AP2132

2A CMOS LDO REGULATOR

Description

The AP2132 series are positive voltage regulator ICs fabricated by CMOS process. The ICs consist of a voltage reference, an error amplifier, a power transistor, a resistor network for setting output voltage, a current limit circuit for current protection, and a chip enable circuit.

The AP2132 have features of large current, low dropout voltage, high output voltage accuracy, and low input voltage. The AP2132 provide a power good (PG) signal to indicate if the voltage level of V_{OUT} reaches 92% of its rating value. And it operates with a V_{IN} as low as 1.4V and V_{PP} voltage 5V with output voltage programmable as low as 0.6V.

The AP2132 are available in 1.2V, 1.5V, 1.8V, 2.5V fixed output voltage versions and adjustable output voltage version. The fixed versions integrate the adjust resistors. It is also available in an adjustable version, which can set the output voltage with external resistor. If the pin of adjustable output voltage is to ground, it will switch to fixed output voltage.

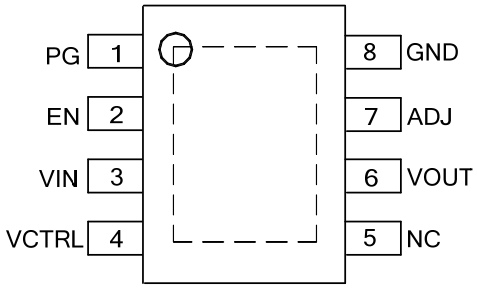
The AP2132 series are available in PSOP-8 package.

Applications

- Notebook

Pin Assignments

(Top View)



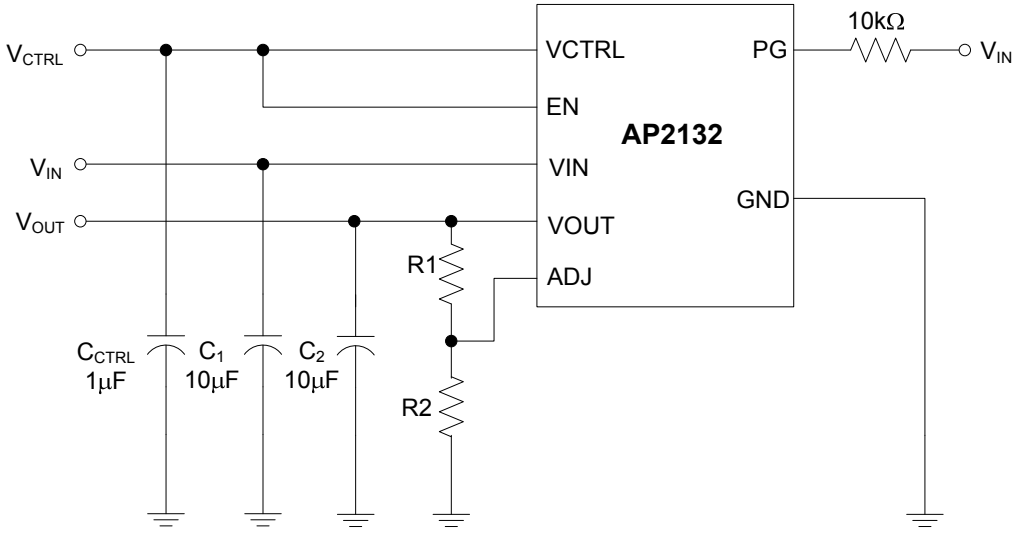
PSOP-8

Features

- Adjustable Output: 0.6V to 3.0V
- Low Dropout Voltage: 300mV@I_{OUT} = 2A, V_{OUT} = 1.2V
- Over Current and Over Temperature Protection
- Enable Pin
- PSOP-8 Package with Thermal Pad
- Maximum Output Current: 2A
- High Output Voltage Accuracy: 2%
- V_{OUT} Power Good Signal
- Excellent Line/Load Regulation
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

