CHIPONE
集创北方

ICN2053

(16-Channel PWM Constant Current LED Sink Driver)

Description

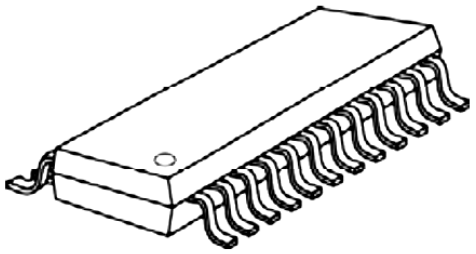
The ICN2053 is a 16-channel PWM constant current sink output LED driver for 1:32 time multiplexing applications. The constant-current value of all 16 channels is set by a single external resistor.

ICN2053 converts serial input date into each pixel's gray scale of the output port by a 16-bit shift register.ICN2053 detects individual LED open errors without extra components. ICN2053 also integrated pre-charge circuit for ghosting reduction, LED protect circuit.

The ICN2053 exploits current precision controlling technology，which makes error between ICs less than ±2.0%, and error between channels less than ±2.0%.

Package

Shrink SOP



SSOP 24-150-0.635

ICN2053

Features

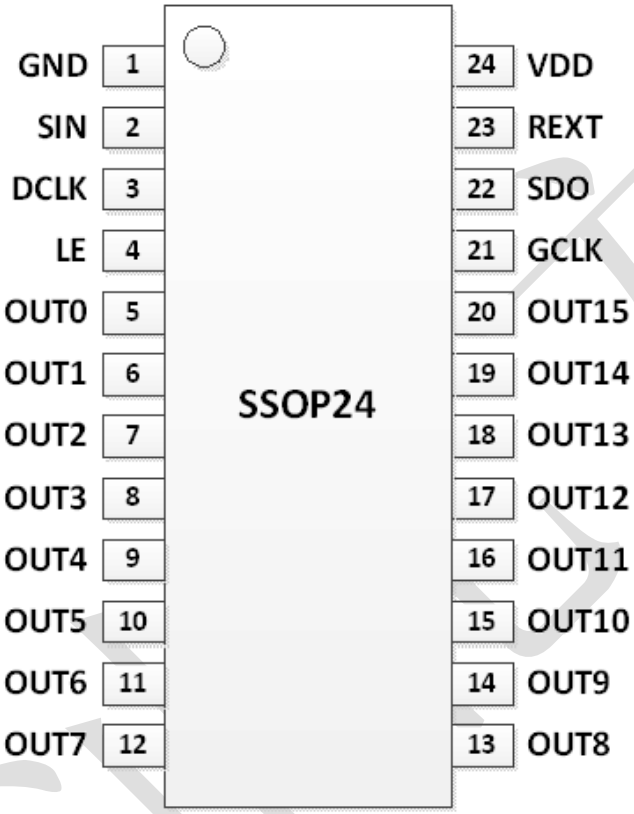
- 16 constant-current output channels
- Support time-multiplexing for 1~32 scans
- Output current setting range：
  0.5~25mA×16@V_{DD}=5V constant current output
  0.5~18mA×16@V_{DD}=4.2V constant current output
  0.5~10mA×16@V_{DD}=3.3V constant current output
- Current accuracy
  Between channel :< ±2.0 %(Max.)
  Between ICs :< ±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}=35MHz(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

