

支持QC快充的高效同步升压型2A双节/3节锂电池充电器

High Efficiency, 2-A, 2-Cell/3-Cell Synchronous Boost Battery Charger with QC Compliant

■ FEATURES

- High-efficiency 2-A, 500kHz sync-boost Charger
- Efficiency, 94% at 5V input, 8V battery, 1A charge
- VIN supports 4V~9.5V, tolerance: 28V
- Cell Balancing Available in two cell charge mode
- Adaptively apply varied voltage with QC compliant, according to the battery voltage
 - 2-cell or 3-cell Li-Ion battery charger, Charge voltage is selectable: 8.1V/8.2V/8.3V/8.4V, 12.3V/12.4V/12.5V/12.6V; other charge voltage can be pre-booked
- Charge current up to 2A can be set through external resistor
- Adaptively input current limit to track the input power ability
- NTC available
- Charge Status indicator pin: LED. Different indicator styles can be pre-booked
- Robustness Features
 - Input Over voltage protection, Input Undervoltage protection, Output overcurrent protection, output overvoltage protection, output shortage protection, charge overtime protection, and Overtemperature Protection
- Packages: Pb-free Packages, QFN4×4-24L
- 内置500kHz同步升压的高效2A充电
- 效率94% ($V_{IN} = 5V$, $V_{BAT} = 8V$, $I_{CHG} = 1A$)
- 输入电压支持4V~9.5V, 容忍最高28V输入
- 双节充电时支持均衡
- 根据电池电压, 支持QC快充自动申请
- 支持双节或三节串联充电, 满电电压可设置: 8.1V/8.2V/8.3V/8.4V, 12.3V/12.4V/12.5V/12.6V
满电电压可定制
- 充电电流可设置, 最大2A
- 支持自动调节充电电流以自适应适配器负载能力
- 支持NTC保护
- LED脚支持充电状态指示, LED指示可定制
- 保护: 输入过压、输入欠压、输出过流、输出过压、输出短路、充电超时、过温保护等
- QFN4×4-24L封装

■ APPLICATIONS

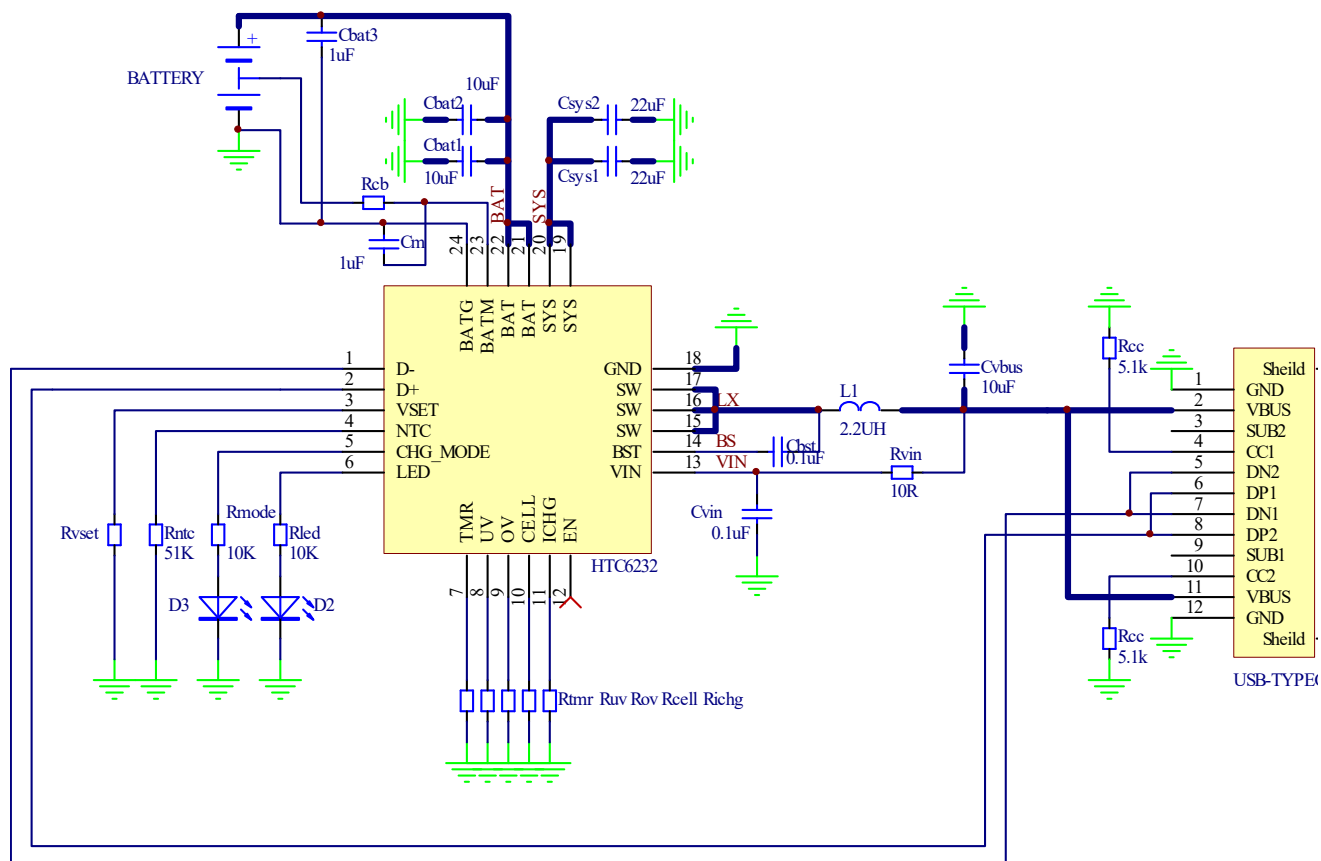
- Bluetooth/Wi-Fi Speakers
- Portable Speakers
- 蓝牙/ Wi-Fi音箱
- 便携式音箱
- POS Printers
- Security Cameras
- POS打印机
- 安全摄像机
- 2-cell / 3-cell Battery Charging
- 2节或三节串联充电场合

