DESCRIPTION

AD5026 is a 16-channel, constant current sink LED driver. It contains High-precision current-drive circuit, 16-bit shift register, Latch and temperature compensation circuit.

AD5026 provides users with great flexibility and device performance in their system design for LED display applications, e.g. LED panels.

AD5026 have the ability of the anti-static technology and anti-jamming technology. It can make chip data transmission more stable and work more reliable. Chip antistatic ability up to more than 4KV.

The AD5026 is available in SSOP24(0.635/1.0) & QFN24 (4X4) Packages.

APPLICATION

- Outdoor LED Video Display
- Indoor LED Video Display
- Message Signs

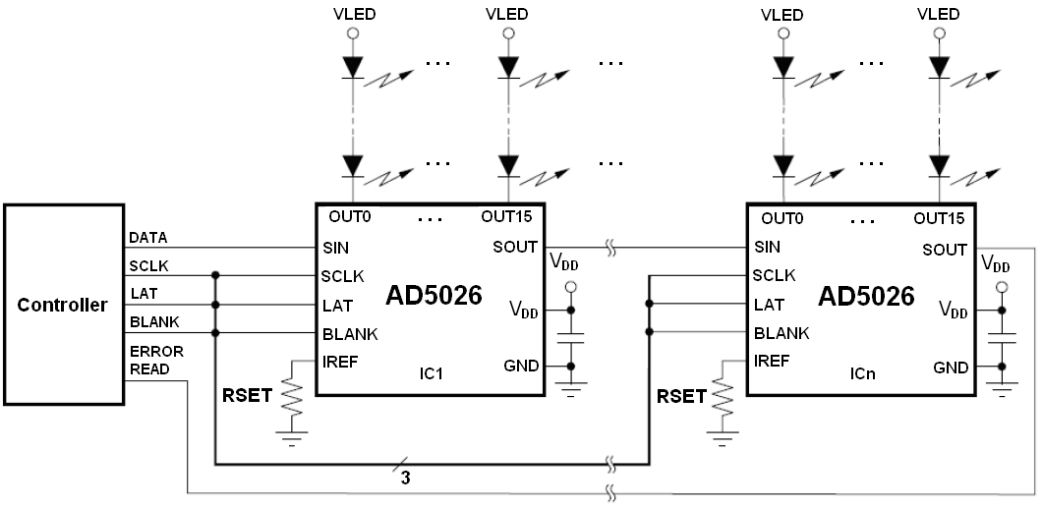
TYPICAL APPLICATION

FEATURES

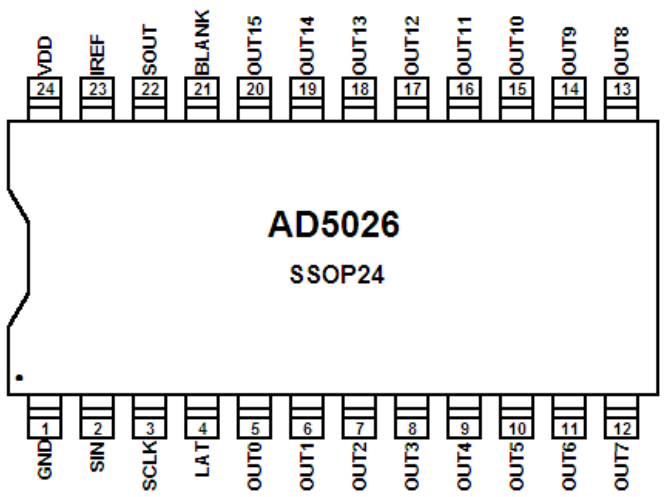
- Output constant current: 2~90mA
- V_{DS} ≧ 300mV (I_{OUT}=20mA)
- Red light min input voltage: 2.3~2.5V
- Blue & Green light min input voltage: 3.6~3.8V
- Constant Current Accuracy:
  Channel-to-Channel<±2%
  Device-to-Device<±3%
- 25MHz clock frequency
- Operating voltage range: 3.3V~5V
- Anti-static damage ability : > 4KV
- Operating Temperature Range: -40℃ ~ +85℃
- Available in SSOP24 (0.635/1.0) & QFN24 (4X4) Packages.

ORDERING INFORMATION

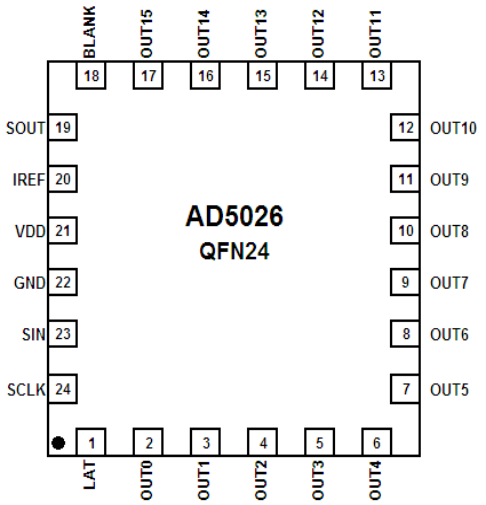
Package Type	Part Number	
SSOP24	MX24	AD5026MX24R-Z
		AD5026MX24VR-Z
QFN24	Q24	AD5026Q24R
		AD5026Q24VR
Note	V: Halogen free Package R: Tape & Reel Z: Dimension Selection A type: 0.635 B type: 1.0 See package information	
AiT provides all RoHS products Suffix " V" means Halogen free Package		