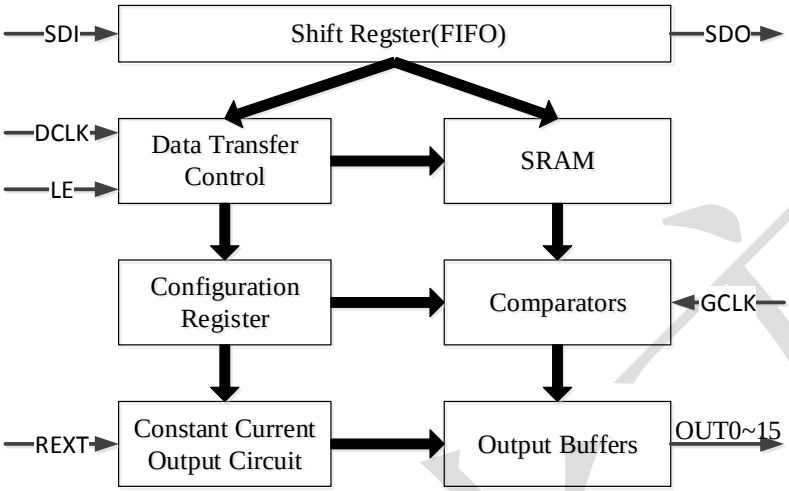
Pin Configuration

SSOP24-P-150-0.635



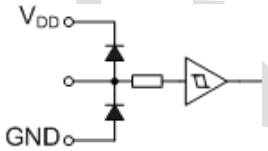
ICN2053(SSOP24)		
Pin No.	**Pin Name**	**Function**
1	GND	Power Ground
2	SIN	Serial data input
3	DCLK	Clock input terminal for data shift and command information
4	LE	Data transfer command input pin
5～20	$\overline{OUT0}$ ~ $\overline{OUT15}$	Constant current output
21	GCLK	The reference clock input 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

ICN2053 Block Diagram

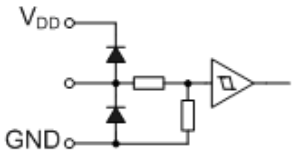


I/O Equivalent Circuits

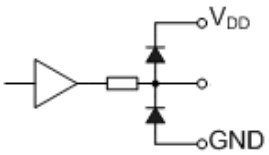
1. GCLK, SDI, LE



2. DCLK



3. SDO



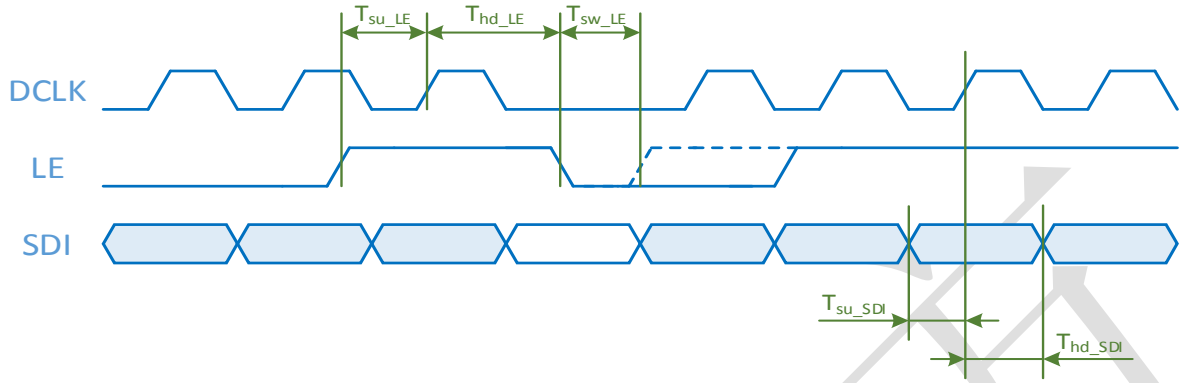
Control Command

Command Name	Number of DCLK Rising Edge when LE is High	Description
DATA_LATCH	1	Transfer Serial data to buffers
WR_DBG	2	Write Debug Register
VSYNC	3	Vertical Synchronal signal
WR_CFG1	4	Write Configuration Register 1
RD_CFG1	5	Read Configuration Register 1
WR_CFG2	6	Write Configuration Register 2
RD_CFG2	7	Read Configuration Register 2
WR_CFG3	8	Write Configuration Register 3
RD_CFG3	9	Read Configuration Register 3
WR_CFG4	10	Write Configuration Register 4
RD_CFG4	11	Read Configuration Register 4
EN_OP	12	Enable All Output Channels
DIS_OP	13	Disable All Output Channels
PRE_ACT	14	Pre-Active command

Data Transfer Order

Data Order	Line	Channel
1	Line 1	Channel 15 (OUT15)
2		Channel 14 (OUT14)
……		……
16		Channel 0 (OUT0)
17	Line 2	Channel 15 (OUT15)
18		Channel 14 (OUT14)
……		……
32		Channel 0 (OUT0)
……		
497	Line 32	Channel 15 (OUT15)
498		Channel 14 (OUT14)
……		……
512		Channel 0 (OUT0)

Timing Diagram



Maximum Rating (Ta=25℃)