■ DESCRIPTION

The HTC6232 is highly-integrated 2A sync-boost switch-mode battery charger for 2-cell or 3-cell Li-Ion and Li-polymer battery.

HTC6232是一款内置同步升压的高集成2A锂电池充电芯片, 支持2节或3节串联锂电池充电。

■ TYPICAL APPLICATION



1. D+, D-连接后，可向USB端自动申请快充电压

2-CELL

VBAT	VIN快充申请电压
$VBAT < 6.2V$	$VIN = 5V$
$6.2V \leq VBAT < 6.8V$	$VIN = 5.4V$
$6.8V \leq VBAT < 7.8V$	$VIN = 6V$
$VBAT \geq 7.8V$	$VIN = 7V$

3-CELL

VBAT	VIN快充申请电压
$VBAT < 9V$	$VIN = 5V$
$9V \leq VBAT < 10.5V$	$VIN = 7V$
$VBAT \geq 10.5V$	$VIN = 9V$

2. VSET, 充电满电电压微调; CELL, 充电电池设置: 2节或3节串联。如下表

RVSET	Charge Voltage	
	CELL Floating 2-Cell	CELL = GND 3-Cell
1K	8.1V	12.3V
68K	8.2V	12.4V
120k	8.3V	12.5V
NC	8.4V	12.6V

3. NTC, 设置 NTC 保护, 不使用时, 接 51k 电阻到地; 其对外放出 20uA 电流, 检测 NTC 端电压进行 NTC 保护, 如下表:

V _{NTC}	Status
V _{NTC} > 1.32V	Low Temperature Protection, Stop Charting
0.56V < V _{NTC} ≤ 1.32V	Normal
0.43V < V _{NTC} ≤ 0.56V	High Temperature Warning, I _{CHG_NTC} = I _{CHG} /2
V _{NTC} ≤ 0.43V	High Temperature Protection, Stop Charging

4. CHG_MODE, LED, 为充电模式指示, 充电状态指示:

State	LED充电状态指示	CHG_MODE充电模式指示
亮 (output high)	充电	恒流
闪烁	异常状态	-
灭 (output low)	满电	涓流

5. TMR, 充电计时保护设置引脚, 通过设置其对地电阻 R_{TMR}, 设置充电超时时间 t_{TMR}。超过该充电超时时间, 芯片停止充电。

R _{TMR}	t _{TMR}
1k	Charge Timing Protection disabled
68k	4 hours
120k	12 hours
NC	24 hours

6. UV, 输入欠压保护设置引脚, 通过设置其对地电阻 R_{UV}, 设置 VIN 端欠压保护电压阈值 V_{IN_UVLO}。当输入电压低于 V_{IN_UVLO}时, 充电电流自动减小。

R _{UV}	V _{IN_UVLO}
1k	4.25V
68k	4.35V
120k	4.45V
NC	4.65V

7. OV, 输入过压保护设置引脚, 通过设置其对地电阻 R_{OV} , 设置 VIN 端过压保护电压阈值 V_{IN_OV} 。当输入电压高于 V_{IN_OV} 时, 充电停止, LED 闪烁, BAT_MODE 维持高。

R _{OV}	V _{IN_OV}	
	CELL Floating 2-Cell	CELL = GND 3-Cell
1K	Overvoltage Protection Disabled	
68K	8V	10.3V
120k	8.4V	10.8V
NC	8.75V	11.25V