PIN DESCTIPTION



Top View



Top View

Pin #		Symbol	Function
SSOP24	QFN24		
4	1	LAT	Data Strobe Input Pin
5	2	OUT0	Output Port
6	3	OUT1	Output Port
7	4	OUT2	Output Port
8	5	OUT3	Output Port
9	6	OUT4	Output Port
10	7	OUT5	Output Port
11	8	OUT6	Output Port
12	9	OUT7	Output Port
13	10	OUT8	Output Port
14	11	OUT9	Output Port
15	12	OUT10	Output Port
16	13	OUT11	Output Port
17	14	OUT12	Output Port
18	15	OUT13	Output Port
19	16	OUT14	Output Port
20	17	OUT15	Output Port
21	18	BLANK	Output Enable
22	19	SOUT	Shift Register Data Output Pin
23	20	IREF	External Resistor Input Port
24	21	VDD	Power Supply
1	22	GND	GND
2	23	SIN	Shift Register Data Input Pin
3	24	SCLK	Shift Register Clock Input Pin

ABSOLUTE MAXIMUM RATINGS

V_{DD}, Supply Voltage	7V
V_{OUT}, Output Voltage	-0.5~10V
I_{OUT}, Output Current	90mA
V_{IN}, Input Voltage	-0.4~V_{DD}+0.4V
F_{CLK}, Clock Frequency	25MHz
I_{GND}, GND Current	1500mA
T_{STG}, Storage Temperature Range	-65~+150°C
T_{OPR}, Operating Temperature Range	-40~+85°C
V_{ESD}, ESD Voltage	4000V

Stresses above may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated in the Electrical Characteristics are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

V_{DD}=5V, T_A=25°C, unless otherwise specified.

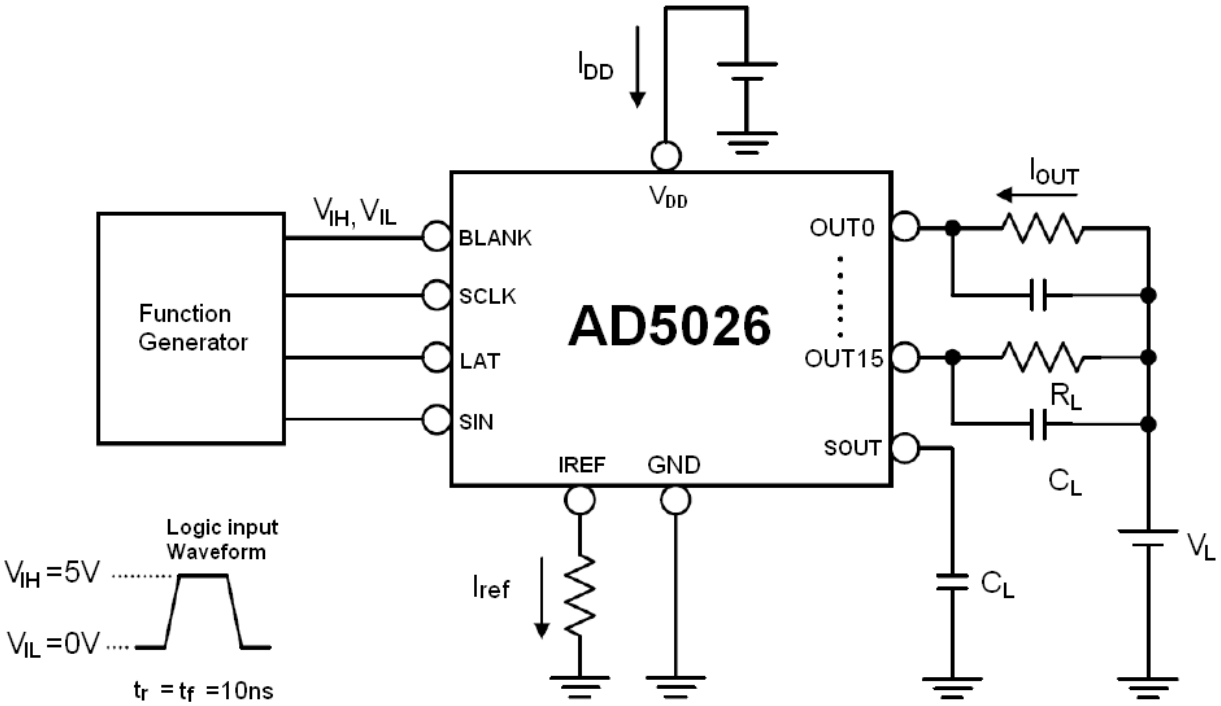
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
High-level output current	I_{OH}		-	-	1	uA
Low-level output Voltage	V_{OL}	I_{OL} = 1mA	-	-	0.3	V
High-level output Voltage	V_{OH}	I_{OH}= -1mA	3	-	-	V
Low-level Output Current	I_{OL1}	Vo ≥0.4V, RSET = 490Ω	-	36	-	mA
	I_{OL2}	Vo ≥0.32V, RSET = 245Ω	-	72	-	
Current Skew	B2B	V_{DS}=800mV, RSET = 490Ω	-	±2		%
		V_{DS}= 300mV, RSET = 490Ω	-	±3		
Pull-up Resistor	$R_{IN(up)}$	EN Pin	-	250	-	KΩ
Pull-down Resistor	$R_{IN(down)}$	LATCH PIn	-	250	-	KΩ
Supply Current (“OFF”)	I_{DD}(OFF) 1	RSET=OPEN OUT 0 to 15 = OFF	-	1.2	-	mA
	I_{DD}(OFF) 2	RSET = 490Ω OUT 0 to 15 = OFF	-	8	-	mA
	I_{DD}(OFF) 3	RSET = 245Ω OUT 0 to 15 = OFF	-	15	-	mA
Supply Current (“ON”)	I_{DD}(ON) 1	RSET = 490Ω OUT 0 to 15 = ON	-	8	-	mA
	I_{DD}(ON) 2	RSET = 245Ω OUT 0 to 15 = ON	-	15	-	mA

AC CHARACTERISTICS

V_{DD}=5V, T_A=25°C, unless otherwise specified.

