



A708

3 CHANNELS 20mA ADVANCED CURRENT REGULATOR

DESCRIPTION

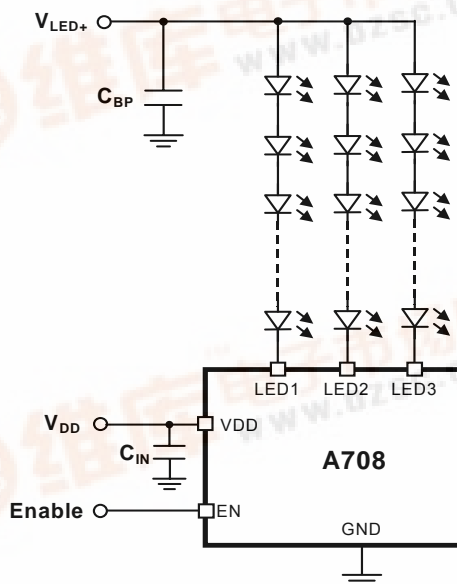
The A708 is a 3 channels 20mA advanced current regulator for driving LEDs. Only bypass capacitor is required and the noise is very low. The special circuit design provides over 90% efficiency because of the very low dropout voltage.

Target end applications are LED backlights for color LCD display, such as mobile phone, smart phone, PDA, notebook, and monitor, etc.

FEATURES

- Fixed 20mA DC constant sink current.
- Individual current sink circuit for each LED string to prevent short / open circuit on LEDs.
- TSOT-26 package available.
- High efficiency.
- Supply voltage range 2.7V ~ 12V.
- Output sustaining voltage up to 17V.
- 0.1uA standby current.
- 2KV HBM ESD protection.
- Advanced Bi-CMOS process.

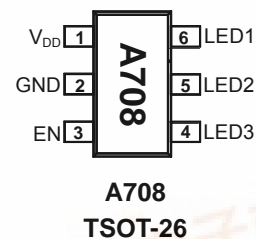
TYPICAL APPLICATION CIRCUIT



APPLICATIONS

- Small Size Color LCD Backlights.
- Mobile Phone, Smart Phone.
- LED Backlight for Portable DVD, NB, Monitors, and UMPC.

PACKAGE PIN OUT



ORDER INFORMATION

T _A (°C)	Y	Plastic TSOT-26
		6-pin
-40 ~ 85		A708YFT
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 Sustaining Voltage, V_{LEDn}	-0.3V to 17V
Voltage at all other pins	-0.3V to 12V
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	θ_{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)
Y	220	4.5	568	363	295

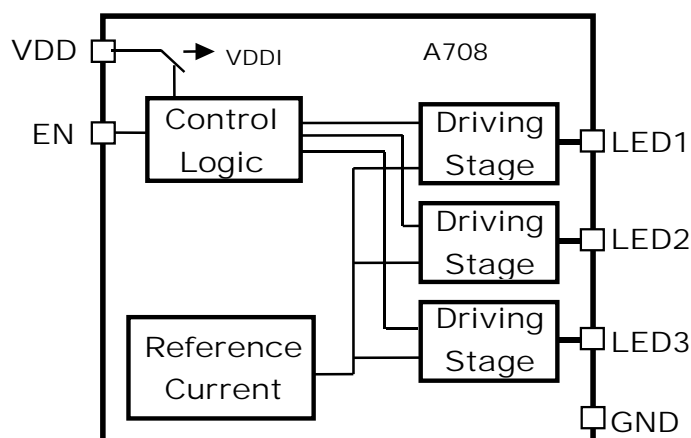
Note :

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

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

The θ_{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
LED1 ~ LED3	Output pins; connect to LED's cathode.
EN	Enable control pin. Pulling this pin high will enable the device. Pulling this pin to GND will disable the device.
V _{DD}	Power supply
GND	Ground
PGND	Power ground

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min	Typ	Max	Unit
Supply Voltage	V _{DD}	2.7		12	V
Output Sink current	I _{LED}			25	mA
Operating free-air temperature range	T _A	-40		+85	°C

