-off) Supply Current: 14μA
- Low Start-up Input Voltage: typical 0.8V
- High Supply Capability: Deliver 3.3V 100mA with 1Alkaline Cell; 5V 300mA with 1 Li-Cell
- Zero Shutdown Mode Supply Current
- High efficiency: 92%
- Fixed switching frequency: 500KHz
- Options for internal or external power switches
- Package type: SOT-26, SOT-89-5

APPLICATIONS

- MP3, PDA, Electronic
- Dictionary, DSC, LCD, RF-Tag,
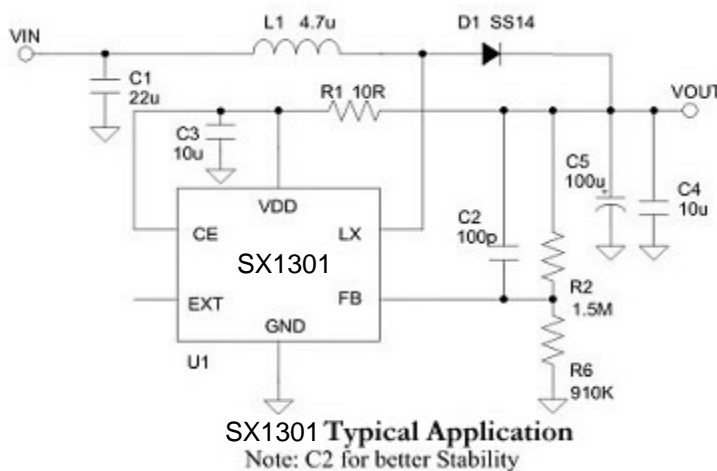- Portable Devices, Wireless Devices, etc.

