

CHIPONE

集创北方

ICND2076

(48-Channel PWM Constant Current LED Sink Driver)

Description

The ICND2076 is a 48-channel PWM constant current sink LED driver for 1:64 time multiplexing applications (with 96KB SRAM). ICND2076 uses built-in resistance to control the output current, simplifies the external circuit, adopts double-edge trigger design, and does not need external GCLK to reduce the EMI of the system.

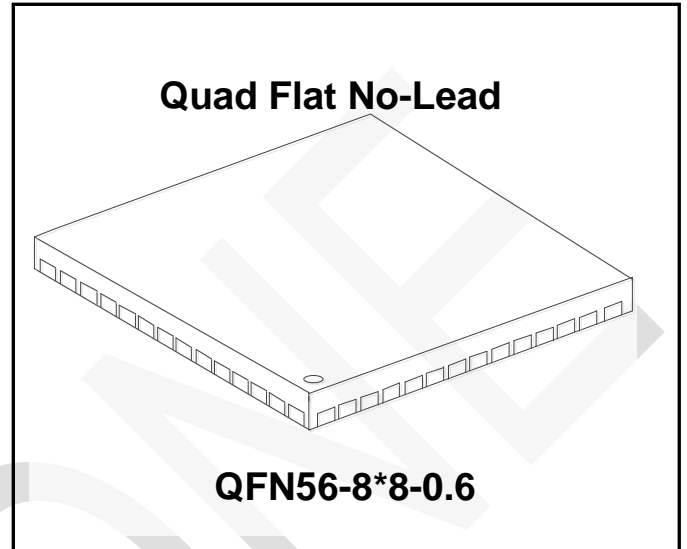
ICND2076 converts serial input data into the gray scale of each pixel. ICND2076 detects individual LED open errors without extra components. ICND2076 also integrated pre-charge circuit for ghosting reduction.

The ICND2076 exploits precise current regulation technology, with both channel-to-channel error and chip-to-chip error less than $\pm 2.0\%$ ($I_{out} < 25mA$)

Features

- ✧ 48 constant-current output channels
- ✧ Support time-multiplexing for 1~64 scans
- ✧ Output current setting range:
0.5~30mA@ $V_{DD}=4.2V$ constant current output
0.5~27mA@ $V_{DD}=3.8V$ constant current output
- ✧ Current accuracy
Between channel : $< \pm 2.0\%$ (Max.)
Between ICs : $< \pm 2.0\%$ @ $I_{out} < 25mA$ (Max.)
Between ICs : $< \pm 2.5\%$ @ $I_{out} \geq 25mA$ (Max.)
- ✧ 8 bit current gain: 22%~200%
- ✧ Fast response of output current: 20ns@ $V_{DD}=5V$
- ✧ Data transfer frequency: $f_{MAX}=25MHz$ (Max)
- ✧ Power supply voltage: $V_{DD}=3.3\sim 5V$
- ✧ Operating Temperature: $-40^{\circ}C$ to $+85^{\circ}C$
- ✧ 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

