

**CONSTANT VOLTAGE AND CONSTANT CURRENT CONTROLLER**

## Description

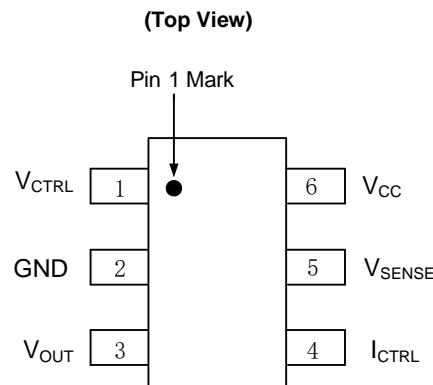
The AP4306 is a highly integrated solution for a constant voltage/constant current mode SMPS application.

The AP4306 contains one 1.21V voltage reference, one low voltage reference used in current sensing circuit and two operational amplifiers. The 1.21V voltage reference, combined with one operational amplifier, makes of an ideal voltage controller for use in adapters and battery chargers. The low voltage reference, combined with another operational amplifier, makes of an ideal current limiter for output low side current sensing.

The AP4306 is fully compatible with AP4305 in functionality and electrical characteristics except its lower reference voltage for current control loop, thus higher power efficiency in SMPS applications such as low power charger can be realized with AP4306 compared to AP4305.

The AP4306 is available in SOT26 package.

## Pin Assignments



**SOT26 (K Package)**

## Features

- Constant Voltage and Constant Current Control
- Precision Internal Voltage Reference
- Low External Component Count
- Easy Compensation
- Low Supply Current: 0.5mA
- Current Control Loop Reference
  - A Version: 70mV
  - Operating Temperature Range: -40 to +105°C
- Operating Supply Voltage: 2.5V to 18V
- **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](https://www.diodes.com/quality/product-definitions/) or your local Diodes representative.**

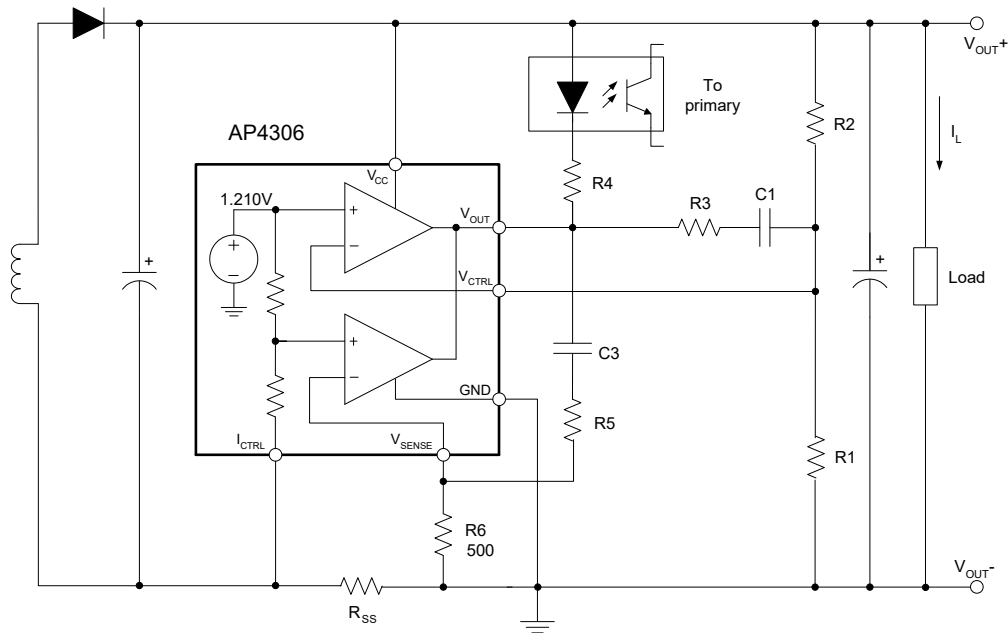
<https://www.diodes.com/quality/product-definitions/>

## Applications

- Adapters
- Battery chargers

- 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.

