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SC1410A
Constant Voltage/Constant Current Battery Charger

Description

The SC1410A is designed to provide a simple, fast charging solution for rechargeable batteries that require constant-current and/or constant voltage charging, including nickel-cadmium (NiCd), nickel-metal-hydride (NiMH) and lithium-ion (Li-Ion). With a voltage reference accuracy of 0.5% the SC1410A satisfies the tight constant-voltage charging requirements of lithium cells.

The SC1410A simplifies battery charger design by integrating a high efficiency PWM with an internal 1.5A switch and 0.1ohm current sense resistor, while the 500kHz switching frequency allows a very small inductor to be used. Only one external resistor is required to program the full 1.5A charging current to within 5% accuracy.

Charging circuits for batteries ranging from 2V to 18V are easily implemented using the SC1410A. No ground sensing of current is required, allowing the battery's negative terminal to be connected directly to ground. No blocking diode is required between the IC and the battery since the SC1410A enters sleep mode and consumes only 3μA when the AC adapter is unplugged. Other features include soft start, overvoltage protection, and a shutdown pin. The SC1410A is available in a 16 pin QSOP package.

Features

- ◆ Charges NiCd, NiMH and Lithium-Ion batteries
- ◆ High efficiency current mode with 1.5A internal switch and sense resistor
- ◆ 3% Typical charging current accuracy
- ◆ Precision 0.5% voltage reference for voltage mode charging or over voltage protection
- ◆ Current sensing can be either terminal of battery
- ◆ Low reverse battery drain current: 3μA
- ◆ Charging current soft start
- ◆ Shutdown control
- ◆ 500kHz switching uses small inductor

Applications

- ◆ Chargers for NiCd, NiMH and Lithium batteries
- ◆ Step down switching regulator with precision adjustable current limit

Typical Application Circuits

Figure 1: 500kHz Li-Ion cell phone charger

Figure 2: Charging Lithium batteries

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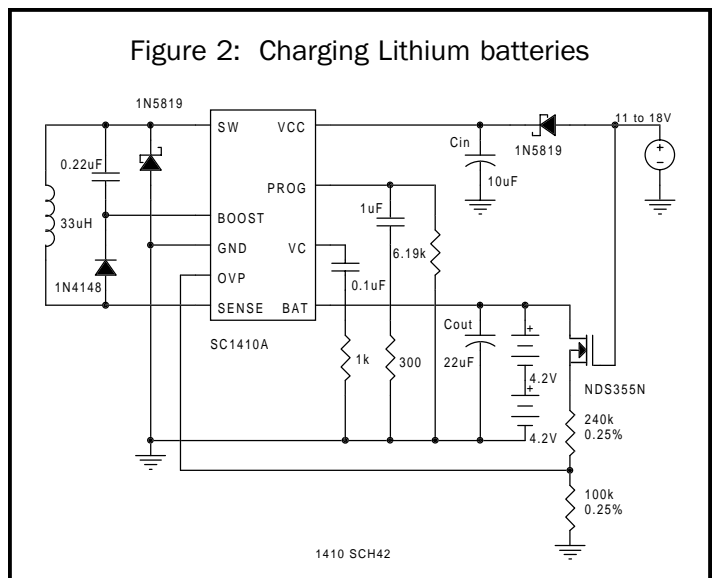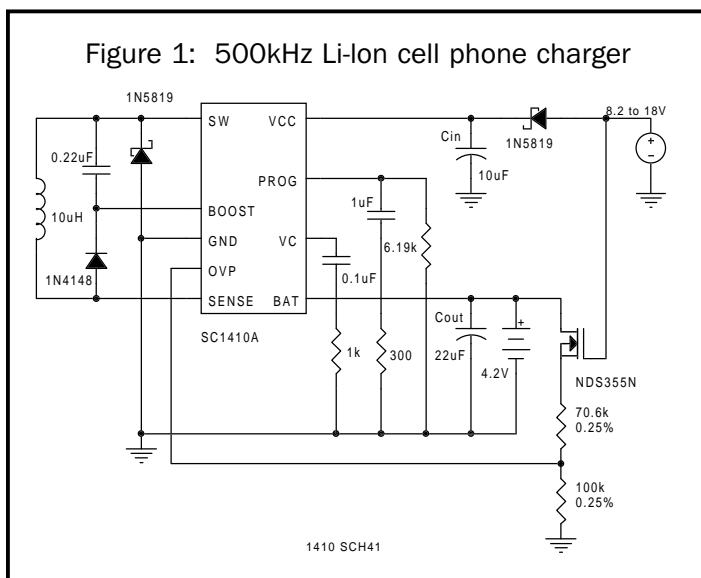
Absolute Maximum Ratings

