1.4MHz, 1.5A ASYNCHRONOUS DC-DC BUCK CONVERTER AP3211

General 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

Applications

- LCD TV
- DPF
- Portable DVD



SOT-23-6

Figure 1. Package Type of AP3211

Pin Configuration

K Package
(SOT-23-6)

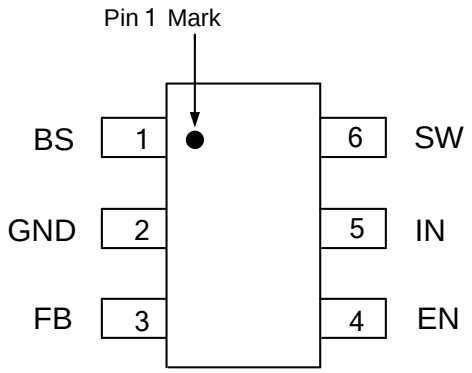


Figure 2. Pin Configuration of AP3211 (Top View)

Pin Description

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 1μA
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

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Functional Block Diagram

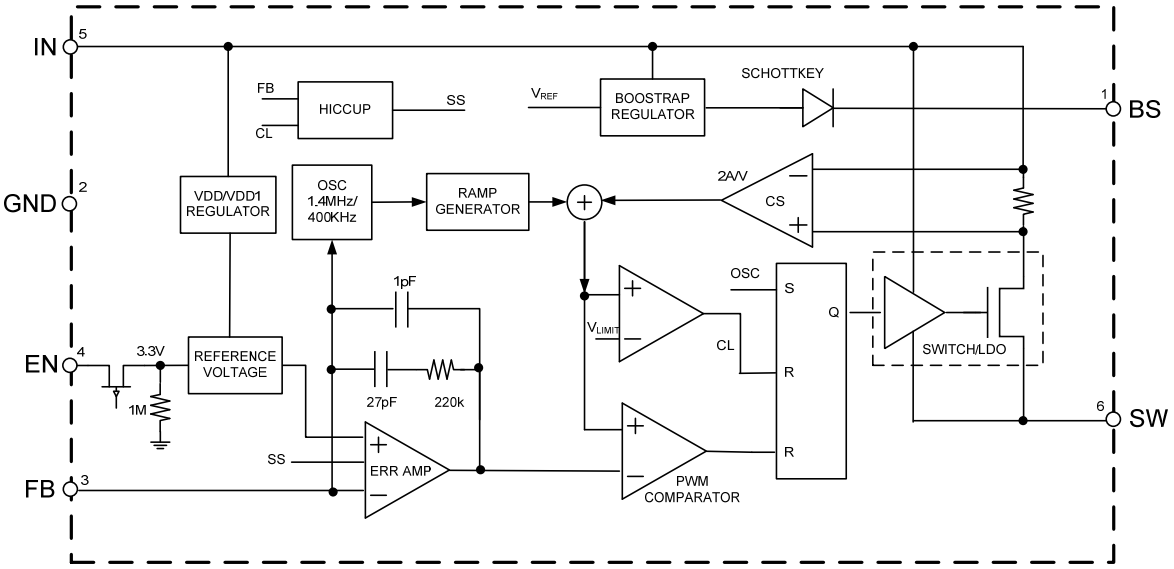
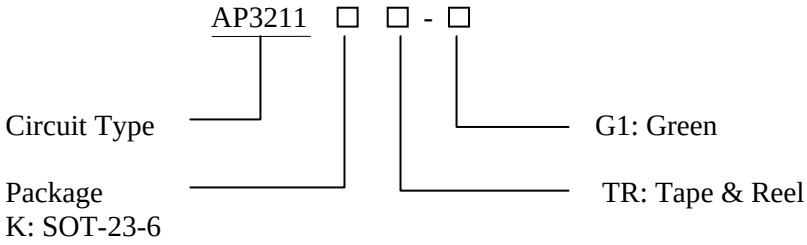


Figure 3. Functional Block Diagram of AP3211

Ordering Information



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

BCD Semiconductor's Pb-free products, as designated with "G1" suffix in the part number, are RoHS compliant and green.

