

## Description

The AP3211 is a 1.4MHz fixed frequency, current mode, PWM buck (step-down) DC-DC converter, capable of driving a 1.5A load with high efficiency, excellent line and load regulation. The device integrates N-channel power MOSFET switch with low on-resistance. Current mode control provides fast transient response and cycle-by-cycle current limit.

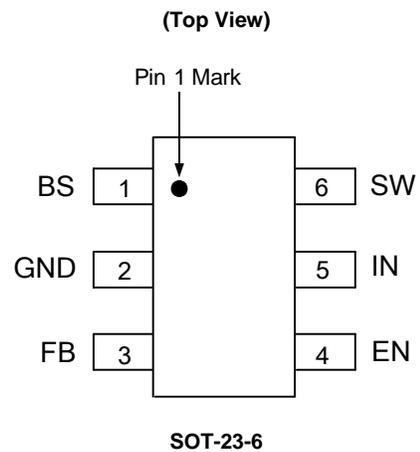
A standard series of inductors are available from several different manufacturers optimized for use with the AP3211. This feature greatly simplifies the design of switch-mode power supplies.

The AP3211 is available in SOT-23-6 package.

## Features

- Input Voltage Range: 4.5V to 18V
- Output Voltage Adjustable from 0.81V to 15V
- Fixed 1.4MHz Frequency
- High Efficiency: up to 92%
- Output Current: 1.5A
- Current Mode Control
- Built-In Over Current Protection
- Built-In Thermal Shutdown Function
- Built-In UVLO Function
- Built-In Over Voltage Protection
- Built-In Soft-Start

