160mA Single channel LED Driver

Features

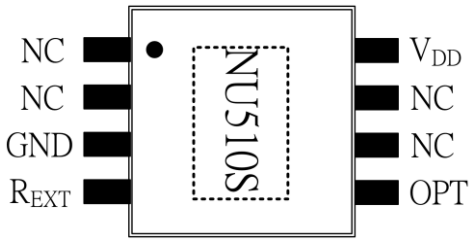
- Up to 160mA single channel constant current regulator
- 1.6V ~ 18V wide supply voltage range supports self-power structure in lighting application
- Current set by an external resistor
- Minimized 1V (160mA) dropout voltage
- Fast current rising and falling
- Less than ±5% Chip to Chip current skew
- Less than ±0.5%/V load (or line) regulation
- 125˚C ~160˚C junction temperature current ramp down thermal protect
- -40˚C ~ 85˚C ambient operating temperature
- Cascade-able for higher voltage drop applications

Applications

- General LED lighting
- Decoration lighting for architecture
- LED torch / flash light
- RGB lighting
- RGB display / indicator

Package Type

- ESOP 8
  (Part No.: NU510SES)



Product Description

NU510S is a 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.

Except for the power supply function, the VDD pin of NU510S is output enable (OE), and can be used in digital PWM controlled circuits for more precise current adjustment in gray level applications.

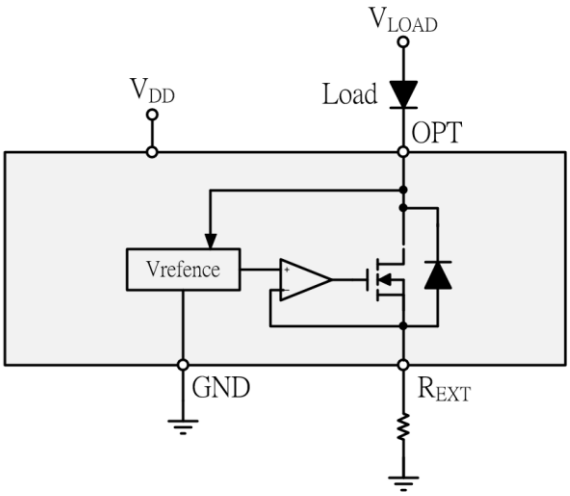
With the feature of wide power supply range design and ultra low I_{DD} consumption, the NU510S supports the self powered structure in LED lighting applications. In this structure, the NU510S no need to be provided a dedicate power circuit even the system power voltage is much higher than the maximum operation voltage of NU510S. The V_{DD} power can be gotten from the proper position in LED series of system.

Terminal Description

Pin name	Function
GND	Ground (Thermal pad)
R_{EXT}	Current setting Resistor
OPT	Current sink
V_{DD}	Power supply
Thermal pad	Ground potential

Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

Block Diagram



Maximum Ratings (T = 25˚C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	0 ~ 20	V
Output voltage(Output enable)	V_{OPT_Enable}	-0.2 ~ 16	V
Output voltage(Output disable)	$V_{OPT\_Disable}$	-0.2 ~ 20	V
Output current	I_{OPT}	200	mA
Power Dissipation (Ta=25°C)	PD	1	W
Thermal Resistance (On PCB, Ta=25°C)	$R_{TH(j-a)}$	100	°C /W
Operating temperature	T_{OPR}	-40~+85	°C
Storage temperature	T_{STG}	-55~+150	°C

Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

Electrical Characteristics and Recommended Operating Conditions

Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	Room Temp. V_{OPT} = 1V		1.6	-	18	V
Supply voltage rising and falling speed *1	V_{DDspd}	$V_{DD} \leqq 5V$		0.05	-	-	uS
		$V_{DD} > 5V$		5	-	-	
Output voltage	V_{OPT_Enable}	$V_{DD} > 1.6V$, $P_D \leqq P_{D\_recomd}$		-	-	15	V
	$V_{OPT\_Disable}$	$V_{DD} < 0.8V$		-	-	18	V
Supply current	I_{DD}	$V_{DD} \leqq 18V$		-	75	100	uA
Minimum dropout voltage	V_{OUT}	$V_{DD} \geqq 3V$	$I_S \leqq 20mA$	-	0.4	-	V
			$I_S \leqq 80mA$	-	0.6	-	
			$I_S \leqq 160mA$	-	1	-	
Output current	I_{OPT}	$V_{DD} \geqq 3V$		-	-	160	mA
Current set voltage	V_{REXT}	$V_{DD} > 1.6V$, Room Temp.		152	160	168	mV
Leakage	$I_{Leakage}$	V_{DD} = 0V, V_{OPT} = 15V		-	-	0.5	uA
Line regulation	%/V_{DD}	13V > V_{DD} > 3V		-	-	±0.5	%/V
Load regulation	%/V_P	15V > V_{OPT} > 0.4V,		-	-	±0.5	%/V
Thermal regulation	%/10°C	V_{DD} = 3V, V_{OPT} = 1V, Temperature < 125°C		-1	-	0	%/10°C
Output ramp down temperature	T1	Output enabled		-	125	-	°C
Shutdown temperature	T2	I_{OPT}=0		-	160	-	
Chip current skew	I_{Skew}	V_{DD} = 3V, V_{OPT} = 1V		-	2	5	%
Power Dissipation	P_{D_recomd}	Room Temp.		-	-	0.65	W

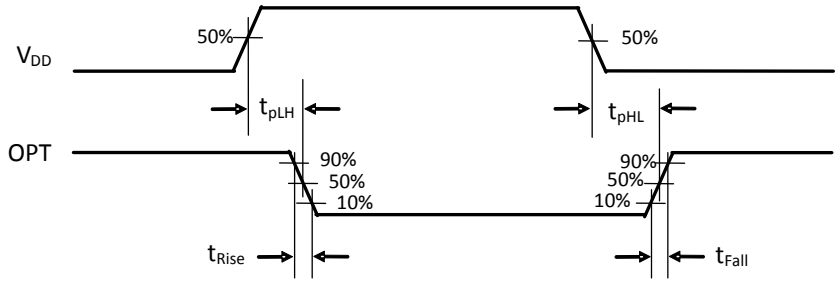
*1 For the stable reason, the rising and falling speed of supply voltage (V_{DD}) on NU510S should be slower when higher V_{DD} than 5V is adopted. Fast and high V_{DD} transition will bring the timing of output current instable. Please refer to typical application circuit in this specification for proper using.

Switching Characteristics (T = 25˚C)

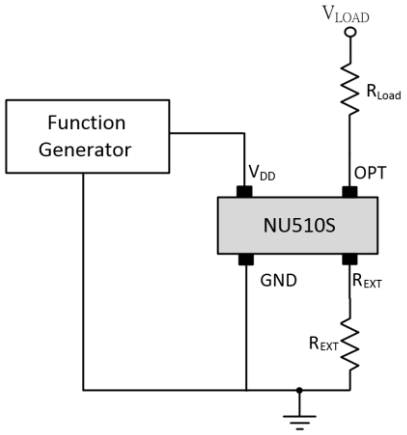
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time V_{DD} from "L" to "H"	t_{pLH}	V_{OPT}= 1V, V_{DD} = 0V → 3V		0.5	1	uS
Output current rising time	t_{Rise}	V_{OPT}= 1V, V_{DD} = 0V → 3V		0.8	1.5	uS
Propagation Delay Time V_{DD} from "H" to "L"	t_{pHL}	V_{OPT}= 1V, V_{DD} = 3V → 0V		30	100	nS
Output current falling time	t_{Fall}	V_{OPT}= 1V, V_{DD} = 3V → 0V		100	300	nS

Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

Timing Waveform



Test Circuit



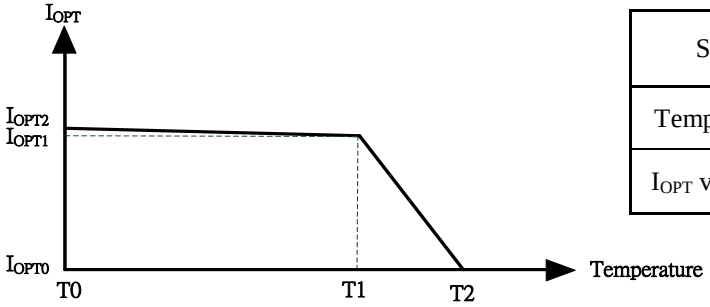
Output Current Setting

The output current of NU510S is set by an external resistor (R_{EXT}). The output current can be figured out by following equation.

$$I_{OPT} \cong \frac{0.16V}{R_{EXT} + 0.2\Omega}$$

Thermal protection

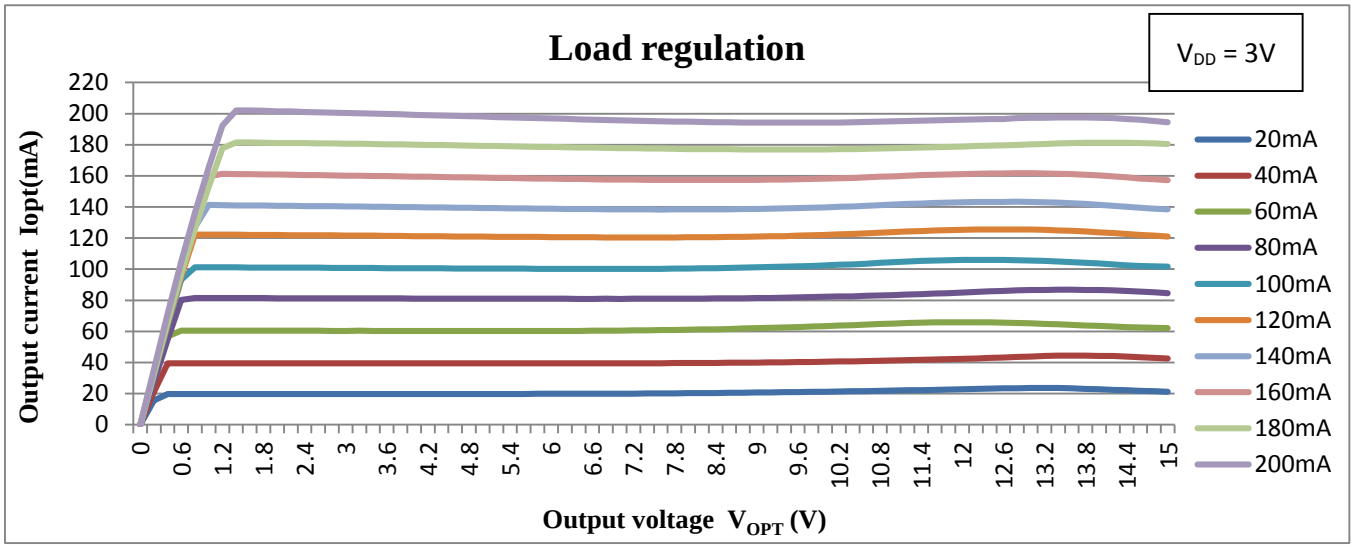
When junction temperature is more than thermal protection temperature (~125˚C), the output current of NU510S will start to decrease to lower down the power dissipation on chip. If the junction temperature reach 160˚C, the output current will almost shut down. The output current will restore in the same way when the temperature decrease.

