

UNISONIC TECHNOLOGIES CO., LTD

UB24205

Preliminary

CMOS IC

LITHIUM-ION/POLYMER BATTERY PROTECTION IC

DESCRIPTION

The UTC UB24205 is a lithium-ion / lithium-polymer rechargeable battery protection IC with internal MOSFETs. It incorporates high accuracy voltage detection circuits and delay circuits.

The UTC UB24205 is suitable for protection of single cell lithium-ion / lithium polymer battery packs from overcharge, over discharge and over current.

The small package and less required external components make it ideal to be integrated into limited space of battery pack.

FEATURES

- * Wide supply voltage range: V_{DD}=1.8V~9.0V
- * Ultra-low quiescent current:
- Ultra-low power-down current:
- Overcharge detection voltage: Vocu=4.250V±0.050V
- Overcharge release voltage: V_{OCR}=4.055V±0.050V Vodl=2.250V±0.100V
- * Over discharge release voltage:
- * Over discharge detection voltage: V_{ODR}=2.850V±0.100V
- * Over current detection voltage:
- * Short circuit detection voltage:
- Charger detection voltage:
- * Reset resistance for over current protection:
- No external MOSFETs
- Delay times are generated by an internal circuit
- (External capacitors are unnecessary).
- Halogen Free

ORDERING INFORMATION

Ordering Number	Package	Packing
UB24205G-S08-R	SOP-8	Tape Reel

IDD=3.0µA (VDD=3.9V)

IPD=0.1µA (VDD=2.0V)

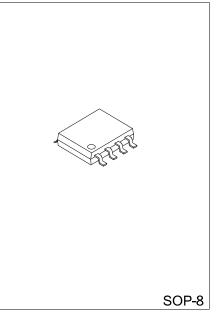
V_{OI1}= 0.150V±0.030V

V_{OI2}=1.35V (Fixed)

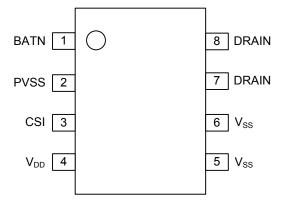
V_{CH}=-0.7V

 $R_{SHORT} > 500 k\Omega$

	(1) R: Tape Reel
(1) Packing Type (2) Package Type	(2) S08: SOP-8
(3) Halogen Free	(3) G: Halogen Free



PIN CONFIGURATION

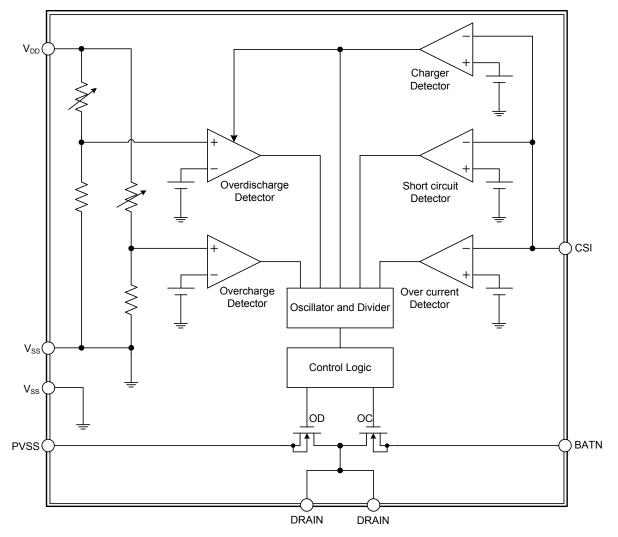


PIN DESCRIPTION

PIN NO.	PIN NAME	DESCRIPTION
1	BATN	Negative charge input, and load negative input
2	PVSS	Negative battery Input
3	CSI	Current sense Input, and charge detect
4	V _{DD}	Positive power input
5,6	V _{SS}	Negative power input
7,8	DRAIN	Output: the drain terminals of two internal MOSFETs



BLOCK DIAGRAM





■ ABSOLUTE MAXIMUM RATING (V_{SS}=0V, Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Input voltage between V_{DD} and V_{SS} (Note2)	V _{DD}	V_{SS} -0.3 ~ V_{SS} +12	V
CSI input pin voltage	V _{CSI}	V_{DD} -15 ~ V_{DD} +0.3	V
BATN input pin voltage	VBATN	V_{DD} -15 ~ V_{DD} +0.3	V
Operating Temperature	T _{ORP}	-40 ~ +85	°C
Storage Temperature	T _{STG}	-40 ~ +125	°C

Note: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Pulse (µsec) noise exceeding the above input voltage (V $_{\text{SS}}\text{+}12\text{V})$ may cause damage to the IC.

