

### 3-CHANNEL LED DRIVER with PWM CONTROLLER

#### Features

- Driver output: Maximum of 100mA per channel with individual external resistor setting
- Maximum driver port voltage of 17V at OFF state
- Serial-in clock frequency to 20 MHz
- Built-in data buffers for cascading clock and data
- PWM luminance control capability (refresh rate of 400+ Hz ) with an internal oscillator ( ~7 MHz )
- Selectable control modes of PWM output:
  - 8-bits luminance data and 5-bits individual color correction ( 13 bits mode)
  - 8-bits luminance data and 6-bits global brightness data ( 14 bits mode )
  - 8-bits luminance data with PWM current output
- Over temperature protection
- Under Voltage Lock-out
- PWM output polarity inversion function
- Power supply voltage: 3.3V ~ 5.0V

#### Applications

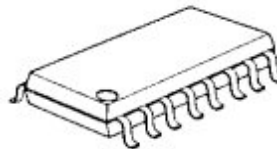
- LED Decorative Lighting
- LED General Lighting
- PWM Generator and Controller
- Flexible Indoor/Outdoor Video or Sign Displays
- LCD Display Backlighting
- Torch/Warning Signs
- Automotive or Instrument Panel Lighting

#### Description

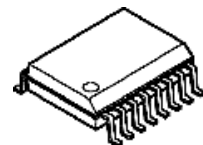
AUR6350 is a 3-channel (R, G, B) current-regulated LED driver with a high-resolution Pulse Width Modulation (PWM) luminance controller. The chip enables serial data-in and data-out interface with built-in shift registers, internal data latches and storage registers. It is designed ideally for full-color LED decorative or general lighting, signs and display applications.

The output current levels of the low dropout-voltage drivers are established by the built-in BandGap reference voltage with external resistors. One external resistor is used for each channel. Built-in internal oscillator generates a high frequency clocking signal and modulation logic to provide PWM light luminance control with three selectable operation modes. Data and clock output buffers can be used for cascading with next AUR6350. The PWM output polarity inversion function is designed for controlling other LED drivers especially in high power LED applications.

