ICND2065

(16-Channel PWM Constant Current LED Sink Driver)

Description

The ICND2065 is a 16-channel PWM constant current sink LED driver for 1:64 time multiplexing applications (with 32 KB SRAM). The constant-current value of all 16 channels is set by a single external resistor.

ICND2065 converts serial input date into the gray scale of each pixel by a 16-bit shift register. ICND2065 detects individual LED open errors without extra components. ICND2065 also integrated pre-charge circuit for ghosting reduction.

The ICND2065 exploits precise current regulation technology, with both channel-to-channel error and chip-to-chip error less than ±2.0%.

Features

✧ 16 constant-current output channels

✧ Support time-multiplexing for 1~64 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

✧ Current accuracy

Between channel :< ±2.0 %(Max.)

Between ICs :< ±2.0 % (Max.)

✧ 8 bit current gain：22%~200%

✧ Fast response of output current:

$\overline{OE}$ (min):20ns@V_{DD}=5V

✧ Data transfer frequency: f_{MAX}=35MHz(Max)

✧ Power supply voltage: V_{DD}=3.3~5V

✧ Operating Temperature: –40°C to +85°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

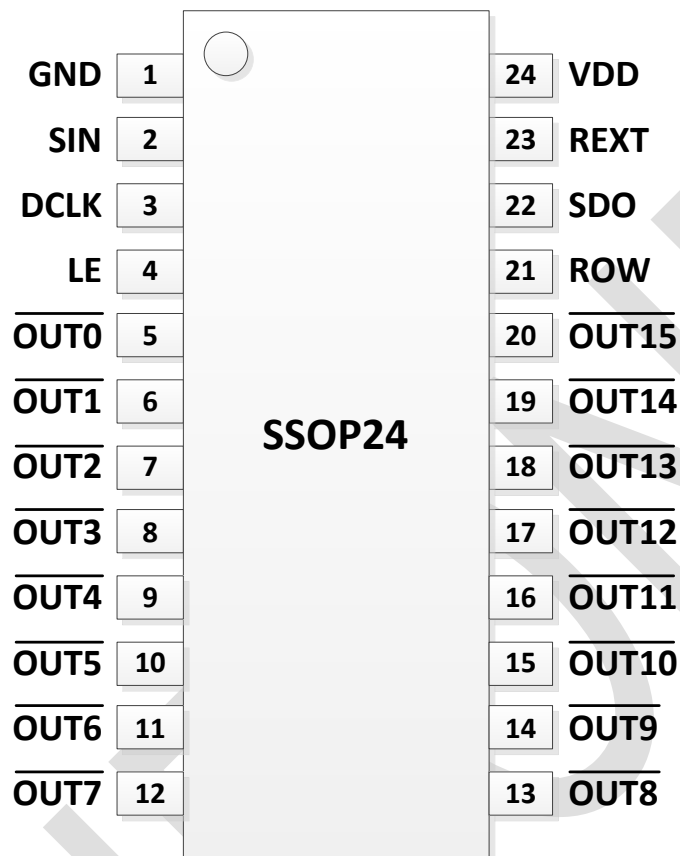✧ Elimination high contrast coupling an color-cast between modules