OREER INFORMATION

SX1301X XX

— Package Type
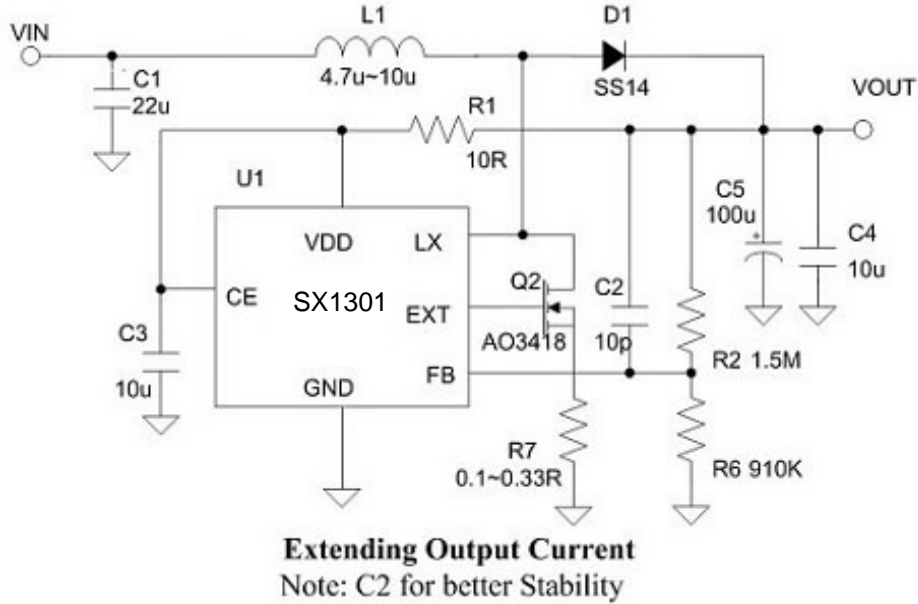23F: SOT-26
89E: SOT-89-5

— Fixed to Letter E

TYPICAL APPLICATION CIRCUITS

(1) Typical Application

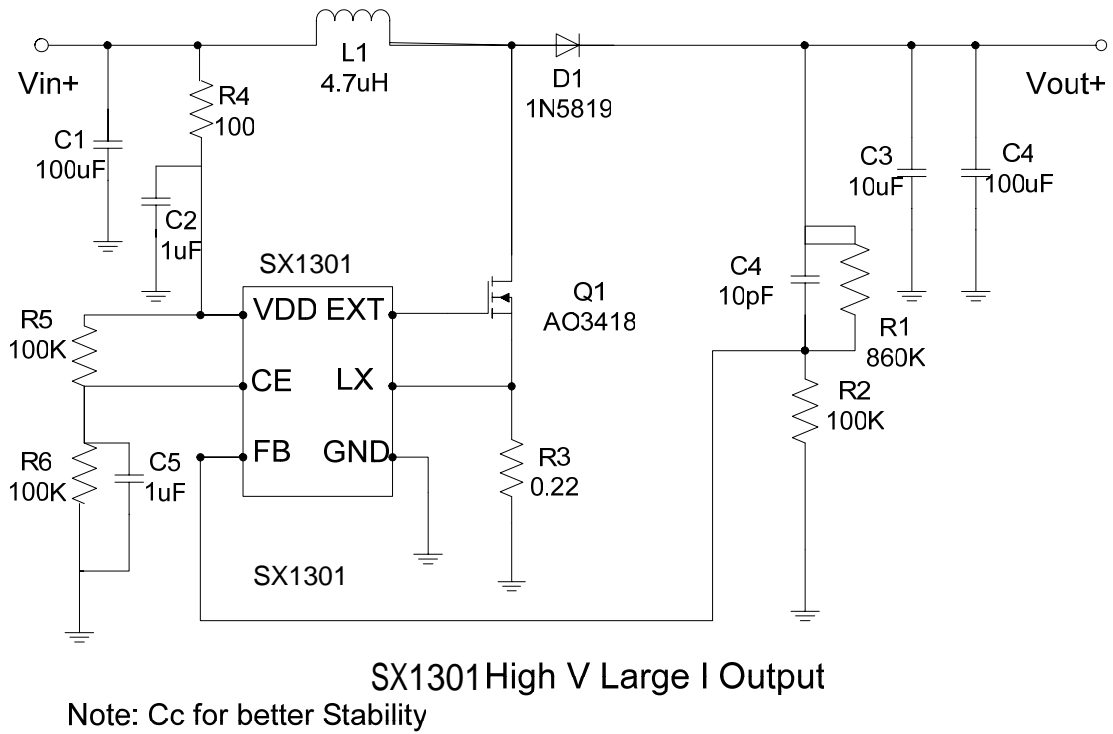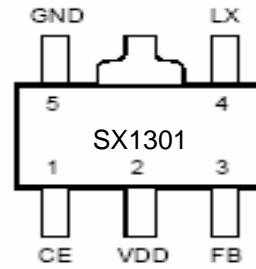1 Alkaline Cell to 3.3V, 100mA Output Current, typically for MP3 Application.

SX1301 **Typical Application**
Note: C2 for better Stability

(2) Extending Output Current

1 Alkaline Cell to 3.3V, 250mA Output Current

Extending Output Current
Note: C2 for better Stability

(3) High Output Voltage, Large Output Current

5V to 12V, 300mA Output Current

SX1301 High V Large I Output
Note: Cc for better Stability

ELECTRICAL CHARACTERISTICS (Note 2,3,4)

(V_{IN}=1.5V, VDD=3.3V, load current=0, TA =25℃, unless otherwise specified.)