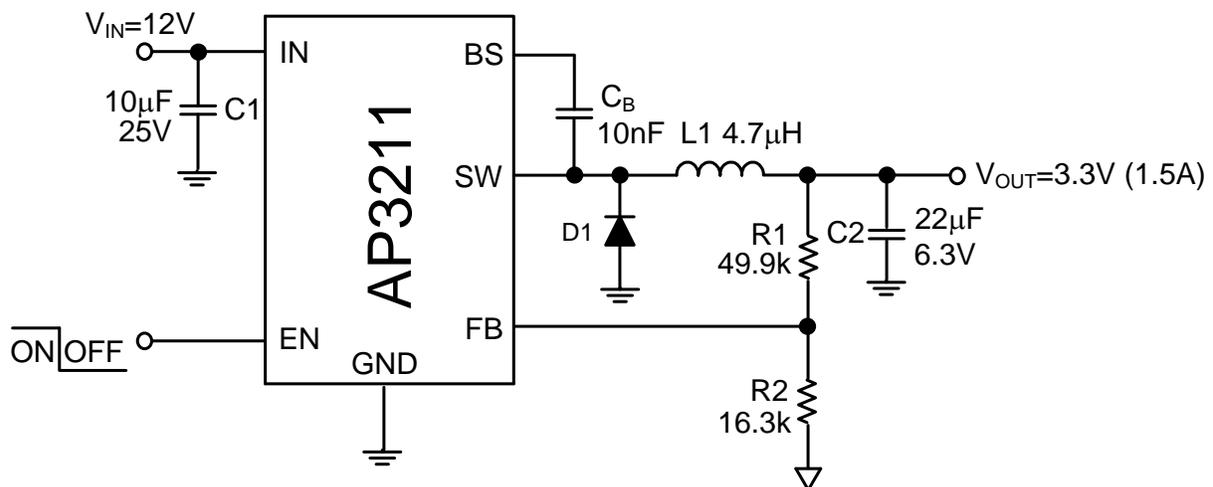
## Pin Assignments



## Applications

- LCD TV
- DPF
- Portable DVD

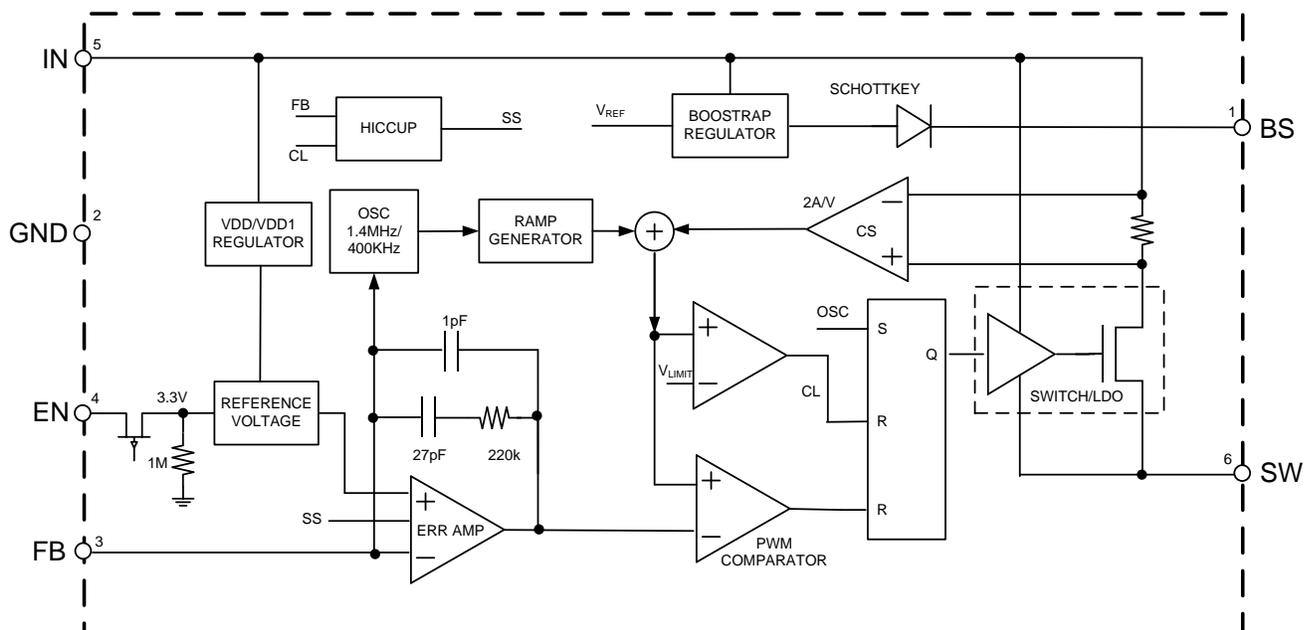
## Typical Applications Circuit



## Pin Descriptions

Pin Number	Pin Name	Function
1	BS	Bootstrap pin. A bootstrap capacitor is connected between the BS pin and SW pin. The voltage across the bootstrap capacitor drives the internal high-side NMOS switch.
2	GND	Ground pin
3	FB	Feedback pin. This pin is connected to an external resistor divider to program the system output voltage. When $V_{FB}$ exceeds 20% of the nominal regulation value of 0.81V, the OVP is triggered. When $V_{FB} < 0.25V$ , the oscillator frequency is lowered to realize short circuit protection.
4	EN	Control input pin. Forcing this pin above 1.5V enables the IC. Forcing this pin below 0.4V shuts down the IC. When the IC is in shutdown mode, all functions are disabled to decrease the supply current below $1\mu A$ .
5	IN	Supply input pin. A capacitor should be connected between the IN pin and GND to keep the DC input voltage constant.
6	SW	Power switch output pin. This pin is connected to the inductor and bootstrap capacitor.

## Functional Block Diagram



## Absolute Maximum Ratings (Note 1)

Symbol	Parameter	Rating	Unit
$V_{IN}$	Input Pin Voltage	-0.3 to 20	V
$V_{EN}$	EN Pin Voltage	-0.3 to $V_{IN}+0.3$	V
$V_{SW}$	SW Pin Voltage	21	V
$V_{BS}$	Bootstrap Pin Voltage	-0.3 to $V_{SW}+6$	V
$V_{FB}$	Feedback Pin Voltage	-0.3 to 6V	V
$\theta_{JA}$	Thermal Resistance	220	°C/W
$T_J$	Operating Junction Temperature	+150	°C
$T_{STG}$	Storage Temperature	-65 to +150	°C
$T_{LEAD}$	Lead Temperature (Soldering, 10sec)	+260	°C
–	ESD (Human Body Model)	2000	V
–	ESD (Machine Model)	200	V

