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# LiB Charge/Discharge Controller for Bicycle LED Light Systems

Device	Application	Input Voltage	Output Power	Topology	I/O Isolation
LC709301F	Bicycle LED Light	4.5 - 5.5	10 W	Charge/Discharge Controller	N/A

	Charge	Discharge
Output Voltage	4.2 V	4.2-5.0 V
Nominal Current	1000 mA	1000 mA
Max Current	2000 mA	2000 mA
Min Current	25 mA	25 mA

Device Efficiency	80 - 85 %
Operating Temp. Range	-40 to 85 °C
Overcharge/Discharge Protection	Yes
Pre-charge Control	Yes
Lib Protection	Yes
Low Battery Indication	Yes

## Circuit Description

The LC709301F is a one-chip solution LSI with charging/discharging and overall control functions for bicycle LED lights. Included is a DC/DC charging system to charge high power lithium-ion batteries quickly and efficiently. Supported are 1-cell lithium-ion/polymer (li+) batteries with charging ranges from 25 mA to 2000 mA. The LC709301F is highly efficient for LED lighting operations with ultra-low stand-by current consumption. It includes various safety features for battery and LED such as over current/voltage protection, thermal shutdown. It supports high, medium, low and flashing modes of operation for LED design. Boost efficiency and standby current for the LC709301F is plotted below.

