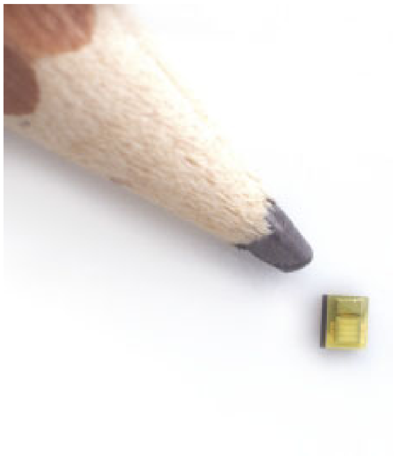
power light source

Luxeon Flash

LXCL-PWF1

Technical Datasheet DS49

Luxeon Flash is a family of ultra-compact light sources specifically designed and tested for use as a camera flash in space-constrained, portable digital imaging applications. The Luxeon Flash products are based on proven Luxeon technology and provide the highest levels of light output available for a solid state light source. The uniquely bright source density characteristics of the Luxeon Flash products will provide greater amounts of light where needed, enabling higher resolution pictures to be taken in lower level ambient light environments at greater distances. Camera cell phones, digital still cameras and PDAs can all incorporate Luxeon Flash into sleek designs while maintaining high levels of light output.



Features

- Highest Flux per LED on the Market
- Very Small Emitter Size
- Radiation Patterns Optimal for Camera Flash (with Lens)
- Smaller than Xenon Strobe Light
- Surface Mount Technology
- Superior ESD protection

Benefits

- High Lux and Long Distances (3m)
- Enables Higher Resolution Pictures in Darker Environments
- Small Emitter Size Allows for Smaller Overall Package Size

Typical Applications

- Wireless camera-phones
- Digital still cameras
- PDAs

Flux Characteristics at 1000 mA[1][2], Junction Temperature T_J = 25° C

	Current (mA)	Minimum Luminous Flux (lm) ϕv	Typical Luminous Flux (lm) ϕ_v
LXCL-PWF1	1000	28	43

Electrical Characteristics at 1000 mA[3], Junction Temperature T_J = 25° C

	Current (mA)	Minimum (V)	Typical (V)	Maximum (V)
LXCL-PWF1	1000	3.2	3.8	4.8

Typical Flux (lm) Output vs. Drive Current[4][5]

Current (mA)	Flux (lm)
100	7
200	12
300	18
350	20
500	26
700	34
1000	43
1500	53
2000	63

Notes:
1. Minimum luminous flux performance guaranteed within published operating conditions. Lumileds maintains a tolerance of ± 10% on flux measurements.
2. Luxeon types with even higher luminous flux levels will become available in the future. Please consult your Lumileds Authorized Distributor or Lumileds sales representative for more information.
3. Lumileds maintains a tolerance of ± 0.06V on forward voltage measurements
4. All values assume a junction temperature T_j of 25°C
5. For flash modes, it is recommended that the drive current be as high as possible (up to 2000 mA) for optimal results

Flash and Torch Mode Operation

Typical On-Axis Intensity (cd) vs. Drive Current[1][2][4]

Current (mA)	High Uniformity Option (cd)	High Intensity Option (cd)	No Lens (cd)
100	5	8	2
200	9	15	4
300	13	21	6
350	15	24	7
500	20	32	9
700	26	41	11
1000	33	53	15
1500	40	63	17
2000	47	75	21

Typical On-Axis Illuminance (lux) vs. Drive Current at .5 meters[1][2][3][4]

Current (mA)	High Uniformity Option (lux)	High Illuminance Option (lux)	No Lens (lux)
100	20	32	9
200	36	58	16
300	53	84	23
350	59	95	26
500	79	127	35
700	102	164	45
1000	132	211	58
1500	158	253	70
2000	188	301	83

Note:

1. Adequate cooling capacity required in order to keep junction temperature Tj less than 100 °C

2. High Uniformity and High Illuminance Option assumes use of the Lumileds reference design optic. The design of this optic is available upon request.

   High Uniformity option is achieved by placing the reference lens at 0.4 mm from the emitter. This will yield uniformity of 41% (relative to center) at the horizontal edge and 24% (relative to center) at the corners.

