

FEATURES

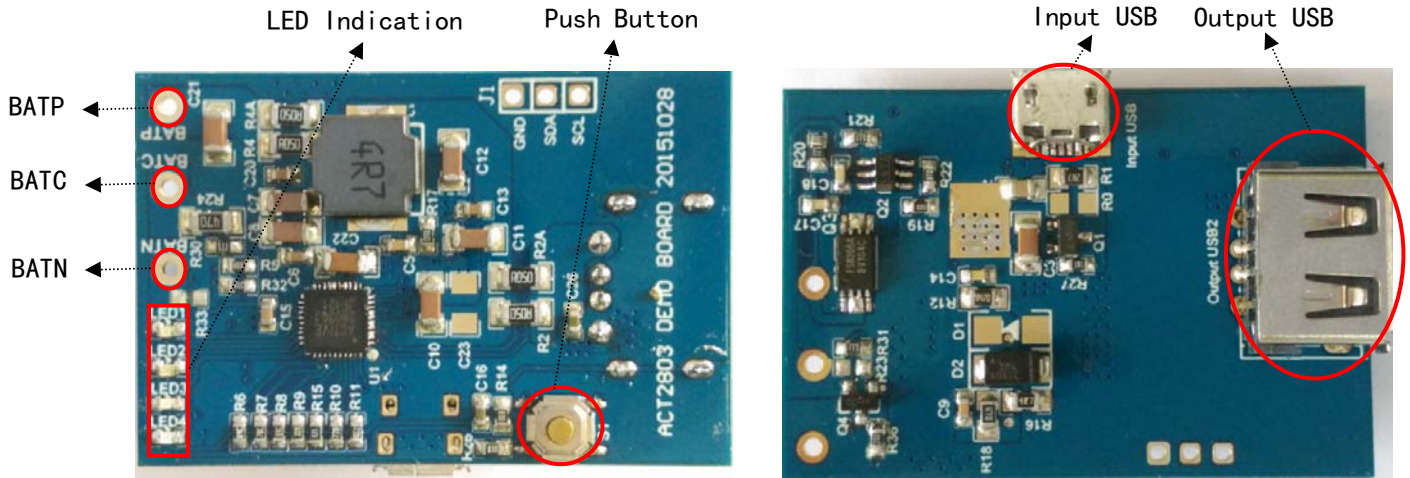
- Dedicated single-chip integrated dual cell battery management
- 4.5V-5.5V input voltage and 2.75A input current limit
- 5.07V+/-1% output with prioritized power path from input to output
- 20V input voltage protection
- 2.4A output with CC regulation
- **Pass MFi test**
- **Meet EN55022 class B radiated EMI standard**
- **Auto detection support USB BC1.2, Chinese YD/T 1591-2009, Apple, and Samsung devices**
- Output short circuit protection and nearly zero power
- Output over voltage protection
- Dual cell battery charger with cell balancing management
- Dual cell battery overcharge, over discharge, over charge current and over discharge current protections
- >91% charge efficiency at 2.75A input current
- >92% discharge efficiency at 2.4A output
- Configurable charge, discharge and HZ modes
- Output plug-in detection to wakeup
- Light load detection
- <10uA low battery drainage current
- Battery operation voltage 6.0V-8.4V
- Battery termination voltage 8.4V for dual cell
- 4 LED battery level indication
- Preconditioning for deeply depleted battery
- Built-in charge and discharge safety timer
- 4.20V/4.35V +/- 0.5% battery charge voltage accuracy of each cell
- Optimized power path and battery charge control
- Thermal regulation for battery charge/discharge
- Weak input sources accommodation
- Battery over voltage protection
- TQFN5x5-40

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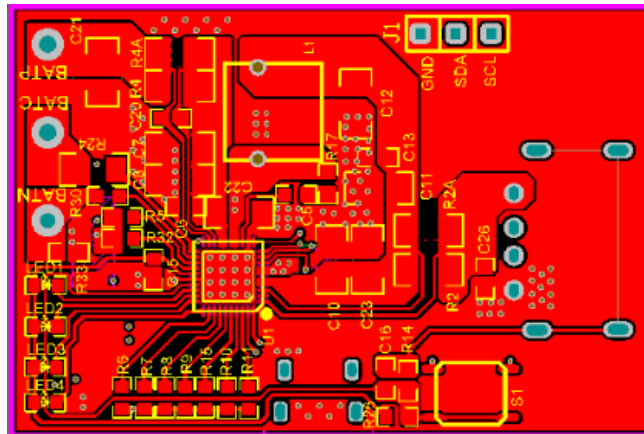
1 DEMO BOARD PHOTOS

