

10 ~ 350mA Single/Dual channel LED Driver

Features

- The easiest used linear constant current LED driver
- 10mA~350mA, single channel constant current regulator
- No external current setting resistor is needed
- 3V ~ 24V wide supply voltage range
- Very low dropout voltage
- Less than ±5% Chip to Chip current skew
- 3kHz PWM dimming support
- Less than 1%/V load (or line) regulation
- 130°C ~160°C junction temperature current ramp down thermal protect
- SOT23-3/SOT89-3 green package

Product Description

NU501 is a simple general-purpose current regulation component that can be easily used in various LED lighting applications. With the excellent load/line regulation and minimized chip current skew, NU501 keep LED's current very stable even when power or load fluctuate in a wide range and make light intensity very uniform in large area of LED light source.

Except power supply function, the V_{DD} pin of NU501 is output enable (OE) also, and can be used in digital PWM controlled circuit to achieve more precise current adjusting in gray level applications.

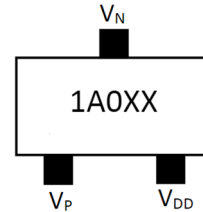
NU501-1AXXX is a series of products, the packaging surface printing is 1AXXX; 1 indicates NU501 series, A indicates version, and XXX indicates current (mA). For example, 1A025 is 25mA. The 1A150 is 150mA.

Applications

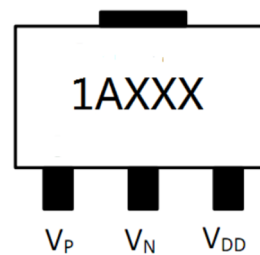
- General LED lighting
- Commercial lighting
- LED torch / flashlight
- RGB lighting

Package Type

- SOT 23-3L (output current ≤ 60mA)



- SOT89-3L (output current ≥ 60mA)



Terminal Description

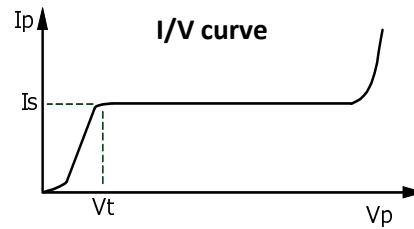
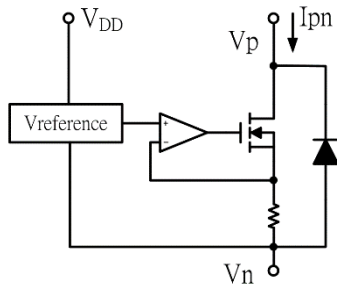
Pin name	Function
V_{DD}	Power supply
V_P	Current in
V_N	Current out

Package & current

Package	SOT23-3L		SOT89-3L	
	current			
	1A010	1A040	1A060	1A240
	1A015	1A045	1A080	1A280
	1A020	1A050	1A090	1A300
	1A025	1A055	1A100	1A320
	1A030	1A060	1A120	1A350
	1A035		1A150	

PS: Before you issue your P.O., please contact your agent or NUMEN technology to make sure the type of output current is available.

Block Diagram and IV characteristic



Maximum Ratings (T = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	-0.3 ~ 28	V
Output voltage	V_P	-0.3 ~ 28	V
Power Dissipation (Ta=25°C)	PD	SOT 23	0.4
		SOT 89	0.7
Thermal Resistance (On PCB, Ta=25°C)	$R_{TH(j-a)}$	SOT 23	300
		SOT 89	180
Operating temperature	T_{OPR}	-40~+85	°C
Storage temperature	T_{STG}	-55~+150	°C

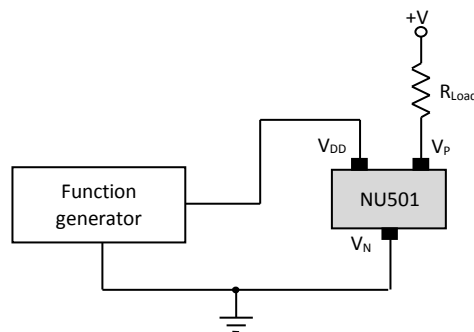
Electrical Characteristics and Recommended Operating Conditions

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	Room Temp.	2.6	-	24	V
Supply current	I_{DD}	-	200	-	700	uA
Thermal protect	T	T1	120	125	130	°C
		T2	155	160	165	
Minimum dropout voltage	V_{PNmin}	$V_{DD} \geq 5V$				V
		$I_{PN}=20mA$	-	0.3	-	
		$I_{PN}=60mA$	-	0.35	-	
Output breakdown voltage	V_{PNBD}	$I_{PN} = 0, V_{DD} = 0V$	-	-	24	V
Output current	I_S^{*2}	Spec.	10	-	350	mA
Line regulation	%/ V_{DD}	$5V > V_{DD} > 24V$	-	0.1	-	%/V
Load regulation	%/ V_P	$8V > V_P > 1.6V$	-	0.1	-	%/V
Thermal regulation	%/10°C	$V_{DD} = V_P = 3V$	-	0.1	-	%/10°C
Chip current skew	I_{skew}	-	-	-	±5	%

