8-String, White LED Backlight Controller

❖ GENERAL DESCRIPTION

The AX2008 is a step-up current mode PWM DC/DC converter with built-in power MOSFET and eight channel current sources. It is designed for driving white LED arrays for medium size LCD panel backlight applications.

The AX2008 features dynamic output voltage control function, which automatically chooses the lowest sense voltage of multiple channels to regulate the feedback voltage of step-up converter. Through the function, the AX2008 is able to dynamically adjust output voltage of step-up converter to optimize the system power efficiency.

The internal step-up converter provides soft-start feature which is determined by external compensation components. The switching frequency is programmable by an external resistor, which is helpful for optimizing the external components sizes and improving the efficiency. In shutdown mode, current consumption of converter can be reduced to only 1uA.

The AX2008 provides eight channels constant current sinks with maximum ±3% current matching. The LED current can be adjusted by an external resistor, which provides users flexibility to control the light intensity of LEDs. In addition, users can precisely adjust LED brightness from 0% to 100% via PWM pin with pulse width modulation.

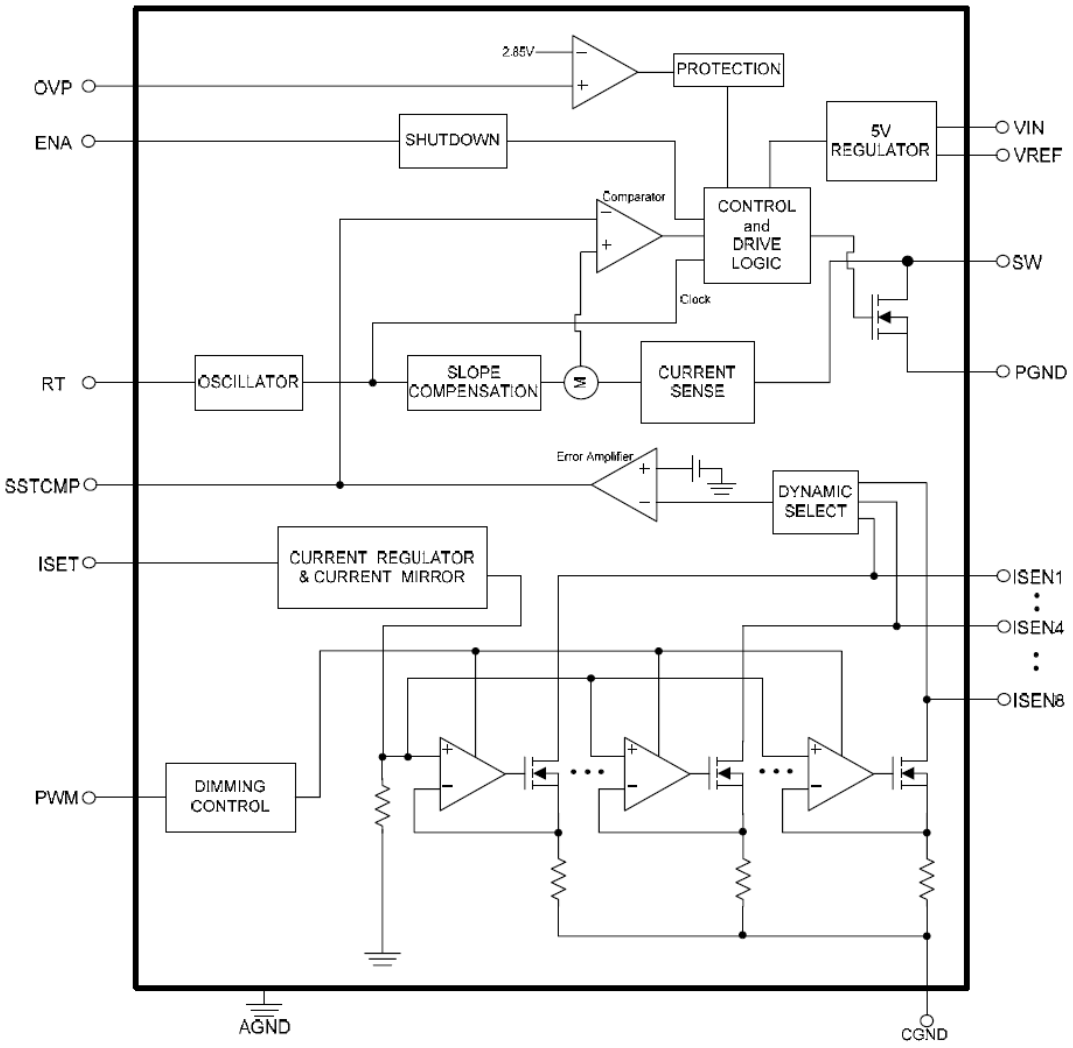
The AX2008 has multiple features to protect the converter from fault conditions. The adjustable over-voltage protection (OVP) function prevents the converter when output loading is open. Over-current protection (OCP) function ensures the system reliability and provides consistent operation. Over-temperature protection (OTP) function protects the converter from overheating in various application conditions.