Note 1: 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
$V_{IN}$	Input Voltage	4.5	18	V
$I_{OUT (MAX)}$	Maximum Output Current	1.5	–	A
$T_A$	Operating Ambient Temperature	-40	+85	°C

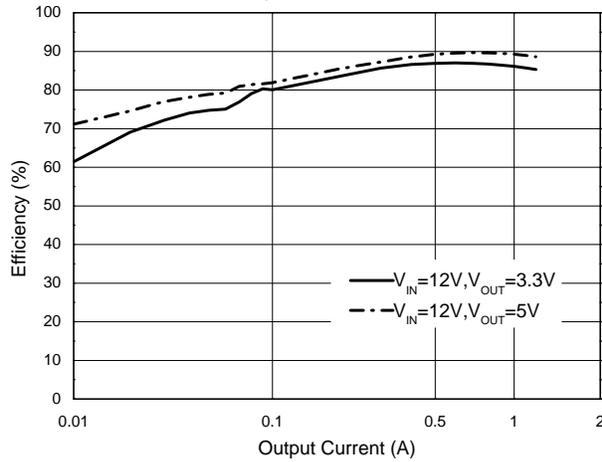
**Electrical Characteristics** ( $V_{IN} = V_{EN} = 12V$ ,  $V_{OUT} = 3.3V$ ,  $T_A = +25^\circ C$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
$V_{IN}$	Input Voltage	–	4.5	–	18	V
$I_Q$	Quiescent Current	$V_{FB} = 0.9V$	–	0.8	1.1	mA
$I_{SHDN}$	Shutdown Supply Current	$V_{EN} = 0V$	–	0.1	1.0	$\mu A$
$V_{FB}$	Feedback Voltage	–	0.785	0.810	0.835	V
$V_{FBOV}$	Feedback Over Voltage Threshold	–	–	0.972	–	V
$I_{FB}$	Feedback Bias Current	$V_{FB} = 0.85V$	-0.1	–	0.1	$\mu A$
$R_{DSON}$	Switch On-resistance	$I_{SW} = 1A$	–	0.35	–	$\Omega$
$I_{LEAK}$	Switch Leakage Current	$V_{IN} = 18V$ , $V_{EN} = 0V$	–	0.1	10	$\mu A$
$I_{LIM}$	Switch Current Limit	–	1.8	2.4	–	A
$V_{ENH}$	EN Pin Threshold	–	1.5	–	–	V
$V_{ENL}$		–	–	–	0.4	
$V_{UVLO}$	Input UVLO Threshold	$V_{IN}$ Rising	3.3	3.8	4.3	V
$V_{HYS}$	Input UVLO Hysteresis	–	–	0.2	–	V
$f_{OSC1}$	Oscillator Frequency	–	1.1	1.4	1.7	MHz
$f_{OSC2}$		Short Circuit	–	460	–	kHz
$D_{MAX}$	Max. Duty Cycle	$V_{FB} = 0.6V$	–	90	–	%
$D_{MIN}$	Min. Duty Cycle	$V_{FB} = 0.9V$	–	–	0	%
$t_{ON}$	Minimum On Time	–	–	100	–	ns
$T_{OTSD}$	Thermal Shutdown	–	–	+160	–	$^\circ C$
$T_{HYS}$	Thermal Shutdown Hysteresis	–	–	+20	–	$^\circ C$
$t_{SS}$	Soft-start Time	–	–	200	–	$\mu s$

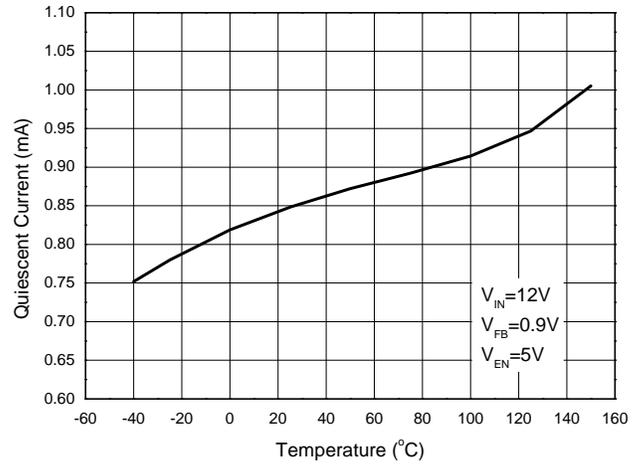
Note 2:  $R_{DSON}$ ,  $t_{ON}$ ,  $T_{OTSD}$ ,  $T_{HYS}$  and  $t_{SS}$  are guaranteed by design.