8. ICHG, 充电电流设置端, 通过设置其对地电阻 R_{ICHG} , 设置恒流充时的充电电流 I_{CHG}

$$I_{CHG} \approx 90/R_{ICHG} \text{ (kohm)}$$

9. EN, 芯片使能端, 高时芯片使能, 低时芯片关闭、停止充电

10. VIN 端极限电压为 28V

11. 电感可使用典型 2.2uH, 饱和电流 I_{SAT} 建议大于 $1.4 \times \frac{8.4 \times I_{CHG}}{4.5 \times 0.9}$ (2cell) or $1.4 \times \frac{12.6 \times I_{CHG}}{4.5 \times 0.9}$ (3cell)

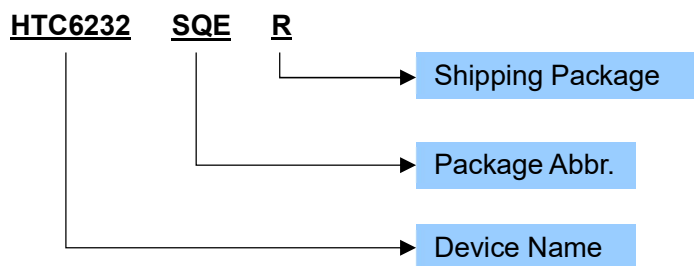
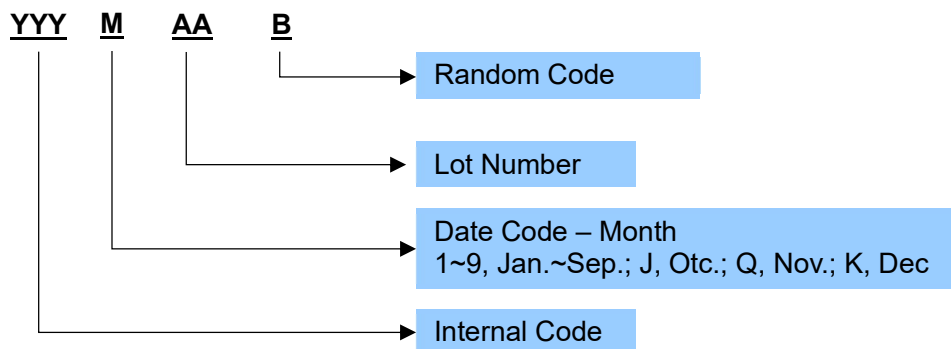
12. SYS 端, 靠近引脚建议放置至少两个 22uF 电容; BAT 端, 靠近引脚建议放置至少 2 个 10uF 电容, 并关注电容额定电压 (建议 $\geq 20V$)

13. 电池均衡功能仅在 2 节串联时有效。不使用电池均衡时, BATM, BATG 可悬空。当其中一节电池电压 $V_{BAT1} > 4.1V$ 而另一节电池电压 $V_{BAT2} < 4.1V$, 均衡功能开启; 当两节电池电压均 $> 4.1V$, 则均衡功能关闭。在非正常充电状态下 (如 NTC 保护、输入过压、电池满电等), 均衡功能亦关闭。

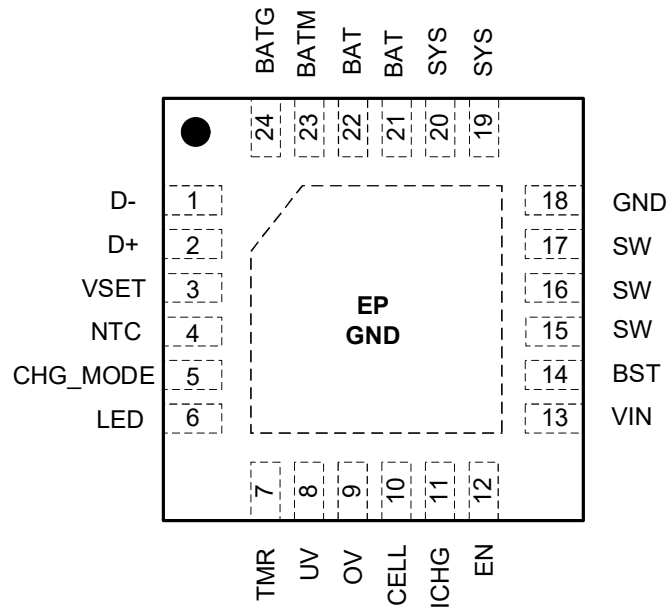
均衡电流 $I_{CB} = 4.1V/R_{CB}$, I_{CB} 建议 $< 40mA$, 关注 R_{CB} 封装, 建议使用 0805 或更大尺寸。

