NEW PRODUCT

AP3036B

WHITE LED STEP-UP CONVERTER

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.

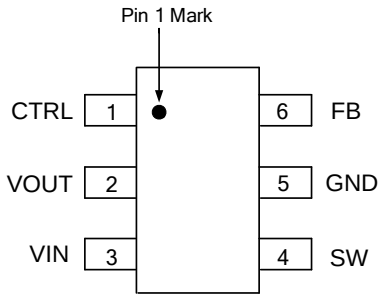
A constant frequency 1.0MHz PWM control scheme is employed in this IC, which means tiny external components can be used. Specifically, 1mm tall inductor and 0.22µF output capacitor for a typical application is sufficient. Additionally, the Schottky diode in boost circuit is integrated on this chip. The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

The output over-voltage 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.

Pin Assignments

(Top View)



SOT26

Applications

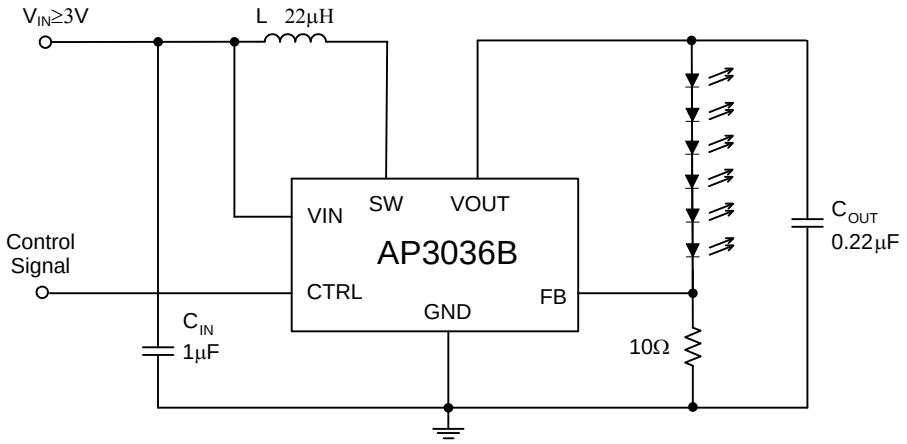
- Cellular Phones
- Digital Cameras
- LCD Modules
- GPS Receivers
- PDAs, Handheld Computers

Features

- Inherently Uniform LED Current
- High Efficiency up to 84%
- No Need for External Schottky Diode
- Output Over-voltage 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**)

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html 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.

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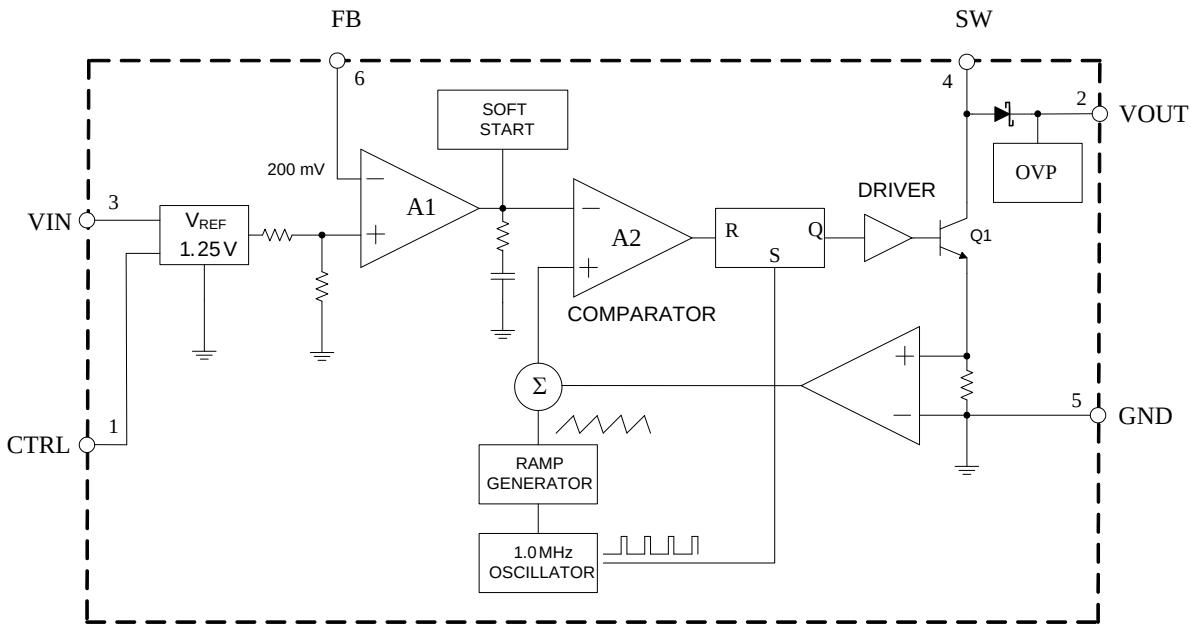
Pin Descriptions

