CC1109

Low Drop-Out Linear LED Driver IC, with Reverse Connection Protection

FEATURES

- V_{CC} pin with the function of reverse connection protection, the reverse current does not exceed 10 uA. Effectively reduce the required external components.
- Wide operating voltage range, V_{CC}：2.5V~24V
- Strong driving ability, output continuous current up to 200mA
- The feedback voltage is as low as 150 mV
- The current has the function of temperature regulation: when the ambient temperature is too high, the output current decreases automatically
- The quiescent current is low, only 500 uA (V_{CC}=12V), which helps to improve the luminous efficiency of lamps.
- Minimum overdrive output voltage (V_{DRV}-V_{FB}): 0.2V@I_{OUT} = 200 mA
- Current mismatch between chips<±4%@ I_{OUT}=200mA
- ESD (HBM) 1.5kV

APPLCATIONS

- LED Laser Module
- Constant-Current LED Module
- Constant-Current LED Light Strip
- LED Fluorescent Tubes
- LED Backlight Source

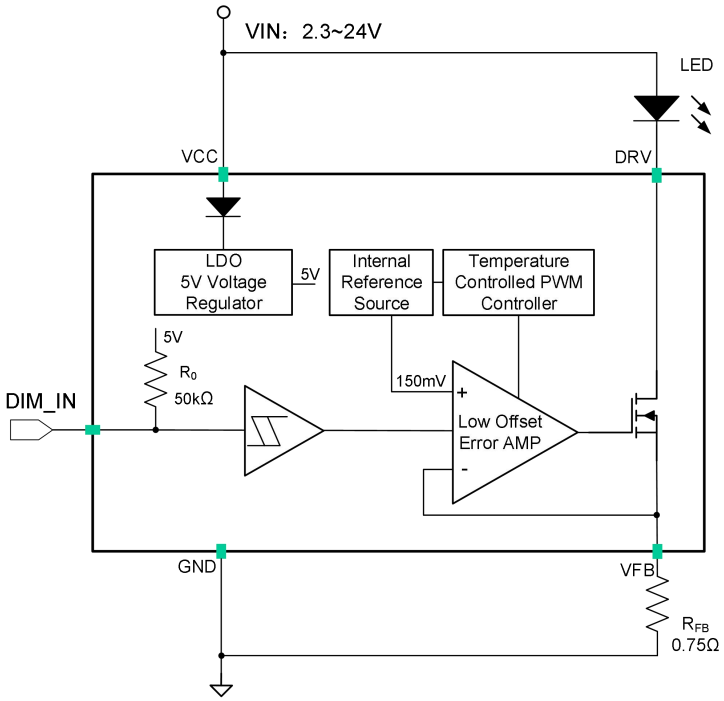
GENERAL DESCRIPTION

CC1109 is a high-precision linear LED driver chip, which provides a single channel constant output current, with a current output range from 5mA to 200 mA. The current value can be set by external resistance (R_{FB}). The operating voltage range is 2.5V~24V. The low current setting voltage of 150mV and the low saturation voltage drop driving stage of 200mV enable CC1109 to provide stable current output in a wide driving voltage range. CC1109 requires few external components and has high application reliability. The chip contains high precision bandgap reference source, 5V voltage-regulator circuit, over-temperature protection circuit, low drop-out drive circuit, and low offset and high precision amplifier.

CC1109 has built-in intelligent over-temperature protection function. The temperature sensor inside the chip can detect the temperature state of the CC1109. When the internal temperature of the CC1109 chip exceeds 110°C, the over-temperature protection circuit will start, and the temperature control PWM circuit will adjust the output duty cycle of the drive. The duty cycle of this signal decreases with the increase of temperature. When the junction temperature of the chip exceeds 150°C, the duty cycle decreases to 0 and the output is completely turn off.

CC1109 adopts SOT89-5 small package. It's operating ambient temperature range is -40~85°C. Comply with RoHS requirements.

