

Features

- 15~350mA single channel constant current regulator
- 1.8V ~ 15V wide supply voltage range supports self-power structure in lighting application
- Support V_{DD} PWM dimming function
- No external current setting resistor is needed
- 0.2V~0.8V minimized low dropout voltage
- Fast current rising and falling transition
- Less than $\pm 4\%$ Chip to Chip current skew
- Less than $\pm 0.5\%/V$ load (or line) regulation
- 130°C ~ 160°C junction temperature current ramp down thermal protect
- -40°C ~ 85°C ambient operating temperature
- Cascade-able for higher voltage drop applications
- Green package

Product Description

NU501-1Cxxx is a small/medium power linear current regulation component that can be easily used in various LED lighting applications. It is equipped the excellent feature of good load/line regulation capability, minimized chip current skew, stable output current in high power or load voltage fluctuating environment that can be used in wide area of LED lighting source to maintain the uniformity of light intensity.

With the feature of wide power supply range design and ultra-low I_{DD} consumption, the NU501-1Cxxx supports the self-powered structure in LED lighting applications. In this structure, the NU501 no need to be provided a dedicate power circuit even the system power voltage is much higher than the maximum operation voltage of NU501-1Cxxx. The V_{DD} power can be gotten from the proper position in LED series of system.

Except for the power supply function, the VDD pin of NU501 is output enable (OE), and can be used in digital PWM controlled circuits for more precise current adjustment in gray level applications.

The minimized power supply voltage let NU501 be used as a current regulative diode (CRD) when V_{DD} and V_P pin are tied together. This application makes NU501 very easy to be used. Just like a diode, when this diode is inserted in LED series, the current in circuit is regulated.

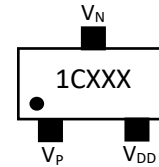
Block Diagram

Applications

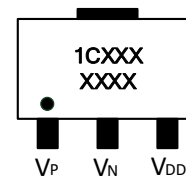
- General LED lighting
- Decoration lighting for architecture
- LED torch / flash light
- RGB lighting
- RGB display / indicator
- Vehicle lamp
- Constant current COB light source

Package Type

- SOT 23-3L



- SOT 89



Terminal Description

Pin name	Function
V_N	Ground
V_P	Current sink
V_{DD}	Power supply

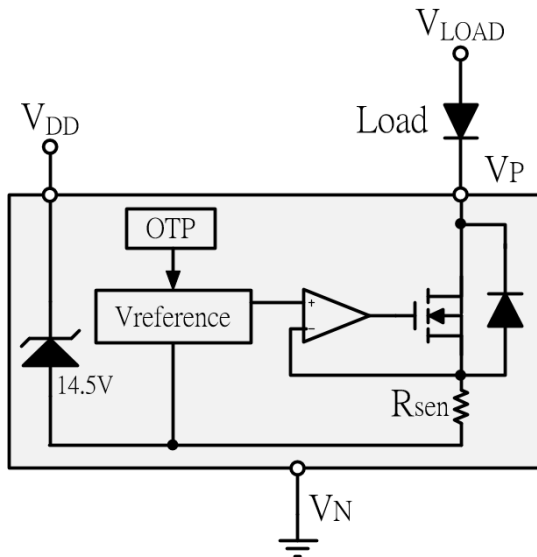
Ordering Information

Part number: NU501-1Cxxx

Example: NU501-1C150 means output current 150mA

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

PS: $\geq 100\text{mA}$ for SOT89 Package



Maximum Ratings (T = 25°C)

Characteristic	Symbol	Rating	Unit	
Supply voltage	V _{DD}	0 ~ 15	V	
Output voltage(Output enable)	V _{PN_Enable}	-0.2 ~ 14	V	
Output voltage(Output disable)	V _{PN_Disable}	-0.2 ~ 20	V	
Output current	I _{PN}	15 ~ 300	mA	
Power Dissipation (Ta=25°C)	PD	SOT 23	0.4	W
		SOT 89	0.7	
Thermal Resistance (On PCB, Ta=25°C)	R _{TH(j-a)}	SOT 23	300	°C/W
		SOT 89	180	
Operating temperature	T _{OPR}	-40~+85	°C	
Storage temperature	T _{STG}	-55~+150	°C	

