DESCRIPTION

The A4063 is a constant current, constant voltage Li-Ion battery charger that uses a current mode PWM step down switching architecture. Using DC-DC control mode, the charge current is set by an external resistor, up to 2A. With a 1.5MHz switching frequency, the A4063 provides small, simple and efficient solution to fast charge single cell Li-Ion battery.

When the input voltage is lower than 4.35V, the chip enters the SLEEP MODE, the power consumption will be reduced to 60μA. Built-in temperature protection and load short-circuit protection ensure high reliability of the IC. There are two LED can display various charging states.

The A4063 is available in PSOP8 package.

FEATURES

- Constant current mode DC-DC PWM control
- Constant voltage LDO control
- 1.5MHz switching frequency
- Anti reverse connection
- Automatic sleep mode for low power consumption
- Automatic recharge
- Available in PSOP8 package

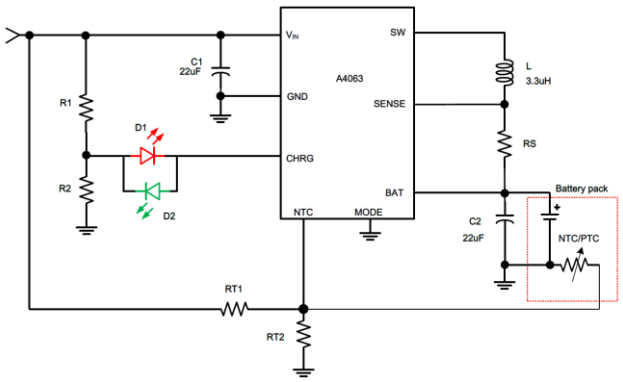
APPLICATION

- Mobile Phone
- Digital Camera
- Portable Devices
- Various Chargers
- Pads

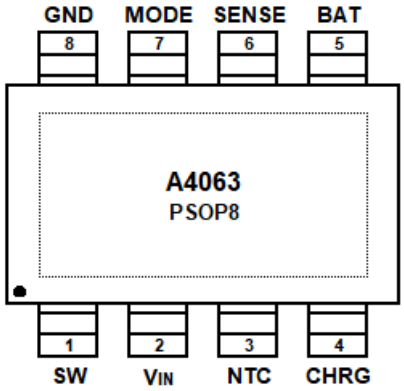
ORDERING INFORMATION

Package Type	Part Number	
PSOP8 SPQ: 3,000pcs/Reel	MP8	A4063MP8R
		A4063MP8VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

TYPICAL APPLICATION



PIN DESCRIPTION



Top View

Pin #	Symbol	Function
1	SW	Charging current output
2	V_{IN}	Power input
3	NTC	Battery temperature detection input. To disable the temperature qualification function, ground the NTC pin.
4	CHRG	Charge status output
5	BAT	Battery sense input
6	SENSE	Current sense input
7	MODE	Charge current program, "L" represents the programming current, then "H" represents the programming current 0.6 times. Default “L”.
8	GND	Ground.

ABSOLUTE MAXIMUM RATINGS

V_{IN}, Input Voltage	V_{SS}-0.3V ~ V_{SS}+6V
V_{SW}, SW Voltage	V_{SS}-0.3V ~ V_{IN}+0.3V
V_{BAT}, BAT Voltage	V_{SS}-0.3V ~ 6V
V_{SENSE}, SENSE Voltage	V_{SS}-0.3V ~ 6V
V_{CHRG}, CHAG Voltage	V_{SS}-0.3V ~ 6V
V_{MS}, MODE Voltage	V_{SS}-0.3V ~ 6V
V_{NTC}, NTC Voltage	V_{SS}-0.3V ~ 6V
V_{FB}, FB Voltage	V_{SS}-0.3V ~ 6V
I_{SW}, SW Switching Current	±2.5A
T_{OPA}, Work Peripheral Temperature	-40℃ ~ 85℃
T_{STR}, Storage Temperature	-65℃ ~ 125℃
V_{ESD}, ESD HBM	4000V