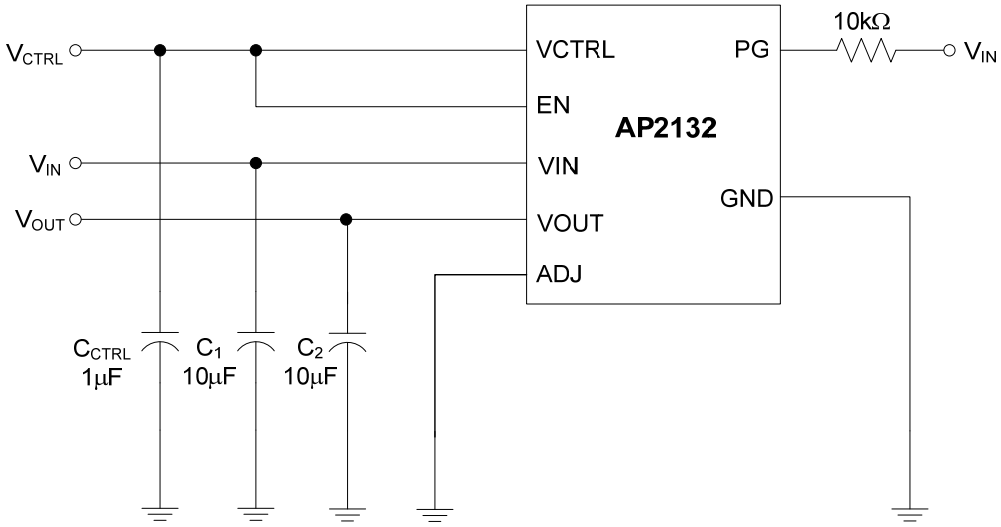
Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.html for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
3. Halogen- and Antimony-free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