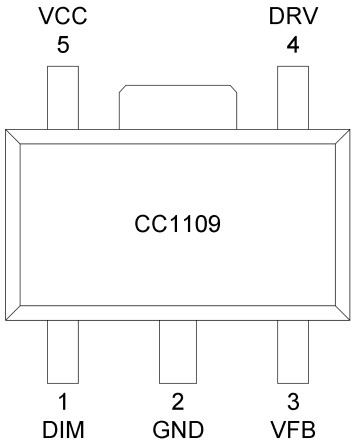
FUNCTION BLOCK DIAGRAM



ORDERING INFORMATION

Part No.	Package	Packing Form
CC1109	SOT89-5	tape reel, 3000 pcs/reel

PINOUT DIAGRAM



SOT89-5 package

Name	Number	Description
DIM	1	PWM dimming control
GND	2	Ground
VFB	3	Output current setting terminal
DRV	4	Output sink current
VCC	5	IC power supply

ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	-30~28	V
DIM Pin Voltage	V_{DIM}	-0.3~5.5	V
VFB Pin Voltage	V_{FB}	-0.3~5.5	V
DRV Pin Voltage	V_{DRV}	-0.3~32	V
Continuous Output Current	I_{OUTC}	200	mA
Thermal Resistance (SOT89-5)	$R_{\theta JA}$	100	°C/W
Operating Ambient Temperature Range	T_A	-40~150	°C
Operating Junction Temperature	T_J	150	°C
Storage Temperature	T_S	-55~150	°C
Electrostatic Protection (ESD)	HBM	1.5	kV

Note: Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

RECOMMENDED WORKING ENVIRONMENT

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{DD}	2.5	24	V
Continuous Current	I_{CONT}	-	200	mA
Ambient Temperature	T_A	-40	85	°C

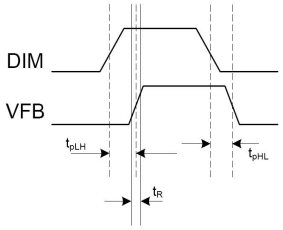
ELECTRICAL PARAMETERS (V_{CC}=12V, T_A=25°C, unless otherwise specified)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{CC}		2.5	-	24	V
Quiescent Current	I_{CC}	DIM pin hangs in the air, V_{CC}=5V, R_{FB}=5Ω, V_{DRV}=2V	-	500	600	uA
DIM Logic Level	V_{DIMH}		2.5	-	-	V
	V_{DIML}		-	-	0.4	V
Output Current	I_{OUTH}	R_{FB}=0.75Ω, DIMDIM pin hangs in the air, V_{DRV}=1V	192	200	208	mA
	I_{OUTL}	R_{FB}=0.75Ω, DIM pin hangs in the air, V_{DRV}=1V	-	-	0.1	uA
Output Saturation Voltage Drop	V_{SAT}	T_A=-40~85°C, I_{DRV}=200mA	-	-	175	mV
Voltage Feedback	V_{FB}	V_{DRV}=2V, R_{FB}=5Ω	144	150	156	mV
Linearity Regulation Rate of Output Current	%/dV_{CC}	R_{FB}=5Ω, V_{DRV}=2V, V_{CC}=2.5~24V	-	0.1	0.3	%
Load Regulation Rate of Output Current	%/dV_{DRV}	R_{FB}=5Ω, DIM pin hangs in the air, V_{DRV}=0.4~5V	-	0.1	0.3	%
VCC Reverses Leakage Current	I_{REV}	V_{CC}=-30V@T_A=-40~85°C	-	-	10	uA
Leakage Current of DRV	I_{OUTL}	V_{CC}=2.5~24V@T_A=-40~85°C	-	-	1	uA
Trigger Temperature(1) of Over-temperature Protection	T_{OTP}		-	110	-	°C
Shutdown Temperature(1) of Over-temperature Protection	T_{OTP_SD}		-	150	-	°C

Note: (1)Guaranteed by design, not mass production test values.

