

3A 220KHz 50V Buck LED Constant Current Driver

XL3001A

Features

- Operation Voltage: 8V~45V
- 0.21V Constant Current Sense Voltage
- Directly drive 1~10 Series 1W LED
- Current Sense Voltage Accuracy $\pm 3\%$
- Fixed 220KHz Switching Frequency
- 3A Constant Output Current Capability
- Internal Optimize Power MOSFET
- High efficiency up to 97%
- Max. Output power up to 12W
- Maximum Duty Cycle 100%
- Excellent line and load regulation
- Built in thermal shutdown function
- Built in current limit protection function
- Temperature Grade 1: -40°C to 125°C
Ambient Operating Temperature Range
- Device HBM ESD Classification Level
Class3A
- Available in SOP8-EP package

General Description

The XL3001A is a 220KHz fixed frequency PWM buck LED constant current driver, capable of driving a 3A load with high efficiency, low ripple and excellent line and load regulation. XL3001A supports wide input operating voltage range of 8V ~ 45V and a maximum duty cycle of 100% output. A built-in loop compensation module reduces components in the system, lowering power system cost and reducing printed circuit board space.

The XL3001A has built-in thermal shutdown, current limit protection and so on.

Applications

- Buck constant current driver
- LED backlight driver
- General purpose LED lighting

Typical application schematic

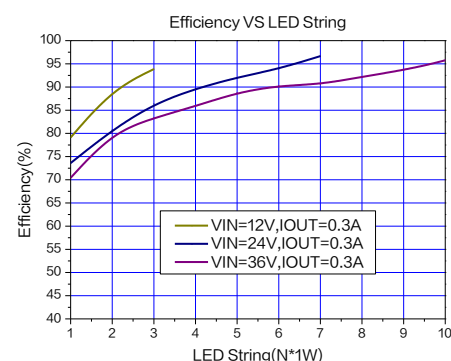
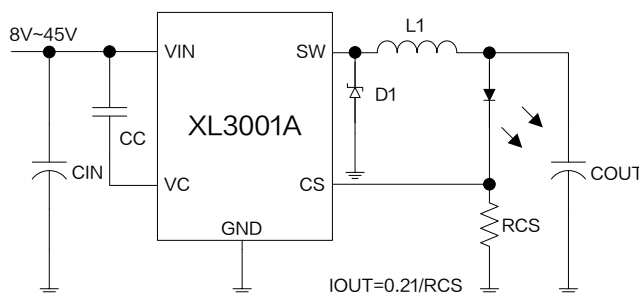


Figure1. XL3001A Typical application schematic and efficiency curve

Pin Configurations

CS	1	8	GND
NC	2	7	GND
XL3001A			
VC	3	6	SW
VIN	4	5	SW

The back exposed PAD is SW

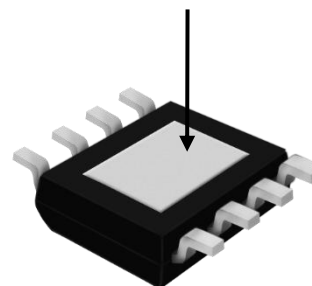


Figure2. Pin Configuration of XL3001A

Table 1 Pin Description

Pin Number	Pin Name	Description
1	CS	Output constant current sense Pin (CS). The CS reference voltage is 0.21V.
2	NC	Not connected.
3	VC	Internal Voltage Regulator Bypass Capacity. In typical system application, The VC pin connect a 1uF capacitor to VIN.
4	VIN	Supply Voltage Input Pin. XL3001A operates from 8V to 45V DC voltage. Bypass Vin to GND with a suitably large capacitor to eliminate noise on the input.
5,6	SW	Power Switch Output Pin (SW). Output is the switch node that supplies power to the output.
7,8	GND	Ground Pin.

Ordering Information

Order Information	Marking ID	Package Type	Eco Plan	Packing Type Supplied As
XL3001A	XL3001A	SOP8-EP	RoHS & HF	4000 Units on Reel

Function Block

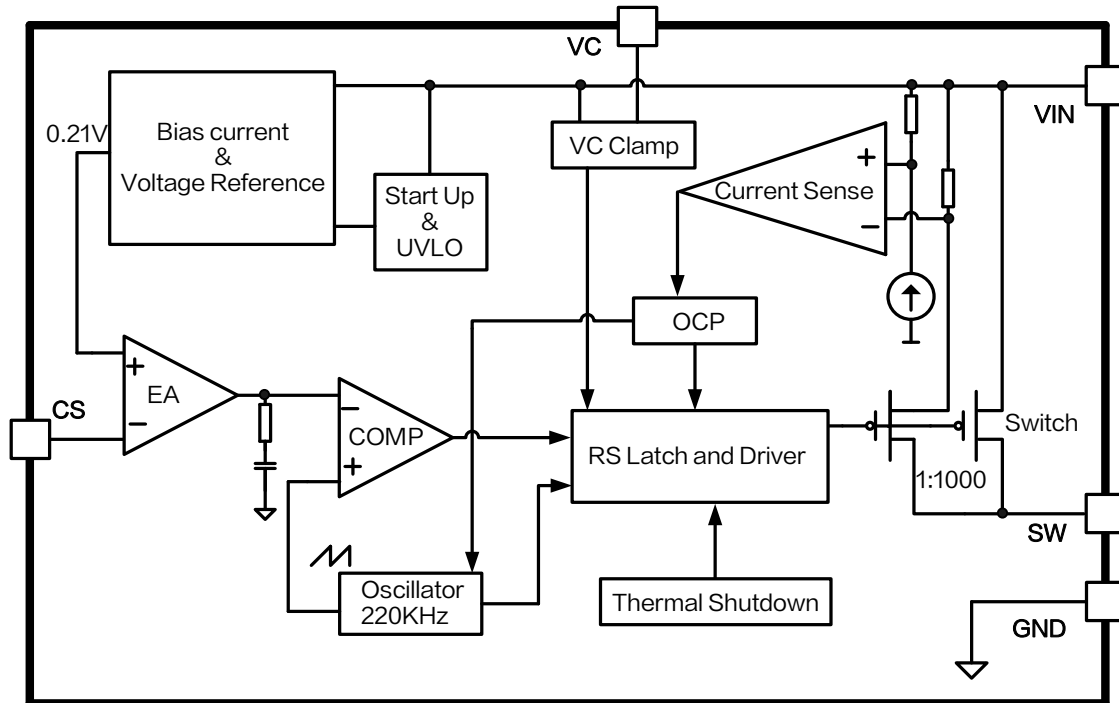


Figure3. Function Block Diagram of XL3001A

Absolute Maximum Ratings (Note1)

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3~50	V
VC Pin Voltage	V_C	-0.3~ V_{IN}	V
Output Switch Pin Voltage	V_{SW}	-0.3~ V_{IN}	V
Current Sense Pin Voltage	V_{CS}	-0.3~7	V
Power Dissipation	P_D	Internally limited	mW
Thermal Resistance (SOP8-EP) (Junction to Ambient, No Heatsink, Free Air)	R_{JA}	60	°C/W
Operating Junction Temperature	T_J	-40~150	°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.

