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numen Technology 數能科技股份有限公司

160mA Single channel LED Driver

Features

- Up to 160mA single channel constant current regulator
- 2.7V ~ 30V wide supply voltage range supports self-power structure in lighting application
- Current set by an external resistor
- Minimized 0.6V (160mA) dropout voltage
- Fast current rising and falling
- Less than ±4% Chip to Chip current skew
- Less than ±0.1%/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

- SOT 23-6 (160mA)
  (Part No.: NU502)

Product Description

NU502 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 NU502 supports the self powered structure in LED lighting applications. In this structure, the NU502 no need to be provided a dedicate power circuit even the system power voltage is much higher than the maximum operation voltage of NU502. The V_{DD} power can be gotten from the proper position in LED series of system.

Terminal Description

Pin name	Function
GND	Ground
R_{EXT}	Current setting Resistor
OPT	Current sink
NC	/
V_{DD}	Power supply

Please visit http://www.numen-tech.com for more patent information.

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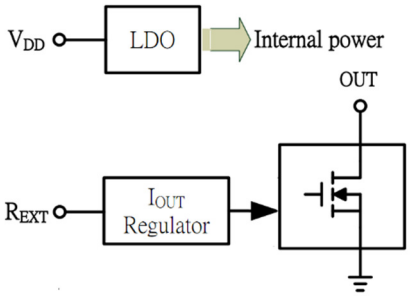
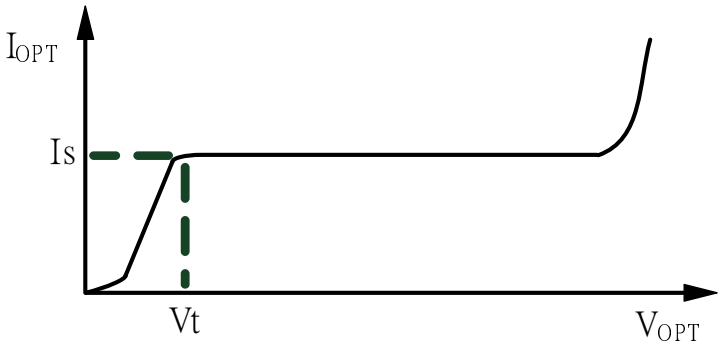
Block Diagram



Ideal IV characteristic



Maximum Ratings (T = 25˚C)

Characteristic	Symbol	Rating	Unit
Supply voltage	V_{DD}	0 ~ 30	V
Output voltage	V_{OPT}	-0.2 ~ 30	V
Output current	I_{OPT}	200	mA
Power Dissipation (Ta=25°C)	PD	0.4	W
Thermal Resistance (On PCB, Ta=25°C)	$R_{TH(j-a)}$	300	°C /W
Operating temperature	T_{OPR}	-40~+85	°C
Storage temperature	T_{STG}	-55~+150	°C

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Electrical Characteristics and Recommended Operating Conditions