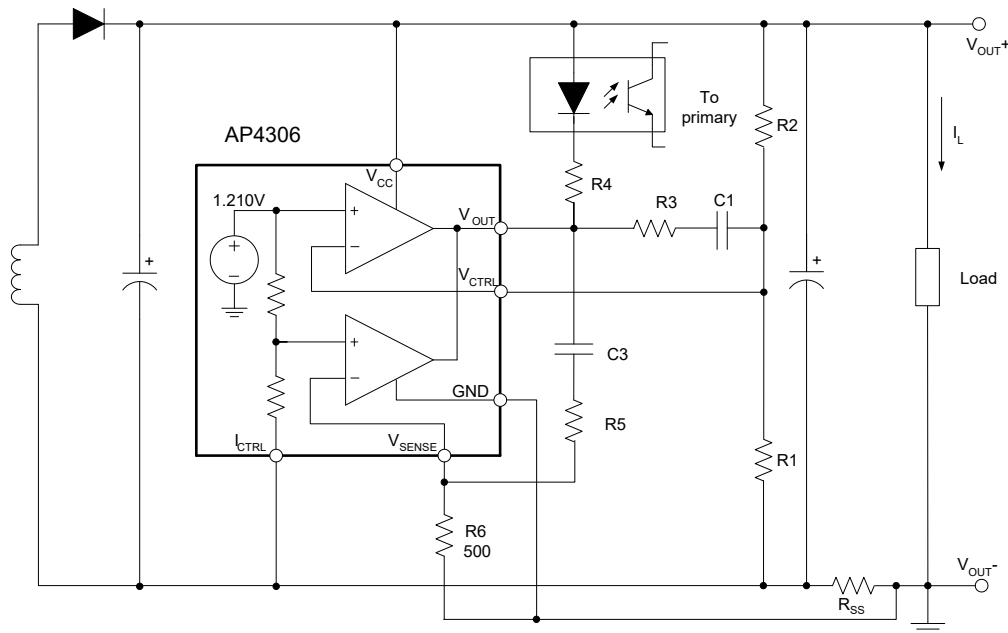
## Typical Applications Circuit



$$V_{OUT} = V_{REF} \times \frac{R1 + R2}{R1}$$

$$CurrentLimit = \frac{V_{SENSE}}{R_{SS}}$$

Typical Application 1

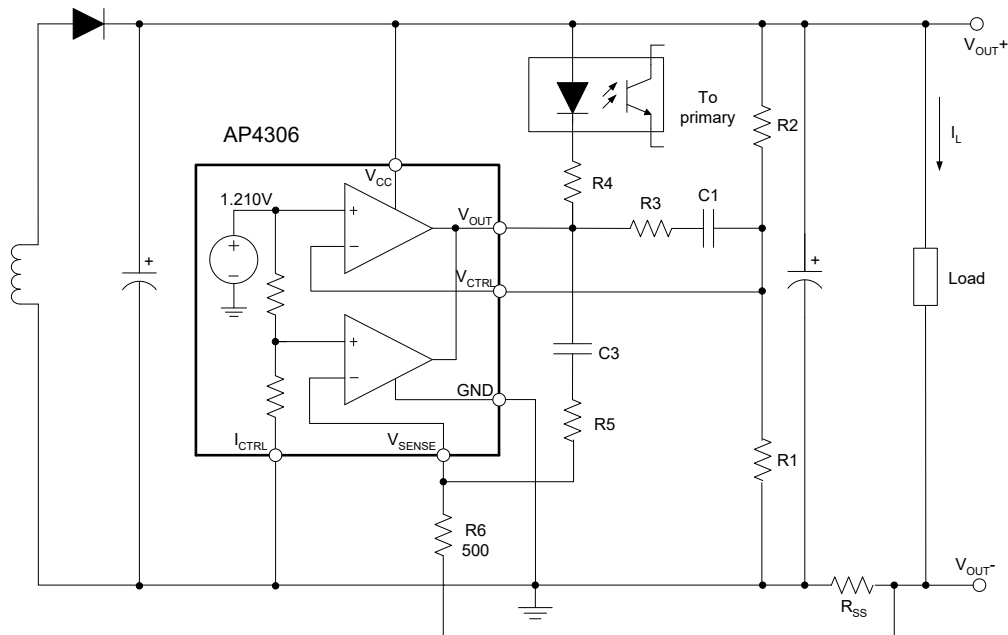


$$V_{OUT} = [V_{REF} + (I_L \times R_{SS})] \times \frac{R1 + R2}{R1} - (I_L \times R_{SS})$$

$$CurrentLimit = \frac{V_{SENSE}}{R_{SS}}$$

Typical Application 2

## Typical Applications Circuit (continued)



$$V_{OUT} = V_{REF} \times \frac{R1 + R2}{R1} - (I_L \times R_{SS})$$

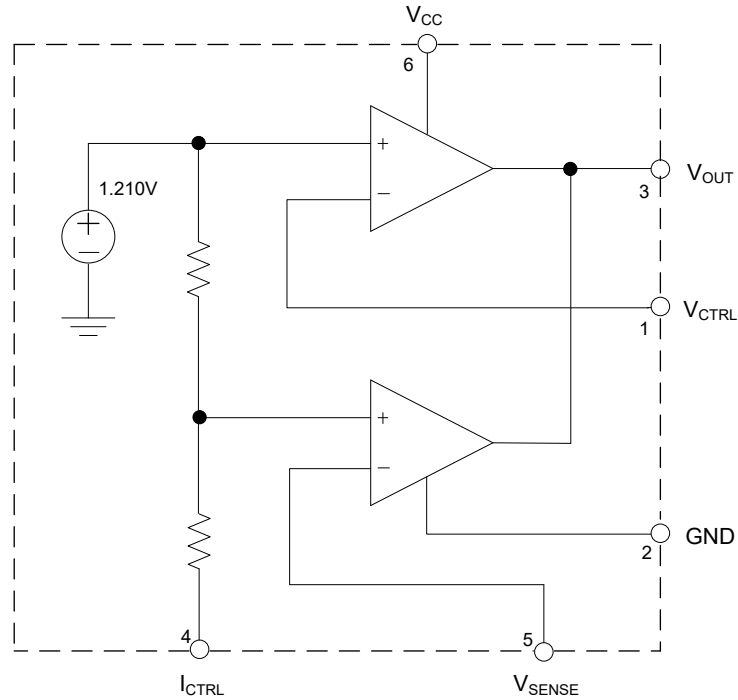
$$CurrentLimit = \frac{V_{SENSE} \times V_{REF}}{(V_{SENSE} + V_{REF}) \times R_{SS}}$$

Typical Application 3

## Pin Descriptions

Pin Number	Pin Name	Function
1	VCTRL	Input pin of the voltage control loop
2	GND	Ground
3	VOUT	Output pin. Sinking current only
4	ICTRL	Input pin of the current control loop
5	VSENSE	Input pin of the current control loop
6	VCC	Power supply

## Functional Block Diagram



## Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating	Unit
$V_{CC}$	Power Supply Voltage	20	V
$V_{IN}$	Input Voltage	-0.3 to $V_{CC}$	V
$T_J$	Junction Temperature	+150	°C
$T_{STG}$	Storage Temperature	-65 to +150	°C
$T_{LEAD}$	Lead Temperature (Soldering, 5sec)	+260	°C
$\theta_{JA}$	Thermal Resistance (Junction to Ambient)	250	°C/W

