LED Driver Datasheet

NU514E

4 channel constant current LED driver

Features

- 4 constant current sink outputs
- 12 ~ 140mA channel sink current
- 3V to 5.5V supply voltage
- Excellent current sink uniformity
  channel to channel: ＜ ± 3%
  chip to chip: ＜ ± 4%
- OE pulse width: 120ns
- Schmitt trigger input
- 165℃ thermal shutdown protect
- 5ns output group delay for stagger output
- Maximum output voltage: 30V
- -40℃ ~ +85℃ operating temperature

Product Description

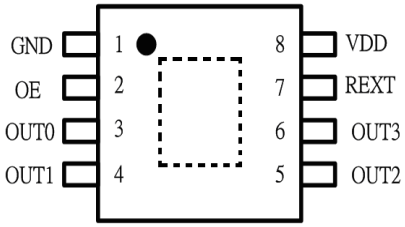
NU514 is a 4 channels constant current sink driver used for LED lighting. NU514 can sink 4 channels constant current simultaneously by the control of a single OE pin. The sink current of output channels can be set easily by an external resistor Rext. Each output channel can be connected with each other to gain higher current driving capability. With this parallel-able output capability, one NU514 can drive constant current from 12mA to 360mA being used to most types of LEDs.

Applications

- General LED Lighting
- Decoration lighting for architecture
- LCD back lighting
- Street lamp

Package Type

- ESOP8
  (Part No.: NU514ES)



Terminal Description

Pin name	Function
V_{DD}	5V/3.3V power supply
GND	Chip ground pin
R_{EXT}	Current setting resistor
OE	Output enable
OUT0 ~ OUT3	Constant current sink terminals
Thermal pad	Chip ground pin potential

Protection Circuit

- 3KV output channel ESD protection

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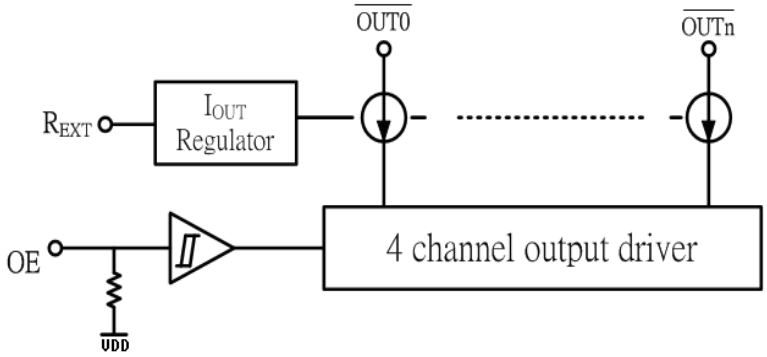
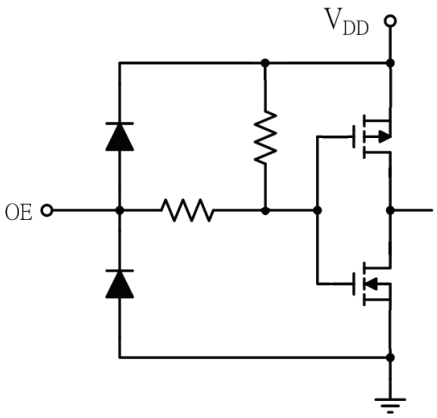
Block Diagram



Equivalent Circuits for OE Input



Maximum Ratings (T = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	0 ~ 6.0	V
Input pin voltage	V_{IN}	-0.2 ~ V_{DD}+0.2	V
Output current	I_{OUT}	160	mA/Channel
Output voltage	V_{OUT}	-0.2 ~ 30.0	V
Total GND terminals current	I_{GND}	640	mA
Power Dissipation (On PCB)	PD	1	W
Thermal Resistance	$R_{TH(j-a)}$	100	°C /W
Junction temperature	T_j	170	°C
Operating temperature (Ambient)	T_{OPR}	-40 ~ +85	°C
Storage temperature	T_{STG}	-55 ~ +150	°C