The AX2008 provides space-saving, thermal enhanced 20-pin TSSOP exposed pad and QFN 4mm x 4mm packages as well to handle power dissipation more efficiently.

❖ FEATURES

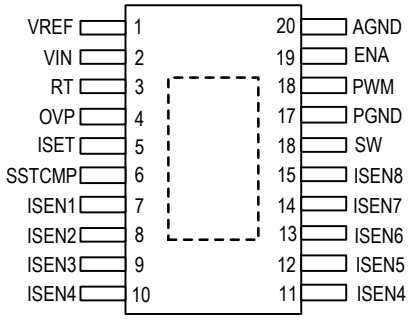
- Operating Voltage from 4.5V to 25V
- Output Voltage from Input Voltage to 40V
- Dynamic Output Voltage Control to Optimize System Efficiency
- 90% Efficiency for Boost Converter
- Integrated Power MOSFET for Boost Converter
- Programmable Switching Frequency
- Soft Start Function
- External Compensation Network
- Eight Constant Current Output Sink Channels
- LED Current Set by an External Resistor.
- Output Current Matching : ±3% (max.) between Channels
- LED Brightness Dimming by External PWM Signal.
- Adjustable Over-Voltage Protection
- Over-Temperature Protection
- RoHS Compliant

❖ BLOCK DIAGRAM

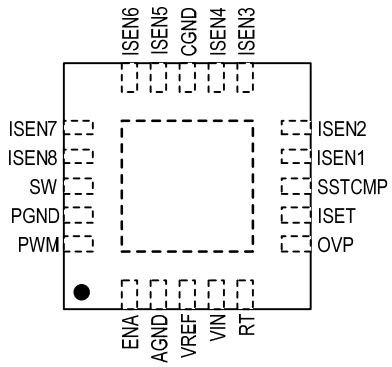


❖ PIN ASSIGNMENT

The packages of AX2008 are TSSOP-20L-EP and QFN-20L (4*4); the pin assignment is given by:



TSSOP-20L-EP



QFN-20L (4X4)

Name	Description
ENA	Enable pin. Pull this pin low to turn off IC
VREF	Voltage reference output
VIN	IC power supply pin
RT	Switching frequency setting pin
OVP	Over-voltage and over-drive protection threshold setting pin
ISET	Pin used to connect an external resistor for setting LED current of each channel
SSTCMP	Soft start and compensation pin
ISEN1	LED current sense for string 1
ISEN2	LED current sense for string 2
ISEN3	LED current sense for string 3
ISEN4	LED current sense for string 4
ISEN5	LED current sense for string 5
ISEN6	LED current sense for string 6
ISEN7	LED current sense for string 7
ISEN8	LED current sense for string 8
SW	Switching pin
PWM	PWM signal input pin for dimming control
CGND	Constant current sinks power ground
PGND	Boost converter power ground
AGND	Analog ground.