Absolute Maximum Ratings (Note 1)

Parameter	Symbol	Value	Unit
Input Pin Voltage	V_{IN}	-0.3 to 20	V
EN Pin Voltage	V_{EN}	-0.3 to V_{IN}+0.3	V
SW Pin Voltage	V_{SW}	21	V
Bootstrap Pin Voltage	V_{BS}	-0.3 to V_{SW}+6	V
Feedback Pin Voltage	V_{FB}	-0.3 to 6V	V
Thermal Resistance	θ_{JA}	220	ºC/W
Operating Junction Temperature	T_J	150	ºC
Storage Temperature	T_{STG}	-65 to 150	ºC
Lead Temperature (Soldering, 10sec)	T_{LEAD}	260	ºC
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

Parameter	Symbol	Min	Max	Unit
Input Voltage	V_{IN}	4.5	18	V
Maximum Output Current	$I_{OUT\ (MAX)}$	1.5		A
Operating Ambient Temperature	T_A	-40	85	ºC

Electrical Characteristics

V_{IN}=V_{EN}=12V, V_{OUT}=3.3V, T_A=25ºC, unless otherwise specified.

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

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

Typical Performance Characteristics

T_A=25ºC, V_{IN}=12V, V_{EN}=5V, V_{OUT}=3.3V, unless otherwise noted.

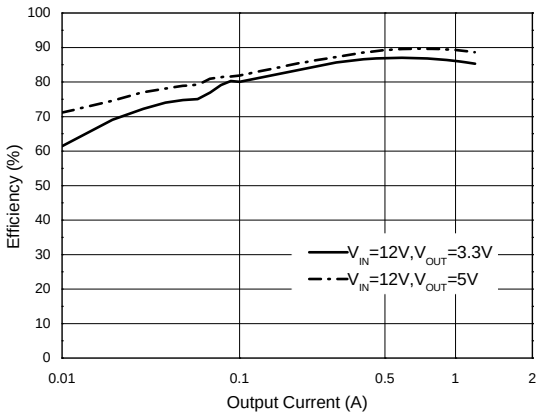


Figure 4. Efficiency vs. Output Current

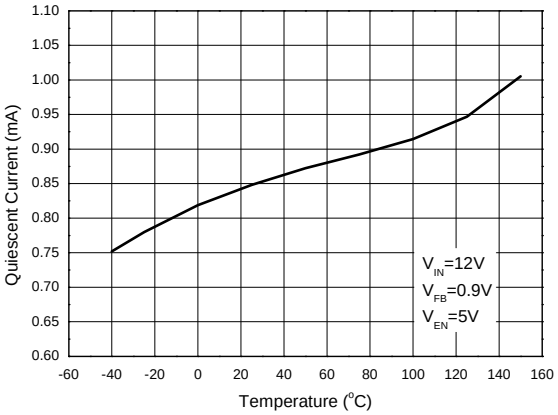


Figure 5. Quiescent Current vs. Temperature

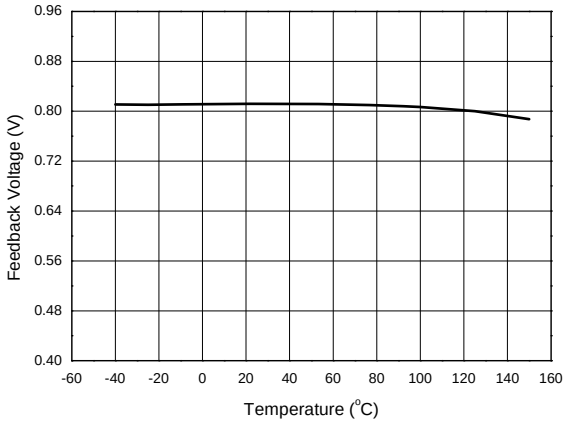


Figure 6. Feedback Voltage vs.Temperature

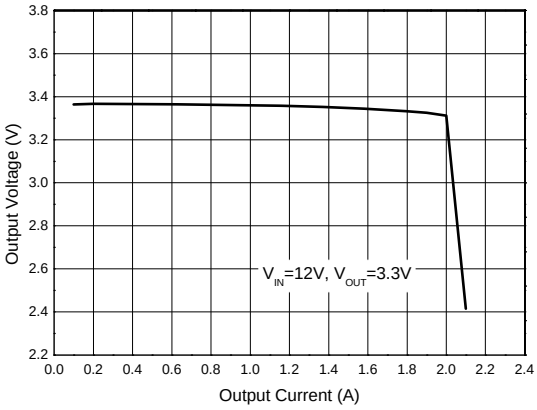


Figure 7. Output Voltage vs. Output Current

Typical Performance Characteristics (Continued)

T_A=25ºC, V_{IN}=12V, V_{EN}=5V, V_{OUT}=3.3V, unless otherwise noted.