ORDERING INFORMATION

Part Number	Description	Package Type	Package Abbr.	MSL Level	Eco Plan	Marking	Shipping Package / MOQ
HTC6232S QER	Standard	QFN4×4-24L	SQE	MSL3	RoHS	HTC6232 YYYMAAB ¹	Tape and Reel (R) /TBD
HTC6232S QER-A	Increase Charge Voltage by 0.4V (compared to standard version) 充电满电电压提升0.4V, 相比标准版						

Part Number

Production Tracking Code


■ TERMINAL CONFIGURATION



Top View

■ TERMINAL FUNCTION

Terminal No.	Name	I/O ¹	Description
1	D-		USB D-
2	D+		USB D+
3	VSET		Charge Voltage Selection. 充电满电电压微调
4	NTC		Temperature Qualification Voltage. 温度保护输入端
5	CHG_MODE		Charge Mode Indicator. 充电模式指示
6	LED		Charge Status Indicator. 充电状态指示
7	TMR		Charge Timing Protection Setting Terminal. 充电计时保护设置引脚
8	UV		Input Voltage Undervoltage protection Setting Terminal. 输入欠压保护设置
9	OV		Input Voltage Overvoltage Protection Setting Terminal. 输入过压保护设置
10	CELL		2-cell or 3-cell batteries selection. 充电电池设置：2节或3节串联
11	ICHG		Charge current setting terminal. 充电电流设置端
12	EN		Enable. 芯片使能端
13	VIN		Power input terminal. 电源输入端
14	BST		Connection point for the bootstrap capacitor. 自举电容端
15,16,17	SW		The switching node pin of the boost converter. 开关节点，连接电感。
18	GND		Ground. 系统地
19,20	SYS		System Connection. 升压输出中间节点
21,22	BAT		Battery Power Connection. 电池连接端。
23	BATM		Connect to the middle point of 2 cell batteries for cell balancing. 电池均衡充电时，连接至2节电池中间位置
24	BATG		Connect to the Negative point of the battery for cell balancing. 电池均衡充电时，连接至电池负端。
EP	GND	G	Provides both electrical and thermal connection from the device to the board. A matching ground pad must be provided on the PCB and the device connected to it via solder. For proper electrical operation, this ground pad must be connected to the system ground. 既是地，又是散热PAD

¹ I: Input; O: Output; G: Ground; P: Power; BST: BOOT Strap; OD: Open drain

■ SPECIFICATIONS¹

● Absolute Maximum Ratings²

PARAMETER	Symbol	MIN	TYP	MAX	UNIT
Power supply voltage for VIN, transient <10ns	V _{IN}	-0.3		28	V
Voltage for BAT, SYS, SW, BATM, D+, D-	V _{BAT}	-0.3		24	V
Voltage for NTC, VSET, LED, CHG_MODE, TMR, UV, OV, CELL, ICHG, EN	V _{NTC}			5.5	V
BST voltage	V _{BST}	-0.3		V _{SW} +5.5	V
Junction Temperature	T _J	-40		150	°C
Storage Temperature	T _{STG}	-40		150	°C

● Recommended Operating Conditions

PARAMETER	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Power supply voltage for VIN	V _{IN}		4	5	9.5	V
Ambient Operating Temperature	T _a		-40	25	85	°C
Charge Current	I _{CHG}		0		2	A