#### Package Information

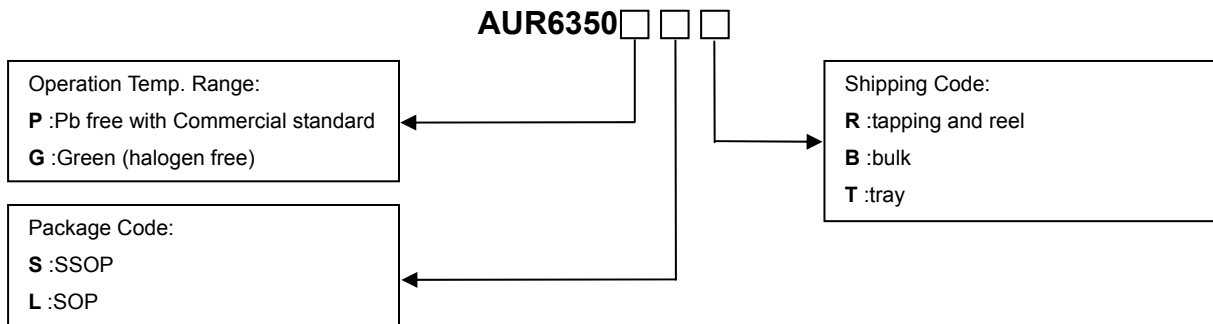


SOP16

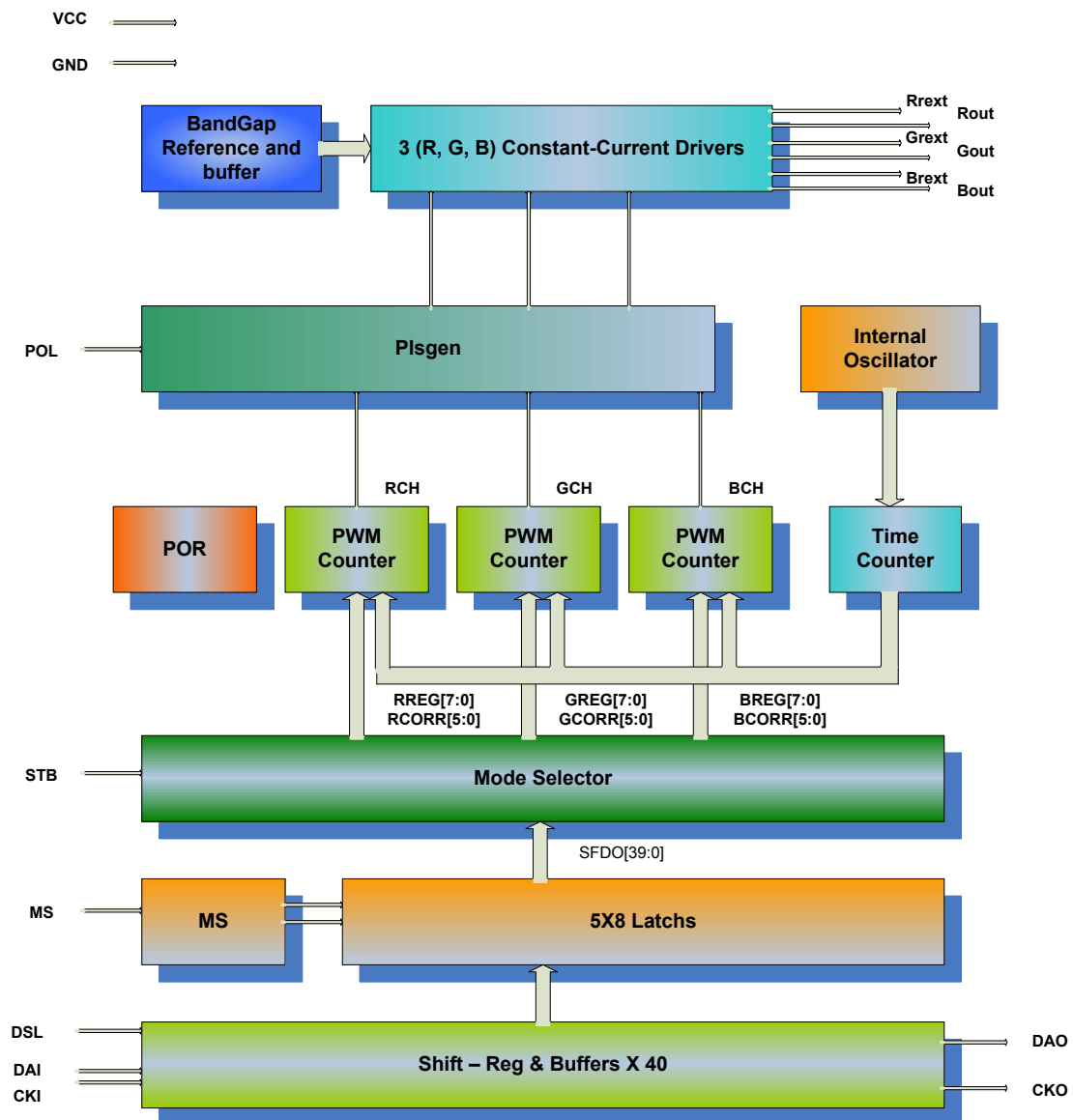


SSOP16

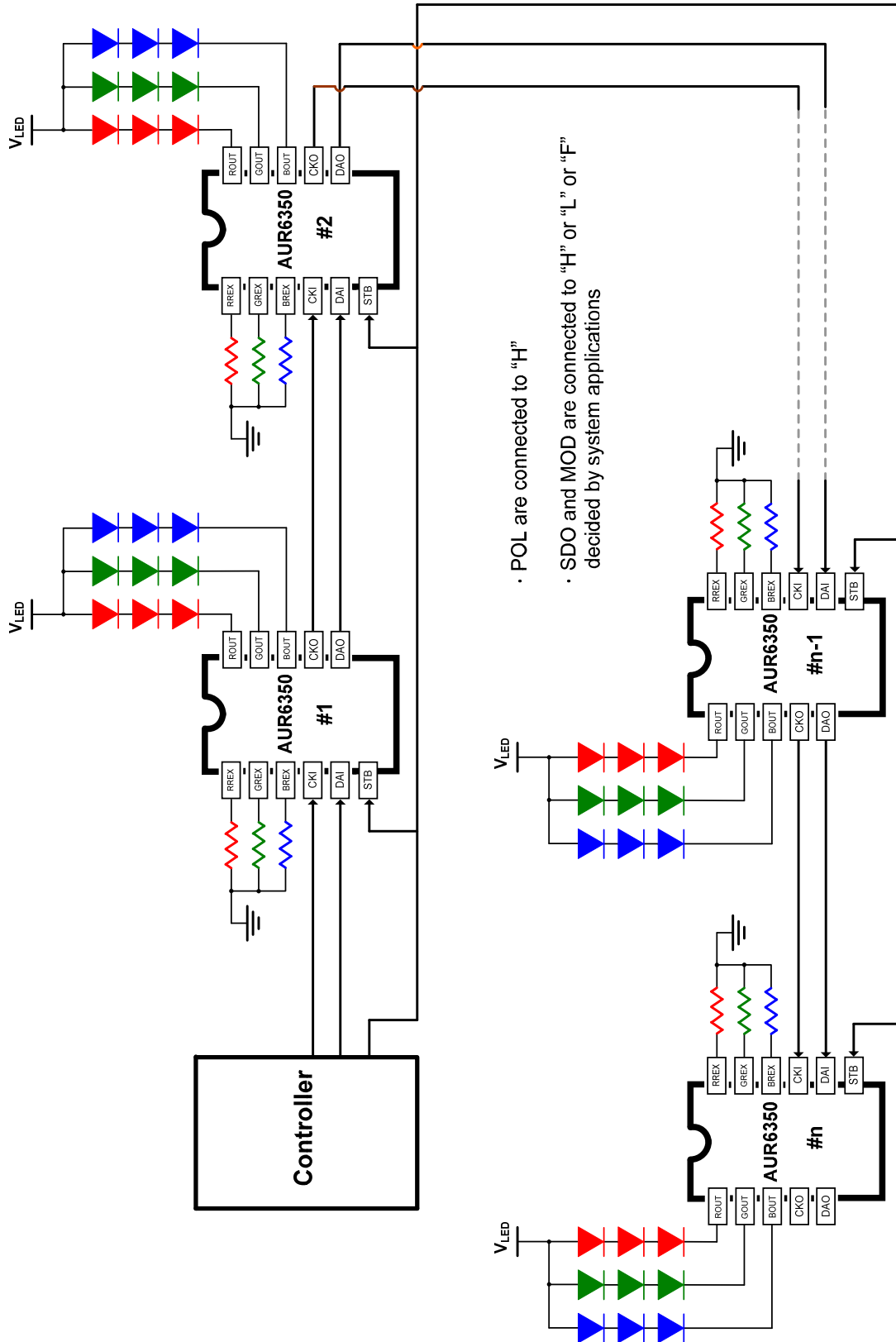
## Ordering Information



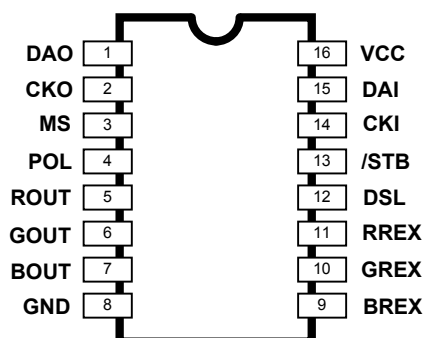
## Block Diagram



## Typical Application



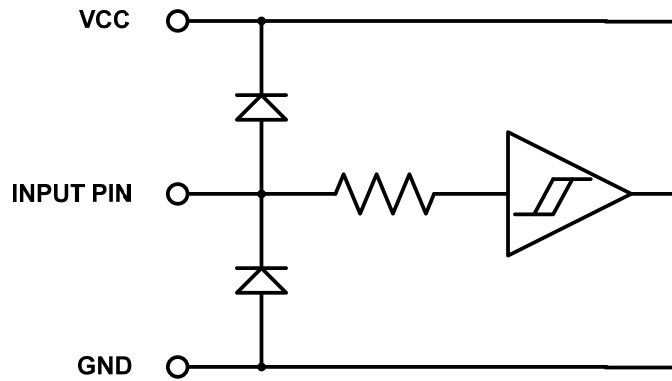
## Pin Description



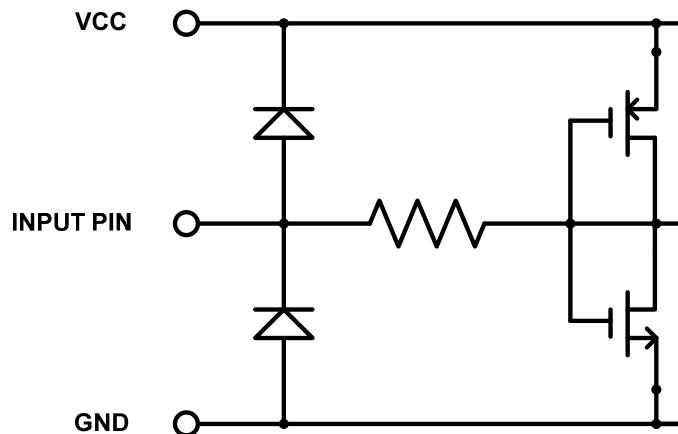
PIN No.	PIN NAME	Pin Type	FUNCTION
1	DAO	DO	Serial data output.
2	CKO	DO	Clock output signal.
3	MS	DI	Mode Selection: "H" for 13-bit / 5byte mode, "L" for 14-bit / 4byte mode, "Floating" for 8-bit / 3byte mode.
4	POL	DI	PWM current output polarity for pulse inversion: "H" for positive polarity, "L" for negative polarity.
5~7	R(G·B)OUT	AO	Open-drain driver current sink.
8	GND	GROUND	Ground Pin
9~11	R(G·B)REX	AI	Driver output current setting pins for external resistor connections between (R, G and B)REX and GND
12	DSL	DI	Serial data output selection: "H": data to be shifted out at the falling edge of CKO, "L" : data to be shifted out at the rising edge of CKO.