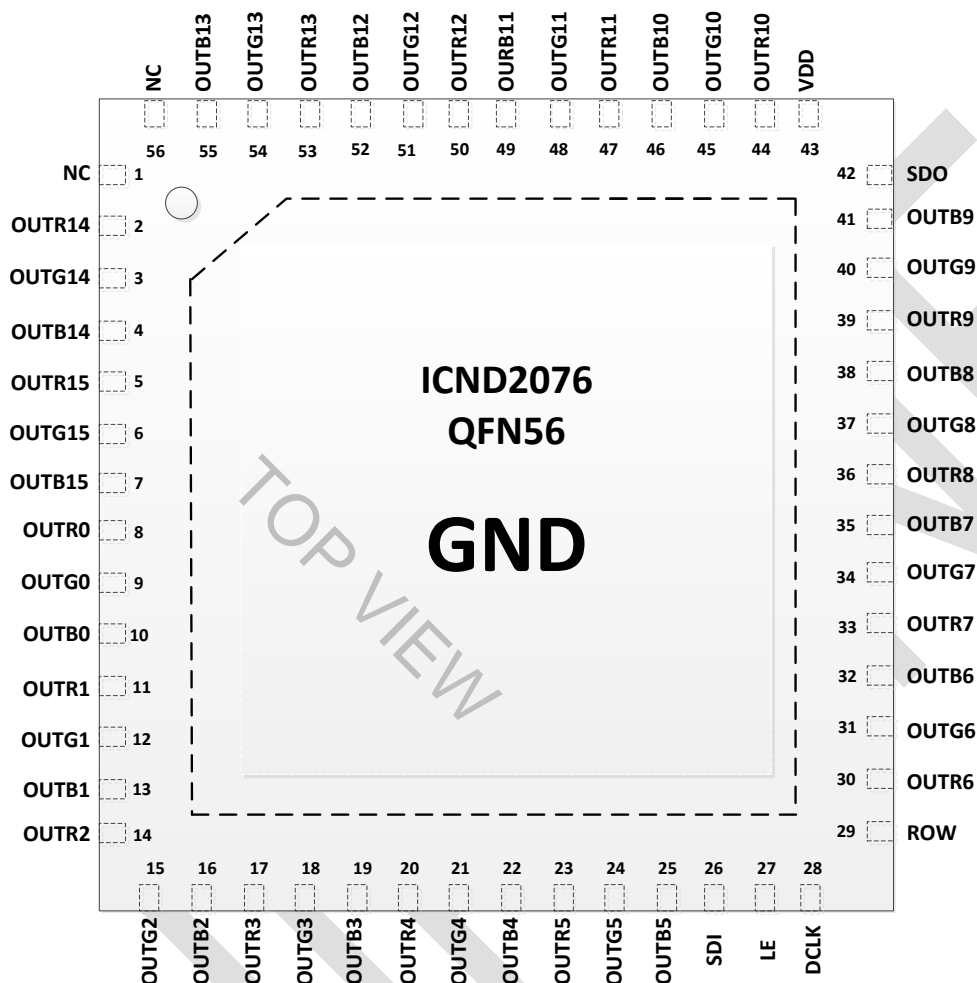
Package



ICND2076

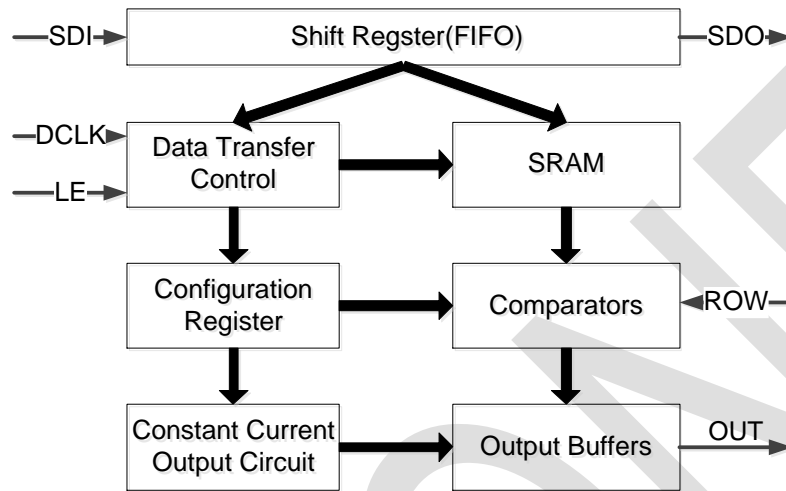
Pin Configuration

QFN56-8*8-0.5



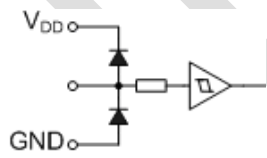
ICND2076 (QFN56)		
Pin No.	Pin Name	Function
1, 56	NC	-
2~25 30~41 44~55	OUTR15~OUTB5, OUTR6~OUTB9, OUTR10~OUTB13	Constant current output R is for red LED,G is for green LED,B is for blue LED
26	SDI	Serial data input
27	LE	Data transfer command input
28	DCLK	Clock input terminal for data shift and command information
29	ROW	Scan Line change signal
42	SDO	Serial data output
43	VDD	Power-supply voltage
Thermal-Pad	GND	Power Ground