● 2-cell Battery Charging

T_A = 25°, L1 = 2.2uH, VIN = 5V, V_{BAT} = 7.4V, unless otherwise noted

PARAMETER	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Power supply voltage for VIN	V _{IN}		4.5	5	-	V
VIN falling threshold	V _{IN_UVLO}	R _{UV} = NC		4.65		V
		R _{UV} = 120k		4.45		V
		R _{UV} = 68k		4.35		V
		R _{UV} = 1k		4.25		V
VIN overvoltage protection, rising threshold	V _{IN_OV}	R _{OV} = NC		8.75		V
		R _{OV} = 120k		8.4		V
		R _{OV} = 68k		8		V
		R _{OV} = 1k, OVP disabled	-	-	-	V
Input supply current (VIN terminal)	I _{VIN}	V _{IN} = 5V, V _{BAT} = NC, EN = H, NO LED		20		mA
Input supply current (VIN terminal) in standby mode	I _{VIN_SD}	V _{IN} = 5V, EN = L		40		uA
Battery discharge current in standby mode	I _{BAT_SD}	EN = 0V, VIN = 0V, V _{BAT} = 7.4V		0.7		uA
Voltage Regulation						
Charge Voltage	V _{BAT_REG}	R _{VSET} = NC	8.3	8.4	8.5	V
		R _{VSET} = 120k	8.2	8.3	8.4	V
		R _{VSET} = 68k	8.1	8.2	8.3	V
		R _{VSET} = 1k	8.0	8.1	8.2	V
Recharge Voltage	V _{BATR}	R _{VSET} = NC		8.2		V
Battery voltage rising threshold to start constant current charge mode	V _{TRK_R}			6		V
Battery voltage falling threshold to stop constant current charge mode	V _{TRK_F}			5.6		V
Battery voltage rising threshold to start trickle current charge mode	V _{SHORT_R}			3.6		V
Battery voltage falling threshold to stop trickle current charge mode	V _{SHORT_F}			3.1		V

¹ Depending on parts and PCB layout, characteristics may be changed.

² Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under recommended operating conditions is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

Charge Current						
Charge current for constant current charge mode	I _{CHG}	R _{ICHG} = 90k		1.0		A
Charge current for trickle current charge mode	I _{TRICKLE}	V _{IN} = 5V, 3.6V ≤ V _{BAT} ≤ 6V, R _{ICHG} = 90k		100		mA
Charge current in short mode	I _{SHORT}	V _{IN} = 5V, V _{BAT} < 3.6V		70		mA
Termination current	I _{TERM}			200		mA

