

CHIPONE

集创北方

ICND2153

(16-Channel PWM Constant Current LED Sink Driver)

Description

The ICND2153 is a 16-channel PWM constant current sink LED driver for 1:32 time multiplexing applications. The constant-current value of all 16 channels is set by a single external resistor.

ICND2153 converts serial input data into the gray scale of each pixel by a 16-bit shift register. ICND2153 detects individual LED open errors without extra components. ICND2153 also integrated pre-charge circuit for ghosting reduction.

The ICND2153 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 1~32 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 :< $\pm 2.0\%$ (Max.)
Between ICs :< $\pm 2.0\%$ (Max.)
- ✧ 8 bit current gain: 12.5%~200%
- ✧ Fast response of output current:
 \overline{OE} (min):20ns@V_{DD}=5V
- ✧ 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
$$I_{out} = \frac{9.23}{R_{EXT}}$$
- ✧ Pre-charge for ghosting reduction
- ✧ LED open detection
- ✧ Enhanced Circuit for Caterpillar Cancelling
- ✧ Low-gray scale enhancement
- ✧ Integrating LED protection circuit

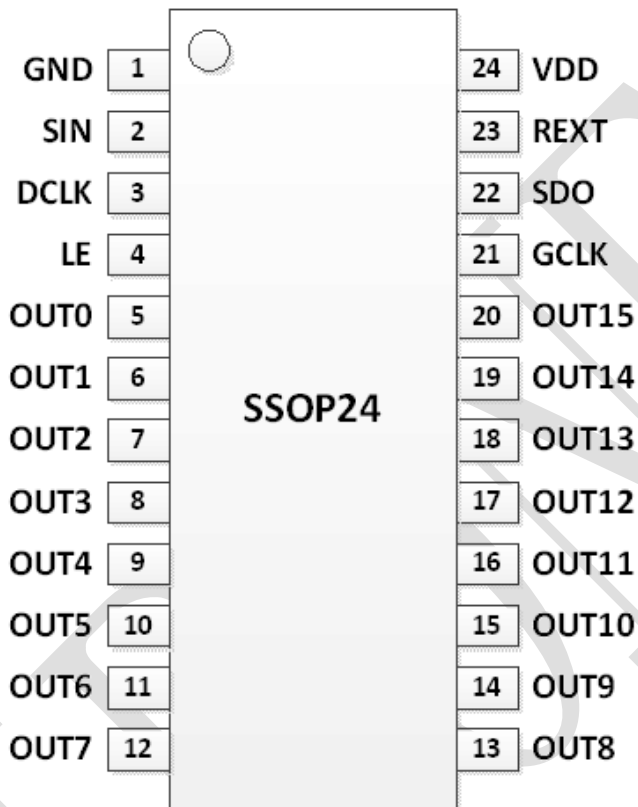