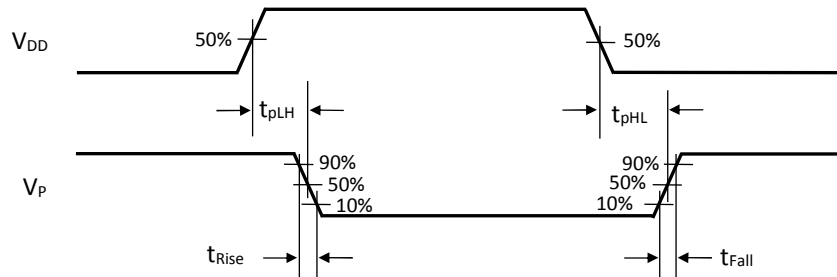
Switching Characteristics (T = 25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time V _{DD} from "L" to "H"	t _{pLH}	V _P =1V, V _{DD} = 0V → 5V	1	-	2.2	μS
Output current rising time	t _{Rise}	V _P =1V, V _{DD} = 0V → 5V	1	-	2	μS
Propagation Delay Time V _{DD} from "H" to "L"	t _{pHL}	V _P =1V, V _{DD} = 5V → 0V	200	-	500	nS
Output current falling time	t _{Fall}	V _P =1V, V _{DD} = 5V → 0V	-	80	120	nS

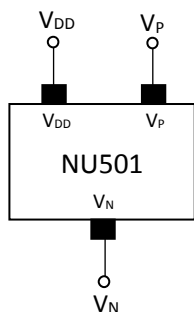
Test Circuit



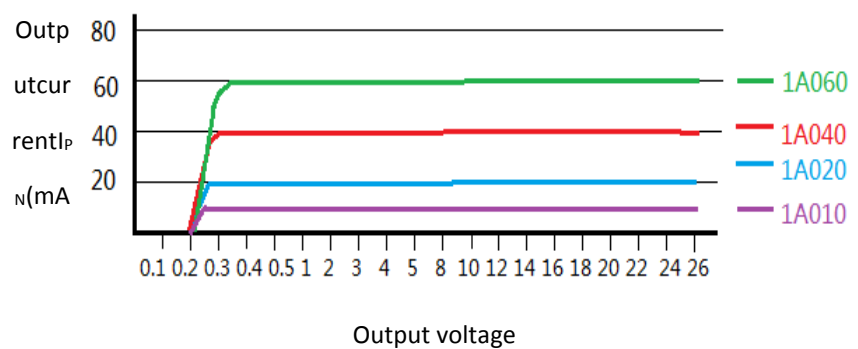
Timing Waveform



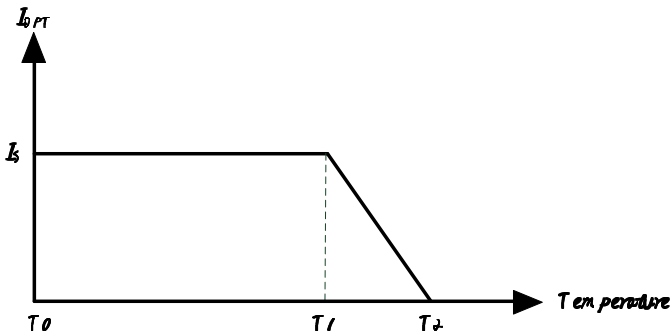
I/V curve



Load regulation characteristic



Thermal protection



State	Normal (T0 ↔ T1)	Thermal protect (T1 ↔ T2)	Unit
Temperature	-40 ↔ 130	125 ↔ 160	°C
I_{PN} variation	±0.1	-28	%/10°C

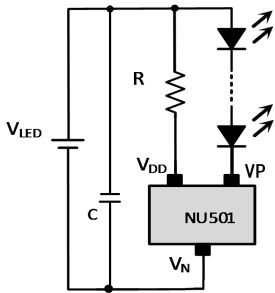
Application design consideration

NU501 is a linear constant current driver. While this device is designed in lighting system, the heat generation should be considered. Generally, the higher current designed in system, the higher power will suffer by this device. To reduce the power consuming by NU501 and to increase the whole system efficiency, the drop voltage across NU501 should be minimized. The following design note can reduce the heat generation from NU501 in the condition of keeping the required output constant current and the needed supply voltage (normal operation condition).