13	/STB	DI	Data-input strobe pulse, latches data into internal registers when /STB is low (level latch).
14	CKI	DI	Clock input pin for serial data transfer. Data is sampled at the rising edge of CKI
15	DAI	DI	Serial data input
16	VCC	POWER	Power supply voltage input

## Equivalent Circuit of Inputs and Outputs

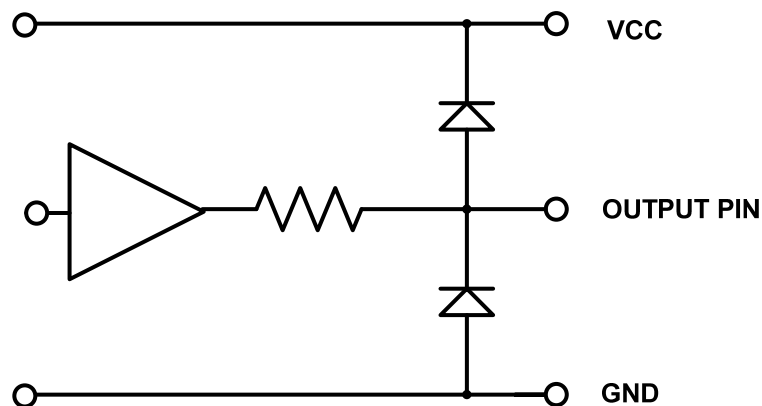
### 1. CKI, DAI, and /STB Pins



### 2. MS, DSL and POL Pins



### 3. CKO and DAO Pins



## Maximum Ratings ( Ta = 25°C , Tj(max) = 140°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Supply Voltage	VCC	- 0.3 ~ 7.0	V
Logic Input Voltage	VIN	- 0.3 ~ VCC+0.3	V
Driver Output Current	IOUT	120	mA
Driver Output Voltage	VOUT	- 0.3 ~ 17	V
Input Clock Frequency	FCKI	25	MHz
GND Pin Current	IGND	360	mA
Power Dissipation	PD	0.82 ( SSOP16 : Ta=25°C ) 0.86 ( SOP16 : Ta=25°C )	W
Thermal Resistance	Rth(j-a)	140.2 ( SSOP16 ) 133.7 ( SOP16 )	°C/W
Operating Temperature	Top	- 40 ~ 85	°C
Storage Temperature	Tstg	- 55 ~ 150	°C