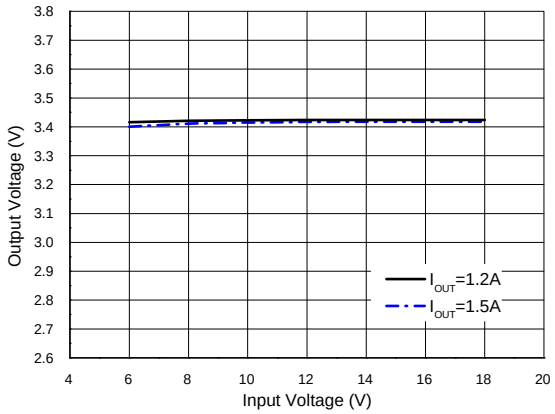


Figure 8. Output Voltage vs. Input Voltage

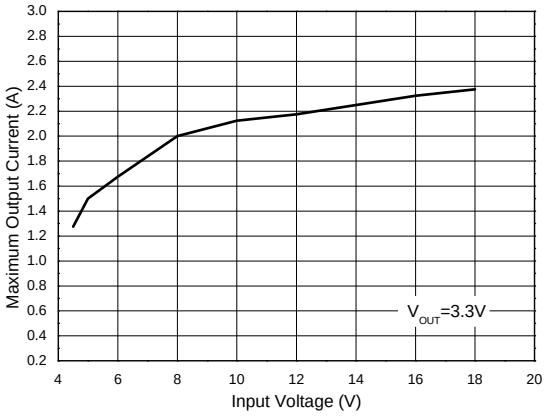


Figure 9. Maximum Output Current vs. Input Voltage

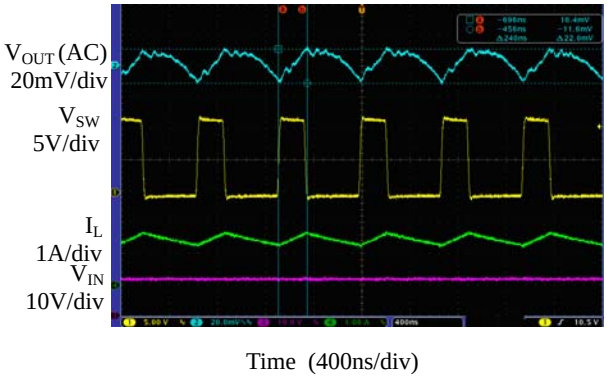


Figure 10. Output Ripple (I_{OUT}=1.5A)

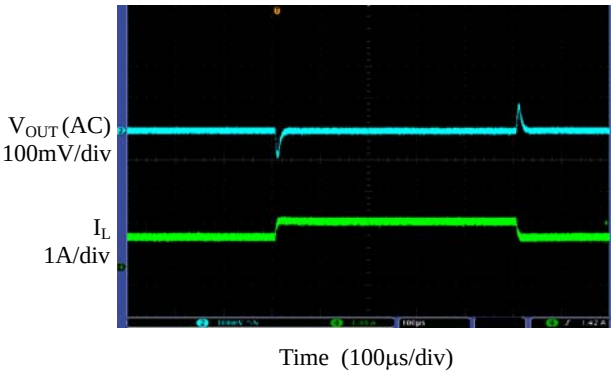


Figure 11.Load Transient (I_{OUT}=1 to 1.5A)

Typical Performance Characteristics (Continued)

T_A=25ºC, V_{IN}=12V, V_{EN}=5V, V_{OUT}=3.3V, unless otherwise noted.