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

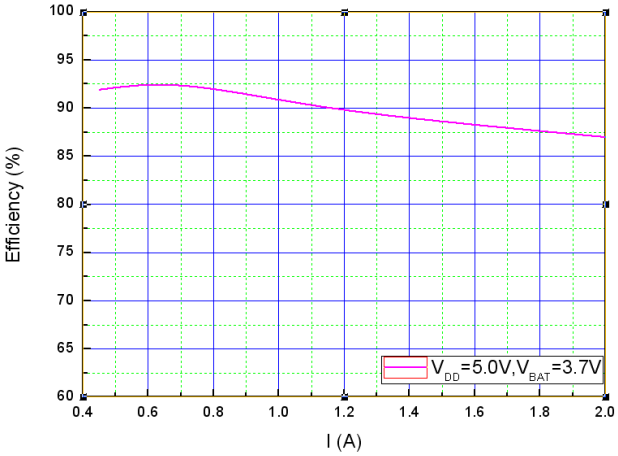
Test Condition: V_{IN}=5V, R_S=0.05ohm, T_A=25℃, unless otherwise specified

Parameter	Symbol	Conditions	Min	Typ	Max	Unit	Test Circuit
Input Voltage	V_{IN}		4.35	5	6	V	1
Battery Regulated Output Voltage	V_{BAT}	V_{IN}>4.35V	4.16	4.2	4.25	V	1
Input Current	I_Q	Standby Mode V_{IN}<4.35V	50	60	70	uA	2
	I_{STB}	End of Charge	0.83	0.92	1.2	mA	2
Battery Terminal Current	I_R	leakage current, V_{BAT}>V_{IN}	0	0.01	0.1	uA	2
	I_B	End of charge	5	6.5	8	uA	2
Constant Current	I_{CHARGE}	R_S=50mohm, V_{MH}="1"	1.8	2	2.2	A	1
		R_S=50mohm, V_{ML}="0"	1.08	1.2	1.32	A	1
Termination Current Threshold	I_{END}	V_{BAT}>4.2V	50	65	80	mA	1
Trickle Charge Threshold Voltage	V_{TR}		2.8	2.92	3	V	1
Recharge Battery Threshold Voltage	ΔV_{REG}	V_{BAT} – $V_{RECHARGE}$	90	130	170	mV	1
Oscillator Frequency	F_{OSC}	R_L=100mA	1.35	1.5	1.65	MHz	1
Mode Low	V_{ML}		-	-	0.8	V	2
Mode High	V_{MH}		1.2	-	-	V	2
MODE Current	I_{MODE}	V_{MODE}=5V	6	7.5	9	μA	2
Low-Voltage Lockout Voltage	V_{UVLO}	V_{IN} adjusted from low to high	4.3	4.35	4.45	V	2
NTC Pin Threshold Voltage (Hot)	V_{HOT}	V_{IN}=5V	1.57	1.67	1.77	V	2
NTC Pin Threshold Voltage (Cold)	V_{COLD}	V_{IN}=5V	3.23	3.33	3.43	V	2
Over Temperature Protection	T_{SD}		143	153	163	℃	1
Hysteresis of Temperature Protection	ΔT_{SD}		20	25	30	℃	1