Electrical Characteristics and Recommended Operating Conditions

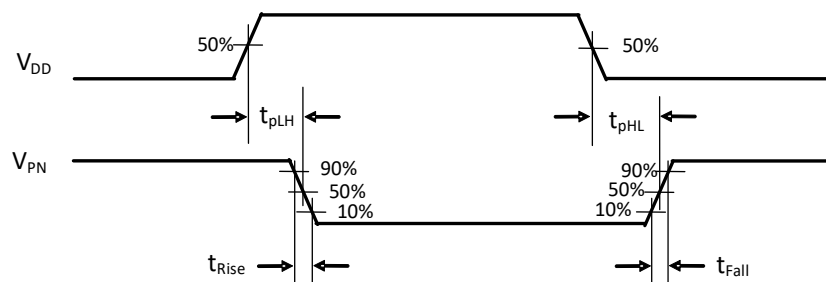
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit	
Supply voltage	V _{DD}	Room Temp. V _{PN} = 1.5V	1.8	-	15	V	
Output voltage	V _{PN_Enable}	V _{DD} > 1.8V, P _D ≤ P _{D_recomd}	-	-	14	V	
	V _{PN_Disable}	V _{DD} < 0.8V	-	-	20	V	
Supply current	I _{DD}	V _{DD} ≤ 15V	-	100	-	uA	
Minimum dropout voltage	V _{PN}	V _{DD} ≥ 4V	I _S * = 20mA	-	0.2	-	V
			I _S = 300mA	-	0.8	-	
Output current	I _{PN}	V _{DD} ≥ 4V	15	-	300	mA	
Leakage	I _{Leakage}	V _{DD} = 0V, V _{PN} = 15V	-	-	0.5	uA	
Line regulation	%/V _{DD}	13V > V _{DD} > 3V	-	-	±0.5	%/V	
Load regulation	%/V _P	9V > V _{PN} > 0.4V	-	-	±0.5	%/V	
Thermal regulation	%/10°C	V _{DD} = 4V, V _{PN} = 1.5V, Junction temp. < 125°C	-0.4	-	0.4	%/10°C	
Output ramp down temperature	T1	Output enabled	-	130	-	°C	
Shutdown temperature	T2	I _{PN} < 10mA	-	160	-		
Chip current skew	I _{skew}	V _{DD} = 4V, V _{PN} = 1.5V	-	2	4	%	
Power Dissipation	P _{D_recomd}	Room Temp.	SOT23	-	-	0.25	W
			SOT89	-	-	0.6	

*1 I_S is center current or saturation current

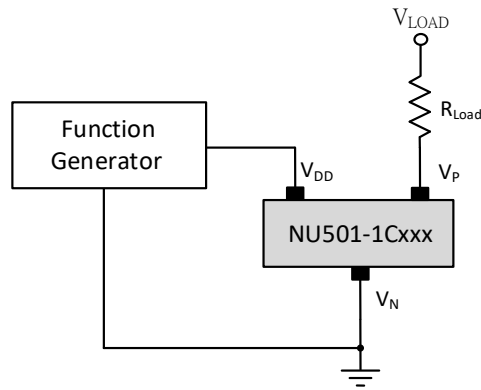
Switching Characteristics (T = 25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time V _{DD} from "L" to "H"	t _{pLH}	V _{PN} =1.5V, V _{DD} = 0V → 3V	-	300	-	nS
Output current rising time	t _{Rise}	V _{PN} = 1.5V, V _{DD} = 0V → 3V	-	600	-	nS
Propagation Delay Time V _{DD} from "H" to "L"	t _{pHL}	V _{PN} =1.5V, V _{DD} = 3V → 0V	-	50	-	nS
Output current falling time	t _{Fall}	V _{PN} = 1.5V, V _{DD} = 3V → 0V	-	100	-	nS