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 external inductor
5	GND	Ground
6	FB	Voltage feedback pin. The reference voltage is 200mV

Functional Block Diagram



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Absolute Maximum Ratings (Note 5)

Symbol	Parameter	Rating	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 Heat Sink)	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" may 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 may 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

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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).

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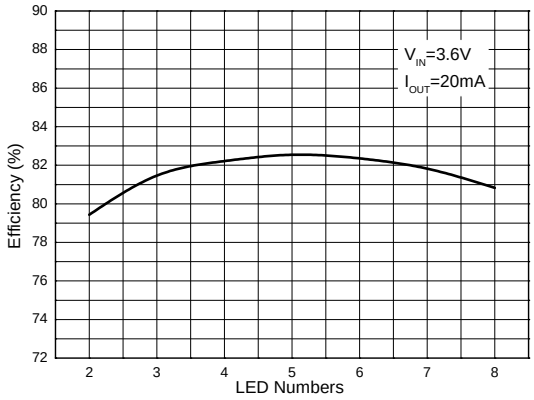
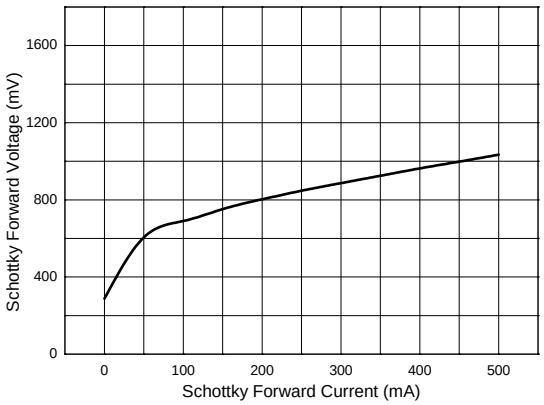
Performance Characteristics (The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

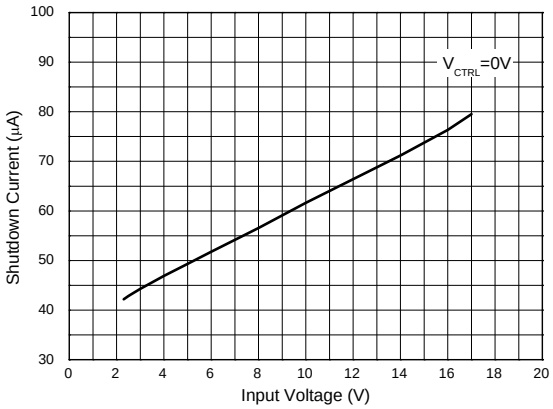
Efficiency vs. LED's Number



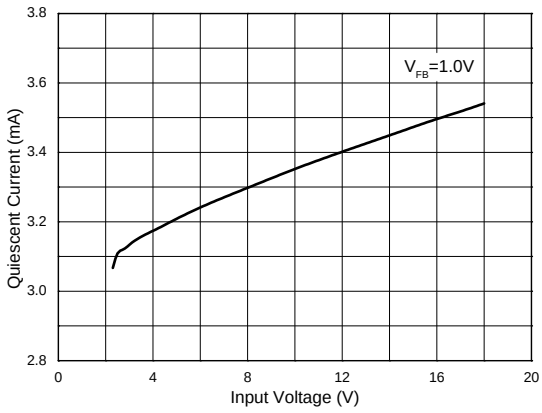
Schottky Forward Voltage vs. Schottky Forward Current