❖ ORDER/MARKING INFORMATION

Order Information	Top Marking
AX2008 XXX X Package Type EG2: TSSOP-20L-EP Q20: QFN-20L (4*4) Packing Blank : Tube A : Taping	Logo ◄--AX2008 → Part number YYWWX → ID code: internal WW: 01~52 Year: 10=2010 11=2011

❖ ABSOLUTE MAXIMUM RATINGS (at T_A = 25°C)

Characteristics	Symbol	Rating	Unit
VIN to GND		28	V
SW to GND		-0.3 to +40	V
ISEN1~ISEN8 to GND		-0.3 to +40	V
ENA,VREF,RT,OVP,ISET,SSTCMP,PWM to GND		-0.3 to +6	V
Power Dissipation	PD	$(T_J - T_A)/ \theta_{JA}$	W
Storage Temperature Range	T_{ST}	-65 to +150	°C
Junction Temperature		+160	°C
Lead Temperature (Soldering, 10sec.)		260	°C
Supply Voltage	VIN	4.5 to 25	V
Boost Converter Output Voltage		≦40	V
Operation Temperature Range	T_{OP}	-40 to +85	°C

Note : θ_{JA} is measured with the PCB copper are (need connect to Exposed pad) of approximately 1 in^2(Multi-layer).

❖ ELECTRICAL CHARACTERISTICS

(V_{IN}=12V, T_A=25°C, unless otherwise specified)

Characteristics	Symbol	Conditions	Min	Typ	Max	Units
INPUT						
Operation Voltage Range	V_{IN}		4.5	-	25	V
VREF Under-Voltage Lockout	V_{UVLO}	V_{IN} rising, typical hysteresis is 100mV	3.4	3.9	4.4	V
Operating Current	I_{IN}	Switching, P_{WM}=5V	-	3	5	mA
No Switching Current	I_Q	P_{WM}=0V	-	0.5	1	mA
Shutdown Current	I_{SD}	V_{ENA}=0V	-	1	5	μA
REFERENCE						
VREF Voltage	V_{REF}		4.75	4.95	5.15	V
OSCILLATOR						
Operating Frequency	F_{OSC}		0.6	0.8	1.0	MHz
Maximum Duty Cycle	T_{DUTY}		85	90	95	%
N-CHANNEL SWITCH						
Current Limit	I_{LIM}		-	3	-	A
On-Resistance	R_{ON}	I_{SW}= 200mA	-	0.3	-	Ω
Switch Leakage Current	I_{SWOFF}	V_{SW}=30V	-	5	20	μA
ENABLE CONTROL						
ENA Input High Level	V_{ENH}		1.8	-	-	V
ENA Input Low Level	V_{ENL}		0.9	-	-	V
ENA Input Current	I_{EN}		-	0.01	1	μA
CONSTANT CURRENT SINKS						
Sustaining Voltage at ISEN Pins	$V_{ISEN(max)}$		-	-	40	V
Average LED Current	$I_{LED(avg)}$	R_{SET}=75KΩ (Note 2)	-	20	-	mA
LED Current Balance Rate (Note 1)	dI_{LED}		-	±1	±3	%
PWM DIMMING CONTROL						
Dimming High Level	V_{DMH}		1.4	-	-	V