Timing Waveform

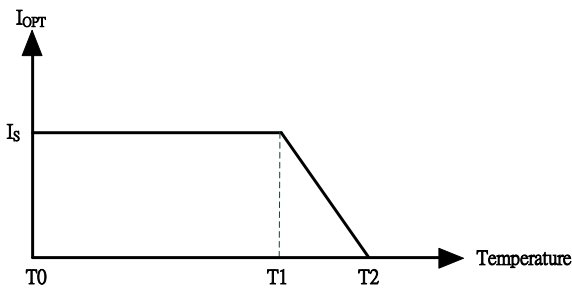


Test Circuit



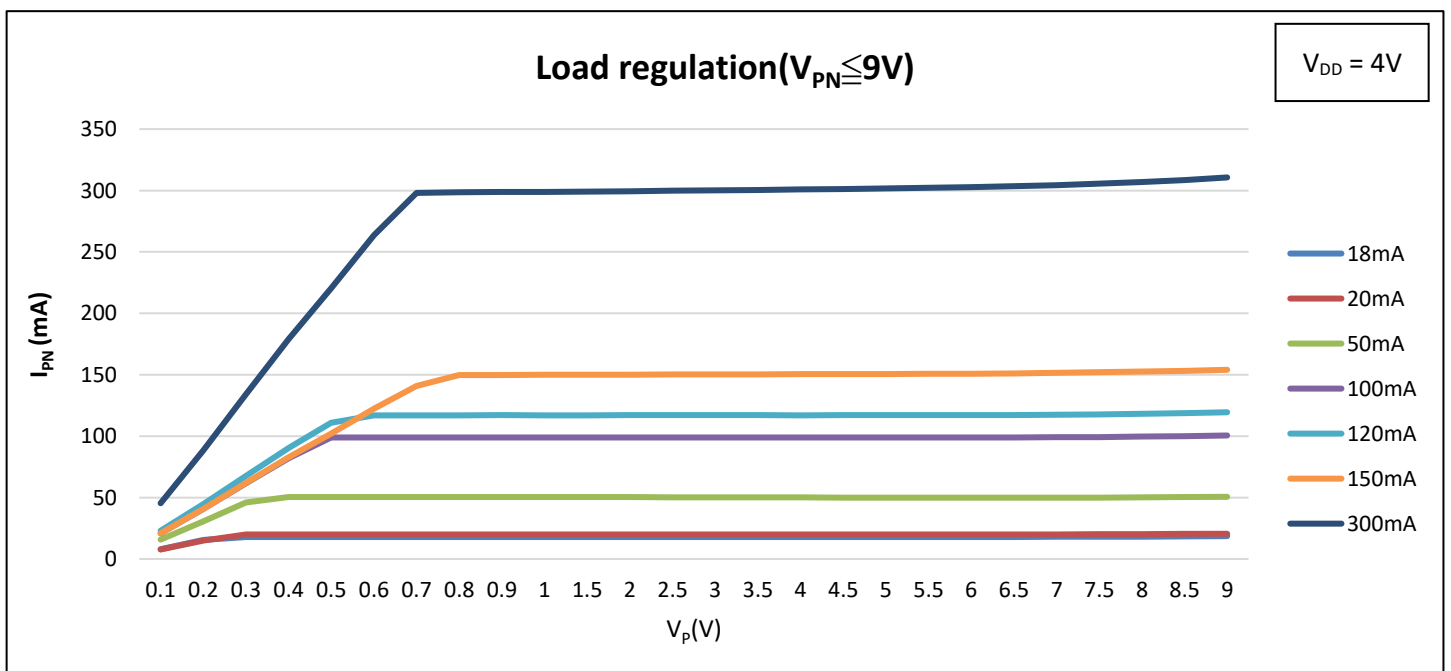
Thermal protection

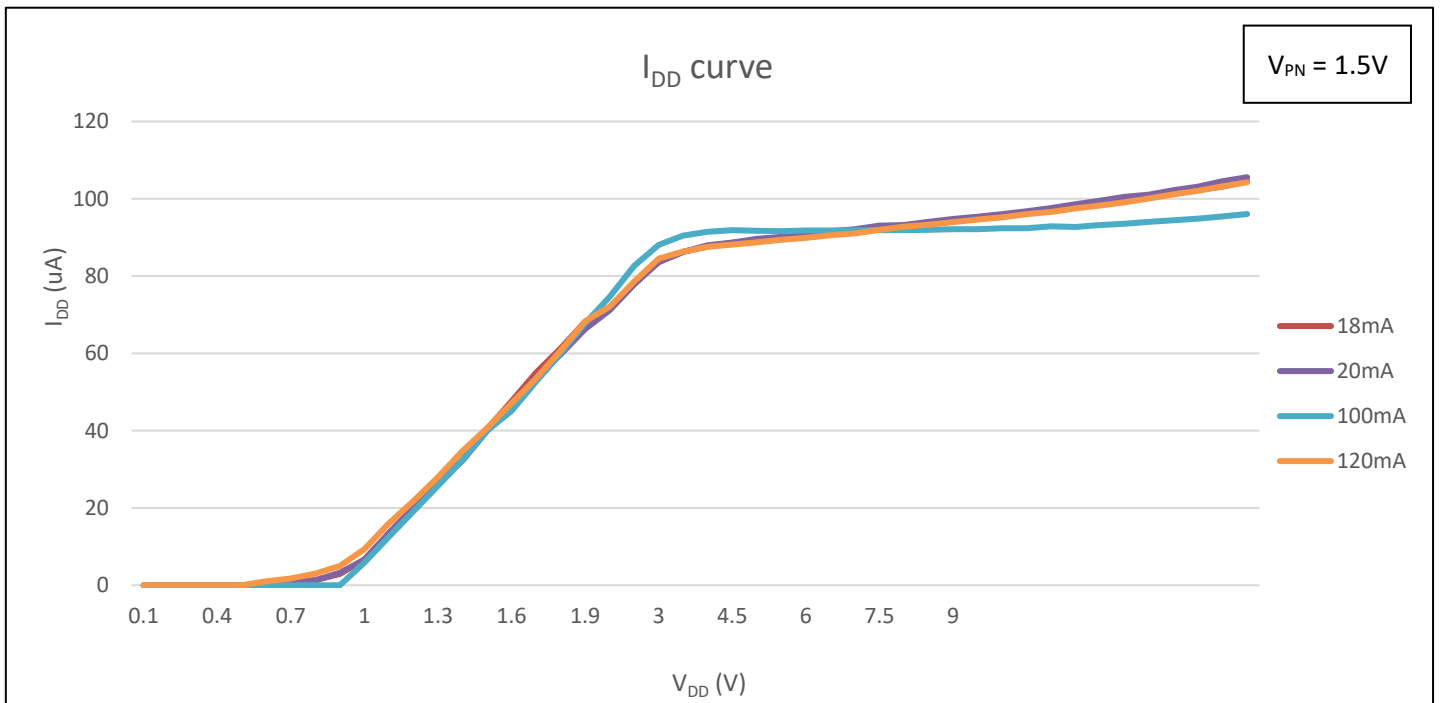
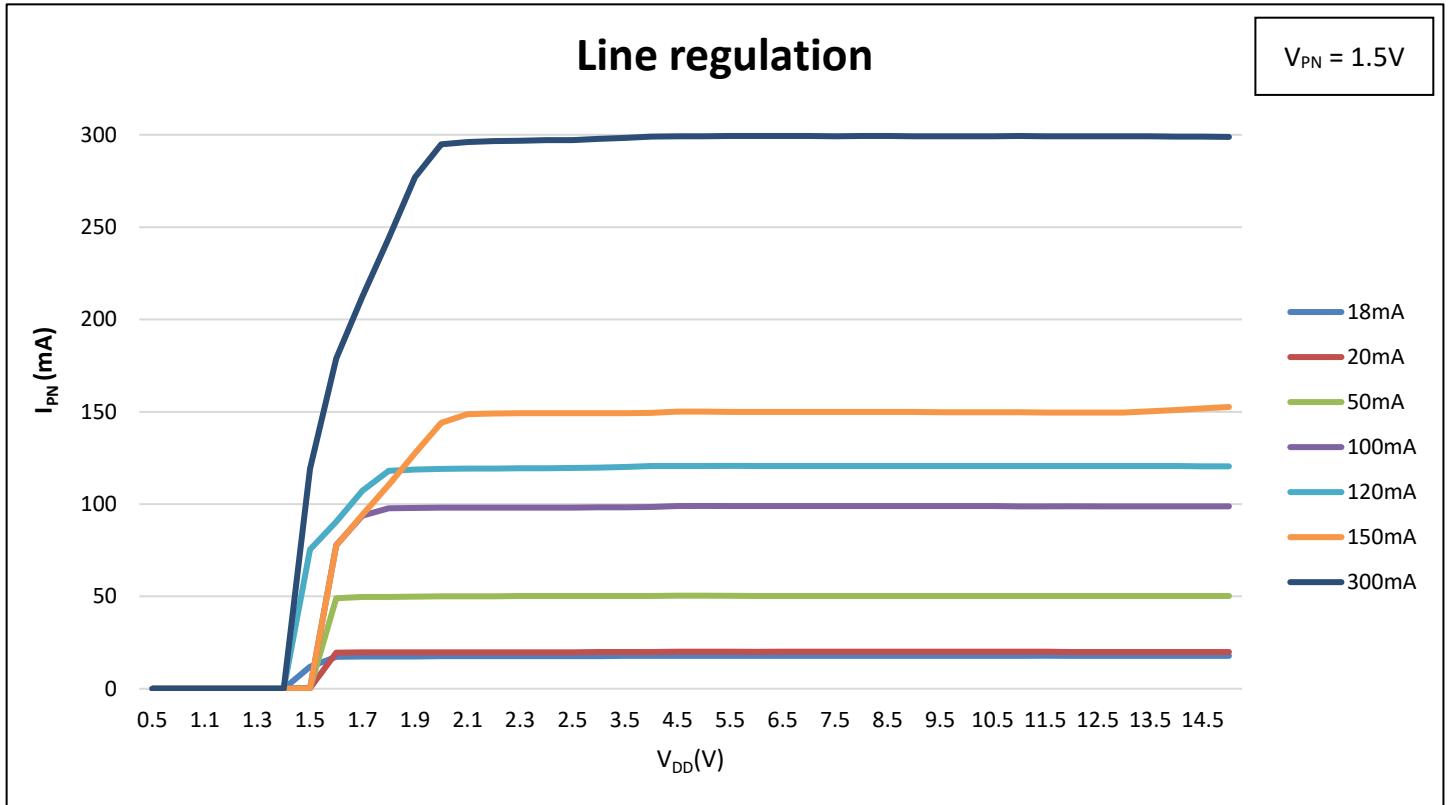
The normal working junction temperature of NU501-1Cxxx is -40°C to 130°C. In this condition, the output current variation is less than 0.4%/10°C. If junction temperature is more than thermal protection temperature (~130°C), the output current of NU501-1Cxxx will start to decrease to lower down the power dissipation on chip. If temperature reach 160°C, the output current will almost shut down. The output current will restore in the same way when the temperature decrease.