Typical Applications Circuit



$$V_{OUT}=\frac{0.6\ (R1+R2)}{R2}$$

Typical Application of AP2132 for Adjustable Version

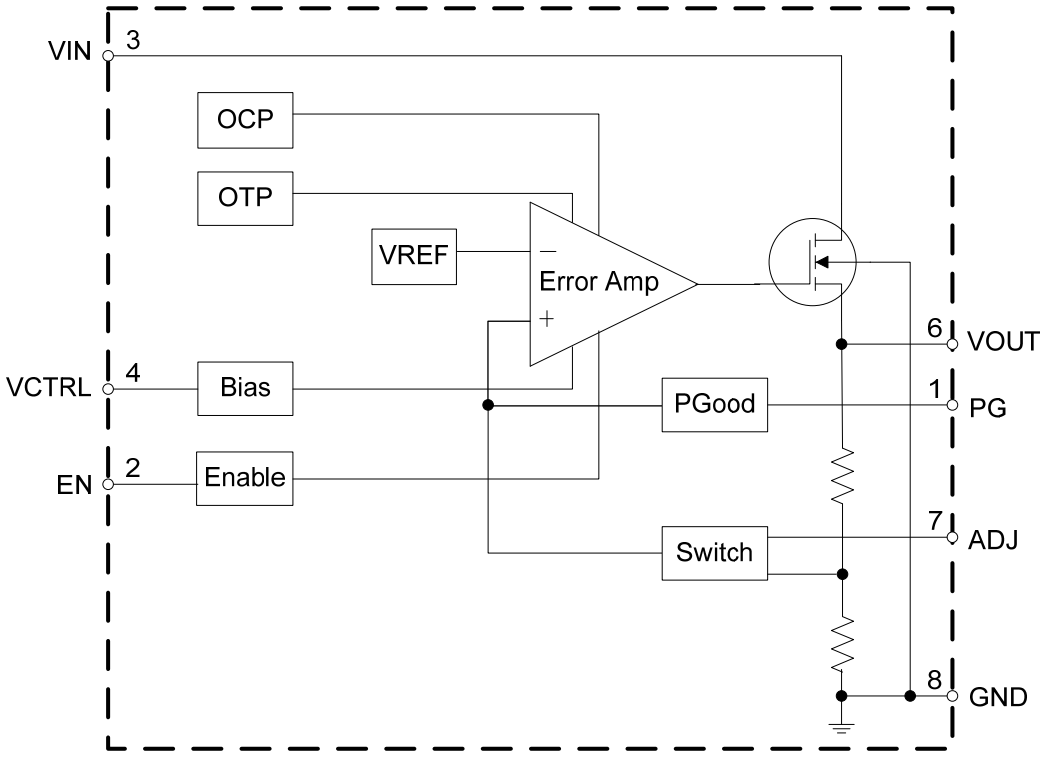


Typical Application of AP2132 for Fixed Version

Pin Description

Pin Number	Pin Name	Function
1	PG	Assert high once V_{OUT} reaches 92% of its rating voltage
2	EN	Enable input
3	VIN	Input voltage
4	VCTRL	Input voltage for controlling circuit
5	NC	Not connected
6	VOUT	Regulated output voltage
7	ADJ	Adjust output: when connected to ground, the output voltage is set by internal resistors; when external feedback resistors are connected, the output voltage will be V_{OUT} = 0.6 (R1+R2)/R2
8	GND	Ground

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Symbol	Parameter	Rating	Unit
V_{IN} V_{CTRL}	Input Voltage Input Voltage for Controlling Circuit	6.0	V
V_{EN}	Enable Input Voltage	-0.3 to 6.0	V
I_{OUT}	Output Current	2.5	A
θ_{JA}	Thermal Resistance (No Heatsink)	130	ºC/W
T_J	Operating Junction Temperature	+150	ºC
T_{STG}	Storage Temperature Range	-65 to +150	ºC
T_{LEAD}	Lead Temperature (Soldering, 10sec)	+260	ºC
–	ESD (Machine Model)	200	V
–	ESD (Human Body Model)	2000	V

Note 4: 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

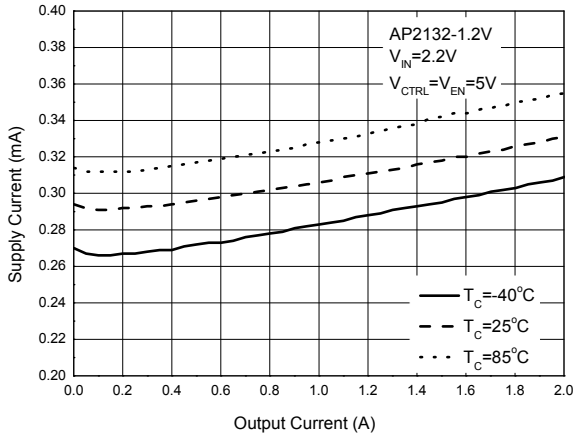
Symbol	Parameter	Min	Max	Unit
V_{IN}	Input Voltage	1.4	5.5	V
V_{CTRL}	Input Voltage for Controlling Circuit	4.5	5.5	V
T_A	Operating Ambient Temperature Range	-40	+85	°C

Electrical Characteristics (@V_{IN} = V_{OUT}+0.5V, V_{CTRL} = V_{EN} = 5V, T_A = +25°C, C_{IN} = C_{OUT} = 10μF, C_{CTRL} = 1μF, I_{OUT} = 10mA, **Bold** typeface applies -40°C ≤ T_A ≤ +85°C unless otherwise specified.)