Package

Shrink SOP

AP: SSOP24-P-150-0.635

Quad Flat No-Lead

AN: QFN24-4*4-0.5
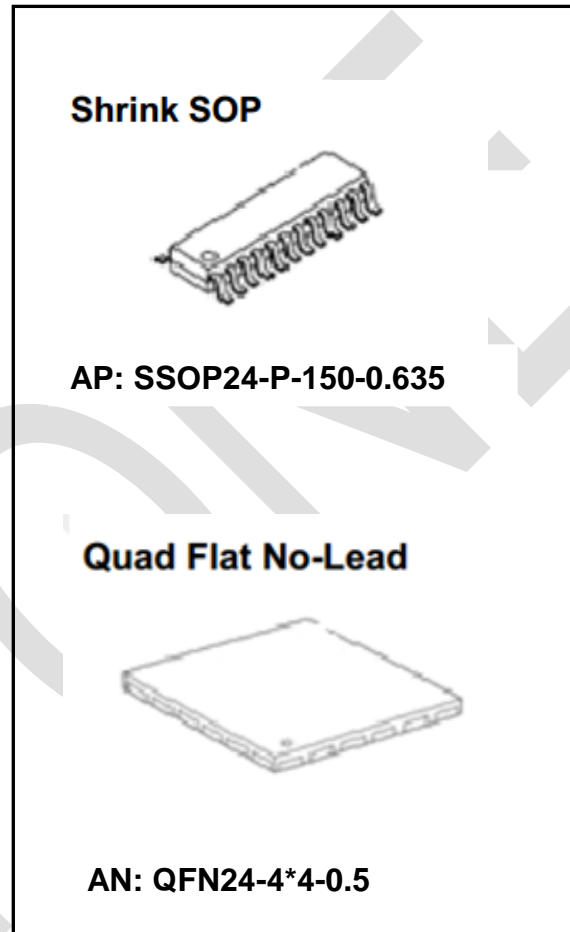
ICND2065

Pin Configuration

1 AP：SSOP24-P-150-0.635

ICND2065(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	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

2 AN-01：QFN24-4*4-0.5
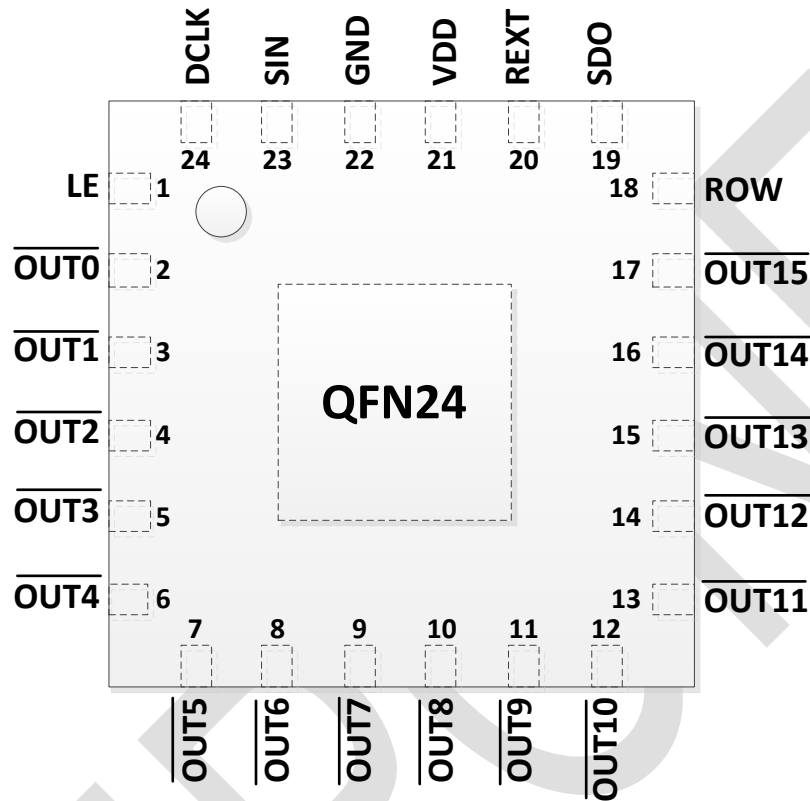

| ICND2065AN-01(QFN24)		
Pin No.	**Pin Name**	**Function**
1	LE	Data transfer command input
2～17	$\overline{OUT0}$ ~ $\overline{OUT15}$	Constant current output
18	ROW	Scan Line change signal
19	SDO	Serial data output
20	REXT	Constant-current value setting .Connection to an external resistor to GND
21	VDD	Power-supply voltage
22	GND	Power Ground
23	SIN	Serial data input
24	DCLK	Clock input terminal for data shift and command information