1. Drop the power supply voltage as low as possible in the normal operation condition.
2. Get the LEDs in current loop as many as possible in the normal operation condition.
3. Get a voltage sharing resistor in series in current loop.
4. If V_{pn} is greater than 8V, or $V_{in} \geq 30V$, it is necessary to connect a zener diode between V_P and V_N pin for chip protection.

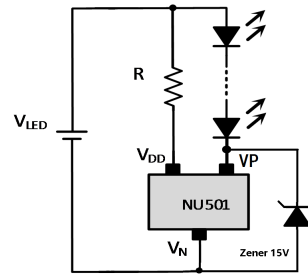
Application Circuits

- Basic lighting application 1



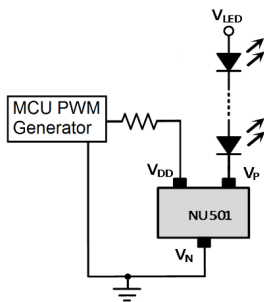
V _{LED} 电压	R 值
12V	7.5kΩ
24V	15kΩ

- Basic lighting application 2

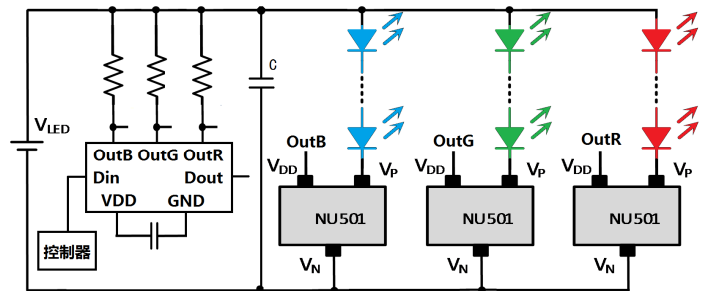


V _{LED} 电压	R 值	Zener 值
36V	36kΩ	15V
48V	47kΩ	15V

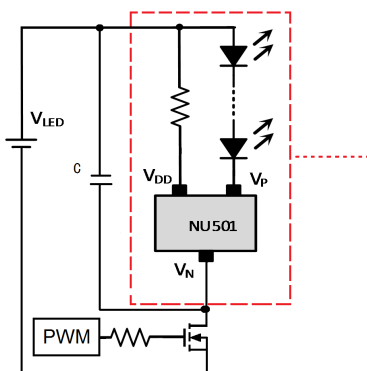
- PWM dimming application



V_{DD} pin dimming application



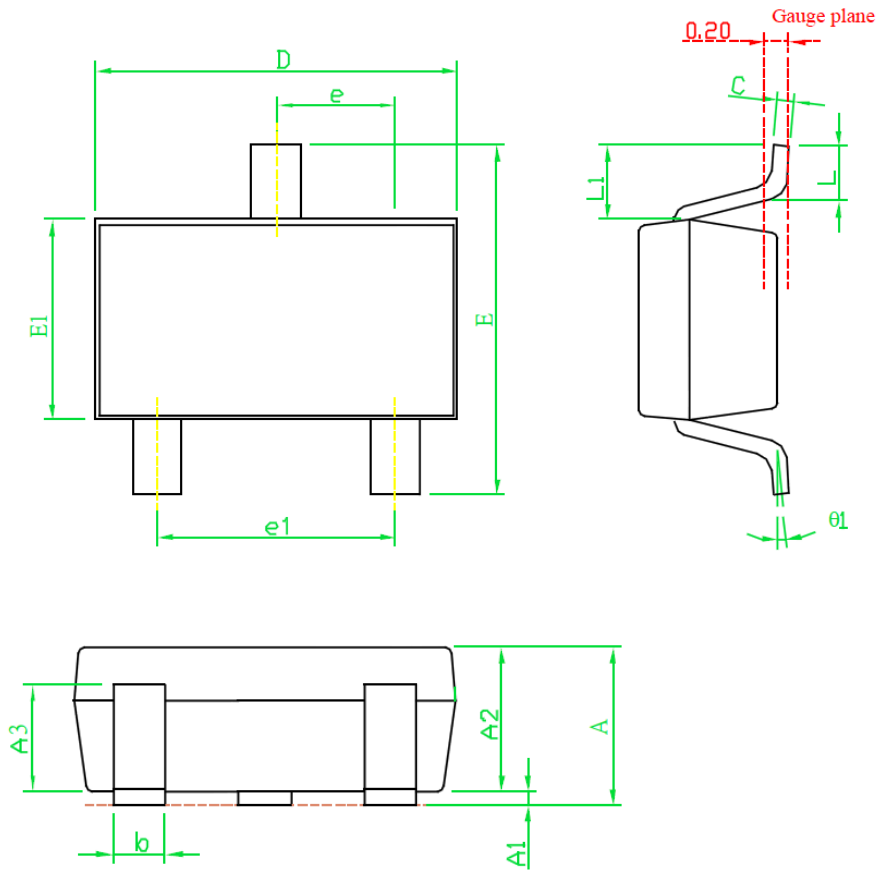
Controller I/O output current expansion application