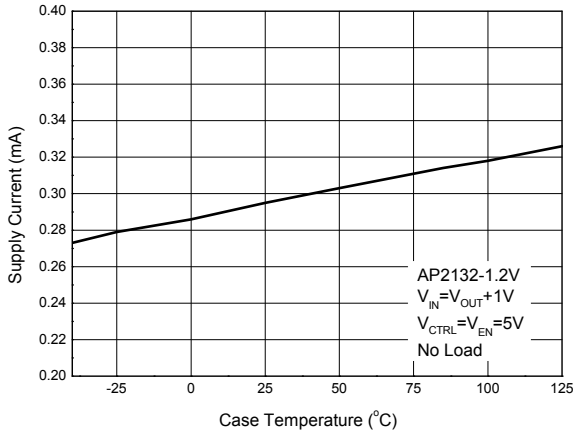
Symbol	Parameter	Conditions		Min	Typ	Max	Unit
V_{OUT}	Output Voltage	V_{IN} = V_{OUT}+0.5V, I_{OUT} =10mA		V_{OUT} × 98%	–	V_{OUT} × 102%	V
V_{IN}	Input Voltage	–		1.4	–	5.5	V
I_{OUT}(max)	Max. Output Current	V_{IN} – V_{OUT} = 1V, V_{OUT} = 98%xV_{OUT}		2	–	–	A
V_{RLOAD}	Load Regulation	V_{IN} = V_{OUT} +0.5V, 10mA ≤ I_{OUT} ≤ 2A		–	10	–	mV
V_{RLINE}	Line Regulation	V_{OUT} + 0.5V ≤ V_{IN} ≤ 5V, I_{OUT} = 10mA		–	2	–	mV
V_{DROP}	Dropout Voltage	I_{OUT} = 500mA		–	80	120	mV
		I_{OUT} = 1A		–	150	200	mV
		I_{OUT} = 2A		–	300	450	mV
I_{SUPPLY}	Supply Current	V_{IN} = V_{OUT}+0.5V, I_{OUT} = 0mA		–	300	–	μA
I_{CTRLH}	VCTRL Current	V_{IN} = V_{OUT}+0.5V, V_{CTRL} = V_{EN} = 5V		–	250	500	μA
I_{CTRLL}		V_{IN} = V_{OUT}+0.5V, V_{CTRL} = 5V, V_{EN} = 0V		–	0.1	1	μA
PSRR	Power Supply Rejection Ratio	Ripple 0.5Vp-p, V_{IN} = V_{OUT}+1V	f = 100Hz	–	60	–	dB
			f = 1kHz	–	60	–	dB
$\frac{\Delta V_{OUT}}{V_{OUT} x \Delta T}$	Output Voltage Temperature Coefficient	I_{OUT} = 10mA, -40°C ≤ T_A ≤ +85°C		–	**±100**	–	ppm/°C
V_{REF}	Reference Voltage	Adjust Short to V_{OUT}		0.588	0.6	0.612	V
–	Enable “High” Voltage	Enable Input Voltage “High”		1.5	–	–	V
–	Enable “Low” Voltage	Enable Input Voltage “Low”		–	–	0.4	V
OTSD	Thermal Shutdown	–		–	+165	–	°C
–	Thermal Shutdown Hysteresis	–		–	+20	–	°C
V_{THPG}	V_{OUT} Power Good Voltage	–		–	92	–	%
–	V_{PG} Hysteresis	–		–	7	–	%
–	Adjust Pin Threshold	–		–	200	–	mV
θ_{JC}	Thermal Resistance (Junction to Case)	PSOP-8		–	40	–	°C/W