2 AN-02：QFN24-4*4-0.5
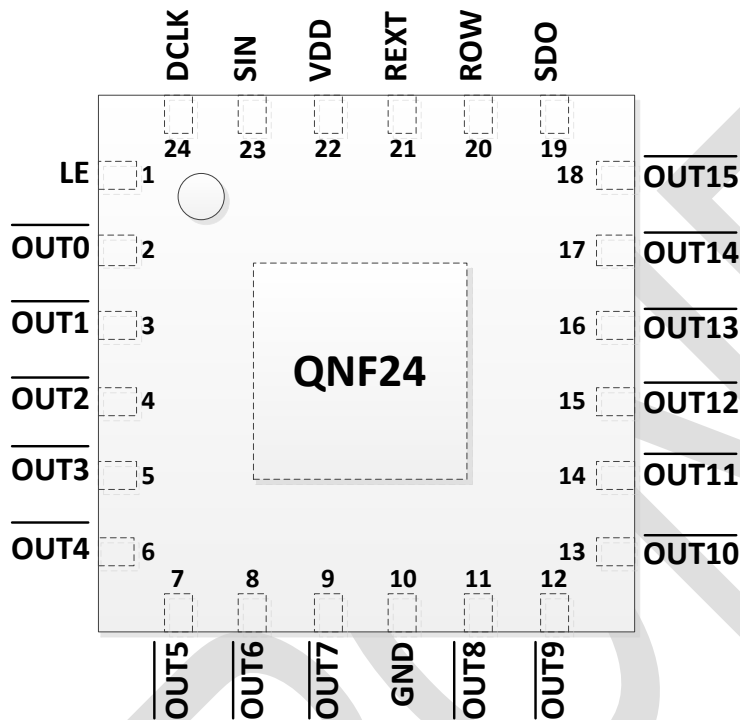
| ICND2065AN-02(QFN24)		
Pin No.	Pin Name	Function
1	LE	Data transfer command input
2～9,11～18	OUT0 ~ OUT15	Constant current output
10	GND	Power Ground
19	SDO	Serial data output
20	ROW	Scan Line change signal
21	REXT	Constant-current value setting .Connection to an external resistor to GND
22	VDD	Power-supply voltage
23	SIN	Serial data input
24	DCLK	Clock input terminal for data shift and command information

