

Single Channel Constant Current Regulator

Features

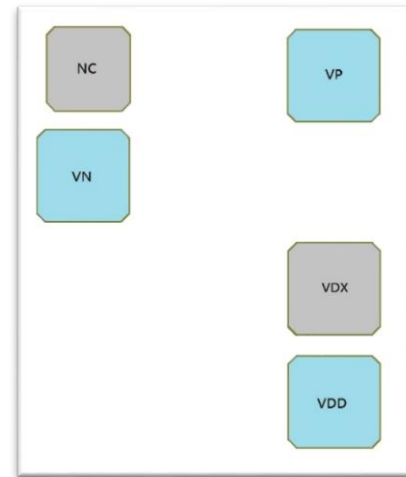
- The most easy used linear constant current LED driver
- 1.6~18V wide supply voltage range supports self-power structure in lighting application
- 20~150mA constant current regulator
- Minimized 0.3~1V output dropout voltage
- Fast response time, support power supply PWM dimming function
- Less than 1%/V line/load regulation
- 125~160 °C junction temperature current ramp down thermal protect
- -40~85°C operating temperature

Dice information

Chip Size: x*y = 440um * 550um

Coordinate	X	Y	Pad size
VP	364	465	110 * 110 (um)
VN	65	346	
VDD	364	76	
VDX *1	364	211	

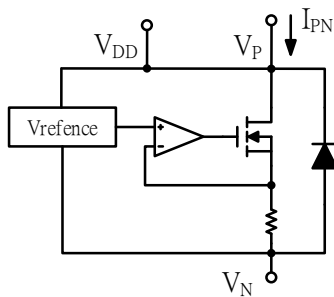
*1 VDX pad is a reserved pad. It can't be used.



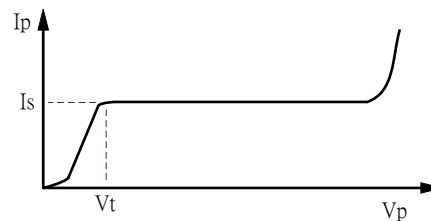
Applications

- Constant Current LED (CCLED)
- Constant Current Light Engine

Block Diagram and Ideal IV characteristic



IV curve



Maximum Ratings (T = 25°C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V _{DD}	-0.2 ~ 20	V
Output voltage	V _{PN}	-0.2 ~ 16	V
Reverse voltage (V _N to V _P / V _{DD})	V _R	0.5	V
Operating temperature	T _{OPR}	-40~+85	°C
Storage temperature	T _{STG}	-55~+150	°C

Protection

HBM ±8KV ESD sensitivity test passed. MIL-STD classification 3B.
Latch up positive/negative I 400mA test passed.

Electrical Characteristics and Recommended Operating Conditions

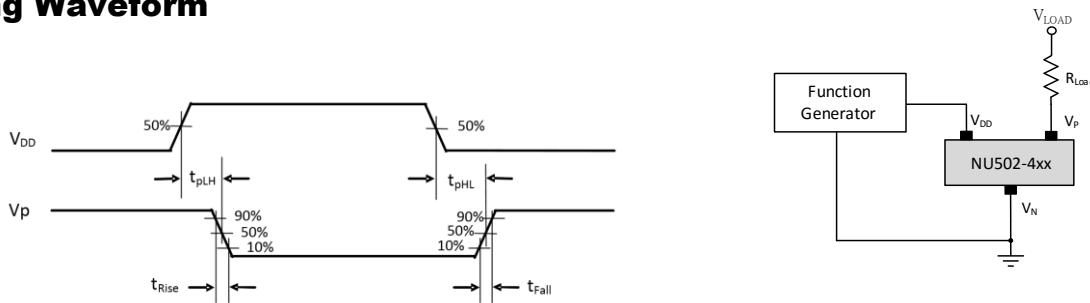
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Working voltage	V_{PNmax}	$I_{PN} = I_S$	1.6	-	15	V
Output current	I_S	Spec.	-	18~165	-	mA
Output current skew	I_{skew}	I_S	-	-	-	%
Line/Load regulation	$\%/V_P$	$9V > V_{PN} > 1.6V$	-	-	± 1	$\%/V$

Switching Characteristics (T = 25°C)

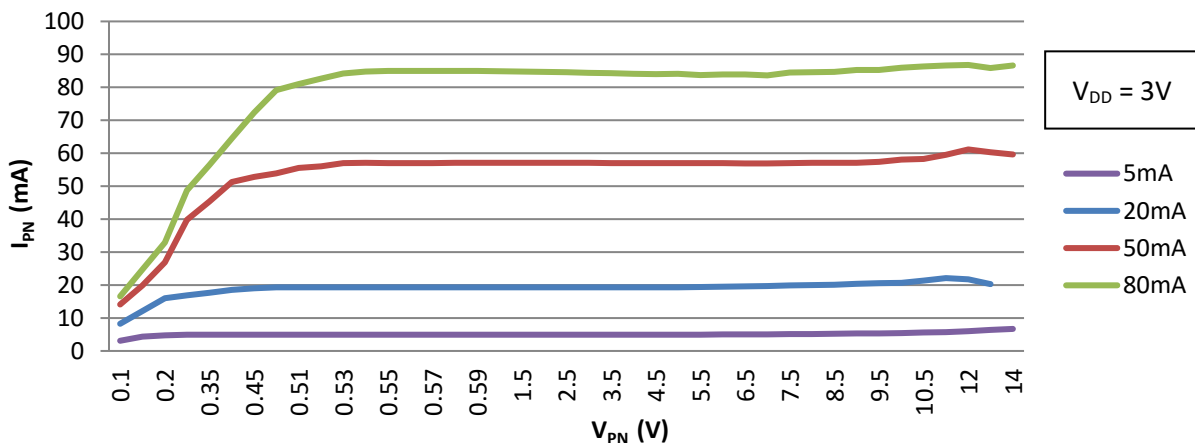
Characteristic	Symbol	Condition	Min.	Typ.	Max.	Unit
Propagation Delay Time V_{DD} from "L" to "H"	t_{pLH}	$V_{PN} = 1V, V_{DD} = 0V \rightarrow 3V$		0.5	1	μS
Output current rising time	t_{Rise}	$V_{PN} = 1V, V_{DD} = 0V \rightarrow 3V$		0.8	1.5	μS
Propagation Delay Time V_{DD} from "H" to "L"	t_{pHL}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