Performance Characteristics

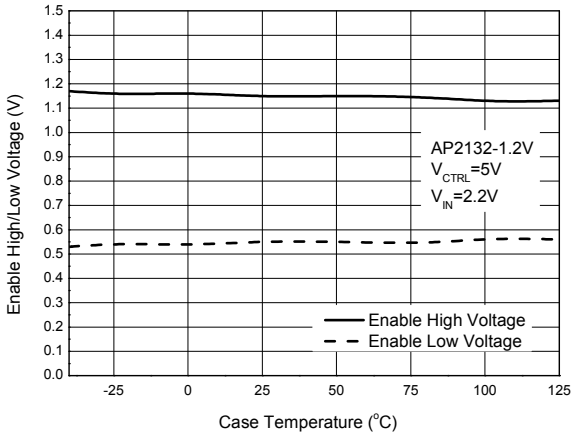
Supply Current vs. Output Current



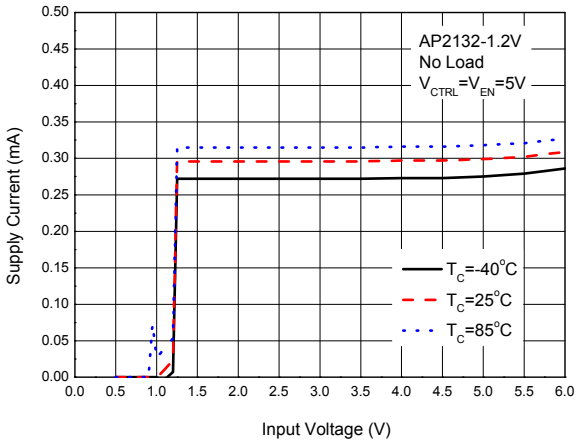
Supply Current vs. Case Temperature



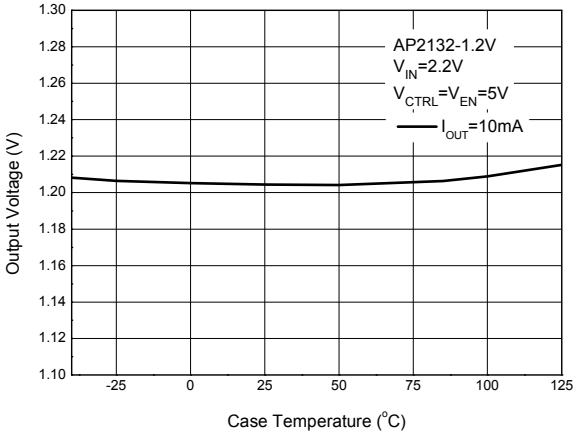
Enable High/Low Voltage vs. Case Temperature



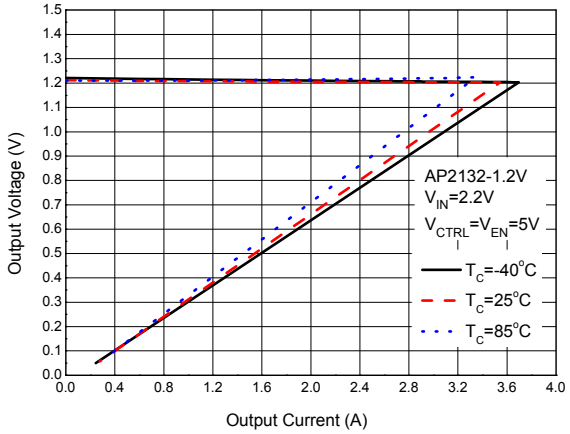
Supply Current vs. Input Voltage



Output Voltage vs. Case Temperature

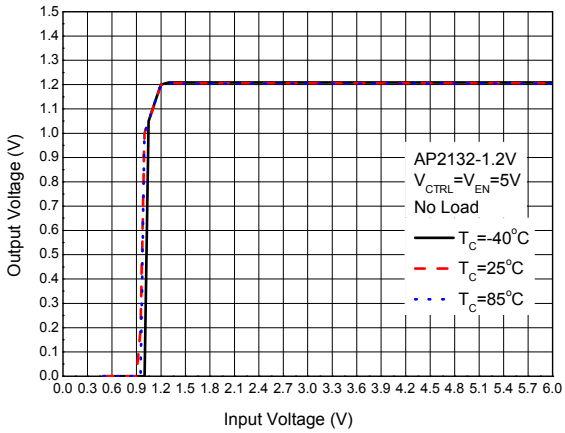


Output Voltage vs. Output Current

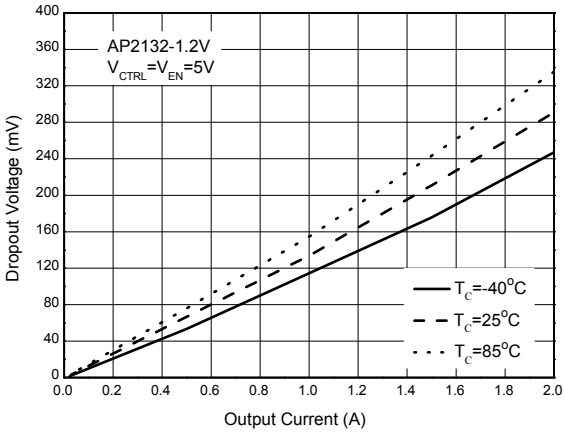


Performance Characteristics (Cont.)