   Uniformity can be traded-off for increased On-Axis Illuminance/Intensity. This is shown in the High Intensity Option and is achieved by placing the reference lens at 0.7mm from the emitter. In this option, the uniformity is 17% at the horizontal edge and 10% at the corners.

3. Illuminance is inversely proportional to the square of the distance.

   For example: if the illuminance at 1 meter is 40, then the illuminance at 2 meters is $40/(2^2) = 10$ lux.

   The illuminance at 3 meters is $40/(3^2) = 4.4$ lux

4. For flash modes, it is recommended that the drive current be as high as possible for optimal results.

Typical On-Axis Illuminance (lux) vs. Drive Current at 1 meter[1][2][3][4]

Current (mA)	High Uniformity Option (lux)	High Illuminance Option (lux)	No Lens (lux)
100	5	8	2
200	9	15	4
300	13	21	6
350	15	24	7
500	20	32	9
700	26	41	11
1000	33	53	15
1500	40	63	17
2000	47	75	21

Note:

1. Adequate cooling capacity required in order to keep junction temperature Tj less than 100 °C

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   The illuminance at 3 meters is $40/(3^2)$ = 4.4 lux

4. For flash modes, it is recommended that the drive current be as high as possible for optimal results.

Thermal Considerations for Flash Mode – Max Drive Current vs. Max Pulse Width [1][2][3]

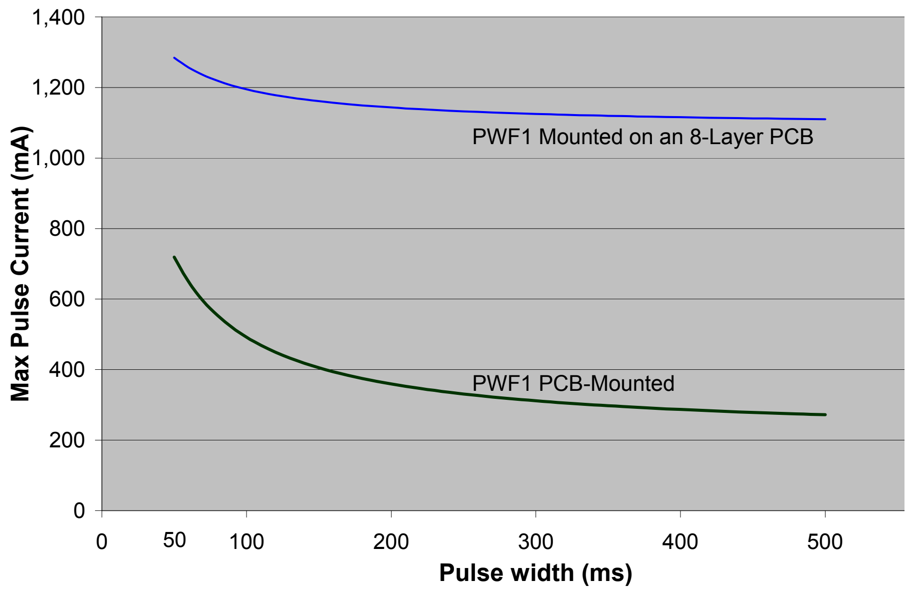


Figure 1
Thermal Considerations for Flash Mode

Notes:

1. Maximum drive currents versus pulse widths for LXCL-PWF1 mounted on a PCB and 8-Layer PCB with a copper clad area of 6 mm in radius.
2. Higher currents (up to 2000 mA) are possible through proper thermal management
3. PCB Mounted design refers to single Sided PCB. The 8-Layer PCB design requires thermal vias

Color Temperature (White) for Flash & Torch Modes

Color Temperature[1] CCT			Total Included Angle[2] (degrees)	Viewing Angle[3] (Degrees)
Min.	Typ.	Max.	$\theta_{0.90V}$	$2\theta\ 1/2$
5000 K	7000 K	10000 K	140	120

Notes:

1. Minimum CRI (Color Rendering Index) for White product types is 70. CCT ±5% tester tolerance.
2. Total included angle at which 90% of total luminous flux is captured.
3. θ½ is the off axis angle from lamp centerline where the luminous intensity is ½ of the peak value.