(DEMO BOARD SIZE: 46mm*31mm)

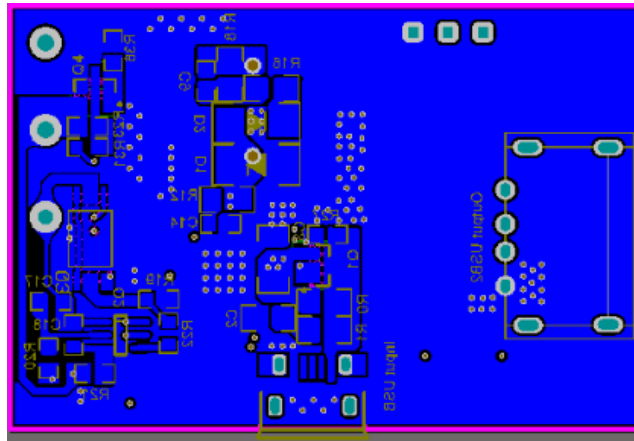


2 PCB LAYOUT

TOP Layer



Bottom Layer



4 BILL OF MATERIALS

Item	Reference	Description	QTY	Manufacturer
1	L1	SWPA8040S4R7NT 4.7uH 5.9A(8*8*4mm)	1	Sunlord
2	D1	MBR1020VL, 20V/1A Schottky, SMA, Optional	1	Panjit
3	D2	MBR1020VL, 20V/1A Schottky, SMA	1	Panjit
4	C1	Ceramic capacitor, 10uF/16V, X7R, 1206	1	Murata/TDK
4	C2	Ceramic capacitor, 4.7uF/10V, X7R, 0805	1	Murata/TDK
5	C3,C10,C11,C12	Ceramic capacitor, 22uF/10V, X7R, 1206	4	Murata/TDK
6	C5,C7,C8	Ceramic capacitor, 22uF/16V, X7R, 1206	3	Murata/TDK
7	C4,C9	Ceramic capacitor, 47nF/16V, X7R, 0603	2	Murata/TDK
8	C6,C13	Ceramic capacitor, 0.1uF/16V, X7R, 0603	2	Murata/TDK
9	C14	Ceramic capacitor, 2.2nF/10V, X7R, 0603	1	Murata/TDK
10	C15	Ceramic capacitor, 1uF/10V, X7R, 0603	1	Murata/TDK
11	C16	Ceramic capacitor, 2.2uF/10V, X7R, 0603	1	Murata/TDK
12	C17,C18	Ceramic capacitor, 0.22uF/10V, X7R, 0603	1	Murata/TDK
11	C19	Ceramic capacitor, 3.3uF/10V, X7R, 0603	1	Murata/TDK
13	C20	Ceramic capacitor, 100nF/10V, X7R, 0603	1	Murata/TDK
16	R1	Chip Resistor, 2.7Ω, 1/8W, 5%, 0805	1	Murata/TDK
17	R2,R2A,R3,R3A	Chip Resistor, 50mΩ, 1/4W, 1%, 1206	4	Sart
18	R5	Chip Resistor, 8kΩ, 1/10W, 1%, 0603	1	Murata/TDK
19	R6	Chip Resistor, 83kΩ, 1/10W, 1%, 0603	1	Murata/TDK
20	R7	Chip Resistor, 63.5kΩ, 1/10W, 1%, 0603	1	Murata/TDK
21	R8	Chip Resistor, 51.4kΩ, 1/10W, 1%, 0603	1	Murata/TDK
22	R9	Chip Resistor, 41.5kΩ, 1/10W, 1%, 0603	1	Murata/TDK
23	R10,R11	Chip Resistor, 540kΩ, 1/10W, 1%, 0603	2	Murata/TDK
24	R12	Chip Resistor, 0.47Ω, 1/8W, 1%, 0805	1	Murata/TDK
26	R14,R26	Chip Resistor, 715K, 1/10W, 5%, 0603	2	Murata/TDK
27	R15	Chip Resistor, 12K, 1/10W, 1%, 0603	1	Murata/TDK
28	R16	Chip Resistor, 4.7Ω, 1/8W, 1%, 0805	1	Murata/TDK
29	R17	Chip Resistor, 10Ω, 1/10W, 5%, 0603	1	Murata/TDK
30	R18	Chip Resistor, 47Ω, 1/8W, 5%, 0805	1	Murata/TDK
31	R20,R21,R30,R31	Chip Resistor, 510Ω, 1/10W, 5%, 0603	4	Murata/TDK
32	R22	Chip Resistor, 1K, 1/10W, 5%, 0603	1	Murata/TDK
33	R24	Chip Resistor, 47Ω, 1/4W, 1%, 1206	1	Murata/TDK
34	R27	Chip Resistor, 100Ω, 1/10W, 1%, 0603	1	Murata/TDK
35	R32	Chip Resistor, 10K, 1/10W, 5%, 0603	1	Murata/TDK