State	Normal (T0 ↔ T1)	Thermal protect (T1 ↔ T2)	Unit
Temperature	-40 ↔ 130	130 ↔ 160	°C
I _{PN} variation	±0.4	-33	%/10°C

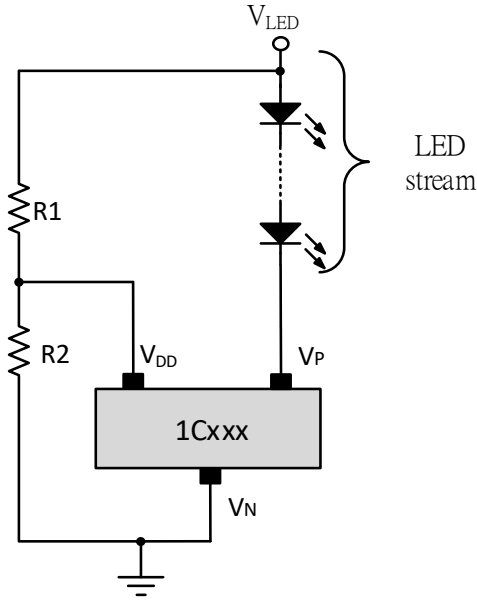
Output I/V Curve





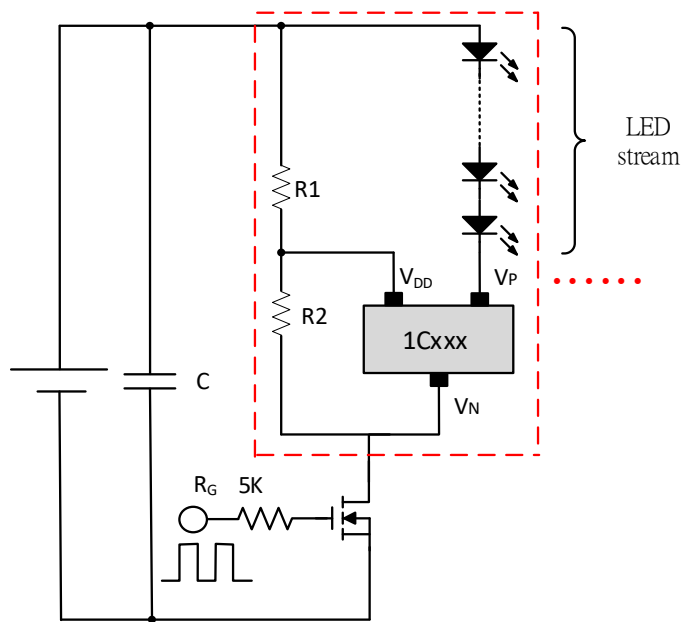
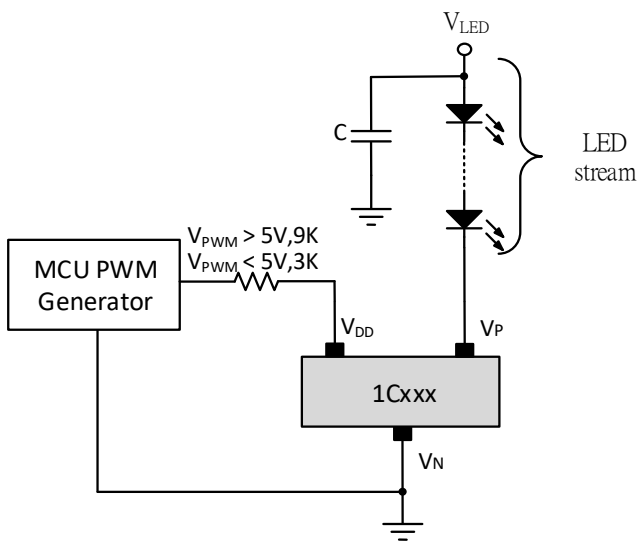
Typical Application Circuit

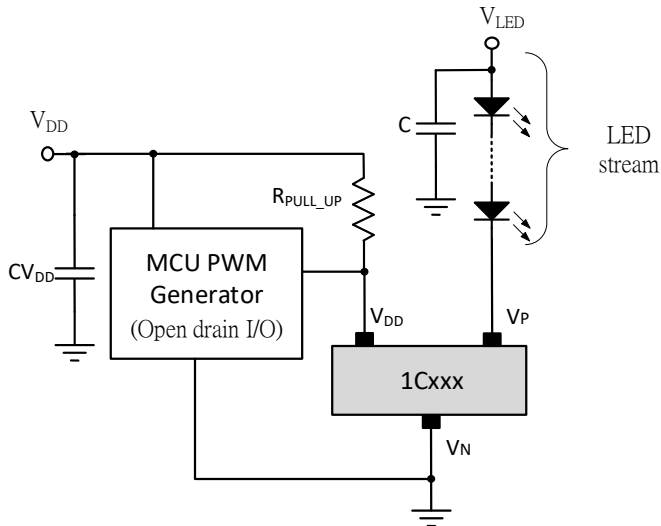
- DC power general lighting - Low V_{PN} dropout