Note: 4. 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
$V_{CC}$	Power Supply Voltage	2.5	18	V
$T_A$	Operating Temperature Range	-40	+105	°C

**Electrical Characteristics** (@V<sub>CC</sub>=5V, T<sub>A</sub>=+25°C, unless otherwise specified.)

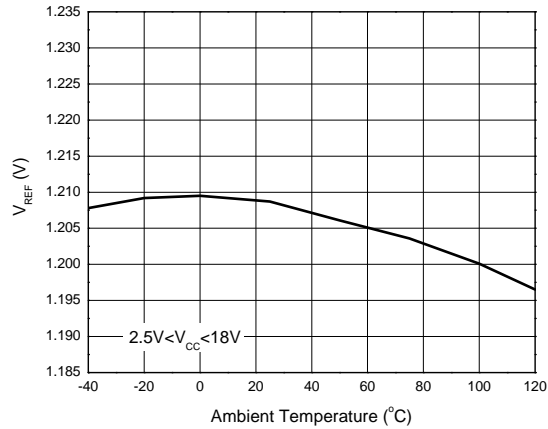
Symbol	Parameters	Conditions		Min	Typ	Max	Unit
TOTAL CURRENT CONSUMPTION							
I <sub>CC</sub>	Total Supply Current Not Including the Output Sinking	T <sub>A</sub> =+25°C		—	0.5	1	mA
		-40°C<T <sub>A</sub> <+105°C		—	0.6	—	
VOLTAGE CONTROL LOOP							
G <sub>mv</sub>	Transconduction Gain (V <sub>CTRL</sub> ). Sink Current Only	T <sub>A</sub> =+25°C		1	3.5	—	mA/mV
		-40°C<T <sub>A</sub> <+105°C		—	2.5	—	
V <sub>REF</sub>	Voltage Control Loop Reference	A Version	T <sub>A</sub> =+25°C	1.198	1.21	1.222	V
			-40°C<T <sub>A</sub> <+105°C	1.162		1.258	
I <sub>IBV</sub>	Input Bias Current (V <sub>CTRL</sub> )	T <sub>A</sub> =+25°C		—	50	—	nA
		-40°C<T <sub>A</sub> <+105°C		—	100	—	
CURRENT CONTROL LOOP							
G <sub>mi</sub>	Transconduction Gain (I <sub>CTRL</sub> ). Sink Current Only	T <sub>A</sub> =+25°C		1.5	7	—	mA/mV
		-40°C<T <sub>A</sub> <+105°C		1.5	7	—	
V <sub>SENSE</sub>	Current Control Loop Reference	A Version	T <sub>A</sub> =+25°C	66.5	70	73.5	mV
			-40°C<T <sub>A</sub> <+105°C	63		77	
I <sub>IBI</sub>	Current Out of Pin I <sub>CTRL</sub> at V <sub>SENSE</sub>	A Version	T <sub>A</sub> =+25°C	—	18	—	μA
			-40°C<T <sub>A</sub> <+105°C	—	35	—	
OUTPUT STAGE							
V <sub>OL</sub>	Low Output Voltage at 10mA Sinking Current	T <sub>A</sub> =+25°C		—	100	—	mV
		-40°C<T <sub>A</sub> <+105°C		—	100	—	
I <sub>OS</sub>	Output Short Circuit Current. Output to V <sub>CC</sub> . Sink Current Only	T <sub>A</sub> =+25°C		—	27	50	mA
		-40°C<T <sub>A</sub> <+105°C		—	35	—	