Typical Forward Voltage (V_F) vs. Drive Currents (I_F) for Both Flash & Torch Modes Junction Temperature T_j = 25° C

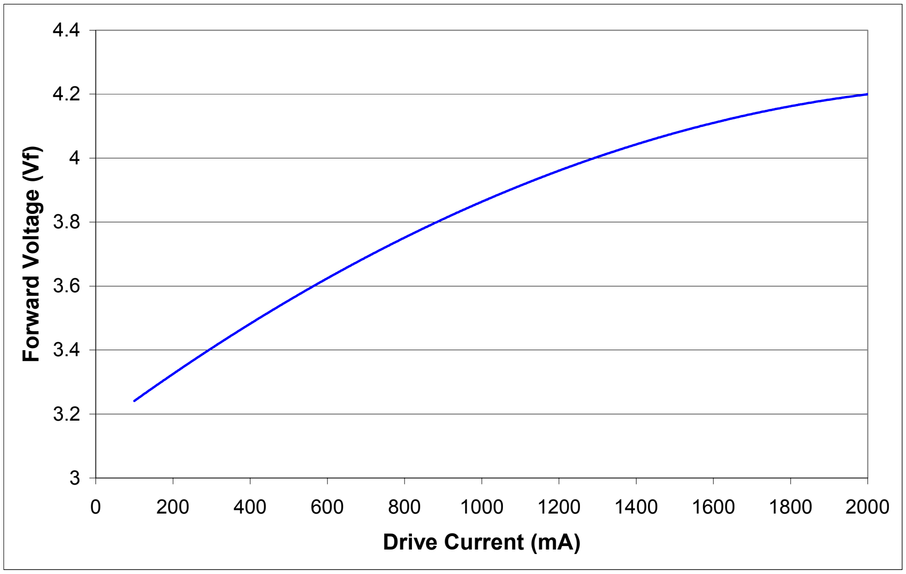


Figure 2
Forward Voltage vs. Drive Current for LXCL-PWF1

Electrical & Thermal Characteristics

Part Number	Dynamic resistance [1] (Ω) R_D	Temperature coefficient of forward voltage[2] (mV/°C) $\Delta V_F / \Delta T_J$	Thermal resistance, junction to case (°C/W) $R\theta_{J-C}$
LXCL-PWF1	0.4	-2.0	9.3

Notes:

1. Dynamic resistance is the inverse of the slope in linear forward voltage model for LEDs.
2. Measured between 25°C ≤ Tj ≤ 110°C at I_F = 350mA.

Absolute Maximum Ratings LXCL-PWF1

Parameter	Value
Peak Pulsed Forward Current (mA) [1]	2000
ESD Sensitivity[2]	± 16,000V HBM
LED Junction Temperature (°C)	150
Storage Temperature (°C)	-40 to +120
Reflow Soldering Temperature (°C)	260 for 5 seconds max
Operating Temperature (°C)	-40 to +120

Notes:

1. Max pulse width of 200 ms with proper thermal management
2. LEDs are not designed to be driven in reverse bias. Lumileds does not guarantee at reverse bias conditions.

