

**CHIPONE**

**集创北方**

**ICND2069**

**(16-Channel PWM Constant Current LED Source Driver)**

## Description

The ICND2069 is a 16-channel PWM constant current source LED driver for 1:64 time multiplexing applications. The constant-current value of all 16 channels is set by a single external resistor.

ICND2069 converts serial input data into the gray scale of each pixel by a 16-bit shift register. ICND2069 detects individual LED open errors without extra components. There is no need GCLK to optimize EMI

The ICND2069 exploits precise current regulation technology, with both channel-to-channel error and chip-to-chip error less than  $\pm 2.0\%$ .

## Features

- ✧ 16 constant-current output channels
- ✧ Support time-multiplexing for 1~64 scans
- ✧ Output current setting range:
  - 0.5~18mA  $\times$  16@VDD=5V, VDS =0.3V
  - 0.5~18mA  $\times$  16@VDD=3.8V, VDS =0.3V
  - 0.5~15mA  $\times$  16@VDD=2.8V, VDS =0.45V
- ✧ Current accuracy
  - Between channel :<  $\pm 2.0\%$  (Max.)
  - Between ICs :<  $\pm 2.0\%$  (Max.)
- ✧ 8 bit current gain: 22%~200%
- ✧ Fast response of output current:
  - $\overline{OE}$  (min):20ns@VDD=5V
- ✧ Data transfer frequency:  $f_{MAX}=35\text{MHz}$ (Max)
- ✧ Power supply voltage: VDD=2.6~5V
- ✧ Operating Temperature:  $-40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$
- ✧ Dynamic energy-saving
- ✧ Pre-charge for ghosting reduction
- ✧ LED open detection
- ✧ Enhanced Circuit for Caterpillar Cancelling
- ✧ Enhancement: Non-uniformity at low gray scale, Color shift, low gray mosaics, Dim line at first scan
- ✧ Integrating LED protection circuit
- ✧ Elimination high contrast coupling an color-cast between modules