ELECTRICAL CHARACTERISTICS

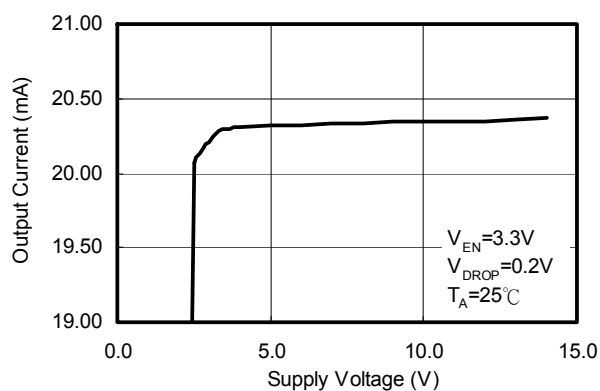
V _{DD} =3.7V, V _{IH} =3.3V, V _{IL} =GND, No Load, T _A =25°C, (Unless otherwise noted)							
Parameter	Symbol	Condition	Min	Typ	Max	Unit	Apply Pin
“Low” Input Voltage	V _{IL}		0		0.4	V	EN
“High” Input Voltage	V _{IH}		1.7		V _{DD}	V	
“Low” Input Current	I _{IL}		-5.0		+5.0	μA	
“High” Input Current	I _{IH}		-5.0		+5.0	μA	
LED Dropout Voltage	V _{LEDL}	Note 1		75	90	mV	LEDn
LED Sink Current	I _{LED}	Rank A	19	20	21	mA	
			18	20	22		
LED Sink Current Deviation	ΔI _{LEDn}	Note 2			±3	%	
Load Regulation		V _{LEDn} =0.15~3V			±3	%	
Line Regulation		V _{DD} =2.7~12V, V _{LEDn} =0.15V			±3	%	
Supply Current	I _{DD}			300	600	uA	V _{DD}
Standby Supply Current	I _{DDSTBY}			0.1		uA	

Note 1: LED Dropout Voltage: 90% × I_{LEDn} @ V_{LEDn}=150mV

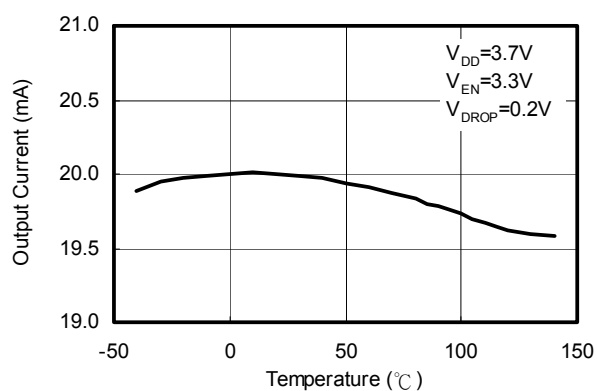
Note 2: I_{LEDn}(max)-I_{LEDn}(average) and I_{LEDn}(average)-I_{LEDn}(min)

CHARACTERISTIC CURVES

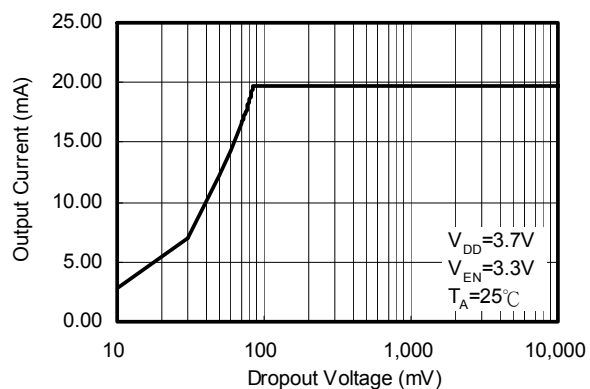
Output Current vs. Supply Voltage



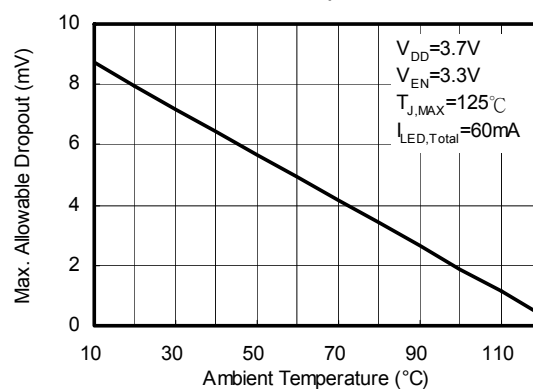
Output Current vs. Temperature



Output Current vs. Dropout Voltage



Max. Allowable V_{DROP} vs. Ambient Temp.



