數能科技股份有限公司

1.2A Single Channel LED Driver

Features

- 100mA~1.2A, single channel constant current regulator
- Output current adjustable by external resistor
- 3V ~ 12V wide range supply voltage
- 1MHz OE dimming support
- 400Hz V_{DD} dimming support
- 0V ~ 17V output sustain voltage
- low output voltage dropout
  0.2V dropout at 150mA output
  0.6V dropout at 1.2A output
- Minimized I_{DD} consumption
- 160℃ half power thermal protect
- Less than ±4% chip current skew
- Less than 0.5%/V line regulation
- Less that 1%/V load regulation
- Green package

Product Description

The NU511 is a single channel, open drain, linear constant current LED driver. With up to 1.2A driving current and maximum 1Mhz PWM dimming control support, NU511 can be used for 0.5W to 3W high power LED string in general or architecture decoration lighting applications.

The capability of wide power supply range makes NU511 work stably in uncertain power supply applications. When the power supply voltage is changed or fluctuating, the output current still remain unchanged. With this dedicate designed function, the V_{DD} power can be derived easily from the whole lighting system.

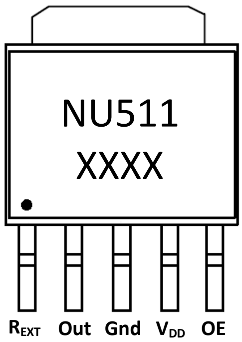
The output current of NU511 is set by an external resistor. While in full current output, the NU511 only need about 0.6V drop on output channel. The minimized voltage drop will increase the working range that limited by LED forward voltage variation in lighting system, to enhance the system efficiency and lower the heat generation from NU511.

Applications

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

Package Type

- TO252-5L



Terminal Description

Pin #	Pin name	Function
1	REXT	R external
2	OUT	Output
3	Gnd	Ground
4	V_{DD}	Power
5	OE	Output enable

Protection Circuit

- 8KV output channel ESD protection

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Maximum Ratings (T = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	3.0 ~ 16	V
Output voltage	V_{OUT}	-0.2 ~ 20	V
Input voltage	V_{OE}	-0.2 ~ V_{DD}	V
Output current	I_{OUT}	1.4	A
Ground terminal current	I_{GND}	1.4	A
Power Dissipation (On PCB)	PD	3.2	W
Thermal Resistance	$R_{TH(j-a)}$	42	°C /W
Operating temperature	T_{OPR}	-40 ~ +130	°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.	3	-	12	V
Output sustain voltage	Vomax	I_{OUT} = 0A	-	-	17	V
Output current	I_{OUT}	-	100	-	1200	mA
Output drop out voltage	V_{OUT}	V_{DD} = 5V, I_{OUT} = 150mA	0.2	-	-	V
		V_{DD} = 5V, I_{OUT} = 350mA	0.3	-	-	V
		V_{DD} = 5V, I_{OUT} = 1200mA	0.6	-	-	V
Chip to chip current skew V_{DD} >=3V	dI_{OUT2}	I_{OUTn} = 1200mA	-	±2	±3.5	%
Leakage	$I_{Leakage}$	V_{OUT} = 7V	-	-	1	uA
OE Input voltage	V_{IH}	V_{DD} < 5V	-	0.7*V_{DD}	-	V
		V_{DD} >= 5V	-	-	3.5	
	V_{IL}	V_{DD} < 5V	-	0.3*V_{DD}	-	
		V_{DD} >= 5V	-	-	1.5	
Pull down resistor (OE)	R_{PD}	-	400	500	700	KΩ
Line regulation	%/V_{DD}	3V < V_{DD} < 12V	-	-	0.5	△%/V
Load regulation	%/V_{OUT}	0.5V < V_{OUT} < 8V	-	-	1	△%/V
Operating Temperature	T_{OPR}	Ambient temperature	-40	-	85	°C
Thermal protect (Junction temperature)	T_{HalfP}	Half current output	-	160	-	°C
Thermal regulation	%/10℃	-	-	-	0.5	△%/10℃
Supply current	I_{DD}	R_{EXT} = Open, Output off	-	0.3	1	mA
		I_{OUT} = 365mA, Output on	2	4	4.5	mA
		I_{OUT} = 700mA, Output on	-	4.7	-	mA
		I_{OUT} = 1000mA, Output on	-	5.0	-	mA
System voltage	V_{LED}	V_{DD} < 12V	5	-	24	V