ICND2076 Block Diagram

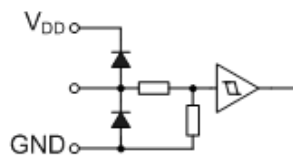


I/O Equivalent Circuits

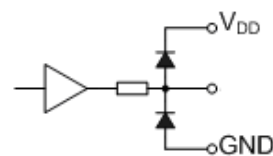
1. ROW, SDI, LE



2. DCLK



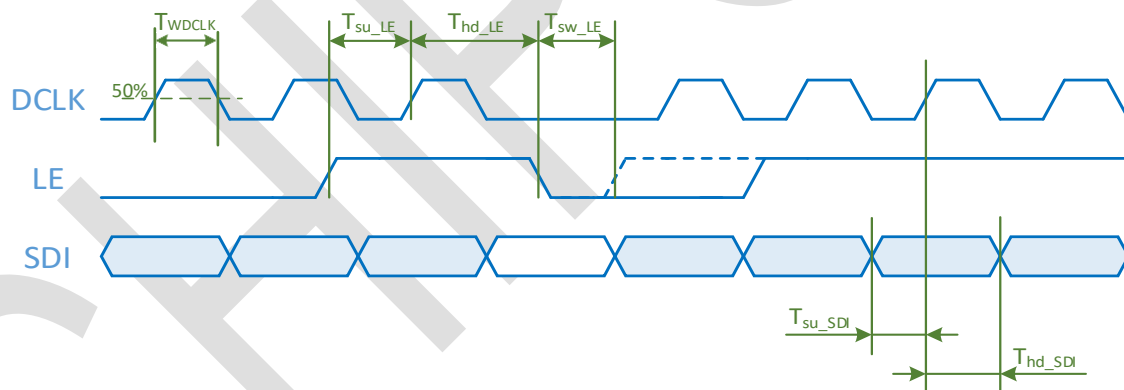
3. SDO



Data Transfer Order

Data Order	Line	Channel
1	Line 1	Channel 15 (OUT15R, OUT15G, OUT15B)
2		Channel 14 (OUT14R, OUT14G, OUT14B)
.....	
16		Channel 0 (OUT0R, OUT0G, OUT0B)
17	Line 2	Channel 15 (OUT15R, OUT15G, OUT15B)
18		Channel 14 (OUT14R, OUT14G, OUT14B)
.....	
32		Channel 0 (OUT0R, OUT0G, OUT0B)
.....		
497	Line 32	Channel 15 (OUT15R, OUT15G, OUT15B)
498		Channel 14 (OUT14R, OUT14G, OUT14B)
.....	
512		Channel 0 (OUT0R, OUT0G, OUT0B)

Timing Diagram



Name	MIN
T_{su_LE}	7ns
T_{hd_LE}	7ns
T_{sw_LE}	10ns
T_{su_SDI}	3ns
T_{hd_SDI}	3ns
T_{WDCLK}	20ns

Maximum Rating ($T_a=25^\circ\text{C}$)

Characteristics	Symbol	Rating	Unit
Supply Voltage	V_{DD}	0~6.0	V
Output Current	I_o	30	mA
Input Voltage	V_{IN}	-0.4~ $V_{DD}+0.4$	V
Output voltage	V_{OUT}	10	V
Clock Frequency	F_{CLK}	25	MHz
Junction Temperature	$T_{j, Max}$	150	$^\circ\text{C}$
Operating Temperature	T_{opr}	-40 ~ 85	$^\circ\text{C}$
Storage Temperature	T_{stg}	-55 ~ 150	$^\circ\text{C}$

Electrical Characteristics (Unless otherwise specified, $V_{DD}=3.3\sim 5.5\text{V}$, $T_a=25^\circ\text{C}$)