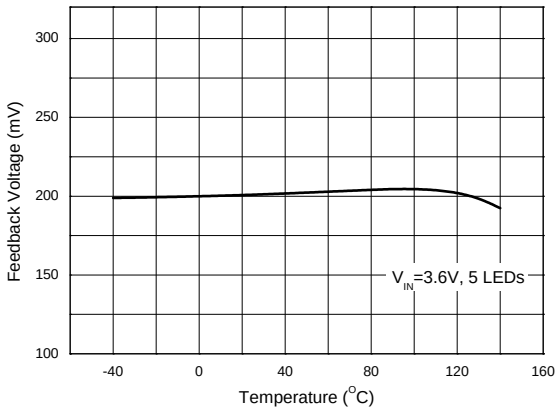
Shutdown Current vs. Input Voltage



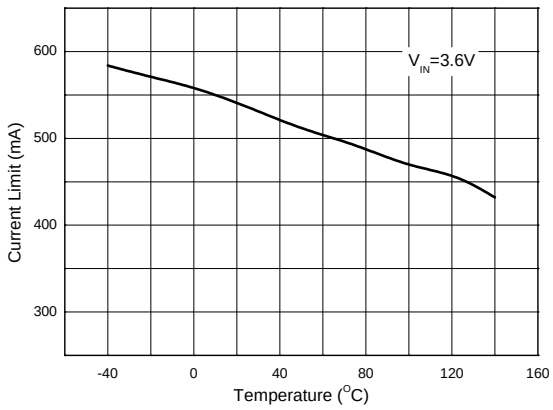
Quiescent Current vs. Input Voltage



Feedback Voltage vs. Temperature



Current Limit vs. Temperature



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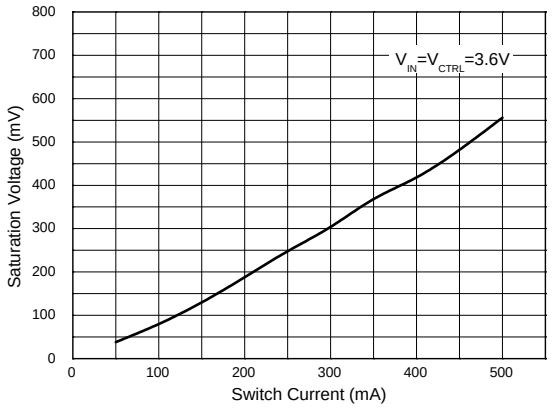
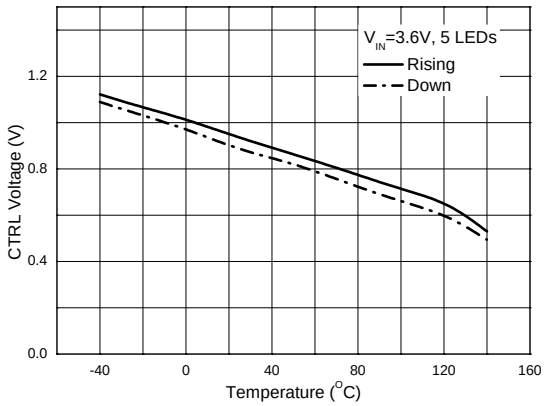
Performance Characteristics (Cont. The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