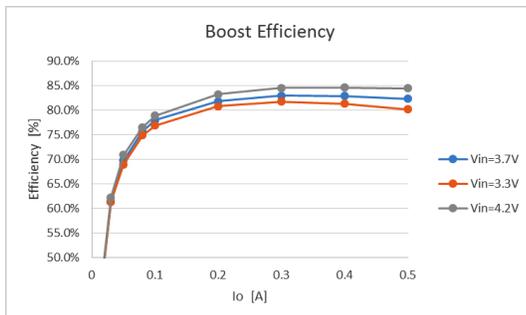


Figure 1: LC709301F boost efficiency based on battery capacity

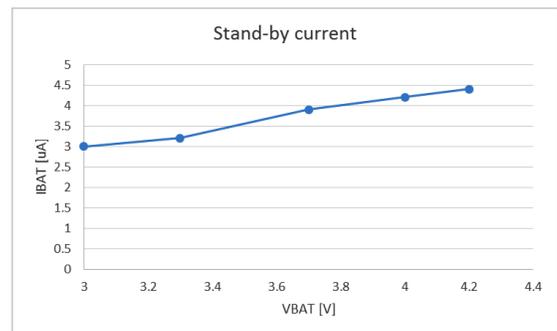


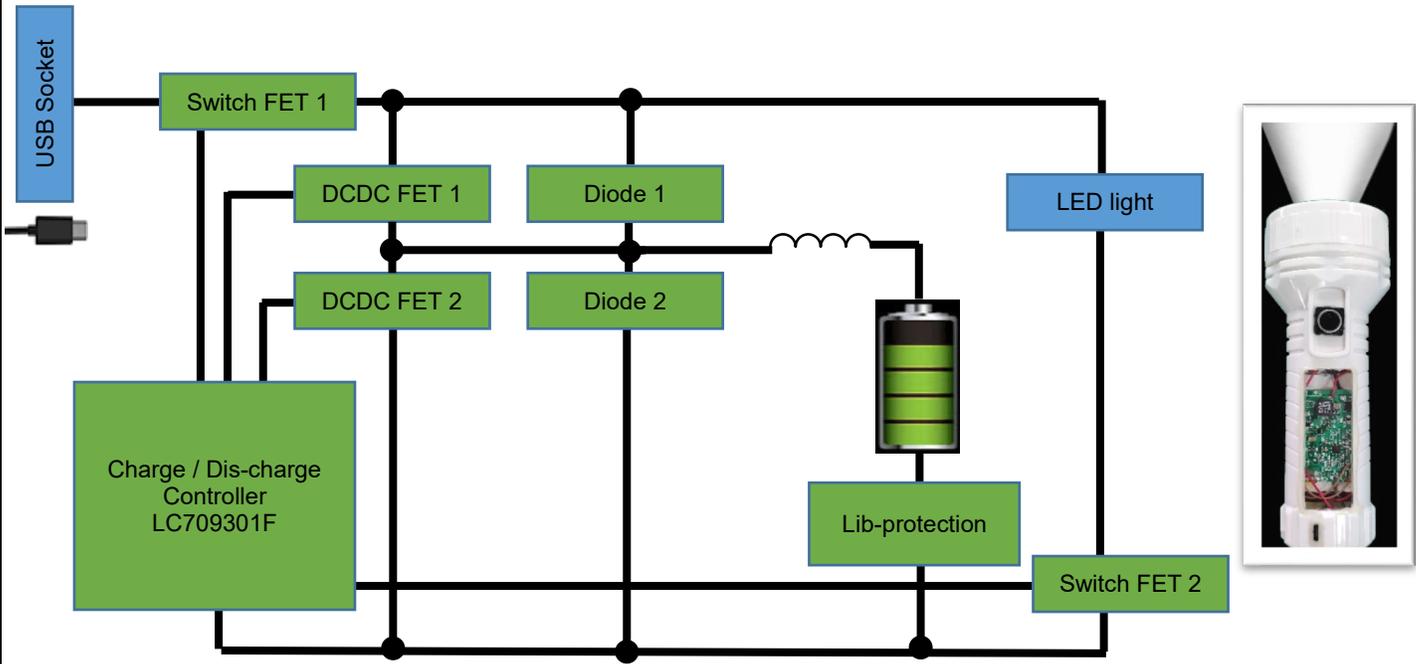
Figure 2: LC709301F standby current including Lib-protection IC

## Key Features

- DC-DC USB charging support up to 2000 mA range
- LED brightness remains constant even if battery voltage continuously degrades with long use
- Ultra-low standby current consumption
- Supports pass-through charge topology, DC5V output is directly powered via USB when wall power is connected
- Programmable MCU with I2C support
- MCU with on-chip thermistor for providing safety to LED and device



# DN05133/D



## Switch MOSFETs

Function	Device	Configuration	Polarity	V <sub>DS</sub> Max (V)	V <sub>GSS</sub> Max (V)	I <sub>D</sub> Max (A)	R <sub>DS(ON)</sub> V <sub>GS</sub> = 4.5 V Typ/Max (mΩ)	R <sub>DS(ON)</sub> V <sub>GS</sub> = 10 V Typ/Max (mΩ)	Package
Switch FET 1 DCDC FET 1	MCH6341	Single	P-Channel	-30	/±20	5	71/100	45/59	MCPH6
Switch FET 2 DCDC FET 2	MCH6431	Single	N-Channel	30	/±20	5	65/91	42/55	MCPH6

## Schottky Diodes

Family	VR (V)	I <sub>O</sub> (A)	Example Device	Packages
Schottky	10	2.0	MBRA210ET3	SMA
Schottky	20	1.0	MBR120ESF	SOD-123FL

## Lib-protection

	Adjustable Range			V <sub>SS</sub> Max /V <sub>GSS</sub> Max (V)	R <sub>DS(ON)</sub> V <sub>GS</sub> = 4.5 V Min/Typ/Max (mΩ)	R <sub>DS(ON)</sub> V <sub>GS</sub> = 3.1 V Min/Typ/Max (mΩ)	Features	Package(s)
	V <sub>OV</sub> Range (V)	V <sub>UV</sub> Range (V)	I <sub>OC</sub> /I <sub>OCH</sub> Range (A)					
LC05111CMT*	4.0 to 4.5	2.2 to 2.7	2 to 8	24/±12	8.8/11.2 /14.0	10.4/13.0 /18.2	Auto Wake-up, 0 V Charge	WDFN-6

## DN05133/D

## Bill of Materials

(LEDHLMGEVB with LC709301F)

