

## Features

- Operation Voltage: 2.5V~25V
- Directly Drive 1~8 Series LED
- Shutdown Current: 3uA
- Fixed 1.2MHz Switching Frequency
- 1A Constant Output Current Capability
- Built in High Frequency Power Transistor
- Built in Schottky Diode
- High Efficiency up to 88%
- Excellent line and load regulation
- EN PIN TTL ON/OFF capability
- Dimming Control Using a PWM Signal in EN PIN
- Boost or SEPIC Topologies
- Built in LED open circuit protection function
- Built in thermal shutdown function
- Device HBM ESD Classification Level Class3A
- Available in DFN3X3-8 package

## General Description

XL6104 is a built in high frequency power transistor and Schottky diode Boost LED constant current driver, fixed 1.2MHz frequency PWM, can support input operating voltage range of 2.5V~25V. XL6104 has high precision constant current output to drive the LED, and built in frequency compensation circuitry allows the use of small external components at a price suitable for lowering the cost of the entire power supply system and reduce the printed circuit board space. The low feedback voltage of 200mV reduces the power consumption of the external sampling resistor, and the EN pin supports both TTL ON/OFF and PWM dimming from 0 to 100%. Suitable for very low quiescent current and ultra-small size applications.

## Applications

- Screen Backlight LED Driver
- Wearable Portable Electronic Devices
- Digital Cameras
- PDAs and Other Handheld Devices
- Auxiliary Displays

## Typical application schematic

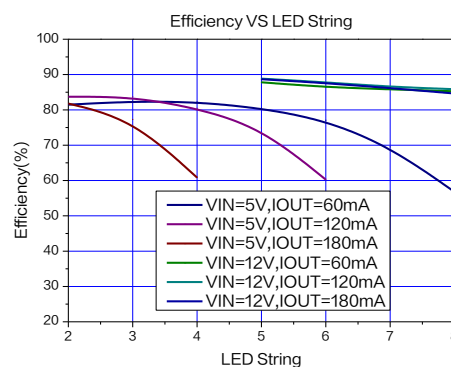
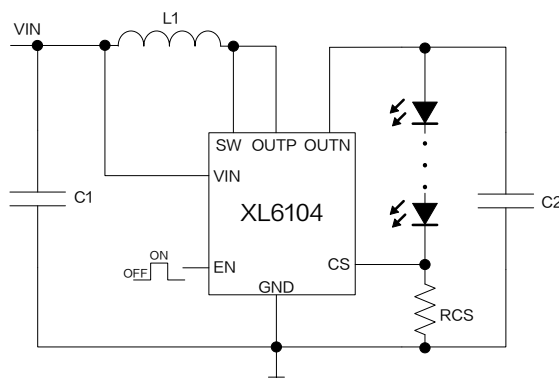


Figure1. XL6104 Typical application schematic and efficiency curve

## Pin Configurations

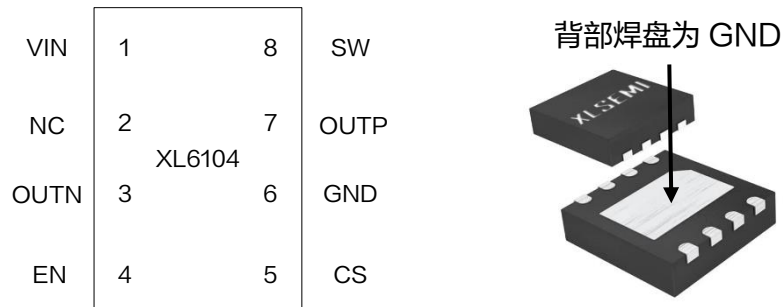


Figure2. Pin Configuration of XL6104

Table 1. Pin Description

Pin Number	Pin Name	Description
1	VIN	Supply Voltage Input Pin. XL6104 operates from 2.5V to 25V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
2	NC	No Connected.
3	OUTN	Output Pin. Internal Schottky diode cathode Pin.
4	EN	Enable Pin. Drive EN pin high to turn on the device, drive it low to turn it off. Floating is default high. Connect to a PWM signal to achieve LEDs brightness dimming.
5	CS	Output constant current sense Pin. The CS reference voltage is 200mV.
6	GND	Ground Pin.
7	OUTP	Internal Schottky diode anode Pin.
8	SW	Power Switch Pin.