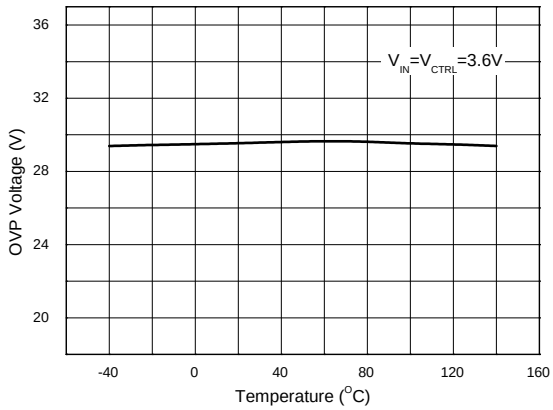
Saturation Voltage vs. Switch Current



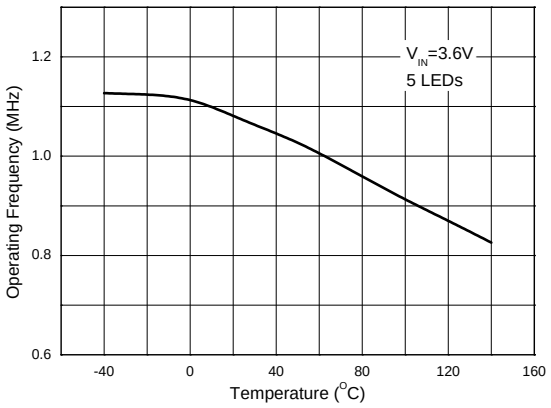
CTRL Pin Voltage vs. Temperature



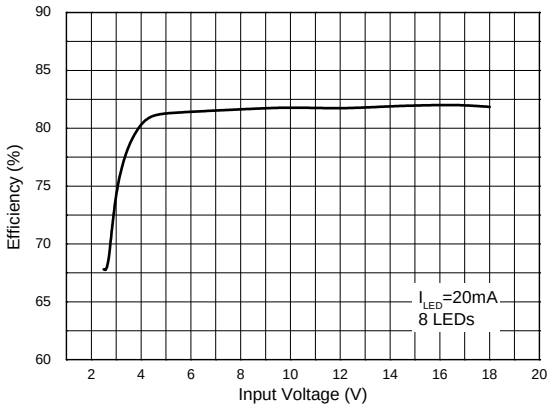
OVP Voltage vs. Temperature



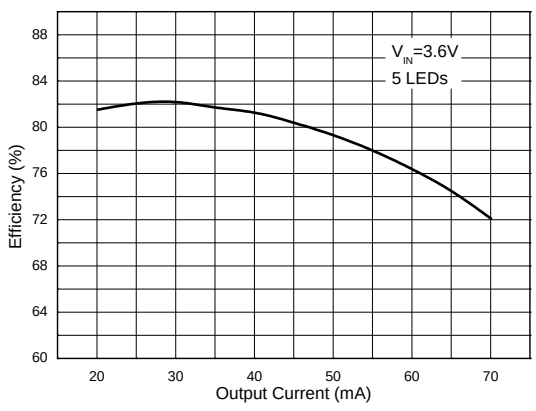
Operating Frequency vs. Temperature



Efficiency vs. Input Voltage



Efficiency vs. Output Current



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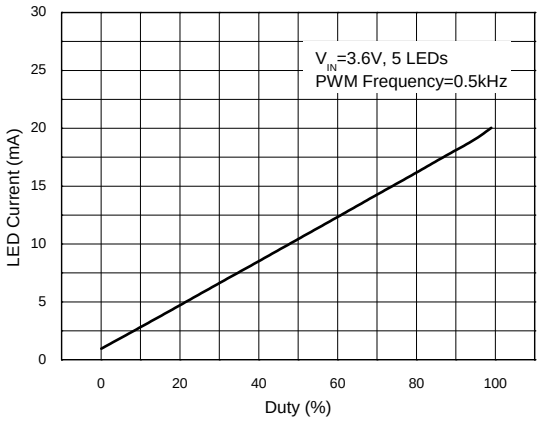
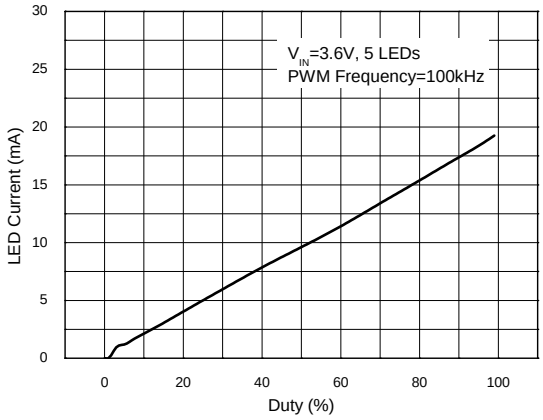
Performance Characteristics (Cont. The WLED forward voltage (V_F) is 3.45V at I_F = 20mA, unless otherwise noted.)

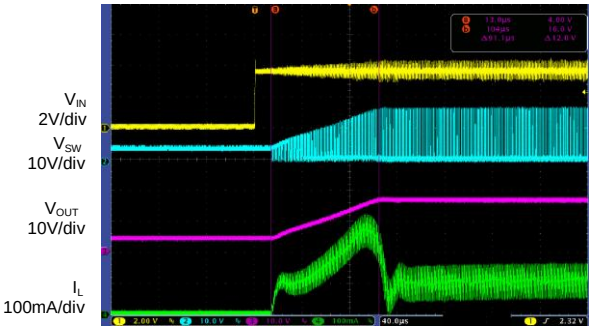
LED Current vs. Duty



LED Current vs. Duty

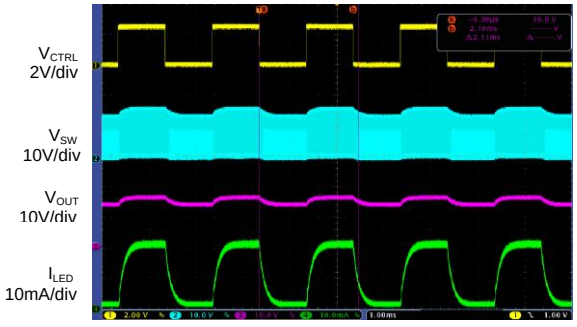


Powering On
(V_{IN} = 3.6V, V_{CTRL} = 2.5V, I_{LED} = 20mA, 5 LEDs)