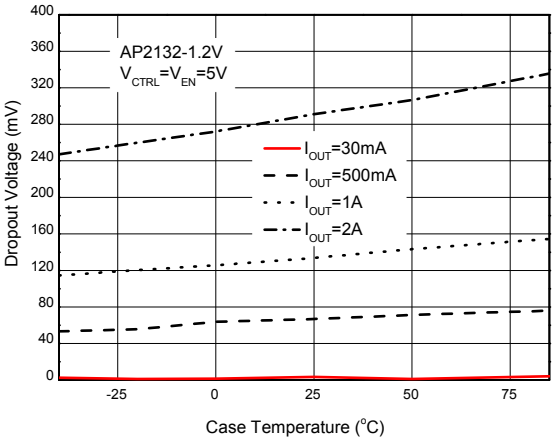
Output Voltage vs. Input Voltage



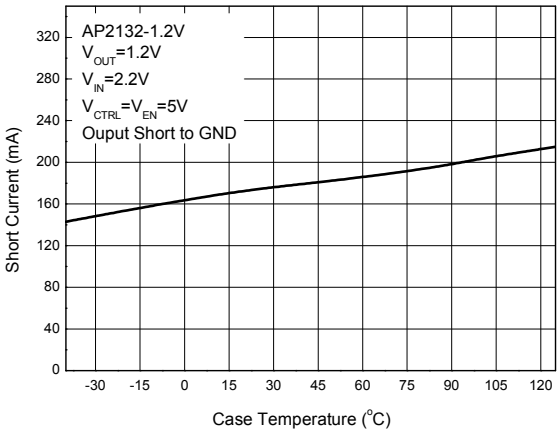
Dropout Voltage vs. Output Current



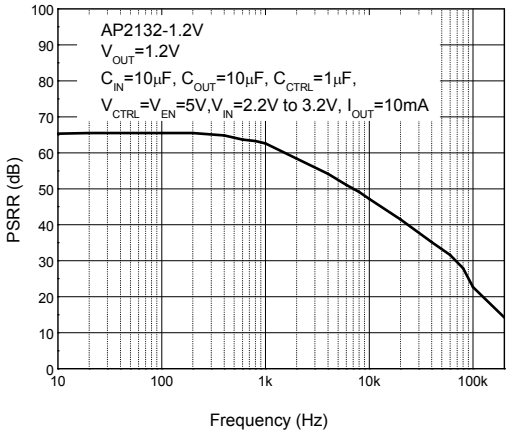
Dropout Voltage vs. Case Temperature



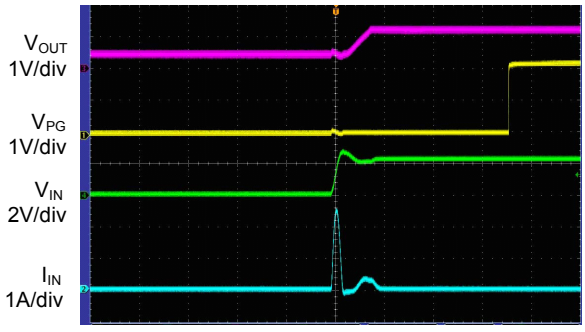
Short Current vs. Case Temperature



PSRR vs. Frequency

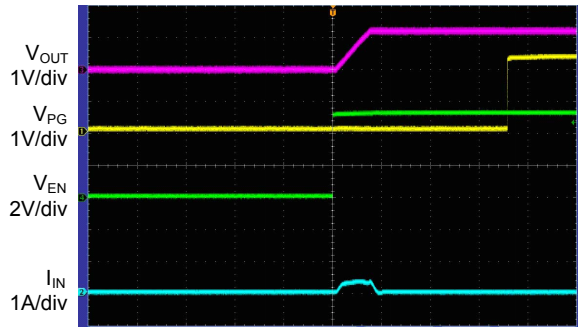


V_{IN} Start up Waveform (V_{CTRL}=V_{EN}=5V, V_{IN}=0 to 2.2V, No Load)

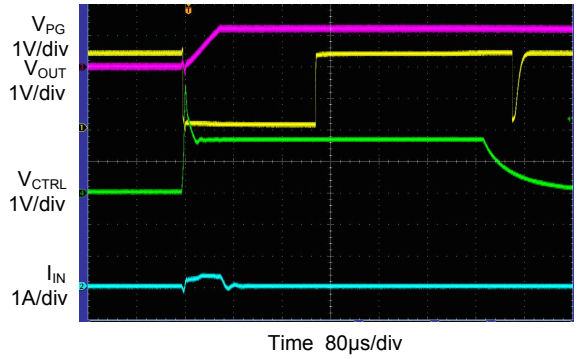


Performance Characteristics (Cont.)

