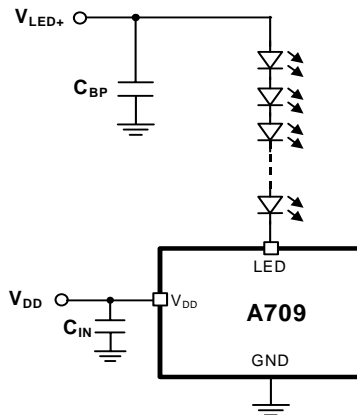


**ADVANCED CURRENT REGULATOR**
**DESCRIPTION**

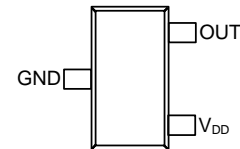
The A709 is a low dropout advanced current regulator rated for 20mA and 40mA for driving LEDs. The noise is very low. The special circuit design provides over 95% efficiency because of the very low dropout voltage. The low quiescent current and low dropout voltage are achieved by advanced Bi-CMOS process.

**FEATURES**

- 20mA and 40mA pure DC constant sink current.
- Output short / open circuit protection.
- Low dropout voltage.
- Low quiescent current.
- SOT-23 3L package available.
- Up to 95% efficiency
- Build-in thermal protection.
- Supply voltage range 2.7V ~ 12V.
- Output breakdown voltage up to 17V.
- 2KV HBM ESD protection
- Advanced Bi-CMOS process.

**TYPICAL APPLICATION CIRCUIT**

**APPLICATIONS**

- LED Backlights.
- Mobile Phone, Smart Phone.
- Lighting
- Channel Letter

**PACKAGE PIN OUT**


3 pin Plastic SOT-23  
(Top View)

**ORDER INFORMATION**

Output Current	W	Plastic SOT-23
		3-pin
20mA		A709WFT-20
40mA		A709WFT-40

Note: The letter "F" is marked for Lead Free process, and letter "T" is marked for Tape & Reel.

**ABSOLUTE MAXIMUM RATINGS** (Note)

Input Voltage, $V_{DD}$	-0.3V to 13.2V
Output Voltage, $V_{OUT}$	-0.3V to 17V
Maximum Junction Temperature, $T_J$	150°C
Storage Temperature Range	-40°C to 150°C
Lead Temperature (soldering, 10 seconds)	260°C

**Note:**

Exceeding these ratings could cause damage to the device. All voltages are with respect to Ground.  
Currents are positive into, negative out of the specified terminal.

**POWER DISSIPATION TABLE**

Package	$\theta_{JA}$ (°C / W)	Derating factor ( mW/°C ) $T_A \geq 25^\circ\text{C}$	$T_A \leq 25^\circ\text{C}$ Power rating (mW)	$T_A = 70^\circ\text{C}$ Power rating (mW)	$T_A = 85^\circ\text{C}$ Power rating (mW)
W	220	4.5	568	363	295

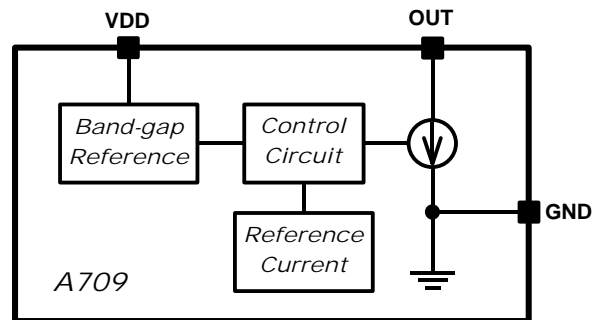
**Note :**

Junction Temperature Calculation:  $T_J = T_A + (P_D \times \theta_{JA})$ .

$P_D$ : Power Dissipation,  $T_A$ : Ambient temperature,  $\theta_{JA}$ : Thermal Resistance-Junction to Ambient

The  $\theta_{JA}$  numbers are guidelines for the thermal performance of the device/PC-board system.

All of the above assume no ambient airflow.

**BLOCK DIAGRAM**


**PIN DESCRIPTION**

Pin Name	Pin Function
OUT	Output pin. Connect to LED's cathode.
V <sub>DD</sub>	Power Supply pin.
GND	Ground pin.