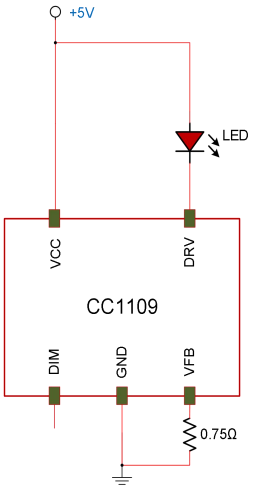
SWITCHING CHARACTERISTICS (V_{CC}=5V @ 25°C unless otherwise specified)

Parameter		Symbol	Conditions	Min.	Typ.	Max.	Unit
Propagation Delay Time （low level to high level）	DIM-VFB	t_{pLH}	V_{CC}=5V; V_{DRV}=2V; R_{FB}=5Ω	-	1.2	-	us
Propagation Delay Time （high level to low level）	DIM-VFB	t_{pHL}		-	1.0	-	us
Current rising time at the current output		t_R		-	1.2	-	us
Current falling time at the current output		t_F		-	1.0	-	us

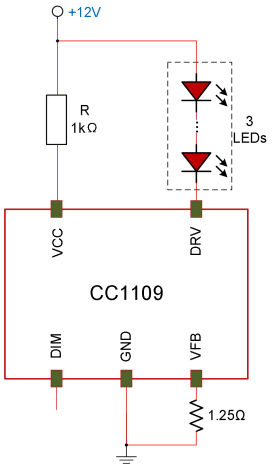


Switching Characteristics

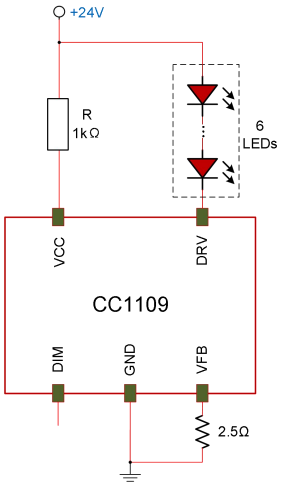
TYPICAL APPLICATION CIRCUITS



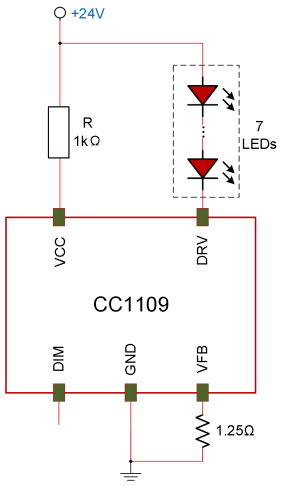
Typical 5V 200mA Application Circuits