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Electrical Characteristics and Recommended Operating Conditions

Characteristic		Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage		V_{DD}	Room Temp.	3	-	5.5	V
Output port sustaining voltage		V_{OUT}	-	-	-	30	V
Output current		I_{OUT}	OUTn = 1V	12	-	140	mA
Output leakage		I_{LEAK}	V_O = 7V and channel off	-	-	0.1	uA
Channel current skew (Output)		dI_{OUT1}	I_{OUT} = 80mA, V_{OUT} = 1V	-	±1	±3	%
Center current skew (IC)		dI_{OUT2}	I_{OUT} = 80mA, V_{OUT} = 1V	-	-	±4	%
Line regulation		$\%/dV_{DD}$	R_{EXT} = 900Ω, V_{OUT} = 1V	-	±0.5	±1	%
Load regulation		$\%/dV_{OUT}$	R_{EXT} = 900Ω	-	±0.1	±3	%
Input voltage		V_{IH}		$0.7V_{DD}$	-	-	V
		V_{IL}		-	-	$0.3V_{DD}$	V
Thermal protect (Junction temperature)		T_{HalfP}	Half current output	-	135	-	°C
		T_{Shut}	All output off	-	165	-	
Pull up resistor (OE)		R_{PU}		400	500	700	KΩ
Supply current	All output "Off"	$I_{DD1(off)}$	R_{EXT} = Open, all output off	-	9	-	mA
		$I_{DD2(off)}$	R_{EXT} = 1200Ω, all output off	-	10	-	mA
		$I_{DD3(off)}$	R_{EXT} = 600Ω, all output off	-	12	-	mA
	All output "On"	$I_{DD1(on)}$	R_{EXT} = 1200Ω, all output on	-	10	-	mA
		$I_{DD2(on)}$	R_{EXT} = 600Ω, all output on	-	6	-	mA

Switching Characteristics

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time (OE from "H" to "L")	t_{pLH}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=80mA, OE= 4V → 0V	100	-	250	nS
Output current rising time (OE from "H" to L")	t_{OERise}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=80mA, OE= 4V → 0V	100	-	250	nS
Propagation Delay Time (OE from "L" to "H")	t_{pHL}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=80mA, OE=0V → 4V	100	-	500	nS
Output current falling time (OE from "L" to "H")	t_{OEFall}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=80mA, OE= 0V → 4V	100	-	250	nS