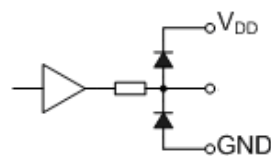## ICND2065 Block Diagram
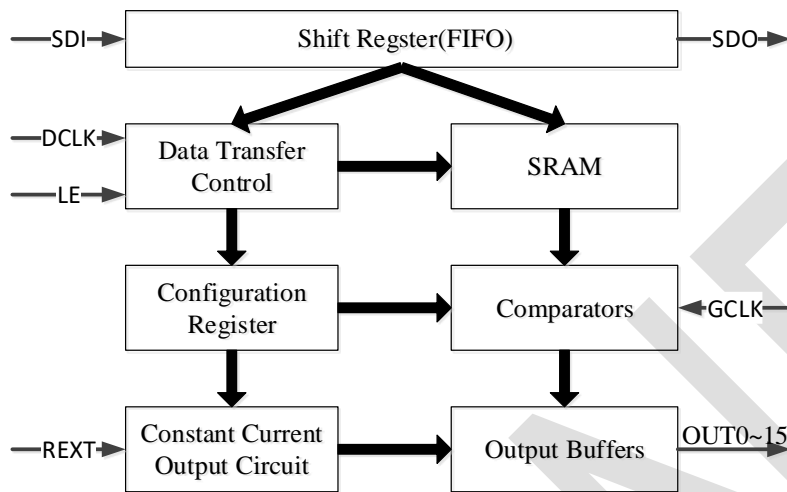
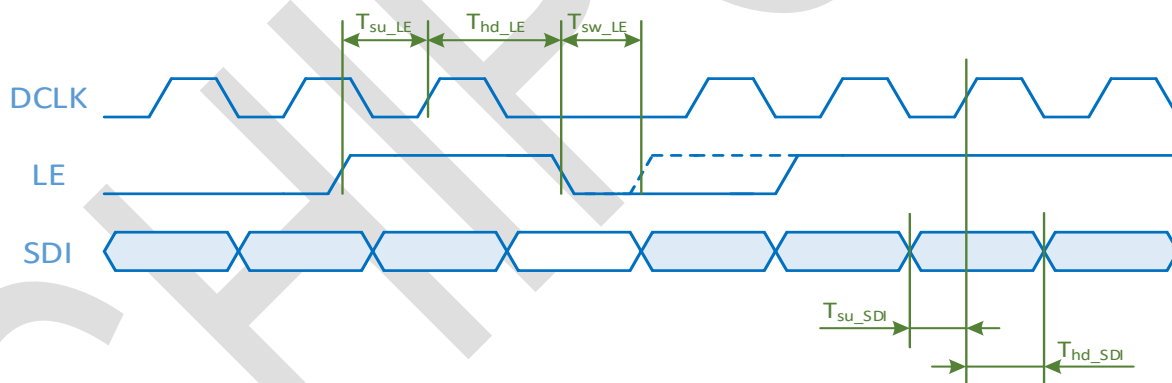## I/O Equivalent Circuits

1. GCLK, SDI, LE
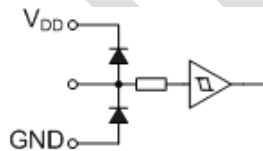
2. DCLK
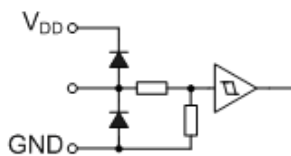
3. SDO

Data Transfer Order

Data Order	Line	Channel
1		Channel 15 (OUT15)
2		Channel 14 (OUT14)
……	Line 1	……
16		Channel 0 (OUT0)
17		Channel 15 (OUT15)
18		Channel 14 (OUT14)
……	Line 2	……
32		Channel 0 (OUT0)
……		
1009		Channel 15 (OUT15)
1010		Channel 14 (OUT14)
……	Line 64	……
1024		Channel 0 (OUT0)

Timing Diagram

| Name	MIN
T_{su_LE}	7ns
T_{hd_LE}	7ns
T_{sw_LE}	10ns
T_{su_SDI}	3ns
$T_{hd\_SDI,}$	3ns

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}	10V	
Clock Frequency		F_{CLK}	35	MHz
GND Terminal Current		I_{GND}	+500	mA
Power Dissipation (On PCB，25℃)	AN	P_D	4.09	W
	AP		1.98	
Thermal Resistance	AN	$R_{th(j-a)}$	30.5	℃/W
	AP		64	
Junction Temperature		T_j	150	℃
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}		-	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	-	4.5	6.0	mA
	I_{DD2}	4	Rext=1.24KΩ，Out off	-	6.0	7.0	mA
Constant current error	ΔI_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