Package



ICND2153

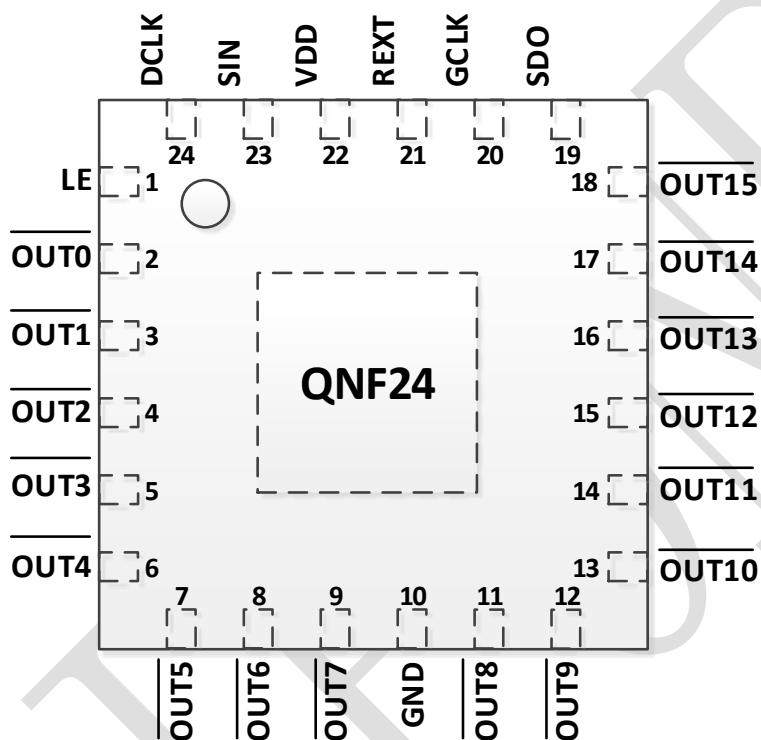
Pin Configuration

1 AP:SSOP24-P-150-0. 635



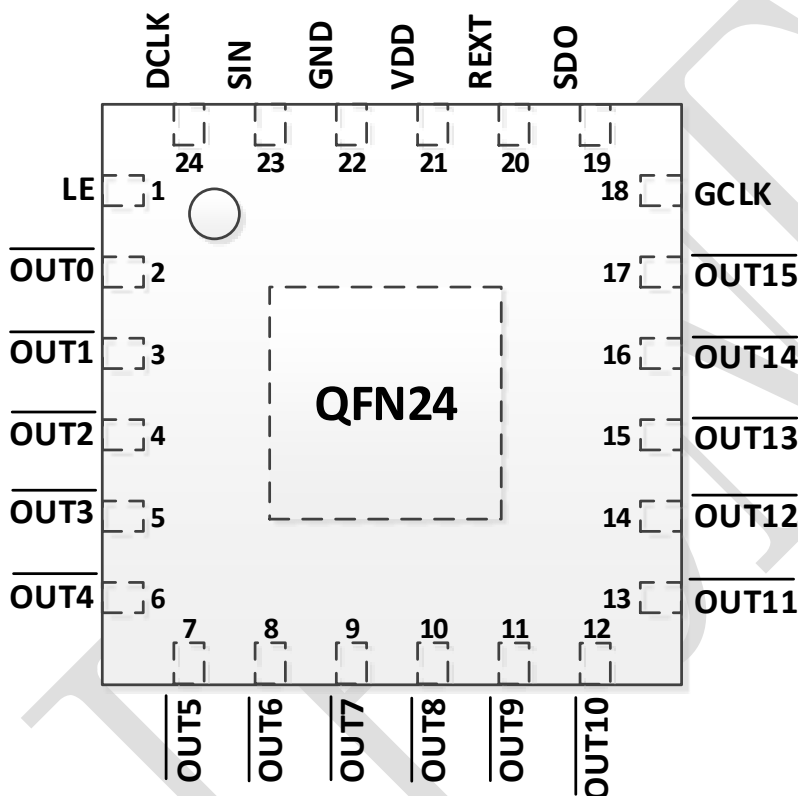
ICND2153AP(SSOP24)		
Pin No.	Pin Name	Function
1	GND	Power Ground
2	SIN	Serial data input
3	DCLK	Clock input terminal for data shift and command information
4	LE	Data transfer command input
5~20	OUT0 ~ OUT15	Constant current output
21	GCLK	The reference clock input pin for PWM gray scale control
22	SDO	Serial data output
23	REXT	Constant-current value setting .Connection to an external resistor to GND
24	VDD	Power-supply voltage

2 AN-02: QFN24-4*4-0.5



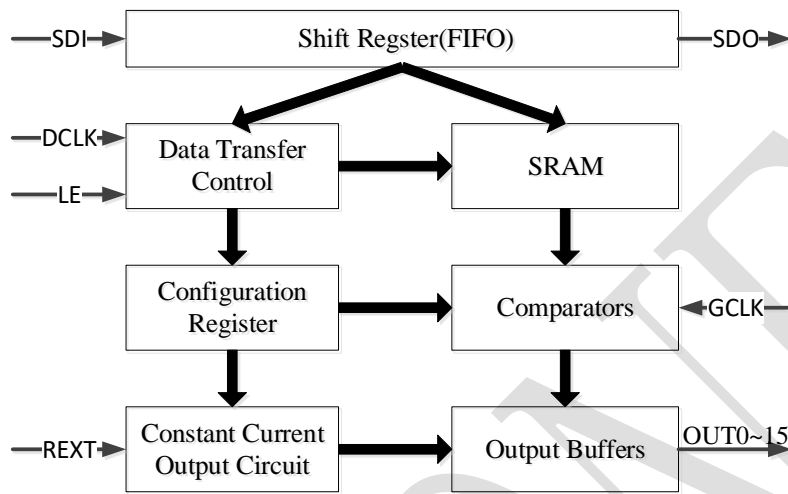
ICND2153AN-02(QFN24)		
Pin No.	Pin Name	Function
1	LE	Data transfer command input
2~9,11~18	OUT0 ~ OUT15	Constant current output
10	GND	Power Ground
19	SDO	Serial data output
20	GCLK	The reference clock input pin for PWM gray scale control
21	REXT	Constant-current value setting .Connection to an external resistor to GND
22	VDD	Power-supply voltage
23	SIN	Serial data input
24	DCLK	Clock input terminal for data shift and command information

