Description

The AP3036B is an inductor-based DC/DC converter designed to drive up to eight white LEDs in series for backlight. Only one feedback resistor is needed to control the LED current and obtain required brightness.

A constant frequency 1.0MHz PWM control scheme is employed in this IC, which means tiny external components can be used. Specifically, 1mm tall inductor and 0.22µF output capacitor for a typical application is sufficient. Additionally, the Schottky diode in boost circuit is integrated on this chip. The AP3036B also provides a disable pin to ease its use for different systems.

The output overvoltage protection is implemented in AP3036B. When any LED is broken or in other abnormal conditions, the output voltage will be clamped.

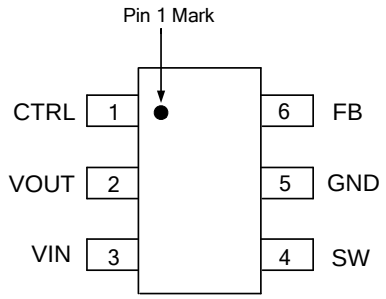
The AP3036B is available in standard SOT26 package.

Features

- Inherently Uniform LED Current
- High Efficiency up to 84%
- No Need for External Schottky Diode
- Output Overvoltage Protection (OVP)
- Fixed 1.0MHz Switching Frequency
- Uses Tiny 1mm Tall Inductor
- Requires Only 0.22µF Output Capacitor
- High Frequency Dimming Control
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Pin Assignments

(Top View)



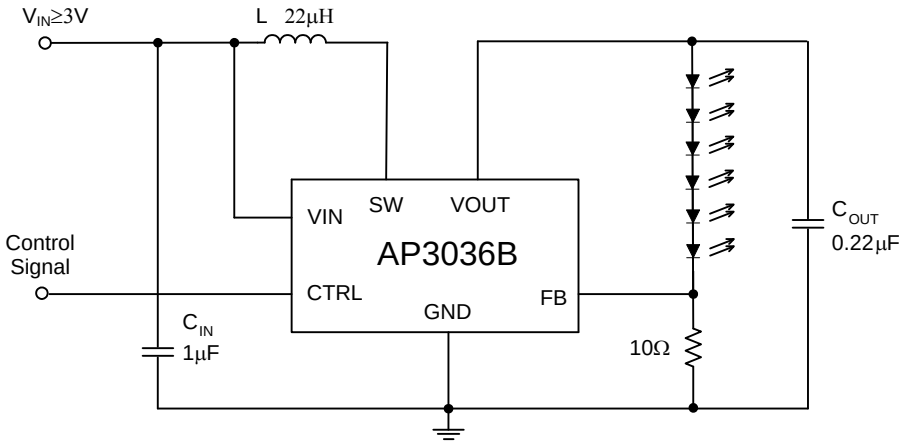
SOT26

Applications

- Cellular phones
- Digital cameras
- LCD modules
- GPS receivers
- PDAs, handheld computers

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

Typical Applications Circuit (Note 4)