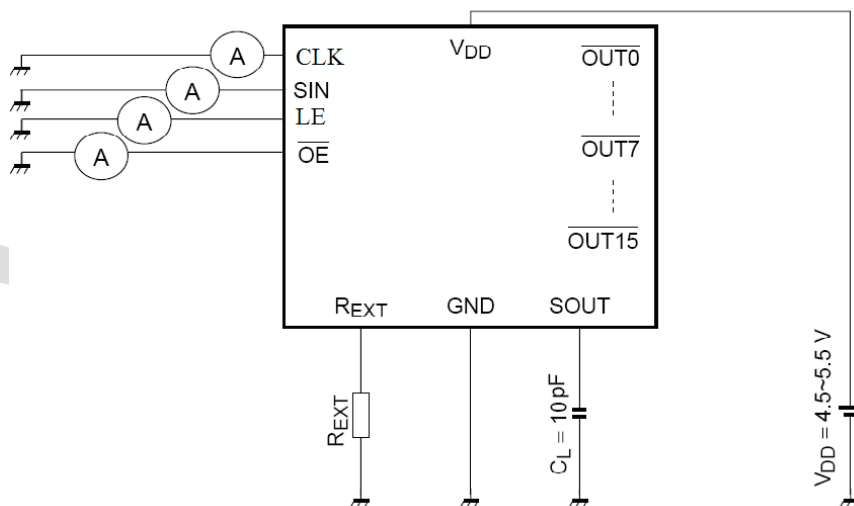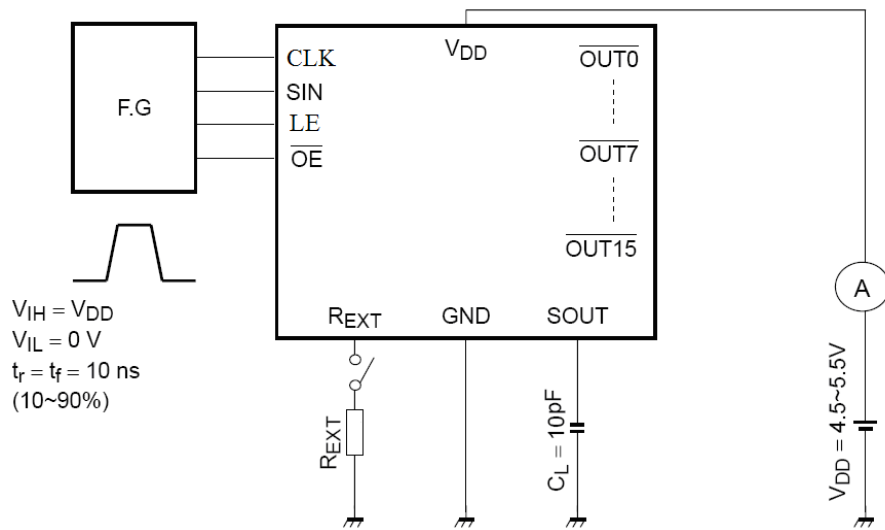**Test Circuit1: High level logic input voltage/Low level logic input voltage**
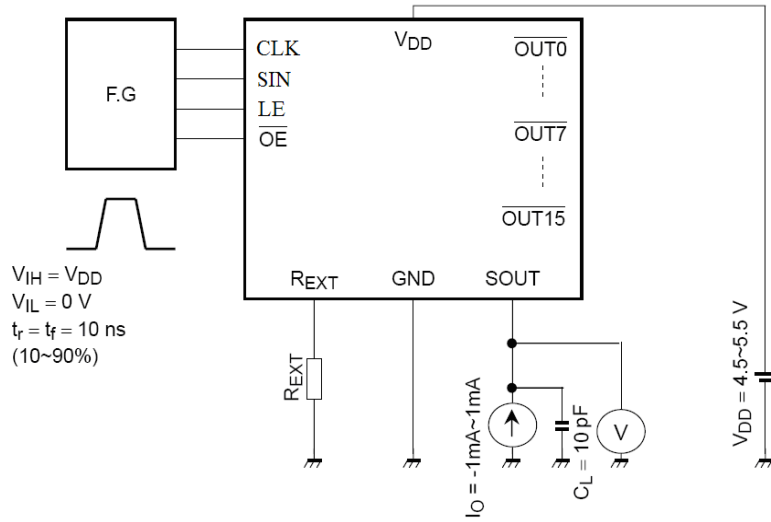