3 AN-01: QFN24-4*4-0.5



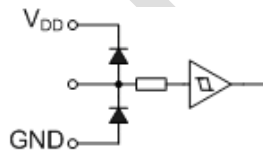
ICND2153AN-01(QFN24)		
Pin No.	Pin Name	Function
1	LE	Data transfer command input
2~17	OUT0 ~ OUT15	Constant current output
18	GCLK	The reference clock input pin for PWM gray scale control
19	SDO	Serial data output
20	REXT	Constant-current value setting .Connection to an external resistor to GND
21	VDD	Power-supply voltage
22	GND	Power Ground
23	SIN	Serial data input
24	DCLK	Clock input terminal for data shift and command information

ICND2153 Block Diagram

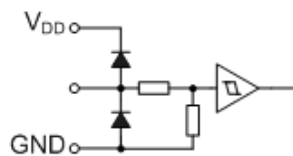


I/O Equivalent Circuits

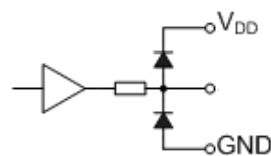
1. GCLK, SDI, LE



2. DCLK



3. SDO



Maximum Rating (Ta=25°C)

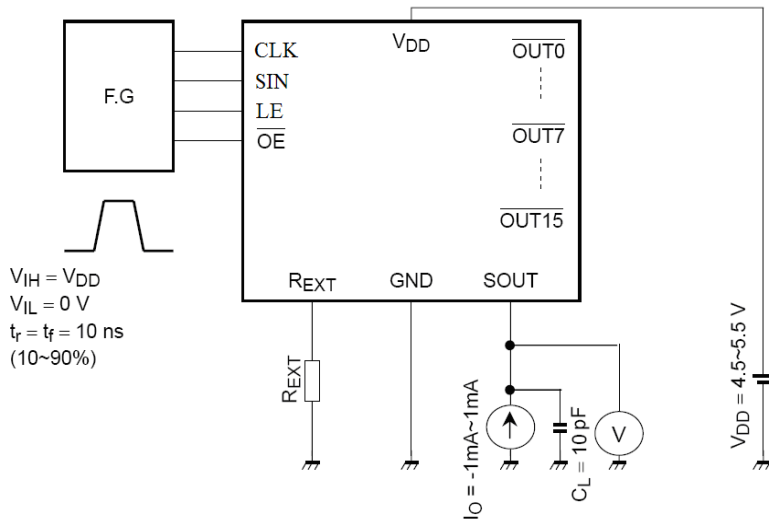
Characteristics	Symbol	Rating	Unit	
Supply Voltage	V _{DD}	0~6.0	V	
Output Current	I _o	25	mA	
Input Voltage	V _{IN}	-0.4~V _{DD} +0.4	V	
Output voltage	V _{OUT}	10V		
Clock Frequency	F _{CLK}	25	MHz	
GND Terminal Current	I _{GND}	+500	mA	
Power Dissipation (On 4 layer PCB, 25°C)	AN	P _D	4.09	W
	AP		1.98	
Thermal Resistance	AN	R _{th(j-a)}	30.5	°C/W
	AP		64	
Junction Temperature	T _j	150	°C	
Operating Temperature	T _{opr}	-40 ~ 85	°C	
Storage Temperature	T _{stg}	-55 ~ 150	°C	

Electrical Characteristics (Unless otherwise specified, V_{DD} =4.5~5.5V, T_a =25°C)