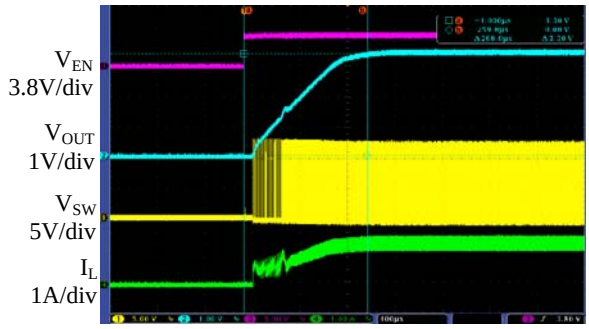


Figure 12. Enable Turn-on Characteristic
(Resistance Load, R_{LOAD}=2.6Ω)

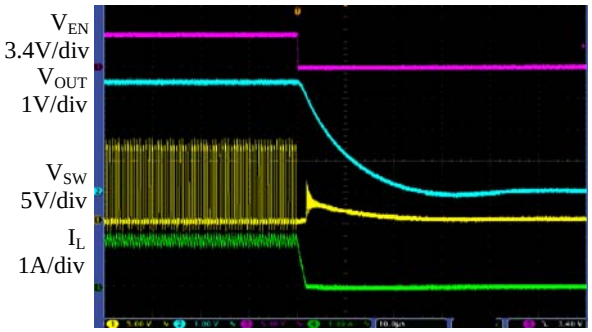


Figure 13. Enable Turn-off Characteristic
(Resistance Load, R_{LOAD}=2.6Ω)

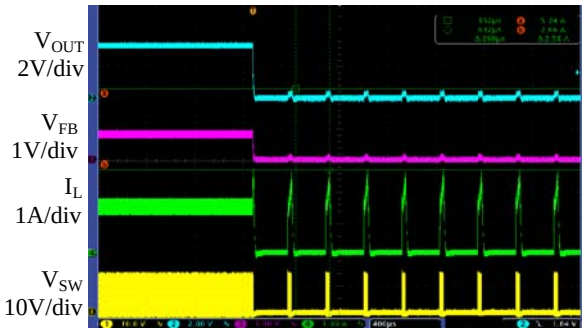


Figure 14. Short Circuit Protection (I_{OUT}=1.5A)

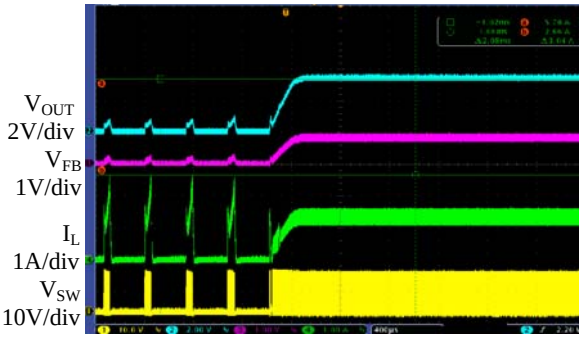


Figure 15.Short Circuit Recovery (R_{LOAD}=2.6Ω)

Typical Performance Characteristics (Continued)

T_A=25ºC, V_{IN}=12V, V_{EN}=5V, V_{OUT}=3.3V, unless otherwise noted.

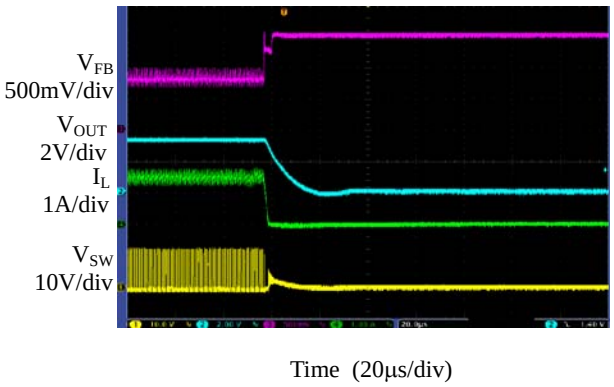


Figure 16. Over Voltage Protection (I_{OUT}=1.5A)

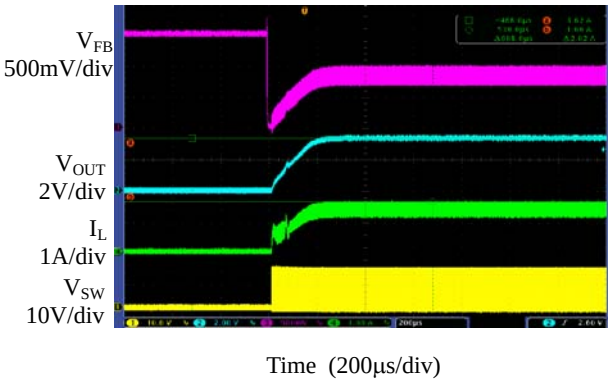


Figure 17. Over Voltage Recovery (I_{OUT}=1.5A)