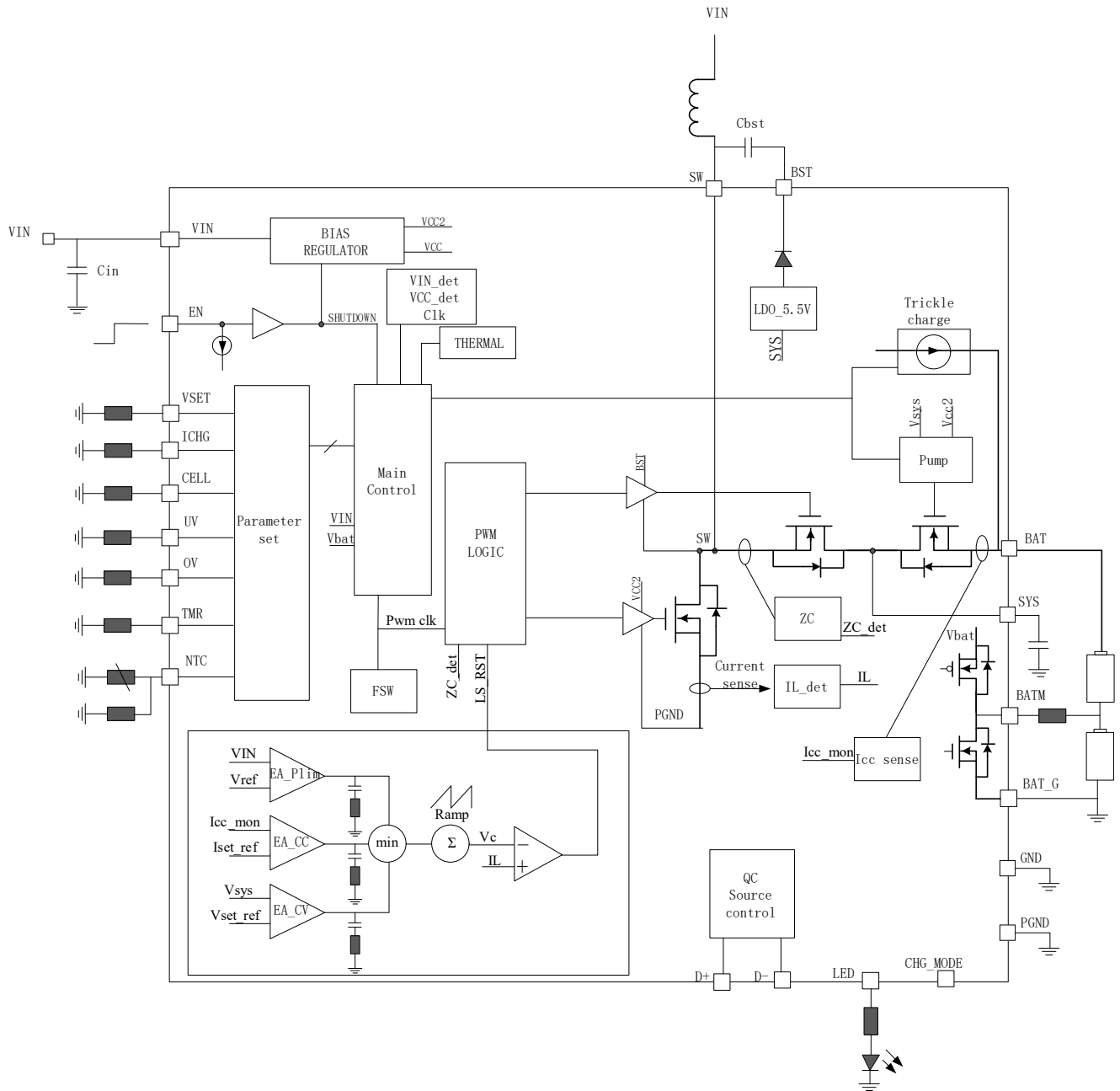
● 3-cell Battery Charging

T_A = 25°, L1 = 2.2uH, V_{IN} = 5V, V_{BAT} = 10.8V, unless otherwise noted

PARAMETER	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Power supply voltage for V _{IN}	V _{IN}		4.5	5	8.75	V
V _{IN} falling threshold	V _{IN_UVLO}	R _{UV} = NC		4.65		V
		R _{UV} = 120k		4.45		V
		R _{UV} = 68k		4.35		V
		R _{UV} = 1k		4.25		V
V _{IN} overvoltage protection, rising threshold	V _{IN_OV}	R _{OV} = NC		11.25		V
		R _{OV} = 120k		10.8		V
		R _{OV} = 68k		10.3		V
		R _{OV} = 1k, OVP disabled	-	-	-	V
Input supply current (V _{IN} terminal)	I _{VIN}	V _{IN} = 5V, V _{BAT} = NC, EN = H, NO LED		30		mA
Input supply current (V _{IN} terminal) in standby mode	I _{VIN_SD}	V _{IN} = 5V, EN = L		40		uA
Battery discharge current in standby mode	I _{BAT_SD}	EN = 0V, V _{IN} = 0V, V _{BAT} = 10.8V		1.5		uA
Voltage Regulation						
Charge Voltage	V _{BAT_REG}	R _{VSET} = NC	12.5	12.6	12.7	V
		R _{VSET} = 120k	12.4	12.5	12.6	V
		R _{VSET} = 68k	12.3	12.4	12.5	V
		R _{VSET} = 1k	12.2	12.3	12.4	V
Recharge Voltage	V _{BATR}	R _{VSET} = NC		12.3		V
Battery voltage rising threshold to start constant current charge mode	V _{TRK_R}			9		V
Battery voltage falling threshold to stop constant current charge mode	V _{TRK_F}			8.4		V
Battery voltage rising threshold to start trickle current charge mode	V _{SHORT_R}			3.6		V
Battery voltage falling threshold to stop trickle current charge mode	V _{SHORT_F}			3.1		V
Charge Current						
Charge current for constant current charge mode	I _{CHG}	R _{ICHG} = 90k		1.0		A
Charge current for trickle current charge mode	I _{TRICKLE}	V _{IN} = 5V, 3.6V ≤ V _{BAT} ≤ 6V, R _{ICHG} = 90k		100		mA
Charge current in short mode	I _{SHORT}	V _{IN} = 5V, V _{BAT} < 3.6V		70		mA
Termination current	I _{TERM}			200		mA