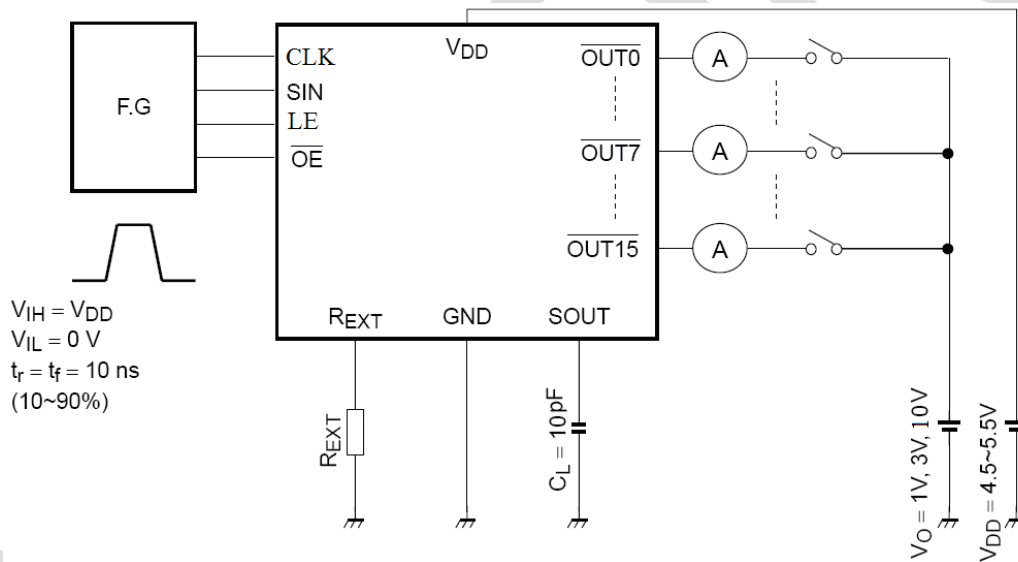**Test Circuit2: High level logic input current/Pull-down resistor**
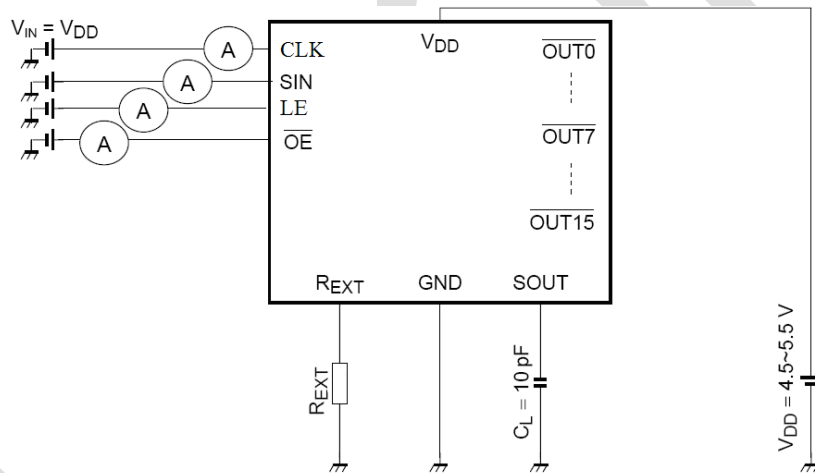
Test Circuit3：Low level logic input current/Pull-up resistor