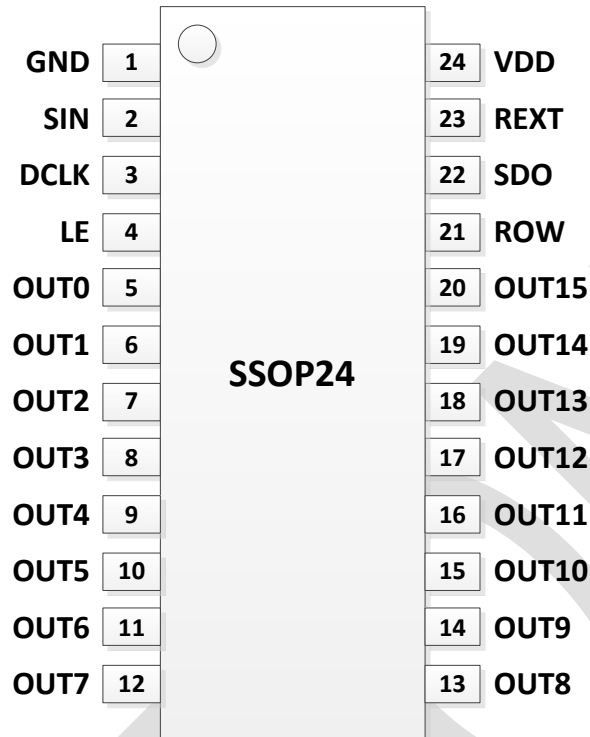
## Package



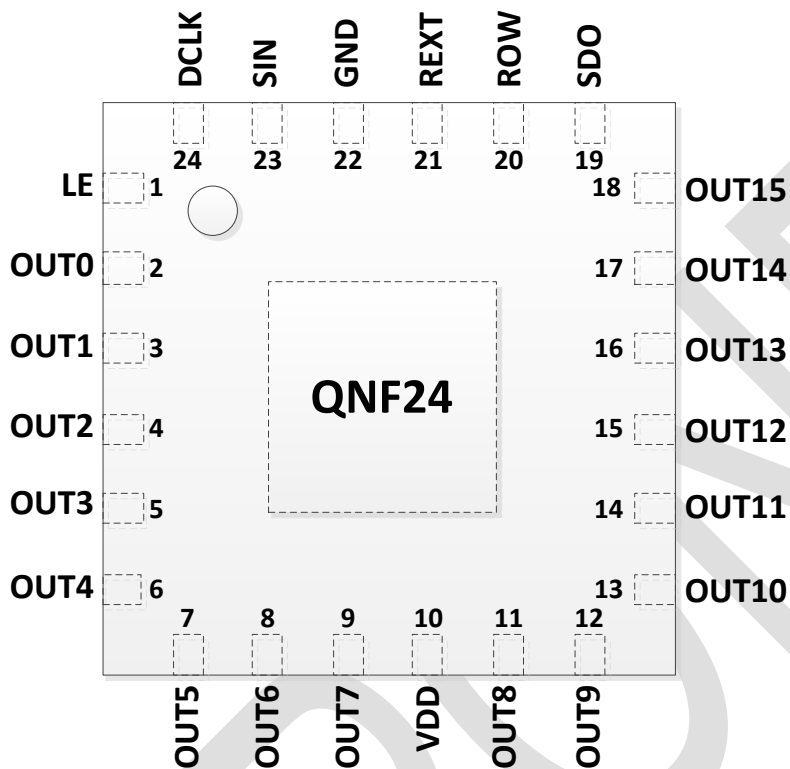
## ICND2069

## Pin Configuration

AP: SSOP24-P-150-0. 635

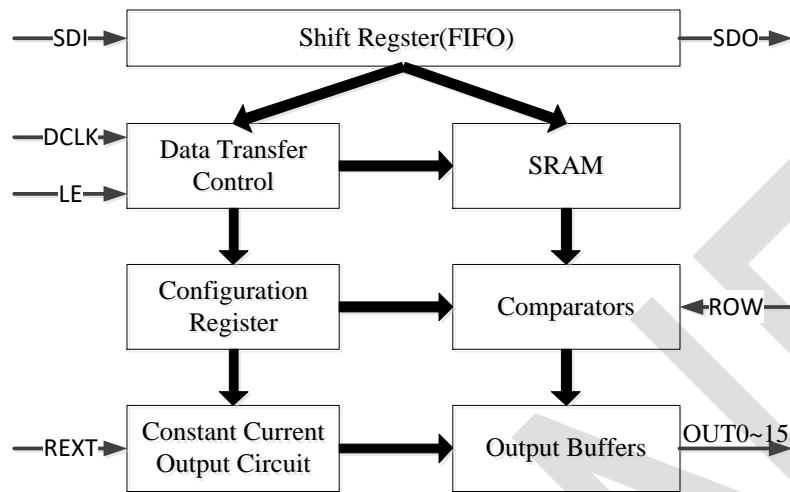


ICND2069AP(SSOP24)		
Pin No.	Pin Name	Function
1	GND	Power Ground
2	SIN	Serial data input
3	DCLK	Clock input terminal for data shift and command information
4	LE	Data transfer command input
5~20	OUT0~OUT15	Constant current output
21	ROW	Scan Line change signal
22	SDO	Serial data output
23	REXT	Constant-current value setting .Connection to an external resistor to GND
24	VDD	Power-supply voltage



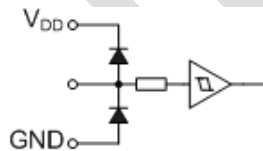
ICND2069AN-01(QNF24)		
Pin No.	Pin Name	Function
1	LE	Data transfer command input
2~9,11~18	OUT0~OUT15	Constant current output
10	VDD	Power-supply voltage
19	SDO	Serial data output
20	ROW	Scan Line change signal
21	REXT	Constant-current value setting .Connection to an external resistor to GND
22	GND	Power Ground
23	SIN	Serial data input
24	DCLK	Clock input terminal for data shift and command information