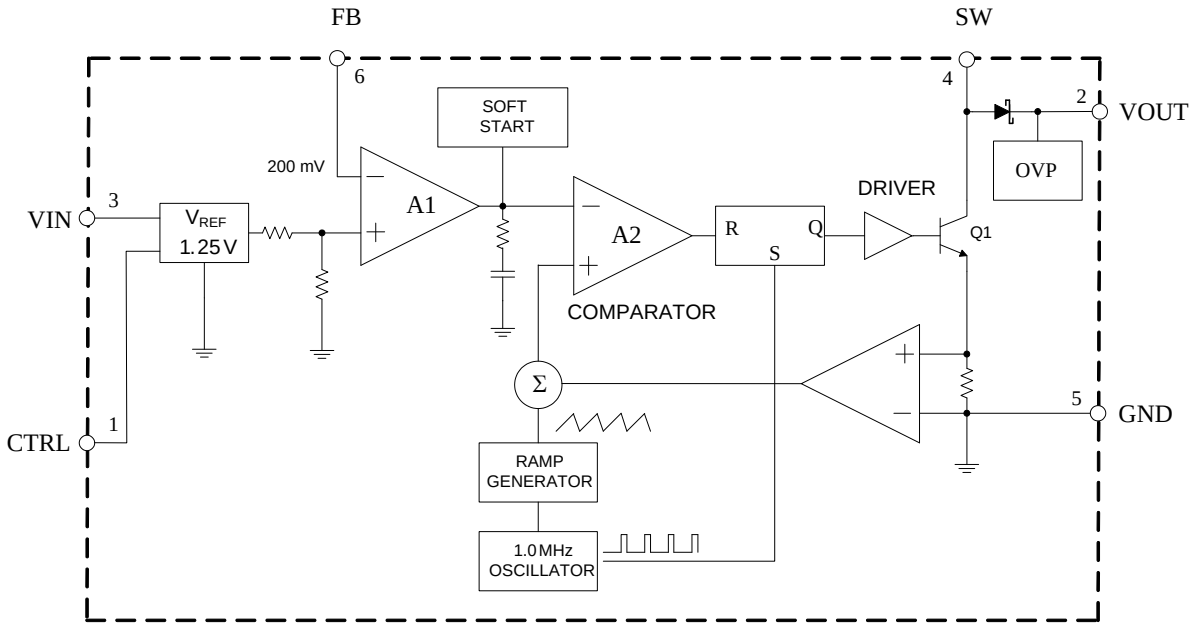


Note: 4. C: X5R or X7R type dielectric, L: SUMIDA CDRH5D28R-220NC or equivalent. And, this circuit can work in full temperature.

Pin Descriptions

Pin Number	Pin Name	Function
1	CTRL	Shutdown and dimming pin. Connect to 1.5V or higher to enable device; Connect to 0.4V or less to disable device; Connect to a PWM signal to achieve LEDs brightness dimming
2	VOUT	Output pin. Connect to the cathode of internal Schottky diode
3	VIN	Input supply pin. Must be connected to a local bypass capacitor
4	SW	Switch pin. Connect to external inductor
5	GND	Ground
6	FB	Voltage feedback pin. The reference voltage is 200mV

Functional Block Diagram



Absolute Maximum Ratings (Note 5)

Symbol	Parameter	Value	Unit
V_{IN}	Input Voltage	20	V
V_{SW}	SW Pin Voltage	38	V
V_{FB}	Feedback Voltage	20	V
V_{CTRL}	CTRL Pin Voltage	20	V
θ_{JA}	Thermal Resistance (Junction to Ambient, No Heatsink)	265	°C/W
T_J	Operating Junction Temperature	+150	°C
T_{STG}	Storage Temperature Range	-65 to +150	°C
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260	°C
—	ESD (Machine Model)	250	V
—	ESD (Human Body Model)	2000	V

Note: 5. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
T_{OP}	Operating Temperature Range	-40	+85	°C
V_{IN}	Input Voltage	2.5	16	V
V_{CTRL}	CTRL Pin Voltage	—	16	V