## Ordering Information

Order Information	Marking ID	Package Type	Eco Plan	Packing Type Supplied As
XL6104	XL6104	DFN3X3-8	RoHS & HF	5000 Units on Reel

### Function Block

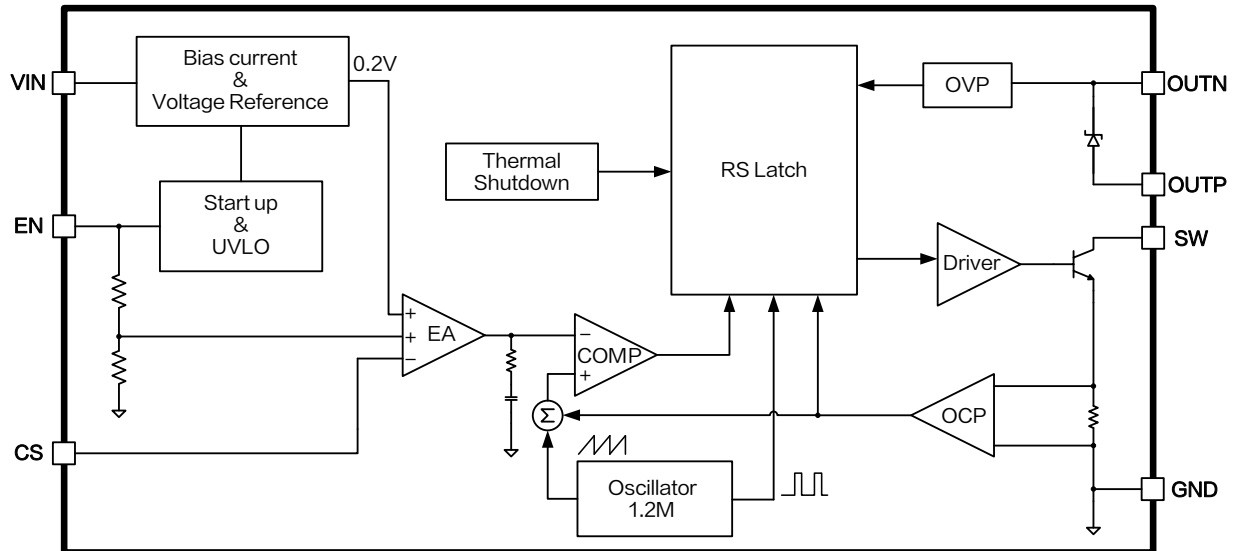


Figure3. Function Block Diagram of XL6104

### Absolute Maximum Ratings ( Note1 )

Parameter	Symbol	Value	Unit
Input Voltage	$V_{IN}$	-0.3~32	V
EN Pin Voltage	$V_{EN}$	-0.3~ $V_{IN}$	V
Current Sense Pin Voltage	$V_{CS}$	-0.3~ $V_{IN}$	V
Switch Pin Voltage	$V_{SW}$	-0.3~40	V
OUTN Pin Voltage	$V_{OUTN}$	-0.3~40	V
Power Dissipation	$P_D$	250	mW
Thermal Resistance (DFN3X3-8) (Junction to Ambient, No Heatsink, Free Air)	$R_{JA}$	55	°C/W
Maximum Junction Temperature	$T_J$	-40~150	°C
Operating Junction Temperature	$T_J$	-40~125	°C
Storage Temperature	$T_{STG}$	-65~150	°C
Lead Temperature (Soldering, 10 sec)	$T_{LEAD}$	260	°C
ESD (HBM)		>4000	V

**Note1:** Stresses greater than those listed under Maximum Ratings may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operation is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