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XL3001A Electrical Characteristics

T_A = 25°C; system parameters test circuit figure4, unless otherwise specified.

Symbol	Parameter	Test Condition	Min.	Typ.	Max.	Unit
V _{CS}	Current Sense Voltage	V _{IN} =12V, V _{OUT} =3.3V I _{OUT} =0.3A	203.7	210.0	216.3	mV
η	Efficiency	V _{IN} =12V, V _{OUT} =9.9V I _{OUT} =0.3A	-	94.0	-	%
η	Efficiency	V _{IN} =24V, V _{OUT} =16.5V I _{OUT} =0.6A	-	94.7	-	%
η	Efficiency	V _{IN} =36V, V _{OUT} =19.8V I _{OUT} =0.6A	-	92.8	-	%

Electrical Characteristics (DC Parameters)

T_A=25°C, V_{IN}=12V, I_{OUT}=0.3A; system parameters test circuit figure4, unless otherwise specified.

Parameters	Symbol	Test Condition	Min.	Typ.	Max.	Unit
Input operation voltage	V _{IN}		8		45	V
VIN UVLO	V _{IN_UVLO}			5		V
Quiescent Supply Current	I _Q	V _{CS} =2V		1.9	5	mA
Oscillator Frequency	F _{OSC}		198	220	242	KHz
Switch Current Limit	I _L	V _{CS} =0V		4		A
MOS On-resistance	R _{DS(ON)}	V _{CS} =0V, I _{SW} =3A		120		mΩ
Thermal Shutdown Temperature	T _{SD}			170		°C
Thermal Shutdown Hysteresis	T _D			20		°C
Max. Duty Cycle	D _{MAX}	V _{CS} =0V		100		%

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Typical System Application Schematic ($I_{OUT}=0.3A$)

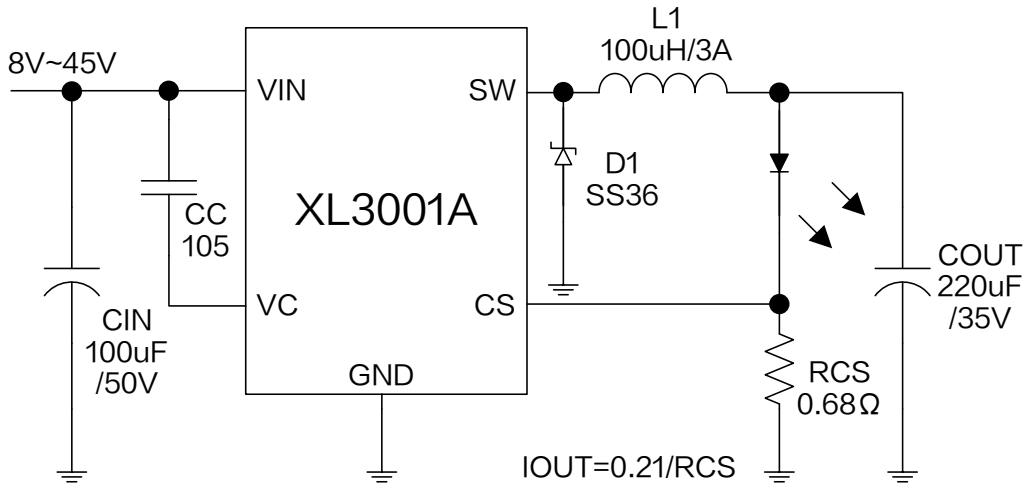


Figure4. XL3001A System Parameters Test Circuit ($V_{IN}=8V\sim 45V, I_{OUT}=0.3A$)

Typical System Application Transfer Efficiency

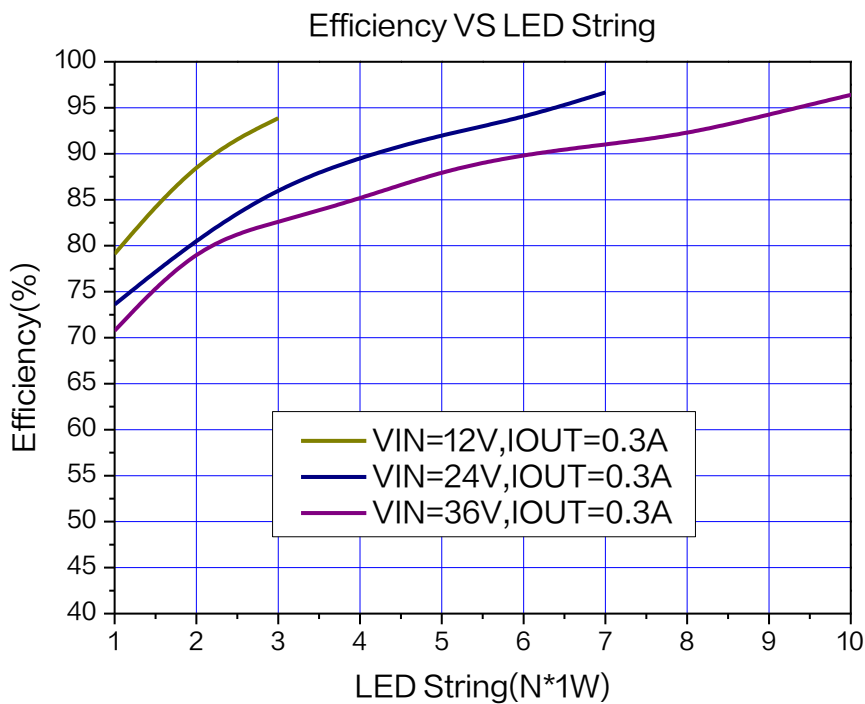


Figure5. XL3001A System Efficiency Curve ($I_{OUT}=0.3A$)