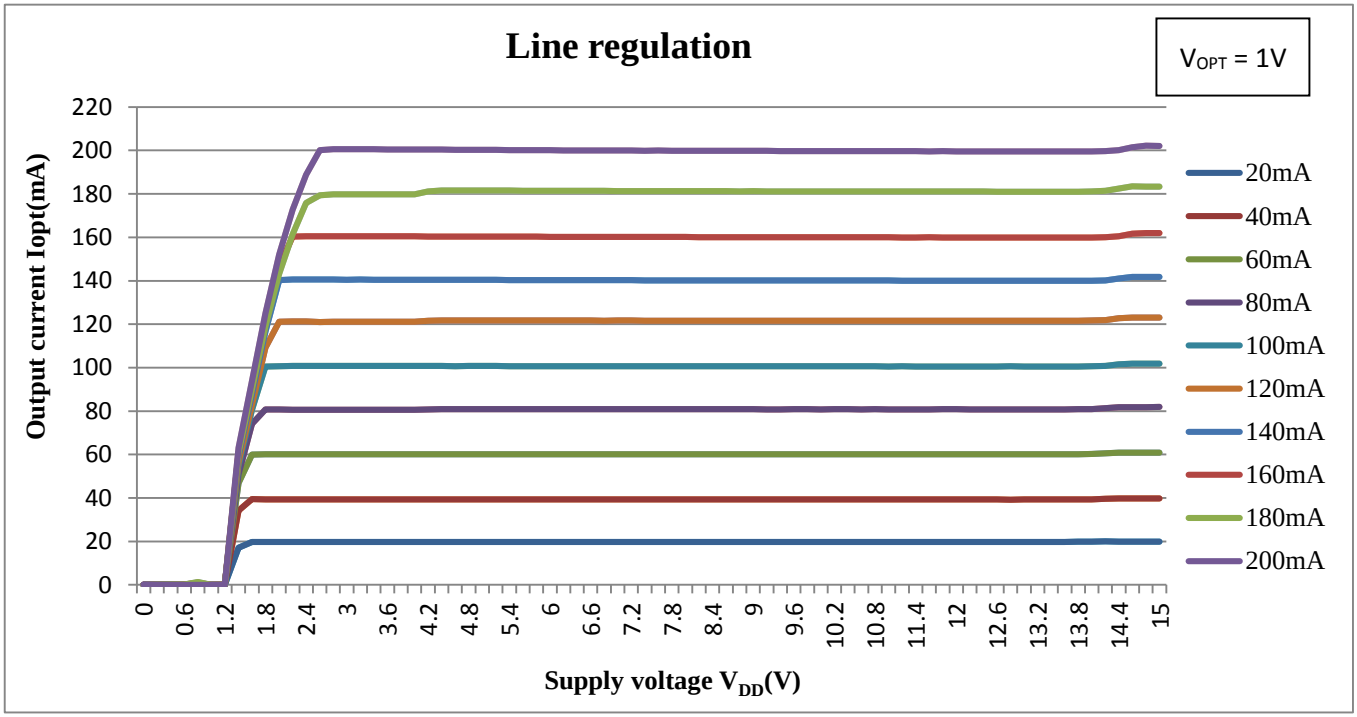


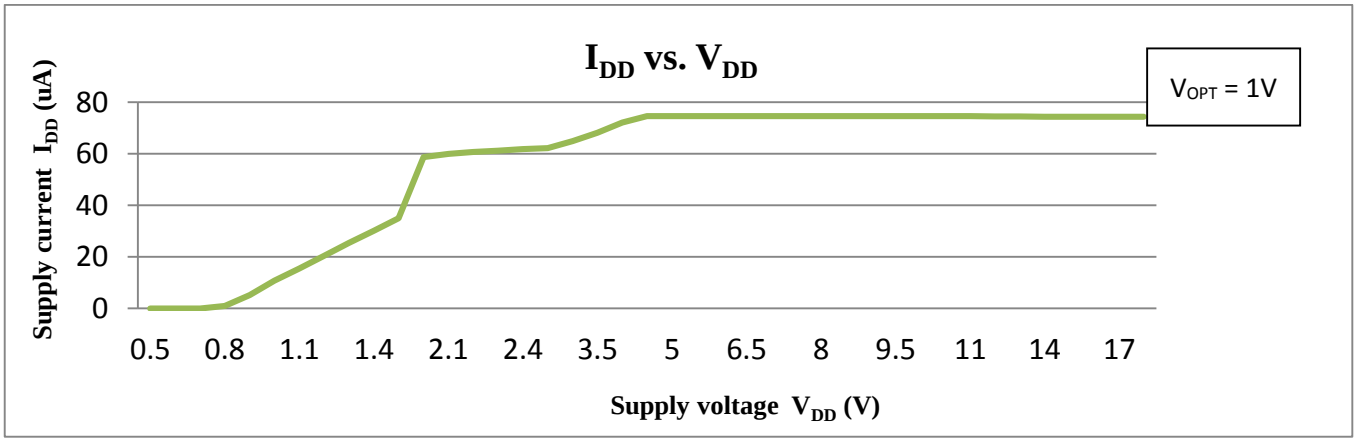
State	Normal (T0 ↔ T1)	Thermal protect (T1 ↔ T2)	Unit
Temperature	-40 ↔ 125	125 ↔ 160	°C
I_{OPT} variation	-0.8	-28	%/10°C

Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

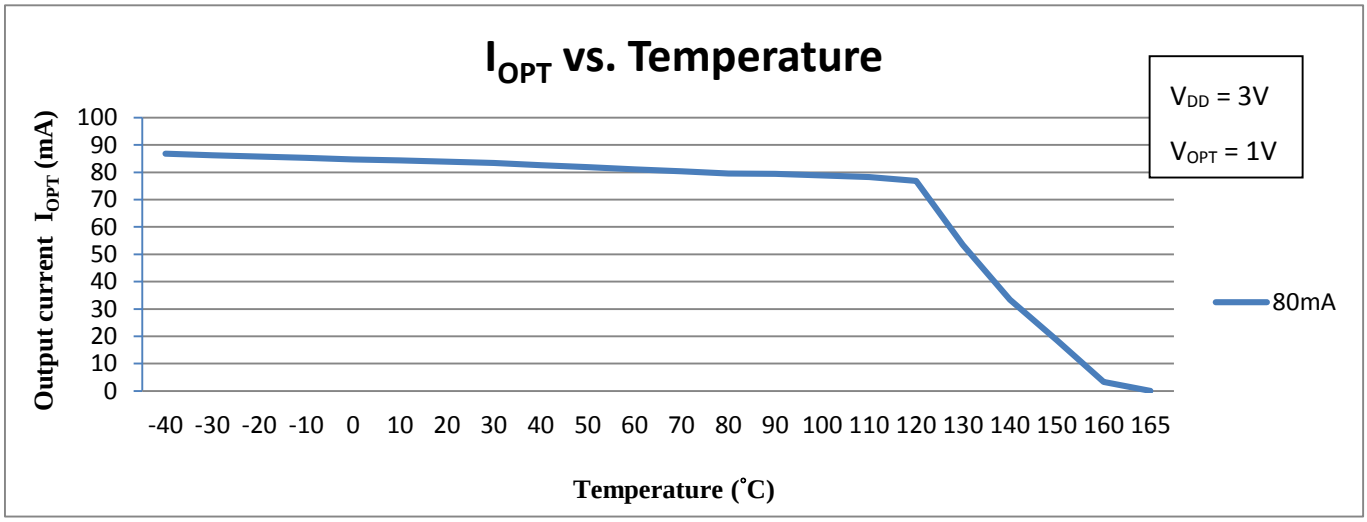
Output I/V Curve





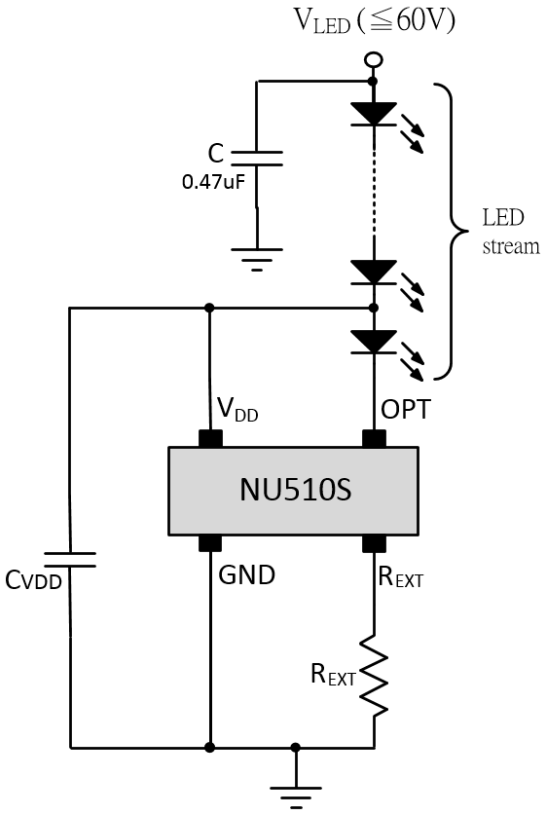


Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

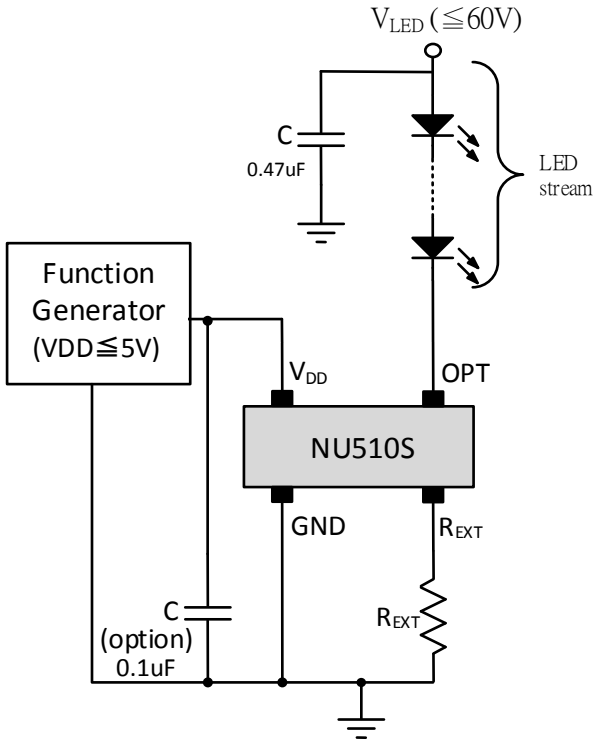


Typical Application Circuit

- DC power general lighting

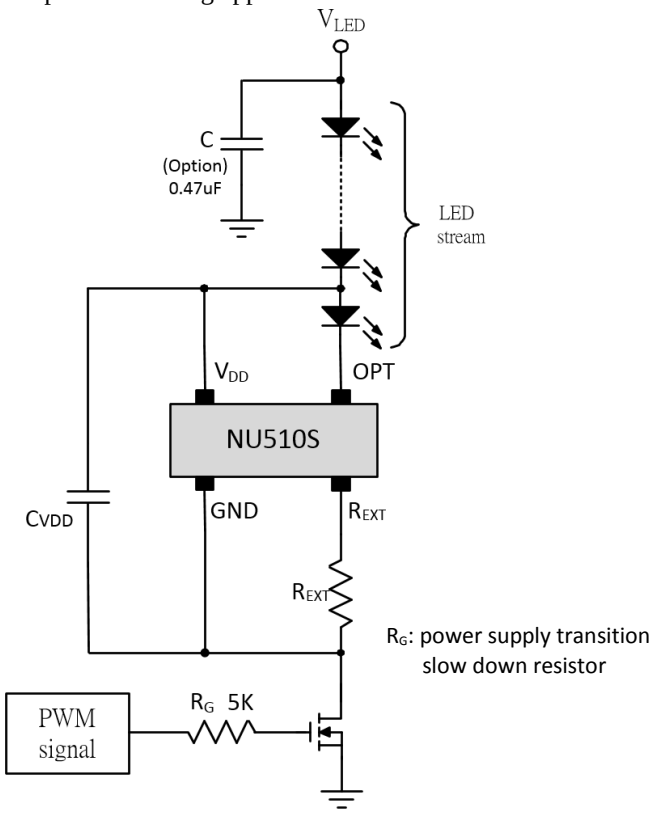


- DC PWM dimming application



Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

- DC power dimming application

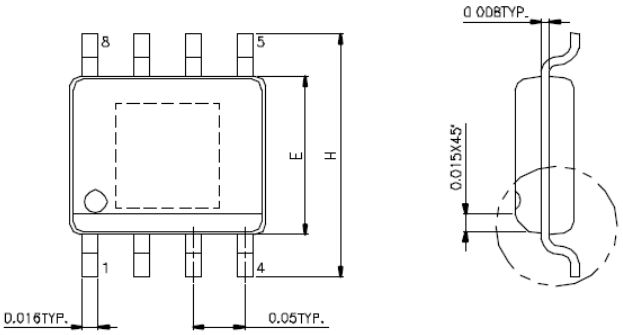


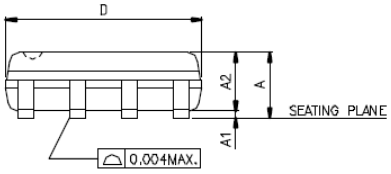
Note: Generally, The capacitance of C_{VDD} capacitor when self-power structure is used can be related with LED typical current. For example, if the typical current of LED is 160mA, the capacitance is about 160nF. The capacitance can be adjusted according to the requirement of real applications.

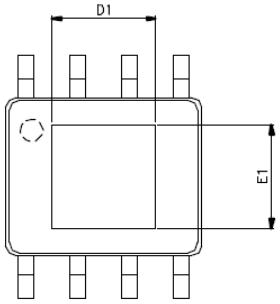
Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805

Package Dimensions

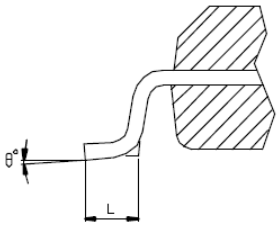