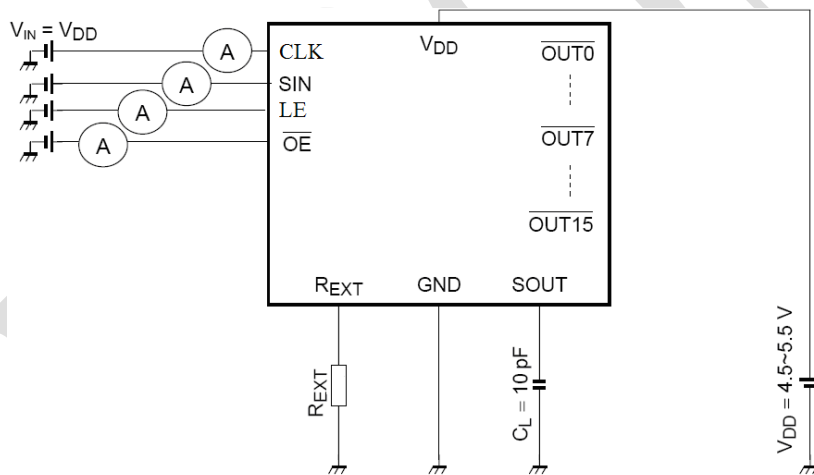
Characteristics	Symbol	Test circuit	Test Conditions	Min	Typ	Max	Unit
High level logic output voltage	V _{OH}	1	I _{OH} =-1mA, SDO	V _{DD} -0.4	-	V _{DD}	V
Low level logic output voltage	V _{OL}	1	I _{OH} =+1mA, SDO	-	-	0.4	V
High level logic input voltage	V _{IH}		-	0.7*V _{DD}	-	V _{DD}	V
Low level 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	R _{ext} =Open, Out off	-	4.3		mA
	I _{DD2}	4	R _{ext} =10KΩ, Out off	-	4.8		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, OUT0 ~ OUT15	-	±0.1	-	%/V
Constant current output voltage regulation	%V _{OUT}	5	V _O =0.6~3.0V, R _{EXT} =3kΩ, OUT0 ~ OUT15	-	±0.1	-	%/V
Pull-down resistor	R _{DOWN}	2	DCLK	100	200	400	kΩ

Test Circuit

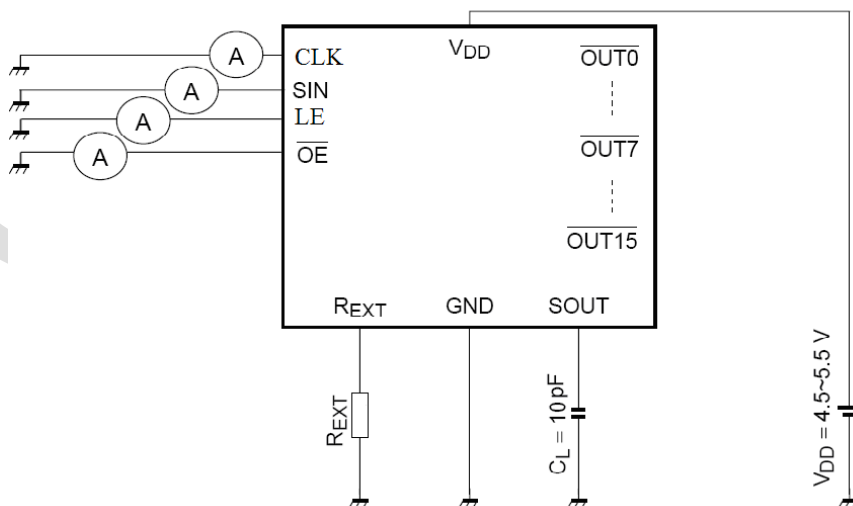
Test Circuit1: High level logic input voltage/Low level logic input voltage



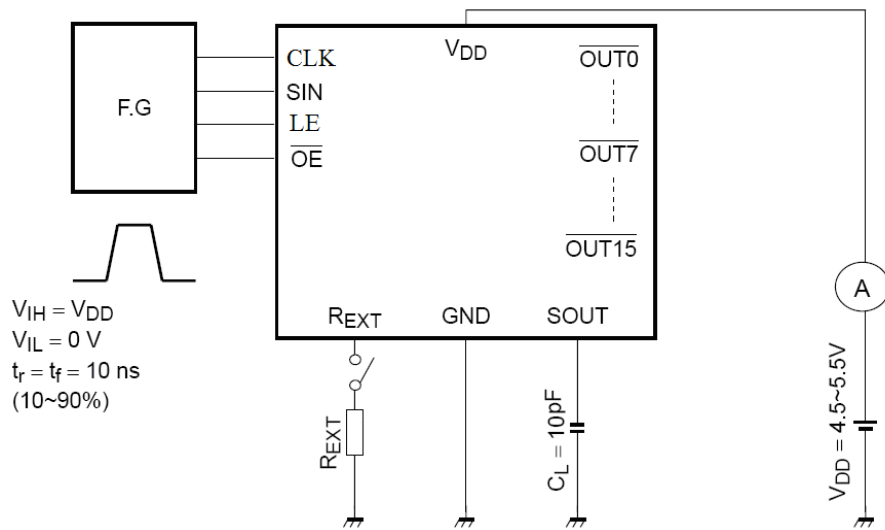
Test Circuit2: High level logic input current/Pull-down resistor