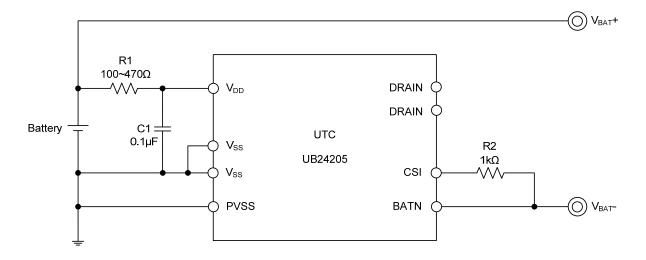
■ ELECTRICAL CHARACTERISTICS (V_{SS}=0V, Ta=25°C, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT		
CURRENT CONSEMPTION								
Supply Current	I _{DD}	V _{DD} =3.9V		3.0	6.0	μA		
Power-Down Current	I _{PD}	V _{DD} =2.0V			0.1	μA		
OPERATING VOLTAGE								
Operating Input Voltage	V _{DS1}	V _{DD} -V _{SS}	1.8		9.0	V		
DETECTION VOLTAGE								
Overcharge Detection Voltage	Vocu		4.200	4.250	4.300	V		
Overcharge Release Voltage	V _{OCR}		4.005	4.055	4.105	V		
Overdischarge Detection Voltage	V _{ODL}		2.150	2.250	2.350	V		
Overdischarge Release Voltage	VODR		2.750	2.850	2.950	V		
Over Current Detection Voltage	V _{OI1}		0.120	0.150	0.180	V		
Short Circuit Detection Voltage	V _{OI2}	V _{DD} =3.0V	1.0	1.35	1.75	V		
Reset Resistance For Over Current Protection	R _{SHORT}	V _{DD} =3.6V	350	500	650	kΩ		
Charger Detection Voltage	V _{CH}		-1.2	-0.7	-0.2	V		
DELAY TIME								
Overcharge Detection Delay Time	T _{oc}	V _{DD} =3.6V ~ 4.5V	0.7	1.3	1.9	S		
Overdischarge Detection Delay Time	T _{OD}	V _{DD} =3.6V ~ 2.0V	100	180	260	mS		
Over Current Detection Delay Time	T _{OI1}	V _{DD} =3.0V	5	10	20	mS		
Short Circuit Detection Delay Time	T _{OI2}	V _{DD} =3.0V	5	10	65	μS		
MOSFET								
Drain-Source Breakdown Voltage	BV _{DSS}	V _{GS} =0V, I _{DS} =1µA	20.0			V		
		V _{GS} =0V, I _{DS} =250µA	20.6			V		
Drain-Source Leakage Current	I _{DSS}	V _{GS} =0V, V _{DS} =20.0V			1	μA		
		V _{GS} =0V, V _{DS} =20.6V			250	μA		
Gate Threshold Voltage	V _{TH}	V _{GS} =V _{DS} , I _{DS} =1µA	0.6		1.4	V		
		V _{GS} =V _{DS} , I _{DS} =250µA	0.6		1.4	V		
Facilitate Dania October	R _{DS(ON)}	V _{GS} =2.5V, I _{DS} =3A			45	mΩ		
Equivalent Drain-Source On-Resistance		V _{GS} =4.5V, I _{DS} =1A			35	mΩ		
UII-RESISTANCE		V _{GS} =4.5V, I _{DS} =3A			33	mΩ		



Preliminary

TYPICAL APPLICATION CIRCUIT





APPLICATION INFORMATION

1. Normal Condition

The voltage of the battery connected between V_{DD} and V_{SS} can be monitored by the UTC **UB24205**. The voltage difference between CSI and V_{SS} can sense the charge and discharge scheme. Under this condition: $V_{ODL} < V_{DD} < V_{OCU}$ and $V_{CH} < V_{CSI} < V_{OI1}$, the UTC **UB24205** will turn on the charging control MOSFET (internal) and discharging control MOSFET (internal), the battery's charging (or discharging) is in normal condition.