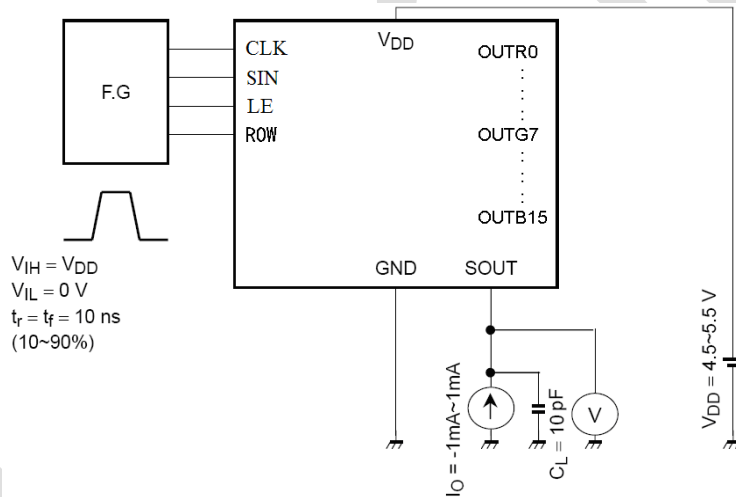
Characteristics	Symbol	Test circuit	Test Conditions	Min	Typ	Max	Unit
High level logic output voltage	V_{OH}	1	$I_{OH}=-1\text{mA}$, SDO	$V_{DD}-0.4$	-	V_{DD}	V
Low level logic output voltage	V_{OL}	1	$I_{OH}=+1\text{mA}$, SDO	-	-	0.4	V
High level logic input voltage	V_{IH}		-	$0.7 \cdot V_{DD}$	-	V_{DD}	V
Low level logic input voltage	V_{IL}	3	-	GND	-	$0.3 \cdot V_{DD}$	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	$V_{IN}=\text{GND}$ SDI,CLK,LE,GCLK	-1	-	-	μA
Power supply current	I_{VDD}	4	$I_{out}=2\text{mA}$	-	10		mA
Constant current error	ΔI_o	5	0.5mA~25mA	-	± 1.0	± 2.0	%
Constant current power supply voltage regulation	$\%V_{DD}$	5	$I_{out}=2\text{mA}$	-	± 0.1	-	$\%/V$
Constant current output voltage regulation	$\%V_{OUT}$	5	$V_o=0.6\sim 3.0\text{V}$, $I_{out}=2\text{mA}$	-	± 0.1		$\%/V$

Switching Characteristics (Unless otherwise specified, $T_a = 25^\circ\text{C}$)

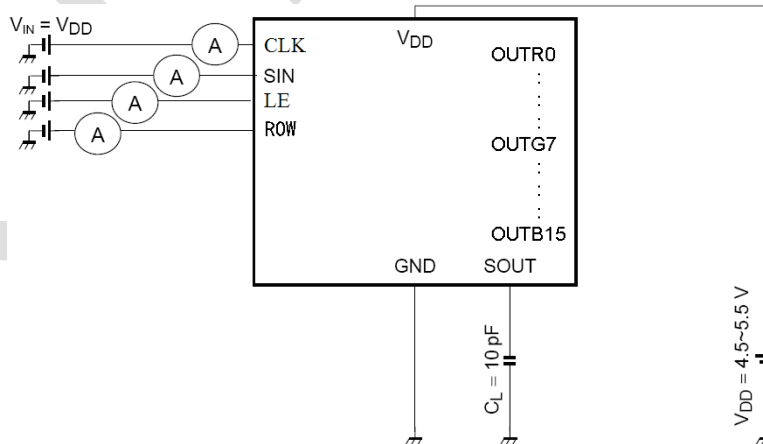
Characteristics		Symbol	Test circuit	Test conditions	Min	Typ	Max	Unit
Propagation delay time	CLK-SDO	t_{pHL}	6	$V_{DD}=5.0\text{V}, C_{load}=5\text{pF}$	-	20		ns
				$V_{DD}=3.8\text{V}, C_{load}=5\text{pF}$		22		
				$V_{DD}=3.3\text{V}, C_{load}=5\text{pF}$		25		
Output rise time		t_{or}	6	$V_{DD}=5.0\text{V}$	-	25	65	ns
				$V_{DD}=3.8\text{V}$		23	65	
				$V_{DD}=3.3\text{V}$		22	65	
Output fall time		t_{of}	6	$V_{DD}=5.0\text{V}$	-	33	55	ns
				$V_{DD}=3.8\text{V}$		30	55	
				$V_{DD}=3.3\text{V}$		29	55	