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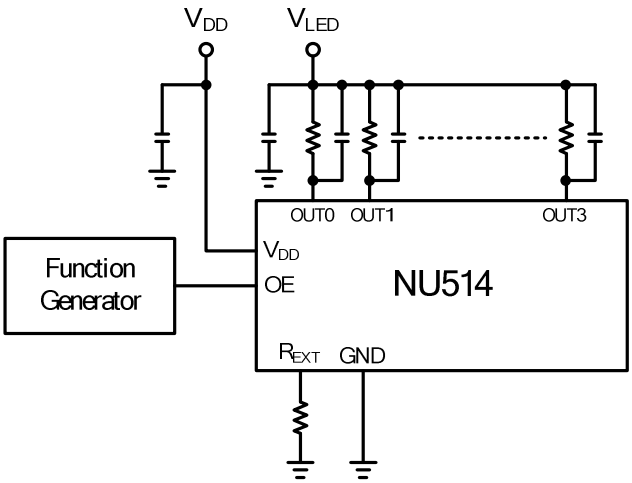
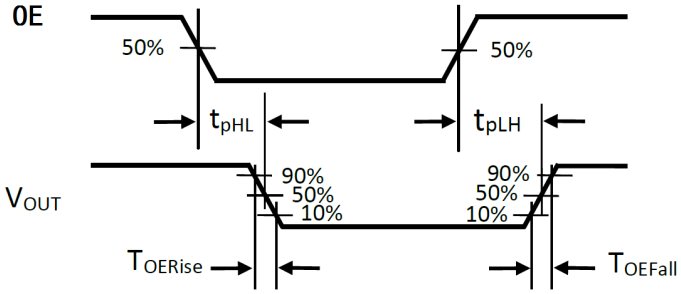
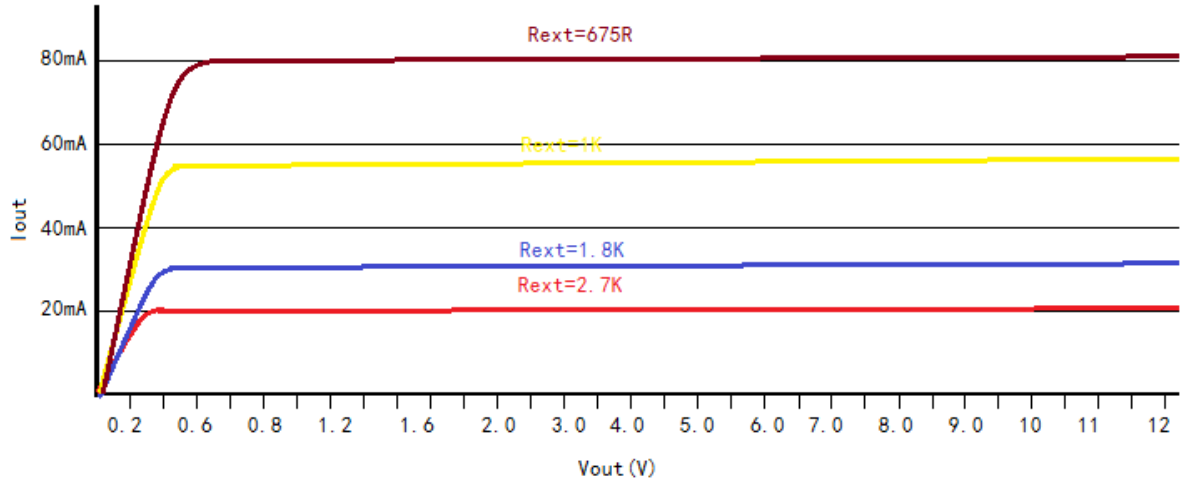
Test Circuit for Switching Characteristics



Timing Waveforms



I/V curve



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Output Current Setting

The output current of each channel of NU514 is set by an external resistor (R_{EXT}). The relationship between output current and external resistor is shown in the figure or calculated from the equation following.

$$I_{OUT}(A) \fallingdotseq \frac{54}{R_{EXT}(\Omega)}$$

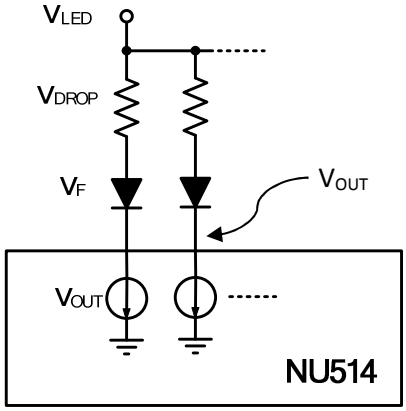
Example: I_{OUT} = 20mA

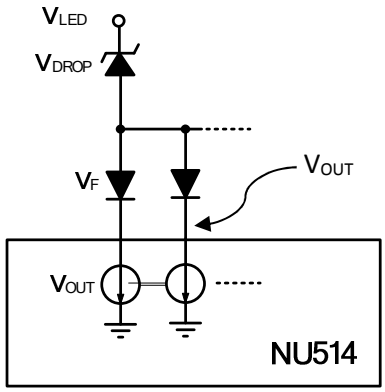
$$0.02(A) \cong \frac{54}{R(\Omega)} \Rightarrow R(\Omega) \cong \frac{54}{0.02(A)} \Rightarrow 2700(\Omega)$$

Application Notes

- In order to maximize the heat dissipation capability and keep the NU514 function normally, the thermal pad under SOP package should be soldered to the PCB and connect to the ground net of system. More the ground area, more the heat dissipation capability that NU514 relies on.
- The V_{OUT} should be as low as possible near the knee point of the output I/V curve to minimize the heat generation from NU514. An external resistors or zener diodes can be used to minimize V_{OUT} in the output current path. The suggestion V_{OUT} voltage is between 0.4v to 1v.