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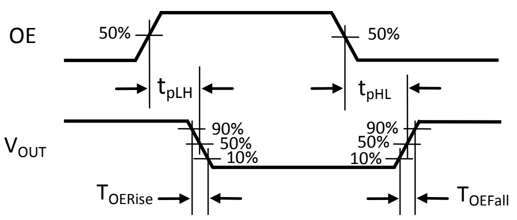
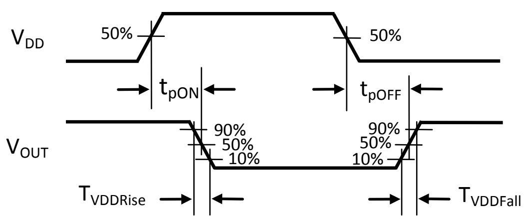
Switching Characteristics (T = 25°C)

Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time (OE from "L" to "H")	t_{pLH}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=120mA, OE= 0V → 4V	200	280	360	nS
Output current rising time (OE from "L" to "H")	t_{OERise}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=120mA, OE= 0V → 4V	30	50	80	nS
Propagation Delay Time (OE from "H" to "L")	t_{pHL}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=120mA, OE= 4V → 0V	560	620	680	nS
Output current falling time (OE from "H" to "L")	t_{OEFall}	V_{DD}=4V, V_{OUT}=1V, I_{OUT}=120mA, OE= 4V → 0V	60	90	130	nS
Propagation Delay Time (V_{DD} from "L" to "H")	t_{pON}	V_{OUT}=1V, I_{OUT}=120mA, V_{DD}=OE= 0V → 3V	-	30	-	uS
Output current rising time (V_{DD} from "L" to "H")	$t_{VDDRise}$	V_{OUT}=1V, I_{OUT}=120mA, V_{DD}=OE= 0V → 3V	-	5		uS
Propagation Delay Time (V_{DD} from "H" to "L")	t_{pOFF}	V_{OUT}=1V, I_{OUT}=120mA, V_{DD}=OE= 3V → 0V	-	3	-	uS
Output current falling time (V_{DD} from "H" to "L")	$t_{VDDFall}$	V_{OUT}=1V, I_{OUT}=120mA, V_{DD}=OE= 3V → 0V	-	5		uS

Timing Waveform



OE timing diagram



V_{DD} timing diagram (V_{DD}=V_{OE})

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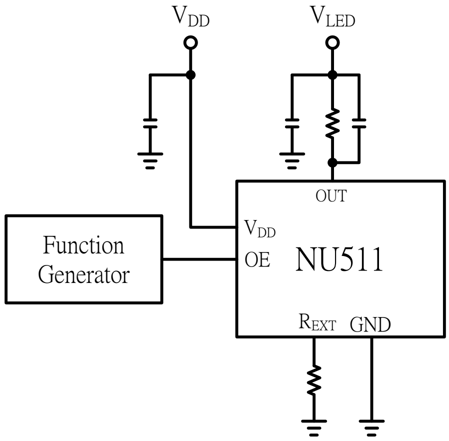
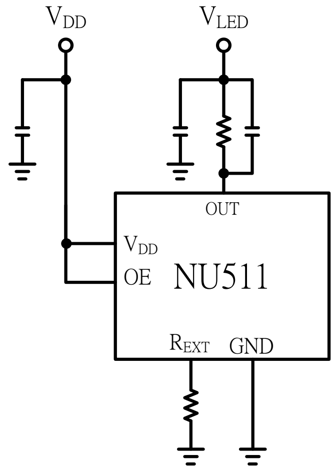
Test Circuit