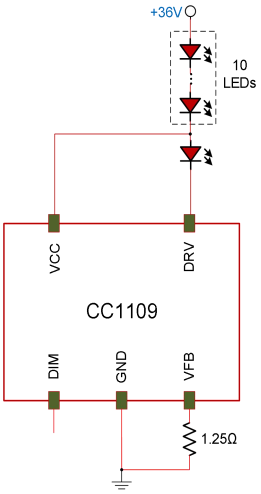
Typical 12V 120mA Application Circuits



Typical 24V 60mA Application Circuits



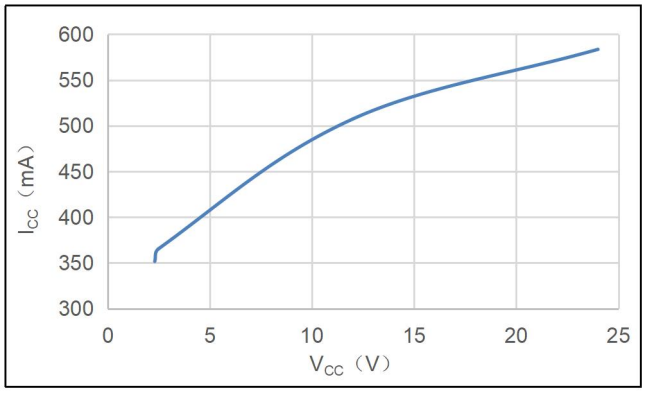
Typical 24V 120mA Application Circuits



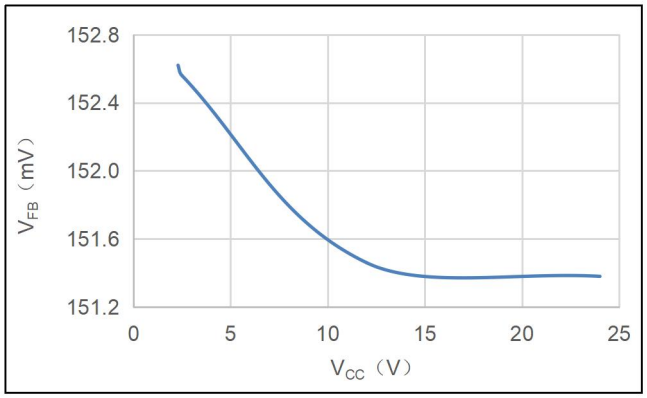
Typical 36V 120mA Application Circuits

Note：In applications where VCC ≥ 12V and VCC pins are directly connected to external supplies, a resistor R (1kΩ) is connected in series to suppress hot-swap voltages。

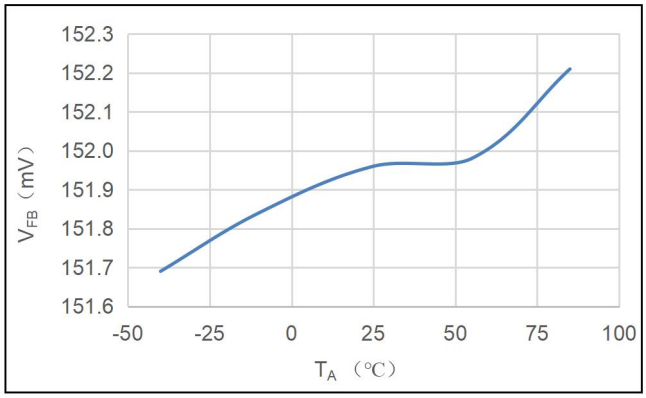
CURVE & WAVEFORM (T_A= 25°C, unless otherwise specified)



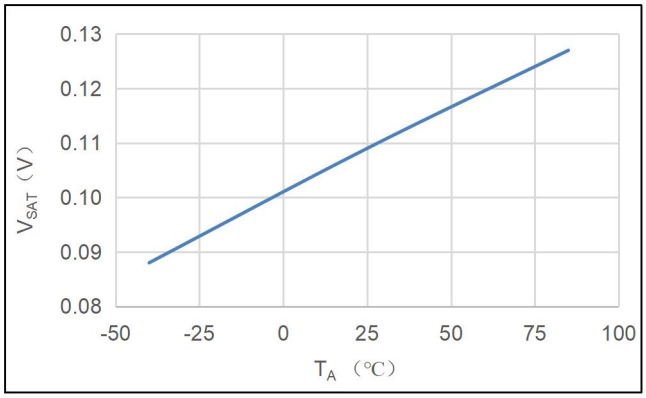
I_{CC} vs. V_{CC}



V_{FB} vs. V_{CC}

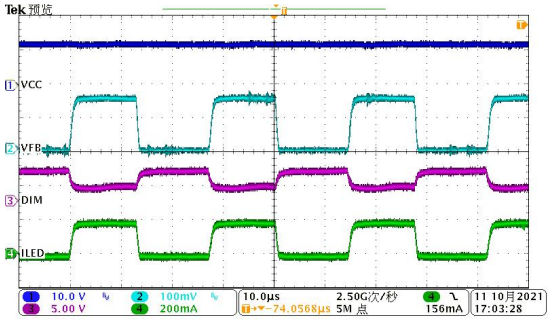


V_{FB} vs. T_A (V_{CC}=12V)