Parameter		Symbol	Conditions	Min	Typ	Max	Unit
Supply Voltage		V_{DD}		3.3	4.2	5.0	V
Output Voltage		V_O		-	-	10	V
Output Current		I_O		2	-	90	mA
		I_{OH}	S_{OUT}=V_{DD}	-	-	-1	mA
		I_{OL}	S_{OUT}=0	-	-	1	
Input Voltage (“H” Level)		V_{IH}		0.7V_{DD}	-	V_{DD}+0.3	V
Input Voltage (“L” Level)		V_{IL}		-0.3	-	0.3V_{DD}	V
Pulse Width	LAT	tw(L)	V_{DD}=3.3 to 5V	20	-	-	ns
	CLK	tw(CLK)		20	-	-	
	ENB	tw(ENB)		50	-	-	
Setup Time for DATA		tsu(D)		5	-	-	ns
Hold Time for DATA		th(D)		10	-	-	ns
Setup Time for LAT		tsu(L)		5	-	-	ns
Hold Time for LAT		th(L)		5	-	-	ns
Clock Frequency		F_{CLK}	Cascade Operation	-	-	25	MHz

AC CHARACTERISTICS TEST CIRCUIT

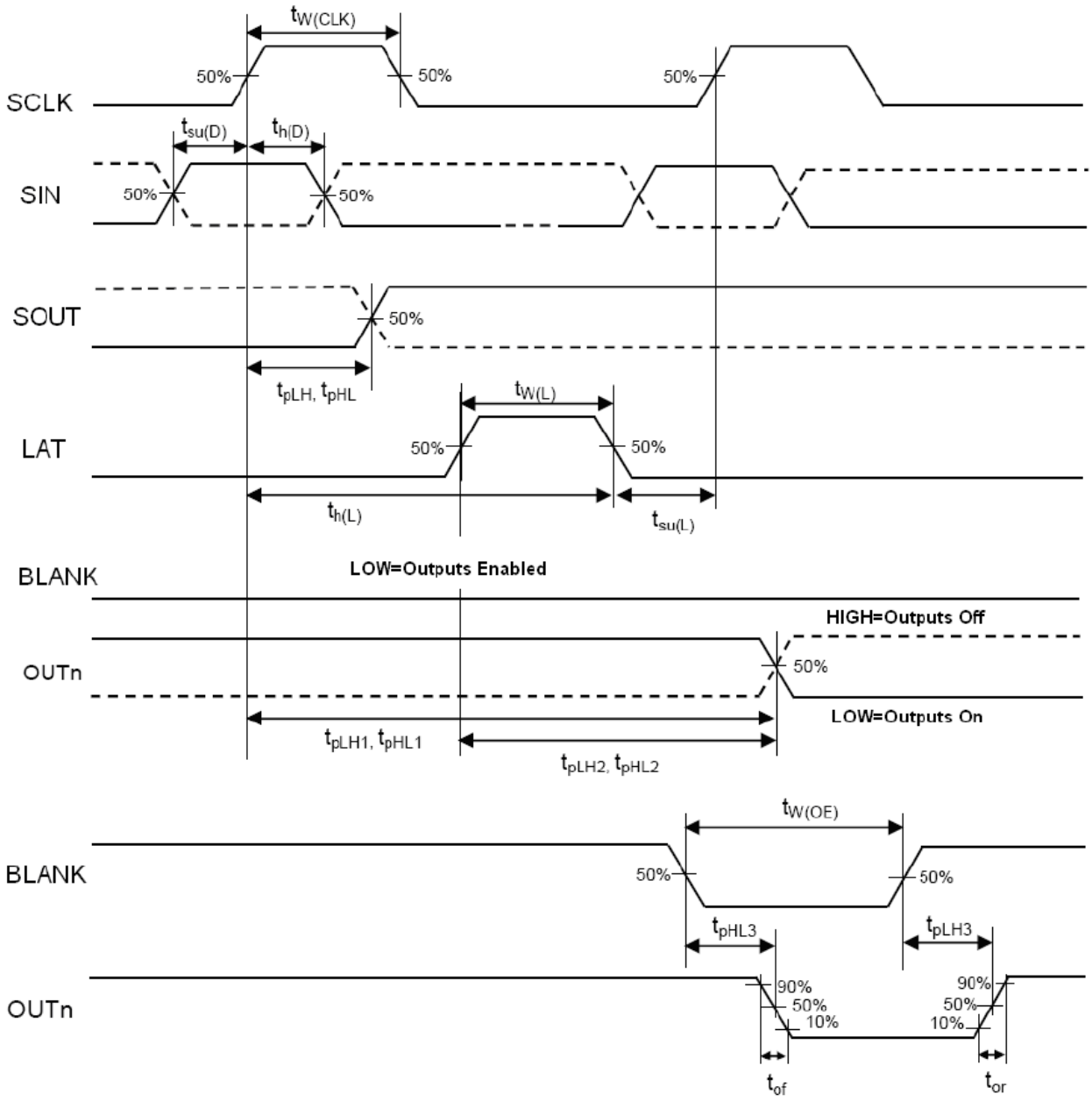


DETAILED INFORMATION

Switching Characteristics

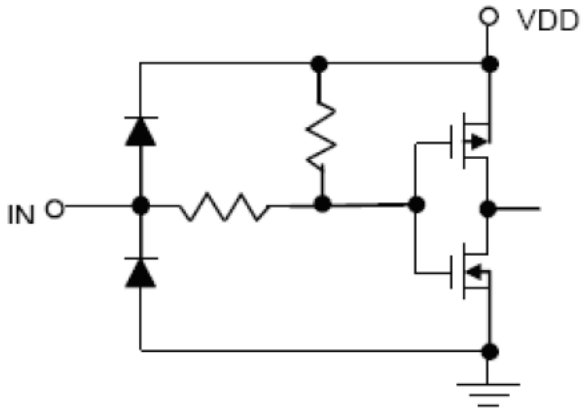
Parameter	Symbol		Conditions	Min	Typ.	Max	Unit
Propagation Delay Time (“L” to “H”)	t_{PLH1}	SCLK to OUTn	V_{DD}=5V V_{IH}=V_{DD} V_{IL}=GND C_L=10pF Io=40mA V_L=4V RSET=450Ω R_L=75Ω		67		ns
	t_{PLH2}	LAT to OUTn			64		ns
	t_{PLH3}	ENB to OUTn			64		ns
Delay Time	t_{PLH}	SCLK to SOUT			5		ns
Propagation Delay Time (“H” to “L”)	t_{PLH1}	SCLK to OUTn			5		ns
	t_{PLH2}	LAT to OUTn			4		ns
	t_{PLH3}	ENB to OUTn			4		ns
Delay Time	t_{PLH}	SCLK to SOUT			5		ns
Output Rise Time of V_{OUT}	t_{or}				84		ns
Output Fall Time of V_{OUT}	t_{of}				3		ns