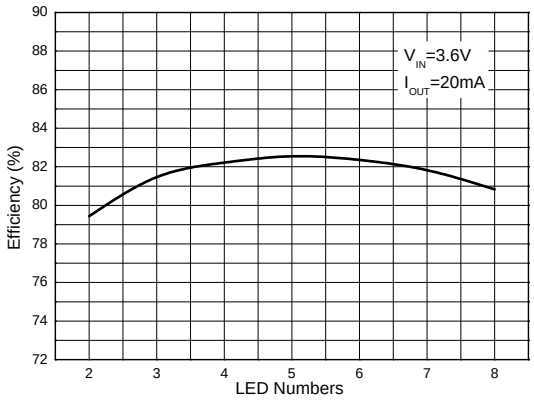
Electrical Characteristics (@V_{IN} = 3V, V_{CTRL} = 3V, T_A = +25°C, unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
V_{IN} (min)	Minimum Operating Voltage	—	2.5	—	—	V
V_{IN} (max)	Maximum Operating Voltage	—	—	—	16	
V_{FB}	Feedback Voltage	I_{OUT} = 20mA, 4 LEDs	188	200	212	mV
I_{FB}	FB Pin Bias Current	—	—	35	100	nA
I_Q	Quiescent Current	V_{FB} = V_{IN}, No Switching	1.6	3.1	3.9	mA
I_{SHDN}	Shutdown Quiescent Current	V_{CTRL} = 0V	—	45	75	μA
f	Switching Frequency	—	—	1.0	—	MHz
D_{MAX}	Maximum Duty Cycle	—	90	93	—	%
I_{LIMIT}	Switch Current Limit (Note 6)	D = 40% or 80%	—	550	—	mA
V_{CESAT}	Switch V_{CE} Saturation Voltage	I_{SW} = 250mA	—	360	—	mV
—	Switch Leakage Current	V_{SW} = 5V	—	0.01	5	μA
V_{CTRL}	CTRL Pin Voltage	High	1.5	—	—	V
		Low	—	—	0.4	
I_{CTRL}	CTRL Pin Bias Current	—	—	100	—	μA
V_{OV}	OVP Voltage	—	—	30	—	V
V_{DROP}	Schottky Forward Drop	I_D = 150mA	—	0.7	—	V
—	Schottky Leakage Current	V_R (Reverse Voltage) = 23V	—	0.1	4	μA
		V_R (Reverse Voltage) = 27V	—	—	150	
t	Soft Start Time	—	—	100	—	μs
θ_{JC}	Thermal Resistance (Junction to Case)	SOT26	—	60	—	°C/W

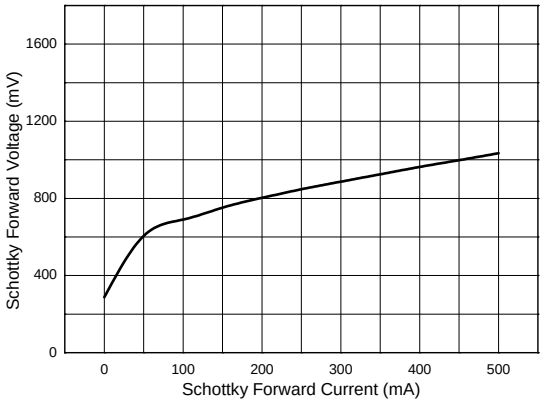
Note: 6. The switch current limit is related to duty cycle. Please refer to Figure LED Current vs. Duty (PWM Frequency = 0.5kHz).

Performance Characteristics (The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

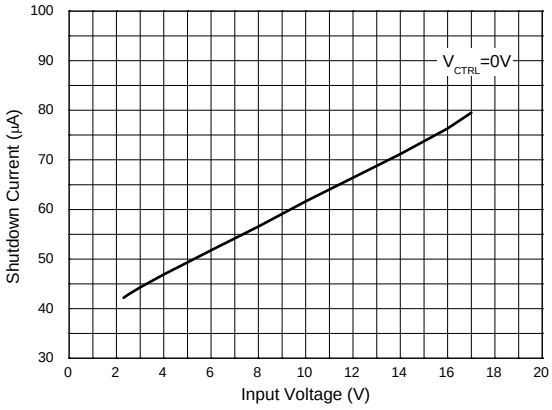
Efficiency vs. LED's Number



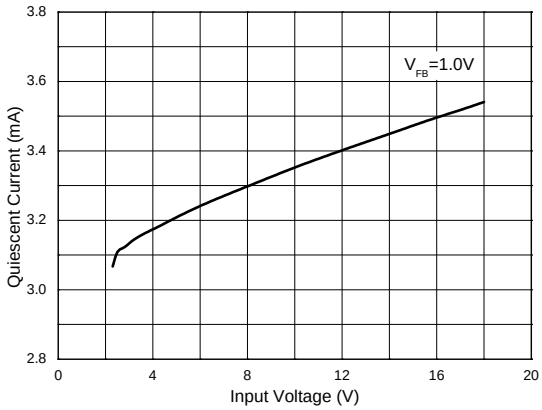
Schottky Forward Voltage vs. Schottky Forward Current