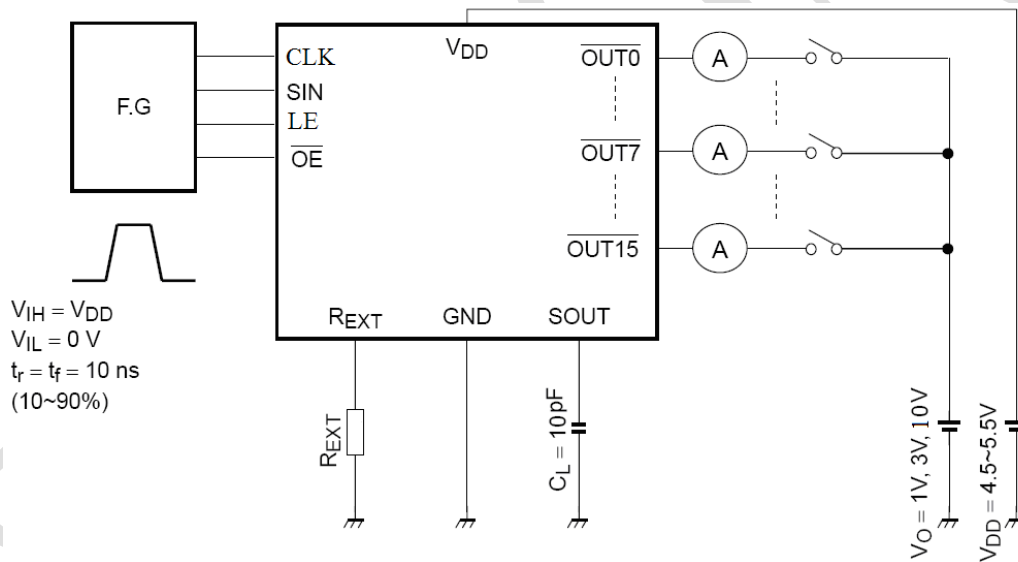
Test Circuit3: Low level logic input current/Pull-up resistor



Test Circuit4: Power supply current



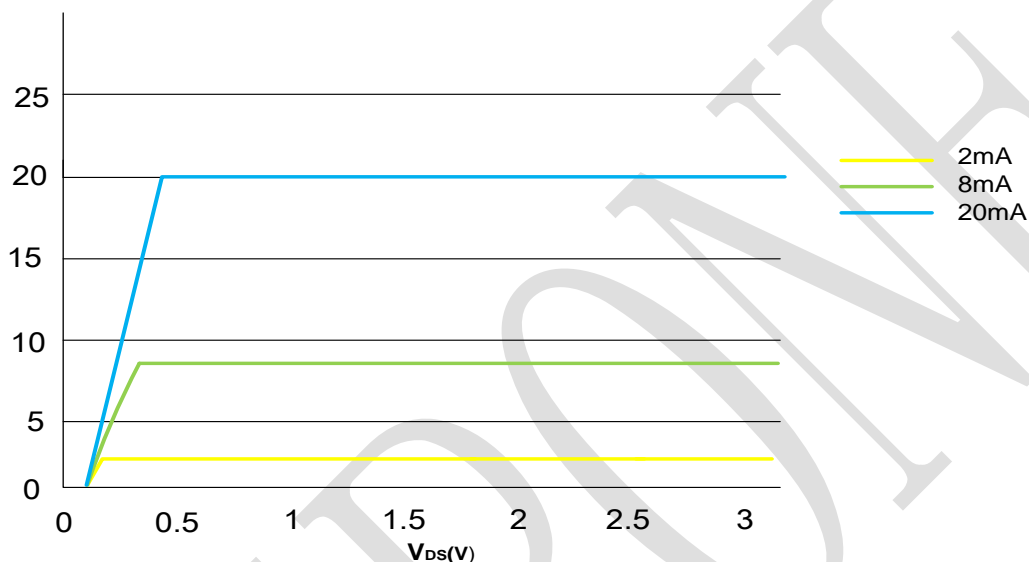
**Test Circuit5: Constant current output/Output OFF leak current/Constant current error
Constant current power supply voltage regulation/Constant current output voltage regulation**



Application Information

ICND2153 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 ICND2153 is set by an external resistor, R_{ext}. The relationship between I_{out} and R_{ext} is :

$$I_{out} = 9.25 / R_{ext} \quad I_{gain} = 100\%$$

cfg2[9]=1, I_{out}=18.5x I_{gain}/(R_{ext} x 256)