2. Overcharge Condition

When the battery voltage becomes higher than the overcharge detection voltage (V_{OCU}) during normal charging condition through a delay time longer than T_{OC} (the overcharge detection delay time), the charging will be stopped.

3. Release of Overcharge Condition

Two ways to return to normal condition from overcharge condition:

- (1) Under the condition: the battery is self discharging, and if V_{DD} < V_{OCR} and V_{OI1} > V_{CSI} > V_{CH} occurs, the UTC UB24205 will be back to normal condition.
- (2) Connect the UTC **UB24205** to a load and remove the charger.

4. Overdischarge Condition

When the battery voltage falls below the overdischarge detection voltage (V_{ODL}) during discharging condition and through a delay time longer than T_{OD} (the overdischarge detection delay time), the discharging will be stopped. And then CSI will be pulled up to V_{DD} through an internal resistance. When $V_{CSI} > V_{OI2}$, the chip will enter into power-down mode. In this mode, the current consumption is lower than 0.1μ A.

5. Release of Power-down mode

There are two ways back to normal condition:

- (1) If $V_{CSI} < V_{CH}$ (Charger detection), when $V_{DD} > V_{ODL}$.
- (2) If $V_{CH} < V_{CSI} < V_{OI2}$, the condition $V_{DD} > V_{ODR}$.

6. Charger Detection

Charger detection is this action: while connecting to a charger after entering into power-down mode, then if $V_{DD} < V_{CH}$ and when $V_{DD} > V_{ODL}$, the system will be back to normal condition as described in 1) of previous section.

7. Abnormal Charge Current Condition

The abnormal charge current condition is when a charger is connected to the battery system in normal condition, then if $V_{DD} < V_{OCU}$ and $V_{CSI} < V_{CH}$ occurs through a delay time than T_{OC} (delay time of overcharge detection), and in this condition the charging will be stopped.

8. Over Current/Short Circuit Condition

The over current (or short circuit) condition is when the current is too large during discharging under normal condition as a result of the voltage detected by CSI is greater than V_{OI1} (or V_{OI2}) through a delay time $T_{OI1}(T_{OI2})$. In this over current (or short circuit) condition, the discharging will be stopped and CSI will be pulled down to V_{SS} through an internal resistance.

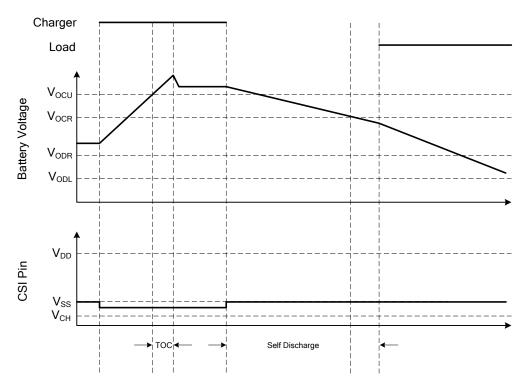
9. Release of Over Current/Short Circuit Condition

If the load is removed or the impedance between V_{BAT+} and V_{BAT-} is larger than 500k Ω as well as V_{CSI}<V_{OI1}, the system will be back to normal condition.

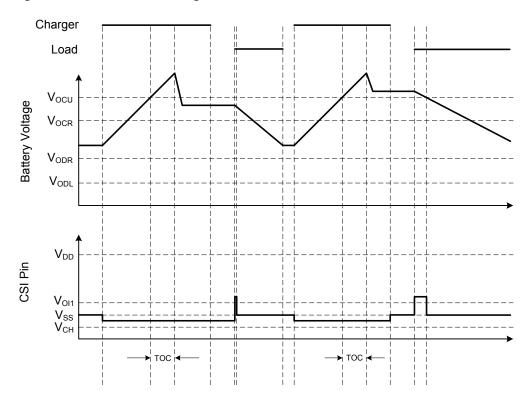


TYPICAL CHARACTERISTICS





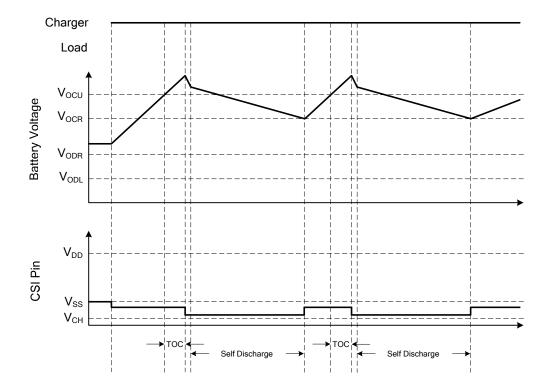
2. Overcharge Condition → Load Discharge → Normal Condition