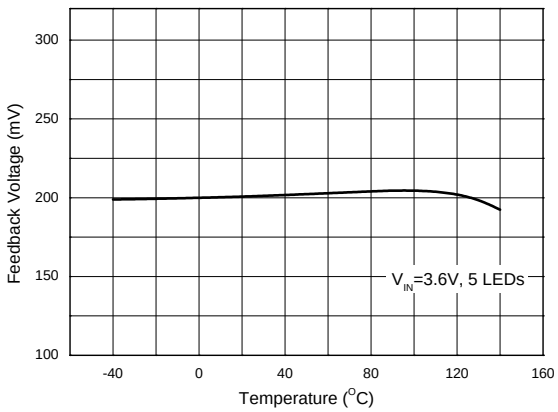
Shutdown Current vs. Input Voltage



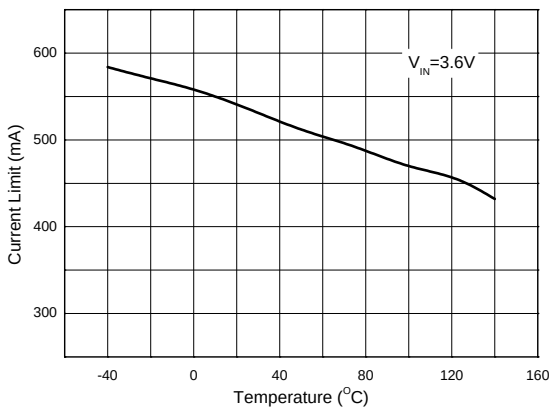
Quiescent Current vs. Input Voltage



Feedback Voltage vs. Temperature

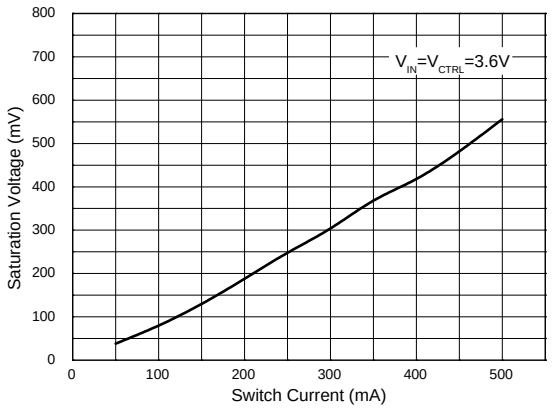


Current Limit vs. Temperature

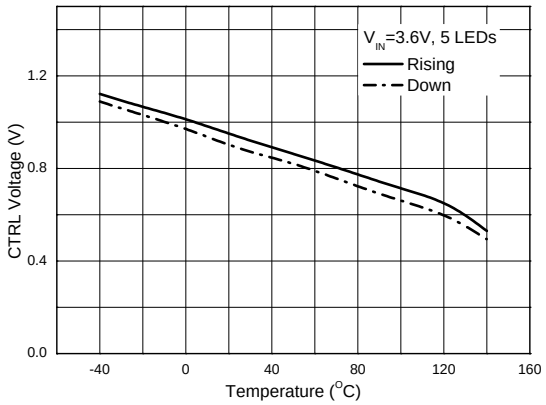


Performance Characteristics (continued) (The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