Timing Wave Form

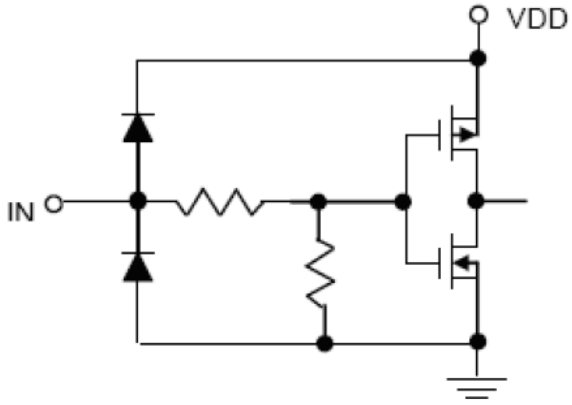


Pin Equivalent Input and Output Schematic Diagrams

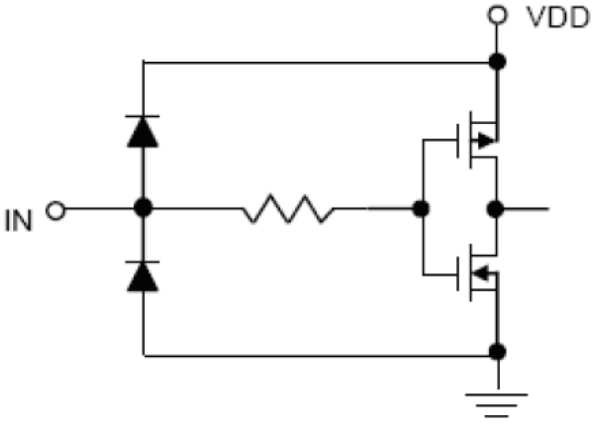
Blank Input



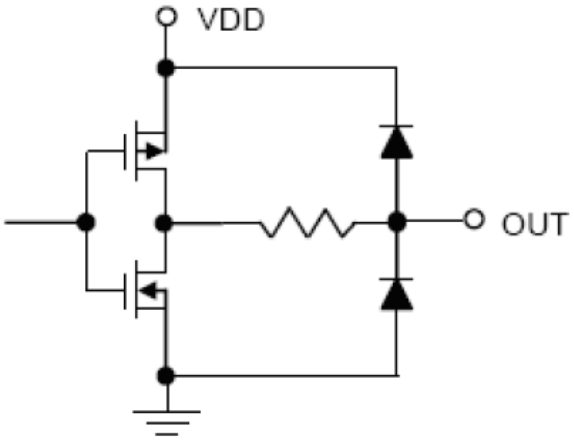
LAT Input



SCLK, SIN Input



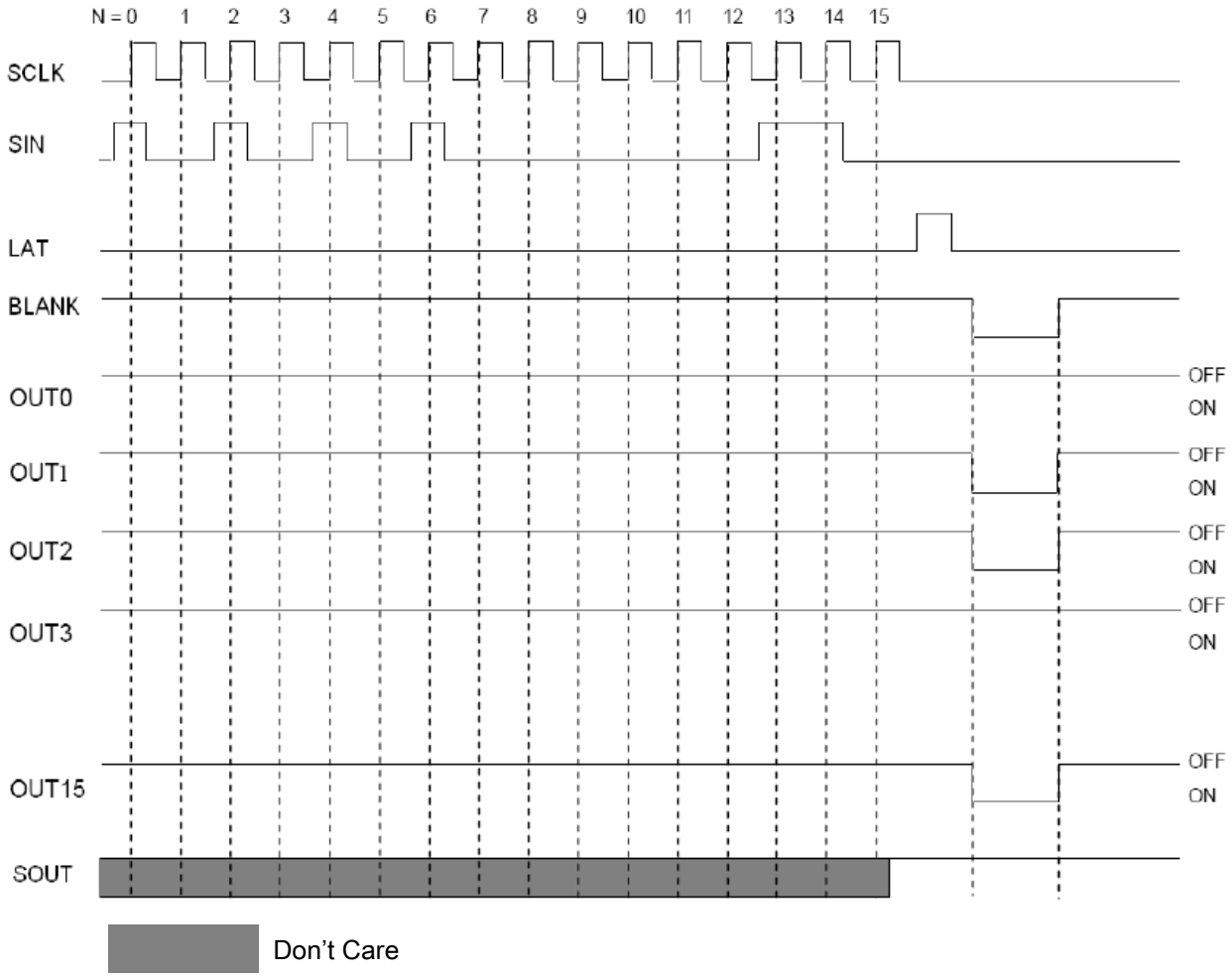
SOUT Output



Description:

1. When the LAT is “low”, the latch circuit latches the data.
2. When the LAT is “high”, the latch circuit does not latch data, the data transmitted directly from the input to the output.
3. When BLANK is “low”, the output of the data to respond to high-low.
4. When BLANK is “high”, the output terminal closed.

Timing Diagram



Truth Table

SCLK	LAT	BLANK	SIN	OUT0…OUT7…OUT15	SOUT
↑	H	L	D_N	$\overline{D_N}$ … $\overline{D_{N-7}}$ … $\overline{D_{N-15}}$ …	D_{N-15}
↑	L	L	D_{N+1}	No Change	D_{N-14}
↑	H	L	D_{N+2}	$\overline{D_N}$ … $\overline{D_{N-5}}$ … $\overline{D_{N-13}}$ …	D_{N-13}