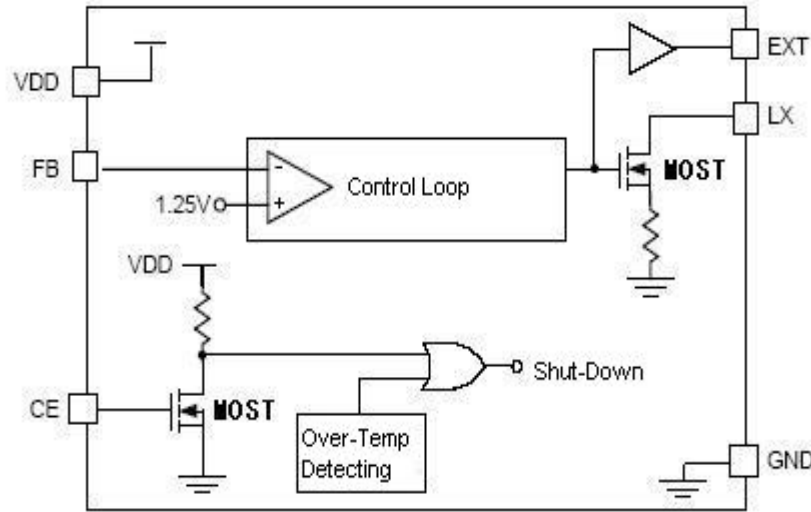| SYMBOL	ITEM	TEST CONDITION	MIN	TYP	MAX	UNIT
V_{ST}	Startup Voltage	IL = 1mA	--	0.80	1.05	V
V_{DD}	Operating VDD Range	VDD pin Voltage	2	--	6	V
I_{OFF}	Shutdown Current I (V_{IN})	CE Pin = 0V, VIN = 4.5V	--	0.01	1	μA
$I_{SWITCH\ OFF}$	Switch-Off Current I(V_{DD})	VIN = 6V	--	14	25	μA
I_{SWITCH}	Continuous Switching Current	VIN = CE= 3.3V, VFB = GND	0.22	0.24	0.7	mA
$I_{NO\ LOAD}$	No Load Current I(V_{IN})	VIN = 1.5V, VOUT = 3.3V	--	56	--	μA
V_{REF}	Feedback Reference Voltage	Close loop, VDD = 3.3V	1.225	1.25	1.275	V
Fs	Switching Frequency	VDD = 3.3V	400	500	600	KHz
D_{MAX}	Maximum Duty	VDD = 3.3V	85	94	--	%
	On Resistance, LX to VDD	VDD = 3.3V	--	0.3	1.1	Ω
I_{LIMIT}	Limit Current	VDD = 3.3V	1	1.5	2	A
	On Resistance, EXT to VDD	VDD = 3.3V	--	4.4	8.5	Ω
	On Resistance, EXT to GND	VDD = 3.3V	--	2.45	8.5	Ω
$\triangle V_{LINE}$	Line Regulation	VIN = 3.5 ~ 6V, IL = 1mA	--	1.25	5	mV/V
$\triangle V_{LOAD}$	Load Regulation	VIN = 2.5V, IL = 1 ~ 100mA	--	0.14	--	mV/mA
	CE trigger Level	VDD = 3.3V	0.4	0.8	1.2	V
TS	Vout Temperature Coefficient			50		ppm/℃
$\triangle$TSD	Thermal Shutdown Hysteresis		--	10	--	℃

Note 2:　Electrical Characteristics state DC and AC electrical specifications under particular test conditions which guarantee specific performance limits. This assumes that the device is within the recommended operating Range. Specifications are not guaranteed for parameters where no limit is given, however, the typical value is a good indication of device performance.

Note 3:　Typicals are measured at 25˚C and represent the parametric norm.

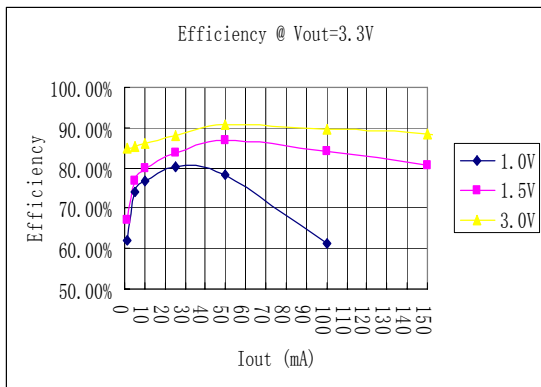**Note 4:**　Datasheet min/max specification limits are guaranteed by design, test, or statistical analysis.
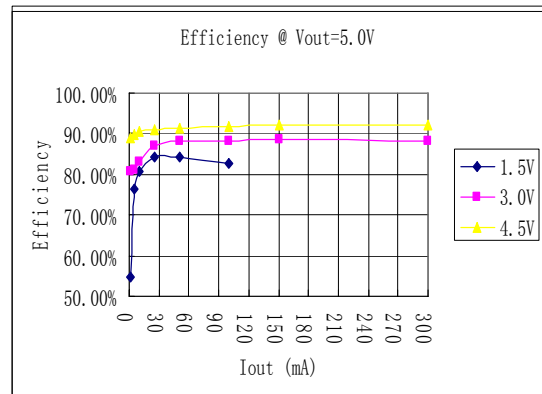
SIMPLIFIED BLOCK DIAGRAM