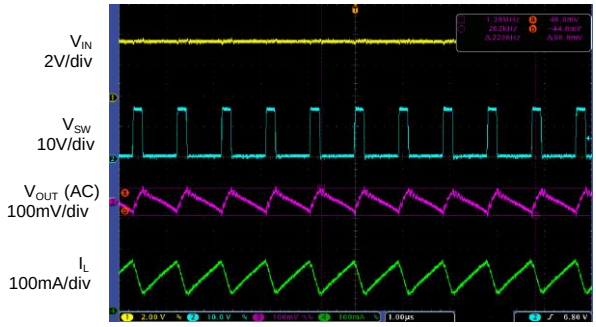
Time 40µs/div

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



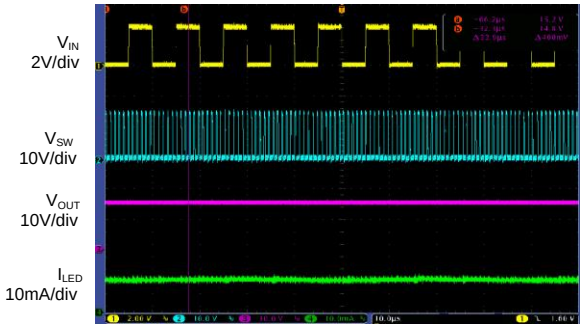
Time 10ms/div

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

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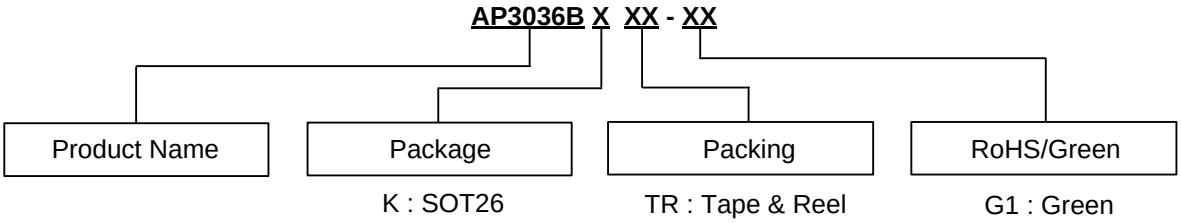
Ordering Information

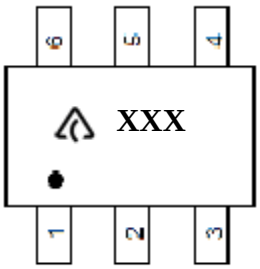


Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

Package	Temperature Range	Part Number	Marking ID	Packing
SOT26	-40ºC to +85ºC	AP3036BKTR-G1	GHR	3000/7"Tape & Reel

Marking Information

(Top View)



: Logo
XXX: Marking ID (See Ordering Information)

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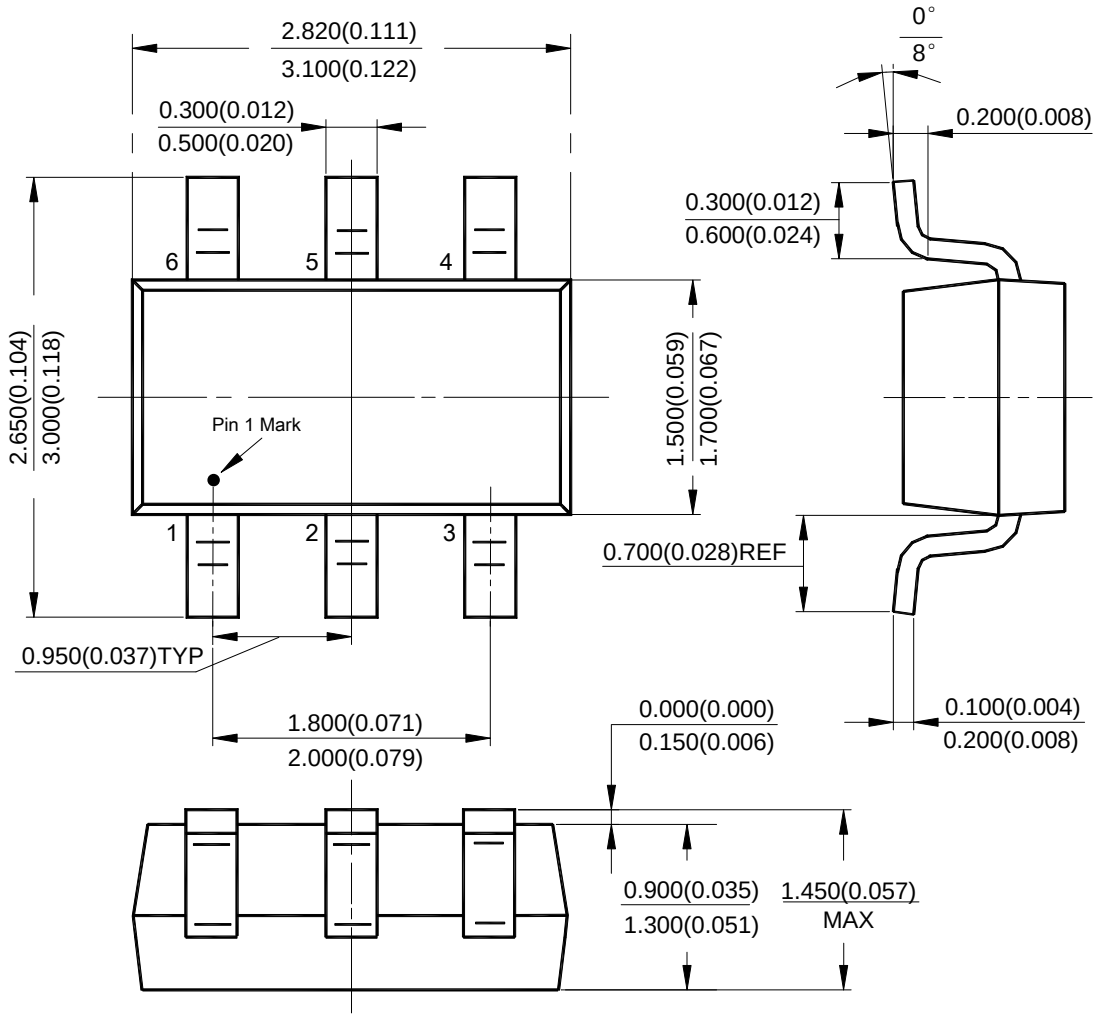
Package Outline Dimensions (All dimensions in mm(inch).)