Test Circuit

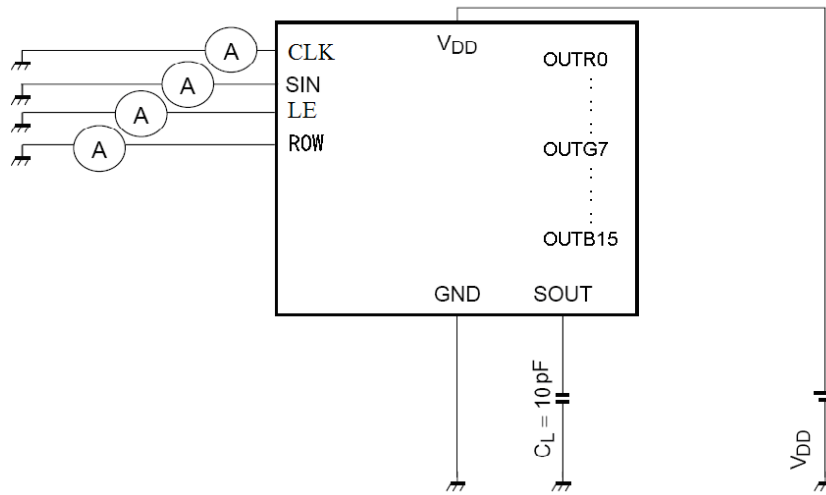
Test Circuit1: High level logic input voltage/Low level logic input voltage



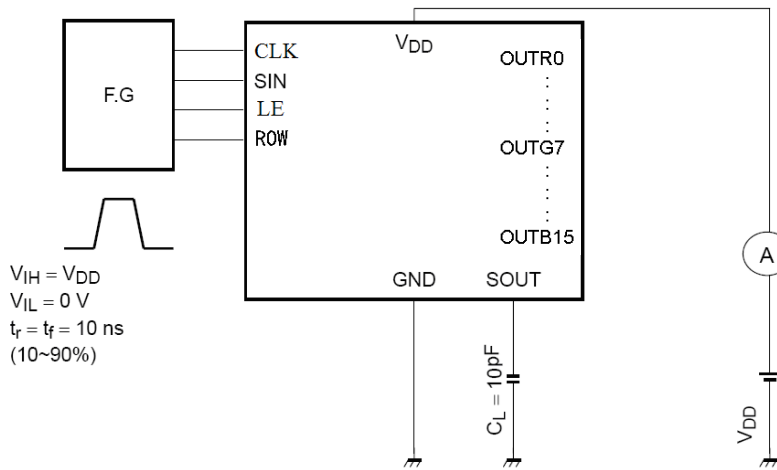
Test Circuit2: High level logic input current/Pull-down resistor



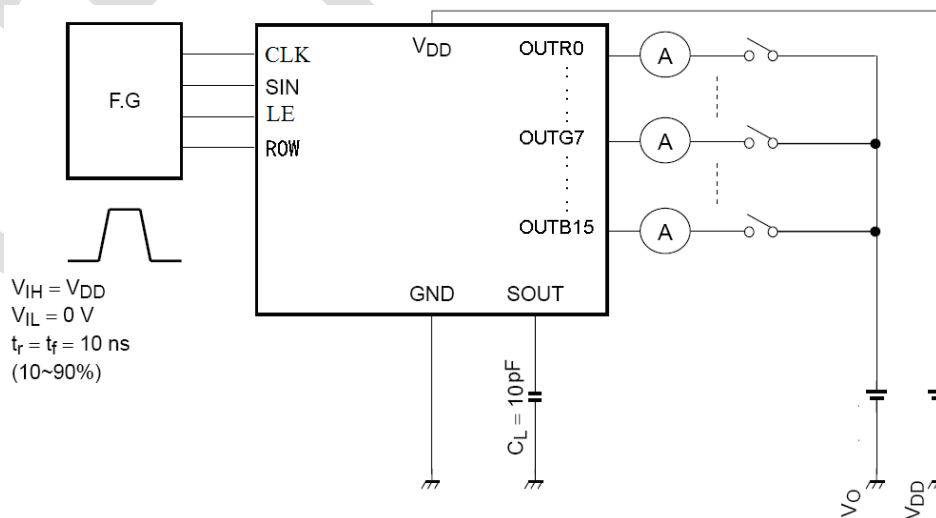
Test Circuit3: Low level logic input current/Pull-up resistor