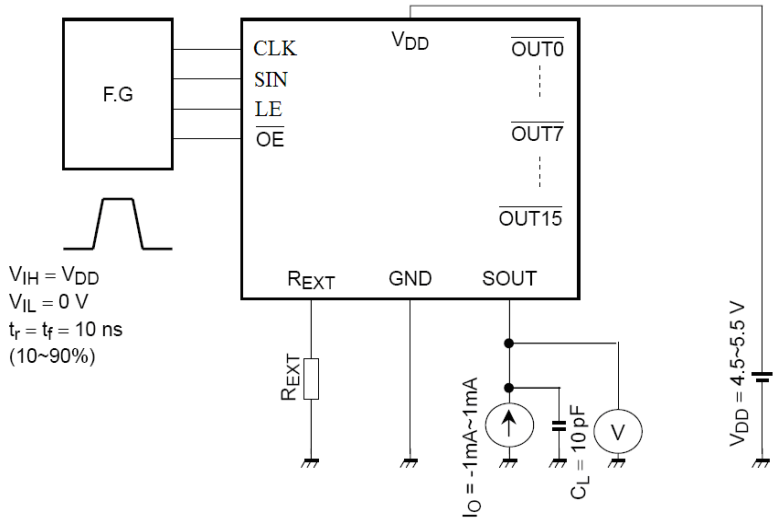
Characteristics		Symbol	Rating	Unit
Supply Voltage		V_{DD}	0~6.0	V
Output Current		I_O	25	mA
Input Voltage		V_{IN}	-0.4~V_{DD}+0.4	V
Output voltage		V_{OUT}	11V	
Clock Frequency		F_{CLK}	35	MHz
GND Terminal Current		I_{GND}	+1000	mA
Power Dissipation (On PCB，25℃)	DN-type	P_D	3.19	W
Thermal Resistance	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℃)

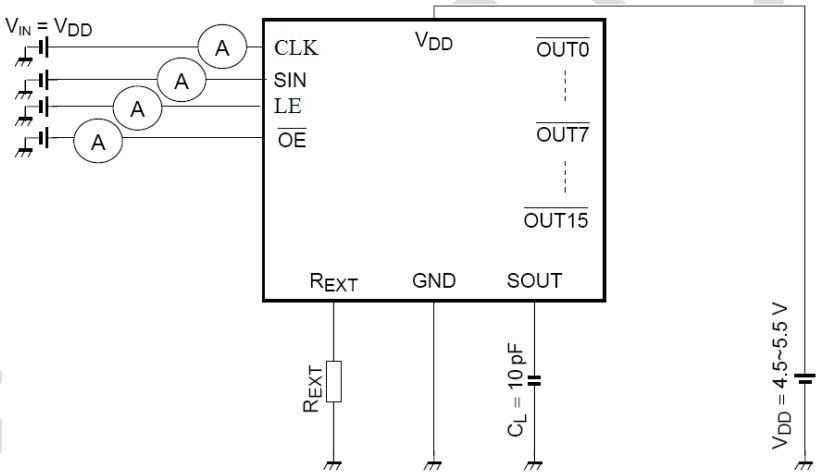
Characteristics	Symbol	Test circuit	Test Conditions	Min	Typ	Max	Unit
High level logic output voltage	V_{OH}	1	I_{OH}=-1mA, SDO	V_{DD}-0.4	-	V_{DD}	V
Low level logic output voltage	V_{OL}	1	I_{OH}=+1mA, SDO	-	-	0.4	V
High level logic input voltage	V_{IH}		0.7*V_{DD}	-	V_{DD}	V	
Low level logic input voltage	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

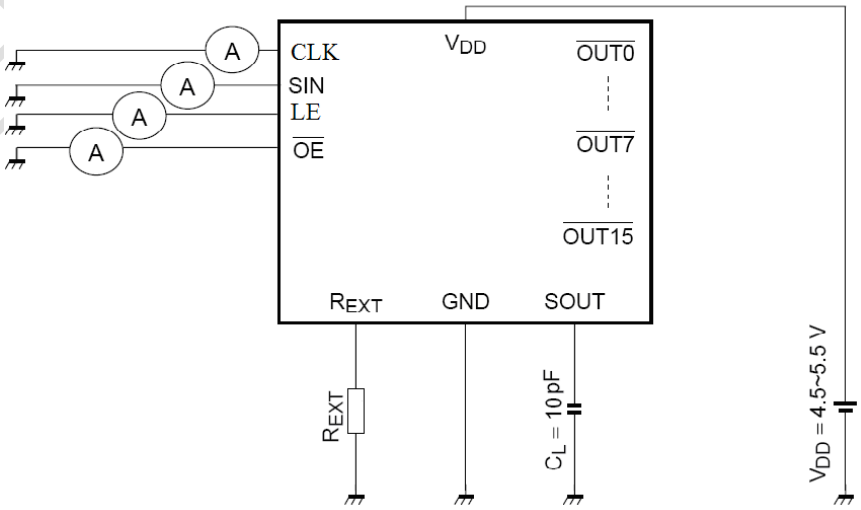
Test Circuit1: High level logic input voltage/Low level logic input voltage