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

ICND2065 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 ICND2065 is set by an external resistor, R_{ext}. The relationship between I_{out} and R_{ext} is：

$$Iout = \frac{18}{R_{EXT}} * \text{Gain}$$

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

SSOP24-P-150-0.635

SSOP24（150mil）PACKAGE OUTLINE DIMENSIONS
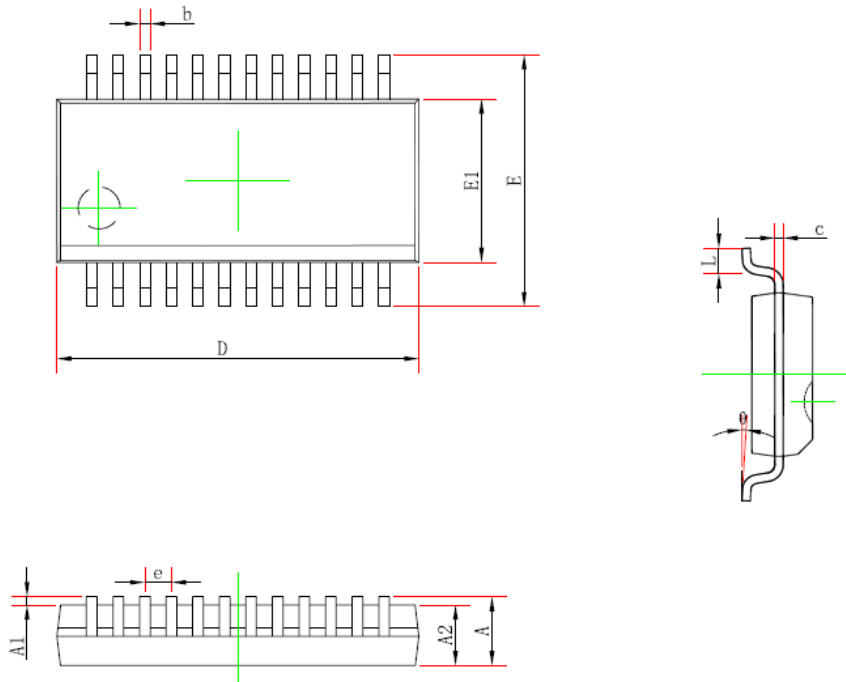
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	**Max**	**Min**	**Max**
A	——	1.750	——	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	——	0.049	——
b	0.203	0.305	0.008	0.012
c	0.102	0.254	0.004	0.010
D	8.450	8.850	0.333	0.348
E1	3.800	4.000	0.150	0.157
E	5.800	6.200	0.228	0.244
e	0.635（BSC)		0.025（BSC)	
L	0.400	1.270	0.016	0.050
θ	0°	8°	0°	8°

QFN24

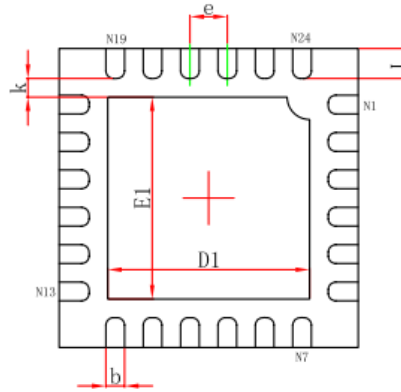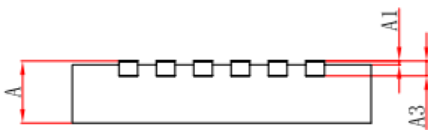QFNWB4×4-24L(P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS
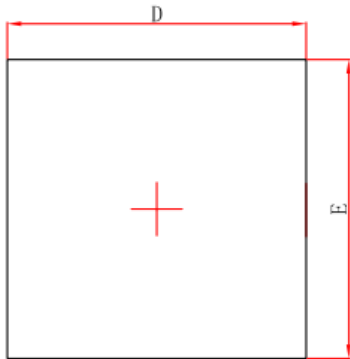
Top View

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）
ICND2065AP	SSOP24-0.635	130
ICND2065AN-01	QFN24-4*4-0.5	38
ICND2065AN-02	QFN24-4*4-0.5	38

Revision History

Rev	Date	Description
1.0	2018/06	Initial Release
1.1	2020/04	Add QFN Package
1.2	2020/08	Add Thermal Resistance

Important information

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