11/18/2019

Designator	Quantity	Description	Value	Tolerance	Footprint	Manufacturer	Manufacturer Part Number	Substitution Allowed	Lead Free
IC1	1	Charge/Discharge controller	-	-	VCT24	ON Semiconductor	LC709301FRF-AUNH	No	Yes
IC2	1	Lib-Protection	-	-	WDFN6	ON Semiconductor	LC05111CMTC20	No	Yes
U3, U4	2	Pch MOSFET	-	-	MCPH6	ON Semiconductor	MCH6341	No	Yes
U1, U2	2	Nch MOSFET	-	-	MCPH6	ON Semiconductor	MCH6431	No	Yes
D1	1	Schottky Diode	-	-		ON Semiconductor	MBRA210ET3	No	Yes
D2	1	Schottky Diode	-	-		ON Semiconductor	MBR120ESFT1G	No	Yes
D3	1	Zenner Diode	-	-		ON Semiconductor	MM525V6ST1G	No	Yes
D4	1	LED	Red	-	1608	Stanley	BR1111C	Yes	Yes
L1	1	Coil	10uH	-		WE	744314101	Yes	Yes
C1 C7, C8	3	Chip Capacitor	0.1u	50V, ±10%	CAP_1005	Murata	GRM155R71H104KE14D	Yes	Yes
C5	1	Chip Capacitor	0.1u	50V, ±10%	CAP_1608	Murata	GRM188F11H104ZA01D	Yes	Yes
C2	1	Chip Capacitor	DNP		CAP_1005	Murata		Yes	Yes
C6	1	Chip Capacitor	1000p	50V, ±10%	CAP_1005	Murata	GRM1552C1H102	Yes	Yes
C3, C4	2	Chip Capacitor	47u	16V, ±10%	CAP_3225	Murata	GRM32ER61C476KE15L	Yes	Yes
C9	1	Chip Capacitor	10u	25V, ±10%	CAP_3216	Murata	GRM31CB31E106KA75L	Yes	Yes
R1, R8-R10, R14, R17	6	Chip Resistor	100k	0.1W, ±1%	RES_1005	Rohm	MCR01MZPJ104	Yes	Yes
R12, R16, R18, R19	4	Chip Resistor	30k	0.1W, ±1%	RES_1005	KOA	RK73H1ETTP3002F	Yes	Yes
T2	1	Chip Resistor	47m	1W, ±1%	RES_3216	Panasonic	ERJ8BWF047V	Yes	Yes
R3-R6	4	Chip Resistor	2.2	1W, ±1%	RES_6432	Panasonic	ERJ1TRQF2R2U	Yes	Yes
R7, R11, R13, R25, R26	5	Chip Resistor	10k	0.1W, ±1%	RES_1005	Rohm	MCR01MRTJ103	Yes	Yes
R24	1	Chip Resistor	220k	0.1W, ±1%	RES_1005	KOA	ERJ2RKD2203X	Yes	Yes
R21	1	Chip Resistor	680	0.125W, ±5%	RES_1005	KOA	RK73B1ETTP681J	Yes	Yes
R20	1	Chip Resistor	1k	0.1W, ±5%	RES_1005	Murata	MCR01MZPJ102	Yes	Yes
R22, R23	2	Chip Resistor	5.1k	0.1W, ±5%	RES_1005	Rohm	RK73B1ETTP512J	Yes	Yes
R15	1	Chip Resistor	330	0.1W, ±5%	RES_1005	Rohm	MCR01MRTF3300	Yes	Yes
R2	1	Chip Resistor	0	-	RES_1005	Rohm	MCR01MRTJ000	Yes	Yes
S1	1	TACT SWITCH	-	-	-	ALPS	SKRPAGE010	Yes	Yes
T1	1	Thermistor	10k	-	-	Murata	NXFT15XH103FA2B050	Yes	Yes
J1	1	3pin Connector	-	-	-	JAE	IL-G-3P-S3T2-SA	Yes	Yes
J2	1	USB_TYPE-C	-	-	-	RoHs	DX07S024JJ2	Yes	Yes
TEST PADS	27	Testpads			PIN_1.5X1.5MM	N/A	N/A		
							IL-G-3P-S3T2-SA		

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