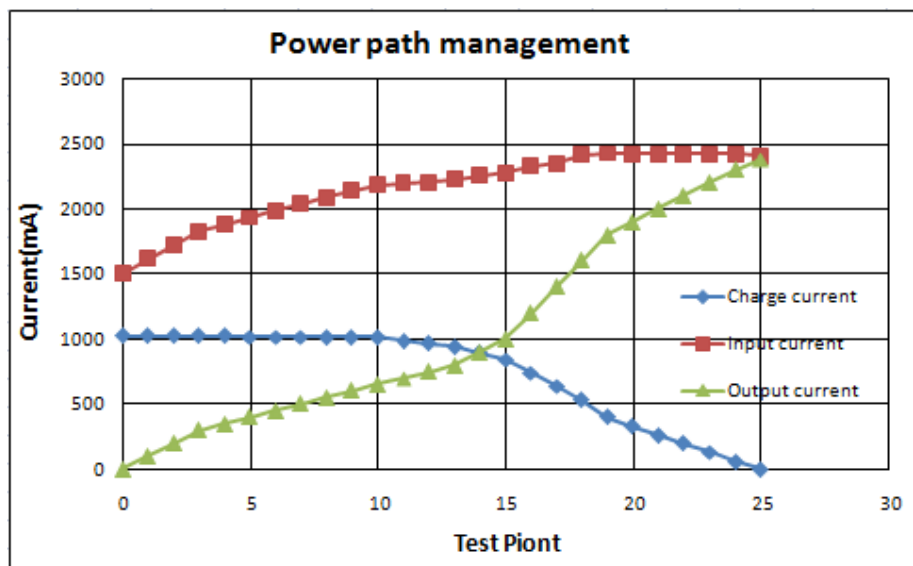
36	LED1,LED2,LED3,LED4	LED, 0603, Blue	4	LED Manu
37	Q1	SSF2318, 20V/6.5A N MOSFET, Optional	1	Silikron
38	Q2	2S Battery protection IC, S8252	1	Seiko
39	Q3	20V Dual N-Channel Power MOSFET, 8205A	1	Fortune
40	PB	Push Button Switch	1	
41	Output USB	10.2*14.6*7mm,4P	1	
42	Micro-USB	MICRO USB 5P/F SMT B	1	
43	U1	IC, ACT2803 T-QFN 5X5-40	1	ACT