**Performance Characteristics** ( $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 12\text{V}$ ,  $V_{EN} = 5\text{V}$ ,  $V_{OUT} = 3.3\text{V}$ , unless otherwise noted.)

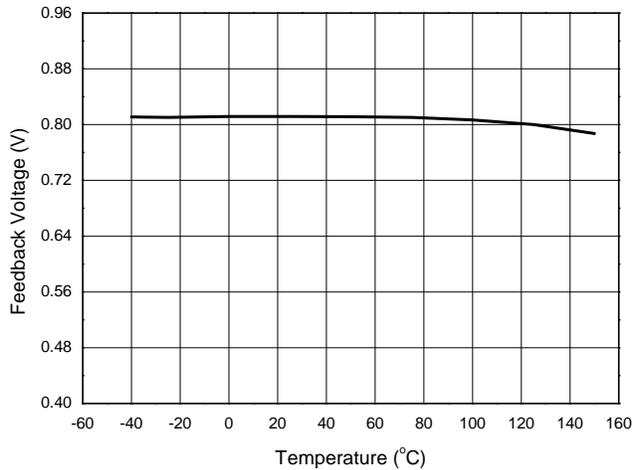
**Efficiency vs. Output Current**



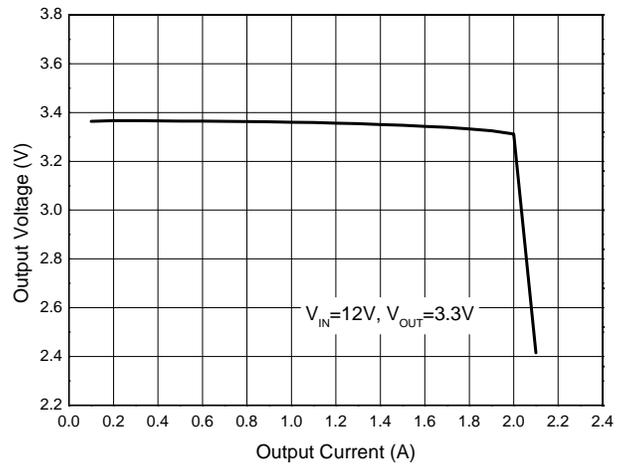
**Quiescent Current vs. Temperature**



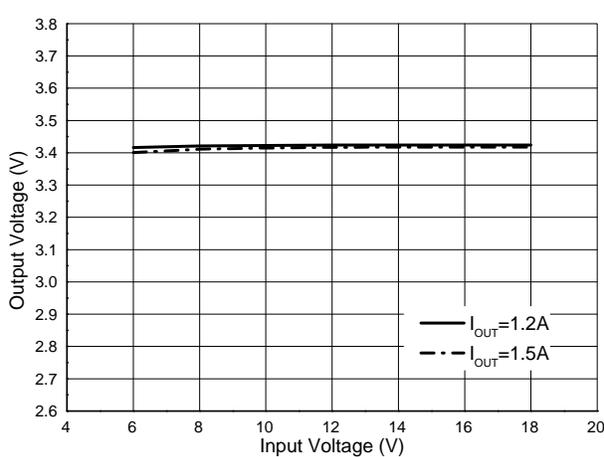
**Feedback Voltage vs. Temperature**



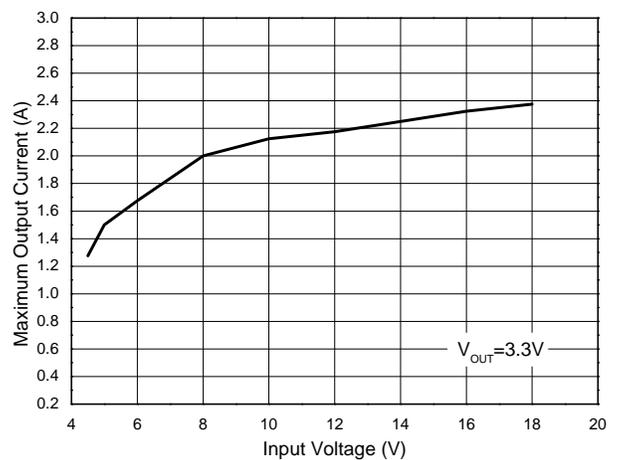