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Typical System Application Schematic ($I_{OUT}=0.6A$)

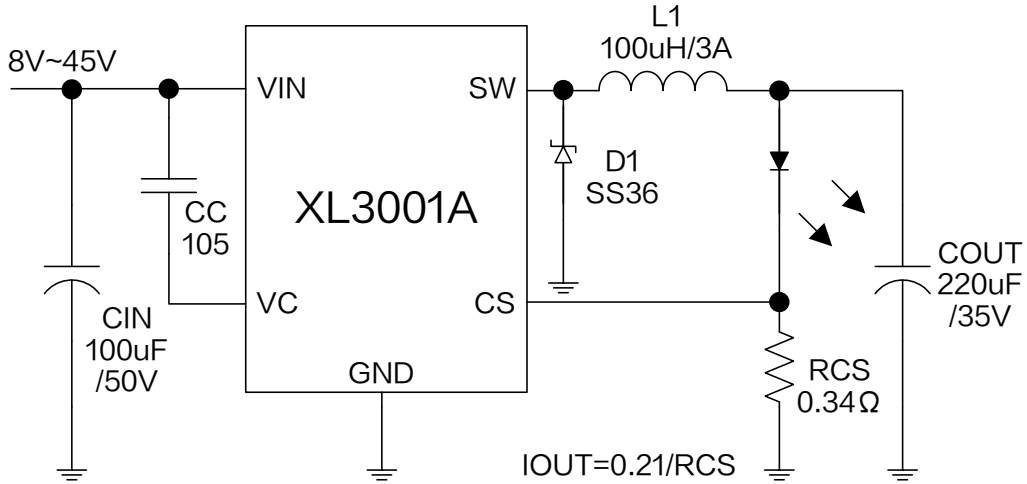


Figure6. XL3001A System Parameters Test Circuit ($V_{IN}=8V\sim 45V, I_{OUT}=0.6A$)

Typical System Application Transfer Efficiency

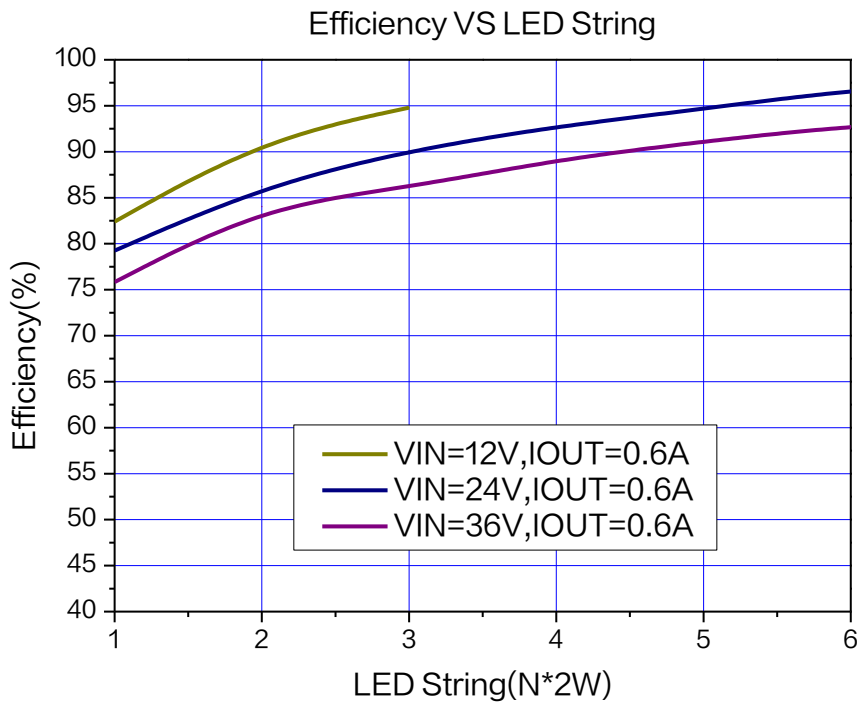


Figure7. XL3001A System Efficiency Curve ($I_{OUT}=0.6A$)

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Typical System Application Schematic ($I_{OUT}=0.9A$)

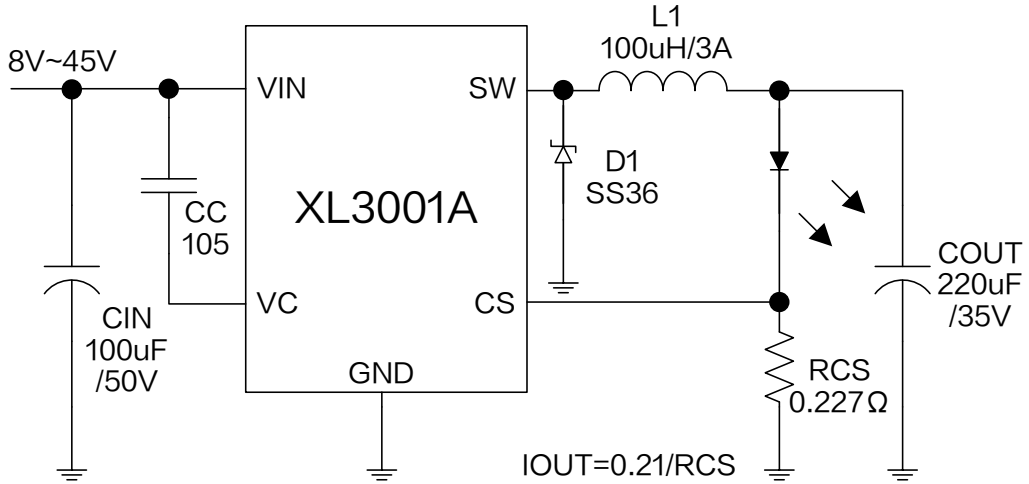


Figure8. XL3001A System Parameters Test Circuit ($V_{IN}=8V\sim 45V, I_{OUT}=0.9A$)

