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120 V, 50 mA ± 15%, 3 W Package

The linear constant current regulator (CCR) is a simple, economical and robust device designed to provide a cost−effective solution for regulating current in LEDs (similar to Constant Current Diode, CCD). The CCR is based on Self−Biased Transistor (SBT) technology and regulates current over a wide voltage range. It is designed with a negative temperature coefficient to protect LEDs from thermal runaway at extreme voltages and currents.

The CCR turns on immediately and is at 20% of regulation with only 0.5 V Vak. It requires no external components allowing it to be designed as a high or low−side regulator.

The 120 V anode−cathode voltage rating is designed to withstand the high peak voltage incurred in A/C offline applications. The high anode−cathode voltage rating withstands surges common in Automotive, Industrial and Commercial Signage applications.

Features

- Robust Power Package: 2.3 W
- Wide Operating Voltage Range
- Immediate Turn-On
- Voltage Surge Suppressing − Protecting LEDs
- UL94−V0 Certified
- SBT (Self−Biased Transistor) Technology
- Negative Temperature Coefficient
- Also available in 30 mA (NSIC2030JBT1G) and 20 mA (NSIC2020JBT1G)
- NSV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC−Q101 Qualified and PPAP Capable
- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

Typical Applications and Reference/Design Documents

- Automobile: Chevron Side Mirror Markers, Cluster, Displays & Instruments Backlighting, CHMSL, Map Light
- AC Lighting Panels, Display Signage, Decorative Lighting, Channel Lettering
- Application Note AND8349/D – Automotive CHMSL
- Application Notes AND8391/D, AND9008/D − Power Dissipation Considerations
- Application Note AND8433/D – A/C Application
- Application Note AND8492/D – A/C Capacitive Drop Design
- Application Note AND9098/D − Protecting a CCR from ISO 7637−2 Pulse 2A and Reverse Pulses
- Design Note DN05013 – A/C Design
- Design Note DN06065 – A/C Design with PFC

http://onsemi.com

SMB
CASE 403A

MARKING DIAGRAM

ORDERING INFORMATION

Device	Package	Shipping†
NSIC2050JBT3G	SMB (Pb−Free)	2500 / Tape & Reel

April, 2014 − Rev. 1
Publication Order Number:
NSIC2050JB/D

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

Rating	Symbol	Value	Unit
Anode−Cathode Voltage	Vak Max	120	V
Reverse Voltage	V_R	500	mV
Operating Junction and Storage Temperature Range	T_J, T_{stg}	−55 to +175	°C
ESD Rating: Human Body Model Machine Model	ESD	Class 3A (4000 V) Class C (400 V)	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

ELECTRICAL CHARACTERISTICS (T_A = 25°C unless otherwise noted)

Characteristic	Symbol	Min

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Total Device Dissipation (Note 1) T_A = 25°C Derate above 25°C	P_D	1210 8.0	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 1)	$R_{\theta JA}$	124	°C/W
Thermal Reference, Junction−to−Tab (Note 1)	$R_{\psi JL}$	17.5	°C/W
Total Device Dissipation (Note 2) T_A = 25°C Derate above 25°C	P_D	1282 8.5	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 2)	$R_{\theta JA}$	117	°C/W
Thermal Reference, Junction−to−Tab (Note 2)	$R_{\psi JL}$	18.2	°C/W
Total Device Dissipation (Note 3) T_A = 25°C Derate above 25°C	P_D	1667 11.1	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 3)	$R_{\theta JA}$	90	°C/W
Thermal Reference, Junction−to−Tab (Note 3)	$R_{\psi JL}$	16.4	°C/W
Total Device Dissipation (Note 4) T_A = 25°C Derate above 25°C	P_D	1765 11.8	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 4)	$R_{\theta JA}$	85	°C/W
Thermal Reference, Junction−to−Tab (Note 4)	$R_{\psi JL}$	16.7	°C/W
Total Device Dissipation (Note 5) T_A = 25°C Derate above 25°C	P_D	1948 13	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 5)	$R_{\theta JA}$	77	°C/W
Thermal Reference, Junction−to−Tab (Note 5)	$R_{\psi JL}$	15.5	°C/W
Total Device Dissipation (Note 6) T_A = 25°C Derate above 25°C	P_D	2055 12.7	mW mW/°C
Thermal Resistance, Junction−to−Ambient (Note 6)	$R_{\theta JA}$	73	

TYPICAL PERFORMANCE CURVES

(Minimum FR−4 @ 100 mm^2, 1 oz. Copper Trace, Still Air)

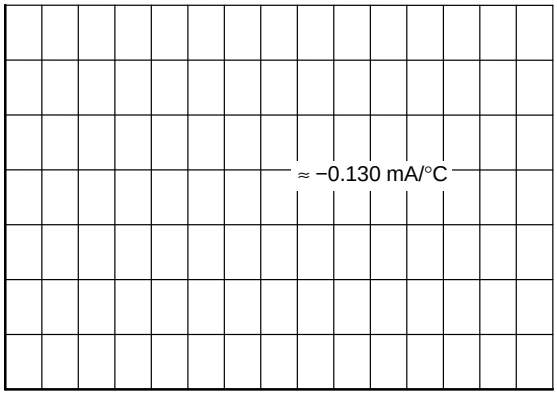
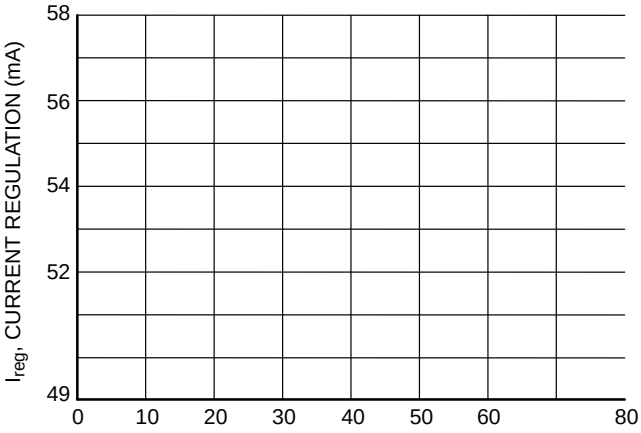