*2 For the stable reason, the rising and falling speed of supply voltage (V_{DD}) on NU502-4xx should be slower when higher V_{PN} than 5V is adopted. Fast and high V_{PN} transition will bring the timing of output current instable. Please refer to typical application circuit in this specification for proper using.

Timing Waveform

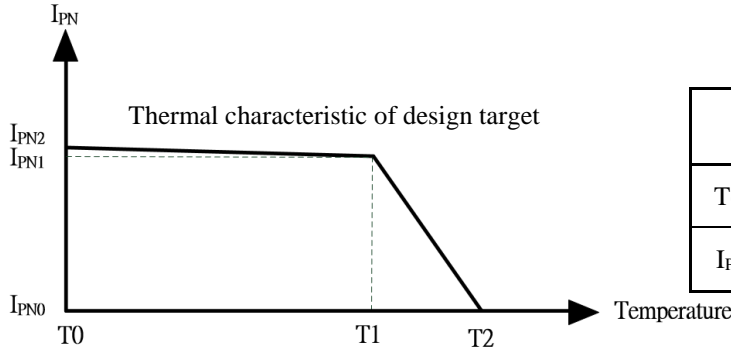


I/V curve

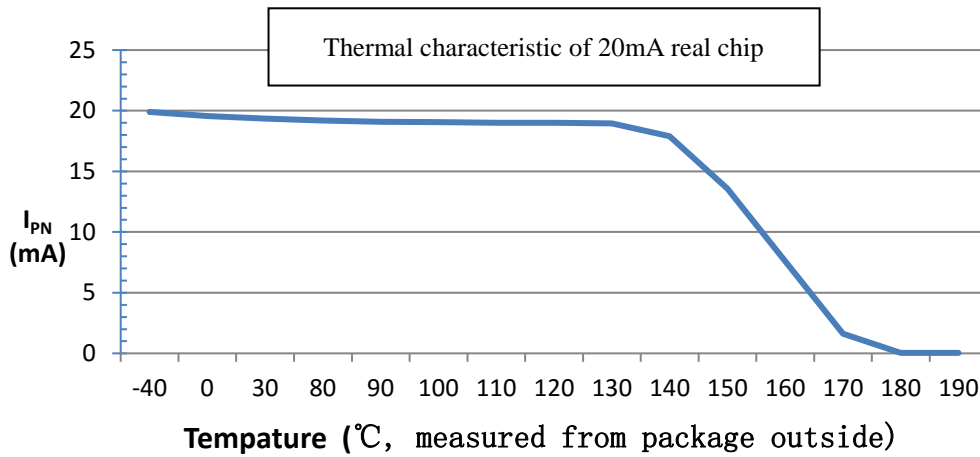


Thermal protection

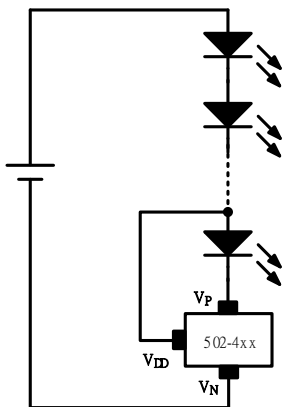
When junction temperature is more than thermal protection temperature (~125°C), the output current of NU502 will start to decrease to lower down the power dissipation on chip. If the junction temperature reach 160°C, the output current will almost shut down. The output current will restore in the same way when the temperature decrease. Whole series chips with different output current have the same thermal characteristics.



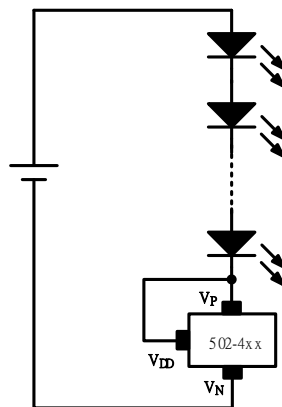
State	Normal (T0 ↔ T1)	Thermal protect (T1 ↔ T2)	Unit
Temperature	-40 ↔ 125	125 ↔ 160	°C
I _{PN} variation	-0.8	-28	%/10°C



Application Circuits



Low dropout application
 $V_{PN_Min} = 0.3V$ (20mA)
 1V (150mA)



Normal application
 $V_{PN_Min} = 1.5V$ (20mA)
 2.2V (150mA)

Special Optical Restrictions

The output current of NU502-xxx will drift when NU502-xxx bare die is exposure to the strong light. NU502-xxx bare die should be covered by non-transparent material or mechanical structure to isolate the light.

Restrictions on product use

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