Resistance	R1	R2
Voltage		
12V	36K	-
24V	36K	6.8K
36V	54K	6.8K
48V	70K	6.8K

- DC PWM dimming application





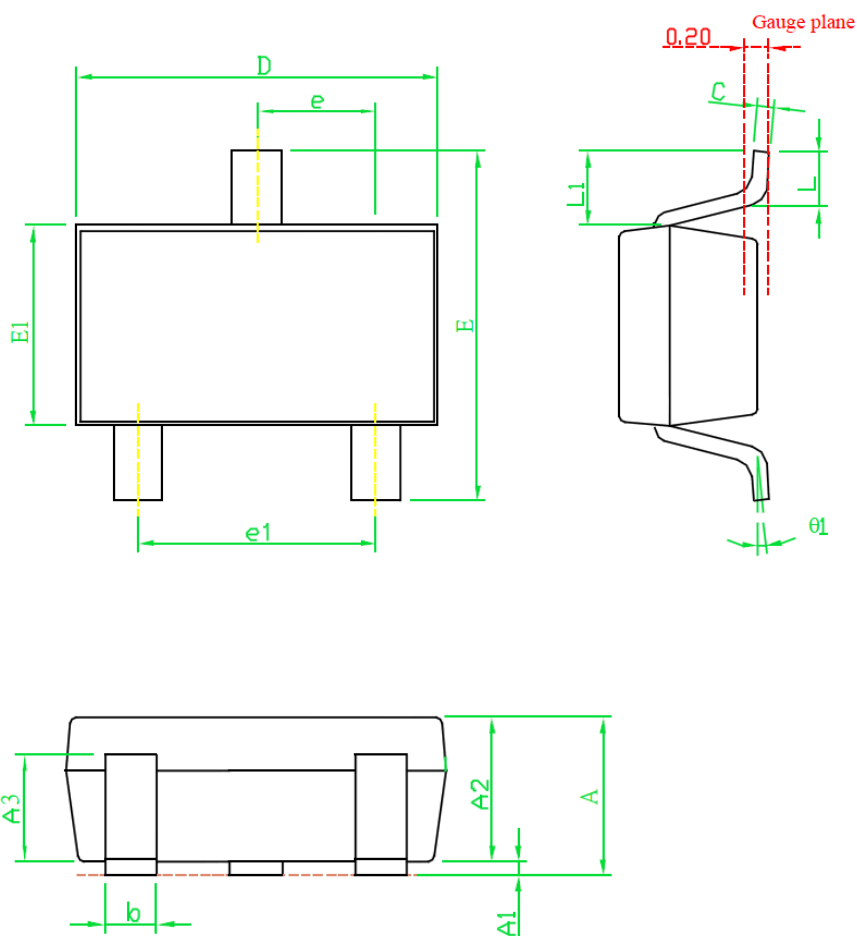
Note 2: The voltage of V_{LED} should follow all the following restrictions:

1. $V_{LED} \leq \frac{P_{D_recmd}}{I_{PN}} + V_{f_all}$
2. $V_{LED} \leq V_{f_all} + 14$
3. $V_{LED} \leq 60V$

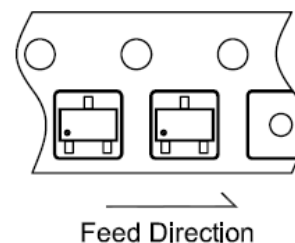
※ V_{f_all} is total V_f of all LEDs.