5 FUNCTIONAL TEST

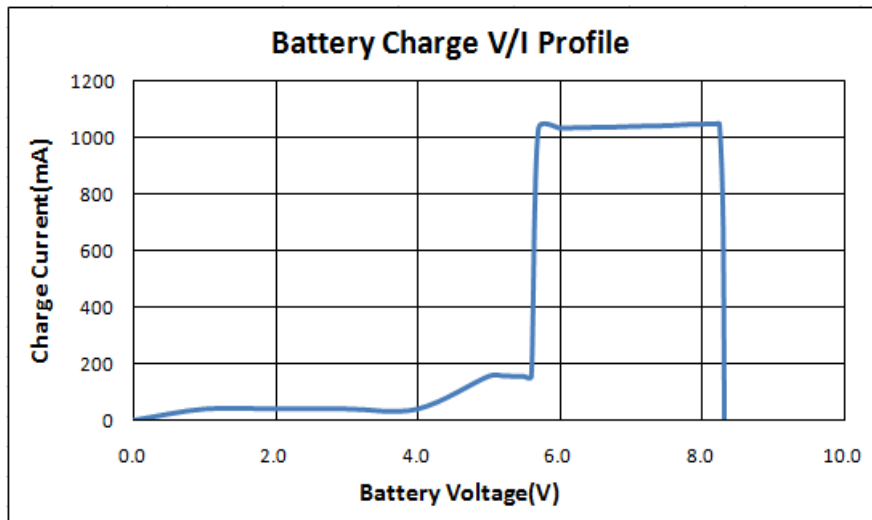
5.1 Power Path Function

Input current(mA)	1499	1717	1931	2139	2227	2275	2329	2349	2412	2424	2421	2417	2408
Output current(mA)	0	200	400	600	800	1000	1200	1400	1600	1800	2000	2300	2380
Charge current(mA)	1019	1020	1018	1016	942	845	743	642	532	399	260	61	0

(Test condition: $V_{in}=5.05V$, $V_{bat}=7.0V$, input current limit=2.75A, fast charge current=1.0A)



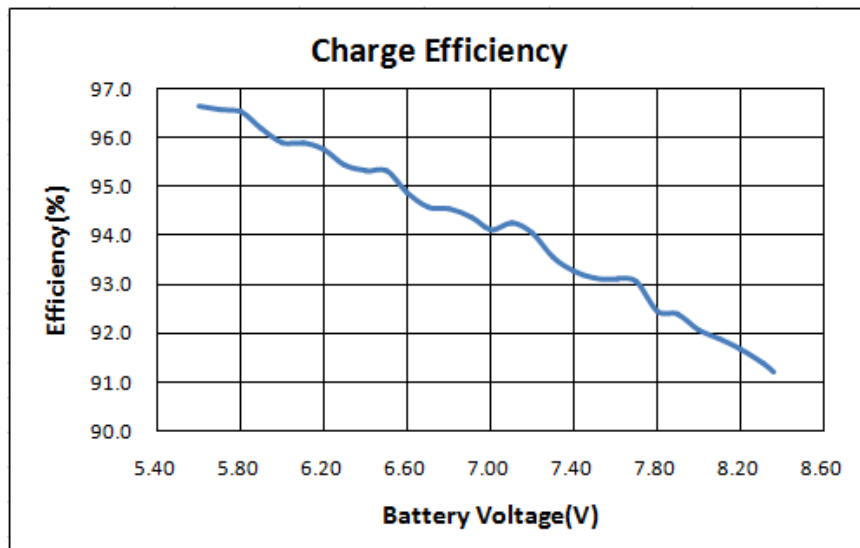
5.2 Battery Charge V/I profile



5.3 Charge Efficiency

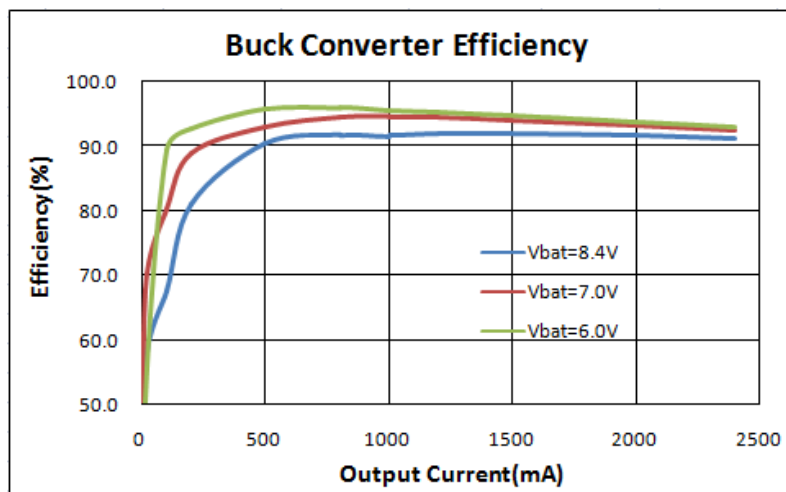
($V_{in}=5V$ and charge current set at 1000mA)

Battery voltage (V)	6.0	6.5	7.0	7.5	8.0	8.2
Efficiency (%)	95.9	95.3	94.1	93.1	92.1	91.7