(1) Package Type: SOT26



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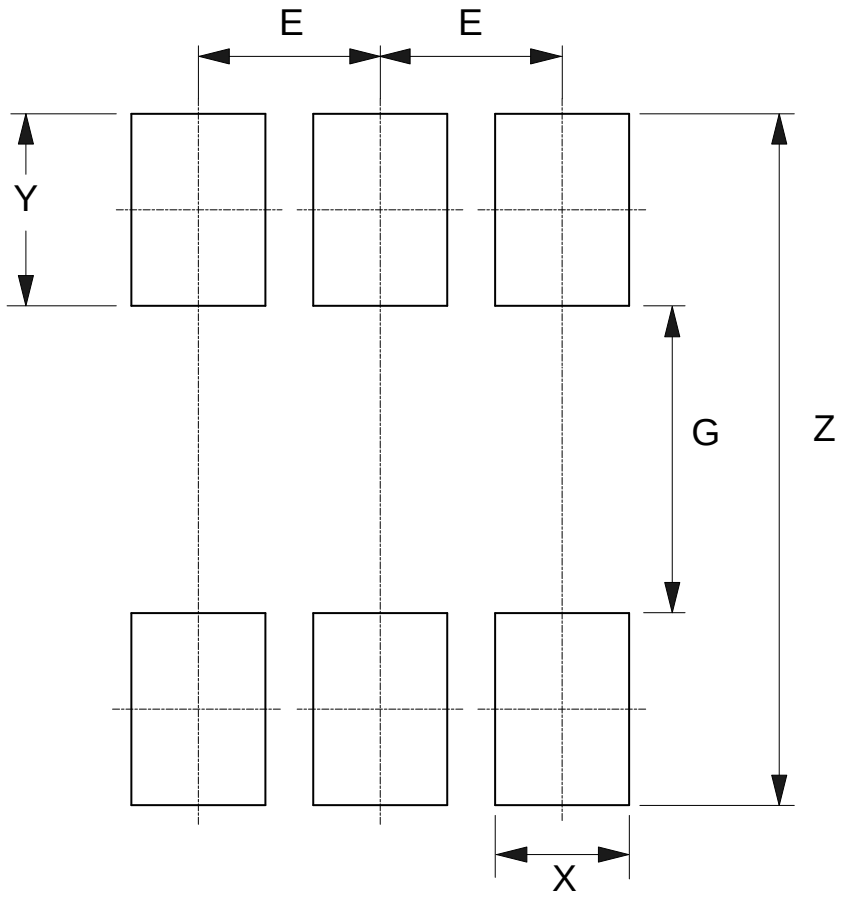
Suggested Pad Layout

(1) Package Type: SOT26



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037

NEW PRODUCT

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