Typical Wavelength Characteristics, T_J = 25°C

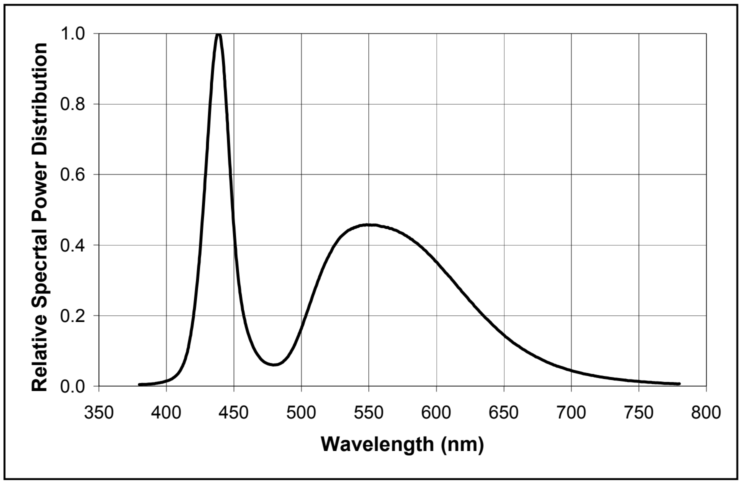


Figure 3
White Color Spectrum of Typical CCT Part, Integrated Measurement

Typical Representative Spatial Radiation Pattern

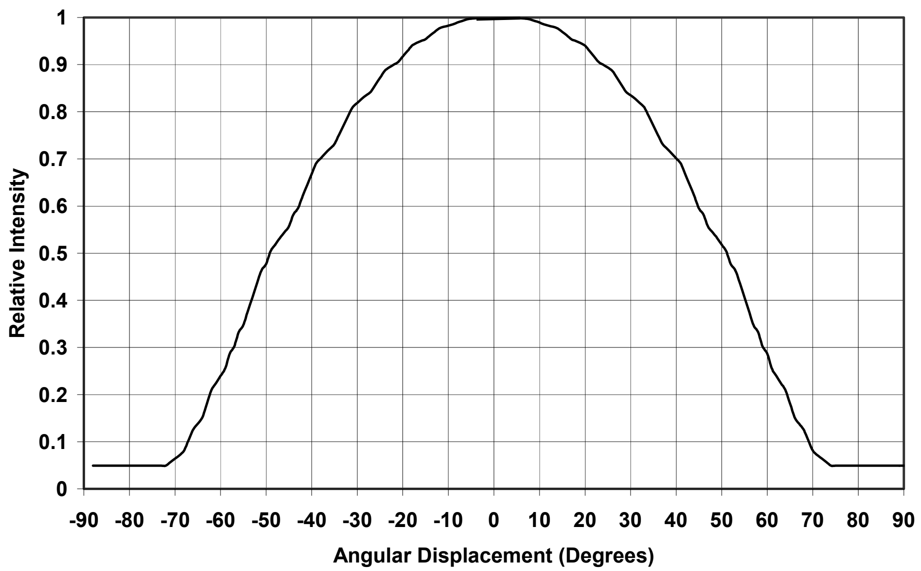
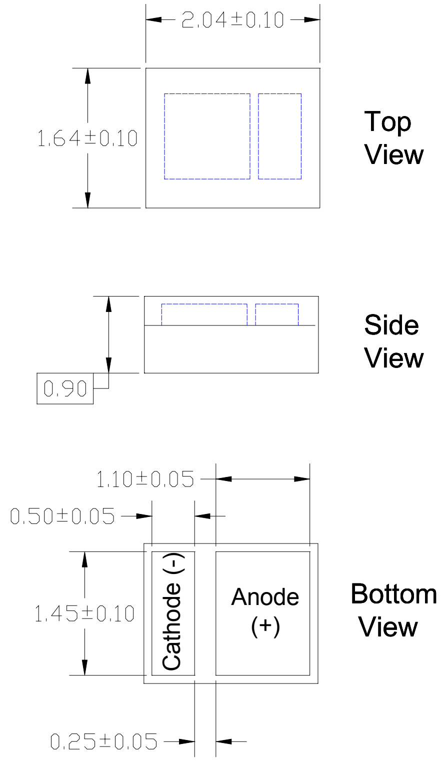


Figure 4
Typical Representative Spatial Radiation Pattern (Far Field) for LXCL-PWF1

Mechanical Dimensions LXCL-PWF1



Notes:

1. Drawings not to scale
2. All dimensions are in millimeters
3. Measurements without tolerances are for reference only

Reel Packaging (LXHL-PWF1)