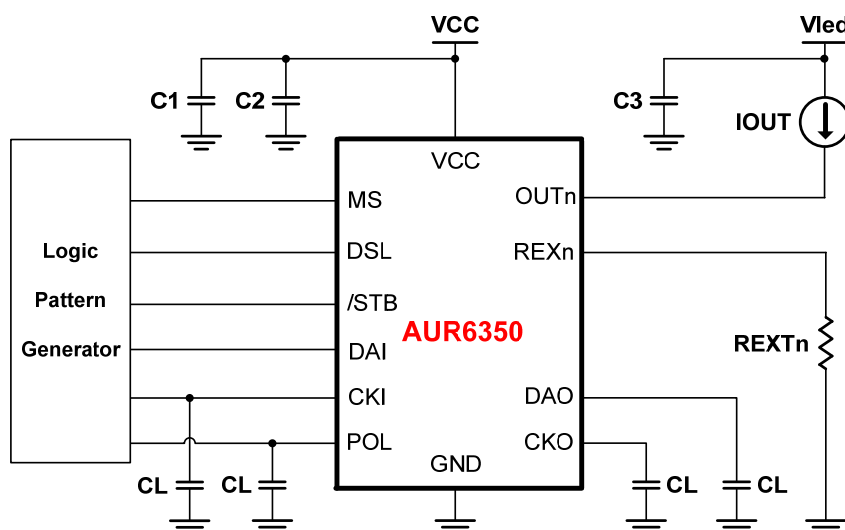
## Recommended Operating Condition

CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Supply Voltage	VCC		3.0	5.0	5.5	V
Driver Output Voltage	VOUT	Driver ON (IOUT = 100mA) (see dropout voltage diagram)	1.0			V
		Driver Off			17	
Output Current	IOUT	(Driver) OUT (R, G, B)	5		100	mA
	IOH	(Logic) SERIAL-OUT			2	
	IOL				-2	
Logic Input Voltage	VIH	VCC = 3.0V ~ 5.5V	0.8VCC		VCC	V
	VIL		GND		0.2VCC	
Input Clock Frequency	FCKI	Single Chip Operation	0		20	MHz
STB Pulse Width	twSTB	VCC = 3.0V ~ 5.5V	20			ns
CKI Pulse Width	twCLK		20			
POL Pulse Width	twPOL		100			
Set-up Time of DAI	tsetup(D)		25			
Hold Time of DAI	tthold(D)		25			
Set-up Time for STB	tsetup(L)		20			
Internal Oscillator Frequency	FOSC		Ta = 25°C VCC = 3.0V ~ 5.5V	5.5	7.0	

## Electrical Characteristics (VCC = 5.0V, Ta = 25°C, Tj(max) = 140°C)

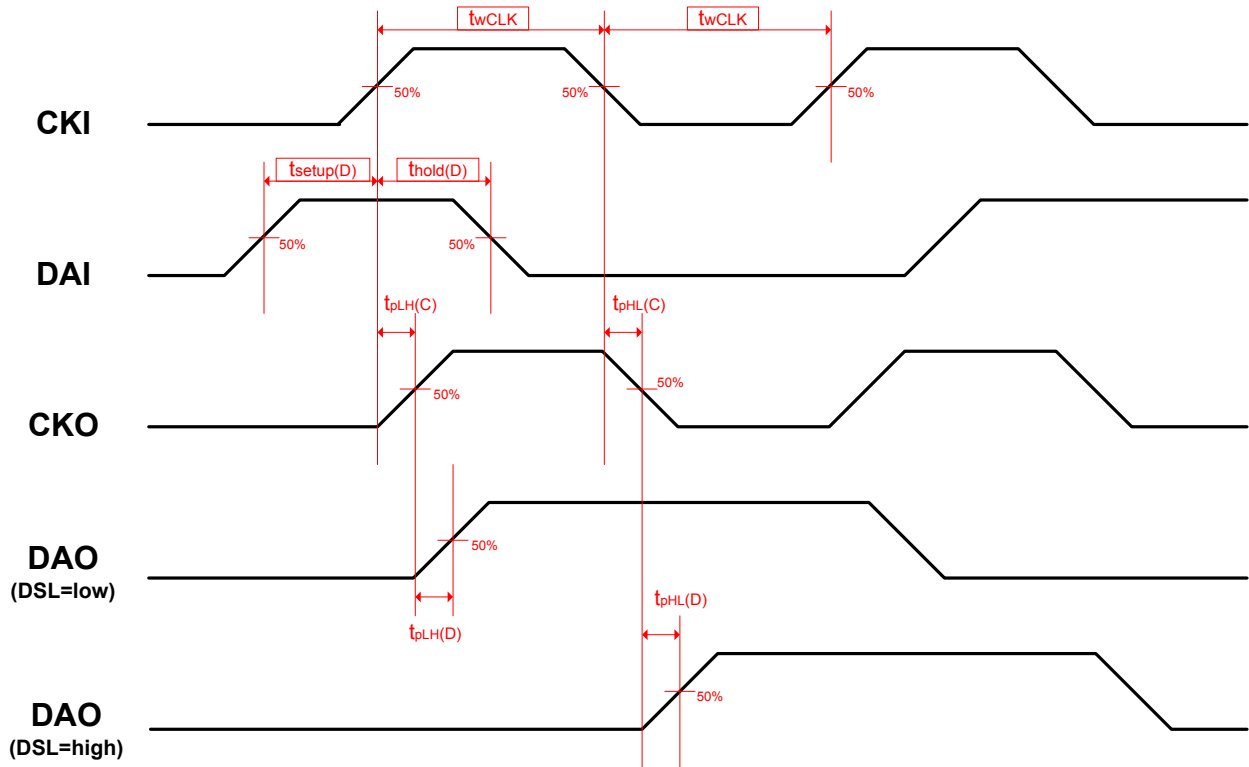
CHARACTERISTIC	SYMBOL	CONDITION	MIN.	TYP.	MAX.	UNIT
Logic Input Voltage 'H' Level	VIH	CMOS	0.8VCC		VCC	V
Logic Input Voltage 'L' Level	VIL	logic level	GND		0.2VCC	
Driver Output Leakage Current	IOL	VOH = 17V			1.0	μA
Logic Output Voltage (S-OUT)	VOL	IOL = 2mA			0.2	V
	VOH	IOH = -2mA	VCC-0.2			
Driver Output Current Skew (Channel to Channel)	IOL1	VOUT = 1.0V REX = 120Ω			±3	%
Driver Output Current Skew (Chip to Chip)	IOL2				±6	%
Driver Current vs. Output Voltage Regulation	% / VOUT	REX = 120Ω VOUT = 1V~3V		0.1	0.5	% / V
Driver Current vs. Supply Voltage Regulation	% / VCC	REX = 120Ω VCC = 3.0V~5.5V			2	
Thermal Shutdown	Tsd		140		160	°C
Supply Current (Analog Portion)	IDD_A	VOUT = 1.0V REXn = 120Ω Driver ON all DI pins are low		1.5		mA
Supply Current (Digital Portion)	IDD_D	CKI = 20MHz DAI = 10MHz		1.5		mA