## ICND2069 Block Diagram

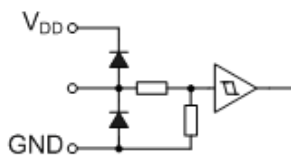


## I/O Equivalent Circuits

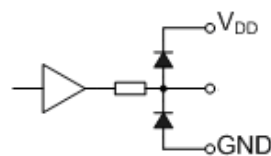
### 1. ROW, SDI, LE



### 2. DCLK



### 3. SDO



**Maximum Rating** (Ta=25°C)

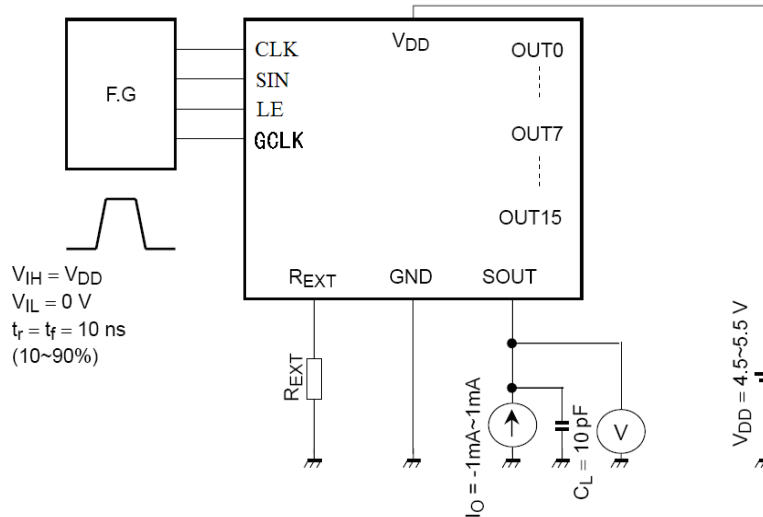
Characteristics		Symbol	Rating	Unit
Supply Voltage		V <sub>DD</sub>	0~6.0	V
Output Current		I <sub>o</sub>	25	mA
Input Voltage		V <sub>IN</sub>	-0.4~V <sub>DD</sub> +0.4	V
Output voltage		V <sub>OUT</sub>	10V	
Clock Frequency		F <sub>CLK</sub>	35	MHz
GND Terminal Current		I <sub>GND</sub>	+500	mA
Power Dissipation (On PCB, 25°C)	DN-type	P <sub>D</sub>	3.19	W
Thermal Resistance	DN-type	R <sub>th(j-a)</sub>	39.15	°C/W
Operating Temperature		T <sub>opr</sub>	-40 ~ 85	°C
Storage Temperature		T <sub>stg</sub>	-55 ~ 150	°C

**Electrical Characteristics** (Unless otherwise specified, V<sub>DD</sub>=4.5~5.5V, T<sub>a</sub>=25°C)

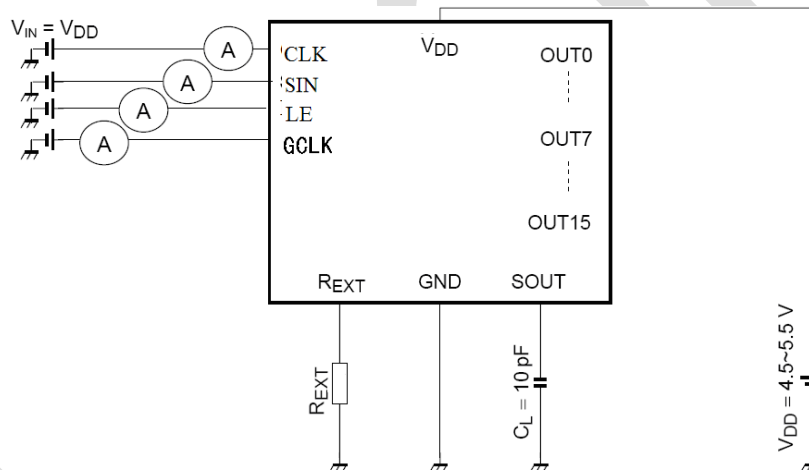
Characteristics	Symbol	Test circuit	Test Conditions	Min	Typ	Max	Unit
High level logic output voltage	V <sub>OH</sub>	1	I <sub>OH</sub> =-1mA, SDO	V <sub>DD</sub> -0.4	-	V <sub>DD</sub>	V
Low level logic output voltage	V <sub>OL</sub>	1	I <sub>OH</sub> =+1mA, SDO	-	-	0.4	V
High level logic input voltage	V <sub>IH</sub>	-		0.7*V <sub>DD</sub>	-	V <sub>DD</sub>	V
Low level logic input voltage	V <sub>IL</sub>	3		GND	-	0.3*V <sub>DD</sub>	V
High level logic input current	I <sub>IH</sub>	2	V <sub>IN</sub> =V <sub>DD</sub> , SDI,CLK,LE,GCLK	-	-	1	μA
Low level logic input current	I <sub>IL</sub>	1	V <sub>IN</sub> =GND SDI,CLK,LE,GCLK	-1	-	-	μA
Power supply current	I <sub>DD1</sub>	4	R <sub>ext</sub> =Open, Out off	-	5		mA
	I <sub>DD2</sub>	4	R <sub>ext</sub> =1.24kΩ, Out off	-	5.5		mA
Constant current error	ΔI <sub>o</sub>	5	0.5mA~25mA	-	±1.0	±2.0	%
Constant current power supply voltage regulation	%V <sub>DD</sub>	5	V <sub>DD</sub> =4.5~5.5V, , R <sub>EXT</sub> =3kΩ, OUT0~OUT15	-	±0.1	-	%/V
Constant current output voltage regulation	%V <sub>OUT</sub>	5	V <sub>O</sub> =0.6~3.0V, R <sub>EXT</sub> =3kΩ, OUT0~OUT15	-	±0.1		%/V
Pull-down resistor	R <sub>DOWN</sub>	2	DCLK	100	200	400	kΩ