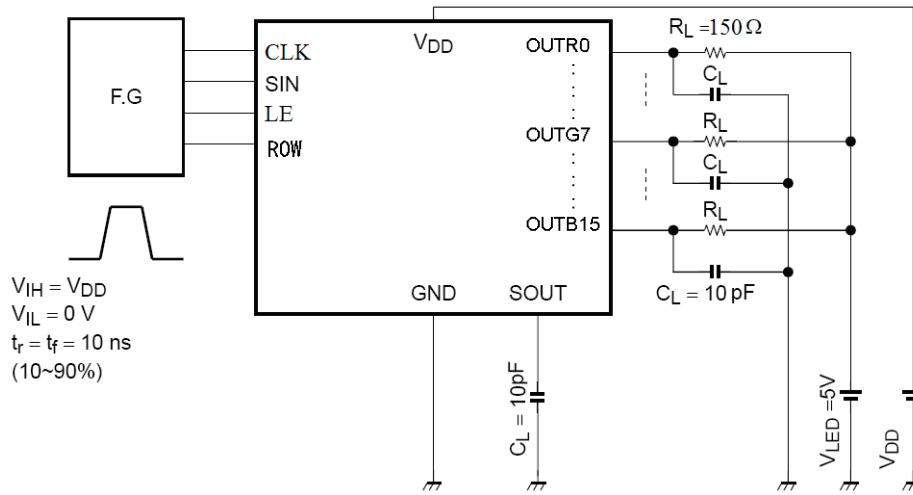
Test Circuit4: Power supply current



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



Test Circuit6: Switching characteristics

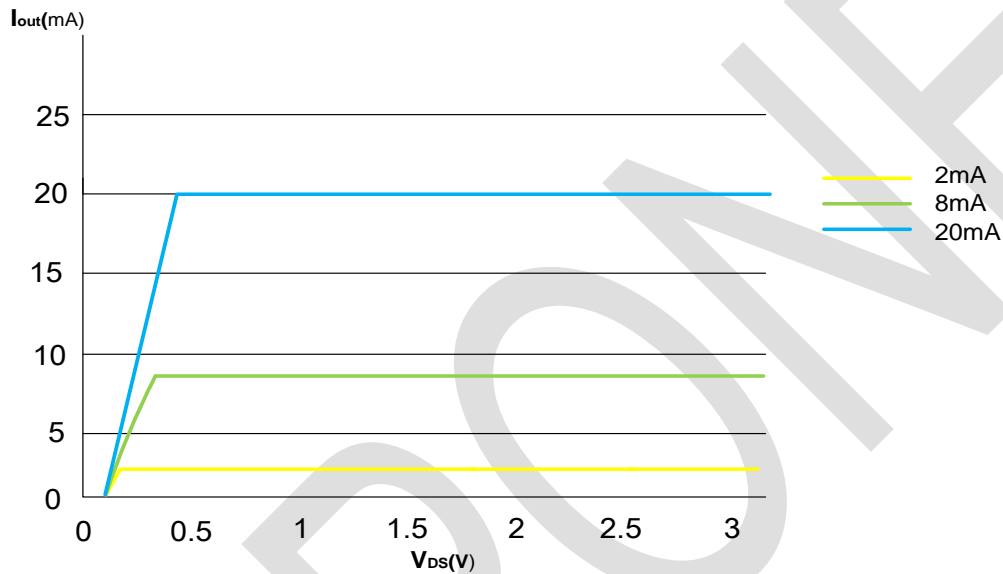


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Application Information

ICND2076 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 $\leq \pm 2.0\%$ ($I_{out} < 25\text{mA}$).
- 2) The current characteristic of output stage is flat. The output current can be kept constant regardless of the variations of LED forward voltage.