1A 1.2MHz 30V Built in SBD Boost LED Constant Current Driver

XL6104

## XL6104 Electrical Characteristics

$T_A = 25^\circ\text{C}$ ; system parameters test circuit figure5, unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
$V_{CS}$	Current Sense Voltage	$V_{IN} = 5V, V_{OUT} = 9.9V$ $I_{LED} = 20mA$	194	200	206	mV
$\eta$	Efficiency	$V_{IN} = 5V, V_{OUT} = 13.2V$ $I_{LED} = 20mA$	-	79.1	-	%
$\eta$	Efficiency	$V_{IN} = 12V, V_{OUT} = 16.5V$ $I_{LED} = 120mA$	-	88.8	-	%

## Electrical Characteristics (DC Parameters)

$T_A = 25^\circ\text{C}, V_{IN} = 3V$ ; system parameters test circuit figure4, unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	$V_{IN}$		2.5		25	V
Shutdown Supply Current	$I_S$	$V_{EN} = 0V$ OUTN flowing		3		$\mu\text{A}$
Quiescent Supply Current	$I_Q$	$V_{CS} = 2V$		2.3		mA
Oscillator Frequency	$F_{OSC}$		0.96	1.20	1.44	MHz
Switch Current Limit	$I_L$	$V_{CS} = 0V$		1		A
Switch $V_{CE}$ Saturation Voltage	$V_{SAT}$	$I_{SW} = 300mA$		0.3		V
Schottky Forward Drop	$V_F$	$I_F = 300mA$		0.8		V
EN Pin Threshold	$V_{EN\_H}$	High(ON)	2.0			V
	$V_{EN\_L}$	Low(OFF)			0.5	
Max. Duty Cycle	$D_{MAX}$	$V_{CS} = 0V$		90		%
Over Voltage Protection	$V_{OUT}$	OUTN OPEN ( $V_{CS} = 0V$ )		30		V
Thermal Shutdown Temperature	$T_{SD}$			150		$^\circ\text{C}$

### Typical System Application–Single Li Battery to Drive LED

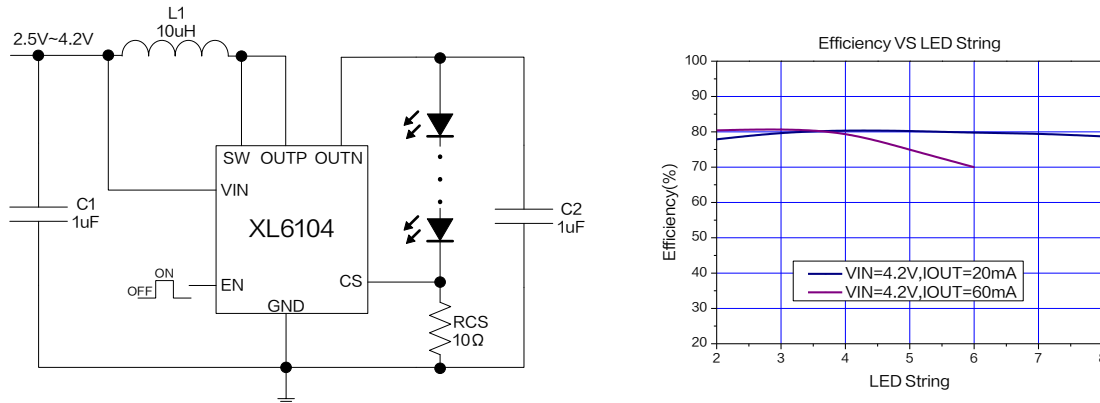


Figure4. XL6104 System Application and efficiency curve

Table 2. Figure4 Typical System Application Schematic Boom

Qty	Ref Des	Description	Mfg Part Number	Mfg
1	L1	10uH,1.1A,Inductor,3*3	YHNR3015-100M	YJYCOIN
2	C1,C2	1uF,50V,Ceramic,X7R,0603	0603B105K500NT	Fenghua
1	RCS	10Ω,1%,1/8W,Thick Film,0805	RS-05K100FT	Fenghua