**Output Voltage vs. Output Current**



**Output Voltage vs. Input Voltage**

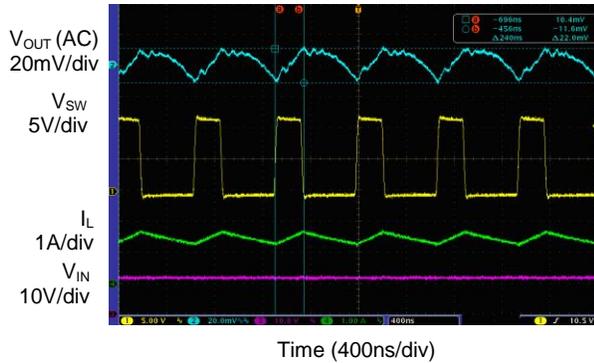


**Maximum Output Current vs. Input Voltage**

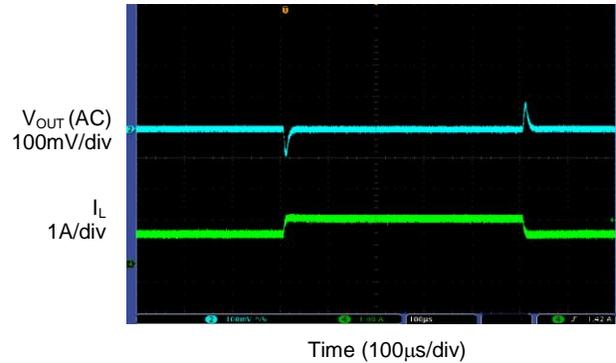


**Performance Characteristics** (Cont.  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 12\text{V}$ ,  $V_{EN} = 5\text{V}$ ,  $V_{OUT} = 3.3\text{V}$ , unless otherwise noted.)

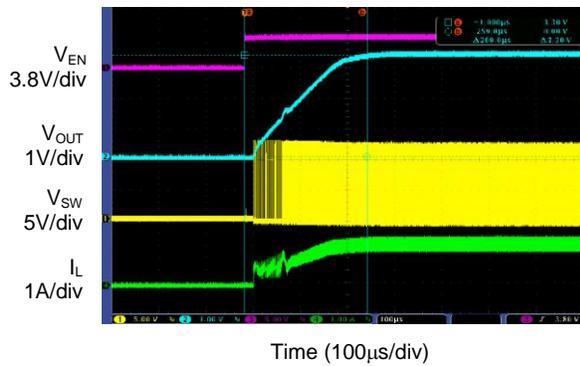
**Output Ripple ( $I_{OUT}=1.5\text{A}$ )**



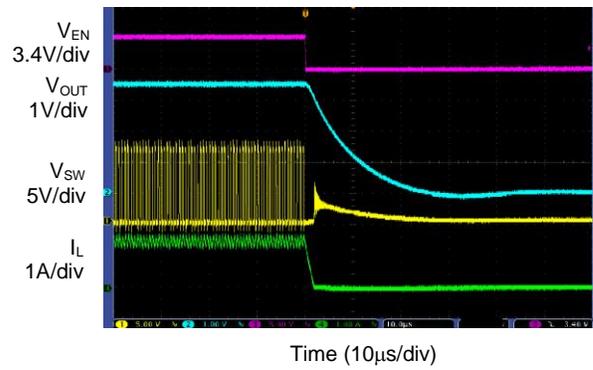
**Load Transient ( $I_{OUT}=1$  to  $1.5\text{A}$ )**



