CHIPONE

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# ICND2163

## (16-Channel PWM Constant Current LED Sink Driver)

## Description

The ICND2163 is a 16-channel PWM constant current sink LED driver for 33:64 time multiplexing applications. The constant-current value of all 16 channels is set by a single external resistor.

ICND2163 converts serial input date into the gray scale of each pixel by a 16-bit shift register.ICND2163 detects individual LED open errors without extra components. ICND2163 also integrated pre-charge circuit for ghosting reduction.

The ICND2163 exploits precise current regulation technology, with both channel-to-channel error and chip-to-chip error less than ±2.0%.

## Package

**Shrink SOP**

**AP: SSOP24-P-150-0.635**

**ICND2163**

## Features

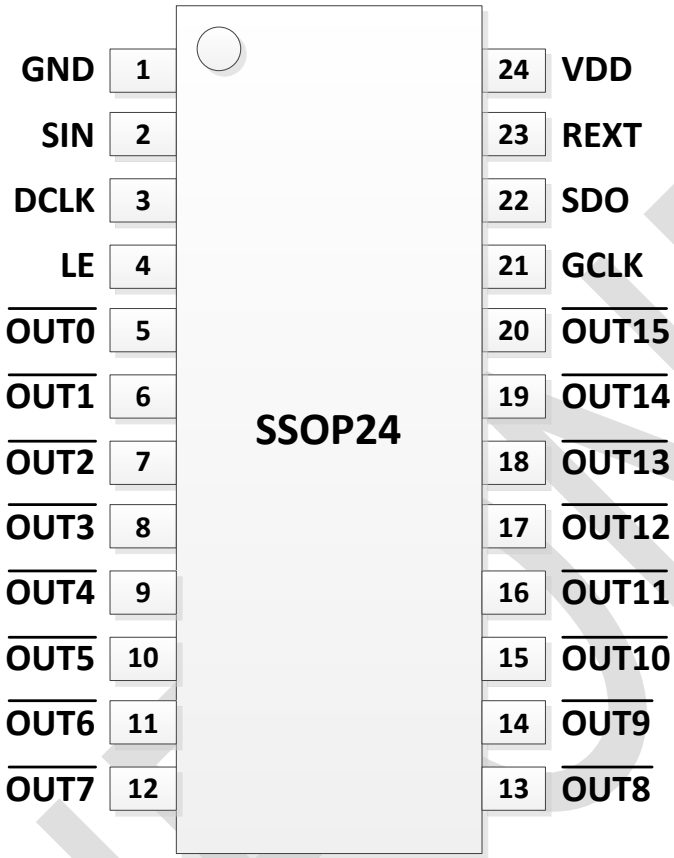
- 16 constant-current output channels
- Support time-multiplexing for 33~64 scans
- Output current setting range：
  0.5~25mA×16@$V_{DD}$=5V constant current output
  0.5~18mA×16@$V_{DD}$=4.2V constant current output
  0.5~10mA×16@$V_{DD}$=3.3V constant current output
- Current accuracy
  Between channel :< ±2.0 %(Max.)
  Between ICs :< ±2.0 % (Max.)
- 8 bit current gain：12.5%~200%
- Data transfer frequency: $f_{MAX}$=25MHz(Max)
- Power supply voltage: $V_{DD}$=3.3～5V
- Operating Temperature: –40°C to +85°C
- Output current equation

$$Iout = \frac{9.23}{R_{EXT}}$$

- Pre-charge for ghosting reduction
- LED open detection
- Enhanced Circuit for Caterpillar Cancelling
- Low-gray scale enhancement
- Integrating LED protection circuit