### Typical System Application–Two Li Batteries to Drive LED

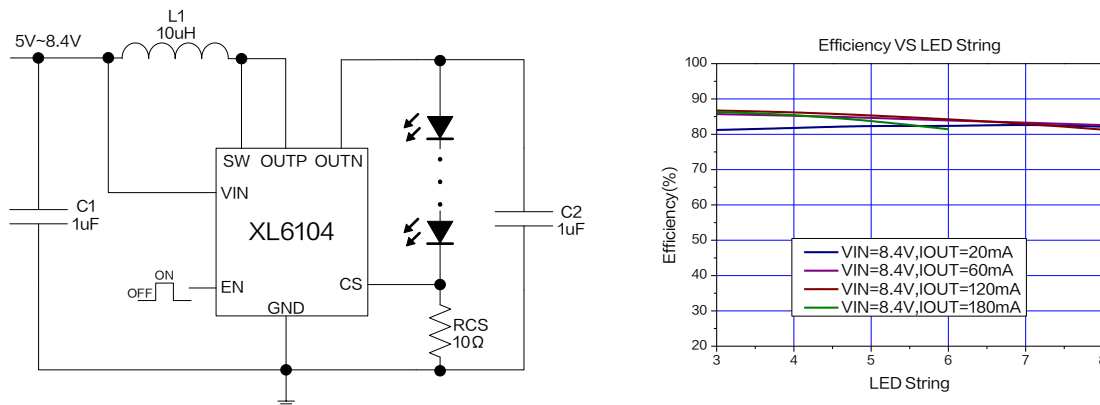


Figure5. XL6104 System Application and efficiency curve

Table 3. Figure5 Typical System Application Schematic Boom

Qty	Ref Des	Description	Mfg Part Number	Mfg
1	L1	10uH,1.1A,Inductor,3*3	YHNR3015-100M	YJYCOIN
2	C1,C2	1uF,50V,Ceramic,X7R,0603	0603B105K500NT	Fenghua
1	RCS	10Ω,1%,1/8W,Thick Film,0805	RS-05K100FT	Fenghua

### Typical System Application– BOOST Topology to Drive LED

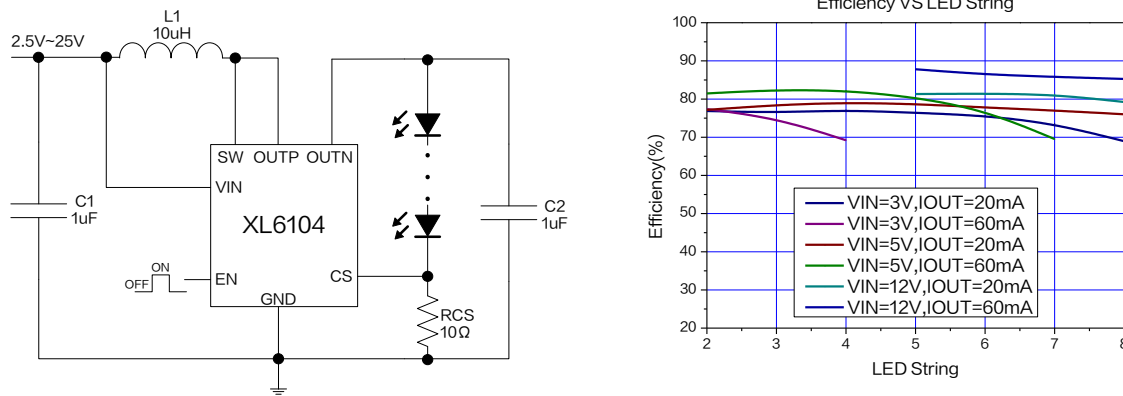


Figure6. XL6104 System Application and efficiency curve

Table 4. Figure6 Typical System Application Schematic Boom

Qty	Ref Des	Description	Mfg Part Number	Mfg
1	L1	10uH,1.1A,Inductor,3*3	YHNR3015-100M	YJYCOIN
2	C1,C2	1uF,50V,Ceramic,X7R,0603	0603B105K500NT	Fenghua
1	RCS	10Ω,1%,1/8W,Thick Film,0805	RS-05K100FT	Fenghua