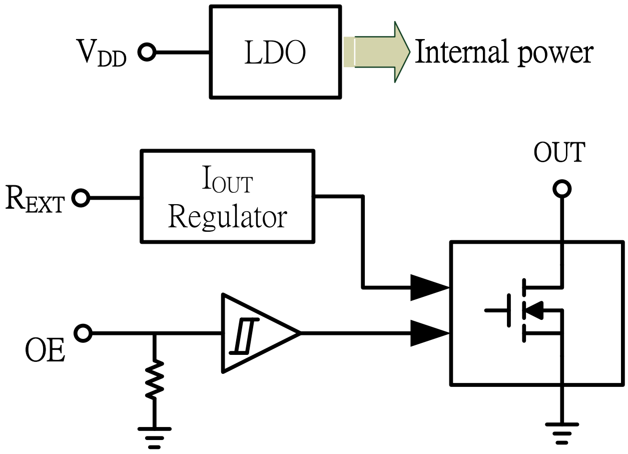


OE dimming and I_{OUT} test circuit



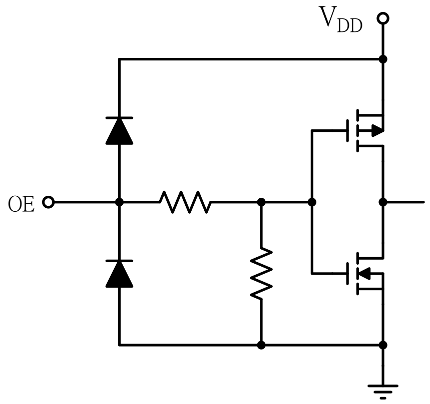
V_{DD} dimming test circuit

Block Diagram



Equivalent Circuits for Inputs

There is only one OE input terminal to which a pull down resistor is connected. While OE is high voltage, the output channel is turned on.



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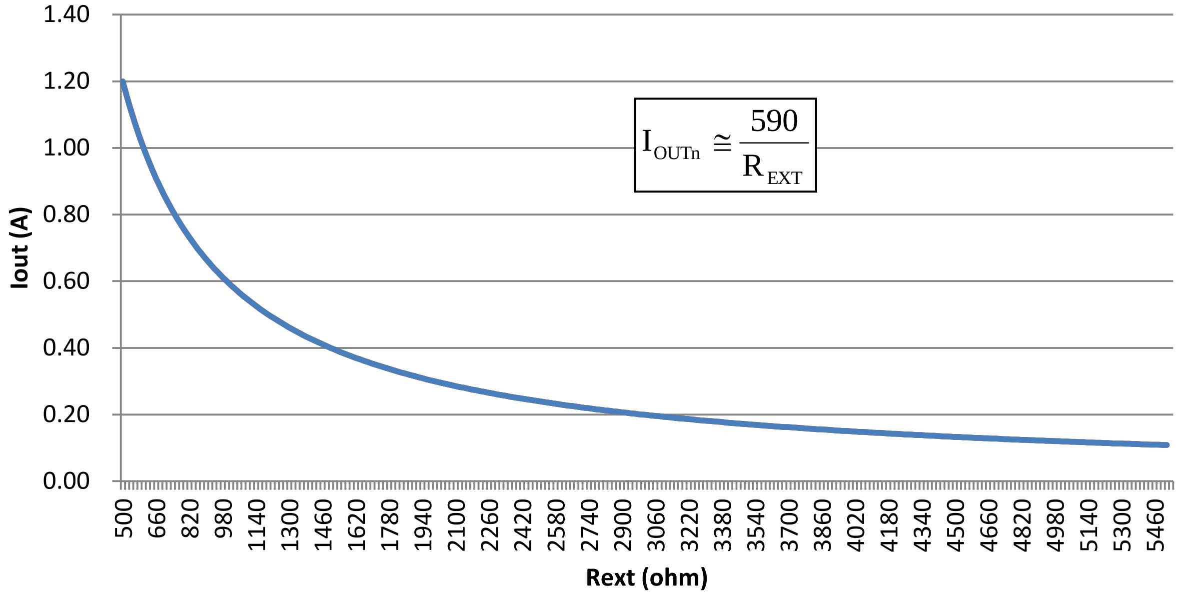
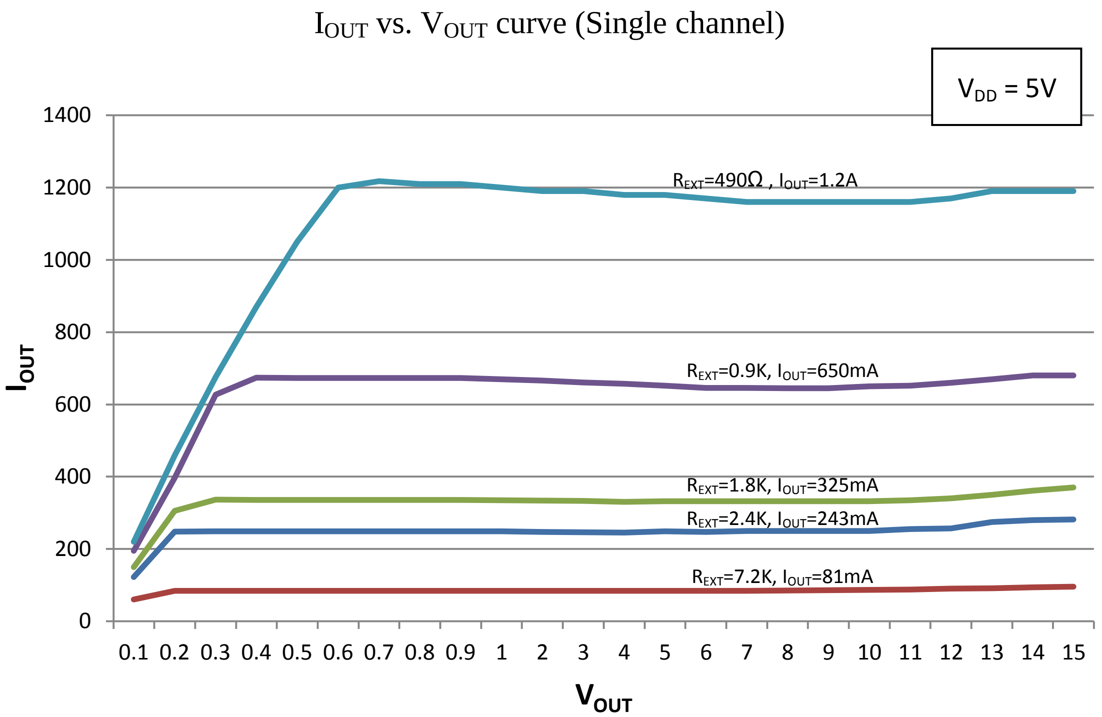
Output Current Setting