Typical System Application Transfer Efficiency

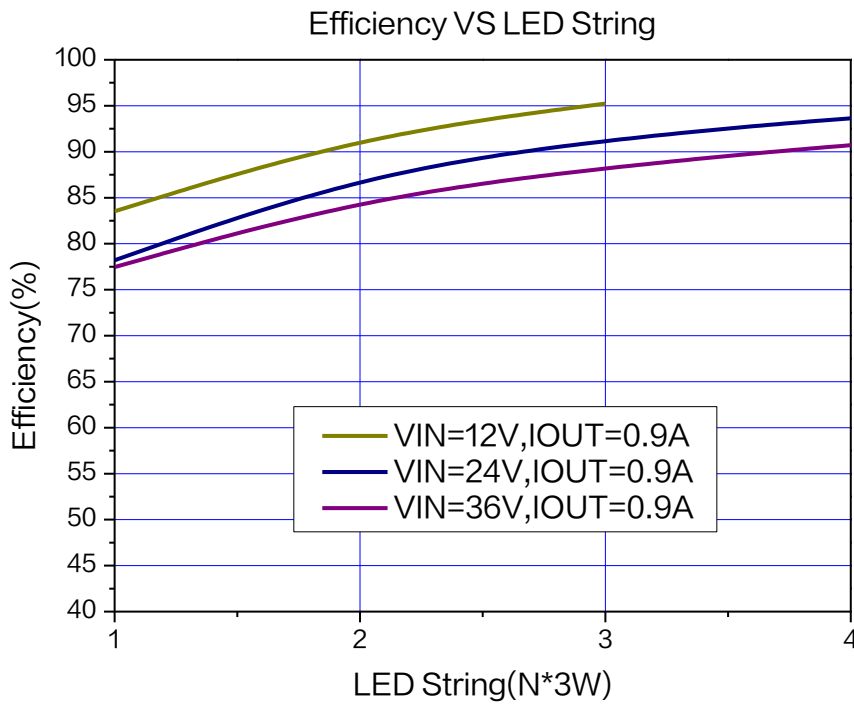


Figure9. XL3001A System Efficiency Curve ($I_{OUT}=0.9A$)

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Typical System Application Schematic ($I_{OUT}=1.2A$)

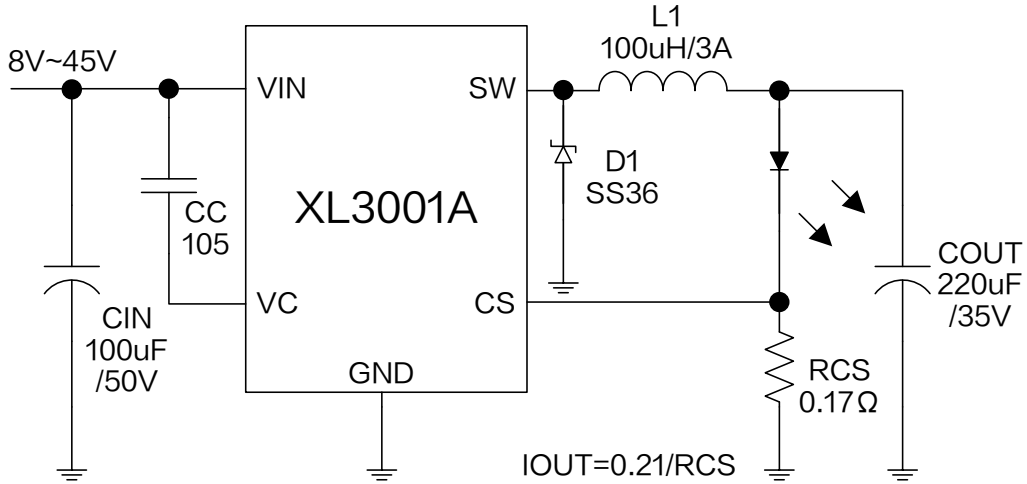


Figure10. XL3001A System Parameters Test Circuit ($V_{IN}=8V\sim 45V, I_{OUT}=1.2A$)

Typical System Application Transfer Efficiency

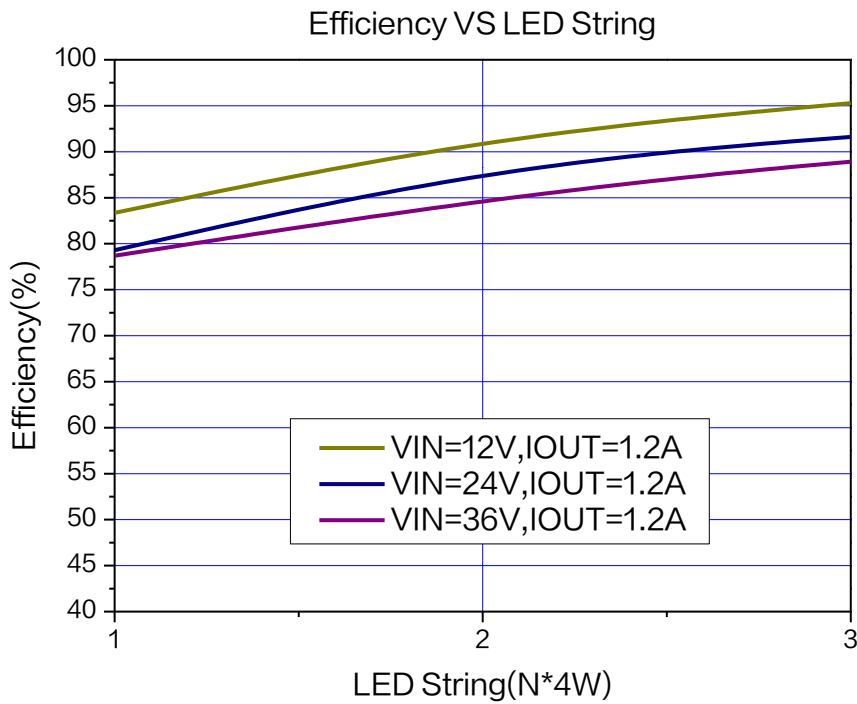


Figure11. XL3001A System Efficiency Curve ($I_{OUT}=1.2A$)

Typical System Application (PWM DIMMING)

PWM dimming function can be used in typical system application with external components. Changing the duty cycle of PWM signal can get different LED current. The PWM signal voltage is 5V.

