NSIC2020JBT3G

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C a G R a & LED D A/C - A a

120 V, 20 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 45% 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.

SMB
CASE 403A

MARKING DIAGRAM

Features

- Robust Power Package: 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 50 mA (NSIC2050JBT3G) and 30 mA (NSIC2030JBT3G)
- 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

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(, 992 0 10 , 454 ,) .0454 1.2642 0 171.9496 2030 3)●

0 3(●) 0 9 59.754 8391/ , 9 / 402 9.754 , / 9.7543

ORDERING INFORMATION

Device	Package	Shipping†
NSIC2020JBT3G	SMB (Pb−Free)	2500 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to

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

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

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

APPLICATIONS INFORMATION

The CCR is a self biased transistor designed to regulate the current through itself and any devices in series with it. The

Higher Current LED Strings

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

Figure 11.

Other Currents

The adjustable CCR can be placed in parallel with any other CCR to obtain a desired current. The adjustable CCR provides the ability to adjust the current as LED efficiency increases to obtain the same light output (Figure 12).

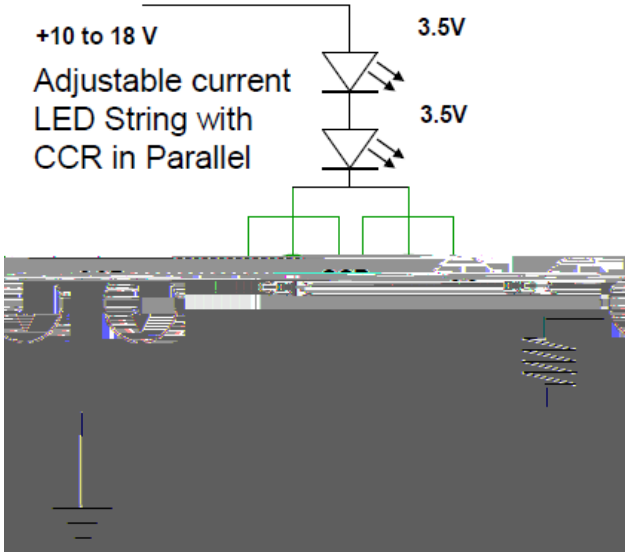


Figure 12.

Dimming using PWM

The dimming of an LED string can be easily achieved by placing a BJT in series with the CCR (Figure 13).

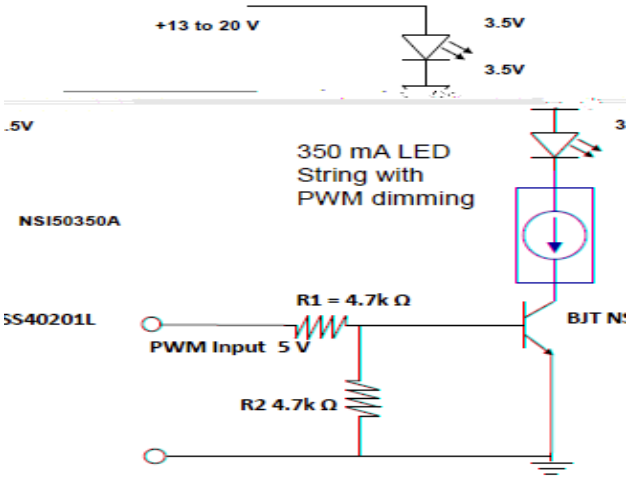


Figure 13.

The method of pulsing the current through the LEDs is known as Pulse Width Modulation (PWM) and has become the preferred method of changing the light level. LEDs being a silicon device, turn on and off rapidly in response to the current through them being turned on and off. The switching time is in the order of 100 nanoseconds, this equates to a maximum frequency of 10 Mhz, and applications will typically operate from a 100 Hz to 100 kHz. Below 100 Hz the human eye will detect a flicker from the light emitted from the LEDs. Between 500 Hz and 20 kHz the circuit may generate audible sound. Dimming is achieved by turning the LEDs on and off for a portion of a single cycle. This on/off cycle is called the Duty cycle (D) and is expressed by the amount of time the LEDs are on (Ton) divided by the total time of an on/off cycle (Ts) (Figure 14).

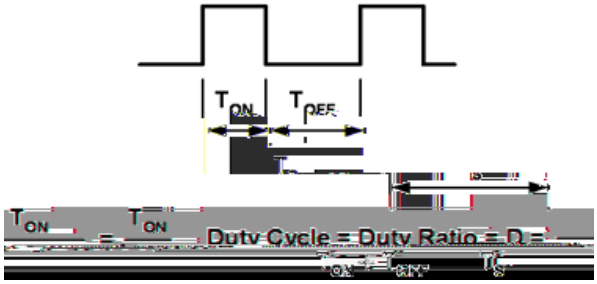
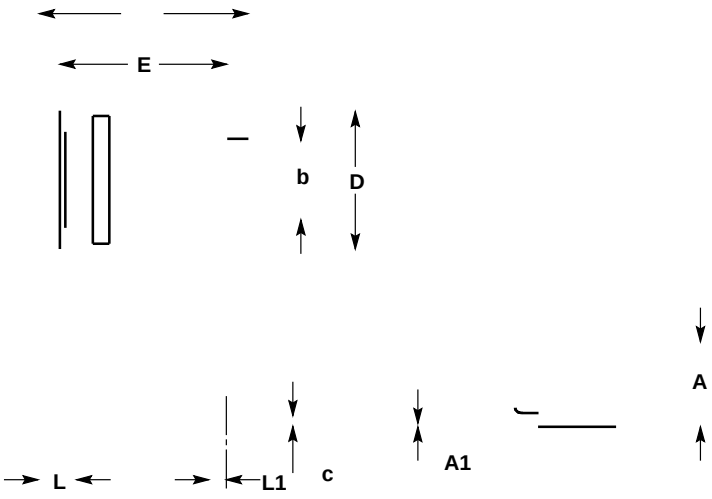


Figure 14.

The current through the LEDs is constant during the period they are turned on resulting in the light being consistent with no shift in chromaticity (color). The brightness is in proportion to the percentage of time that the LEDs are turned on.



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