The output current of each channel of NU511 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/V Curve



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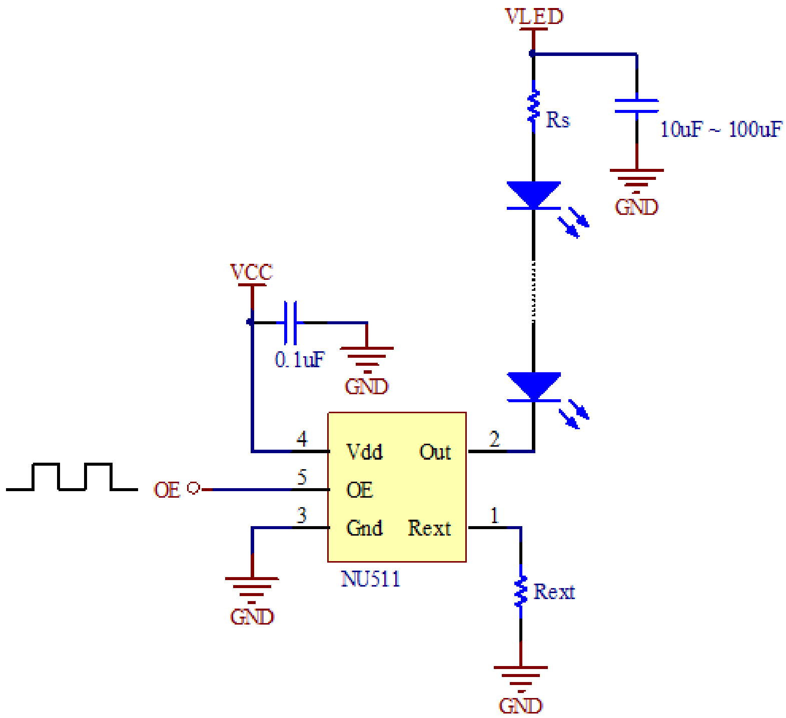
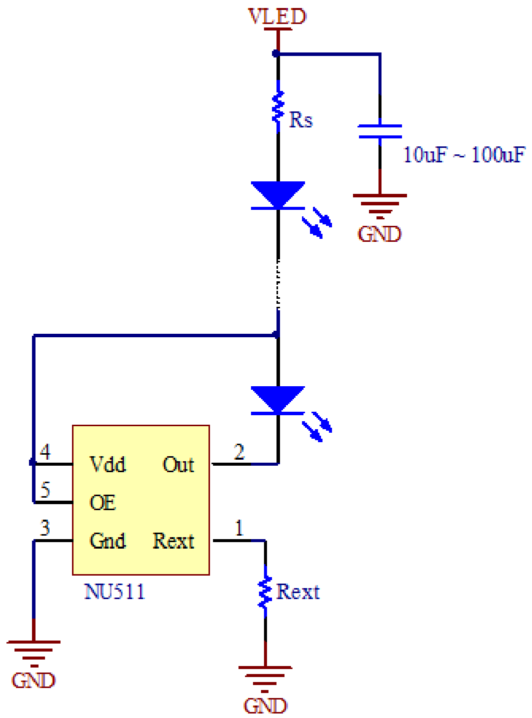
Typical Application Circuit