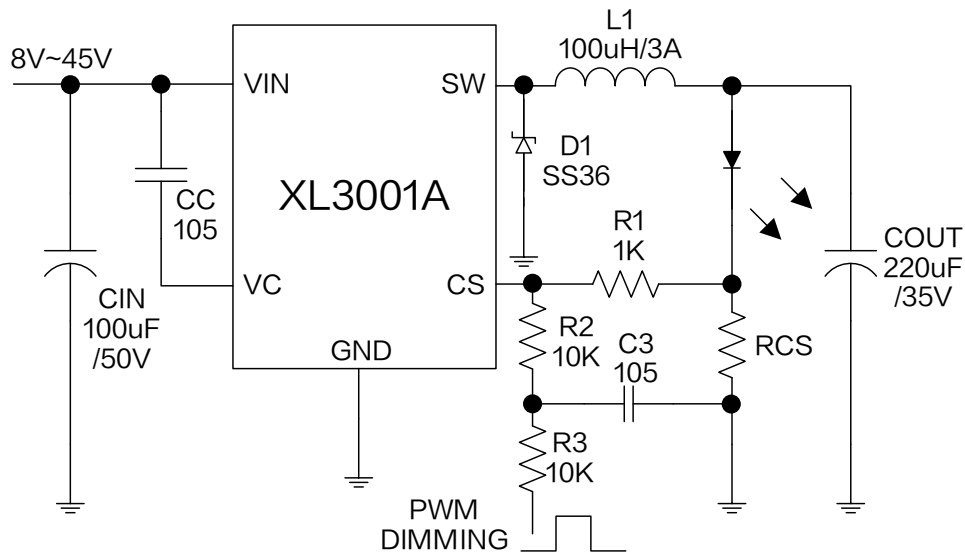


Figure12. XL3001A System Parameters Test Circuit (PWM DIMMING)

Typical System Application (LED Open Protection)

LED Open Protection function can be used in typical system application with external components. The output voltage can be limited in a suitable value by choosing different zener diode when the output LED open. The zener diode voltage chosen by output led voltage's 1.3 times.

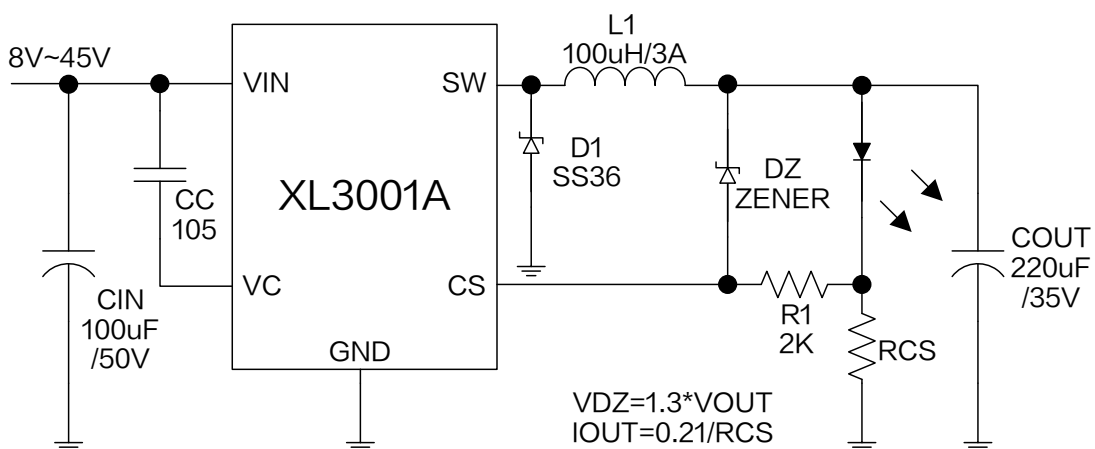


Figure13. XL3001A System Parameters Test Circuit (LED Open Protection)

Typical System Application (EMI Countermeasures)

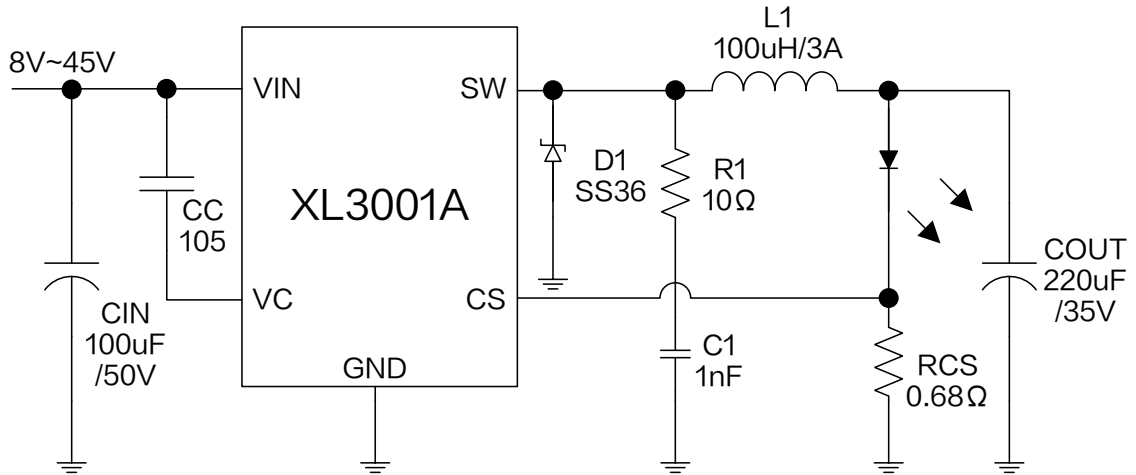


Figure14. XL3001A System Parameters Test Circuit (EMI Countermeasures)

Typical Characteristics (LED forward voltage V_F is 3.3V at $I_F=0.3A$, unless otherwise noted.)