Parameter	Symbol	Maximum	Units
Supply Voltage	V_{MAX}	20	V
Switch Voltage with respect to GND		-3	V
Boost Pin Voltage with respect to GND		+24/-5	V
VC, PROG, OVP Pin Voltage		8	V
I_{BAT} (Average)		1.5	A
Thermal Resistance, Junction to Case	θ_{JC}		°C/W
Thermal Resistance, Junction to Ambient	θ_{JC}		°C/W
Operating Temperature Range	T_A	0 to 70	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Lead Temperature (Soldering) 10 Sec.	T_{LEAD}	300	°C

Electrical Characteristics

Unless specified: VCC = 16V, V_{BAT} = 8V; I_{BAT}=0

Parameter	Conditions	Min	Typ	Max	Units
Supply Current	V_{PROG} = 2.7V, VCC < 20V		4.5	6.5	mA
DC Battery Current, I_{BAT}	8V < VCC < 18V, 0V < V_{BAT} ≤18V R_{PROG} = 4.93k R_{PROG} = 3.28k R_{PROG} = 49.3k	0.93 1.35 75	1.5 100	1.07 1.65 125	A A mA
Minimum Input Operating Voltage	Undervoltage lockout	6.2	7	7.8	V
Reverse Current from Battery	V_{BAT} ≤ 12V, 0°C ≤ T_J ≤ 70°C		3	20	µA
Boost Pin Current	VCC - V_{BOOST} ≤ 18V 2V ≤ V_{BOOST} - VCC ≤ 16V (Switch ON)		0.25 6	30 14	µA mA
Switch					
Switch ON Resistance	VCC = 10V I_{SW} = 1.5A. V_{BOOST} - V_{SW} ≥ 2V S_W =1A, V_{BOOST} - V_{SW} < 2V		0.5	0.65 2.0	Ω
$\Delta I_{BOOST}/\Delta I_{SW}$ During Switch ON	V_{BOOST} = 24V, I_{SW} ≤ 1A		20	35	mA/A
Switch OFF Leakage Current	VSW = 0V, VCC ≤ 18V		4	200	µA
Maximum V_{BAT} with Switch ON				Vcc-2	V
Minimum I_{PROG} for Switch ON			4	20	µA
Minimum I_{PROG} for Switch OFF	V_{PROG} ≤ 1V	0.5	2.4		mA

Electrical Characteristics (Cont.)

Unless specified: V_{CC} = 16V, V_{BAT} = 8V, V_{MAX} (maximum operating V_{CC})

Parameter	Conditions	Min	Typ	Max	Units
Current Sense Amlifier Inputs (SENSE, BAT)					
Sense Resistance (RS1)			0.08	0.12	Ω
Total Resistance from SENSE to BAT			0.2	0.25	Ω
BAT Bias Current	VC < 0.3V VC > 0.6V		-200 700	-375 1300	μA
Input Common Mode Limit (Low)		-0.25			V
Input Common Mode Limit (High)				Vcc-2	V
Reference					
Reference Voltage	R_{PROG} = 3.28k, Measured at OVP with VA supplying I_{PROG} and Switch OFF	2.448	2.465	2.482	V
Reference Voltage Tolerance	8V ≤ Vcc ≤ 18V, 0°C ≤ T_J ≤ 70°C 8V ≤ Vcc ≤ 18V, 0°C ≤ T_J ≤ 125°C	2.446 2.441	2.465	2.480 2.489	V
Oscillator					
Switching Frequency		440	500	550	kHz
Maximum Duty Cycle		77			%
Current Amplifier (CA2)					
Transconductance	V_C = 1V, I_{VC} = ± 1μA	150	250	550	μmho
Maximum VC for Switch OFF				0.6	V
I_{VC} Current (Out of Pin)	V_C ≥ 0.6V			100	μA
Voltage Amplifier (VA)					
Transconductance	Output current from 100μA to 500μA	0.5	1.2	2.5	mho
Output Source Current, Vcc = 10V	V_{PROG} = V_{OVP} = V_{REF} +30mV	1.3			mA
OVP Input Bias Current	At 0.75mA VA Output Current		50	150	nA