**Thermal Impedance**

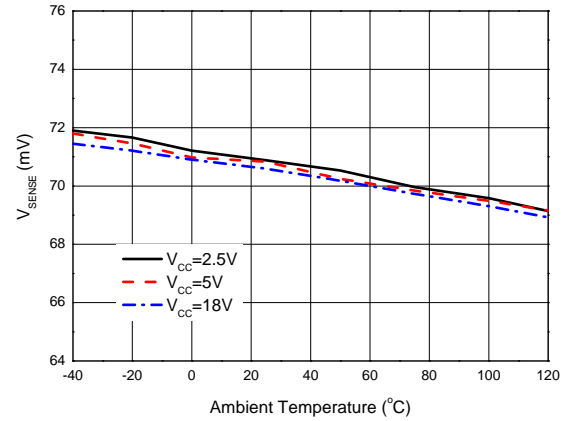
Symbol	Parameters	Value	Unit
θ <sub>JC</sub>	Thermal Resistance (Junction to Case)	84	°C/W

## Performance Characteristics

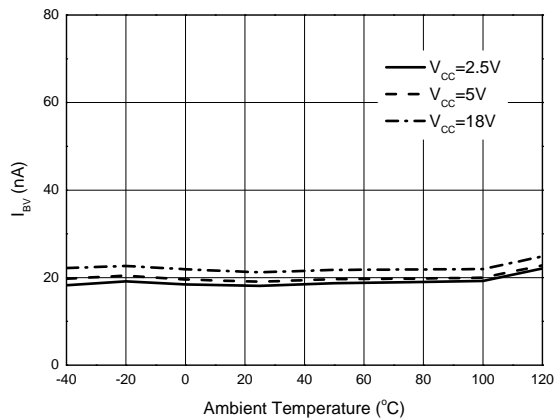
**V<sub>REF</sub> vs. Ambient Temperature**



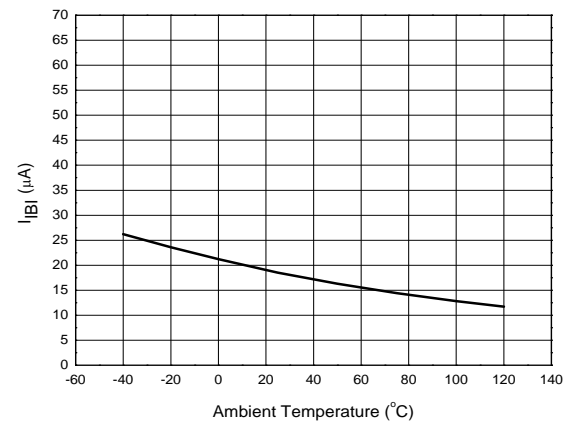
**V<sub>SENSE</sub> vs. Ambient Temperature**



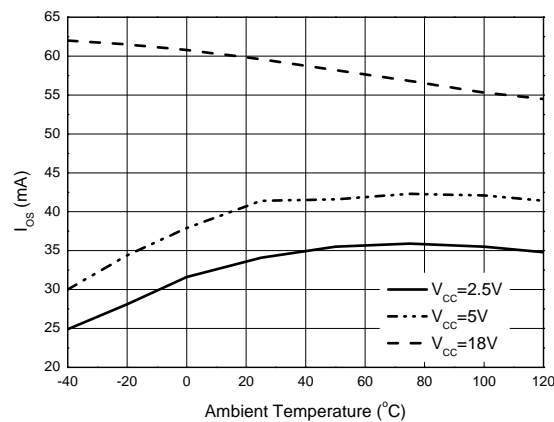
**I<sub>IBV</sub> vs. Ambient Temperature**



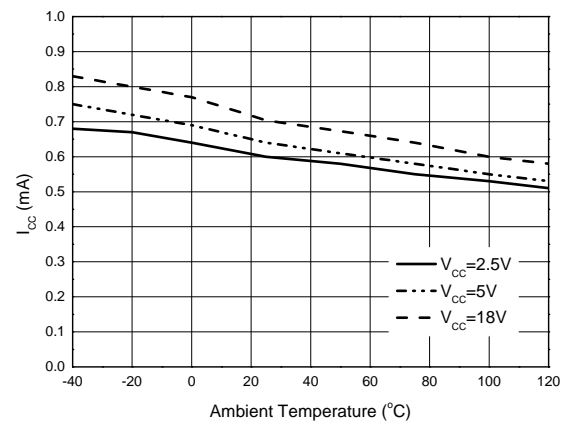
**I<sub>IBI</sub> vs. Ambient Temperature**



