YHM2714/5/6
Tiny 500mA/750mA Standalone Linear Charger

YHMICROS
炙火微电子

Features

- 3.4V to 5.5V input range for Efficient Linear Charging
- Programmable Charging Current by external resistor:
  YHM2714: Max.500mA
  YHM2715: Max.750mA
  YHM2716: Max.750mA
- Preset 4.2V/4.35V with ±0.5% Accuracy:
  YHM2714: 4.2V
  YHM2715: 4.35V
  YHM2716: 4.4V
- Device Status Output from STA pin
- C/20 Charge Termination
- 2.8V Pre Charge Threshold
- Built-In Robust Protection Including Battery OVP, Thermal Regulation
- Safety Related Certifications:
  IEC62368-1：2018 CB Certification
- Tiny 0.67mm x 1.02mm 6-pin WLP with 0.35mm pitch

Applications

- Smart Watch/Band
- TWS Earbud
- Bluetooth Portable Device

General Description

YHM2714/5/6 is tiny single-cell Li-ion battery charger for space-limited portable applications. The full charger function features Pre-charge, constant current fast charge and constant voltage regulation, charge termination, and auto recharge.

YHM2714/5/6 can deliver up to 500mA/750mA charging current, be programmed externally with a single resistor. YHM2714/5/6 automatically terminates the charge cycle when the charge current drops to 1/20 of the programmed value after the final float voltage is reached. Thermal feedback regulates the charge current to limit the die temperature during high power operation or high ambient temperature.

The device status is indicated on STA pin output for charging, discharging and charge done.

YHM2714/5/6 comes in a 6-bump, 0.35mm pitch, 0.67mm x1.02mm wafer-level package (WLP).

YHM2714/5/6
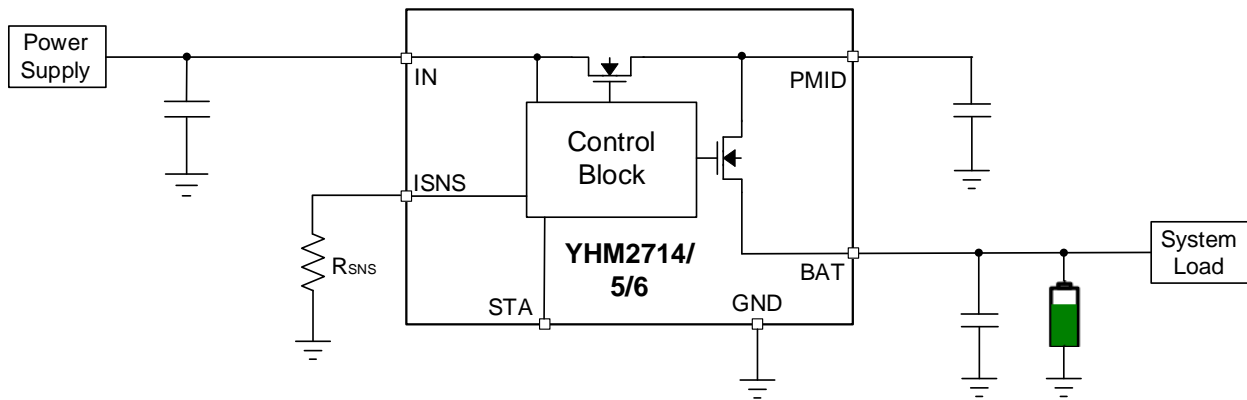## Tiny 500mA/750mA Standalone Linear Charger

Fig 1. YHM2714/5/6 Typical Application

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YHM2714/5/6 Pin Configurations

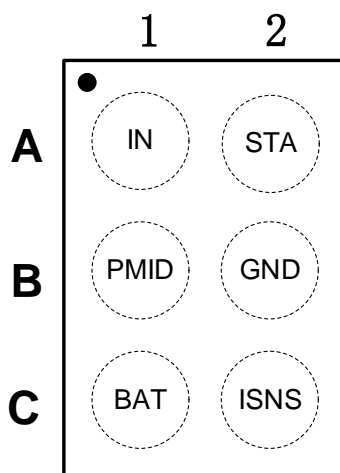**Fig 2. YHM2714/5/6 WLP-6 Pin Assignment(Top Through View）**