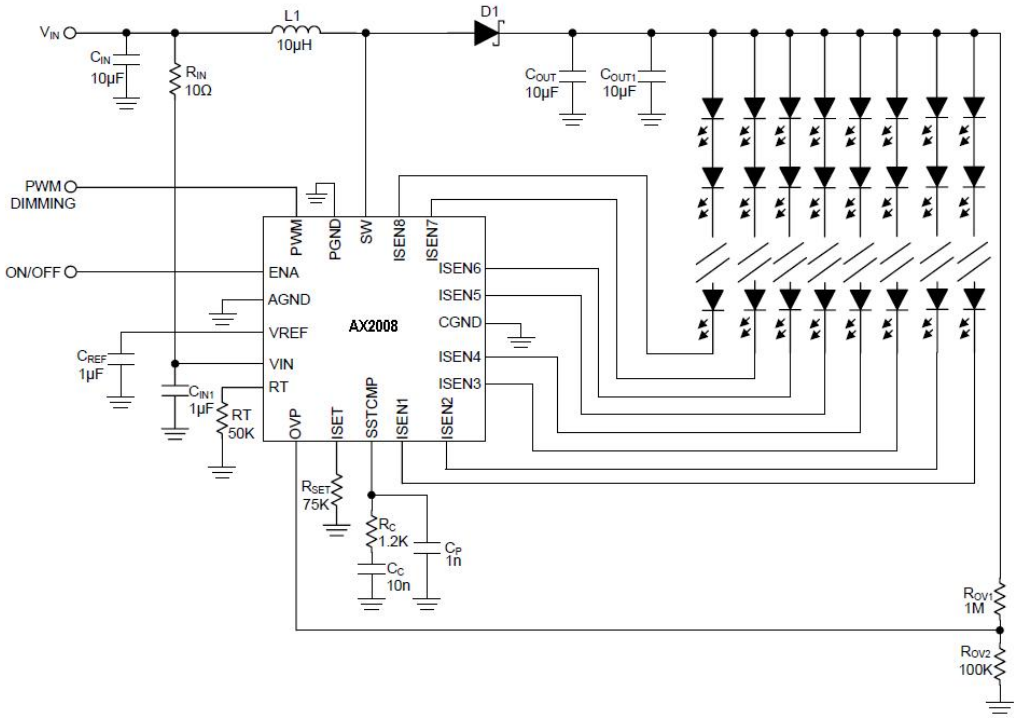
Dimming Low Level	V_{DML}		-	-	0.5	V
CONTROL and PROTECTION						
ISET Voltage	V_{ISET}		480	500	520	mV
Over-Voltage Protection Threshold	V_{OVP}		480	500	520	mV
Soft-Start Charge Current	I_{SST}		-	8	-	μA
Thermal Shutdown	T_{SD}		-	160	-	°C
Thermal Shutdown Hysteresis	ΔT_{SD}		-	40	-	°C

Note1: $dI_{LED} = \pm \frac{(I_{max} I_{min})}{2 \times I_{avg}} X\ 100\%$

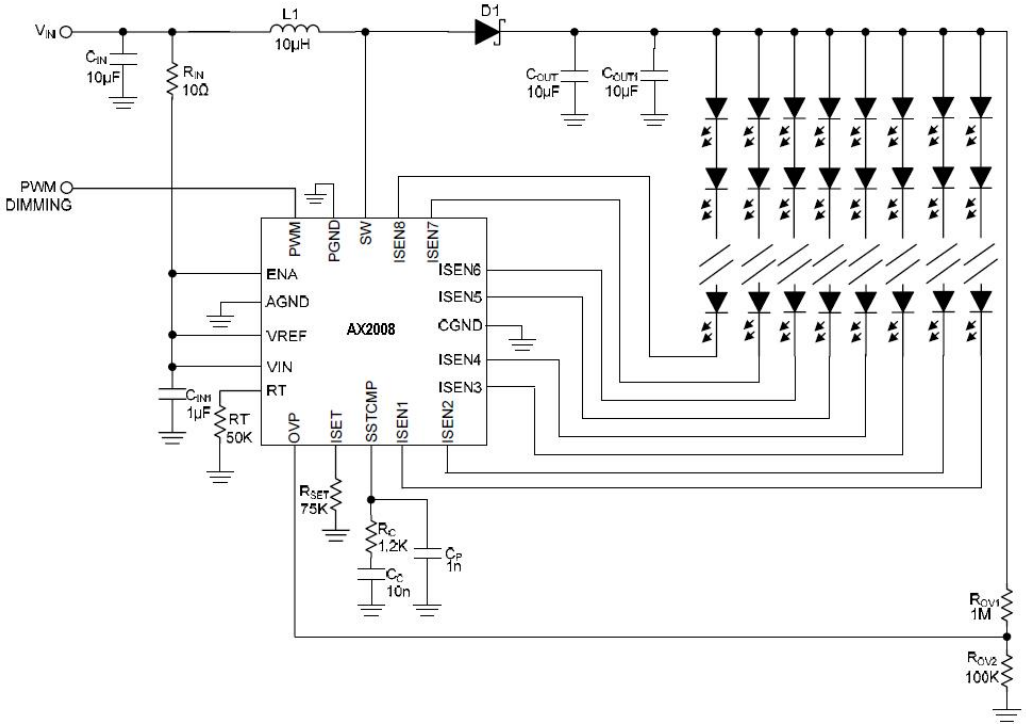
Note2: ILED [mA]= $\frac{1500}{R_{ISET}[K\Omega]}$