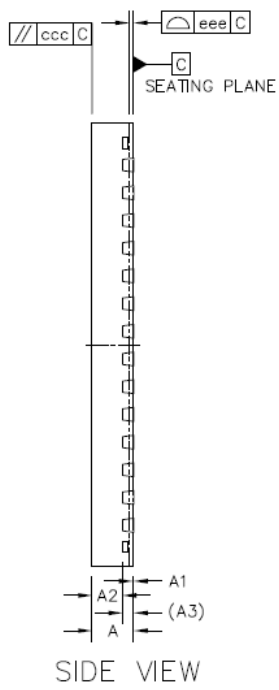
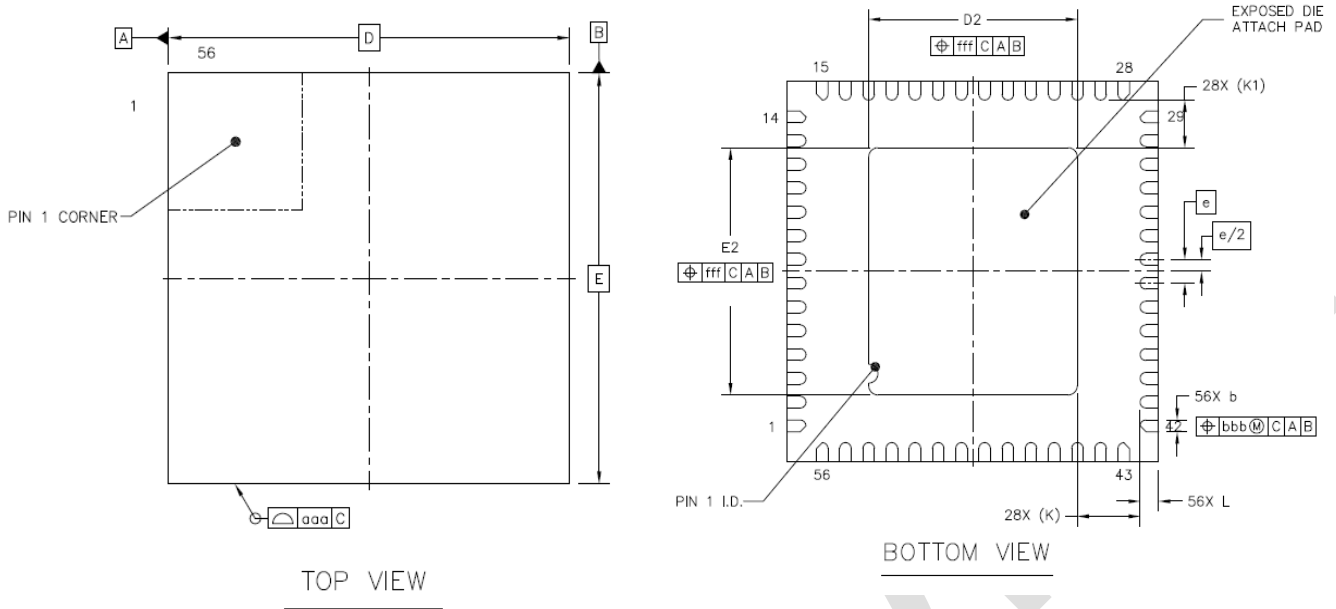
Setting Output Current

$I_{OUT} = 77.79\mu\text{A} * (igain - 63) / (current_range + 1) * 6$ $igain < 7 \geq 1$
 $I_{OUT} = 77.79\mu\text{A} * (igain + 65) / (current_range + 1) * 2$ $igain < 7 \geq 0$
 Red $igain$: reg0x05[31:24] $current_range$: reg0x04 [19:15]
 Green $igain$: reg0x07[31:24] $current_range$: reg0x06[19:15]
 Blue $igain$: reg0x09[31:24] $current_range$: reg0x08 [19:15]

Note:
 $igain > 42$
 $current > 2$

Package Outline

QFN56 8*8-0.5



		SYMBOL	MIN	NOM	MAX
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3	0.203 REF		
LEAD WIDTH		b	0.2	0.25	0.3
BODY SIZE	X	D	8 BSC		
	Y	E	8 BSC		
LEAD PITCH		e	0.5 BSC		
EP SIZE	X	D2	4.4	4.5	4.6
	Y	E2	5.1	5.2	5.3
LEAD LENGTH		L	0.3	0.4	0.5
LEAD TIP TO EXPOSED PAD EDGE		K	1.35 REF		
		K1	1 REF		
PACKAGE EDGE TOLERANCE		aaa	0.1		
MOLD FLATNESS		ccc	0.1		
COPLANARITY		eee	0.08		
LEAD OFFSET		bbb	0.1		
EXPOSED PAD OFFSET		fff	0.1		

Product Ordering Information

Product number	Package (Pb-Free)	Weight (mg)
ICND2076AN	QFN56 8*8-0.5	TBD

Revision History

Rev	Date	Description
0.1	2019/03	Initial Release
0.2	2019/03	Change Rext
0.3	2019/04	Change ICND2056 to ICND2076
0.4	2019/04	Change Current I _g ian and Package Outline
0.5	2019/08	Add Switching Characteristics@3.3V and 5V
0.6	2019/08	Change Test Circuit5
0.7	2019/12	Update Output Current Range
0.8	2020/02	Add Junction Temperature and TWDCLK

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