POWER MANAGEMENT   PRELIMINARY

Pin Configuration

TOP VIEW

```
        GND  ┌─ 1        16 ─┐  GND
         SW  ┌─ 2        15 ─┐  VCC2
       BOOST ┌─ 3        14 ─┐  VCC1
        GND  ┌─ 4        13 ─┐  PROG
        OVP  ┌─ 5        12 ─┐  VC
         NC  ┌─ 6        11 ─┐  NC
       SENSE ┌─ 7        10 ─┐  BAT
        GND  ┌─ 8         9 ─┐  GND
```

(16 Pin QSOP)
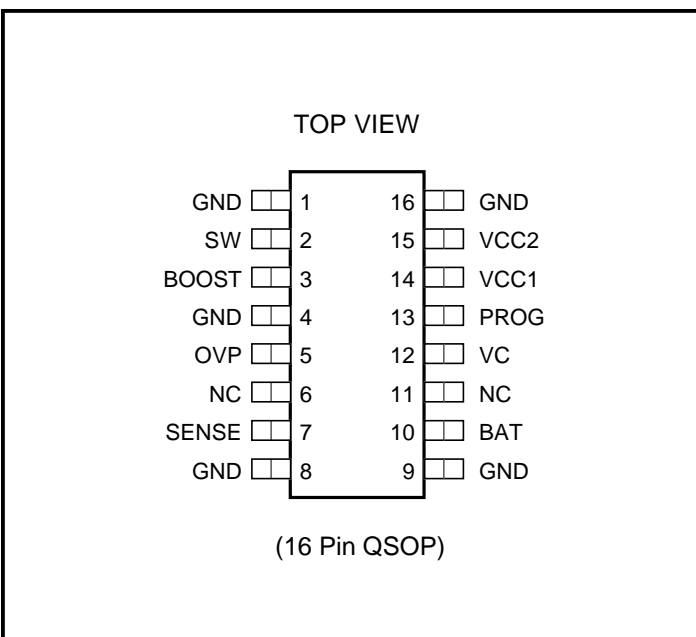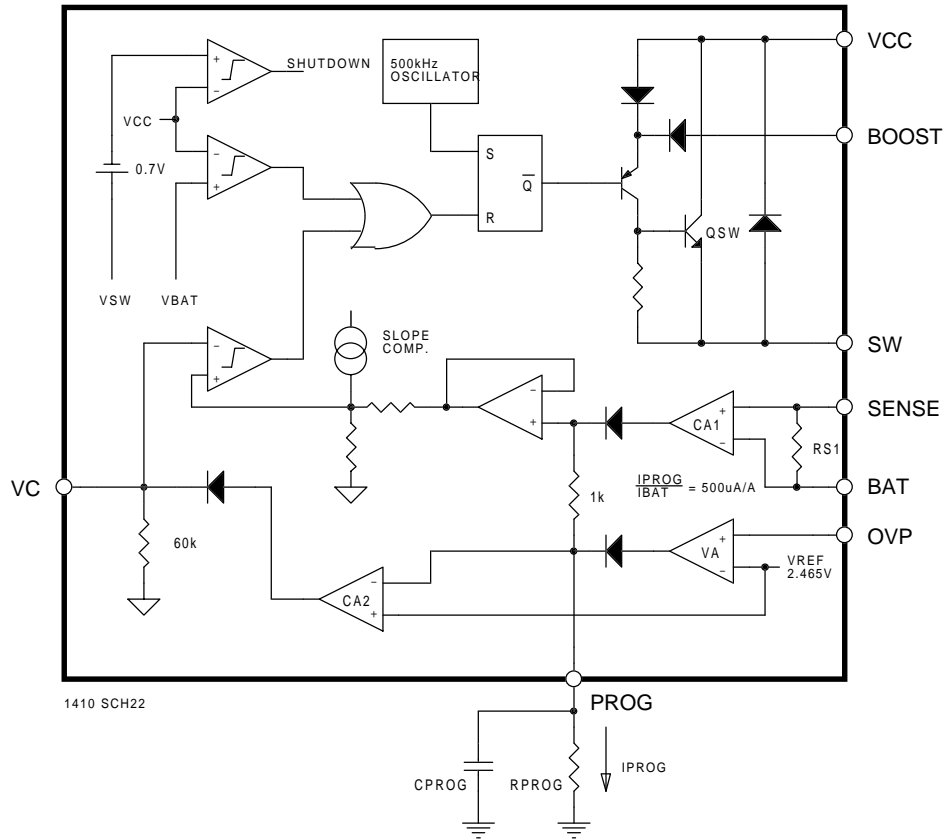
Ordering Information