## Test Circuit

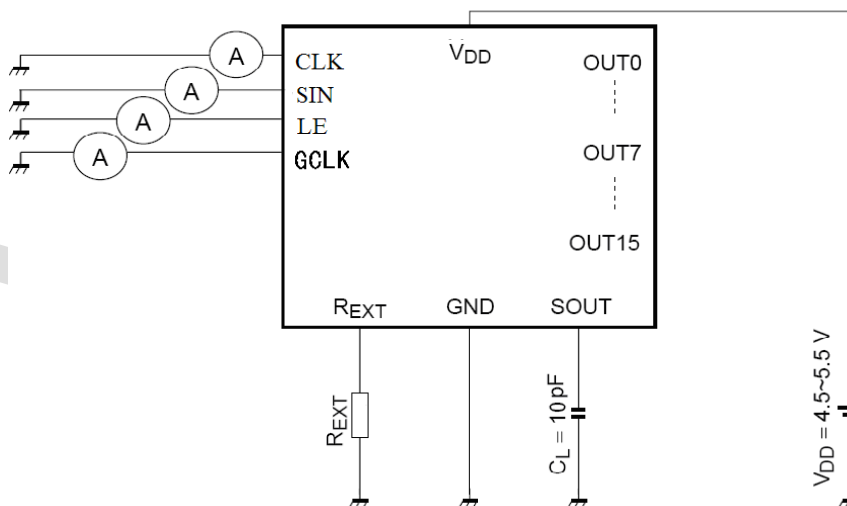
### Test Circuit1: High level logic input voltage/Low level logic input voltage



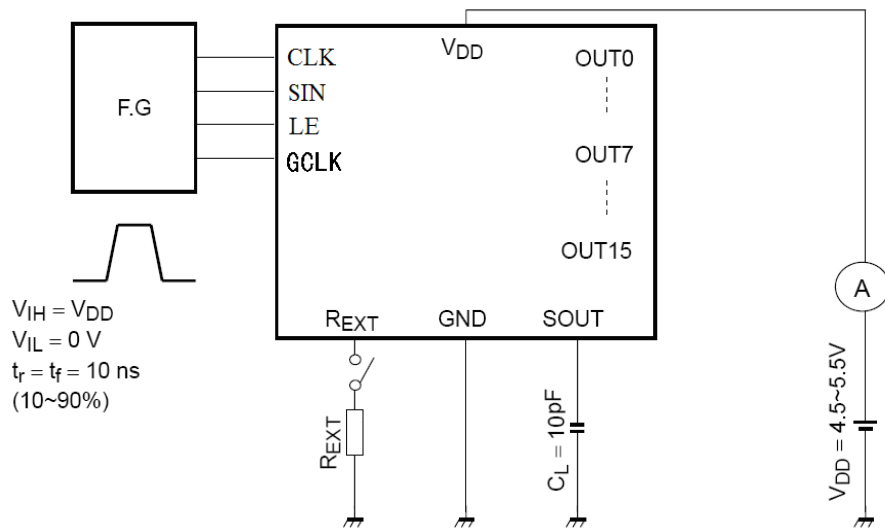
### Test Circuit2: High level logic input current/Pull-down resistor