## Test Diagram

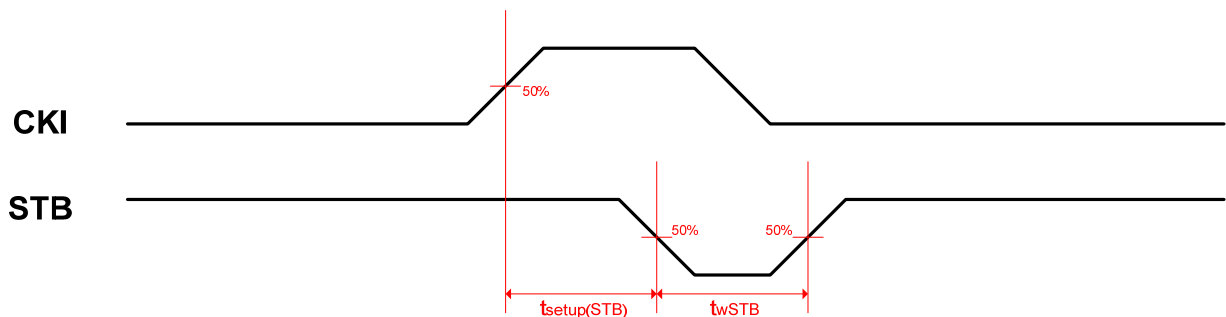


## I/O Timing Diagrams:

### a) Timing of CKI, DAI, CKO and DAO



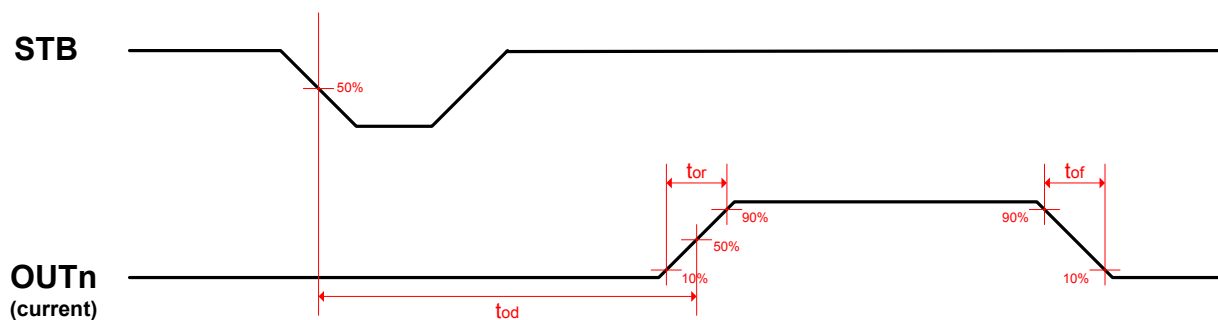
### b) Timing of CKI and STB



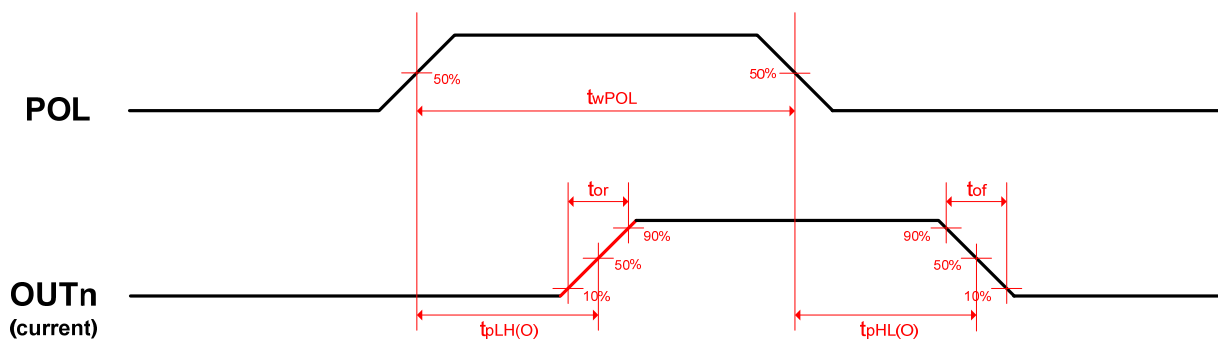


## I/O Timing Diagrams:

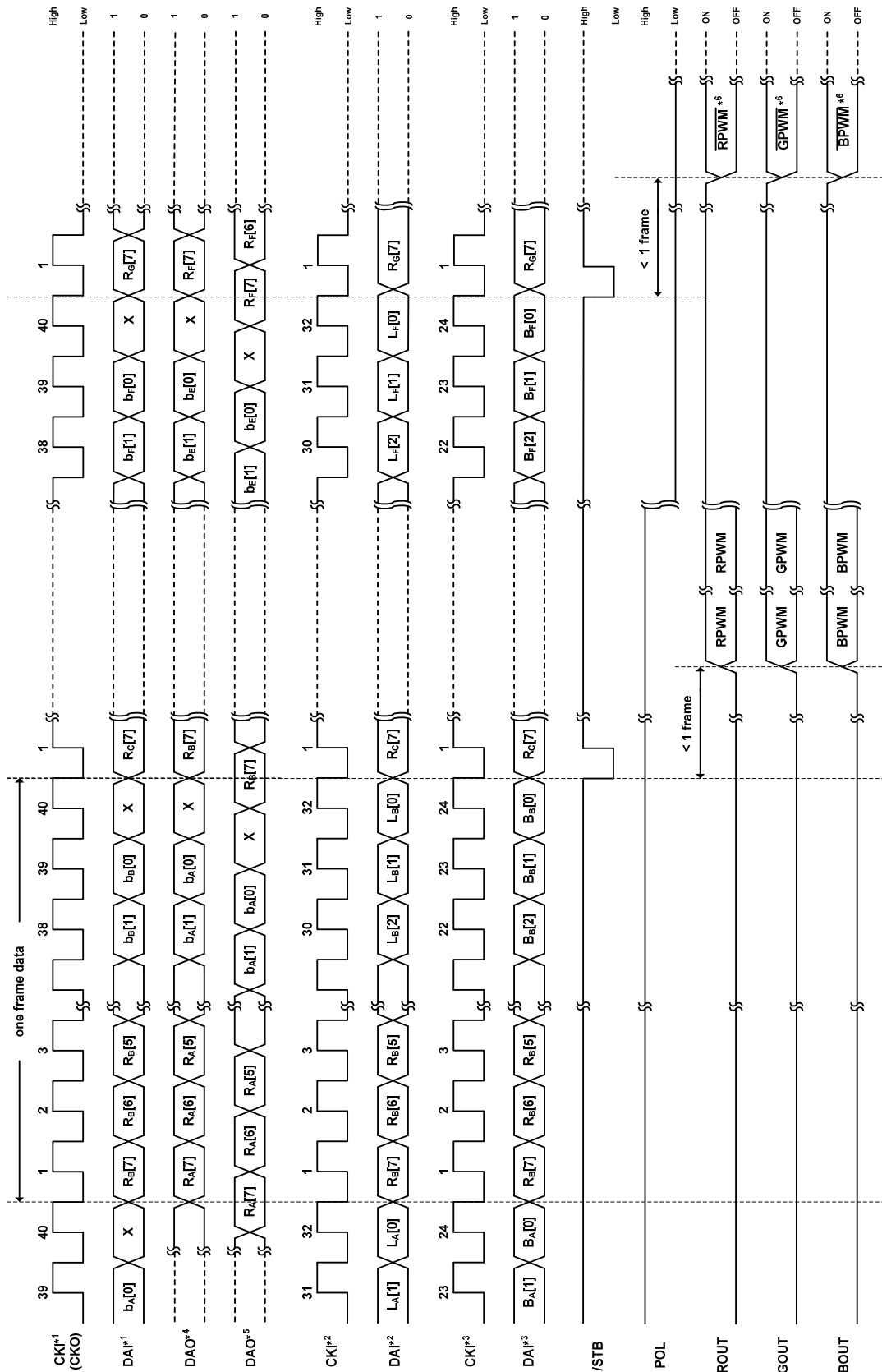