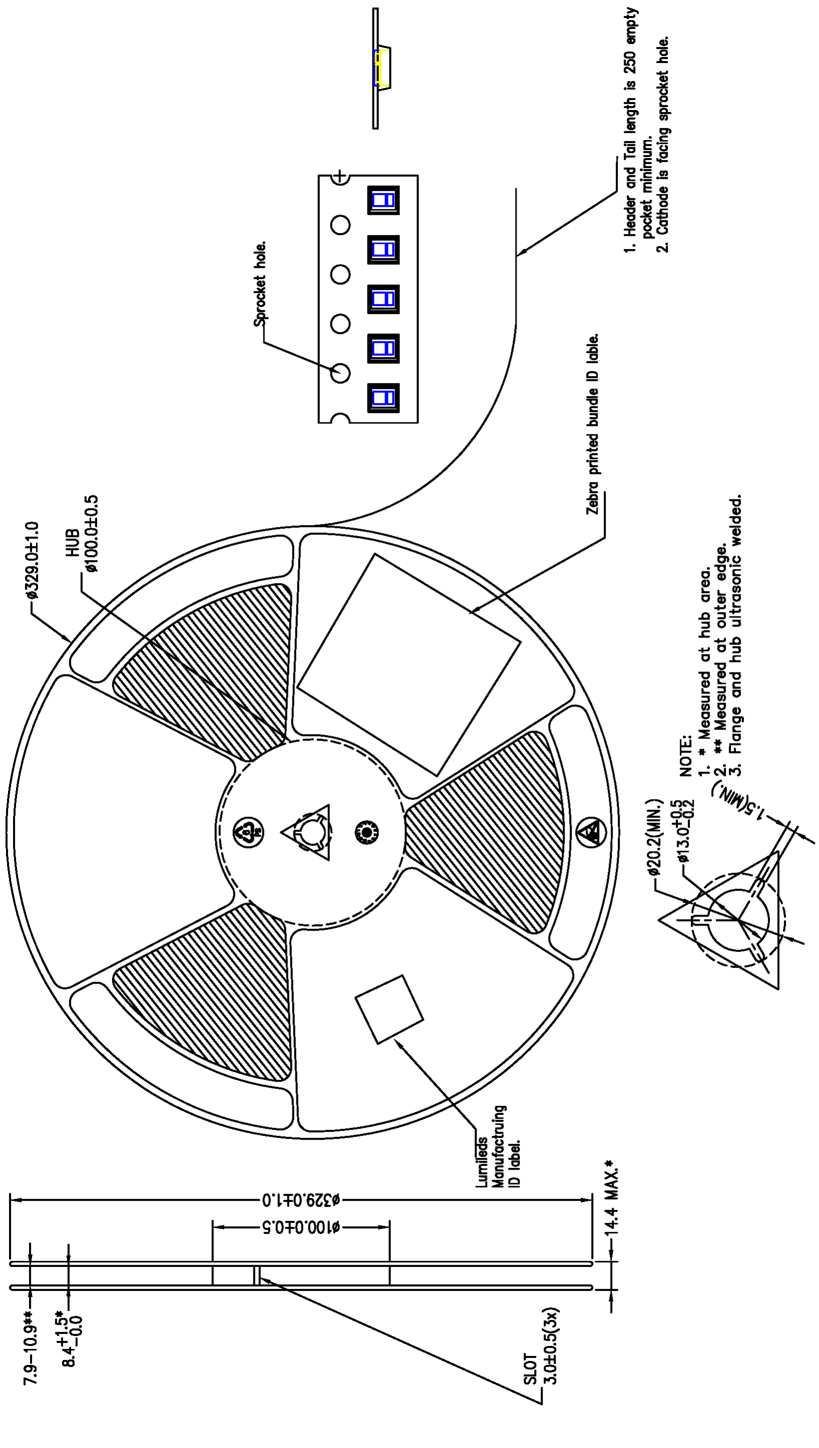
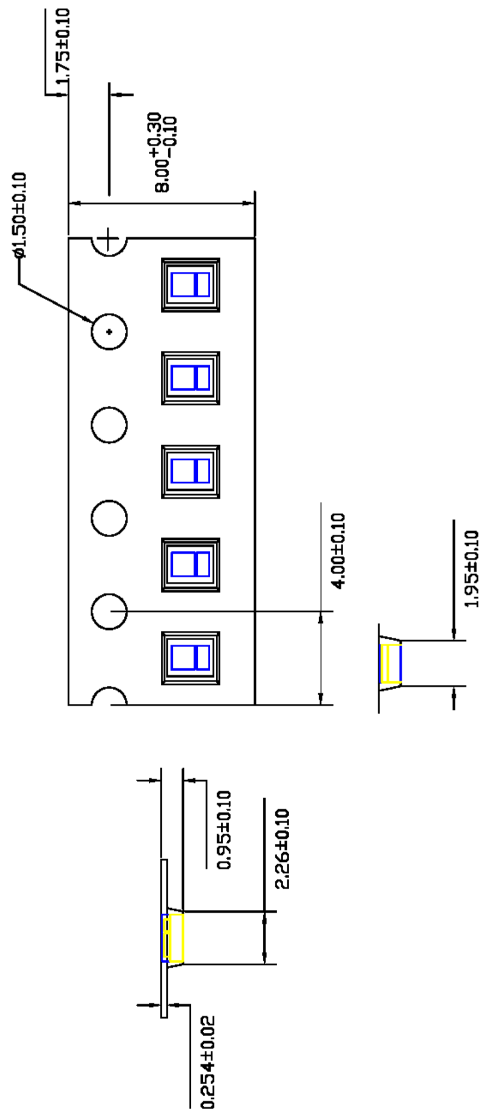