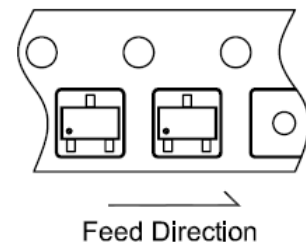
Power line dimming application

Package Dimensions

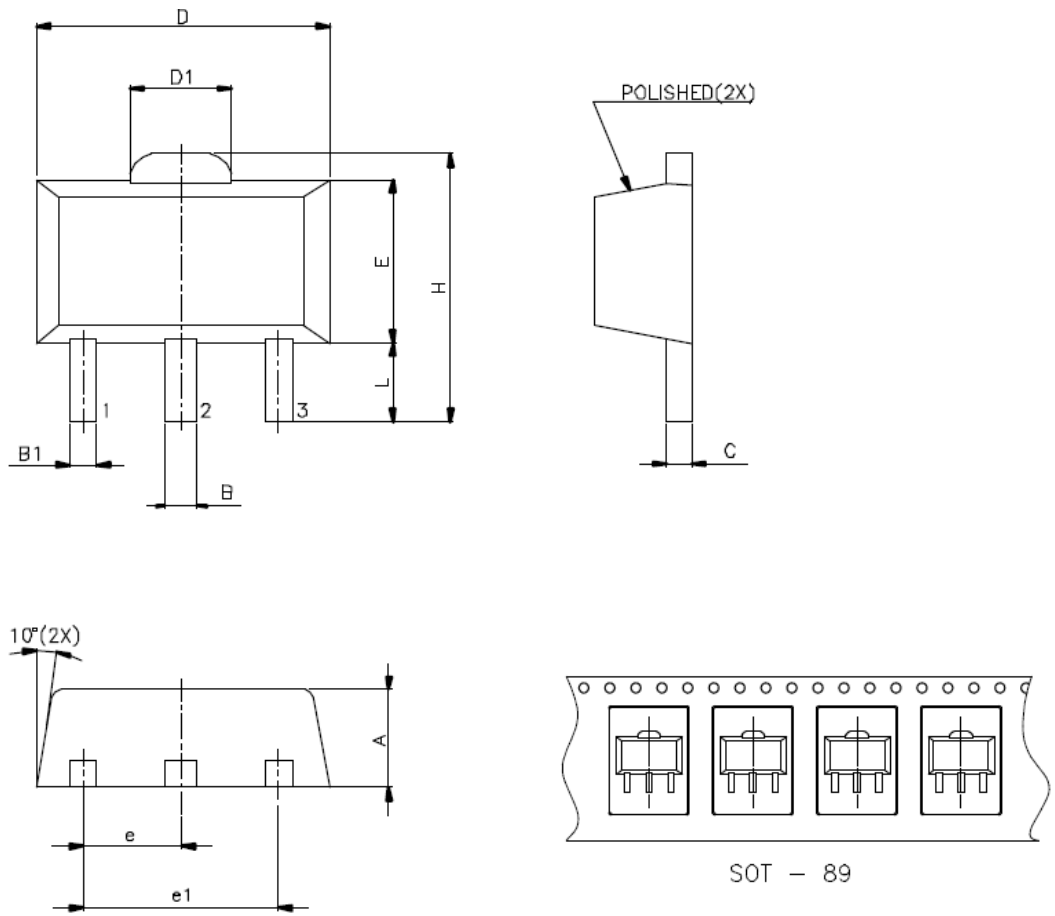
- SOT23-3L



SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	1.10	1.40
A1	0.00	---	0.10
A2	1.00	1.10	1.30
A3	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E1	1.40	1.60	1.80
e	---	0.95(TYP)	---
e1	---	1.90(TYP)	---
E	2.60	2.80	3.00
L	0.37	---	---
θ1	1°	5°	9°
L1	0.5	0.6	0.7



● SOT89L



SYMBOLS	MIN.	MAX.
A	1.40	1.60
B	0.44	0.56
B1	0.36	0.48
C	0.35	0.44
D	4.40	4.60
D1	1.35	1.83
E	2.29	2.60
H	3.94	4.25
e	1.50 BSC	
e1	3.00 BSC	
L	0.89	1.2

UNIT : mm

Restrictions on product use

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