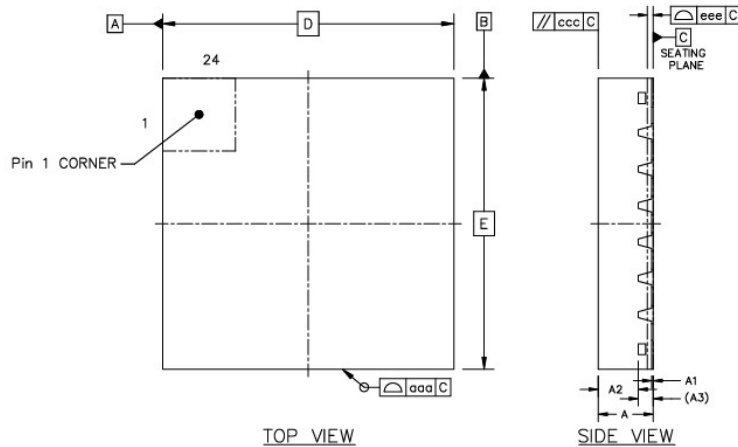
Other Electrical Characteristics

PARAMETER	Symbol	CONDITION	MIN	TYP	MAX	UNIT
Oscillator and PWM						
Switching frequency	f_{SW}			500		kHz
Power MOSFET						
RDS(ON) of LS-FET	R_{NFET_M}			35		mΩ
RDS(ON) of HS-FET	R_{NFET_R}			45		mΩ
RDS(ON) of Blocking FET	R_{NFET_M}			50		mΩ
Current Limit	I_{LIM}			6		A
I/O						
LED pin drive current	I_{LED}				5	mA
NTC pin output current	I_{NTC}			20		uA
High voltage of EN terminal	V_{EN_H}		1.4			V
Low voltage of EN terminal	V_{EN_L}				1.2	V
Thermal Regulation and Thermal Shutdown						
Thermal shutdown temperature	T_{SD}	Rising threshold		135		°C
Thermal shutdown temperature	T_{SDHYS}			25		°C

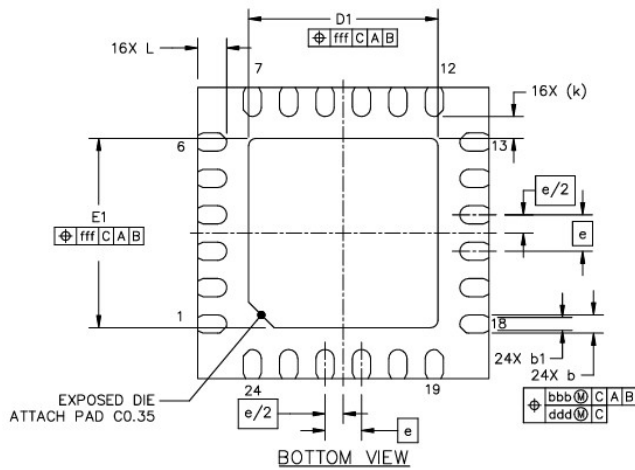
FUNCTIONAL BLOCK DIAGRAM


■ PACKAGE OUTLINE

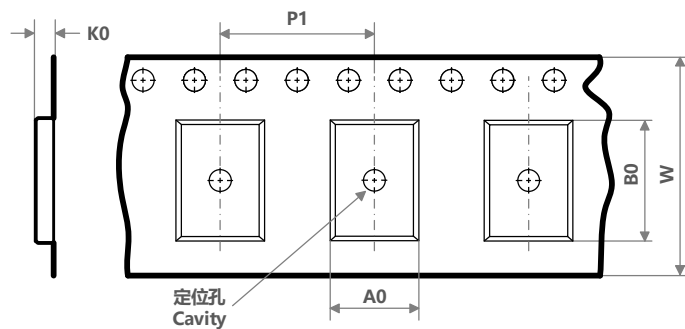
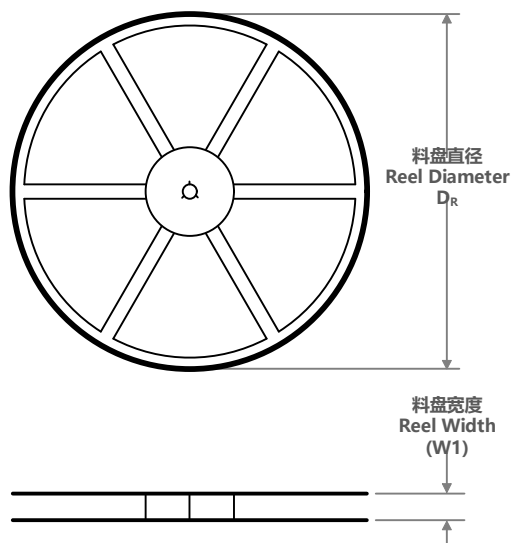
SQE (QFN4×4-24L)



	SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS	A	0.7	0.75	0.8
STAND OFF	A1	0	0.02	0.05
MOLD THICKNESS	A2	---	0.55	---
L/F THICKNESS	A3	0.203	REF	
LEAD WIDTH	b	0.2	0.25	0.3
	b1	0.18	REF	
BODY SIZE	X	D	4	BSC
	Y	E	4	BSC
EXPOSED PAD SIZE	X	D1	2.5	2.6
	Y	E1	2.5	2.6
LEAD PITCH	e	0.5	BSC	
LEAD LENGTH	L	0.3	0.4	0.5
LEAD TIP TO EXPOSED PAD EDGE	k	0.3	REF	
PACKAGE EDGE TOLERANCE	aaa	0.1		
MOLD FLATNESS	ccc	0.1		
COPLANARITY	eee	0.08		
LEAD OFFSET	bbb	0.1		
	ddd	0.05		
EXPOSED PAD OFFSET	fff	0.1		