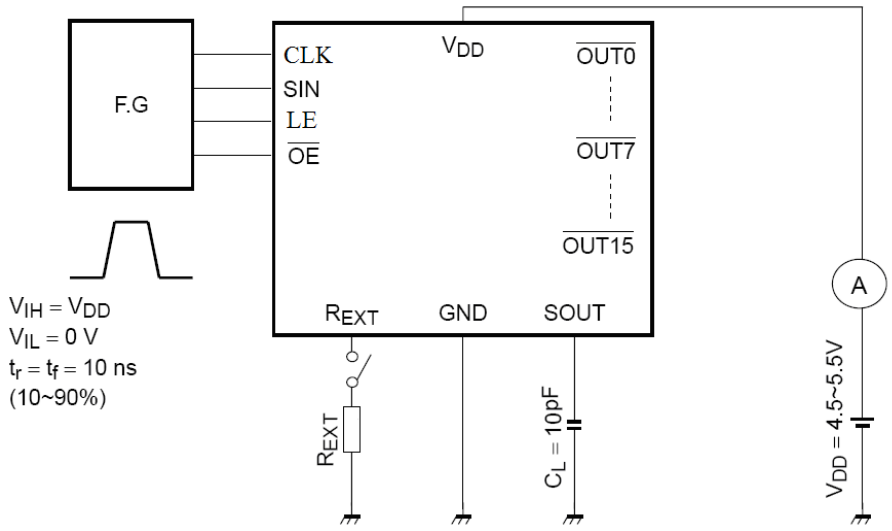
Test Circuit2: High level logic input current/Pull-down resistor



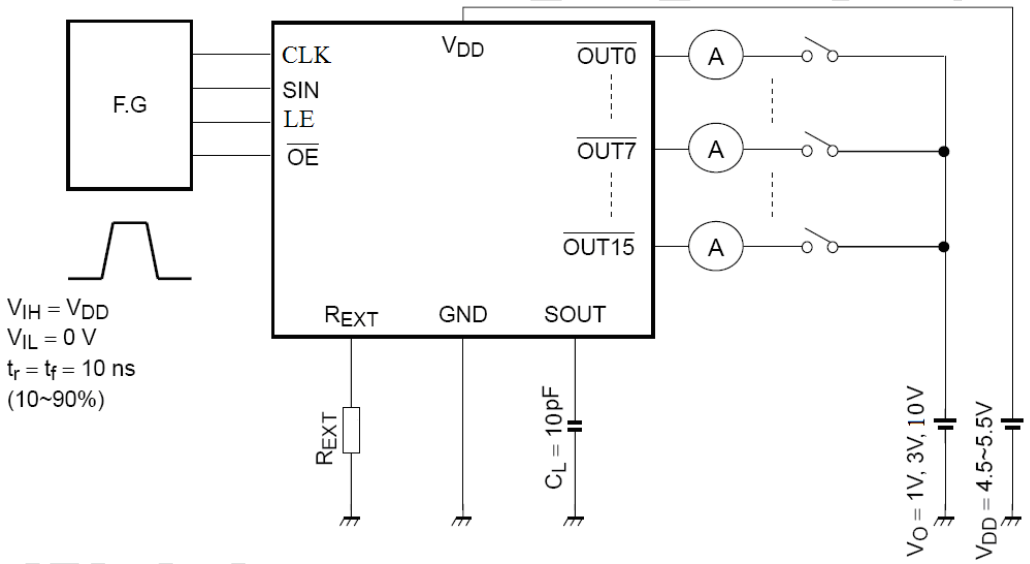
Test Circuit3：Low level logic input current/Pull-up resistor