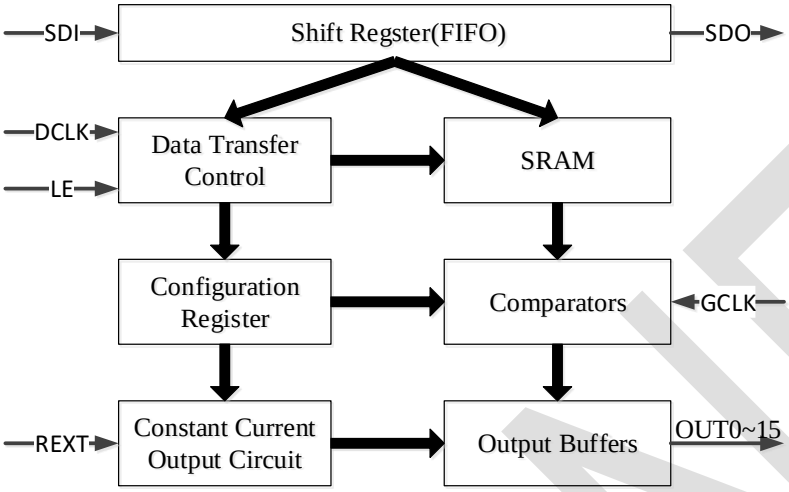
## Pin Configuration

AP: SSOP24-P-150-0.635



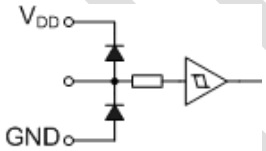

| ICND2163AP(SSOP24) | | |
|---|---|---|
| **Pin No.** | **Pin Name** | **Function** |
| 1 | GND | Power Ground |
| 2 | SIN | Serial data input |
| 3 | DCLK | Clock input terminal for data shift and command information |
| 4 | LE | Data transfer command input |
| 5～20 | $\overline{OUT0}$ ~ $\overline{OUT15}$ | Constant current output |
| 21 | GCLK | The reference clock input pin for PWM gray scale control |
| 22 | SDO | Serial data output |
| 23 | REXT | Constant-current value setting .Connection to an external resistor to GND |
| 24 | VDD | Power-supply voltage |

## ICND2163 Block Diagram

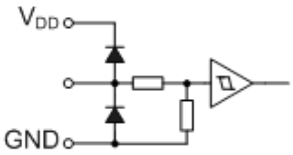



## I/O Equivalent Circuits

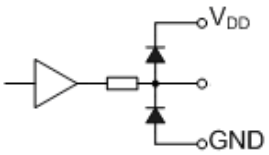
**1. GCLK, SDI, LE**




**2. DCLK**




**3. SDO**



## Maximum Rating (Ta=25℃)

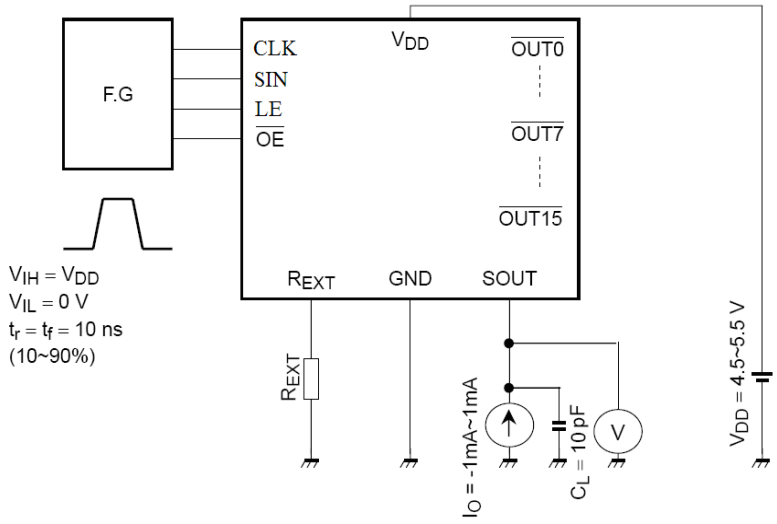
| Characteristics | | Symbol | Rating | Unit |
|---|---|---|---|---|
| Supply Voltage | | $V_{DD}$ | 0~6.0 | V |
| Output Current | | $I_O$ | 25 | mA |
| Input Voltage | | $V_{IN}$ | -0.4~$V_{DD}$+0.4 | V |
| Output voltage | | $V_{OUT}$ | 11V | |
| Clock Frequency | | $F_{CLK}$ | 25 | MHz |
| GND Terminal Current | | $I_{GND}$ | +500 | mA |
| Power Dissipation (On PCB，25℃) | DN-type | $P_D$ | 3.19 | W |
| Thermal Resistance | DN-type | $R_{th(j-a)}$ | 39.15 | ℃/W |
| Operating Temperature | | $T_{opr}$ | -40 ~ 85 | ℃ |
| Storage Temperature | | $T_{stg}$ | -55 ~ 150 | ℃ |