❖ APPLICATION CIRCUIT

(1) VIN=5.5V to 25V

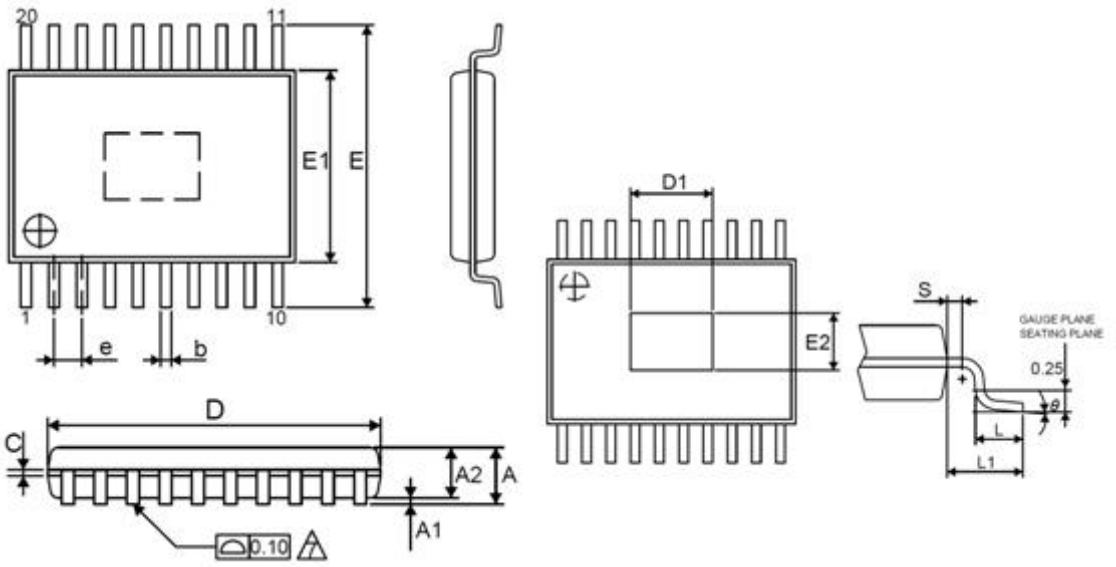


(2) VIN=4.5V to 5.5V



❖ PACKAGE OUTLINES

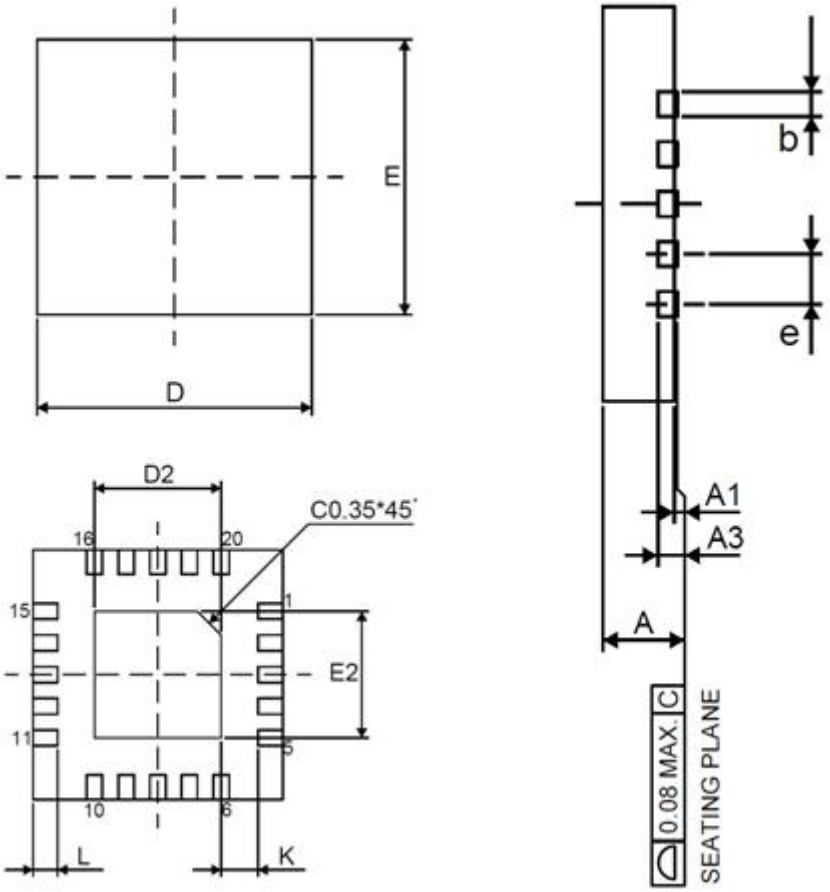
(1) TSSOP-20L-EP



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	-	-	1.20	-	-	0.047
A1	0.00	-	0.15	0.000	-	0.059
A2	0.80	1.00	1.05	0.031	0.039	0.041
b	0.19	-	0.30	0.007	-	0.012
C	0.09	-	0.20	0.004	-	0.008
D	6.40	6.50	6.60	0.252	0.256	0.260
D1	3.79	3.99	4.19	0.149	0.157	0.165
E1	4.30	4.40	4.50	0.169	0.173	0.177
E	6.4 BSC			0.252 BSC		
E2	2.60	2.80	3.00	0.102	0.110	0.118
e	0.65 BSC			0.026 BSC		
L1	1.00 BSC			0.040 BSC		
L	0.5	0.6	0.75	0.002	0.024	0.030
s	0.2	-	-	0.008	-	-
θ	0°	-	8°	0°	-	8°

1. JEDEC OUTLINE: MO-153 ACT
2. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15mm PRE SIDE
3. DIMENSION "E1" DOES NOT INCLUDE INTERLEAD FLASH AND PROTRUSIONS. INTERLEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.25mm PRE SIDE