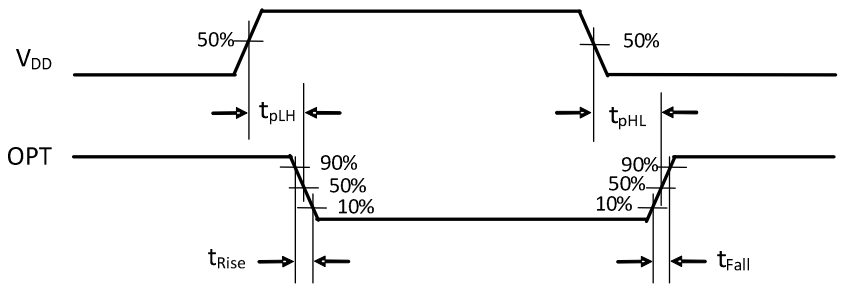
Characteristic	Symbol	Condition		Min.	Typ.	Max.	Unit
Supply voltage	V_{DD}	Room Temp. V_{OPT} = 1V		2.7	-	24	V
Supply voltage rising and falling speed *1	V_{DDspd}	$V_{DD} \leqq$ 5V		0.05	-	-	uS
		V_{DD} > 5V		5	-	-	
Output voltage	V_{OPT} V_{OPT}	V_{DD} > 3V, $P_D \leqq P_{D\_recomd}$		--	-	24	V
Supply current	I_{DD}	$V_{DD} \leqq$ 24V		200	250	300	uA
Minimum dropout voltage	V_{OUT}	$V_{DD} \geqq$ 3V	$I_S \leqq$ 20mA	-	0.3	-	V
			$I_S \leqq$ 150mA	-	0.6	-	
Output current	I_{OPT}	$V_{DD} \geqq$ 3V		-	-	160	mA
Line regulation	%/V_{DD}	24V > V_{DD} > 3V		-	-	±0.1	%/V
Load regulation	%/V_P	24V > V_{OPT} > 0.4V,		-	-	±0.1	%/V
Thermal regulation	%/10°C	V_{DD} = 3V, V_{OPT} = 1V, Temperature < 125°C		-	-	-1	%/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.		-	-	0.25	W

*1 For the stable reason, the rising and falling speed of supply voltage (V_{DD}) on NU502 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 (OE from "L" to "H")	t_{pLH}	V_{OPT}=1V, I_{OPT}=120mA, V_{DD} = 0V → 5V	1	-	2.2	uS
Output current rising time (OE from "L" to "H")	t_{OERise}	V_{OPT} =1V,I_{OPT} =120mA, V_{DD} = 0V → 5V	1	-	2	uS
Propagation Delay Time (OE from "H" to "L")	t_{pHL}	V_{OPT} =1V,I_{OPT} =120mA, V_{DD} = 5V → 0V	200	320	500	nS
Output current falling time (OE from "H" to "L")	t_{OEFall}	V_{OPT} =1V,I_{OPT} =120mA, V_{DD} = 5V → 0V	30	80	120	nS

Timing Waveform



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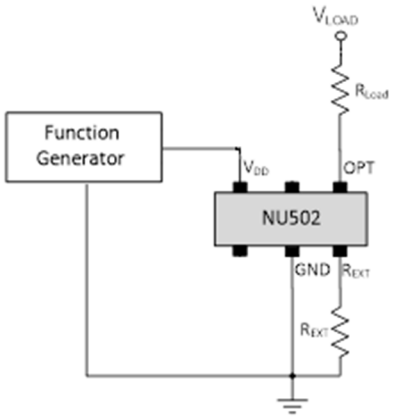
Test Circuit



Output Current Setting

The output current of NU502 is set by an external resistor (R_{EXT}). The output current can be figured out by following equation.

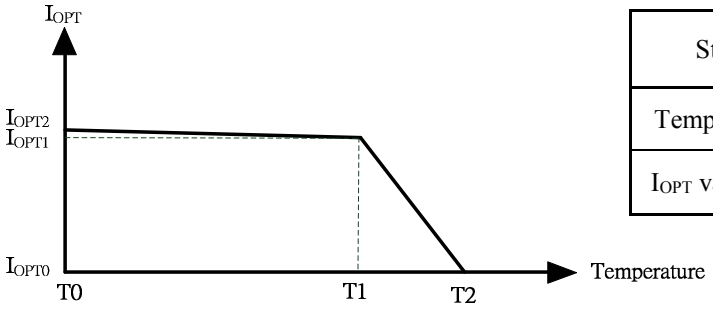
Iout (A)=1000/Rext (Ω)

Example: I_{OUT} = 80mA

Rext=1000/0.08(A)=12500 (Ω)

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.