Typical Application

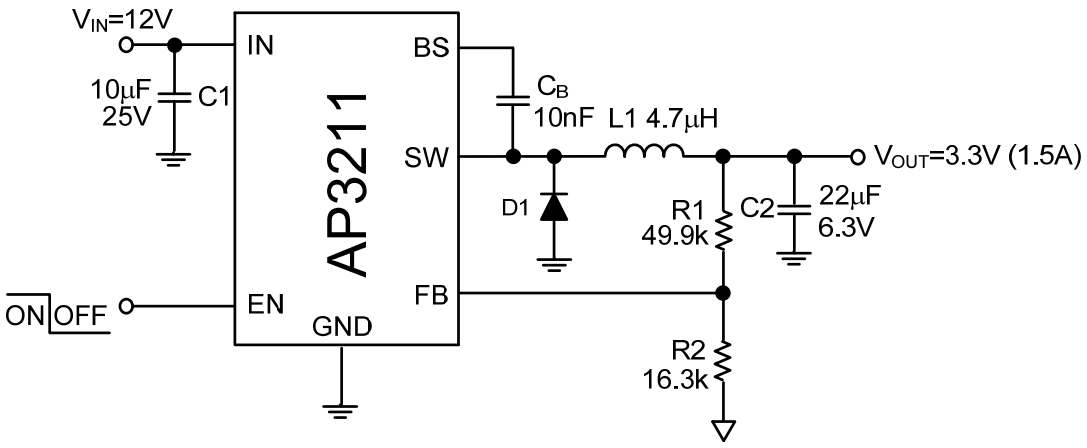
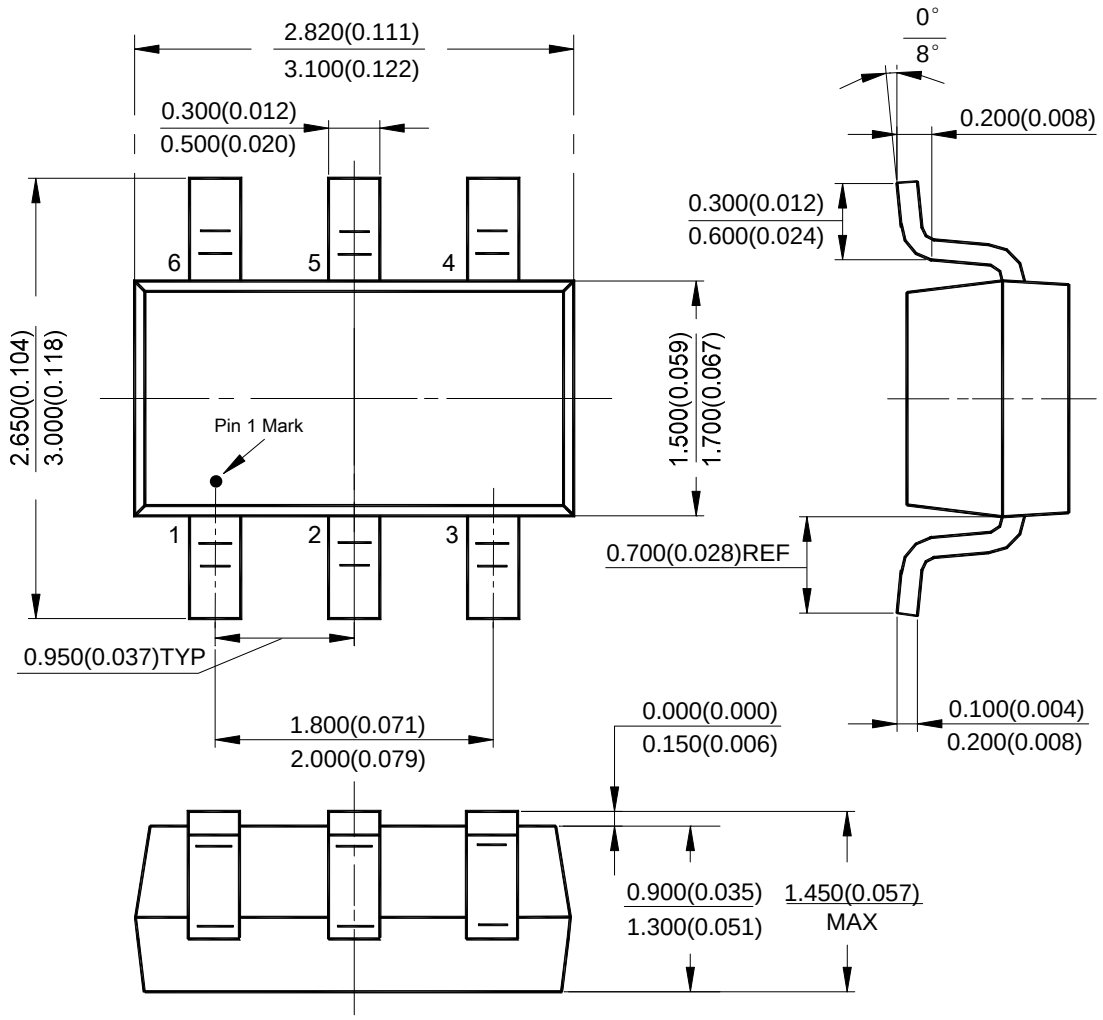