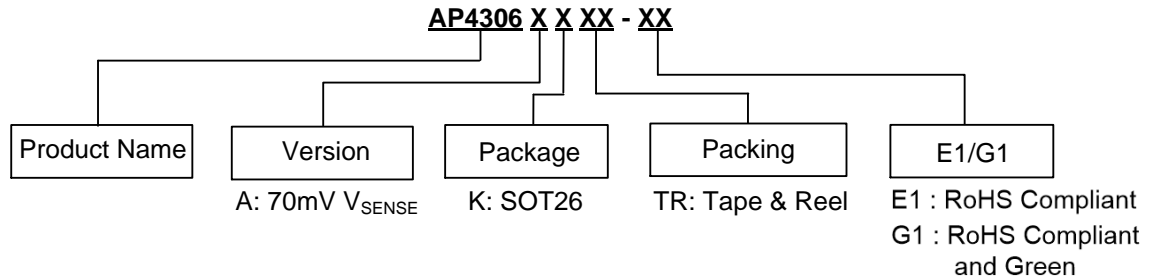
**I<sub>OS</sub> vs. Ambient Temperature**



**I<sub>CC</sub> vs. Ambient Temperature**

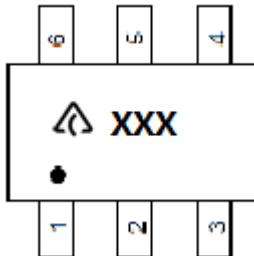



## Ordering Information



Part Number		Marking ID		Version	Package	Packing	
RoHS Compliant	RoHS Compliant and Green	RoHS Compliant	RoHS Compliant and Green			Qty.	Carrier
AP4306AKTR-E1	AP4306AKTR-G1	E7L	G7L	70mV $V_{SENSE}$	SOT26	3000	Tape & Reel