- ESOP 8







E.P. VERSION ONLY



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

Restrictions on product use

- NUMEN Tech. reserves the right to update these specifications in the future.
- The information contained herein is subject to change without notice.
- NUMEN Technology will continually working to improve the quality and reliability of its products. Nevertheless, semiconductor device in general can malfunction or fail due to their inherent electrical sensitivity and vulnerability to physical stress. It is the responsibility of the buyer, when utilizing NUMEN products, to comply with the standards of safety in making a safe design for the entire system, and to avoid situations in which a malfunction or failure of such NUMEN products could cause loss of human life, bodily injury or damage to property. In developing your designs, please ensure that NUMEN products are used within specified operating ranges as set forth in the most recent NUMEN products specifications.
- The NUMEN products listed in this document are intended for usage in general electronics applications (lighting system, personal equipment, office equipment, measuring equipment, industrial robotics, domestic appliances, etc.). These NUMEN products are neither intended nor warranted for usage in equipment that requires extraordinarily high quality and/or reliability or a malfunction or failure of which may cause loss of human life or bodily injury ("Unintended Usage"). Unintended Usage include atomic energy control instruments, airplane or spaceship instruments, transportation instruments, traffic signal instruments, combustion control instruments, medical instruments, all types of safety devices, etc.. Unintended Usage of NUMEN products listed in this document shall be made at the customer's own risk.

Please visit http://www.numen-tech.com for more patent information.
3F., No. 96, Sec. 1, Jiafong 6th Road, Jhubei City, Hsinchu County 302, Taiwan. TEL: +886-3-658-9936 FAX: +886-3-550-2805