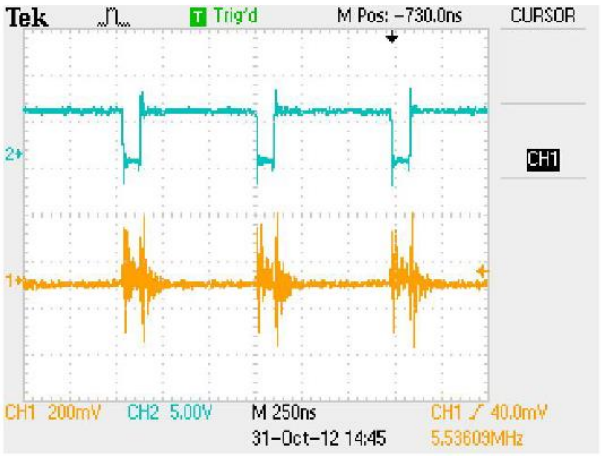
TYPICAL PERFORMANCE CHARACTERISTIC

V_{IN}=5V, charge current 2A

1. Charging current and charging efficiency

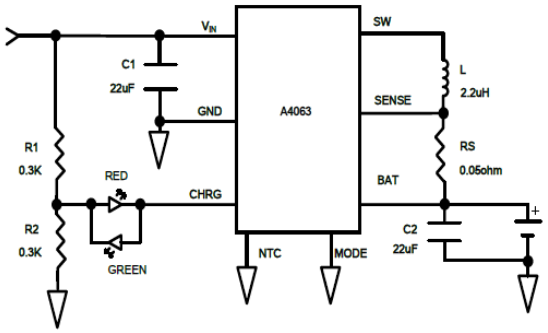


2. SW wave and output ripple

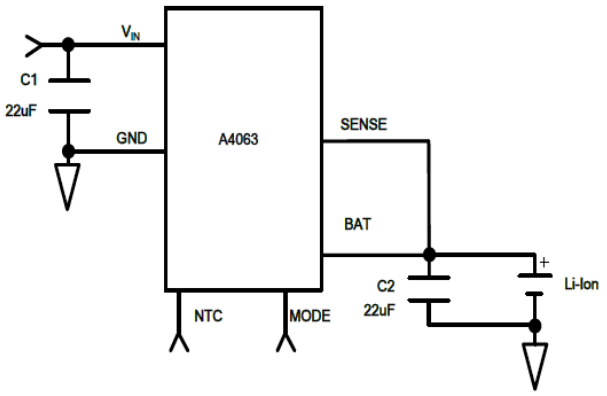


TEST CIRCUIT

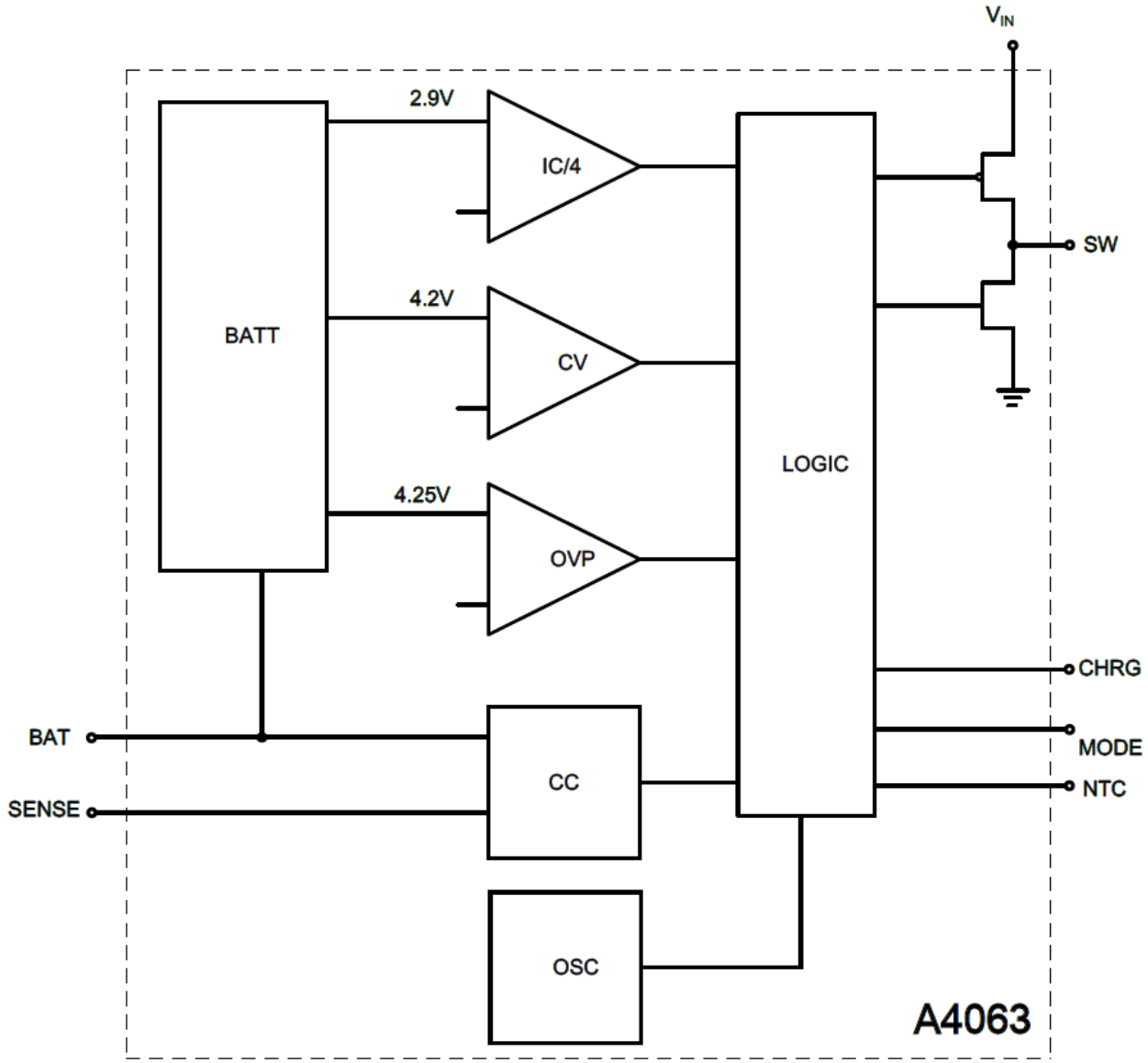
1. Test Circuit 1



2. Test Circuit 2



BLOCK DIAGRAN



DETAILED INFORMATION

Operation

A4063 is a constant current, constant voltage Li-Ion battery charger that uses a current mode PWM step-down switching architecture. The charge current is set by an external sense resistor (R_S) between the SENSE and BAT pins.

When the input voltage is below the UVLO level (4.35V), the chip enters SLEEP MODE, then the chip power consumption reduce to 60μA or less. When the input voltage rises above the UVLO voltage, the charger enters charging mode. If the battery voltage is lower than the trickle charge threshold voltage (2.9V), the charger enters trickle charge mode, and the trickle charge set to 25 % of the maximum charge current. When the battery voltage exceeds the trickle charge threshold, the charger enters constant current charging mode, then the charging current is defined by the internal 100mV reference and external sense resistor to decide, calculated as follows: I_{BAT}=100mV/R_S

When the battery voltage is close to the target value 4.2V, the charge current drops and the chip enters constant voltage charging mode LDO. When the charge current drops to 65mA, the chip stops charging, the green LED turns on. If the battery does not leave BAT terminal and the battery voltage drops to 4.07V, the chip will automatically enter RECHARGE state, and restart the charge cycle.

Current Setting

When MODE is low, I_{BAT}=100mV/R_S; When MODE is high, the charging current is automatically reduced to 60mV/R_S. A4063 can determine the allowable maximum current according to the input voltage, when the input voltage is less than 4.6V, the charge current is reduced to 500mA.

Temperature Protection

A4063 built-in temperature compensation circuit, when the internal temperature reaches 100℃, the maximum charging current will fall with increasing temperature, reducing the possibility of thermal breakdown. When the temperature rises to 153℃, the chip enters the temperature protection, stopping charge cycle.
For 4.2V Li-Ion battery, just connect BAT and FB pin.

Charging Status

Operating States	Error	Charge	Full	No Load
Red LED (D1)	Always off	Always bright	Always off	Flashing
Green LED (D2)	Always off	Always off	Always bright	Always bright

The lamp brightness is determined by R1, R2 resistance, the current of D1 (or D2) is $0.5*V_{IN}/R1$.