### Typical System Application– SEPIC Topology to Drive LED

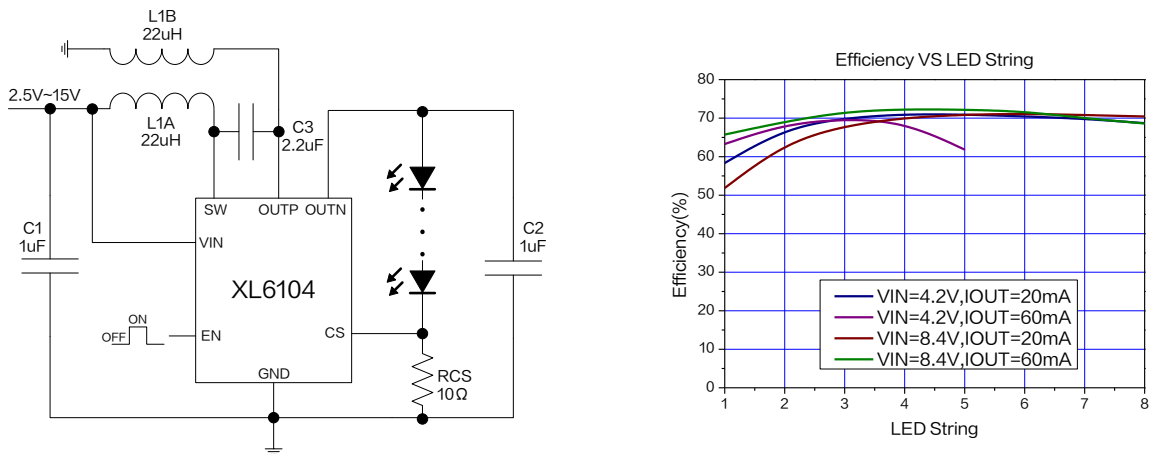


Figure7. XL6104 System Application and efficiency curve

Table 5. Figure7 Typical System Application Schematic Boom

Qty	Ref Des	Description	Mfg Part Number	Mfg
2	L1A,L1B	10uH,1.1A,Inductor,3*3	YHNR3015-100M	YJYCOIN
2	C1,C2	1uF,50V,Ceramic,X7R,0603	0603B105K500NT	Fenghua
1	C3	2.2uF,50V,Ceramic,X7R,0805	0805X225K500NT	Fenghua
1	RCS	10Ω,1%,1/8W,Thick Film,0805	RS-05K100FT	Fenghua

