BATTERY MANAGEMENT ICs

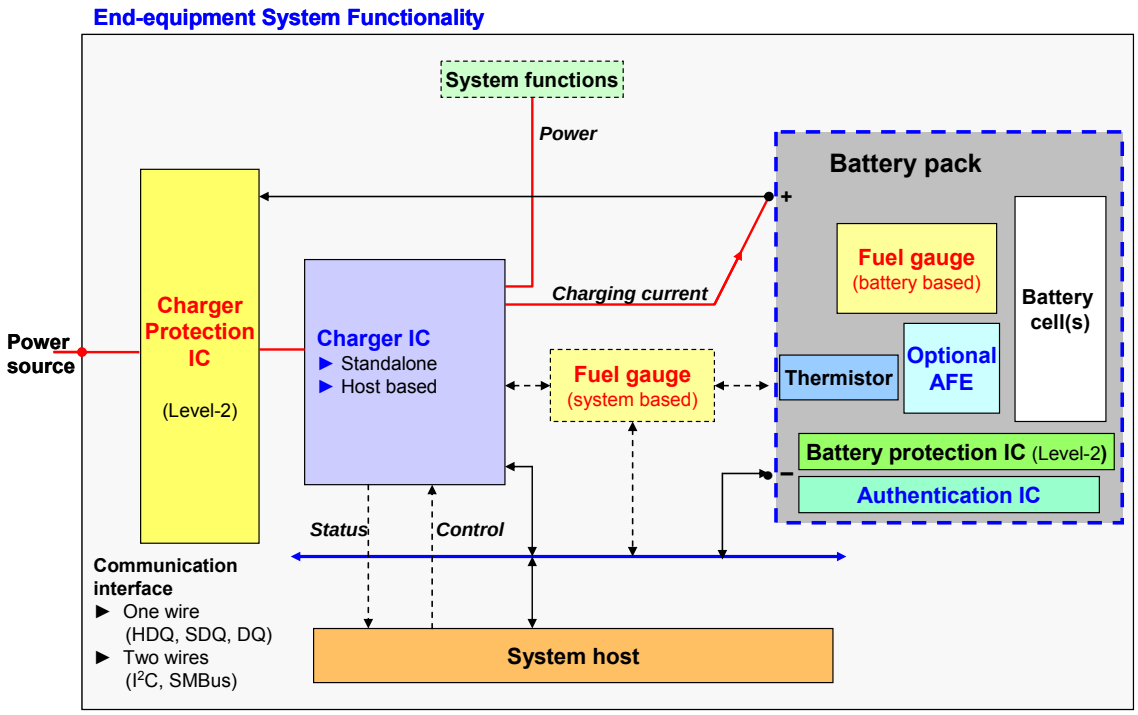
From Headsets to Electric Vehicles

ABSTRACT

This landmark report delivers an in-depth analysis of the fast changing $3B+ battery management IC market. The requirement for power-efficient and high performance solutions in Li-Ion/Poly battery-powered devices continues to open profitable growth opportunities for existing IC vendors (profit-driven Linear Technology is a major participant) as well as for numerous start-up entrants.

Battery management ICs are application-specific and analog-intensive mixed-signal ICs used in numerous end-systems and their battery packs. The complexity and variety of battery management ICs is driven by end-equipment types, battery types, and battery management architectures.

The report provides the product classification and market segmentation used in our bottom-up analysis of products and vendors. The report analyzes various battery charger, fuel gauge, protection, and authentication ICs – more than 600 core products of twenty vendors and eleven end-systems; these core products constitute about 3,000+ standard products. Standalone charger ICs alone accounted for about 1.9B units and $1.4B revenues in 2009, while standalone fuel gauge ICs accounted for about 1.6B units and $1.4B in revenues.



The report classifies battery charger ICs into a five-level hierarchy by integration, topology, algorithm execution, input power sources, and application attributes. Fuel gauge ICs are classified by algorithm execution (intelligence), integration, battery chemistry, cell configuration, and protection and monitoring features.

End-equipment power is segmented into three main power levels; energy harvesting devices and electric vehicles are separate emerging segments.