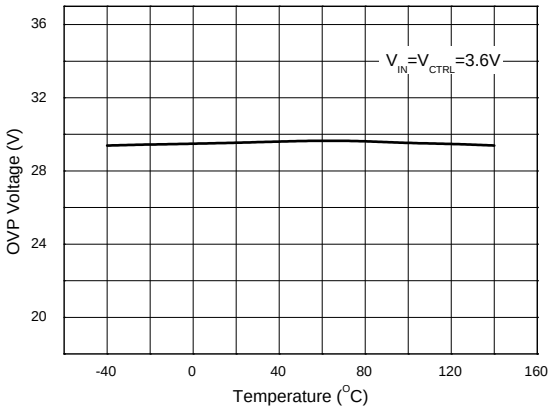
Saturation Voltage vs. Switch Current



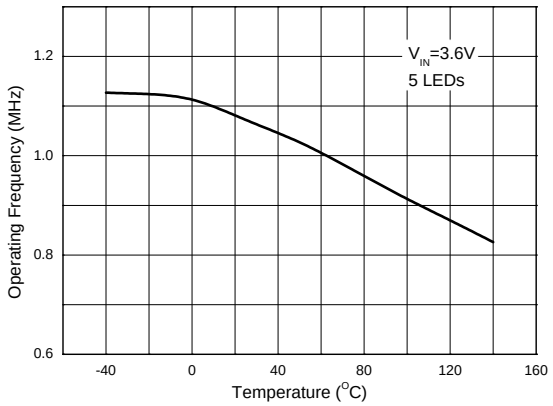
CTRL Pin Voltage vs. Temperature



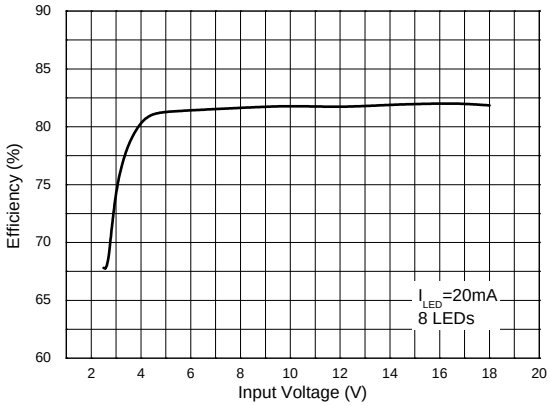
OVP Voltage vs. Temperature



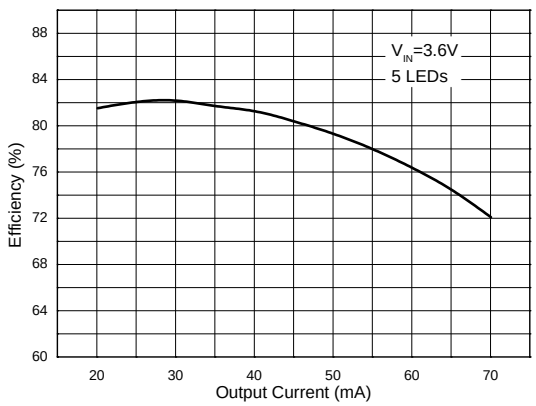
Operating Frequency vs. Temperature



Efficiency vs. Input Voltage

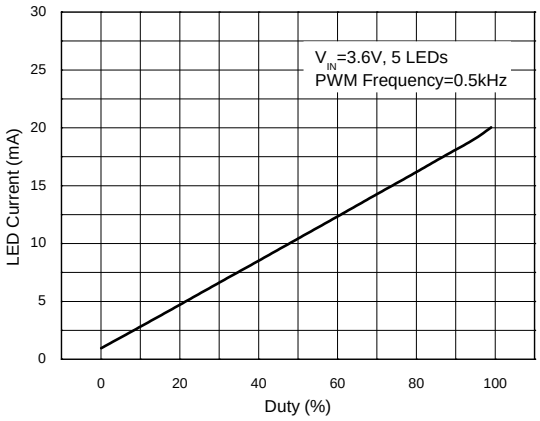


Efficiency vs. Output Current

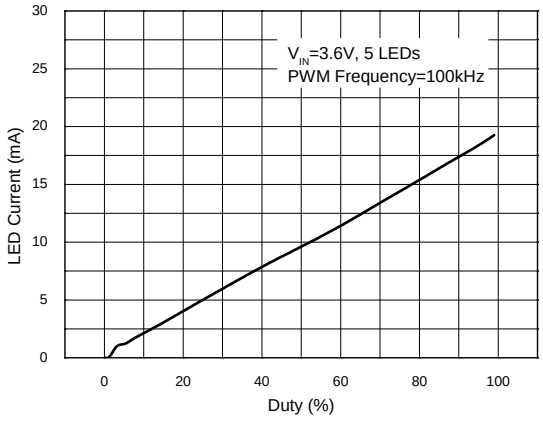


Performance Characteristics (continued) (The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