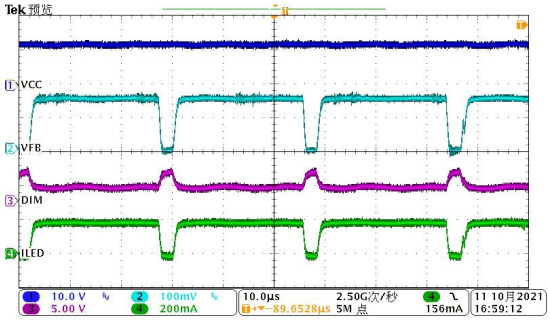


V_{SAT} vs. T_A (V_{CC}=12V)

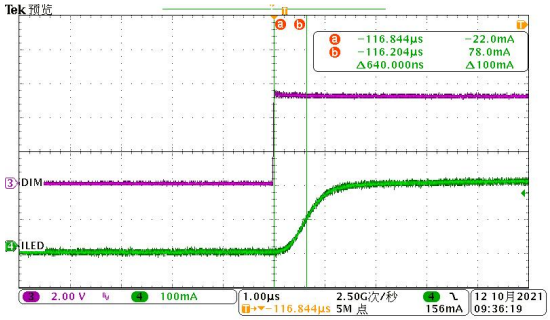
CURVE & WAVEFORM



High Temperature Protection V_{FB}=70mV Chopper

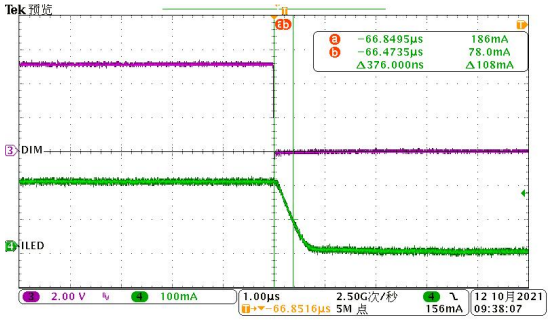


High Temperature Protection V_{FB}=135mV Chopper



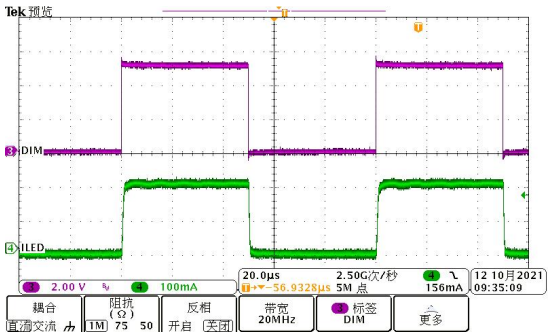
Output Current Rising Edge Waveform t_R

(at room temperature, DIM is 50% duty cycle)



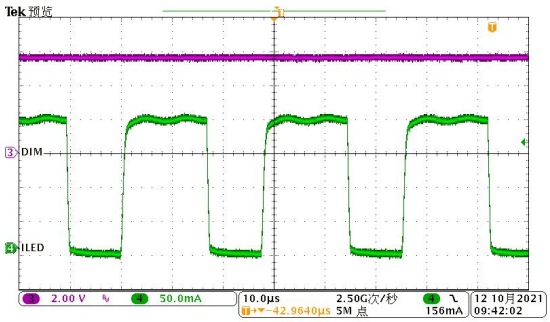
Output Current Falling Edge Waveform t_F

(at room temperature, DIM is 50% duty cycle)



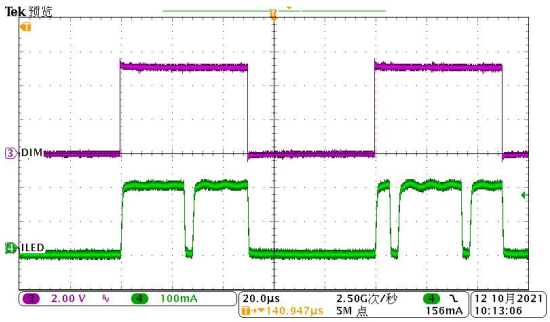
DIM & ILED Waveform

(at room temperature, DIM is 50% duty cycle



DIM & ILED Waveform

(at high temperature, DIM is 100% duty cycle)



DIM & ILED Waveform

(at high temperature, DIM is 50% duty cycle)

APPLICATION

PRODUCT DESCRIPTION

CC1109 is a multi-function linear LED driver IC, its maximum driving current can reach 200 mA, and the driving pin only needs to maintain 0.5V voltage.