  Ex: $V_{OUT} = V_{LED} - (V_{DROP} + V_F)$





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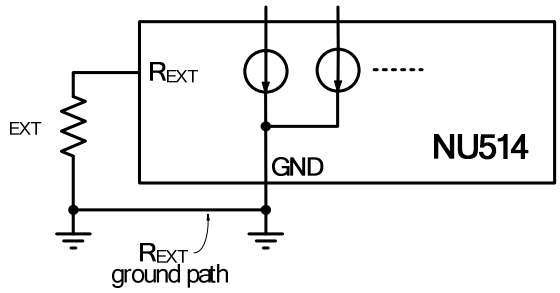
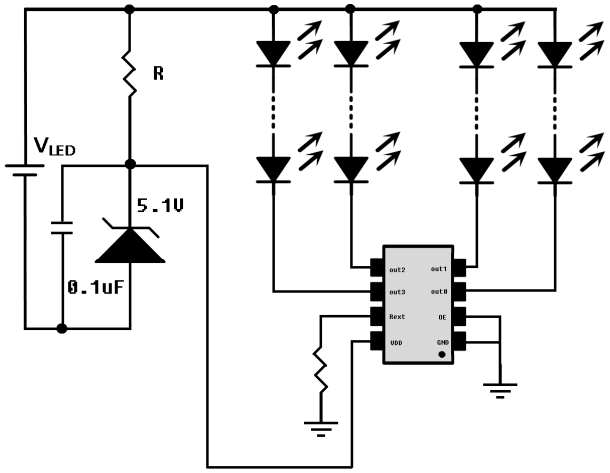
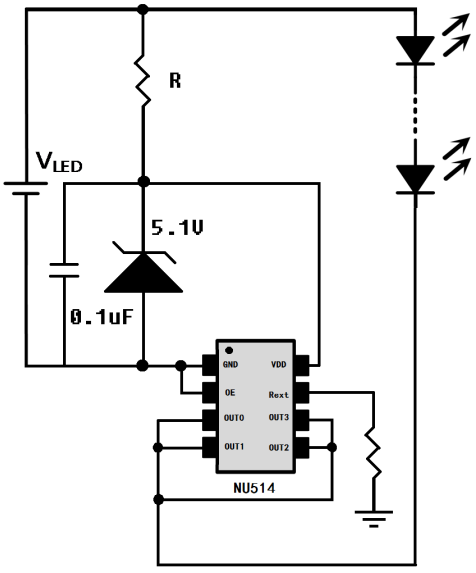
- The R_{EXT} ground path should be as short and wide as possible to minimize the chip current skew.