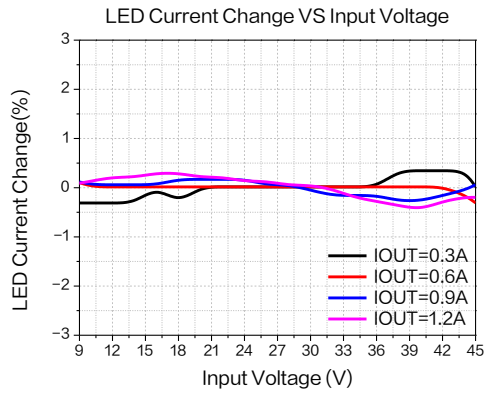


Figure15.Line Regulation

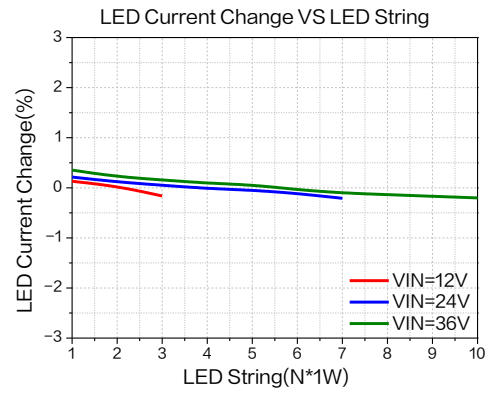


Figure16.Load Regulation

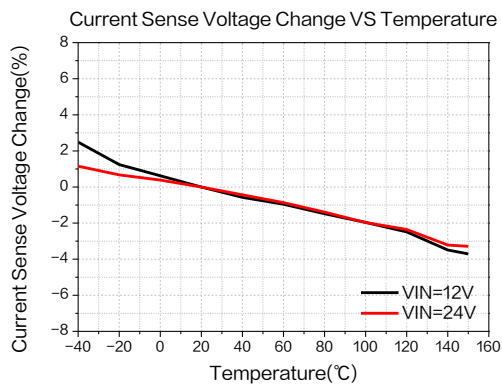


Figure17.Current Sense Voltage Regulation

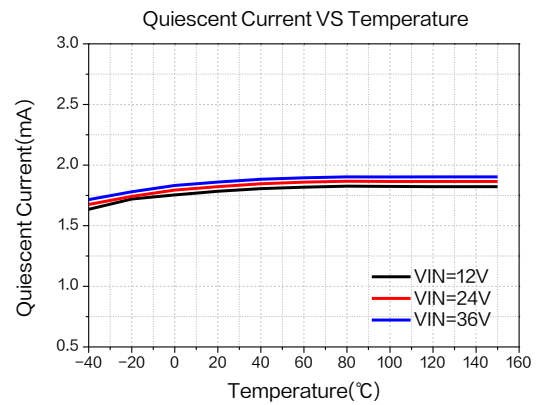


Figure18.Quiescent Current

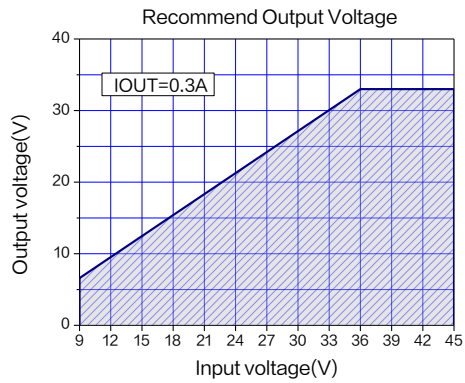


Figure19.Max Output Voltage
(I_{OUT}=0.3A, T_A=25°C)

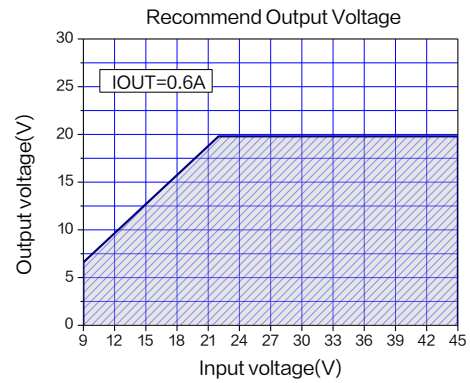


Figure20.Max Output Voltage
(I_{OUT}=0.6A, T_A=25°C)

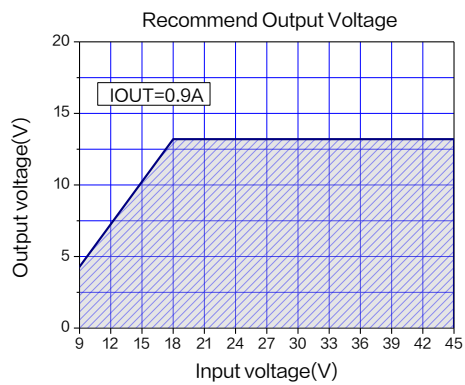


Figure21.Max Output Voltage
(I_{OUT}=0.9A, T_A=25°C)

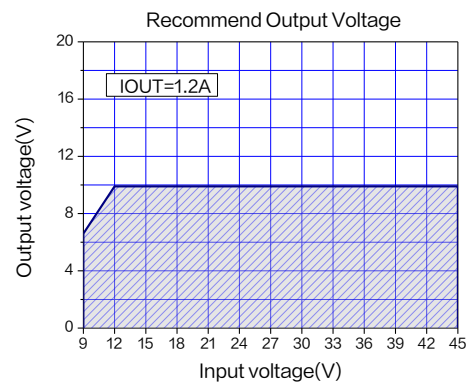


Figure22.Max Output Voltage
(I_{OUT}=1.2A, T_A=25°C)

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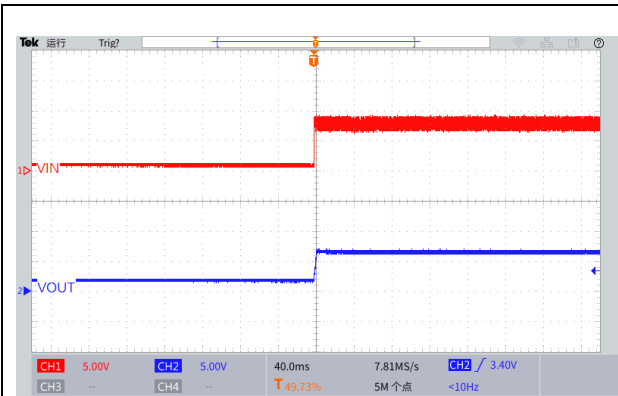