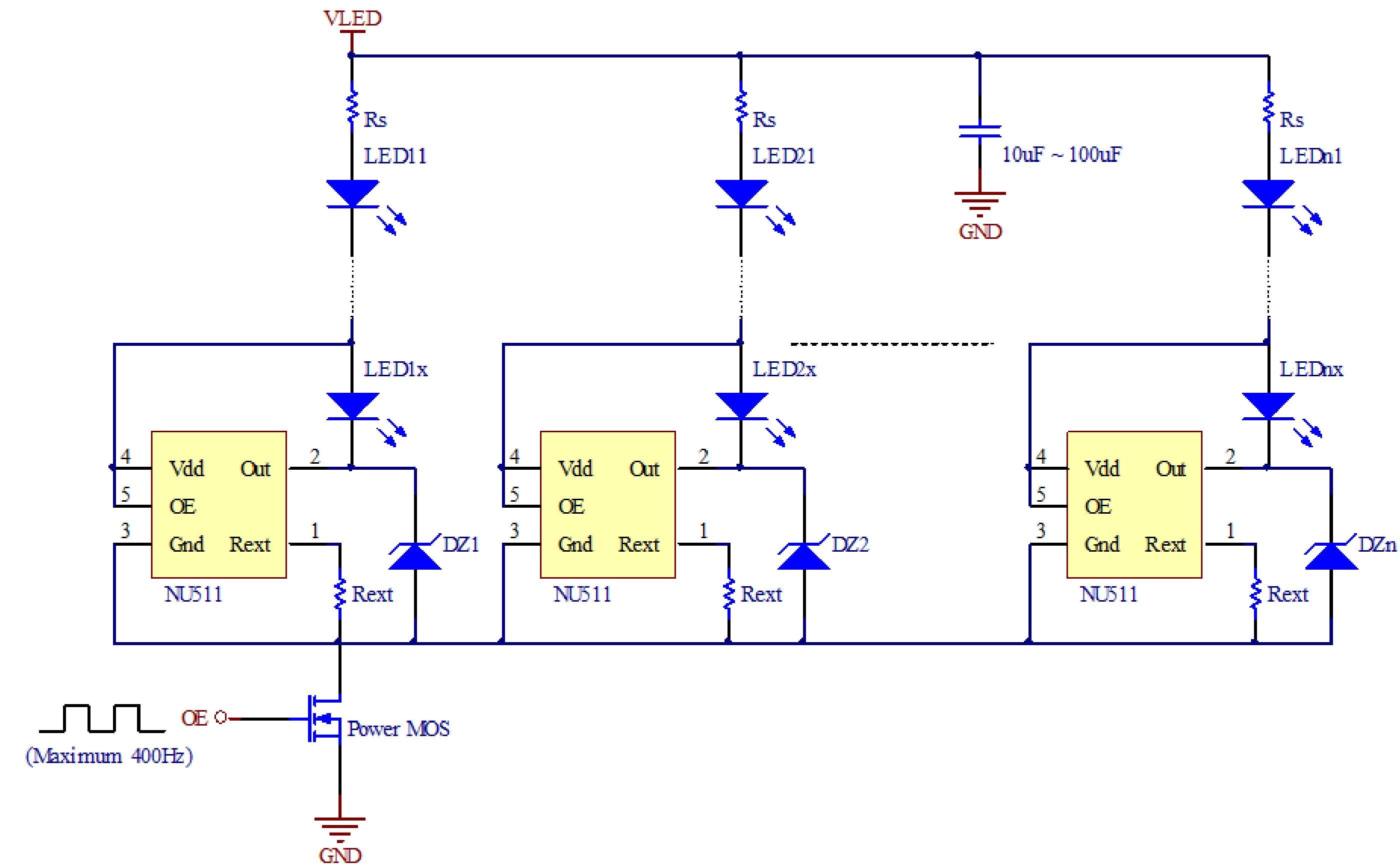
- Dimming application



- General lighting application 1



- General lighting application 2



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Note:

1. For the heat consideration on driver, V_{OUT} of NU511 should be minimized. The power calculation equation is shown as bellow.

   $$V_{OUT} = VLED - V_F * n$$

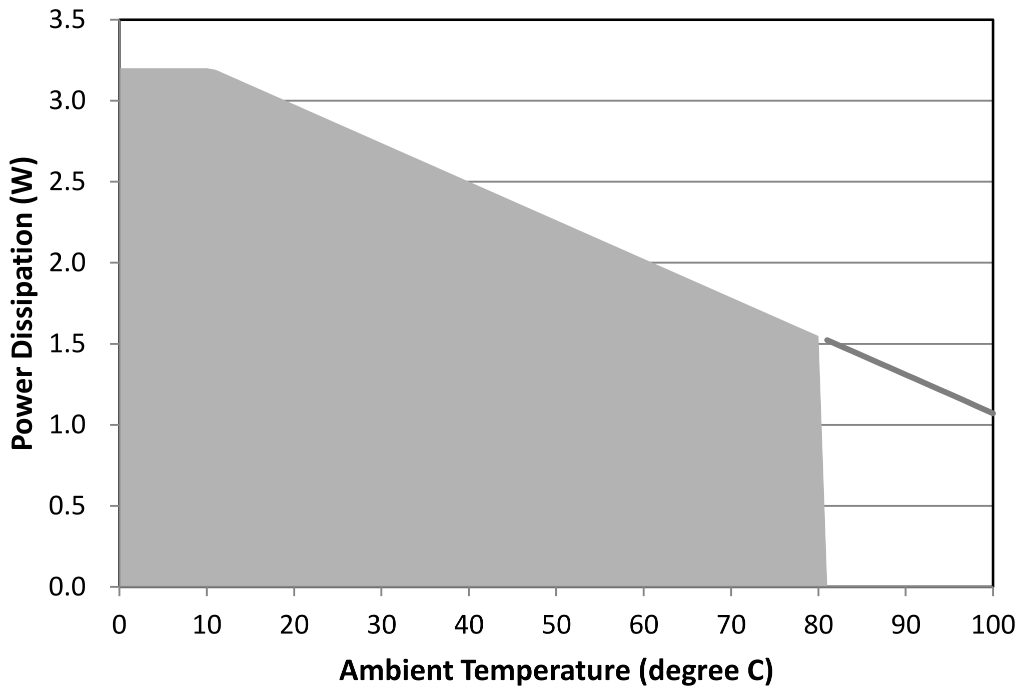
   $$P_D = V_{OUT} * I_{OUT}$$

   Where $\mathbf{V_{OUT}}$ is the voltage on output pins, $\mathbf{I_{OUT}}$ is output current of NU511, $\mathbf{V_F}$ is voltage drop of LED and **n** is the number of LEDs. In some higher V_{OUT} applications, to series a proper resistor in output current path can decrease the V_{OUT} and get less heat generation from NU511.