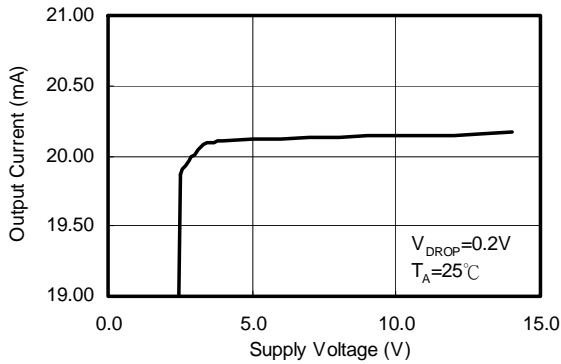
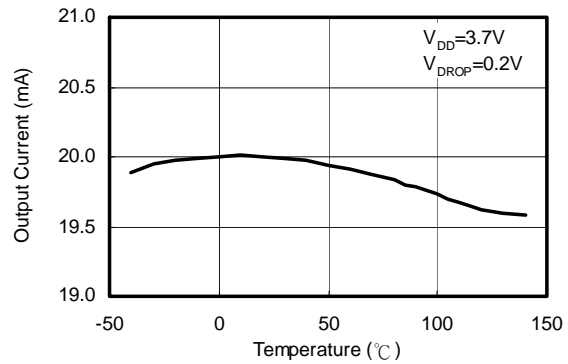
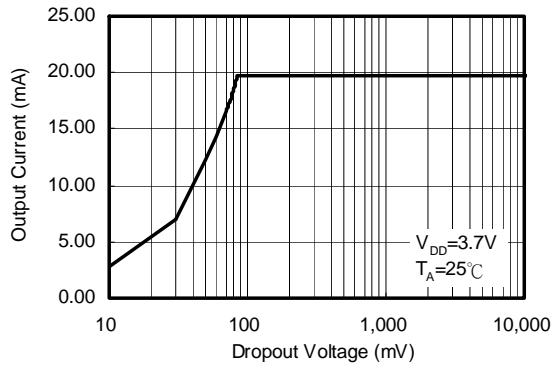
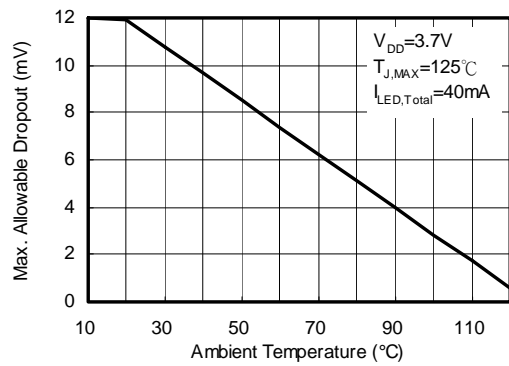
**RECOMMENDED OPERATING CONDITIONS**

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V <sub>DD</sub>	2.7		12	V
Operating Free-Air Temperature	T <sub>A</sub>	-40		+85	°C
Operating Junction Temperature	T <sub>J</sub>			+125	°C

**ELECTRICAL CHARACTERISTICS**

V <sub>DD</sub> =3.7V, T <sub>A</sub> =25°C, No Load, (Unless otherwise noted)							
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Apply Pin
OUT Pin Dropout Voltage	V <sub>DROP</sub>	Note		75	90	mV	OUT
LED Sink Current	I <sub>LED</sub>	A709WFT-20	18	20	22	mA	
		A709WFT-40	36	40	44		
Load Regulation		V <sub>OUT</sub> =0.15~3V			±3	%	
Line Regulation		V <sub>DD</sub> =2.7~12V, V <sub>OUT</sub> =0.15V			±3	%	
Supply Current	I <sub>DD</sub>			300	600	uA	V <sub>DD</sub>