Figure 18. Typical Application Circuit of AP3211

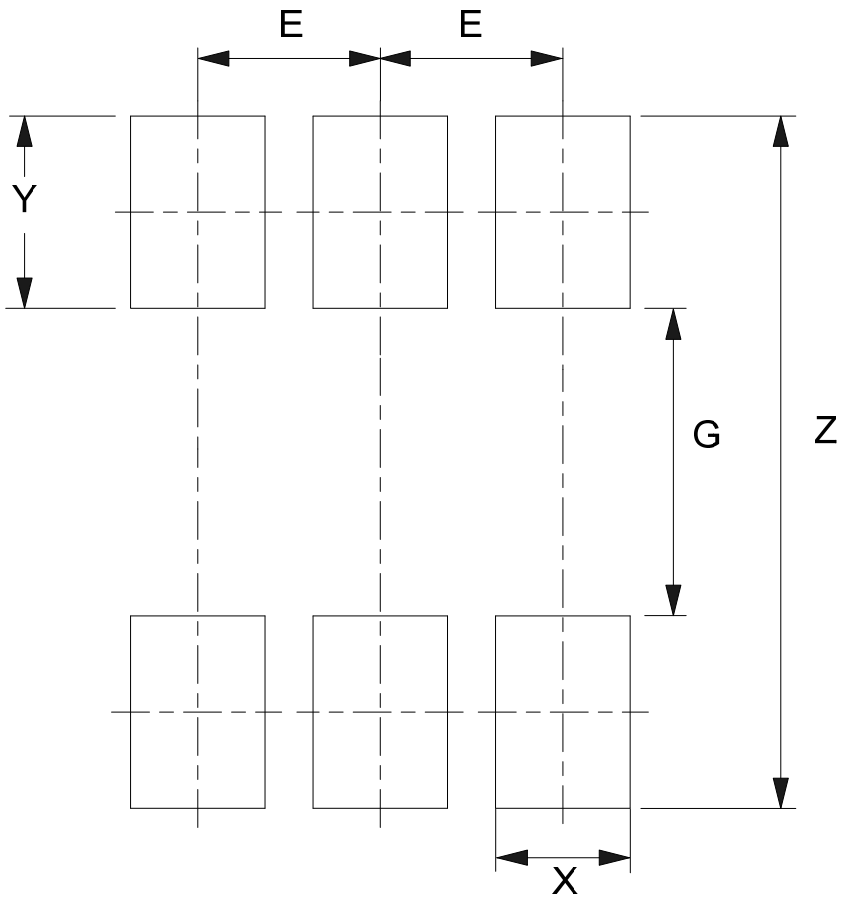
Mechanical Dimensions

SOT-23-6 **Unit: mm(inch)**



Mounting Pad Layout

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



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