↓	X	L	D_{N+3}	$\overline{D_N}$ … $\overline{D_{N-5}}$ … $\overline{D_{N-13}}$ …	D_{N-13}
↓	X	H	D_{N+3}	Off	D_{N-13}

Note: When Dn = "H", OUT0 to OUT15 = ON; When Dn = "L", OUT0 to OUT15 = OFF

Constant Current

The AD5026 uses a high-precision constant current driver circuit and temperature compensation circuitry. To ensure the chip at different temperature conditions, different working voltage and the use of harsh environment, the bit output current I_{OUT} constant good results.

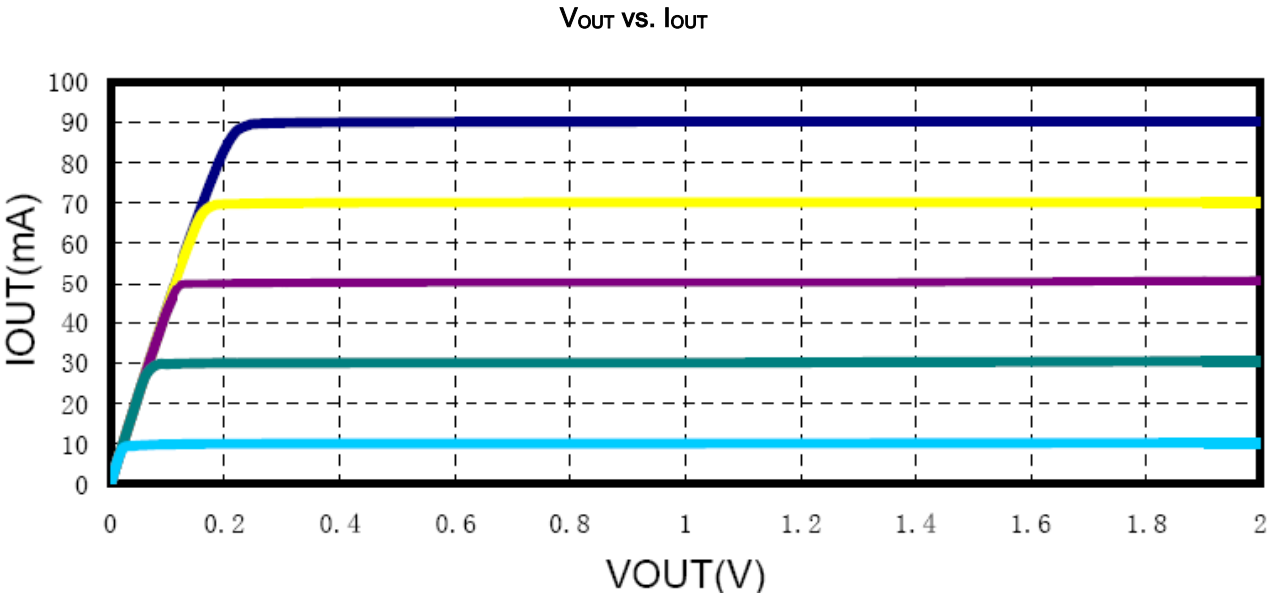


Figure 1 Constant-current characteristic curves

From the figure we can see, when to meet the constant-current conditions, AD5026 constant-current driver output stage voltage drop is very low. For example, when the output drive current I_{OUT} = 10 mA, V_{OUT} is about 30 mV. The unique ultra-low pressure drop characteristics, allowing AD5026 work below 3.3V