### c) Timing of STB and OUT



### d) Timing of POL and OUT

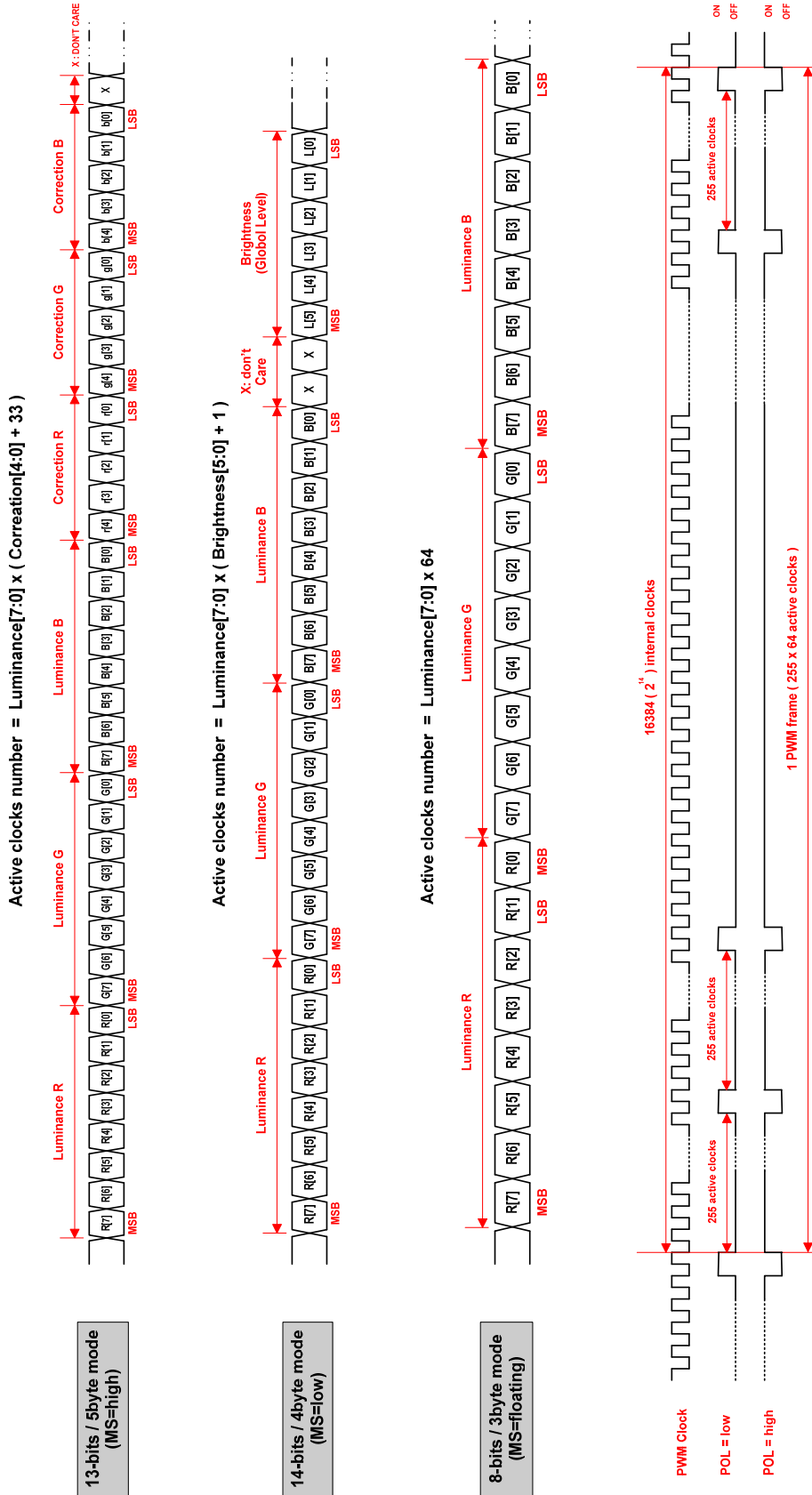


## Data Timing Diagrams:



\*<sup>1</sup> 13-bits/5 byte mode (MS = high).  
 \*<sup>2</sup> 14-bits/4 byte mode (MS = low).  
 \*<sup>3</sup> 8-bits/3 byte mode (MS = floating).  