YHM2714/5/6 WLP Pin Descriptions

WLP	Name	Description
A1	IN	Input and Power Supply. Bypass this input with a ceramic capacitor to ground.
A2	STA	Status Output.
B1	PMID	Place at least 4.7μF ceramic capacitor from PMID to GND.
B2	GND	Ground.
C1	BAT	Battery Pin. Place at least 2.2μF ceramic capacitor from BAT to GND, and as close to the IC as possible.
C2	ISNS	Charge Current Program Pin. The charge current is programmed by connecting a 0.1% resistor to GND. This pin can be floating or connect to GND by huge resistor to achieve nearly stop charging.

Function Table

STA PIN	Status
Internally pull down to ground by 5kΩ	Charging
Internal pull up to V_{BAT} by 0.1μA	Other Status except Charging

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1 Absolute Maximum Ratings

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Disclaimer: YHMICROS reserves the right to make any change in circuit design, specification or other related things if needed without notice at any time.

Symbol	Parameters		Min.	Max.	Unit
V_{IN}	IN to GND		-0.3	6 (8V for 500µs)	V
V_{BAT}	BAT to GND		-0.3	6	V
V_{OTHER}	Other Pin to GND		-0.3	$Max(V_{IN}, V_{BAT})$ + 0.3	V
I_{IN}	Input Current		0	1100	mA
T_{STG}	Storage Junction Temperature		-65	+150	°C
T_J	Operating Junction Temperature			+150	°C
T_L	Lead Temperature (Soldering, 10 Seconds)			+260	°C
θ_{JA}	Thermal Resistance, Junction-to-Ambient (100mm² pad of 1 oz. copper)				°C/W
All Pins	Electrostatic Discharge Capability	Human Body Model, EIA/JESD22-A114	2		KV
		Charged Device Model, JESD22-C101	1		

Note 1.   Refer to JEDEC JESD51-7, use a 4-layerboard

2   Recommended Operating Conditions

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance.

Parameters	Min.	Max.	Unit
V_{IN}	3.4	5.5	V
I_{CHG}	10	750	mA
V_{OTHER}	0	5.5	V
C_{IN}	0.1		µF
C_{PMID} (at least 3µF of ceramic capacitance with DC bias de-rating)	4.7		µF
C_{BAT}	2.2		µF
Ambient Operating Temperature, T_A	-40	85	°C
Operating Junction Temperature, T_J	-40	150	°C

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3 Detailed Electrical Characteristics

(V_{IN} = 5V, V_{BAT} = 3.7V, T_A = -40°C to +85°C. Typical values are at T_A = +25°C, unless otherwise noted) (Note 1)

