Five-in-one earphone charging case dedicated chip

Chip introduction

LP7800K is a single-chip solution IC designed for small-capacity lithium battery charging/ discharging applications. It integrates linear charging management module, synchronous boost, control module, status indication, load identification, and discharge module;

Charging management has built-in overvoltage protection function, input withstand voltage up to 30V, built-in power MOS, charging current 300mA, charger current adaptive function, charging status indication function;

Discharge management has built-in synchronous voltage boosting, load connection identification, and key-on functions;

Discharge current detection function, automatic cutoff of discharge when the discharge current is less than 10mA; Built-in discharge indication and low battery prompt functions;

Provides simple and easy-to-use solutions for the application of small-capacity lithium battery systems; the packaging form used by LP7800K is ESOP8.

Features

- Standby power consumption: 23uA
- High input withstand voltage: 30V
- Linear charging, charging current 300mA
- With charger current adaptive function
- Intelligent constant temperature charging function
- Synchronous boost output 5V
- Automatic load recognition function
- Switching frequency 1MHz
- Discharge efficiency as high as 93%
- Discharge cut-off current 10mA
- Discharge module over-current, short-circuit and over-temperature protection functions
- Built-in charging and discharging indicator function, low battery prompt function

Label information

LP7800K □ □□ □

- □ indicator light
  - 2: 2 light version
  - 4: 4 light version
- □□ Package type
  - SP:ESOP8
- □ F: Lead-free

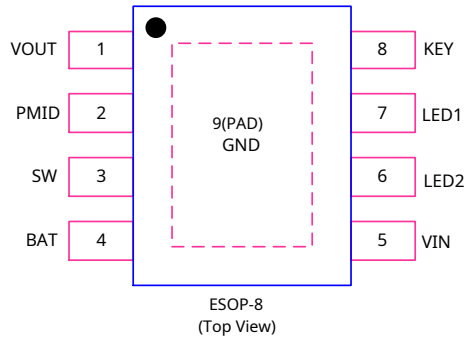
Silk screen printing and packaging information

model	silk screen	encapsulation	Package
LP7800K2SPF	LP7800K wxya	ESOP8	4K/disc
LP7800K4SPF	LP7800K4 wxya		
Silk screen marking: Y: Year of production W: Week of production X: Batch number			

Application scope

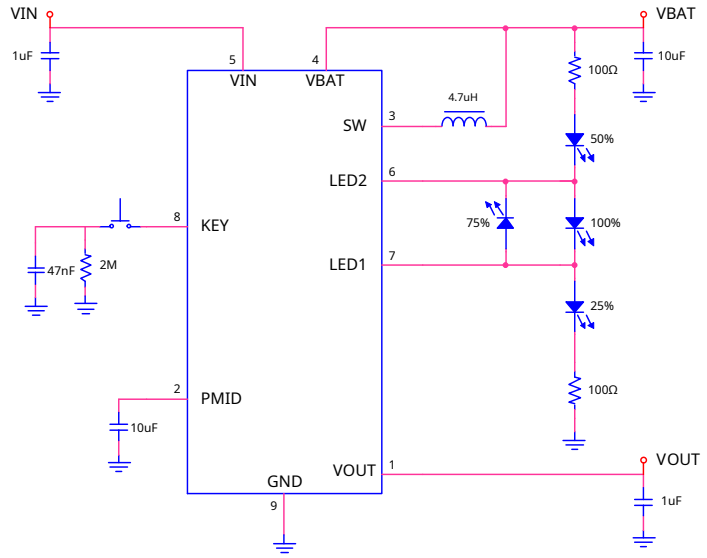
- TWS earphone compartment
- Lithium battery system charging/discharging applications