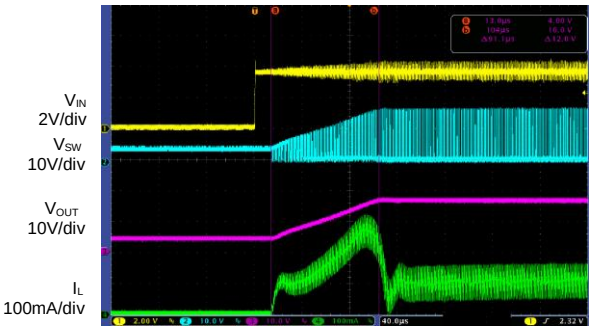
LED Current vs. Duty



LED Current vs. Duty

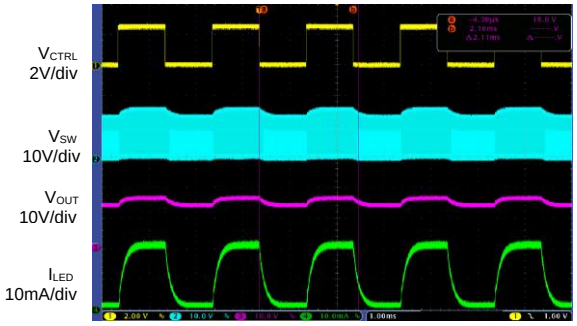


Powering On
(V_{IN} = 3.6V, V_{CTRL} = 2.5V, I_{LED} = 20mA, 5 LEDs)



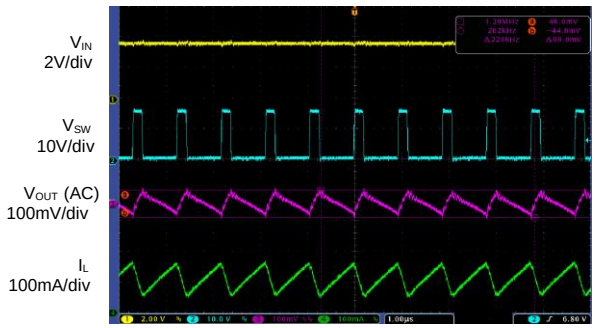
Time 40µs/div

PWM Dimming
(V_{IN} = 3.6V, V_{PWM} = 2.5V, f_{PWM} = 0.5kHz, Duty = 50%, 5 LEDs)



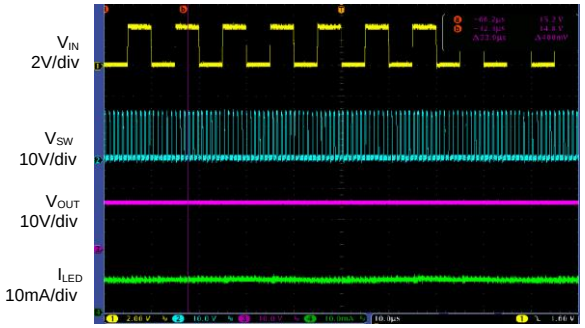
Time 10ms/div

Output Voltage Ripple
(V_{IN} = V_{CTRL} = 3.6V, I_{LED} = 20mA, 5 LEDs)



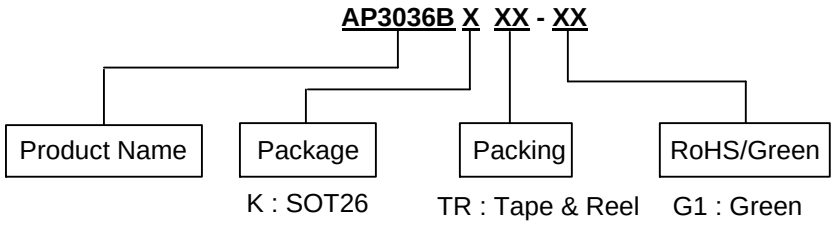
Time 1µs/div

PWM Dimming
(V_{IN} = 3.6V, V_{PWM} = 2.5V, f_{PWM} = 100kHz, Duty = 50%, 5 LEDs)



Time 10µs/div

Ordering Information

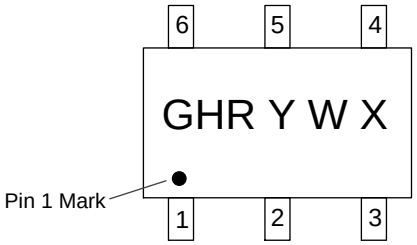


Part Number	Package	Temperature Range	Identification Code	Packing	
				Qty.	Carrier
AP3036BKTR-G1	SOT26	-40°C to +85°C	GHR	3000	7” Tape & Reel

Note: 7. Diodes Incorporated’s IC’s Pb-free products with "G1" suffix in the part number are RoHS compliant and green.