### Typical System Application– PWM dimming circuit

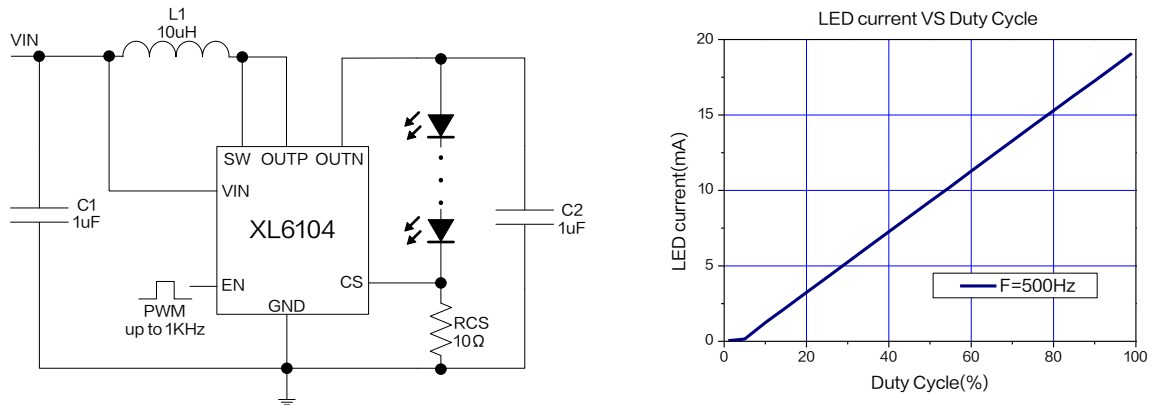


Figure 8. XL6104 Dimming circuit and PWM dimming curve

### Typical Characteristics (LED forward voltage $V_F$ is 3.3V at $I_F=20mA$ , unless otherwise noted.)

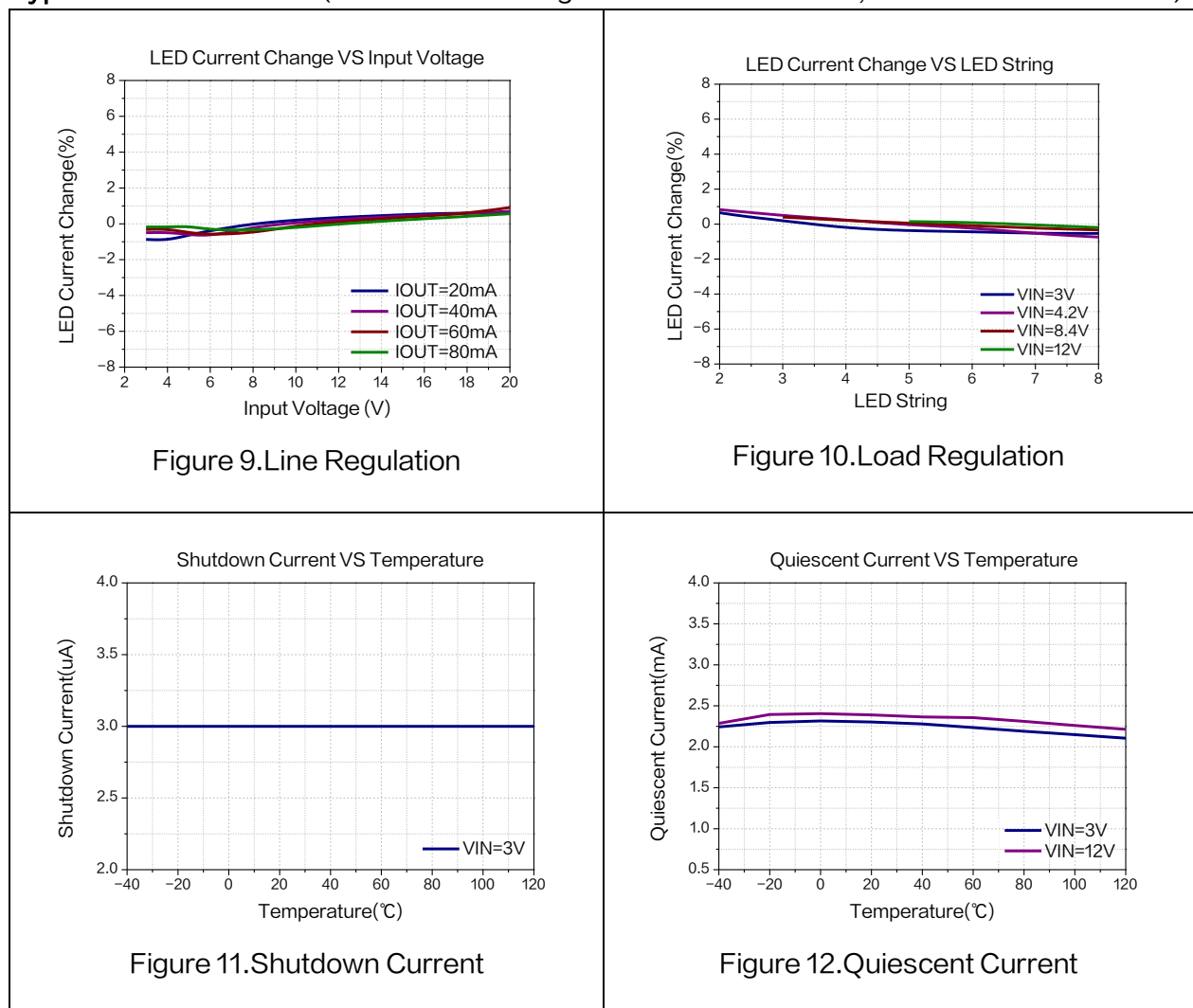


Figure 9. Line Regulation

Figure 10. Load Regulation

Figure 11. Shutdown Current