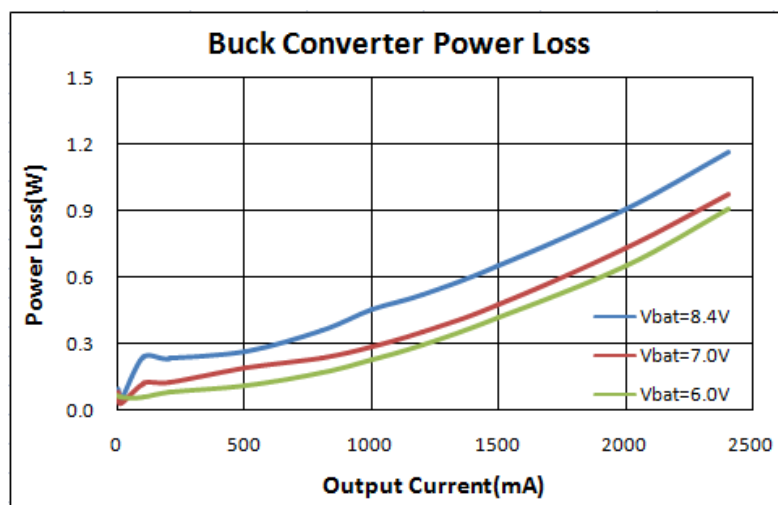


5.4 Buck Efficiency and Power Loss (Ta=25°C)

Vbat	Efficiency (%)				
	Io=500mA	Io=1000mA	Io=1500mA	Io=2000mA	Io=2400mA
6.0V	95.8	95.6	94.7	93.9	92.9
7.0V	93.0	94.6	94.1	93.2	92.5
8.4V	90.4	91.7	92.0	91.7	91.2

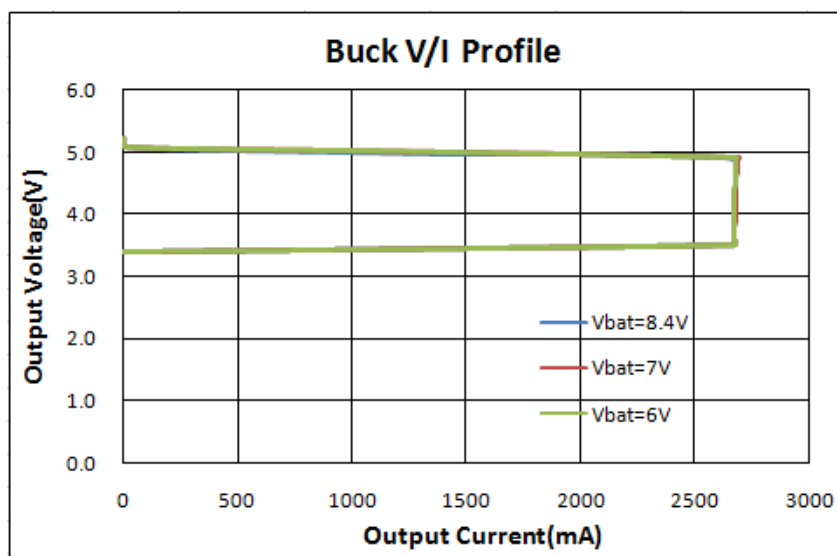


Vbat	Power Loss (W)				
	Io=500mA	Io=1000mA	Io=1500mA	Io=2000mA	Io=2400mA
6.0V	0.11	0.23	0.42	0.65	0.91
7.0V	0.19	0.29	0.47	0.73	0.98
8.4V	0.27	0.46	0.65	0.91	1.16



5.5 Buck Constant Current and Constant Voltage Regulation (Ta=25°C)

	Vbat=6.0V		Vbat=7.0V		Vbat=8.0V	
	Vout(V)	Iout(mA)	Vout (V)	Iout(mA)	Vout(V)	Iout(mA)
CC Load	5.23	0	5.23	0	5.23	0
	5.08	12	5.08	10	5.08	10
	5.02	1000	5.02	1000	5.01	1000
	4.99	1500	4.99	1500	4.98	1500
	4.96	2000	4.97	2000	4.96	2000
	4.94	2400	4.95	2400	4.94	22400
CV Load	4.92	2682	4.92	2692	4.92	2630
	4.9	2681	4.9	2687	4.9	2675
	4.8	2677	4.8	2685	4.8	2680
	4.6	2676	4.6	2683	4.6	2678
	4.4	2675	4.4	2681	4.4	2677
	4.2	2674	4.2	2679	4.2	2676
	4	2673	4	2677	4	2675
	3.9	2672	3.9	2676	3.9	2674
	3.8	2672	3.8	2675	3.8	2672
	3.7	2671	3.7	2674	3.7	2671
	3.6	2671	3.6	2674	3.6	2670
	3.5	2671	3.5	2673	3.5	2668
	3.4	0	3.4	0	3.4	0