Pin information

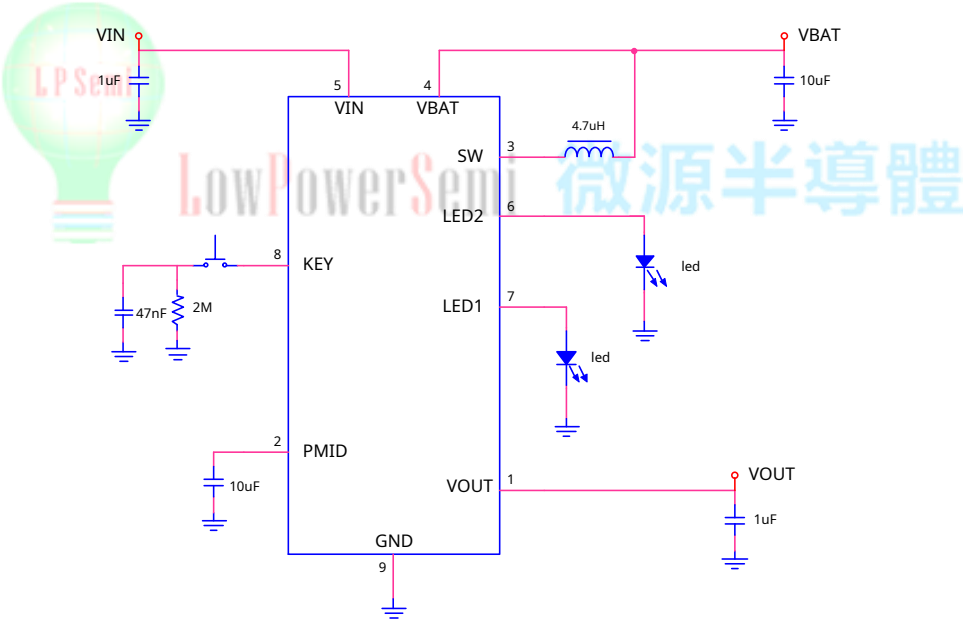
Pin information	

serial number	Pin name	describe	
		LP7800K2	**LP7800K4**
1	VOUT	Discharge output	Discharge output
2	PMID	Boost output	Boost output
3	SW	switching output	switching output
4	BAT	Battery pins, internally connected to charge output and discharge input	Battery pins, internally connected to charge output and discharge input
5	VIN	charging input	charging input
6	LED2	Discharge indicator light	Indicator port 2
7	LED1	charging indicator	Indicator port 1
8	KEY	Button control	Button control
9	GND	land	land

Application schematic



LP7800K4SOF application circuit diagram



LP7800K2SOF application circuit diagram

Limit parameters Note 1

- VIN ---------- - 0.3V~30V
- LX ---------- - 0.3V~12V
- Other pins---------- ---------- Maximum welding - 0.3V~7V
- temperature (10 seconds) -- ---------- ---------- Storage 260°C
- temperature---------- ---------- ---------- -55°C~150°C maximum junction
- temperature---------- ---------- ---------- 150°C

ESD coefficient

- Human Body Model (HBM)---------- ---------- Mechanical 2KV
- Model (MM) ------- ---------- ---------- 200V

Note 1: Exceeding the parameter values listed in the extreme parameters may cause permanent damage to the equipment, and long-term exposure to extreme conditions may affect the reliability of the equipment.

Recommended working conditions

-Working environment temperature range---------- ---------- -20°C~80°C

Electrical parameters

(T_A=25°C, V_{IN}=5V, unless otherwise stated.)