Figure 12. Quiescent Current

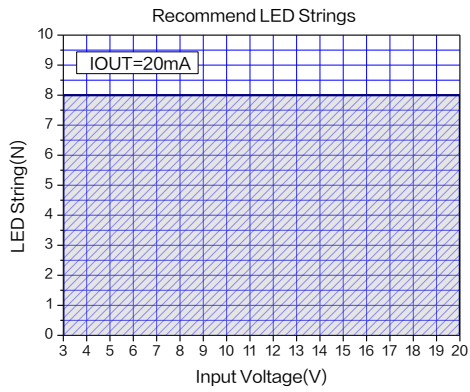


Figure 13.Max LED Strings( $I_{OUT}=20mA$ )

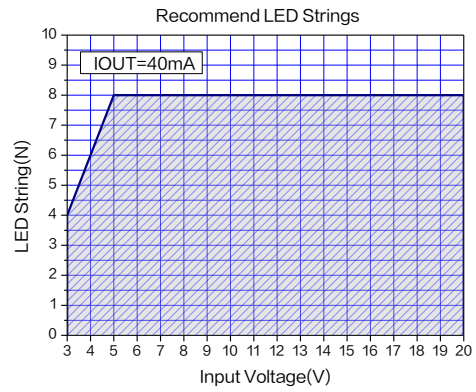


Figure 14.Max LED Strings( $I_{OUT}=40mA$ )

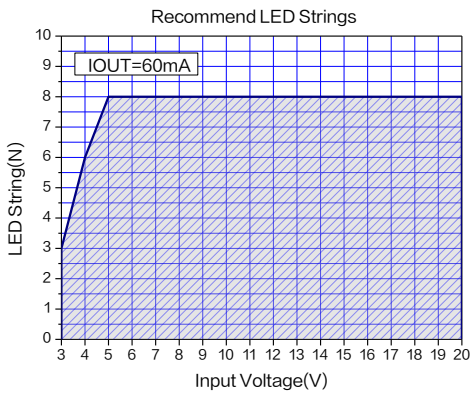


Figure 15.Max LED Strings( $I_{OUT}=60mA$ )

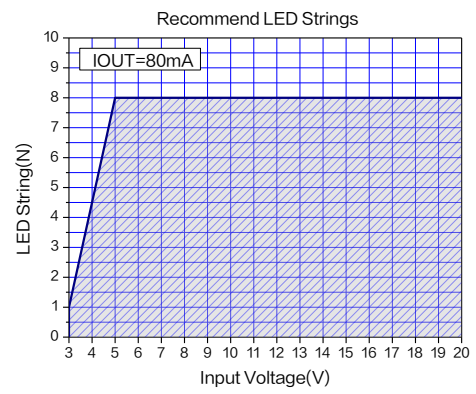


Figure 16.Max LED Strings( $I_{OUT}=80mA$ )