APPLICATION INFORMATION

Enable

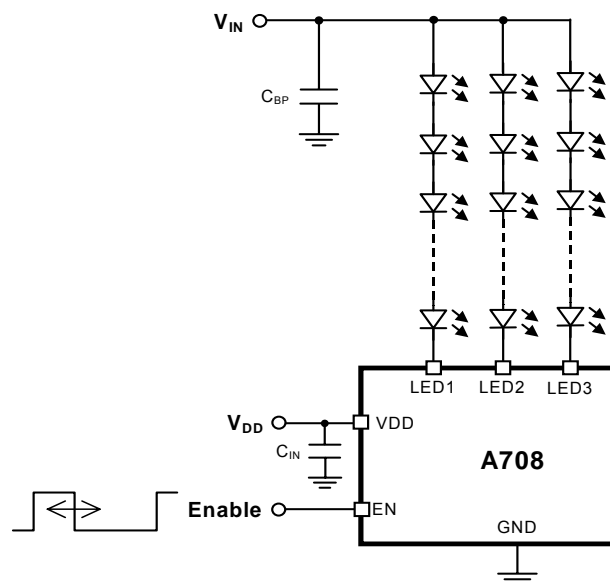
Pulling the EN pin to high will enable the device sinking constant current on LED pins. Pulling the EN pin to ground will shutdown the device. This pin should not be left floating and need to be terminated.

LED Number in the String Driven by Each Channel

The breakdown voltage of LEDn pin is 17V so that each channel can drive up to 9 pcs of LEDs in series. When the chip is disabled, the forward voltage of the LED may drop to half of the rated value because of the extremely small leakage current.

LED Brightness Control

The LED sink current was fixed at 20mA. Apply PWM signal to EN pin and control the duty that could control the LED brightness from 0% to maximum.



Efficiency

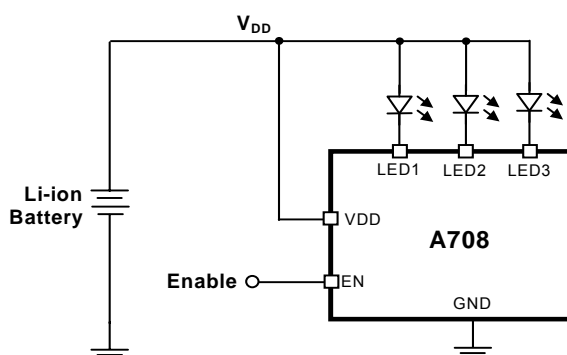
The ACR (Advanced Current Regulator) architecture offers ultra low output dropout that significantly improves the efficiency compared to Inductive Boost type or Capacitor Charge Pump type LED driver. The system efficiency, defined as the ratio between the LEDs power and the input supplied power, is:

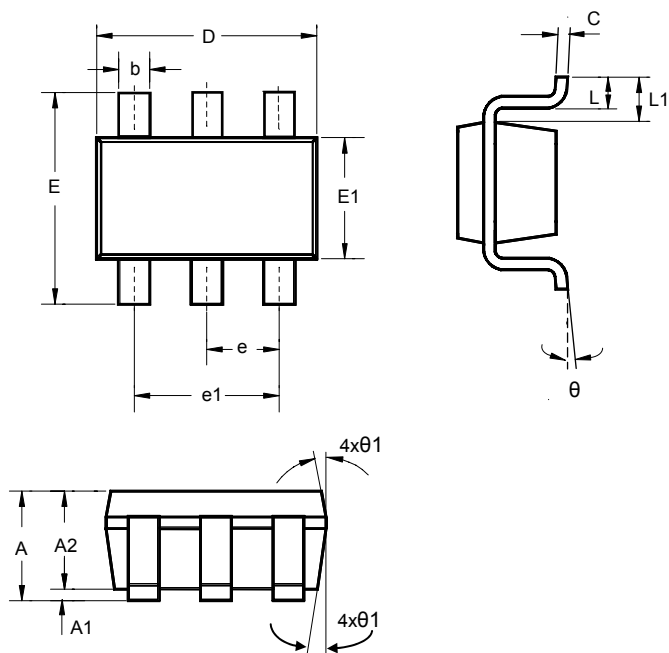
$$\text{Efficiency} = (V_{F1} \times I_{LED1} + V_{F2} \times I_{LED2} + V_{F3} \times I_{LED3}) / (V_{DD} \times I_{DD})$$

Where, V_F is the forward voltage of LED.

Li-ion Battery Voltage Supply

The A708 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 20mA 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
Surface Mount TSOT-26


SYMBOLS	MILLIMETERS		
	MIN	TYP	MAX
A	---	---	1.00
A1	0.00	0.05	0.10
A2	0.84	0.87	0.90
b	0.35	0.40	0.50
C	0.10	0.125	0.15
D	2.70	2.90	3.10
E	2.60	2.80	3.00
E1	1.40	1.60	1.80
e	---	0.95	---
e1	---	1.90	---
L	0.30	0.40	0.60
L1	0.5	0.6	0.7
θ	0°	4°	8°
θ1	4°	10°	12°

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