Figure 5
Reel dimensions and orientation

Notes:

1. Drawings not to scale.
2. All dimensions are in millimeters.
3. All dimensions without tolerances are for reference only.

Emitter Packaging (LXHL-PWF1)



Notes:

1. Drawings not to scale.
2. All dimensions are in millimeters.
3. All dimensions without tolerances are for reference only.

Figure 6
Tape Dimensions

About Luxeon

Luxeon is the new world of solid-state lighting (LED) technology. Luxeon Power Light Source Solutions offer huge advantages over conventional lighting and huge advantages over other LED solutions. Luxeon enables partners to create and market products that, until now, were impossible to create. This means the opportunity to create products with a clear ompetitive advantage in the market. Products that are smaller, lighter, sleeker, cooler, and brighter. Products that are more fun to use, more efficient, and more environmentally conscious than ever before possible!

Company Information

Luxeon is developed, manufactured and marketed by Lumileds Lighting, U.S., LLC. Lumileds is a world-class supplier of Light Emitting Diodes (LEDs) producing billions of LEDs annually. Lumileds is a fully integrated supplier, producing core LED material in all three base colors (Red, Green, Blue) and White. Lumileds has R&D development centers in San Jose, California and Best, The Netherlands. Production capabilities in San Jose, California and Malaysia.

Lumileds is pioneering the high-flux LED technology and bridging the gap between solid-state LED technology and the lighting world. Lumileds is absolutely dedicated to bringing the best and brightest LED technology to enable new applications and markets in the Lighting world.

Lumileds may make process or materials changes affecting the performance or other characteristics of Luxeon. These products supplied after such change will continue to meet published specifications, but may not be identical to products supplied as samples or under prior orders.

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Driver Integrated Circuits for Luxeon Flash Applications

Luxeon Flash (LXCL-PWF1) Drivers

Supplier	P/N	Description	Max I_{OUT}	V_{REF}	Efficiency (see Note 2)	Component Count (see Note 3)	Comments
On Semi	NCP5030, see Note 1.	Synchronous Buck/Boost	1200mA	0.20	86%	14	(DBB) current source output.
Maxim	MAX1577, see Note 1.	1X/2X Charge Pump	1100mA	0.3 0.1 0.06	Torch: 47% to 94% Flash: 51% to 61%	6 (inductorless)	3 selectable LED currents
Linear Technology	LTC3216, see Note 1.	1X, 1.5X, 2X Charge Pump	1000mA	0.54	Torch: 64% to 94% Flash: 51% to 62%	8 (inductorless)	3 selectable LED currents
Linear Technology	LTC3441	Synchronous Buck/Boost	1000mA	1.22	83%, see Note 4	15, see Note 4	(DBB)
Monolithic Power	MP1527	Boost	1000mA	1.22	68%	15	Needs external schottky and external true-load disconnect
On Semi	NCP1422	Boost	800mA	1.20	68%	9	Includes true-load disconnect
Sipex	SP7648, see Note 1	Boost	800mA	0.8, 0.3	83%	14	2 selectable LED currents. Includes true-load disconnect
National	LM3224, see Note 1.	Boost	700mA	1.26	67%	12	Needs external schottky and external true-load disconnect
Sipex	SP6685, see Note 1.	1X, 2X Charge Pump	700mA see Note 5	0.15 to 0.22, 0.05	Torch: 48% to 95% Flash: 48% to 55%	7 (inductorless)	2 selectable LED currents
Sipex	SP6648	Boost	700mA	1.25	76% see Note 4	13, see Note 4	Need's external true-load disconnect
Texas Instruments	TPS61020	Boost/LDO	700mA	0.5	79%	14	Includes true-load disconnect. If $V_O < V_{IN}$ operates as linear regulator.
On Semi	NCP1421	Boost	600mA	1.20	68%	9	Includes true-load disconnect
Advanced Analogic Technology	AAT3112	Dual 2X Charge Pump	500mA see Note 5	NA	Torch: 42% to 51% Flash: 45% to 50%	12 (inductorless)	Fixed 4.5V output doesn't regulate LED current well
Fairchild	FAN4855	Boost	500mA	1.24	67%	8	Includes true-load disconnect
Linear Technology	LT1618	Boost, with additional current mode	500mA	0.05	80%	11	(Boost-Buck), using 50mV reference. See pg 16 of data sheet
Linear Technology	LTC3453, see Note 1.	Synchronous Buck/Boost	500mA	0.22	85%	8	(DBB) 3 selectable LED currents
Maxim	MAX1576	1X, 1.5X, 2X Charge Pump	400mA	NA	Torch: 58% to 88% Flash: 54% to 73%	9 (inductorless)	3 selectable LED currents
National	LM2753, see Note 1.	2X Charge Pump	400mA, see Note 5	NA	Torch: 42% to 51% Flash: 44% to 50%	7 (inductorless)	Fixed 5V output doesn't regulate LED current well