5.6 Battery Leakage Current in HZ Mode

Test Conditions	Battery Input Current (μA)	Power Loss (μW)
Vbat=6V	2.5	15
Vbat=7V	2.6	18.2
Vbat=8V	2.8	22.4
Vbat=8.4V	3.1	26

5.7 Ripple and Noise

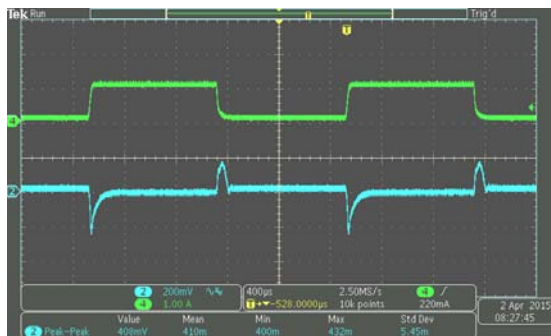
Ripple & noise are measured by using 20MHz bandwidth limited oscilloscope.

Output Ripple at 2.4A Load	Vbat=6.0V	Vbat=7.0V	Vbat=8.4V
Ripple(mV)	45	40	40

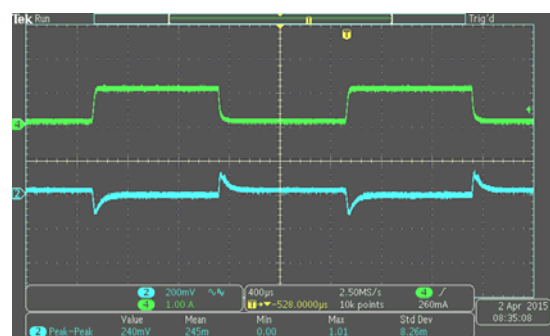
5.8 Load Dynamic Response Load Step

(Output=80mA-1A-80mA load step)

Vbat=8V

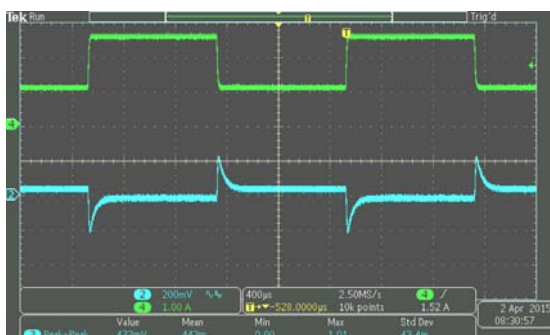


Vbat=6.6V

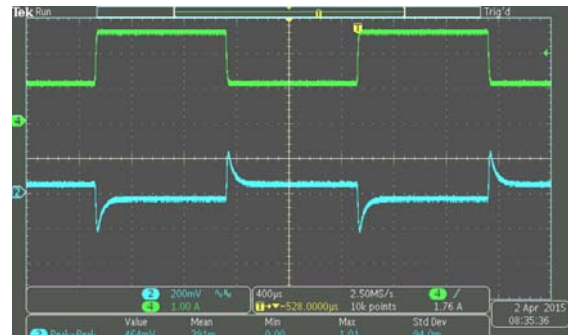


(Output=1A-2.4A-1A load step)