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

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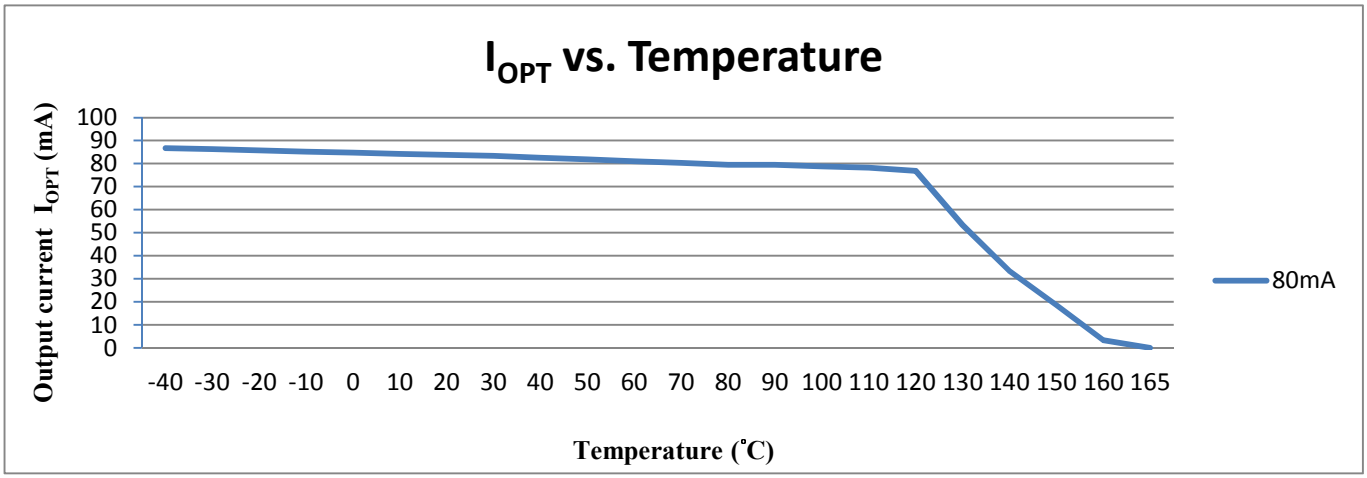
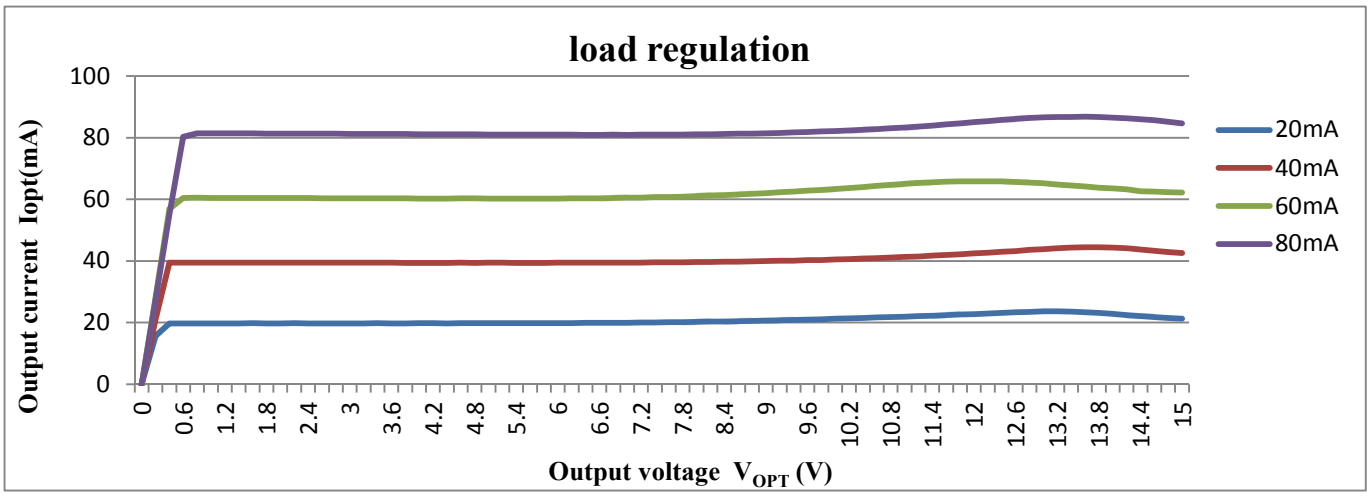
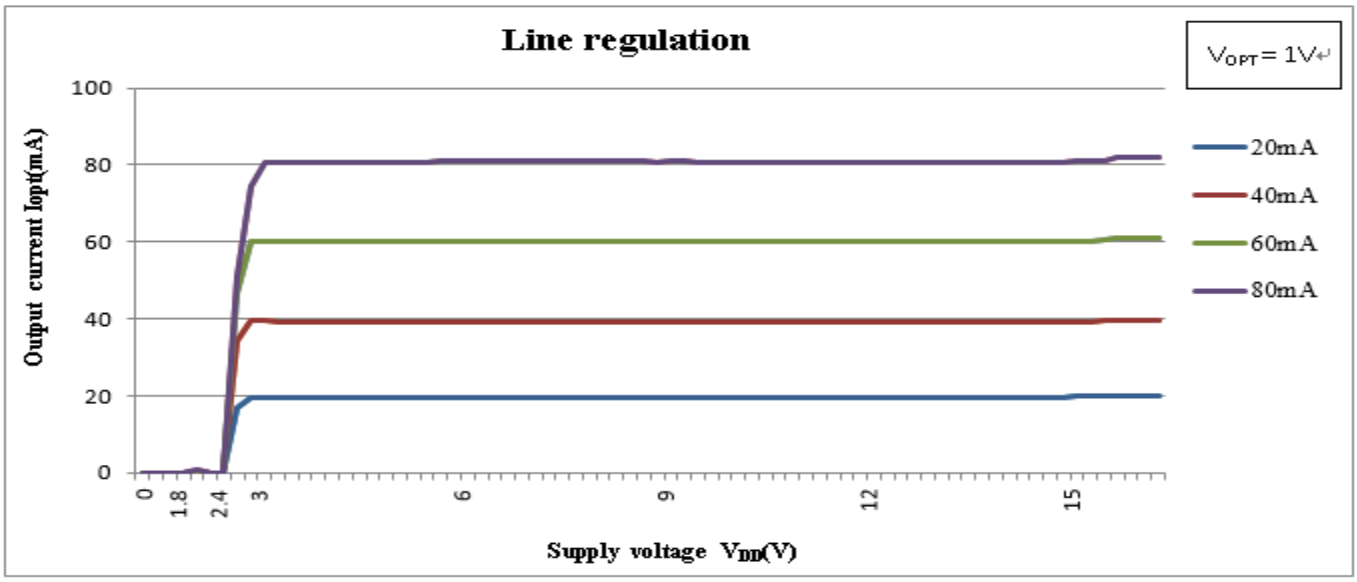
Output I/V Curve