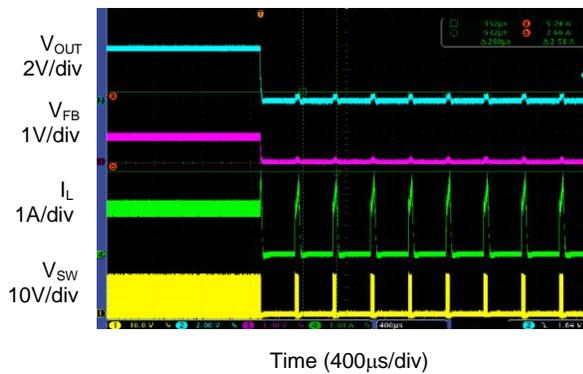
**Enable Turn-on Characteristic (Resistance Load,  $R_{LOAD}=2.6\Omega$ )**



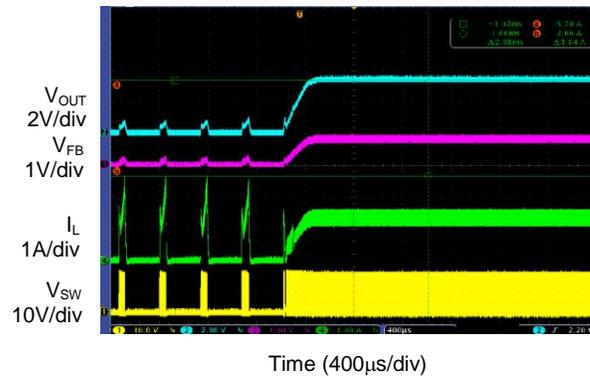
**Enable Turn-off Characteristic (Resistance Load,  $R_{LOAD}=2.6\Omega$ )**



**Short Circuit Protection ( $I_{OUT}=1.5\text{A}$ )**

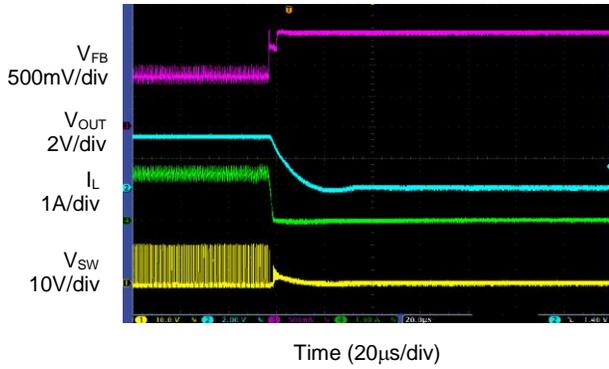


**Short Circuit Recovery ( $R_{LOAD}=2.6\Omega$ )**

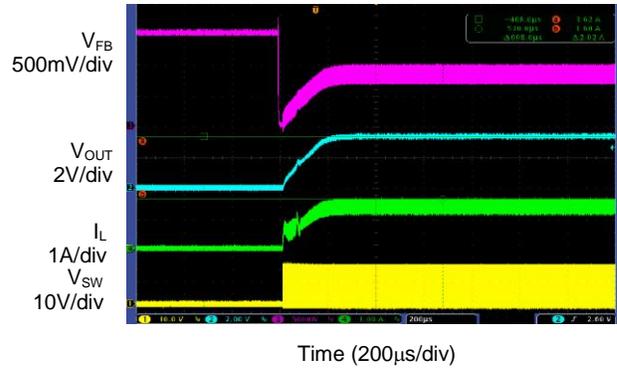


**Performance Characteristics** (Cont.  $T_A = +25^\circ\text{C}$ ,  $V_{IN} = 12\text{V}$ ,  $V_{EN} = 5\text{V}$ ,  $V_{OUT} = 3.3\text{V}$ , unless otherwise noted.)

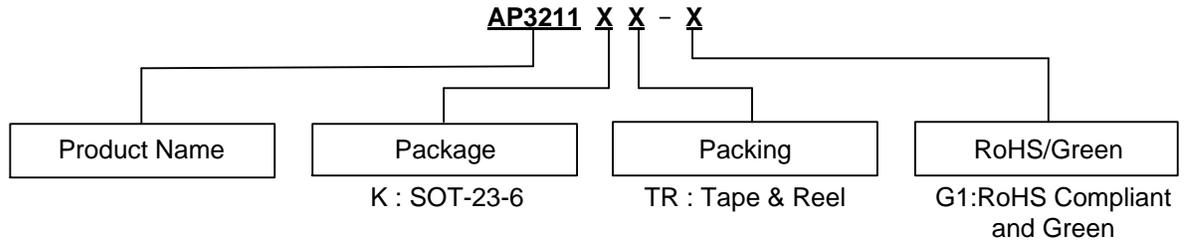
**Over Voltage Protection ( $I_{OUT}=1.5\text{A}$ )**