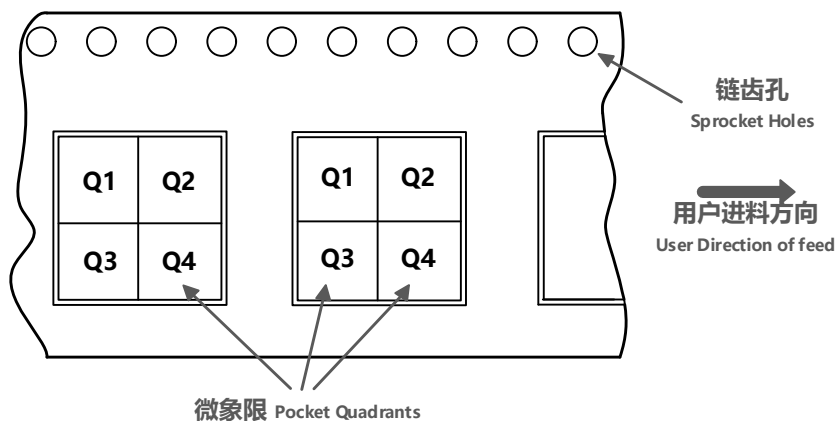


■ TAPE AND REEL INFORMATION

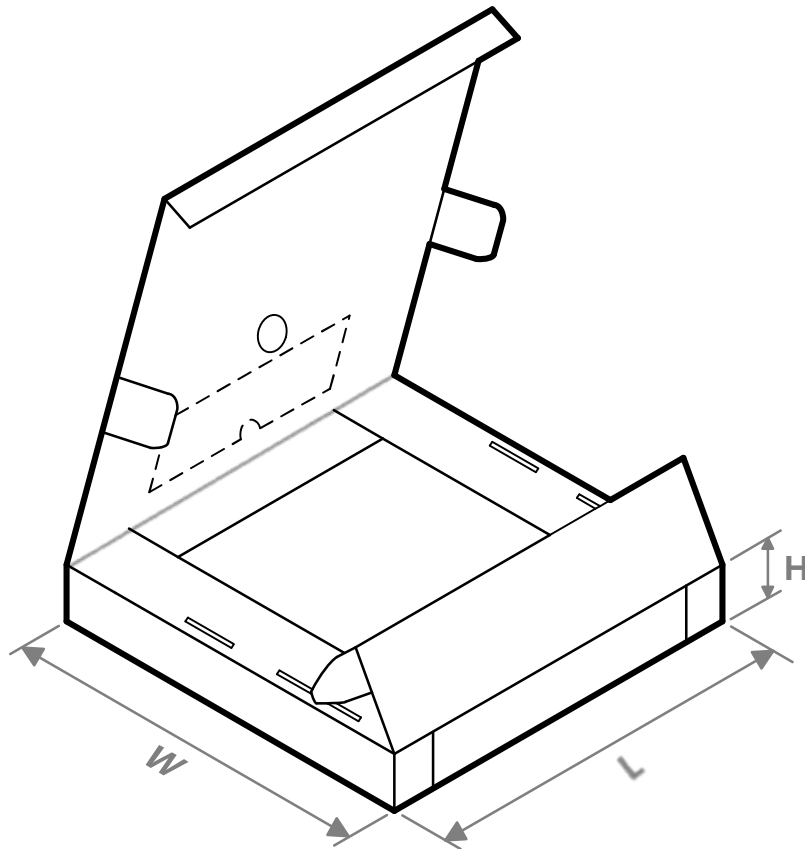


A0	Dimension designed to accommodate the component width; 料槽宽度
B0	Dimension designed to accommodate the component length; 料槽长度
K0	Dimension designed to accommodate the component thickness; 料槽厚度
W	Overall width of the carrier tape; 载带整体宽度
P1	Pitch between successive cavity centers; 相邻槽中心间距

编带 PIN1 方位象限分配 Quadrant Assignments for Pin1 Orientation in Tape



器件料号 Part No.	封装类型 Package Type	封装标识 Package Abbr.	引脚数 Pins	SPQ	料盘直径 D_R (mm)	料盘宽度 W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 象限 Quadrant
HTC6232SQER	QFN4×4	SQE	24	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

TAPE AND REEL BOX INFORMATION


器件料号 Part No.	封装类型 Package Type	封装标识 Package Abbr.	引脚数 Pins	SPQ	长度 Length (mm)	宽度 Width (mm)	高度 Height (mm)
HTC6232SQER	QFN4×4	SQE	24	TBD	TBD	TBD	TBD

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