255 ≥ I_{gain} ≥ 64 50%–200%

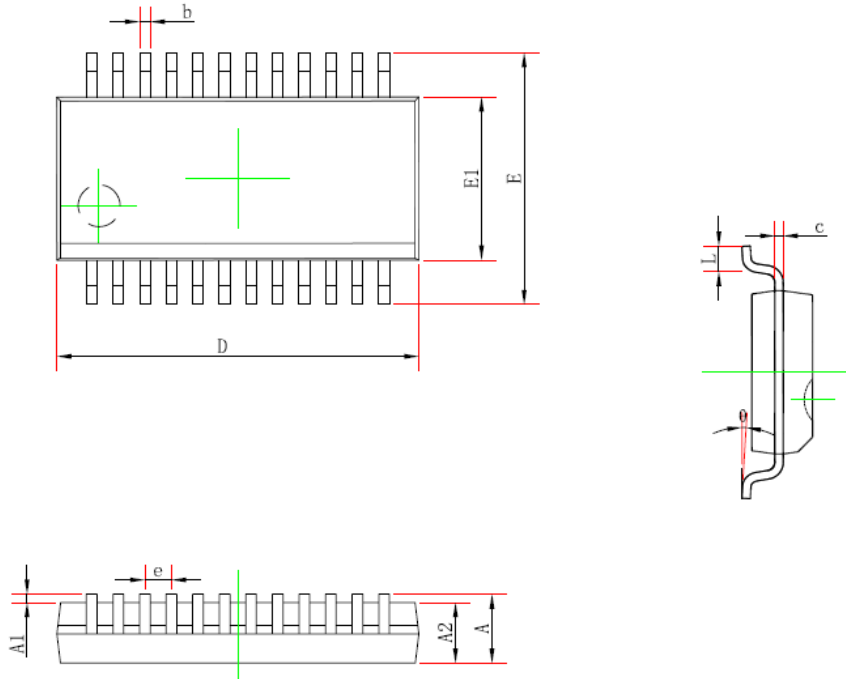
cfg2[9]=0, I_{out}=18.5x I_{gain}/(R_{ext} x 1024)

255 ≥ I_{gain} ≥ 64 12.5–50%

Package Outline

(1) SSOP24-P-150-0.635

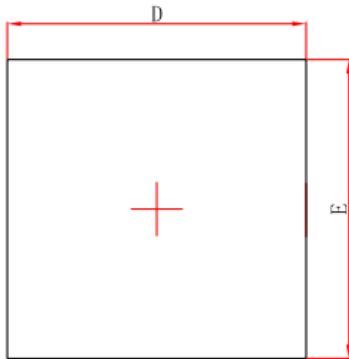
SSOP24 (150mil) PACKAGE OUTLINE DIMENSIONS



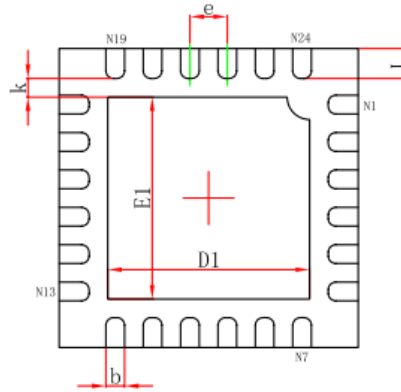
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min	Max	Min	Max
A	—	1.750	—	0.069
A1	0.100	0.250	0.004	0.010
A2	1.250	—	0.049	—
b	0.203	0.305	0.008	0.012
c	0.102	0.254	0.004	0.010
D	8.450	8.850	0.333	0.348
E1	3.800	4.000	0.150	0.157
E	5.800	6.200	0.228	0.244
e	0.635 (BSC)		0.025 (BSC)	
L	0.400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

(2) QFN24-4*4-0.5

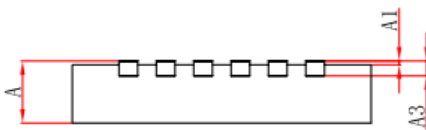
QFNWB4×4-24L (P0.50T0.75/0.85) PACKAGE OUTLINE DIMENSIONS



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)
ICND2153AP	SSOP24-0.635	130
ICND2153AN-01	QFN24-4*4-0.5	38
ICND2153AN-02	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	2019/01	Add LED forward voltage
1.3	2020/04	Change Thermal Information
1.4	2020/07	Add Current formula

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