**Over Voltage Recovery ( $I_{OUT}=1.5\text{A}$ )**



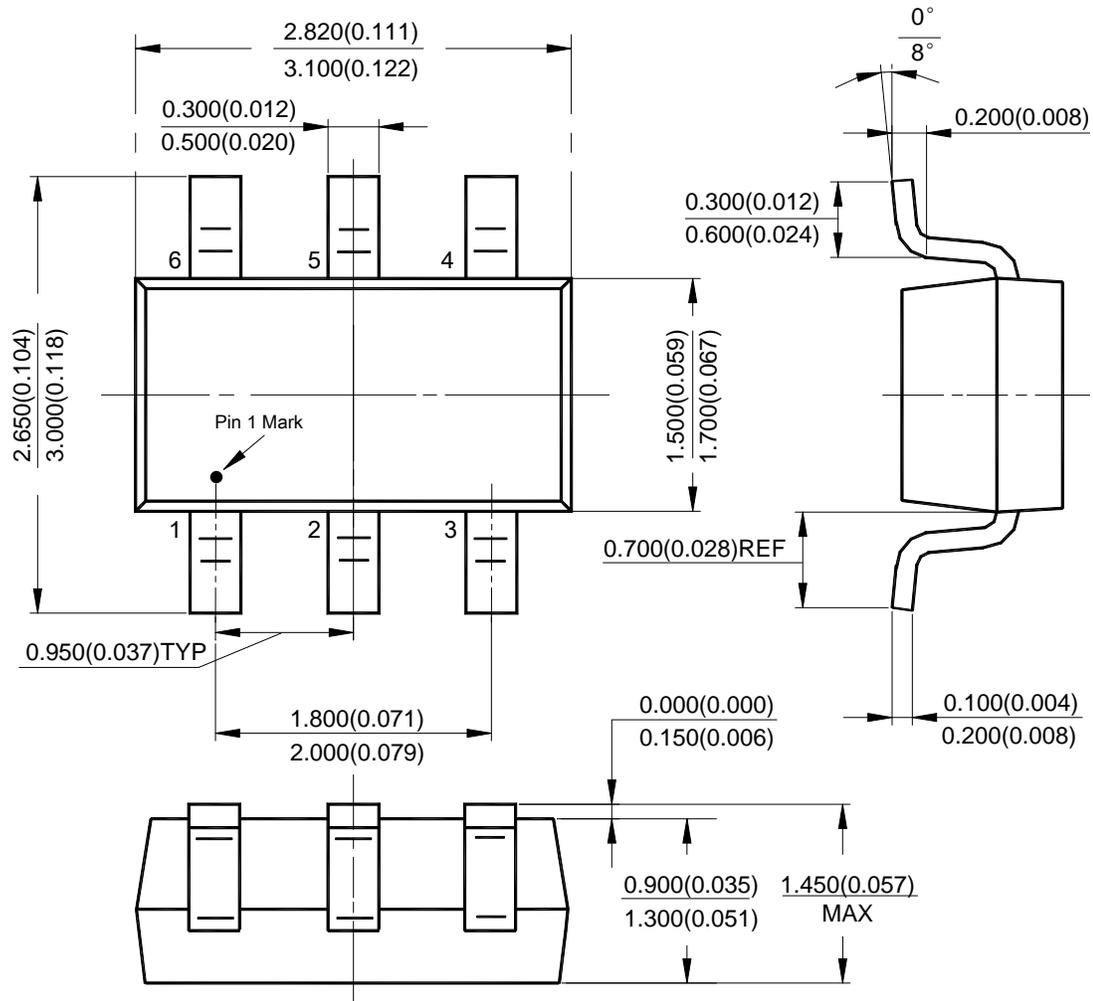
**Ordering Information**



Package	Temperature Range	Part Number	Marking ID	Packing
SOT-23-6	-40 to +85°C	AP3211KTR-G1	GCI	Tape & Reel