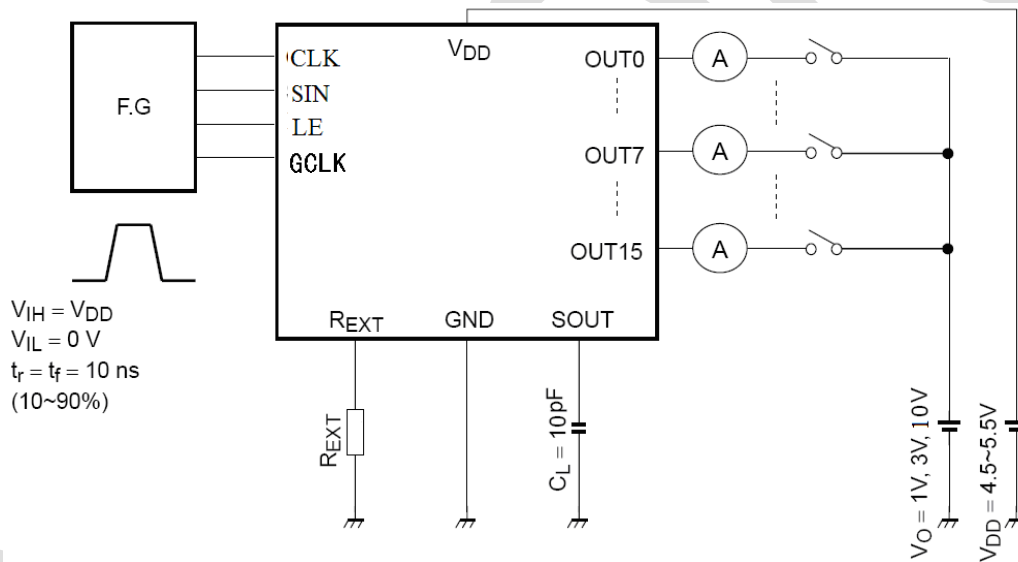
### Test Circuit3: Low level logic input current/Pull-up resistor



**Test Circuit4: Power supply current**



**Test Circuit5: Constant current output/Output OFF leak current/Constant current error  
Constant current power supply voltage regulation/Constant current output voltage regulation**





## Application Information

ICND2069 exploits precise current regulation technology, providing small channel-to-channel and IC-to-IC current variations.

- 1) The maximum current variation between channels is less than  $\pm 2.0\%$ , and that between ICs  $< \pm 2.0\%$ .
- 2) The current characteristic of output stage is flat. The output current can be kept constant regardless of the variations of LED forward voltage.

## Setting Output Current

The output current ( $I_{out}$ ) of ICND2069 is set by an external resistor,  $R_{ext}$ . The relationship between  $I_{out}$  and  $R_{ext}$  is :