Figure23. Start-Up Characteristic
($V_{IN}=8V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

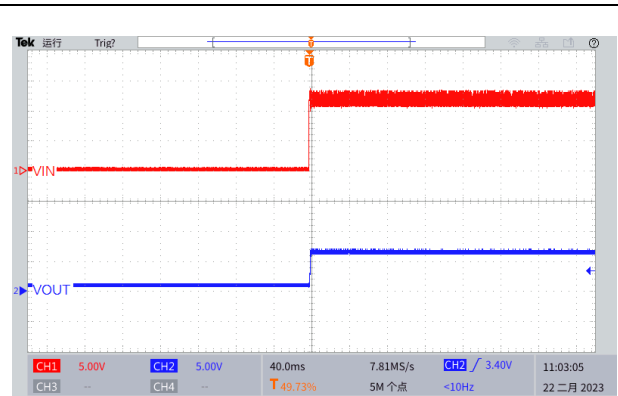


Figure24. Start-Up Characteristic
($V_{IN}=12V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

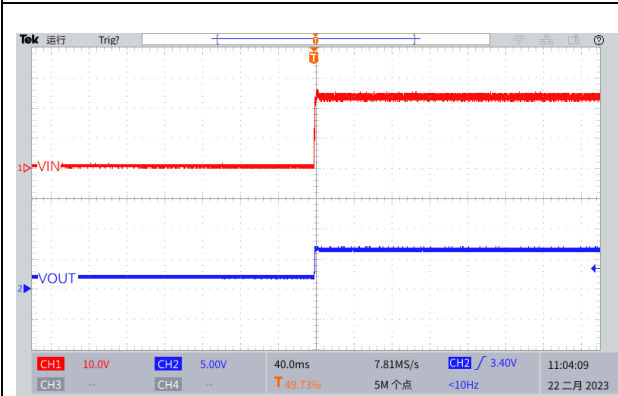


Figure25. Start-Up Characteristic
($V_{IN}=24V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)



Figure26. Start-Up Characteristic
($V_{IN}=36V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

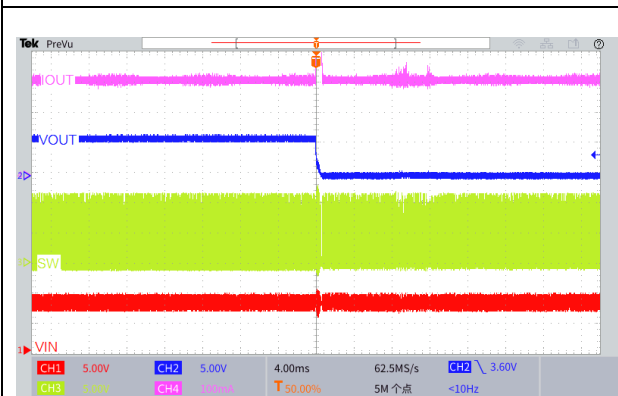


Figure27. LED Short Protection
($V_{IN}=8V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

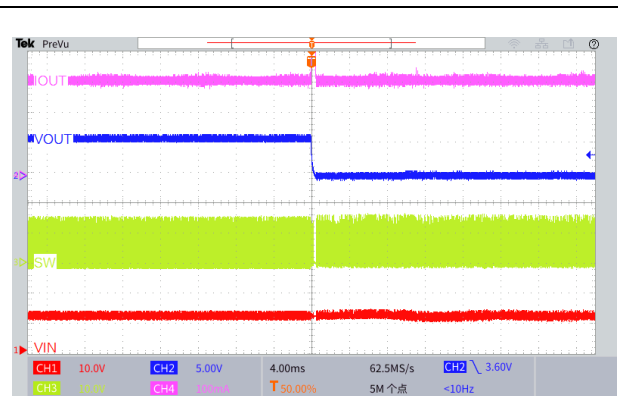


Figure28. LED Short Protection
($V_{IN}=12V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

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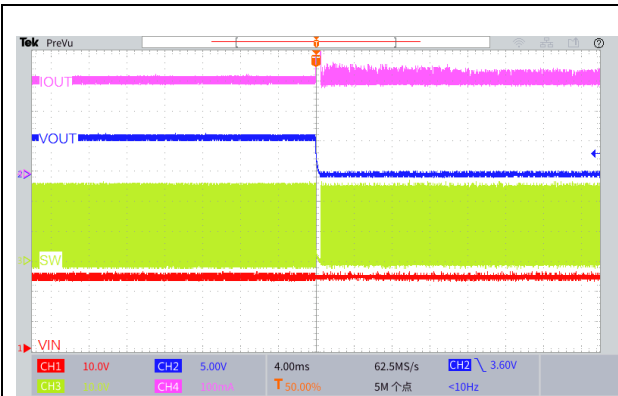


Figure29. LED Short Protection
($V_{IN}=24V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

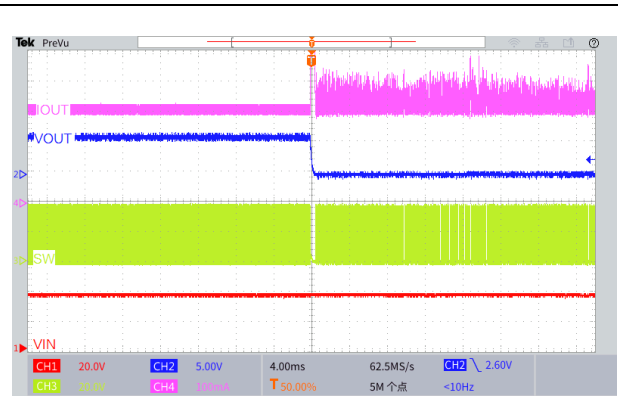


Figure30. LED Short Protection
($V_{IN}=36V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