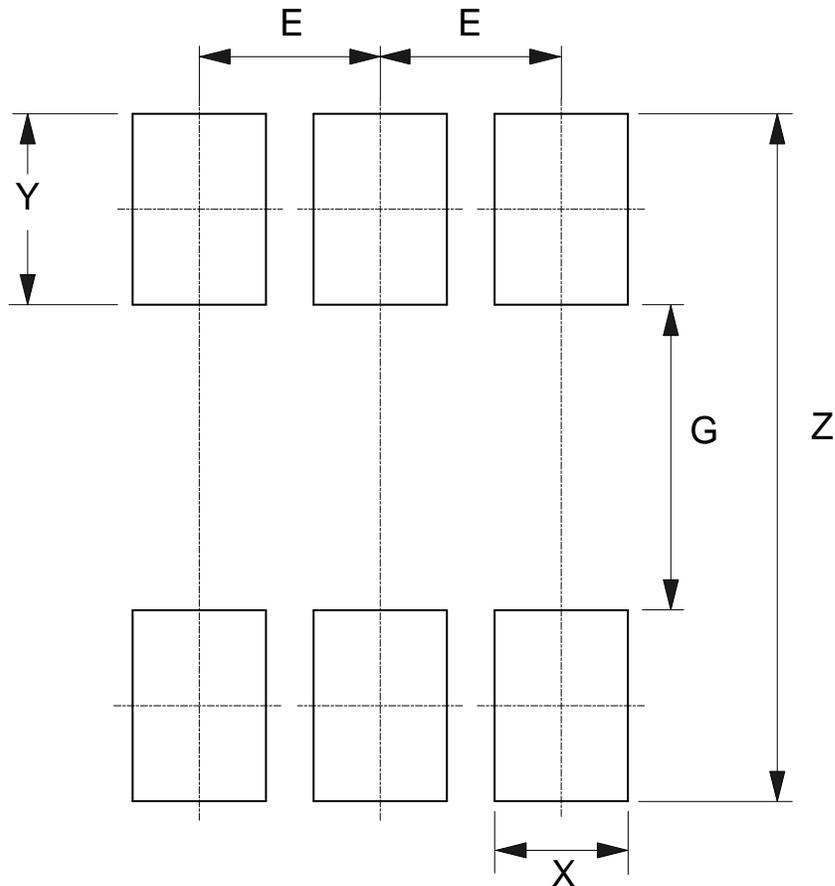
**Package Outline Dimensions** (All dimensions in mm(inch).)

(1) Package Type: SOT-23-6



**Suggested Pad Layout**

(1) Package Type: SOT-23-6



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

**IMPORTANT NOTICE**

DIODES INCORPORATED MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

Diodes Incorporated and its subsidiaries reserve the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. Diodes Incorporated does not assume any liability arising out of the application or use of this document or any product described herein; neither does Diodes Incorporated convey any license under its patent or trademark rights, nor the rights of others. Any Customer or user of this document or products described herein in such applications shall assume all risks of such use and will agree to hold Diodes Incorporated and all the companies whose products are represented on Diodes Incorporated website, harmless against all damages.

Diodes Incorporated does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel. Should Customers purchase or use Diodes Incorporated products for any unintended or unauthorized application, Customers shall indemnify and hold Diodes Incorporated and its representatives harmless against all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized application.

Products described herein may be covered by one or more United States, international or foreign patents pending. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks.

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 Incorporated.

**LIFE SUPPORT**

Diodes Incorporated products are specifically not authorized for use as critical components in life support devices or systems without the express written approval of the Chief Executive Officer of Diodes Incorporated. As used herein:

A. Life support devices or systems are devices or systems which:

1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

Customers represent that they have all necessary expertise in the safety and regulatory ramifications of their life support devices or systems, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of Diodes Incorporated products in such safety-critical, life support devices or systems, notwithstanding any devices- or systems-related information or support that may be provided by Diodes Incorporated. Further, Customers must fully indemnify Diodes Incorporated and its representatives against any damages arising out of the use of Diodes Incorporated products in such safety-critical, life support devices or systems.

Copyright © 2018, Diodes Incorporated

[www.diodes.com](http://www.diodes.com)