E.g., V_{IN} = 5V, taking R1 = R2 = 330Ω, LED current is 7.5mA.

Inductor Selection

For most designs, the A4063 operates with inductors of 1.5μH to 10μH. Low inductance values are physically smaller but require faster switching, which results in some efficiency loss. The inductor value can be derived from the following equation:

$$L = \frac{V_{OUT} \times (V_{IN} - V_{OUT})}{V_{IN} \times \Delta I_L \times f_S}$$

Where fs is the operation frequency, ΔI_L is inductor Ripple Current. Large value inductors lower ripple current and small value inductors result in high ripple currents. Choose inductor ripple current approximately 40% of the maximum load current for optimum voltage-positioning load transients.

Input Capacitor Selection

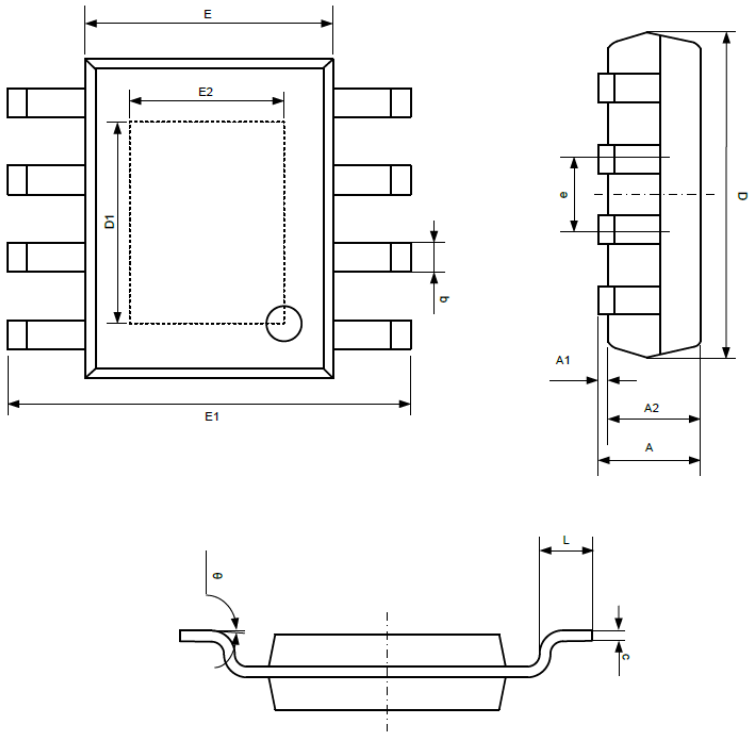
The input capacitor reduces the surge current drawn from the input and switching noise from the device. The input capacitor impedance at the switching frequency shall be less than input source impedance to prevent high frequency switching current passing to the input. A low ESR input capacitor sized for maximum RMS current must be used. Ceramic capacitors with X5R or X7R dielectrics are highly recommended because of their low ESR and small temperature coefficients. A 4.7μF ceramic capacitor for most applications is sufficient.

Output Capacitor Selection

The output capacitor is required to keep the output voltage ripple small and to ensure regulation loop stability. The output capacitor must have low impedance at the switching frequency. Ceramic capacitors with X5R or X7R dielectrics are recommended due to their low ESR and high ripple current. A 10uF ceramic can satisfy most applications.

PACKAGE INFORMTION

Dimension in PSOP8 (Unit: mm)



Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	1.350	1.750	0.053	0.069
A1	0.050	0.150	0.002	0.006
A2	1.350	1.550	0.053	0.061
b	0.330	0.510	0.013	0.020
c	0.170	0.250	0.007	0.010
D	4.700	5.100	0.185	0.200
D1	3.202	3.420	0.126	0.134
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	2.313	2.513	0.091	0.099
e	1.270 BSC		0.050 BSC	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

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