## Marking Information

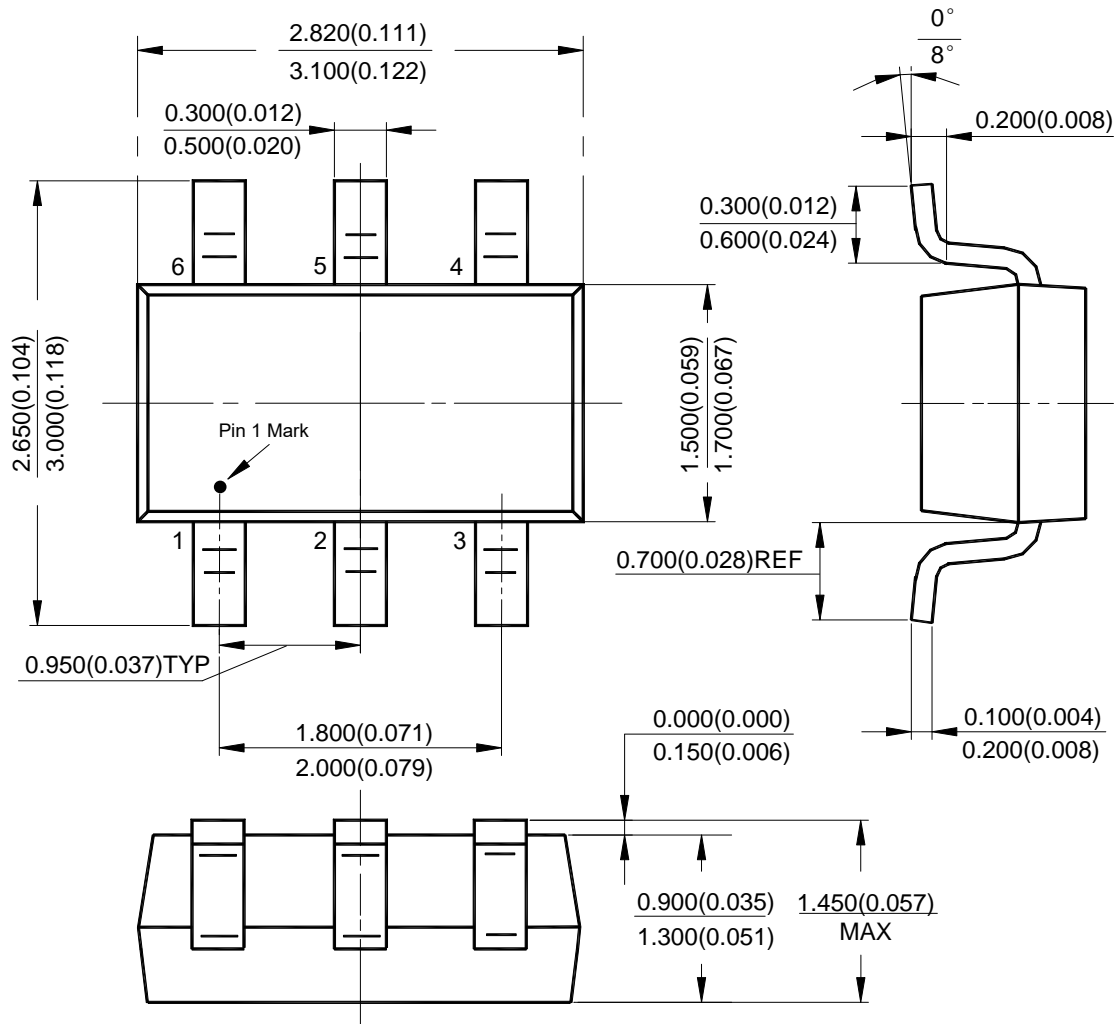


 : Logo  
 XXX: Marking ID (See ordering information)

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

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

## (1) Package Type: SOT26

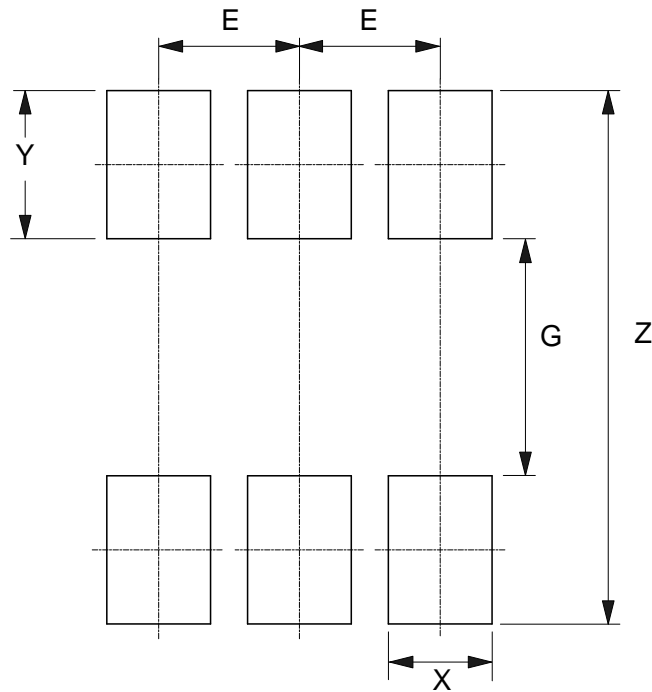




## Suggested Pad Layout

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

(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

## Mechanical Data

- Moisture Sensitivity: Level 1 per JESD22-A113
- Terminals: Finish – Matte Tin Plated Leads, Solderable per JESD22-B102 Ⓔ3
- Weight: 0.016 grams (Approximate)

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