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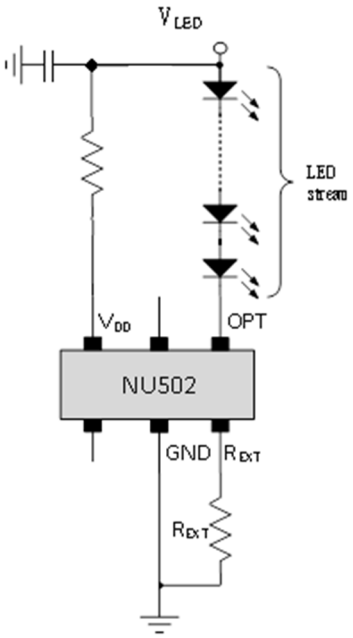
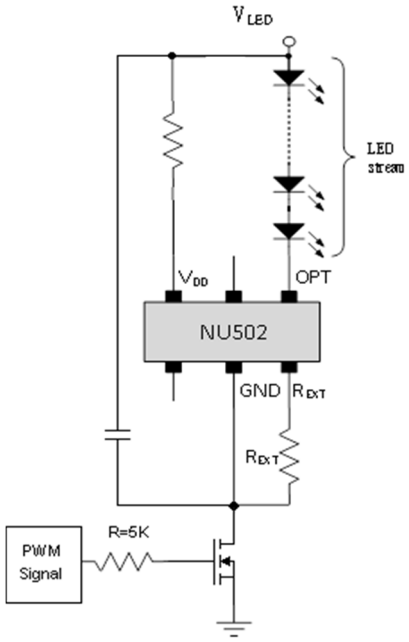
Typical Application Circuit