PARAMETER	SYMBOL	CONDITIONS	MIN	TYP	MAX	UNITS
Input						
Input Voltage Range	V_{IN}		3.4		5.5	V
Input Undervoltage Lockout Threshold	V_{IN_UVLO}	Input Falling		3.2		V
Input Undervoltage Lockout Threshold Hysteresis	$V_{IN\_UVLO\_HYS}$	Input Rising		200		mV
Quiescent Supply Current	I_{INQ}	T_A =+25°C, Charge Mode		0.5		mA
		-40°C ≤ T_A ≤ +85°C, Charge Mode			2	
Battery Charger						
Battery Quiescent Current	I_{BATQ}	V_{IN} = 5V, Charge Done		2		μA
		V_{IN} = 0V, V_{BAT} = 4.35V		150		nA
Battery Charge Voltage Regulation	V_{REG}	YHM2714, T_A = +25°C		4.2		V
		YHM2715, T_A = +25°C		4.35		V
		YHM2716, T_A = +25°C		4.4		V
		Accuracy, T_A = +25°C	-0.5		0.5	%
Fast Charge Current	I_{REG}	R_{SNS} = 25kΩ		60		mA
		R_{SNS} = 10kΩ		150		
		R_{SNS} = 5kΩ		300		
		Accuracy, T_A = +25°C, R_{SNS} = 2kΩ	-5		5	%
Junction Temperature Threshold	T_{J_REG}			120		°C
Pre-Charge Current	I_{PRE}			4		mA
Pre-Charge Threshold Voltage	V_{BAT_PRE}	V_{BAT} Rising	2.7	2.8	2.9	V
Pre-Charge Threshold Hysteresis				100		mV
Termination Current Threshold	I_{TERM}	=0.05×I_{REG}, R_{SNS} = 2kΩ		12.5		mA
Termination Deglitch Time	t_{TERM_DGL}			32		ms
Battery Auto-recharge Voltage Threshold	V_{RECH}			200		mV
Battery Auto-recharge Voltage Deglitch Time	t_{RECH_DGL}			120		ms
Battery Overvoltage Protection Threshold	V_{BAT_OVP}	V_{BAT} Rising, higher than V_{REG}		100		mV
Battery Overvoltage Protection Threshold Hysteresis	$V_{BAT\_OVP\_HYS}$			90		mV
THERMAL PROTECTION						
Thermal Shutdown	T_{SHDN}			150		ºC

Thermal Hysteresis	T_{HYST}		20	ºC
LOGIC				
Output High Voltage of STA	V_{OH_STA}		1.475	V
Output Low Voltage of STA	V_{OL_STA}	I_{SINK}=5mA	0.15	V

Note 1: All specifications are 100% production tested at T_A = +25°C, unless otherwise noted. Specifications are over T_A = -40°C to +85°C and are guaranteed by design.

Note 2: Guaranteed by design; not production test.

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4   Detailed Description

4.1 General Introduction

The YHM2714/5/6 is a tiny single-cell standalone Li-ion battery charger. The full charger function features Pre-charge, constant current fast charge and constant voltage regulation, charge termination, and auto recharge. The internal bias circuit of the IC is powered from V_{MAX}, which is the higher voltage of either V_{IN} or V_{BAT}. The POR voltage of the device is 1.8V.

4.2 Charge Profile

A charge cycle begins when V_{IN} rises above the UVLO threshold level. If the V_{BAT} is less than 2.8V, the charger enters Pre-charge mode. In this mode, the YHM2714/5/6 supplies 4mA charge current for dead battery. When V_{BAT} rises above 2.8V, the charger enters constant-current mode, where the programmed charge current is supplied to the battery. When V_{BAT} approaches V_{REG}, the YHM2714/5/6 enters constant-voltage mode and the charge current begins to decrease. When the charge current drops to 1/20 of the programmed value, the charge cycle ends. When this voltage drops below the recharge threshold, another charge cycle begins and current is once again supplied to the battery.
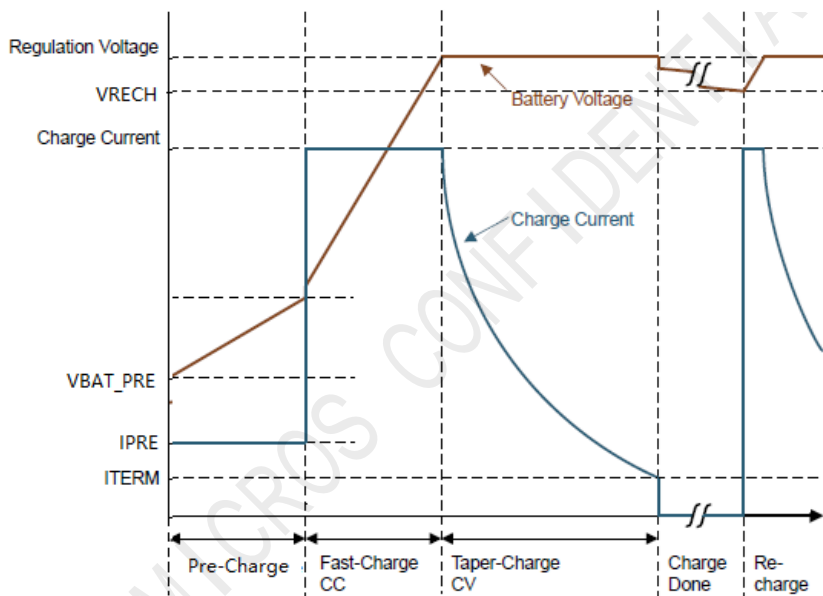