TYPICAL OPERATING CHARACTERISTICS
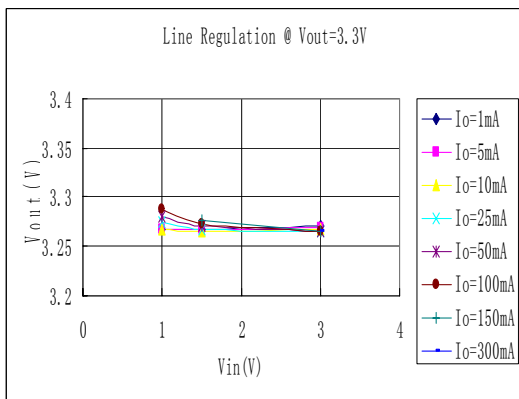
(1) Efficiency

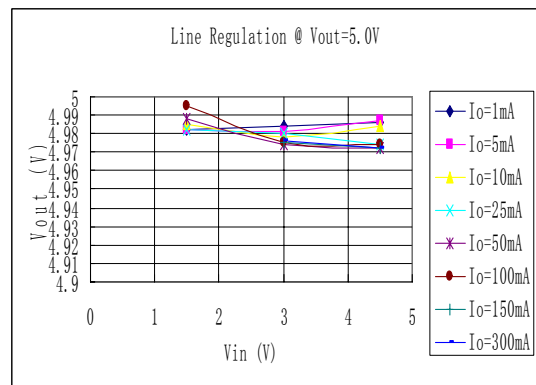(1.1) Vout=3.3V

(1.2) Vout=5.0V

(2) Line Regulation
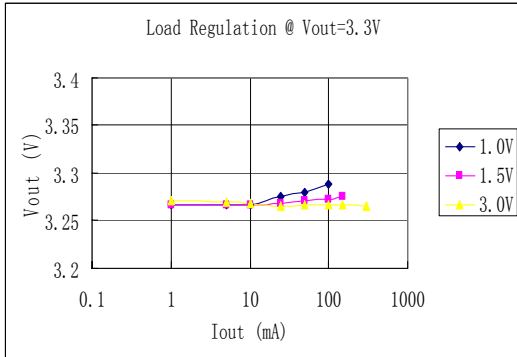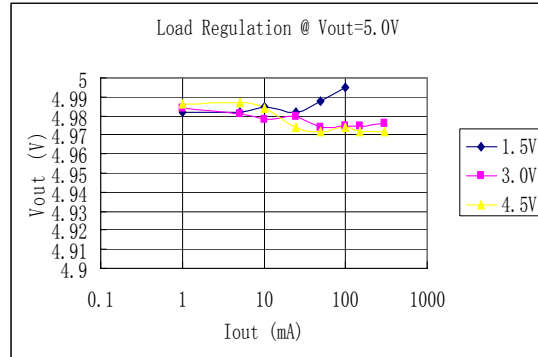
(2.1) Vout=3.3V

(2.2) Vout=5.0V

TYPICAL OPERATING CHARACTERISTICS

(3) Load Regulation

(3.1) Vout=3.3V

(3.2) Vout=5.0V

APPLICATION INFORMATION

1)   **Output Voltage Setting**
   Referring to Typical Application Circuit 1, the output voltage of switching regulator (Vout) is set with following equation:
   $$Vout = (1+R1/R2)*Vfb$$

2)   **Feedback Loop Design**
   Referring to Typical Application Circuit 1 again, the selection of R1 and R2 is a trade-off between quiescent current consumption and interference immunity besides abiding by the above equation.
   ● Higher R reduces quiescent current (I=1.25V/R2)
   ● Lower R gives better interference immunity, and is less sensitive to interference, layout parasitic, FB node leakage, and improper probing to FB pin.