Bipolar is a must process technology for battery management ICs — the use of BiCMOS and BCD dominates. The trend toward universal adapters (“chargers”) requires an added degree of protection and favors increasing use of BCD technology

IC vendor	Total core products	Low power segment Low-end DSC, cell phone, media player (1 cell)	Mid power segment DSC, camcorder, PDA, smart phone (1 to 2 series cells)	High power segment Notebook PC, medical and military equipment (2 to 4 series cells)
Texas Instruments	245	●	◑	◑
Linear Technology	82		◑	◑
Maxim	87		◑	●
Intersil	45	●	◑	◕
Microchip Technology	29	●	◔	
AnalogicTech	23	●	◑	
Semtech	11	●		
Analog Devices	3	◔		●
Freescale	8	◑	●	
Atmel	7		◑	●
Summit ME	8	●		
National Semiconductor	11	●		
STMicroelectronics	6	●		
Renesas	20	●	◑	
Broadcom	3	◑	●	
Qualcomm	3	◑	●	
ST-Ericsson	3	◑	●	
Rohm Semiconductor	5	●		

Linear Technology offers 78 core products — three standalone fuel gauge ICs and 75 core battery charger ICs:

Single Function Charger ICs:

Battery charger IC type	Core products		Battery attributes			USB 2.0 compliant		Key trends
	#	%	Charge I_{max} (A)	# series cells	Type	#	%	
Linear topology	28	100%				7	25%	
■ Standalone	23	96%	2	1,2	Li-Ion/Pol	6	21%	Most products are for single cell applications.
■ Non-standalone	5	4%	1	1	Li-Ion/Pol	1	4%	Charge termination performed by a microcontroller. Some products are USB 2.0 compliant.
Switching topology	26	100%						
■ Standalone	15	58%	8	1 to 16	Li-Ion/Pol, NiMH/ NiCd, lead acid	0	0%	5 products are SBS 1.1 compliant Smart Chargers.
■ Non-standalone	11	42%	8	1 to 16	Li-Ion/Pol, NiMH/ NiCd, lead acid	0	0%	
Linear charger with power manager	10	100%						
■ Standalone	10	100%	1.5	1	Li-Ion/Pol	10	100 %	Most products feature a switching power manager.
■ Non-standalone	0	0%	—	—	—	0	0%	
Total	**64**	**100%**	**8**	**16**	**—**	**24**	**37%**	**—**

Multifunction Charger ICs:

Battery charger IC type	Core products		Battery attributes			# of regulated outputs	Key trends
	#	%	Charge I_{max} (A)	# series cells	Type		
Linear topology	6	100%	0.95	1	Li-Ion/ Pol	1 to 2	2 products are USB 2.0 compliant
■ Standalone	6	100%		1	Li-Ion/ Pol		
■ Non-standalone	0	0%		1	Li-Ion/ Pol		
Switching topology	0	0%	–	1	Li-Ion/ Pol		
■ Standalone	0	0%		1	Li-Ion/ Pol		
■ Non-standalone	0	0%		1	Li-Ion/ Pol		
Linear charger with power manager	9	100%	1.5	1	Li-Ion/ Pol	2 to 5	6 products feature a switching power manager. 6 products are USB 2.0 compliant.
■ Standalone	9	100%		1	Li-Ion/ Pol		
■ Non-standalone	0	0%		1	Li-Ion/ Pol		
Total	**15**	**–**	**1.5**	**1**	**Li-Ion/ Pol**	**1 to 5**	

In comparison, the start-up AnalogicTech offers only a single function standalone charger ICs targeted at mass market applications featuring a single cell Li-Ion/Pol battery and USB 2.0 compliant power source.

Battery charger IC type	Core products		Battery attributes			USB 2.0 compliant		Key trends
	#	%	Charge I_{max} (A)	# series cells	Type	#	%	
Linear topology	22	100%						
■ Standalone	22	100%	2	1	Li-Ion/Pol	22	100%	
■ Non-standalone	0	0%	—	—	—	—	—	
Switching topology	1	100%						
■ Standalone	1	100%	2	1	Li-Ion/Pol	0	0%	Switching/linear hybrid topology
■ Non-standalone	0	0%	—	—	—	—	—	
Total	**23**	**100%**	**2**	**1**	**Li-Ion/Pol**	**22**	**96%**	**—**

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