 \*<sup>4</sup> DSL = high  
 \*<sup>5</sup> DSL = low  
 \*<sup>6</sup>  $\overline{\text{PWM}}$  means the inverse waveform of PWM.

## Data Frames and Format:

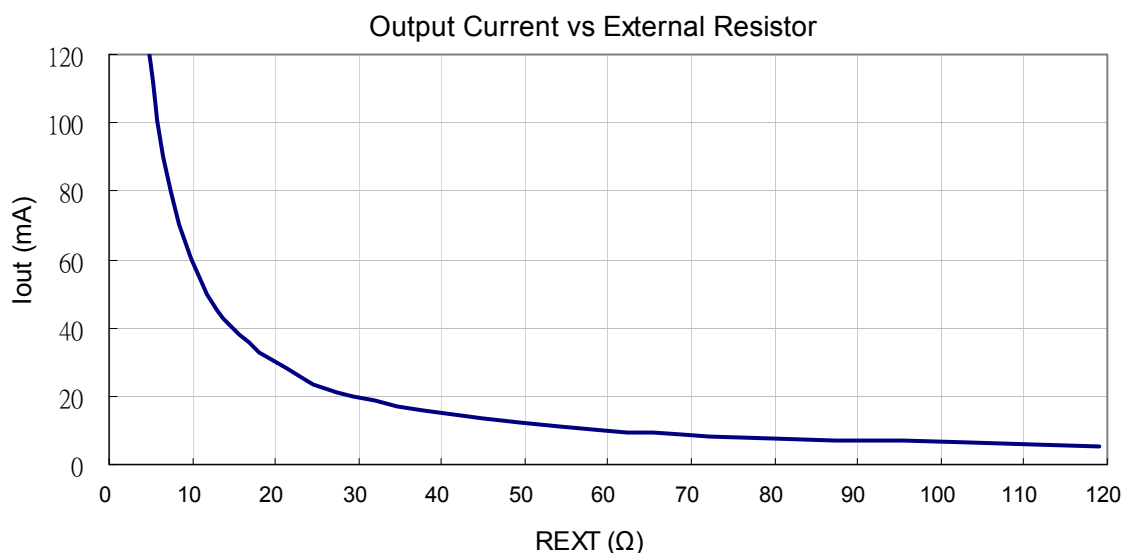


Examples for the maximum active clocks : (Luminance[1,1,1,1,1,1,1,1] X Brightness[1,1,1,1,1,1])