Adjusting Output Current

The output current of each channel (I_{OUT}) is set by an external resistor, RSET. The relationship between I_{OUT} and RSET is shown in the following:

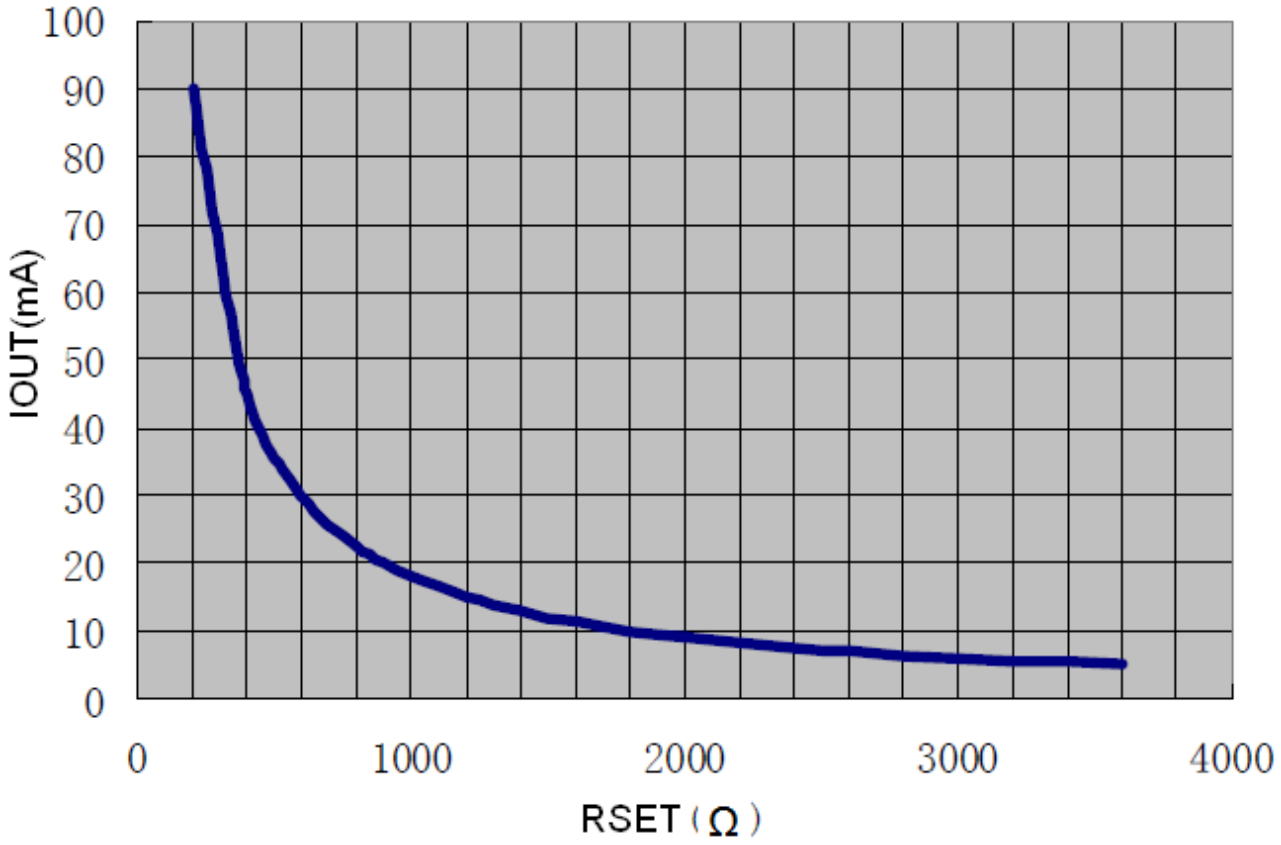
$$I_{OUT}(mA)=18\times1000/RSET$$

When the AD5026 for the LED Marquee, the bit output current I_{OUT} is the LED operating current I_{LED} Marquee operating current I_{LED} is the type of LED Marquee determined.

Common AD5026 bit output current I_{OUT} and external resistor RSET corresponding data are as follows:

I_{OUT}(mA)	30	25	20	15	10	5	3
RSET(Ω)	600	720	900	1200	1800	3600	6000

AD5026 Resistance of the External Resistor, RSET, in Ω



Package Power Dissipation (P_D)

PD with the temperature rise rate of rise as below:

	TA < +25℃	TA < +70℃	TA < +85℃
SSOP24-0.635	1667mW	1067mW	867mW
SSOP24-1.0	2016mW	1290mW	1048mW
QFN24	2907mW	1860mW	1512mW

The package thermal resistance is calculated by JESD51-5

Calculation of thermal resistance:

SSOP24-0.635

$$\begin{aligned} Rth\ (j\text{-}a) &= Rth\ (j\text{-}c) + Rth\ (c\text{-}a) \\ &= 55℃/W + 20℃/W \\ &= 75\ \ ℃/W \end{aligned}$$

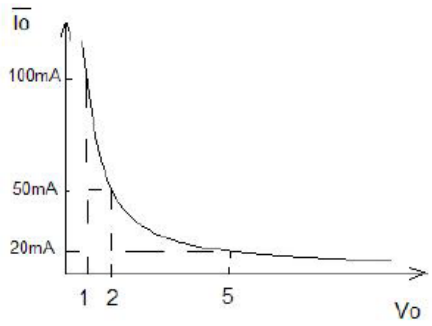
Note: The thermal resistance of the package Rth (j-a) consists of two parts, Rth (j-c) is PN junction to the thermal resistance of the shell and tube. Rth(c-a) is shell and tube to the outdoor air thermal resistance.