Note 1. This IC was still in development as of September 30, 2004. However samples and data sheets are available from the IC manufacturer.
Note 2. Efficiency is estimated based on assumed IC efficiency of 90% times the output current ratio, {i.e. Efficiency = (90%)[V_F LED/(V_F LED + V_{SENSE})]}, for inductor-based DC/DC Converters. Please contact the IC Manufacturers for actual efficiencies. For Charge-Pump DC/DC Converters, the efficiency is given as a range for $3.2 \le V_{BATT} \le 3.8V$ for nominal LED V_F at the driver's maximum rated I_{OUT} current in Flash Mode, and at 200 mA in Torch Mode.
Note 3. Component count includes the IC itself, the LED, the number of external components needed for bypass and filtering, and the number of external components needed to generate two LED forward currents (i.e. Torch and Flash modes) and to provide a true switch-off.
Note 4. Uses more complicated external circuit that improves LED efficiency by reducing voltage drop across R_{SENSE} to be less than V_{REF}.
Note 5. IC may not be able to deliver the full rated max I_{OUT} toward the low end of the expected battery voltage range of 3.2 to 3.8V.

Luxeon Flash (LXCL-PWF2) Drivers

Supplier	P/N	Description	Max I_{OUT}	V_{REF}	Efficiency (see Note 2)	Component Count (see Note 3)	Comments
Linear Technology	LTC1872	Controller, using external FET	1000mA	0.80	82%	14	(BO) Needs external power FET, external schottky and external true-load disconnect
Monolithic Power	MP1517	Boost	1000mA	0.70	83%	12	Needs external schottky and external true-load disconnect
Sipex	SP6682	1.5X, 2X Charge Pump used as Controller	1000mA	0.306	86%	11	(BO) Needs external power FET, external schottky and external true-load disconnect
Linear Technology	LT3479, see Note 1.	Boost	700mA	0.10 to 1.25, see Comments	88%	15	Reference voltage is available externally and can be divided down to 100mV.
Maxim	MAX8715	Boost	500mA	1.24	77%	14	Needs external schottky and external true-load disconnect
Micrel	MIC2291	Boost	500mA	0.095	89%	10	Needs external schottky and external true-load disconnect
National	LM3224, see Note 1.	Boost	500mA	1.26	76%	12	Needs external schottky and external true-load disconnect

Note 1. This IC was still in development as of September 30, 2004. However samples and data sheets are available from the IC manufacturer.
Note 2. Efficiency is estimated based on assumed IC efficiency of 90% times the output current ratio, {i.e. Efficiency = (90%)[V_F LED/(V_F LED + V_{SENSE})]}, for inductor-based DC/DC Converters. Please contact the IC Manufacturers for actual efficiencies.
Note 3. Component count includes the IC itself, the LED, the number of external components needed for bypass and filtering, and the number of external components needed to generate two LED forward currents (i.e. Torch and Flash modes) and to provide a true switch-off.

(BO) = Boost Mode, (DBB) = dynamic buck/boost modes, (CP) = Charge Pump