Typical Application Circuit





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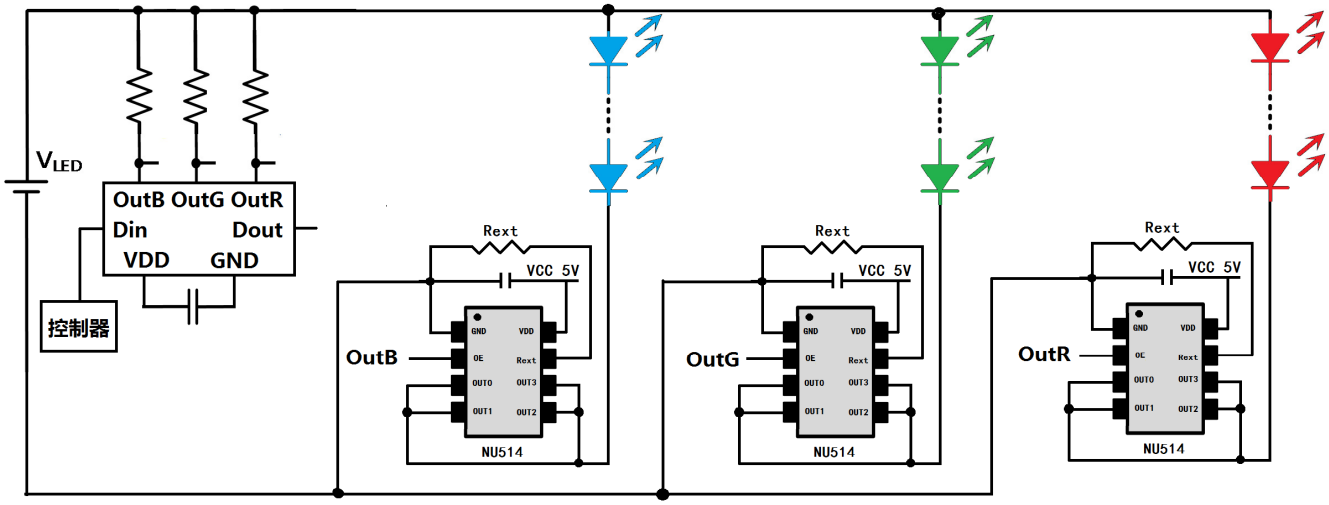

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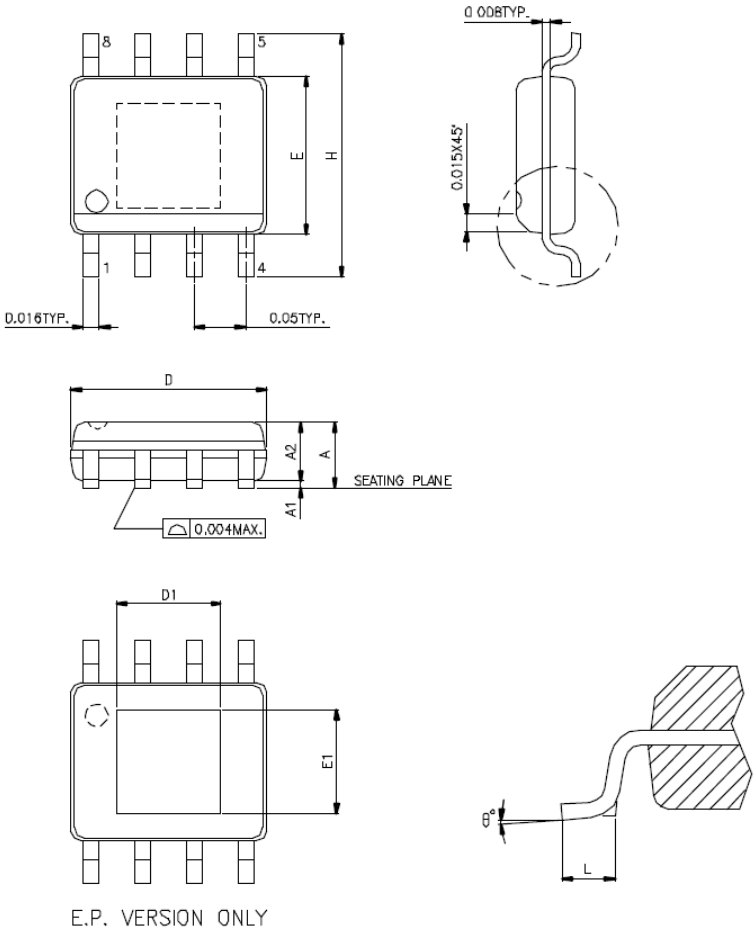
Package Dimensions



SYMBOLS	MIN.	MAX.
A	0.053	0.069
A1	0.002	0.006
A2	–	0.059
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ°	0	8

UNIT : INCH

THERMALLY ENHANCED DIMENSIONS

PAD SIZE	E1	D1
90X90E	0.081 REF	0.081 REF
95X130E	0.086 REF	0.117 REF

UNIT : INCH

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