- DC power general lighting

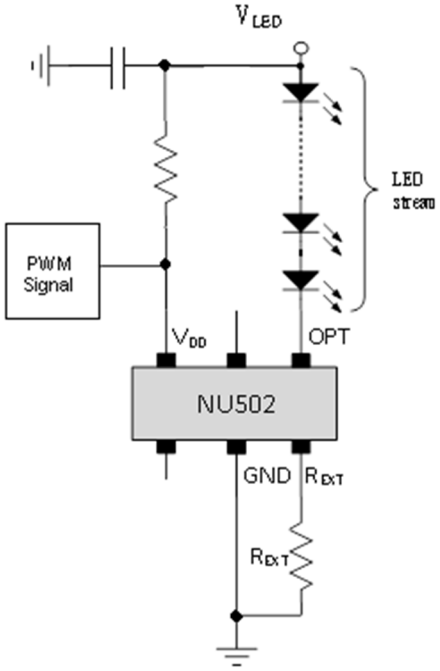


- DC power dimming application

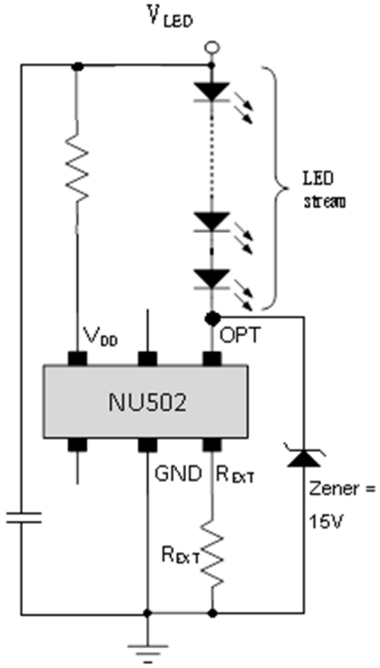


RG: power supply transition slow down resistor

- DC PWM dimming application



- DC power general lighting (Vled＞30V)