Marking Information

(Top View)

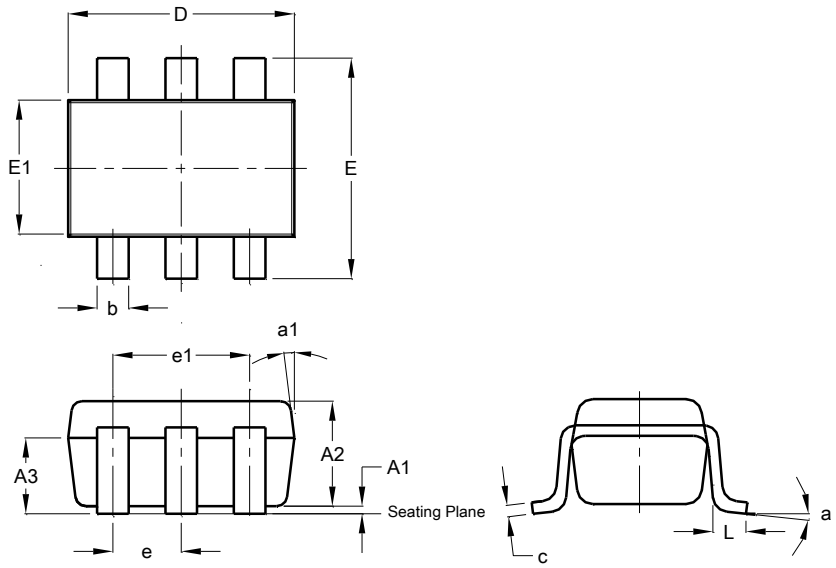


GHR: Identification Code
Y: Year 0 to 9 (ex: 3 = 2023)
W: Week: A to Z: week 1 to 26
a to z: week 27 to 52
z represents week 52 and 53
X: Internal code

Package Outline Dimensions

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT26

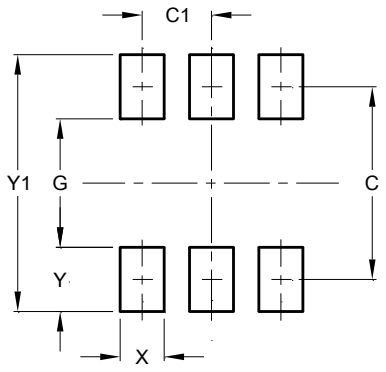


SOT26			
Dim	**Min**	**Max**	**Typ**
A1	0.013	0.10	0.05
A2	1.00	1.30	1.10
A3	0.70	0.80	0.75
b	0.35	0.50	0.38
c	0.10	0.20	0.15
D	2.90	3.10	3.00
e	-	-	0.95
e1	-	-	1.90
E	2.70	3.00	2.80
E1	1.50	1.70	1.60
L	0.35	0.55	0.40
a	-	-	8°
a1	-	-	7°
All Dimensions in mm			

Suggested Pad Layout

Please see http://www.diodes.com/package-outlines.html for the latest version.

SOT26



Dimensions	Value (in mm)
C	2.40
C1	0.95
G	1.60
X	0.55
Y	0.80
Y1	3.20

Mechanical Data

- Moisture Sensitivity: Level 3 per JESD22-A113
- Terminals: Matte Tin Plated Leads, Solderable per M2003 JESD22-B102 (e3)
- Weight: 0.016 grams (Approximate)

IMPORTANT NOTICE

1. DIODES INCORPORATED (Diodes) AND ITS SUBSIDIARIES MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes' products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes' products. Diodes' products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of Diodes' products for their intended applications, (c) ensuring their applications, which incorporate Diodes' products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes' products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes' products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes' products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

9. This Notice may be periodically updated with the most recent version available at https://www.diodes.com/about/company/terms-and-conditions/important-notice

www.diodes.com