Vbat=8V



Vbat=6.6V



5.9 LED Indication

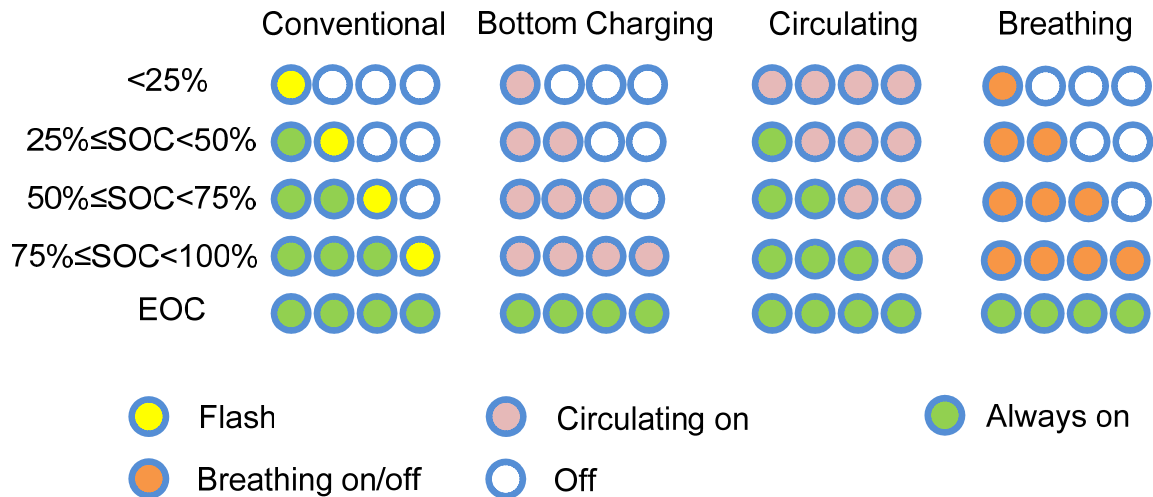
Conventional LED indication

PB time>40ms (HZ Mode)	LED1	LED2	LED3	LED4
$V_{BAT} < V_{cut-off}$	Off	Off	Off	Off
$V_{cut-off} \leq V_{BAT} < V_{LED1}$	Flash	Off	Off	Off
$V_{LED1} \leq V_{BAT} < V_{LED2}$	On	Off	Off	Off
$V_{LED2} \leq V_{BAT} < V_{LED3}$	On	On	Off	Off
$V_{LED3} \leq V_{BAT} < V_{LED4}$	On	On	On	Off
$V_{BAT} \geq V_{LED4}$	On	On	On	On

Charge Mode	LED1	LED2	LED3	LED4
$V_{BAT} < V_{LED2}$	Flash	Off	Off	Off
$V_{LED2} \leq V_{BAT} < V_{LED3}$	On	Flash	Off	Off
$V_{LED3} \leq V_{BAT} < V_{LED4}$	On	On	Flash	Off
$V_{LED4} \leq V_{BAT}$ Charge Mode	On	On	On	Flash
$V_{LED4} \leq V_{BAT}$ EOC Mode	On	On	On	On

ACT2804 is designed with a simple ADC to convert 5 levels of PT pin voltage into 5 application patterns.

INDICATION PATTERN	PT Resistor
Conventional Always On In Discharge	R15=3.3K
Conventional 5s Indication in Discharge	R15=12K
Breathing 5s Indication in Discharge	R15=24K
Bottom Charging 5s Indication in Discharge	R15=42K
Circulating 5s Indication in Discharge	R15=68K



5.10 System Management

- PB is pressed for >5s or Discharge load is <10mA for 12.5s, Discharge mode is go into HZ mode
- PB is pressed for 40ms, Discharge mode is turned on
- PB is pressed for 40ms, LED indication is on for 5.0 seconds
- 2 seconds transition time between Charge Mode and Boost Mode

5.11 Key Components Temperature Test (Ta=25C, burning for 2 hours)

Charge mode, 1.0A charge current

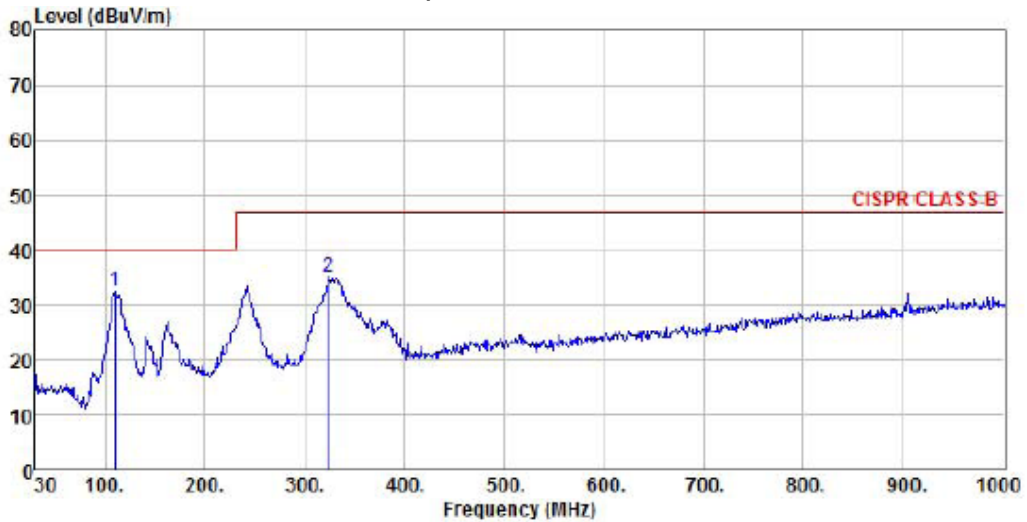
Vin(V)	IC(°C)	Inductor(°C)	Vbat(V)
5.0	36.5	34.3	6
5.0	45.4	41.8	7.5
5.0	51.6	46.6	8.2