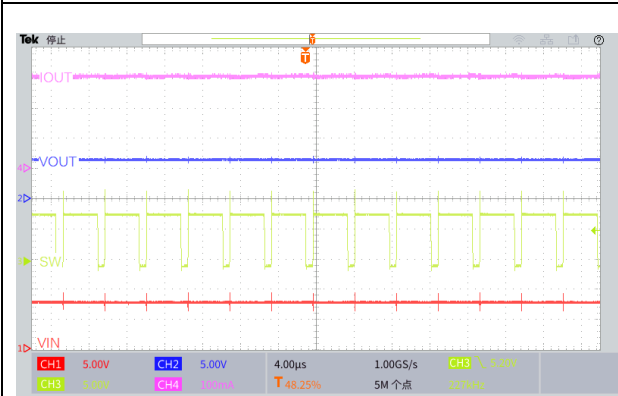


Figure31. LED Current Ripple
($V_{IN}=8V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

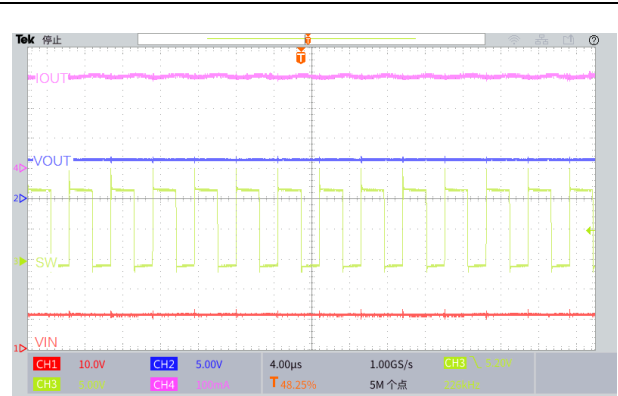


Figure32. LED Current Ripple
($V_{IN}=12V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

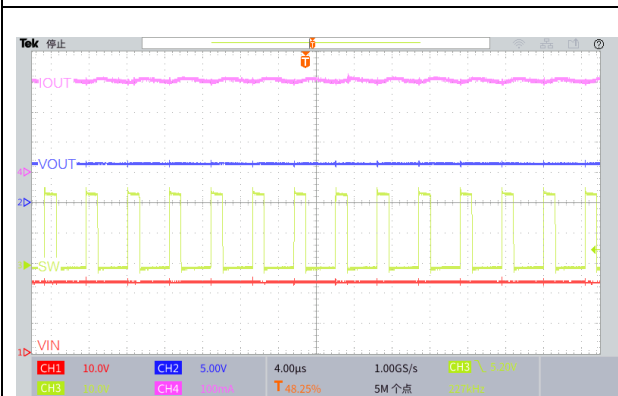


Figure33. LED Current Ripple
($V_{IN}=24V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

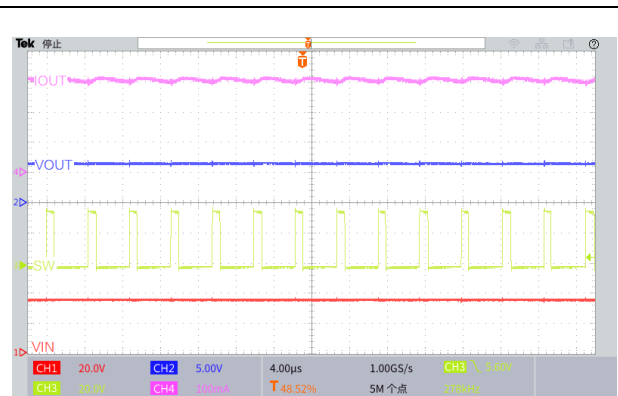
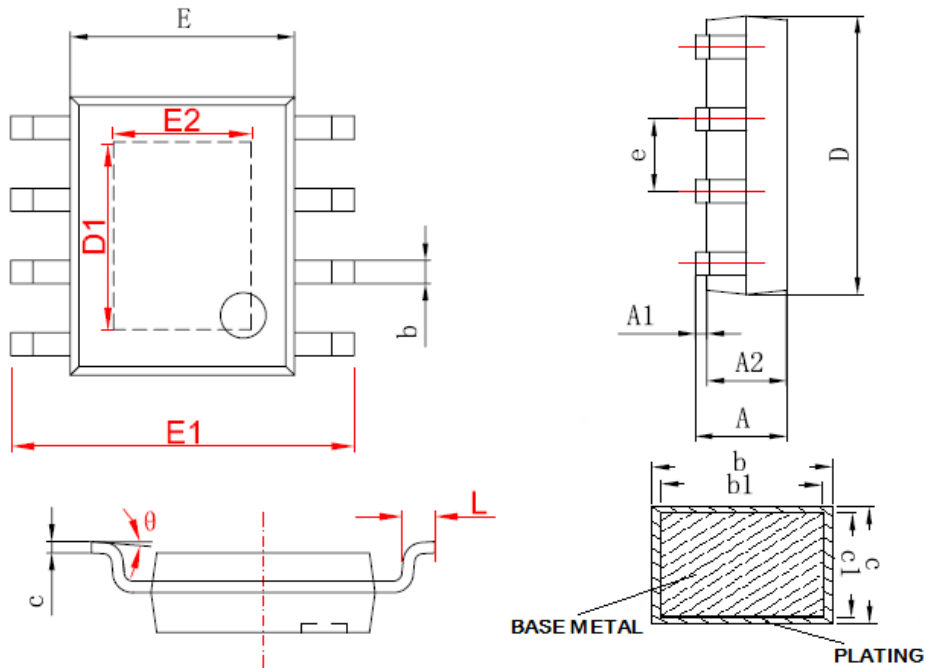


Figure34. LED Current Ripple
($V_{IN}=36V$, $V_{OUT}=6.6V$, $I_{OUT}=0.3A$)

Package Information

SOP8-EP



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.350	1.750	0.053	0.069
A1	0.000	0.150	0.000	0.006
A2	1.250	1.650	0.049	0.065
b	0.306	0.510	0.012	0.020
b1	0.296	0.480	0.011	0.019
c	0.170	0.250	0.006	0.010
c1	0.170	0.230	0.006	0.009
D	4.700	5.100	0.185	0.200
D1	2.650	3.467	0.104	0.136
E	3.800	4.000	0.150	0.157
E1	5.800	6.200	0.228	0.244
E2	1.930	2.534	0.076	0.100
e	1.140	1.400	0.045	0.055
L	0.450	0.800	0.017	0.031
θ	0°	8°	0°	8°

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