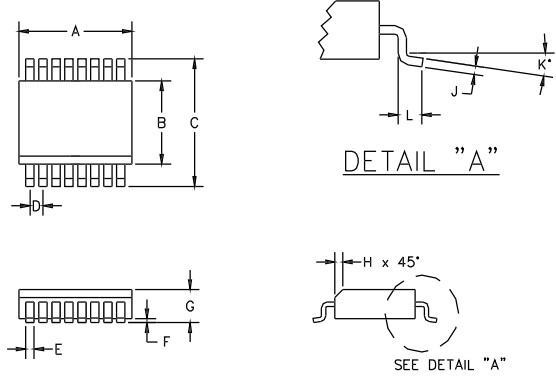| Device [1]	Package
SC1410ACQSTR	QSOP-16

Note:
(1) Only available in tape and reel packaging. A reel contains 2500 devices.

Pin Descriptions

Pin Number	Pin Name	Pin Function
1,8,9,16	GND	These Ground Pins are fused to the die attach paddle for optimum thermal performance connect these pins to large PCB copper area.
2	SW	Switch output.
3	BOOST	This pin is used to bootstrap and drive the switch power NPN transistor to a low on-voltage for low power dissipation.
4	GND	Ground pin.
5	OVP	Feedback node for constant voltage output, ground if not required.
6,11	NC	No connection, do not connect to these pins.
7	SENSE	Current amplifier CA1 input. Sensing can be at either terminal of the battery.
10	BAT	Current amplifier CA1 input.
12	VC	Control signal of the inter loop of the current mode PWM. Switching starts at 0.7V and higher VC corresponds to higher charging current in normal operation. A capacitor of at least 0.1uf to GND filters out noise and controls the rate of soft start. To shut down switching, pull this pin low. Typical output current is 30uA.
13	PROG	This pin is for programming the charging current and for system loop compensation.
14	VCC1	Supply for the chip.
15	VCC2	Supply for the chip.

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Block Diagram

1410 SCH22

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Outline Drawing - QSOP-16

DIMENSIONS					
DIMᴺ	INCHES		MM		NOTE
	MIN	MAX	MIN	MAX	
A	.189	.196	4.80	4.98	2
B	.150	.157	3.81	3.99	3
C	.228	.244	5.79	6.20	–
D	.025 BSC		.635 BSC		–
E	.008	.012	0.20	0.30	–
F	.0040	.0098	0.10	0.25	–
G	.0532	.0688	1.35	1.75	–
H	.009	.019	0.22	0.49	–
J	.006	.010	0.15	0.25	–
K	0°	8°	0°	8°	–
L	.016	.050	0.40	1.27	–

③ DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTUSIONS.
   INTER-LEAD FLASH AND PROTUSIONS SHALL NOT EXCEED .25 mm (.010")
   PER SIDE.

② DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTUSIONS OR GATE
   BURRS. MOLD FLASH, PROTUSIONS AND GATE BURRS SHALL NOT EXCEED
   .15 mm (.010") PER SIDE.

① CONTROLLING DIMENSION : MILLIMETER

Land Pattern -QSOP-16 (Drawing Pending)

Contact Information

Semtech Corporation
Power Management Products Division
652 Mitchell Rd., Newbury Park, CA 91320
Phone: (805)498-2111   FAX (805)498-3804