   Hence for applications without standby or suspend modes lower R1 and R2 values are preferred, while for applications concerning the current consumption in standby or suspend modes, higher valu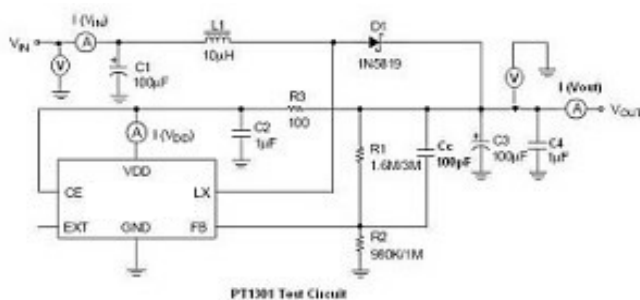es of R1 and R2 are needed. Such high impedance feedback loop is sensitive to any interference, which requires careful PCB layout and avoid any interference, especially to FB pin. To improve the system stability, a proper value capacitor between FB pin and Vout is suggested. An empirical suggestion is around 100pF for MΩ feedback resistors and 10nF～0.1uF for lower R values.

3)   **PCB Layout Guide**
   PCB Layout shall follow these guidelines for better system stability:
   ● A full GND plane without any gap break.
   ● VDD to GND bypass Cap – The 1μF MLCC noise bypass Cap between pin 5 and pin 3 shall have short and wide connections.
   ● Vin to GND bypass Cap – Add a Cap close to the inductor when Vin is not an idea voltage source.
   ● Minimize the FB node copper area and keep it far away from noise sources.
   ● Minimize the parasitic capacitance connected to LX and EXT nodes to reduce the switch loss.

TEST CIRCUITS

PT1301 Test Circuit

PACKAGE INFORMATION

(1) SOT-26

SYMBOL	DIMENSION (in mm)		DIMENSION (in Inch)	
	MIN	MAX	MIN	MAX
A	0.787	1.450	0.031	0.057
A1		0.152		0.006
B	1.397	1.803	0.055	0.071
b	0.250	0.559	0.010	0.022
C	2.591	2.997	0.102	0.118
D	2.692	3.099	0.106	0.122
e	0.838	1.041	0.033	0.041
H	0.080	0.254	0.003	0.010
L	0.300	0.610	0.012	0.024

PACKAGE INFORMATION

(2) SOT-89-5

SYMBOL	DIMENSION (in mm)		DIMENSION(in Inch)	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.460	0.520	0.014	0.020
B	2.400	2.600	0.094	0.102
b1	0.406	0.533	0.016	0.021
C		4.250		0.167
C1	0.800		0.031	
D	4.400	4.600	0.173	0.181
D1		1.700		0.067
e	1.400	1.600	0.055	0.063
H	0.380	0.430	0.014	0.017

- 本资料内容，随产品的改进，可能会有未经预告之更改。
- 本资料所记载设计图等因第三者的工业所有权而引发之诸问题，本公司不承担其责任。另外，应用电路示例为产品之代表性应用说明，非保证批量生产之设计。
- 本资料内容未经本公司许可，严禁以其他目的加以转载或复制等。
- 本资料所记载之产品，未经本公司书面许可，不得作为健康器械、医疗器械、防灾器械、瓦斯关联器械、车辆器械、航空器械及车载器械等对人体产生影响的器械或装置部件使用。
- 尽管本公司一向致力于提高质量与可靠性，但是半导体产品有可能按照某种概率发生故障或错误工作。为防止因故障或错误动作而产生人身事故、火灾事故、社会性损害等，请充分留心冗余设计、火势蔓延对策设计、防止错误动作设计等安全设计。