## Electrical Characteristics (Unless otherwise specified, $V_{DD}$ =4.5~5.5V，$T_a$ =25℃)

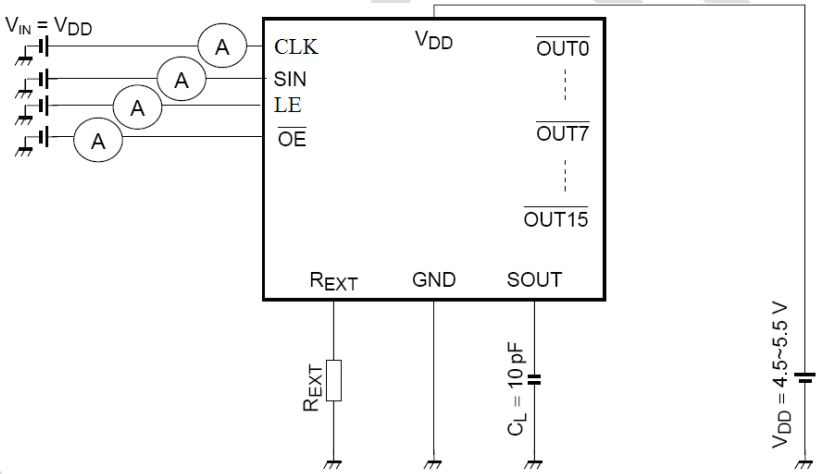
| Characteristics | Symbol | Test circuit | Test Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|---|
| High level logic output voltage | $V_{OH}$ | 1 | $I_{OH}$=-1mA, SDO | $V_{DD}$-0.4 | - | $V_{DD}$ | V |
| Low level logic output voltage | $V_{OL}$ | 1 | $I_{OH}$=+1mA, SDO | - | - | 0.4 | V |
| High level logic input voltage | $V_{IH}$ | 3 | - | 0.7*$V_{DD}$ | - | $V_{DD}$ | V |
| Low level logic input voltage | $V_{IL}$ | 3 | - | GND | - | 0.3*$V_{DD}$ | V |
| High level logic input current | $I_{IH}$ | 2 | $V_{IN}$=$V_{DD}$, SDI,CLK,LE,GCLK | - | - | 1 | μA |
| Low level logic input current | $I_{IL}$ | 1 | $V_{IN}$=GND SDI,CLK,LE,GCLK | -1 | - | - | μA |
| Power supply current | $I_{DD1}$ | 4 | Rext=Open，Out off | - | 6 | | mA |
| Constant current error | $\Delta I_O$ | 5 | 0.5mA~25mA | - | ±1.0 | ±2.0 | % |
| Constant current power supply voltage regulation | %$V_{DD}$ | 5 | $V_{DD}$=4.5~5.5V, , $R_{EXT}$=3kΩ, $\overline{OUT0}$ ~ $\overline{OUT15}$ | - | ±0.1 | - | %/V |
| Constant current output voltage regulation | %$V_{OUT}$ | 5 | $V_O$=0.6~3.0V, $R_{EXT}$=3kΩ, $\overline{OUT0}$ ~ $\overline{OUT15}$ | - | ±0.1 | | %/V |
| Pull-down resistor | $R_{DOWN}$ | 2 | DCLK | 100 | 200 | 400 | kΩ |

## Test Circuit

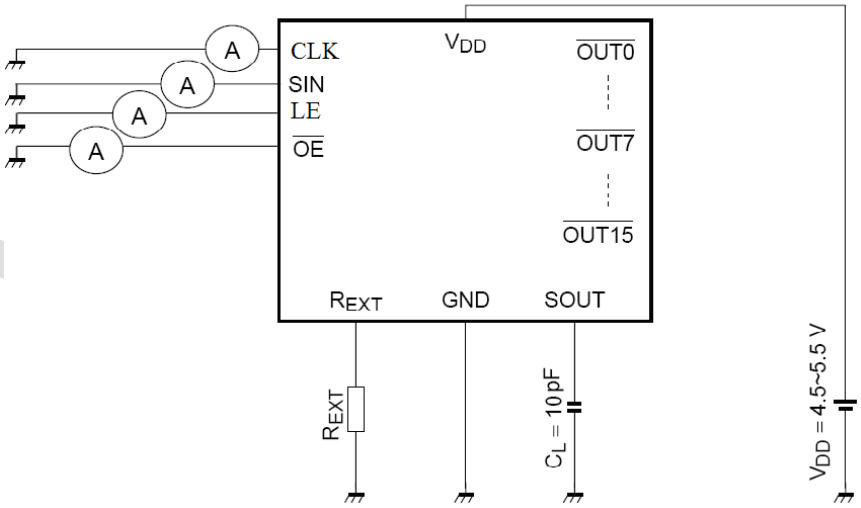
**Test Circuit1: High level logic input voltage/Low level logic input voltage**