Discharge mode, 2.4A output current

Vbat(V)	IC(°C)	Inductor(°C)	Vout(V)
6.0	49.0	43.2	5.0
7.0	50.3	44.2	5.0
8.0	52.5	46.2	5.0
8.4	53.1	46.9	5.0

6 EMI TEST

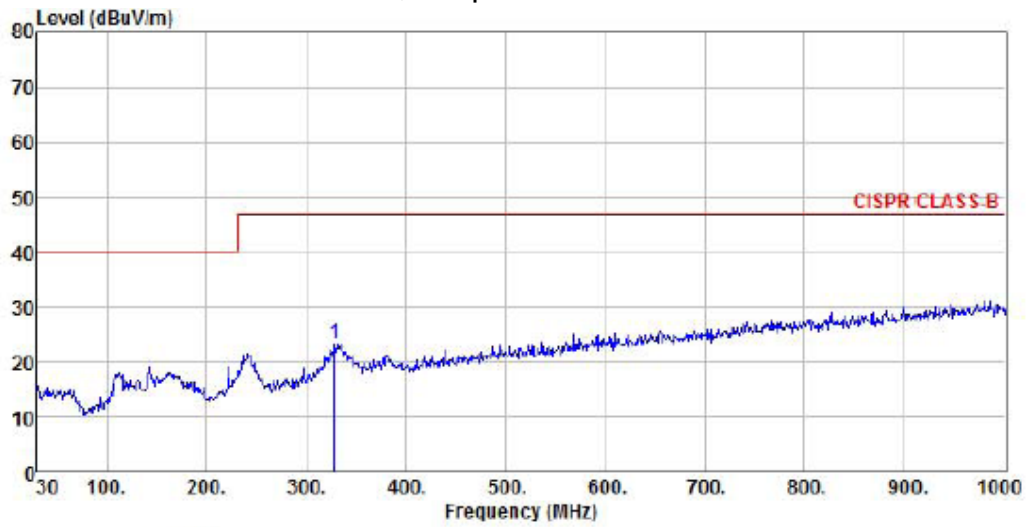
Vbat=7.8V, Output: 5V/2.4A Horizontal



Site : chamber
 Condition : CISPR CLASS-B 3m VULB9160 HORIZONTAL
 EUT :
 Model Name : ACT2803
 Temp/Humi : 21 °C / 50 %
 Power Rating:
 Mode : 5V/2.4A
 Memo :

	Freq	ReadAntenna Level	Antenna Factor	Cable Loss	Preamp Factor	Level	Limit Line	Over Limit	Remark
	MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 pp	109.54	20.11	11.07	1.41	0.00	32.59	40.00	-7.41	Peak
2	323.91	18.84	13.74	2.51	0.00	35.09	47.00	-11.91	Peak

Vbat=7.8V, Output: 5V/2.4A Vertical



Site : chamber
 Condition : CISPR CLASS-B 3m VULB9160 VERTICAL
 EUT :
 Model Name : ACT2803
 Temp/Humi : 21 °C / 50 %
 Power Rating:
 Mode : 5V/2.4A
 Memo :

	ReadAntenna	Cable	Preamp		Limit	Over		
Freq	Level	Factor	Loss	Factor	Level	Line	Limit	Remark
MHz	dBuV	dB/m	dB	dB	dBuV/m	dBuV/m	dB	
1 pp 328.76	7.09	13.87	2.48	0.00	23.44	47.00	-23.56	Peak