symbol	parameter	condition	minimum value	Typical value	maximum value	unit
Charging part						
V_{IN}	Input working voltage		4.5		6	V
I_{IN}	Input Current	R_{ISET}=NC		400		uA
		V_{BAT}=4.3V		280		uA
V_{REG}	Input adaptive voltage			4.4		V
V_{OVP}	Overvoltage protection voltage	V_{IN}rise		6.5		V
$V_{OCP-HYS}$	Overvoltage protection hysteresis voltage			400		mV
V_{FLOAT}	battery full voltage			4.2		V
I_{BAT}	Battery terminal current			300		mA
		V_{BAT}=4.2V, boost shutdown		twenty three		uA
V_{TRIKL}	Trickle charge voltage threshold			2.9		V
$V_{TRIKL-HYS}$	Trickle charge hysteresis voltage			0.1		V
I_{TRIKL}	Trickle charge current	V_{BAT}< V_{TRIKL}		10		%I_{BAT}
ΔV_{RECHRG}	Recharge voltage threshold			150		mV
Discharge part						
V_{OUT}	Boost output voltage			5		V
I_{OUT}	Discharge current				500	mA
V_{OUT}	Standby output voltage	V_{EN}=V_{BAT},standby mode		2.7		V
I_{OUT1}	Standby discharge current	Standby state, Vout=2.7V condition		30		uA
F_{SW}	On-off level			1		MHz
I_{END}	Discharge end current			10		mA
t_{END}	No load check time	The load current is continuously less than I_{END}		16		s
V_{SD-BAT}	Low battery shutdown voltage	Battery voltage drops		3		V
V_{LV-BAT}	Low battery warning voltage			3.3		V
I_{led}	LED pin output current	LP7800K2SPF		3		mA
T_{OTP}	Over temperature protection temperature			150		℃

Application Notes

LP7800K integrates a linear charging module and a synchronous boost and discharge module, with status indicator light display, supports simultaneous charging and discharging, and has a load detection function. The discharge module provides various abnormal protections such as overcurrent, short circuit, and overtemperature, which can effectively protect the safety of the battery and system.

Charging mode

LP7800K integrates a complete linear charging module to charge the battery with trickle current, constant current and constant voltage. In constant current mode, the charging current is internally fixed at 300mA. When the battery voltage is lower than the precharge threshold voltage, the chip enters trickle charging mode. In trickle mode, the charging current is 1/10C. When the battery voltage is close to the float charge voltage, the chip enters the constant voltage charging mode. In the constant voltage mode, the charging current gradually decreases. When the charging current decreases to less than 1/10C, the charging cycle ends and LED1 switches to the charging completed state. . When the battery voltage drops below the recharge voltage, the system will automatically start a new charging cycle.

discharge mode

LP7800K provides a synchronous boost module as a discharge output and integrates a power MOS. When the chip detects that the load is inserted (the detection current is 15uA), the boost module starts to work, and the VOUT terminal outputs 5V. When the discharge current decreases below the cut-off current (10mA) and lasts for 16 seconds, the boost module stops working. At this time, the chip will maintain the OUT terminal at the standby voltage of 2.7V. The boost module will not restart until the load is detected again. start up.

Discharge undervoltage protection

LP7800K supports charging and discharging of the battery at the same time. In order to prevent the battery from outputting a large current at the same time during the trickle charging stage, causing the battery voltage to become lower as it is charged, the discharging part is equipped with input undervoltage detection. When V_{BAT}When it drops below 3.0V, the discharge output does not boost. When V_{BAT}<3.3V, the boost will not be automatically turned on after load identification. Only when V_{BAT}>3.3V, the boost function will start normally.

LED indicator light display

LP7800K2SPF uses an external LED light to indicate the charging and discharging status and power. The relationship between the LED display and the corresponding working status is shown in the table below.

Charge		
state	LED1	LED2
Charge	1Hz flashing	destroy
full	Bright	destroy
discharge		
3.3≤VBAT≤4.2	destroy	Bright
3＜VBAT＜3.3	destroy	1Hz flashing
VBAT＜3	destroy	destroy

LP7800K4SPF uses 4 LED lights to indicate the charging and discharging status. The 4 indicator lights correspond to 25%, 50%, 75%, and 100% of the battery power respectively. When the adapter is connected, the battery is in a charging state. As the battery voltage rises, the power indicator light goes from extinguishing to flashing and then always on, indicating the charging progress. When the boost module is working, the battery is in a discharged state. As the battery voltage drops, the power indicator turns off from the steady light in sequence until the battery voltage is lower than 3.3V and the indicator light corresponding to 25% power flashes, indicating the remaining power of the battery. When the adapter is not connected and the boost module is not turned on, all indicators are off. The relationship between LED display and corresponding working status is shown in the table below.