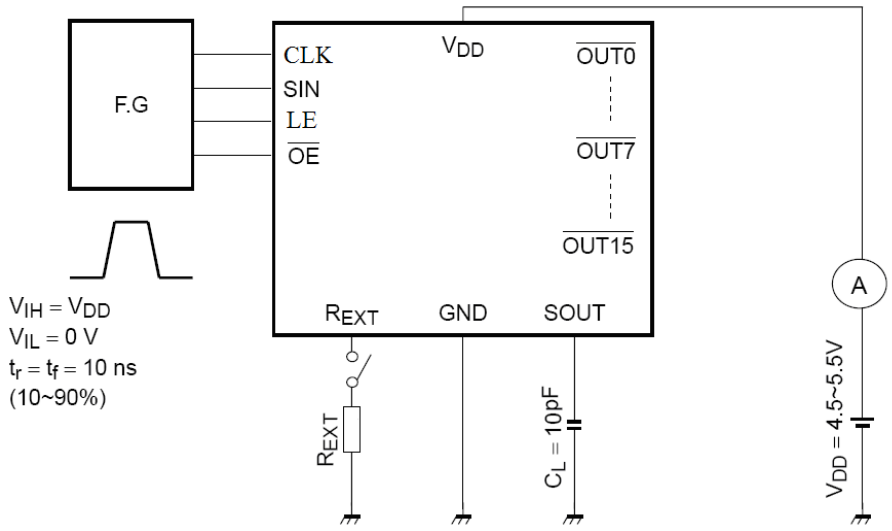

**Test Circuit2: High level logic input current/Pull-down resistor**



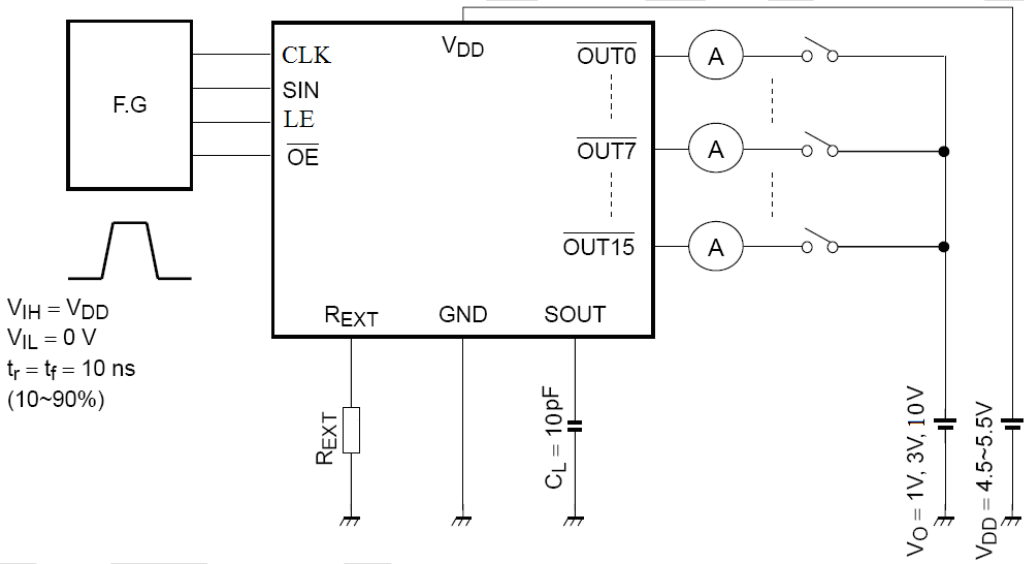

**Test Circuit3：Low level logic input current/Pull-up resistor**



**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**

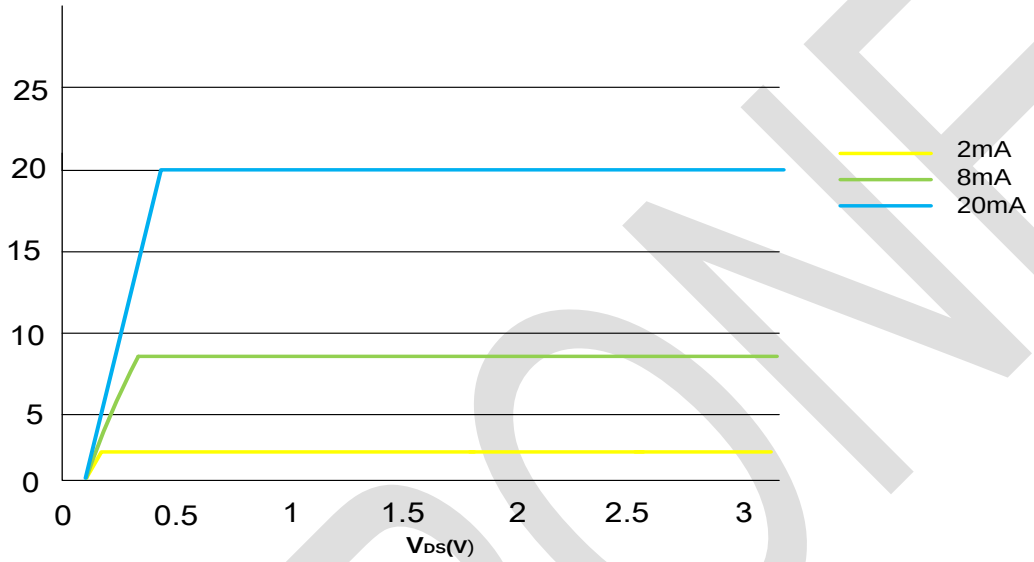


## Application Information

ICND2163 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 ±2.0%，and that between ICs<±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 ICND2163 is set by an external resistor, $R_{ext}$. The relationship between $I_{out}$ and $R_{ext}$ is ：

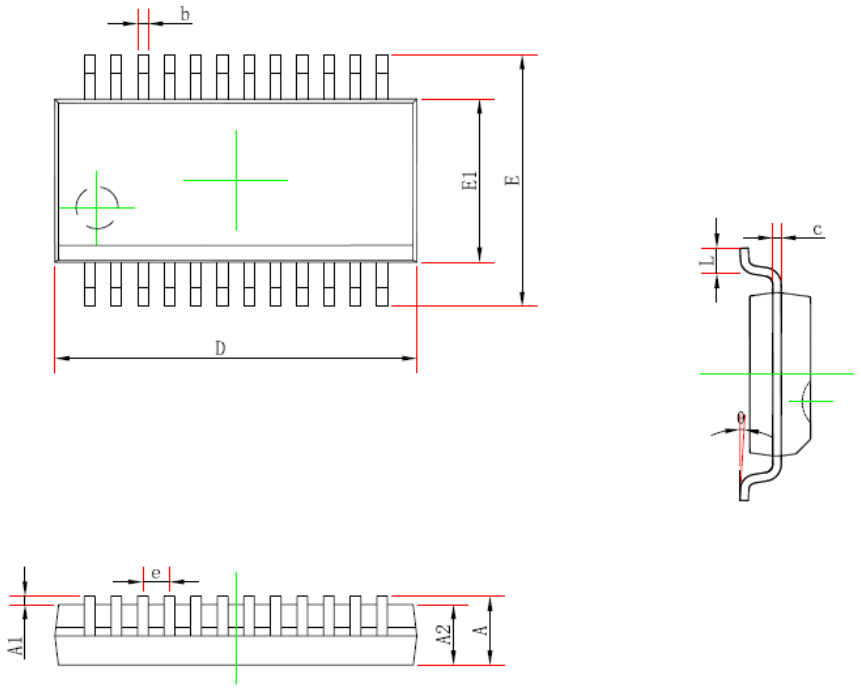
$$I_{out}=9.23/R_{ext} \quad (I_{gain}=100\%)$$

cfg2[9]=1, Iout=18.5x Igain/(Rext x 256)
255≥Igain≥64 50%-200%
cfg2[9]=0, Iout=18.5x Igain/(Rext x 1024)
255≥Igain≥64 12.5-50%

## Package Outline

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 |
| θ | 0° | 8° | 0° | 8° |

## Product Ordering Information

| Product number | Package （Pb-Free） | Weight（mg） |
|---|---|---|
| ICND2163AP | SSOP24-0.635 | 130 |

## Revision History

| Rev | Date | Description |
|---|---|---|
| 1.0 | 2019/04 | Initial Release |
| 1.1 | 2020/07 | Add Current formula |

# Important information

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