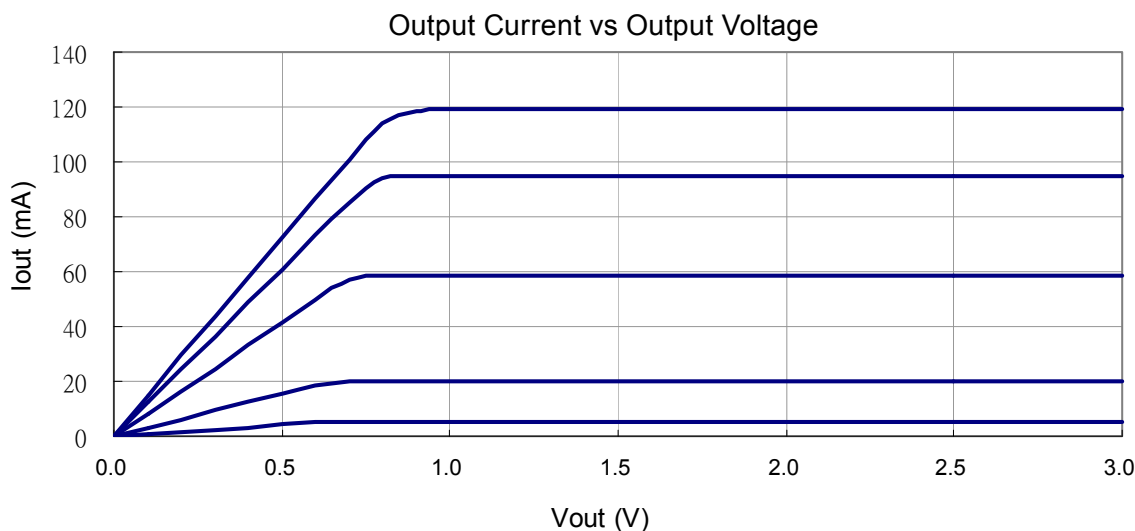
## Output Current and Drop-Out Voltage:

The output current level of individual driver is established by an external resistor REX for each channel. The output range of each driver is designed from 5mA to 100mA according to the equation below. It is recommended the voltage at driver output ports should be as low as possible for consideration of power dissipation and constant current operations. If operating driver over working temperature, AUR6350 will go into shutdown mode automatically and recover to normal mode until the junction temperature is lower than 140°C. A characteristic curve of output current levels vs. setting resistor values is displayed in the following diagram.

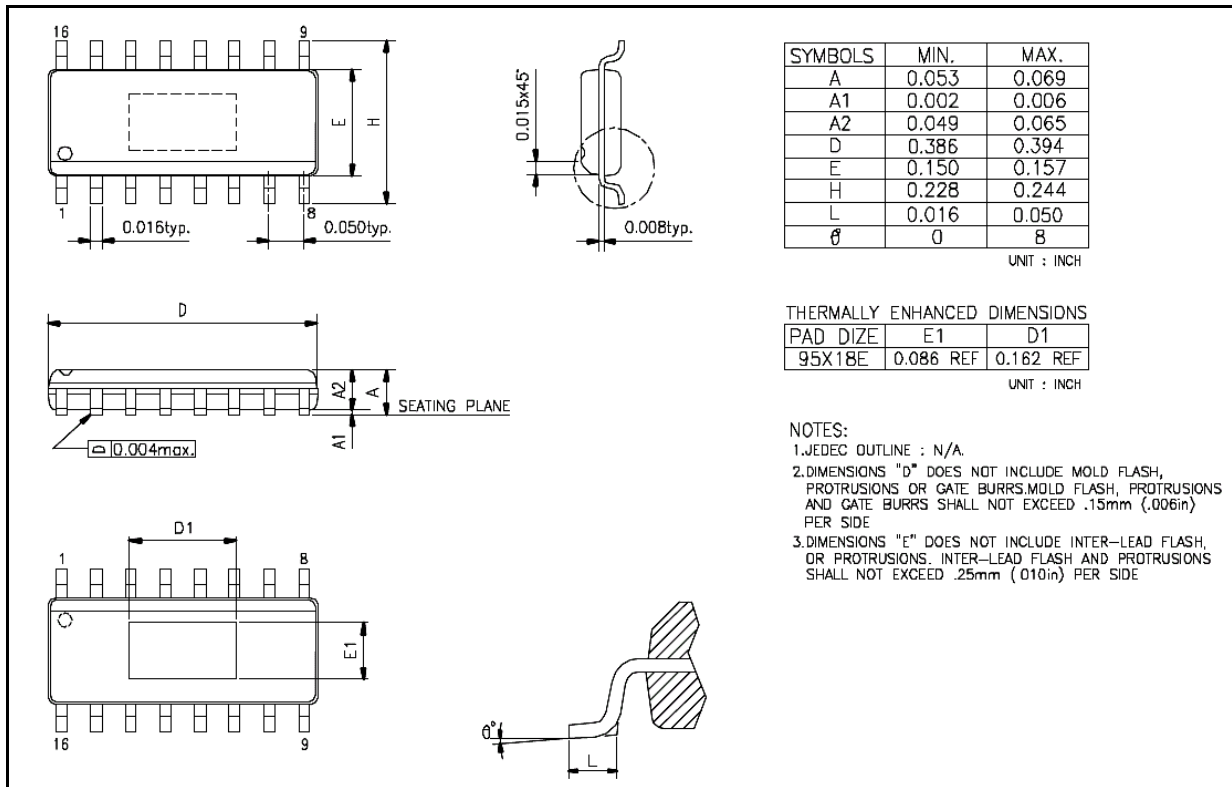
$$I_{out} (A) = 0.6 V / REX \Omega$$



The output current is kept constant for driving multiple LEDs in series with each driver before reaching the dropout voltage limits. LEDs with various forward voltages ( $V_F$ ) can be used within usable voltage headroom. Typical output current characteristic of an output driver is shown below for illustrating driver dropout voltage vs. output current level.



## © AUR6350 Package Specification – SOP16 Outline Drawing



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