Fig 3. Battery Charge Profile

4.3 Charge Current Programming

The fast charge current is programmed using a single resistor from the ISNS pin to ground. The program resistor and the charge current are calculated using the following equations:

$$R_{SNS} = 1500/I_{REG}.$$

4.4 Thermal Regulation and Thermal Shutdown

The YHM2714/5/6 will reduce the programmed charge current by half if the die temperature attempts to rise above 120°C. This feature protects the YHM2714/5/6 from excessive temperature and allows the user to push the limits of the power handling capability of a given circuit board without risk of damaging the chip. When the junction temperature reaches 150°C, both Q1 and Q2 turn off.

4.5 Status

The STA pin can indicate charging, discharging and charge done status. When the battery is in discharging or charge done, the STA pin is internally pull up to BAT voltage by 0.1µA. When the battery is in charging, the STA pin is internally pull down to ground by 5kΩ. If pull down STA pin to ground when the chip is in charging, the typical power consumption is 0.4µA (V_{BAT}=4V).

5　Control Flow Chat
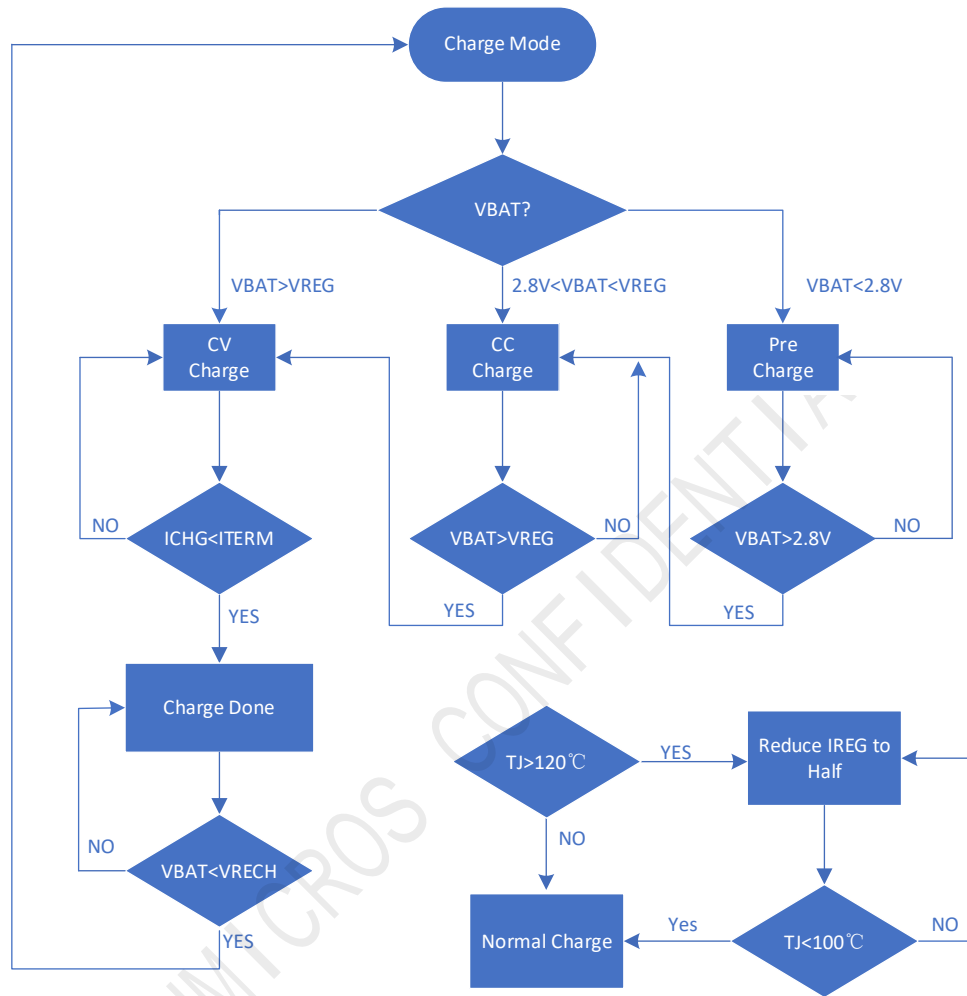
Fig 4. Charging Flow Chat

Package Dimensions

WLCSP-6 0.67x1.02

TOP VIEW
(MARK SIDE)

BOTTOM VIEW
(BALL SIDE)

SIDE VIEW

25um Backside tape
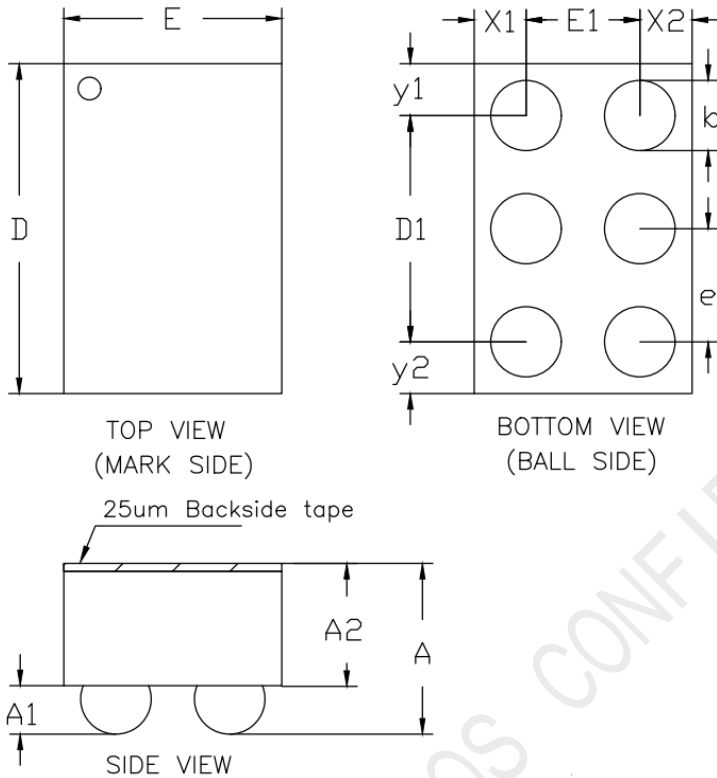
COMMON DIMENSIONS (UNITS OF MEASURE=MILLIMETER)			
SYMBOL	MIN	NOM	MAX
A	0.483	0.528	0.573
A1	0.130	0.150	0.170
A2	0.353	0.378	0.403
D	1.000	1.020	1.040
D1	0.700BSC		
E	0.650	0.670	0.690
E1	0.350BSC		
b	0.200	0.220	0.240
e	0.350BSC		
x1	0.160 REF		
x2	0.160 REF		
y1	0.160 REF		
y2	0.160 REF		

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Ordering Information

Part Number	Temp Range	Pin Package	Top Mark	MOQ
YHM2714W6T	-40°C to 85°C	6 WLCSP	YW XX	3000
YHM2715W6T	-40°C to 85°C	6 WLCSP	YW XX	3000
YHM2716W6T	-40°C to 85°C	6 WLCSP	YW XX	3000

T = Tape and reel.
YW: Date Code. Y = year, W = week.
XX: Internal tracking ID.

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YHMicros Website*: WWW.YHMICROS.COM*