Battery voltage(V)	**LED1 (25%)**	**LED2 (50%)**	**LED3 (75%)**	**LED4 (100%)**
V_{BAT}<3.5	flashing	destroy	destroy	destroy
3.5<V_{BAT}<3.7	Bright	flashing	destroy	destroy
3.7<V_{BAT}<3.9	Bright	Bright	flashing	destroy
3.9<V_{BAT}<V_{FLOAT}	Bright	Bright	Bright	flashing
full	Bright	Bright	Bright	Bright

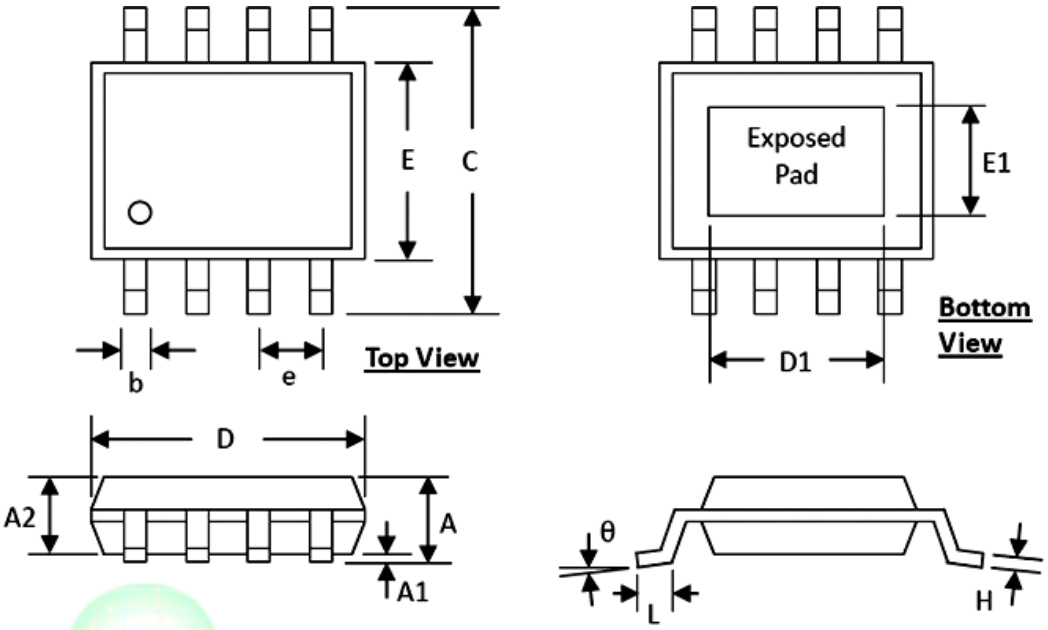
Table 1: Indicator light status during charging

Battery voltage(V)	**LED1 (25%)**	**LED2 (50%)**	**LED3 (75%)**	**LED4 (100%)**
3.9<V_{BAT}	Bright	Bright	Bright	Bright
3.7<V_{BAT}<3.9	Bright	Bright	Bright	destroy
3.5<V_{BAT}<3.7	Bright	Bright	destroy	destroy
3.3<V_{BAT}<3.5	Bright	destroy	destroy	destroy
V_{BAT}<3.3	flashing	destroy	destroy	destroy

Table 2: Indicator light status during discharge

Package information

ESOP-8



SYMBOLS	DIMENSION (MM)		DIMENSION (INCH)	
	MIN	MAX	MIN	MAX
A	1.30	1.70	0.051	0.067
A1	0.00	0.15	0.000	0.006
A2	1.25	1.52	0.049	0.060
b	0.33	0.51	0.013	0.020
C	5.80	6.20	0.228	0.244
D	4.80	5.00	0.189	0.197
D1	3.15	3.45	0.124	0.136
E	3.80	4.00	0.150	0.157
E1	2.26	2.56	0.089	0.101
e	1.27 BSC		0.050 BSC	
H	0.19	0.25	0.0075	0.0098
L	0.41	1.27	0.016	0.050
θ	0°	8°	0°	8°