Note: LED Dropout Voltage:  $90\% \times I_{LED} @ V_{OUT}=150mV$

**CHARACTERISTIC CURVES**
**Output Current vs. Supply Voltage**

**Output Current vs. Temperature**

**Output Current vs. Dropout Voltage**

**Max. Allowable  $V_{Drop}$  vs. Ambient Temp.**


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**APPLICATION INFORMATION**


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**Efficiency**

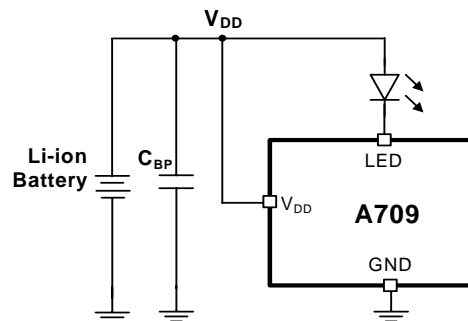
The ACR (Advanced Current Regulator) architecture offers ultra low output dropout that significantly improves the efficiency compared to Inductive Boost type or Capacitor Charge Pump type LED driver. The system efficiency, defined as the ratio between the LEDs power and the input supplied power, is:

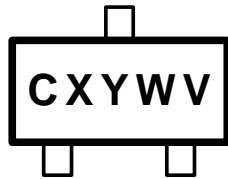
$$Efficiency = \frac{V_F \times I_{OUT}}{V_{DD} \times (I_{DD} + I_{OUT})} \cong \frac{V_F \times I_{OUT}}{V_{DD} \times I_{OUT}} = \frac{V_F}{V_{DD}}$$

Where,  $V_F$  is the forward voltage of LED.

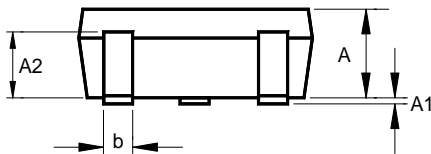
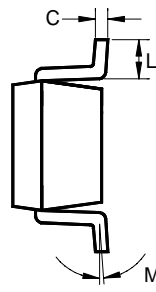
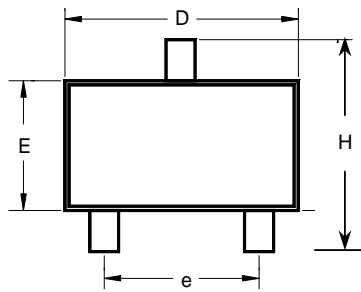
**Li-ion Battery Voltage Supply**

The A709 can work with Li-ion battery. The supply voltage of Li-ion battery ranges from 4.5V down to lower than 3V while the white/blue LED forward voltage ( $V_F$ ) is in the range of 2.9V to 3.5V at 20~40mA current. The supply voltage range and LED forward voltage can be set to fully utilize Li-ion battery energy. For example, if the forward voltage of white LED is 3.2V at 20mA, the Li-ion battery can discharge until output voltage reaches 3.275V (normally around 1% ~ 3% power left in the battery). When Li-ion battery voltage is lower than the 3.275V, the LED current (brightness) will start to decrease.



**PACKAGE**
**Top Marking for SOT-23**

**C : A709**
**X : Output Current Options**

C = 20mA; E = 40mA;

**Y : Year Code**
**W : Week Code**
**V : Identification Code**
**Surface Mount SOT-23**


	INCHES			MILLIMETERS		
	MIN	TYP	MAX	MIN	TYP	MAX
A	0.039	0.043	0.051	1.00	1.10	1.30
A1	0.000	-	0.004	0.00	-	0.10
A2	0.028	0.032	0.035	0.70	0.80	0.90
b	0.014	0.016	0.021	0.35	0.40	0.51
C	0.004	0.005	0.010	0.08	0.15	0.25
D	0.106	0.114	0.122	2.70	2.90	3.10
E	0.047	0.055	0.063	1.20	1.40	1.60
e	0.075 TYP.			1.90 TYP.		
H	0.082	0.094	0.107	2.10	2.40	2.70
L	0.007	-	0.020	0.20	-	0.50
M	0°	5°	9°	0°	5°	9°

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ADDtek assumes no liability to customer product design or application support. ADDtek warrants the performance of its products to the specifications applicable at the time of sale.

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