EX: When V_{DD}=5V, I_{OUT}=20mA, P_D = 5* 9 = 45mW

$$P_{DMAX} = \frac{Tj - Ta}{Rthj - a} = \frac{150 - 25}{75} = 1.667W$$

$$\overline{Io} = \frac{Pd\max - Pd}{Vo * 16} = \frac{1.622}{16 * Vo} \approx \frac{0.1}{Vo}$$

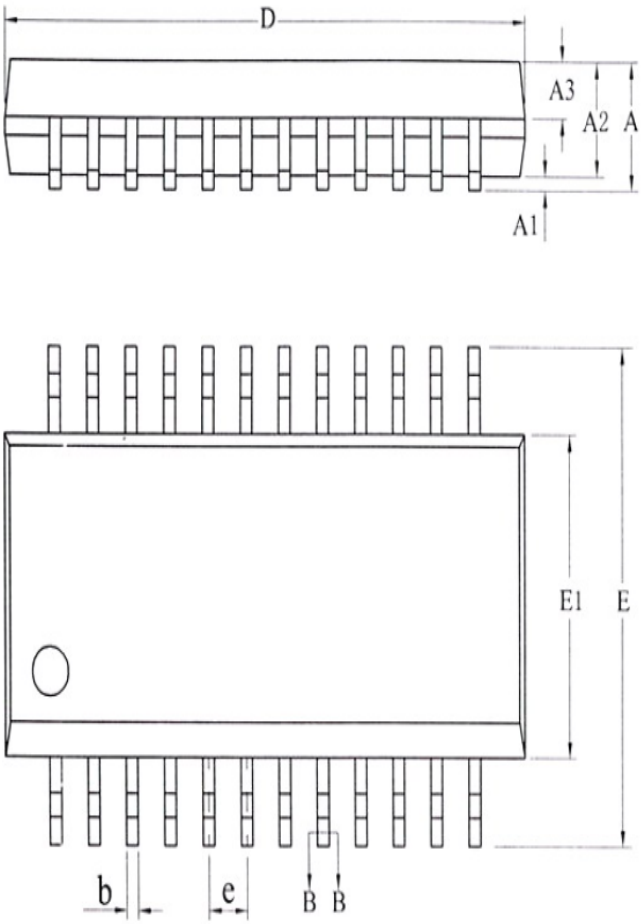
If blue light voltage is 3V, V_O is about 2V, $\overline{Io}$ is 50mA.



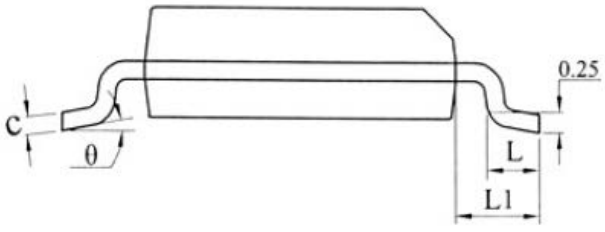
V_O and $\overline{Io}$ curve

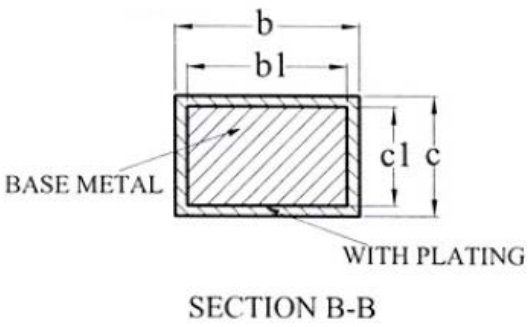
PACKAGE INFORMATION

Dimension in SSOP24 – Type A (0.635) Package (Unit: mm)