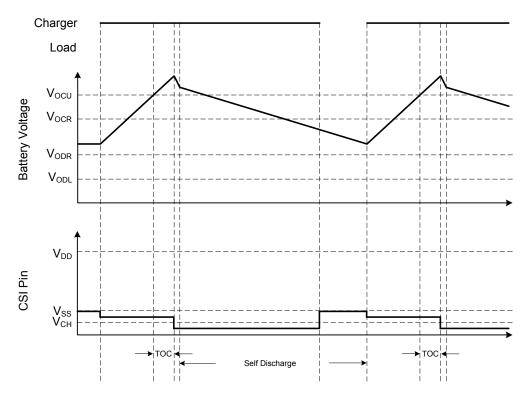
Preliminary

TYPICAL CHARACTERISTICS(Cont.)



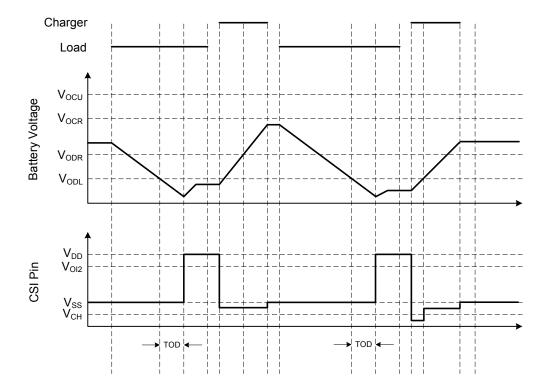
3. Overcharge Condition \rightarrow Charger remains connected and V_{CSI}>V_{CH} \rightarrow Self Discharge

4. Overcharge Condition → Charger remains connected and V_{CSI}<V_{CH} → Self Discharge



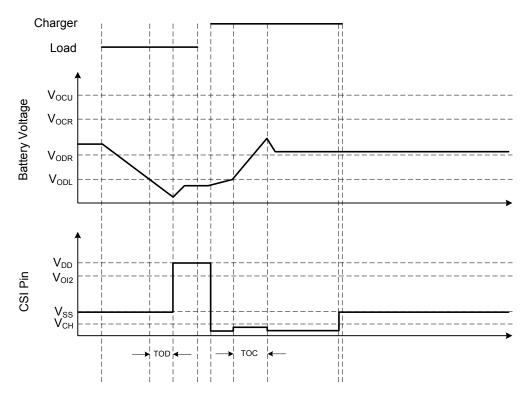


TYPICAL CHARACTERISTICS(Cont.)



5. Overdischarge Condition → Charging By a Charger → Normal Condition

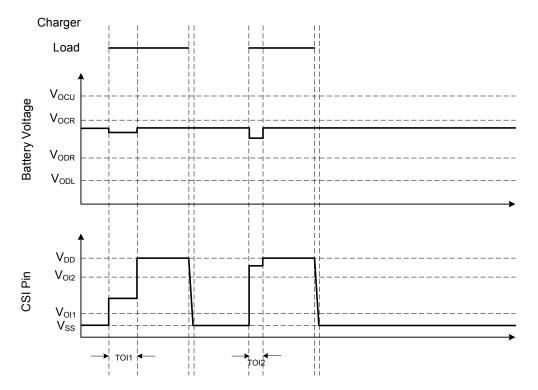






TYPICAL CHARACTERISTICS(Cont.)

7. Over Current and Short Circuit Condition → Normal Condition



UTC assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all UTC products described or contained herein. UTC products are not designed for use in life support appliances, devices or systems where malfunction of these products can be reasonably expected to result in personal injury. Reproduction in whole or in part is prohibited without the prior written consent of the copyright owner. The information presented in this document does not form part of any quotation or contract, is believed to be accurate and reliable and may be changed without notice.