Package Dimensions

- SOT 23-3L



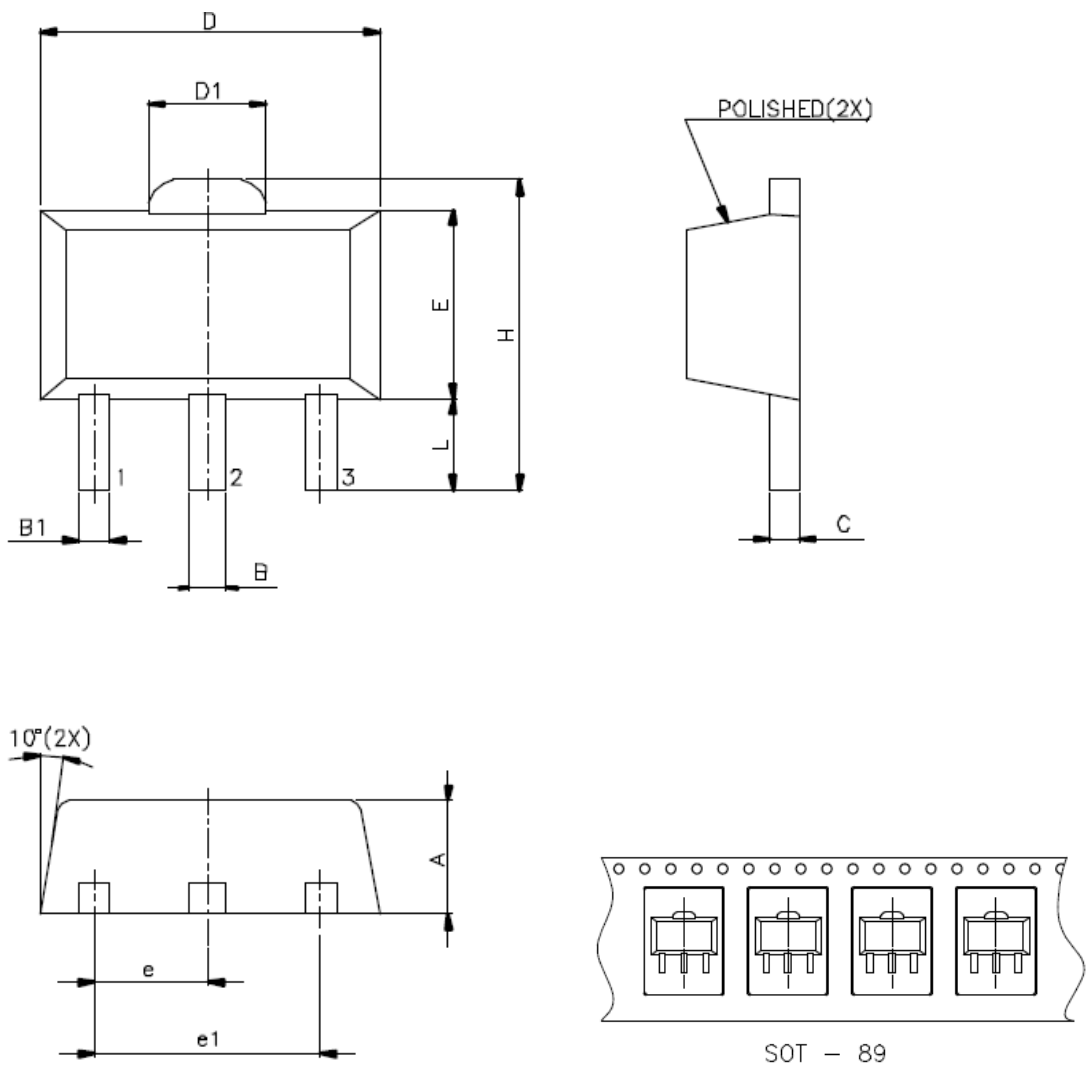
SYMBOLS	DIMENSIONS IN MILLIMETERS		
	MIN	NOM	MAX
A	1.00	1.10	1.40
A1	0.00	----	0.10
A2	1.00	1.10	1.30
A3	0.70	0.80	0.90
b	0.35	0.40	0.50
C	0.10	0.15	0.25
D	2.70	2.90	3.10
E1	1.40	1.60	1.80
e	----	0.95(TYP)	----
e1	----	1.90(TYP)	----
E	2.60	2.80	3.00
L	0.37	----	----
$\theta1$	1°	5°	9°
L1	0.5	0.6	0.7



Taping Specification

PACKAGE	Q'TY/REEL
SOT 23-3L	3,000 ea
SOT 89	1,000 ea

- SOT89



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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