DIM has an internal pull-up resistor, when the DIM pin is suspended, the chip outputs the maximum current.

LED DRIVER CURRENT SETTING

The output current value of the CC1109 is set by an external resistor that should be connected between the ground terminal (GND) and the current setting terminal (VFB) with a feedback voltage of 0.15V. The output current can be set by adjusting the value of the external resistor up to 200mA. The output current value can be estimated using the following equation：

$$I_{LED}=V_{FB}/R_{FB}$$

V_{FB} is the CC1109 constant current reference set voltage, typically 150mV; R_{FB} is the current setting resistance between V_{FB} pin and GND pin. When the LED drive current is 60 mA, the R_{FB} should select a resistance of 2.5Ω with 1% accuracy.

Under certain conditions, the efficiency of CC1109 is relatively low, so the maximum power consumption cannot exceed 400mW in normal operation.

Due to the limitation of power consumption, the drive current of CC1109 is inversely proportional to the voltage of the DRV pin: when the chip works normally, the higher the voltage of DRV, the lower the output current of CC1109.

RECOMMENDING APPLY CONDITIONS

Apply Conditions	Drive Current I_{LEDMAX} (mA)
5V, 1 white LED	200mA
12V, 3 white LEDs connected in series	120mA
24V, 6 white LEDs connected in series	60mA
24V, 7 white LEDs connected in series	120mA
36V, 11 white LEDs	120mA

OVER-TEMPERATURE PROTECTION

CC1109 built-in no-flicker over-temperature protection circuit:

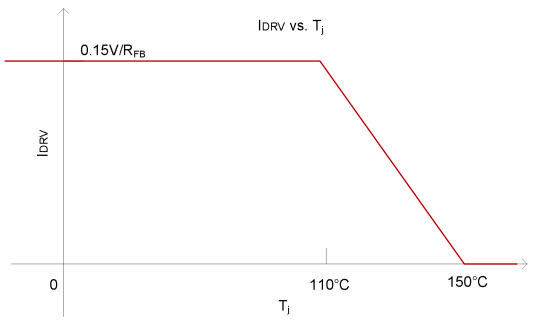
A. When T_J = 110°C, the built-in temperature control PWM circuit will start to work, produce a PWM signal of 30 kHz ~ 40 kHz and the duty cycle decreases with the temperature increase, which controls the duty cycle of the output current.