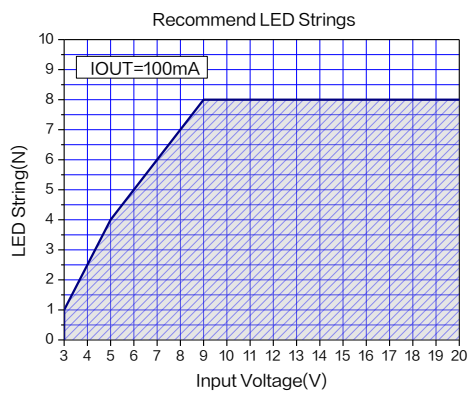


Figure 17.Max LED Strings( $I_{OUT}=100mA$ )

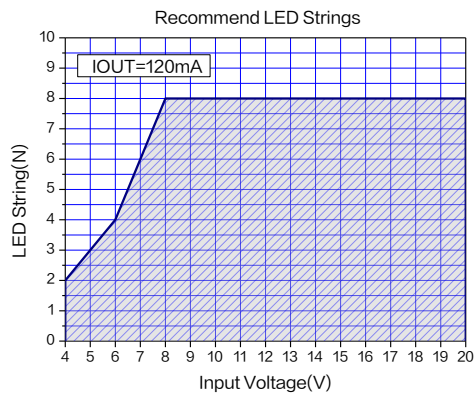
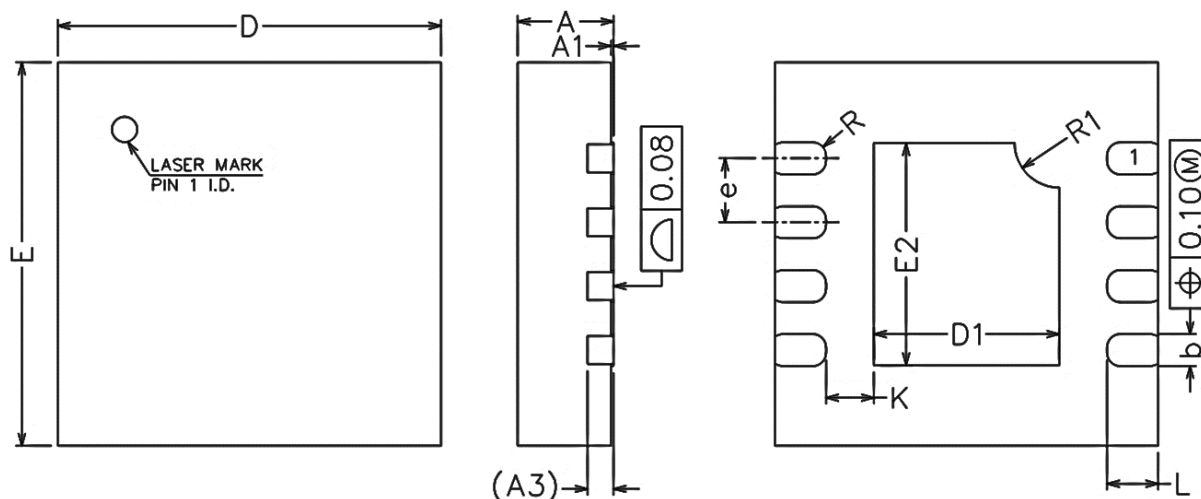


Figure 18.Max LED Strings( $I_{OUT}=120mA$ )



## Package Information

### DFN3X3-8



Symbol	Dimensions In Millimeters			Dimensions In Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.700	0.750	0.800	0.027	0.030	0.032
A1	0.000	0.020	0.050	0.000	0.001	0.002
A3	0.203 REF.			0.008 REF.		
b	0.200	0.250	0.300	0.007	0.010	0.012
D	2.900	3.000	3.100	0.114	0.118	0.122
E	2.900	3.000	3.100	0.114	0.118	0.122
D2	1.350	1.450	1.550	0.053	0.057	0.061
E2	1.640	1.740	1.840	0.064	0.068	0.072
e	0.400	0.500	0.600	0.016	0.020	0.024
K	0.275	0.375	0.475	0.011	0.015	0.019
L	0.300	0.400	0.500	0.012	0.016	0.020
R	0.100 REF.			0.004 REF.		
R1	0.350 REF.			0.014 REF.		

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### Important Notice

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