4. DIMENSION "b" DOES NOT INCLUDE DAMBAR PROTRUSIONS. ALLOWABLE DAMBAR PROTRUSIONS SHALL BE 0.08mm TOTAL IN EXCEED OF THE "b" DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBER CONNOT BE LOCATED ON THE LOWER RADIUS OF THE FOOT. MINMUM SPACE BETWEEN PROTRUSION AND ADJACENT LEAD IS 0.07mm.

(2) QFN-20L (4*4)



Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.70	0.75	0.80	0.028	0.030	0.031
A1	0.00	0.02	0.05	0.000	0.001	0.002
A3		0.2 REF			0.008 REF	
b	0.18	0.25	0.30	0.007	0.010	0.012
D		4.00 BSC			0.157 BSC	
D2	1.90	1.95	2.05	0.075	0.077	0.081
E		4.00 BSC			0.157 BSC	
E2	1.90	1.95	2.05	0.075	0.077	0.081
e		0.5 BSC			0.02 BSC	
L1	0.3	0.4	0.5	0.012	0.016	0.02
K	0.2	-	-	0.008	-	-

1. JEDEC OUTLINE: MO-220 WGGD
2. DIMENSION "b" APPLIES TO METALLIZED TERMIAL AND IS MEASURED BETWEEN 0.15mm AND 0.30mm FROM THE TERMIAL TIP. IF THE TERMIAL HAS THE OPTIONAL RADIUS ON THE OTHER END OF THE TERMIAL, THE DIMENSION b SHOULD NOT BR MEASURED IN THAT RADIUS AREA.