2. For the efficiency consideration, higher VLED voltage and more LEDs in current path will get higher electrical efficiency. With the wide range supply voltage design and self powering structure like the lighting application circuit on previous page, NU511 can be used in maximum 24V (VLED) power system.

3. More LED in series, the total voltage drop variation on LEDs will increase. This variation is derived from the different $\mathbf{V_F}$ bins of LEDs and LED temperature rising while system is working. That probably increases $\mathbf{P_D}$. So, it is another trade off to select the proper VLED voltage and the number of LEDs in system. The more output current is driving, the less LED in series is better.

Power Dissipation



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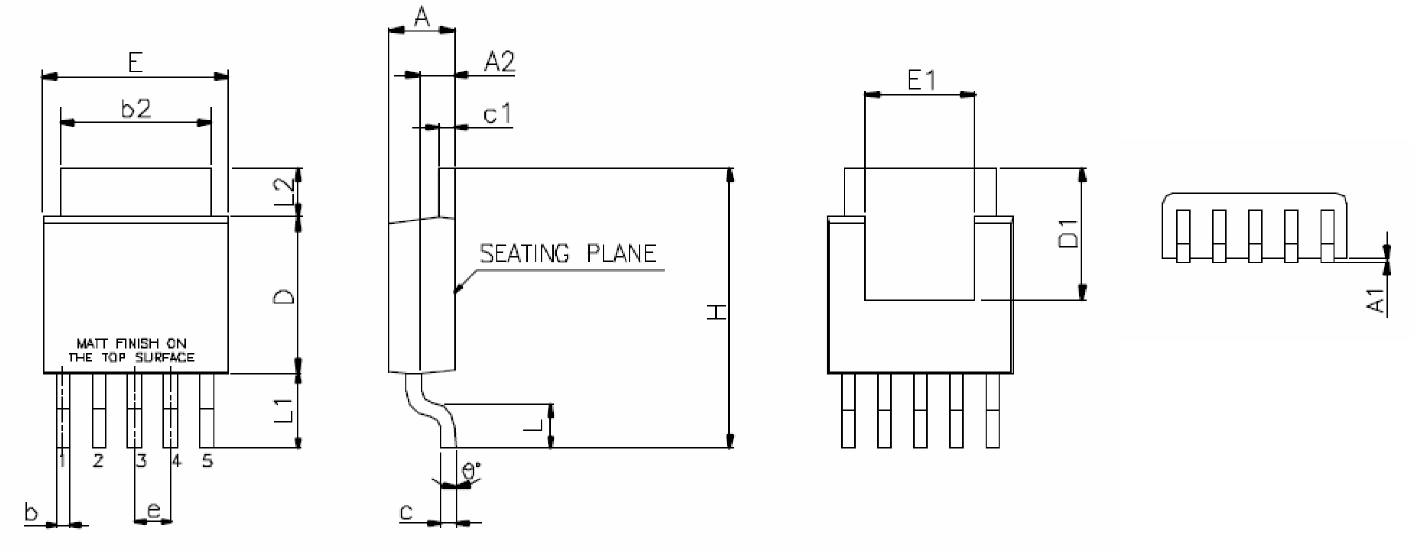
Package Dimensions



SYMBOLS	DIMENSIONS IN INCH		DIMENSIONS IN MILLIMETER	
	MIN.	MAX.	MIN.	MAX.
A	0.086	0.094	2.18	2.39
A1	0.000	0.005	0.00	0.13
A2	0.040	0.050	1.02	1.27
b	0.020 TYP.		0.51 TYP.	
b2	0.205	0.215	5.21	5.46
c	0.018	0.023	0.46	0.58
c1	0.018	0.023	0.46	0.58
D	0.210	0.220	5.33	5.59
D1	0.180	–	4.57	–
E	0.250	0.265	6.35	6.73
E1	0.150	–	3.81	–
e	0.050 BSC.		1.27 BSC.	
H	0.370	0.410	9.40	10.41
L	0.055	0.070	1.40	1.78
L1	0.105 REF.		2.67 REF.	
L2	0.06	0.08	1.52	2.03
θ	0°	4°	0°	4°

NOTES:
1. JEDEC OUTLINE : N/A

Taping Specification

PACKAGE	Q'TY/REEL
TO252-5	3,000 ea

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