Test Circuit4: Power supply current



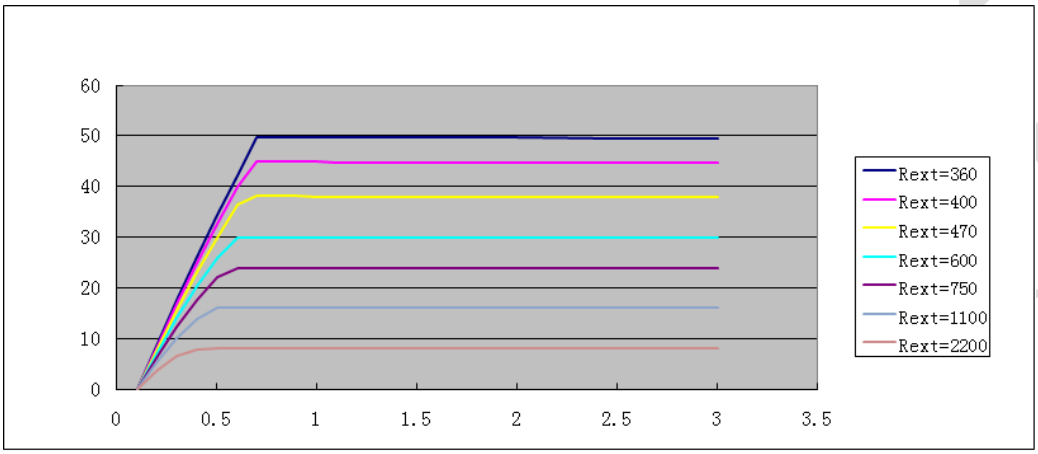
Test Circuit5: Constant current output/Output OFF leak current/Constant current error
Constant current power supply voltage regulation/Constant current output voltage regulation



Application Information

ICN2053 exploits current precision controlling technology，and provides nearly no current variations from channel to channel and from IC to IC.

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, and can be kept constant regardless of the variations of LED forward voltage.



Setting Output Current

The output current (I_{out}) of ICN2053 is set by an external resistor, R_{ext}. The relationship between I_{out} and R_{ext} is ：

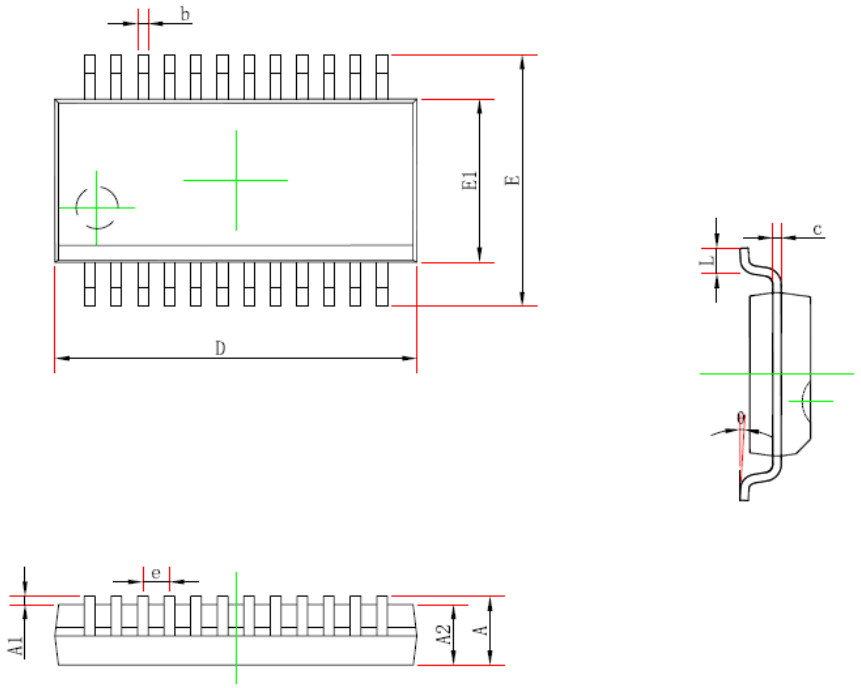
$$V_{R-EXT}=1.232V;$$

$$Iout=(V_{R-EXT}/Rext)*7.5$$

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）
ICN2053BP	SSOP24-0.635	130

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