Figure 2. Steady State Current ($I_{reg(SS)}$) vs. Anode−Cathode Voltage (Vak)

Vak, ANODE−CATHODE VOLTAGE (V)

Figure 3. Pulse Current ($I_{reg(P)}$) vs. Anode−Cathode Voltage (Vak)



$I_{reg(P)}$, PULSE CURRENT (mA)

Figure 4. Steady State Current vs. Pulse Current Testing

Figure 5. Current Regulation vs. Time

T_A, AMBIENT TEMPERATURE (

Figure 6. Power Dissipation vs. Ambient Temperature @ T_J = 175°C: Small Footprint

APPLICATIONS INFORMATION

The CCR is a self biased transistor designed to regulate the current through itself and any devices in series with it. The device has a slight negative temperature coefficient, as shown in Figure 2 – Tri Temp. (i.e. if the temperature increases the current will decrease). This negative temperature coefficient will protect the LEDS by reducing the current as temperature rises.

The CCR turns on immediately and is typically at 20% of regulation with only 0.5 V across it.

The device is capable of handling voltage for short durations of up to 120 V so long as the die temperature does not exceed 175°C. The determination will depend on the thermal pad it is mounted on, the ambient temperature, the pulse duration, pulse shape and repetition.

AC Applications

The CCR is a DC device; however, it can be used with full wave rectified AC as shown in application notes AND8433/D and AND8492/D and design notes DN05013/D and DN06065/D. Figure 8 shows the basic circuit configuration.

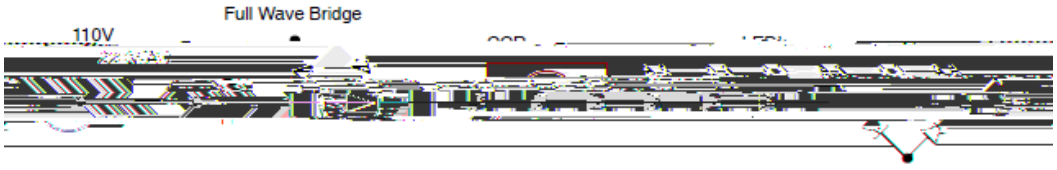


Figure 8. Basic AC Application

Single LED String

The CCR can be placed in series with LEDs as a High Side or a Low Side Driver. The number of the LEDs can vary from one to an unlimited number. The designer needs to calculate the maximum voltage across the CCR by taking the maximum input voltage less the voltage across the LED string (Figures 9 and 10).

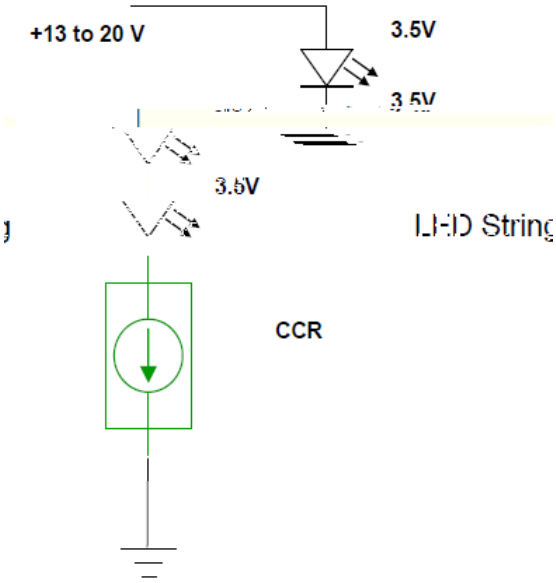
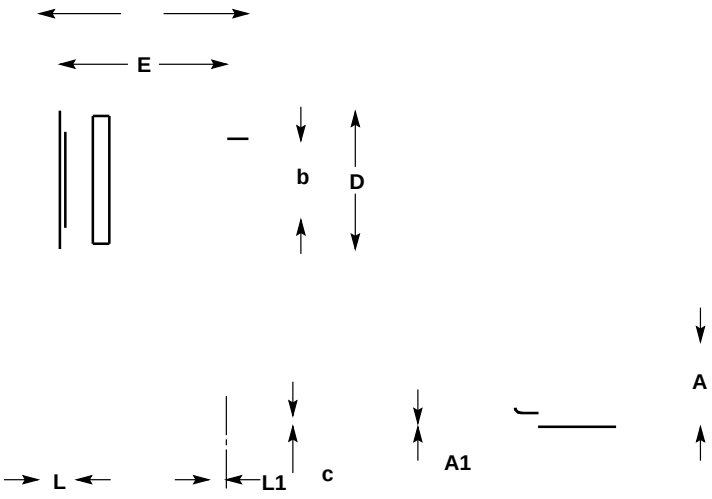


Figure 9.

Figure 10.

Higher Current LED Strings

Two or more fixed current CCRs can be connected in parallel. The current through them is additive (Figure 11).



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION b SHALL BE MEASURED WITHIN DIMENSION L1.

AYWW
XXXXX▪
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XXXXX = Specific Device Code
A = Assembly Location
Y = Year
WW = Work Week
▪ = Pb−Free Package