B. When T_J < 110°C, the duty cycle is 100%.

C. when 110°C < T_J < 150°C, the output station control output current decreases as the junction temperature increases.

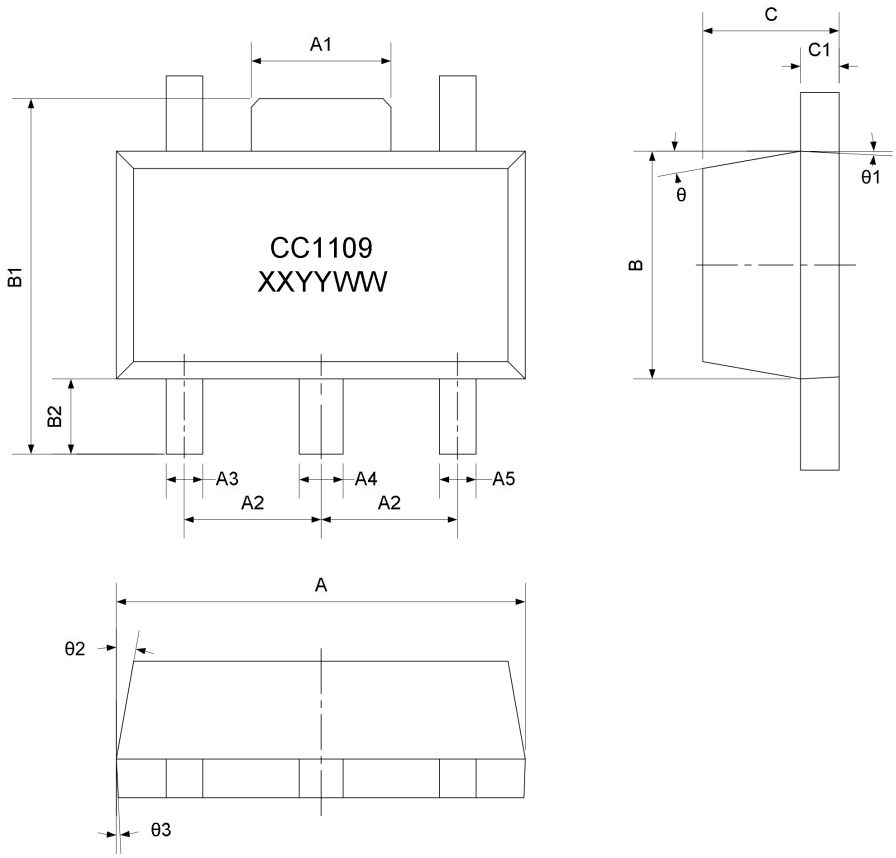
D. When T_J > 150°C, the output duty cycle will be reduced to zero, and the output current will be completely shutdown, thus ensuring the safety of the driving IC.

Because the the frequency is up to 30 kHz ~ 40 kHz, the flashing of LED lights is completely invisible under the over-temperature protection.



PACKAGING INFORMATION

SOT89-5 package



Symbol	Millimeters	
	Min.	Max.
A	4.40	4.60
A1	1.55REF	
A2	1.50BSC	
A3	0.35	0.45
A4	0.43	0.53
A5	0.35	0.45
B	2.40	2.60
B1	4.00	4.40
B2	0.80	1.20
C	140	1.60
C1	0.37	0.47
θ	6°	
θ1	3°	
θ2	6°	
θ3	3°	

Note:

1. All dimensions units are millimeters.

Marking:

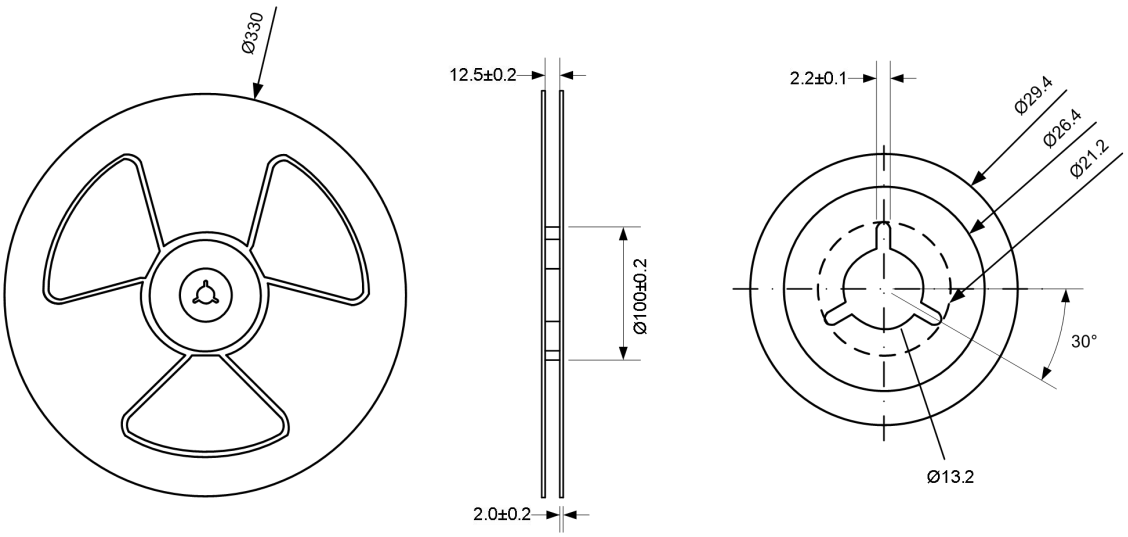
1st ： CC1109 – Product name

2nd ： XXYYWW - Batch No.