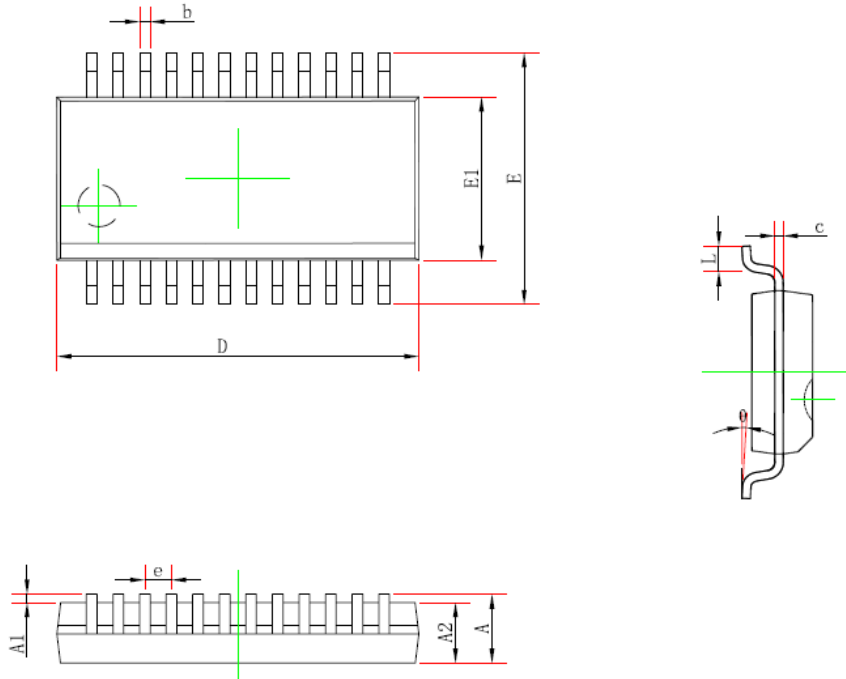
$$I_{out} = \frac{12}{R_{EXT}} * Gain$$

For 67% < Gain < 200%	Gain = (Igain - 127) * 1.56%	255 ≥ Igain ≥ 170
For 22% < Gain < 67%	Gain = Igain * 0.525%	127 ≥ Igain ≥ 42

**Package Outline**

(1) SSOP24-P-150-0.635

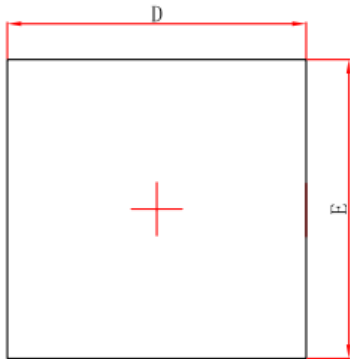
**SSOP24 (150mil) PACKAGE OUTLINE DIMENSIONS**



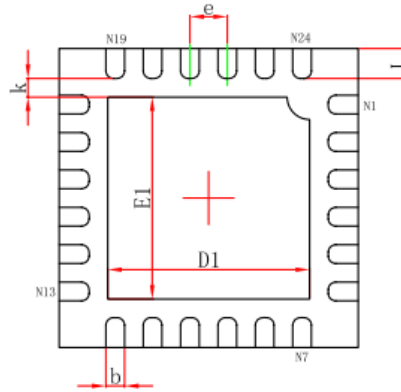
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	—	1.750	—	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	—	0.049	—
b	0.203	0.305	0.008	0.012
c	0.102	0.254	0.004	0.010
D	8.450	8.850	0.333	0.348
E1	3.800	4.000	0.150	0.157
E	5.800	6.200	0.228	0.244
e	0.635 (BSC)		0.025 (BSC)	
L	0.400	1.270	0.016	0.050
$\theta$	0°	8°	0°	8°

(2) QFN24

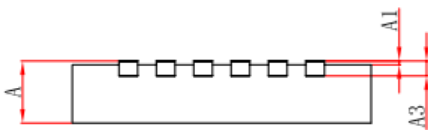
QFNWB4×4-24L (P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



Top View



Bottom View



Side View

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700/0.800	0.800/0.900	0.028/0.031	0.031/0.035
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	3.924	4.076	0.154	0.160
E	3.924	4.076	0.154	0.160
D1	2.600	2.800	0.102	0.110
E1	2.600	2.800	0.102	0.110
k	0.200MIN.		0.008MIN.	
b	0.200	0.300	0.008	0.012
e	0.500TYP.		0.020TYP.	
L	0.324	0.476	0.013	0.019

## Product Ordering Information

Product number	Package (Pb-Free)	Weight (mg)
ICND2069AP	SSOP24-0.635	130
ICND2069AN-01	QFN24-4*4-0.5	38

## Revision History

Rev	Date	Description
1.0	2018/08	Initial Release
1.1	2018/11	Add QFN Package
1.2	2019/04	Change VDD Range
1.3	2020/02	Change Current Range

## Important information

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