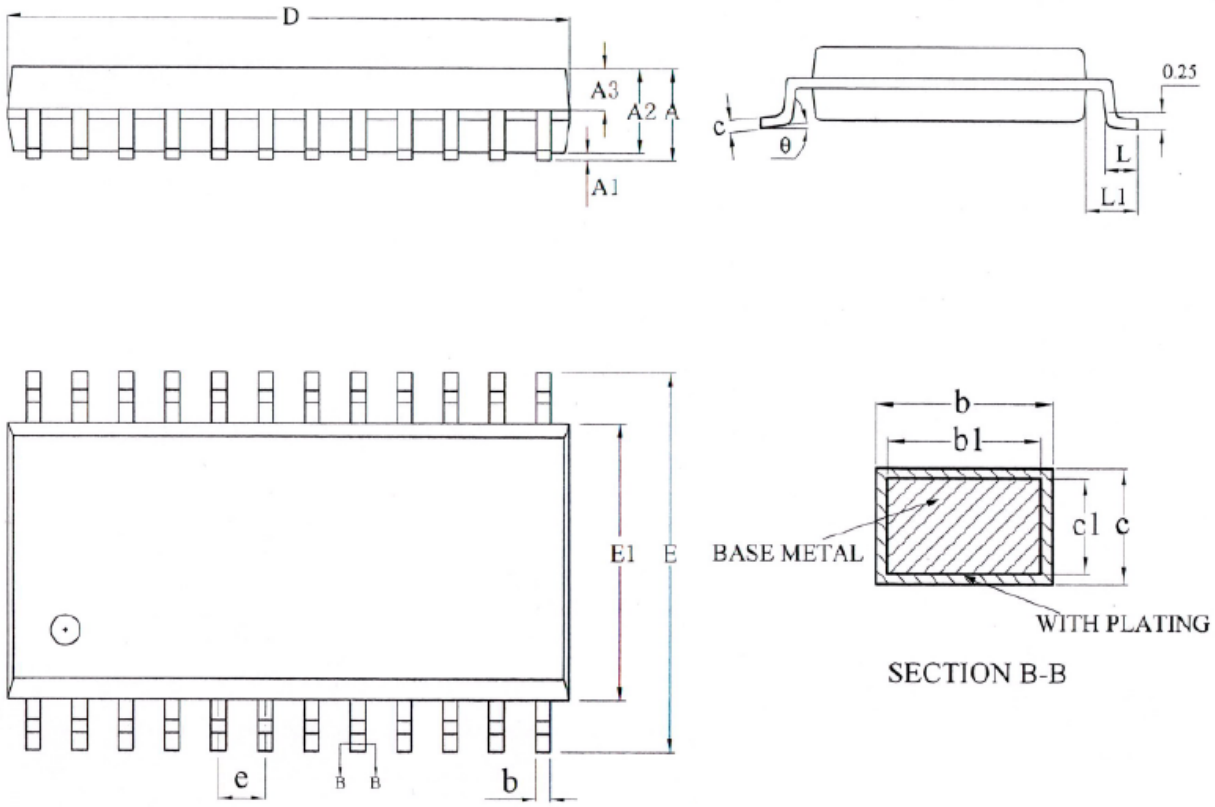


Symbol	Min	Nom	Max
A	-	-	1.77
A1	0.08	0.18	0.28
A2	1.20	1.40	1.60
A3	0.55	0.65	0.75
b	0.23	-	0.33
b1	0.22	0.25	0.28
c	0.21	-	0.26
c1	0.19	0.20	0.21
D	8.45	8.65	8.85
E	5.80	6.00	6.20
E1	3.70	3.90	4.10
e	0.635BSC		
L	0.50	0.65	0.80
L1	1.05BSC		
θ	0	-	8°



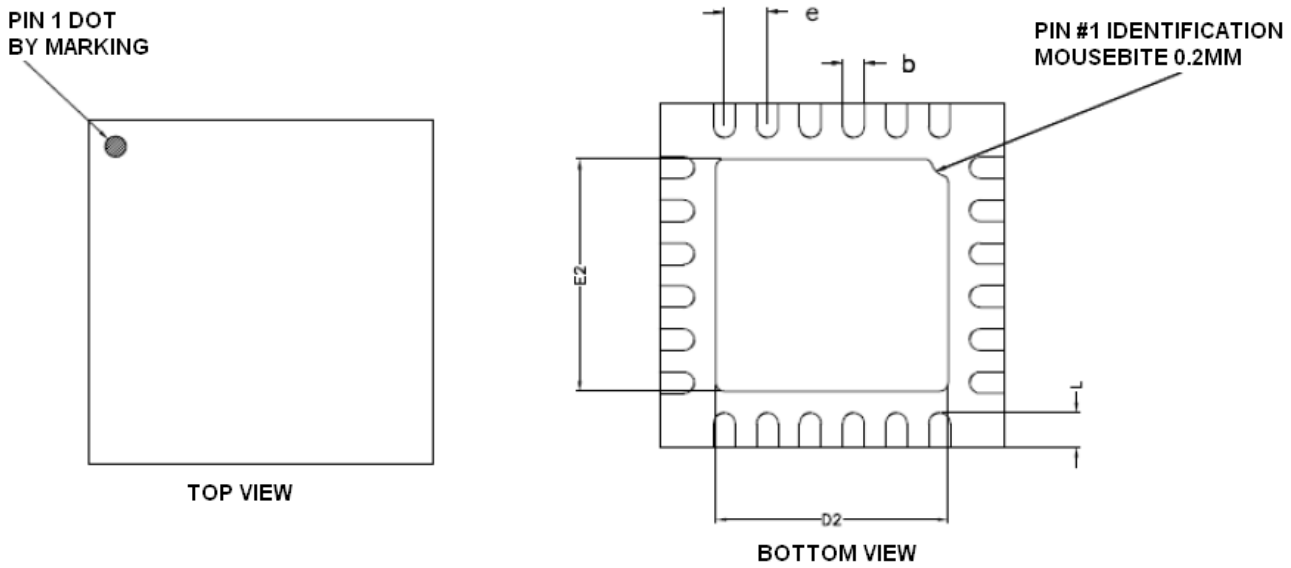


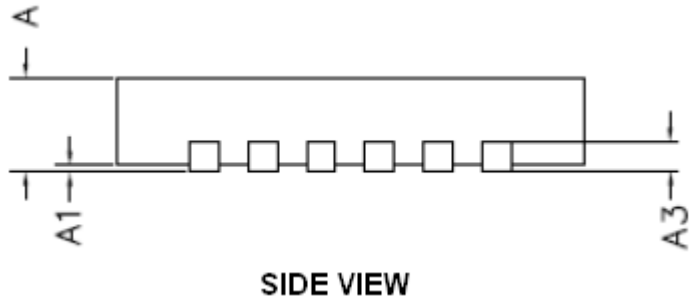
Dimension in SSOP24 – Type B (1.0) Package (Unit: mm)



Symbol	Min	Nom	Max
A	-	-	1.90
A1	0.05	-	0.15
A2	1.40	1.50	1.60
A3	0.47	0.67	0.87
b	0.39	-	0.47
b1	0.38	0.40	0.43
c	0.15	-	0.20
c1	0.14	0.15	0.16
D	12.80	13.00	13.2
E	7.70	7.90	8.10
E1	5.80	6.00	6.20
e	1.00BSC		
L	0.25	0.45	0.65
L1	0.985BSC		
θ	0	-	8°
L/F (mil)	160*170		

Dimension in QFN24 (4x4) Package (Unit: mm)





Symbol	Min	Nom	Max
A	0.70	0.75	0.80
A1	0.00	-	0.05
A3		0.2REF	
D	3.95	4.00	4.05
E	3.95	4.00	4.05
b	0.20	0.25	0.30
L	0.35	0.40	0.45
D2	2.65	2.70	2.75
E2	2.65	2.70	2.75
e		0.50 BSC	

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