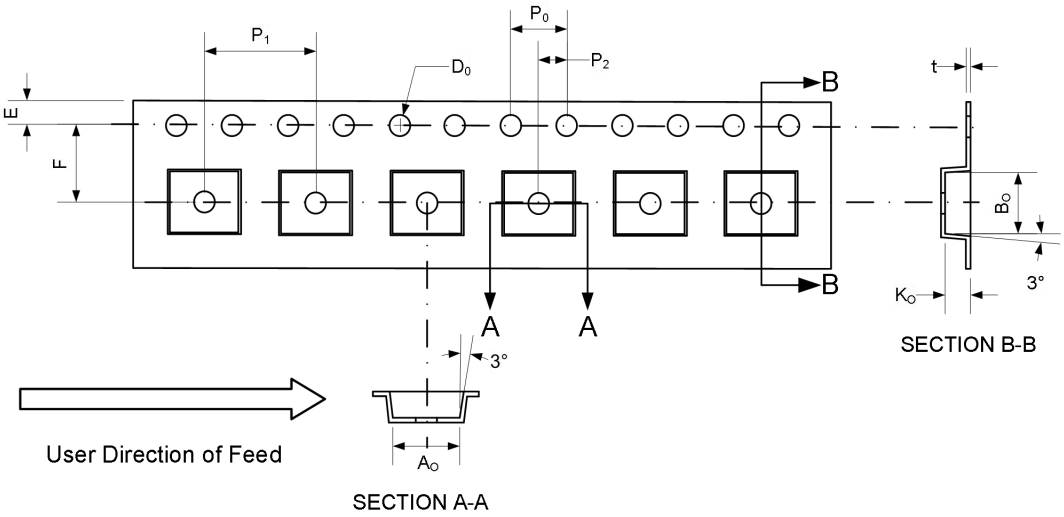
- XX - code
- YY - Last two digits of the year of packaging
- WW - Number of weeks at the time of packaging

Packaging Information

Reel dimensions



Carrier tape dimensions



Symbol	W	A_O	B_O	K_O	E	F	D1	D_0	P_0	P_1	P_2	t
Min.	11.90	4.60	4.70	1.75	1.65	5.40	-	-	3.90	7.90	1.90	0.20
Typ.	12.00	4.70	4.80	1.85	1.75	5.50	1.50	1.50	4.00	8.00	2.00	0.25
Max.	12.10	4.80	4.90	1.95	1.85	5.60	1.60	1.60	4.10	8.10	2.10	0.30

CrossChip

CrossChip Microsystems Inc. was founded in 2013, is a national high-tech enterprise, engaged in integrated circuit design and sales. The company has strong technical strength, has more than 60 kinds of patents, mainly used in Hall sensor signal processing, with the following product lines:

- ✓ High precision linear Hall sensor
- ✓ All kinds of Hall switches
- ✓ Single phase motor drive
- ✓ Single chip current sensor
- ✓ AMR Magnetoresistance sensor
- ✓ Isolation drive class chip

Contact us

Chengdu

Address: 4th floor, unit 2, building 3, No. 88, Tianchen Road, Gaoxinxi Zone, Chengdu, Sichuan Province

Tel: + 86 - 028 - 87787685

Email: support@crosschipmicro.com

Website: https://www.crosschipmicro.com

Shenzhen

Address: 605 room, 6F, Beike building, NO.18 Keyuan Rd, Yuehai Street, Nanshan District, Shenzhen

Shanghai

Address: Room 602, Building 1, Shengda Tiandi Yuanchuanggu, No. 88, Shengrong Road, Pudong New District, Shanghai

Suzhou

Address: NO.78 Jinshan Rd East, Suzhou High-tech Zone,Huqiu District, Suzhou City, Jiangsu Province