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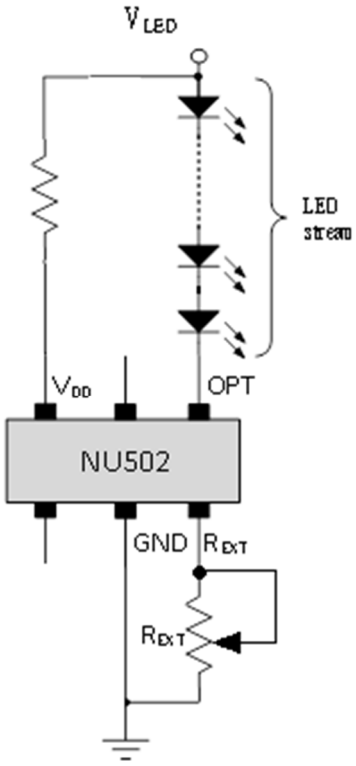
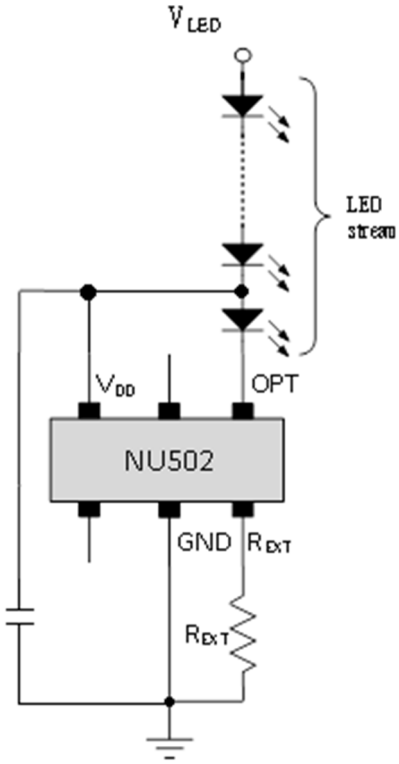
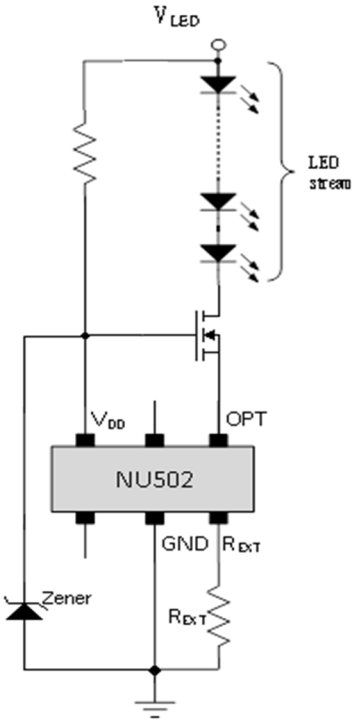
- Linear dimming application



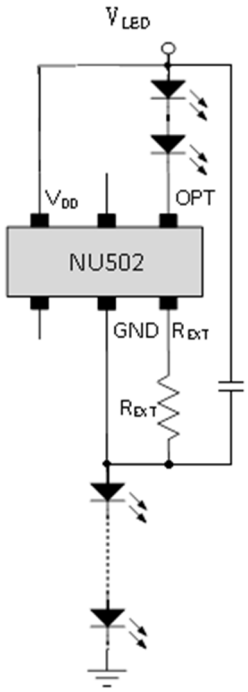
- DC power general lighting



- Hight Voltage general



- DC power general lighting



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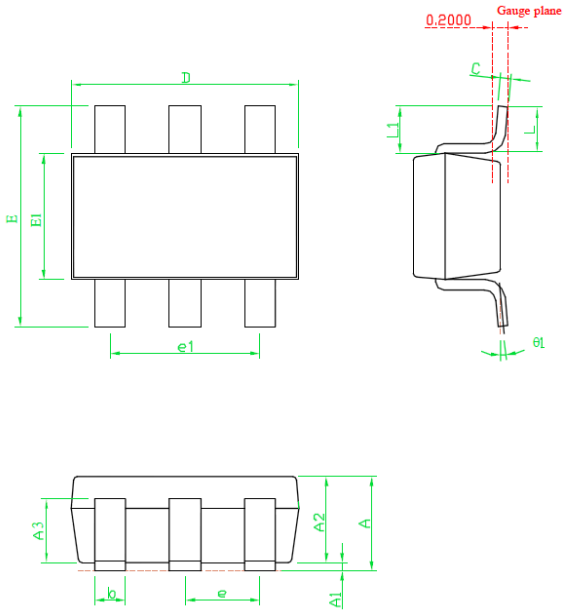
Package Dimensions

- SOT 23-6



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
e1	---	1.90(TYP)	---
E	2.60	2.80	3.00
L	0.37	---	---
θ1	1°	5°	9°
e	---	0.95(TYP)	---
L1	0.5	0.6	0.7

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