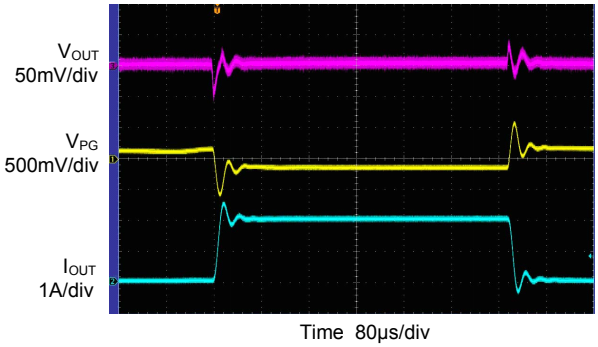
V_{EN} Start up Waveform
(V_{CTRL}=5V, V_{EN}=0 to 5V, V_{IN}=2.2V, No Load)



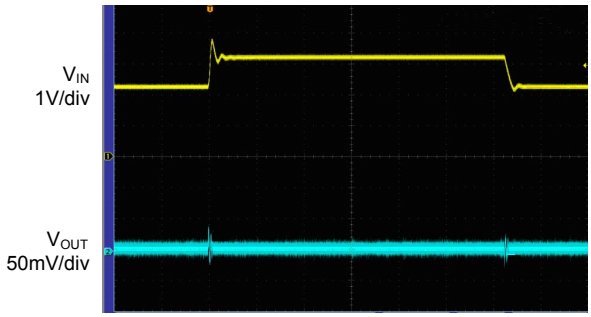
V_{CTRL} Start up and Shut down Waveform
(V_{CTRL}=0 to 5V, V_{EN}=5V, V_{IN}=2.2V, No Load)



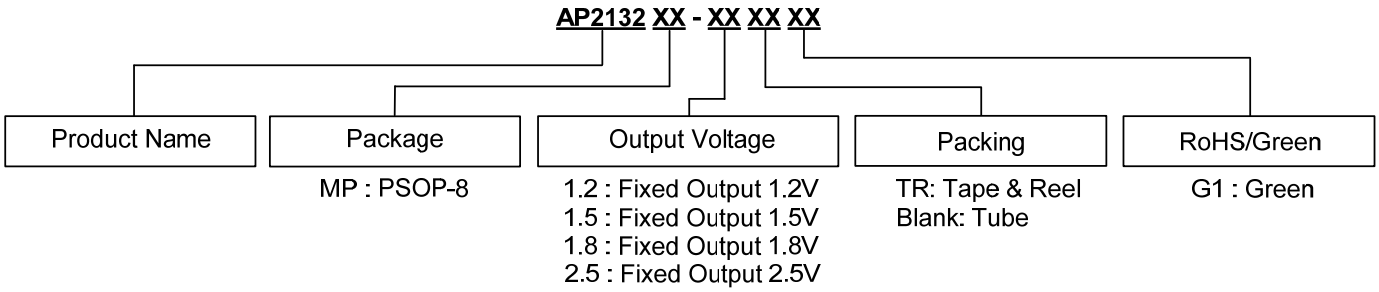
Load Transient
(V_{CTRL}=V_{EN}=5V, V_{IN}=2.2V, I_{OUT}=0 to 2A)



Line Transient
(V_{CTRL}=V_{EN}=5V, C_{IN}=C_{CTRL}=1μF, C_{OUT}=10μF, V_{IN}=2.2V to 3.2V, I_{OUT}=10mA)



Ordering Information

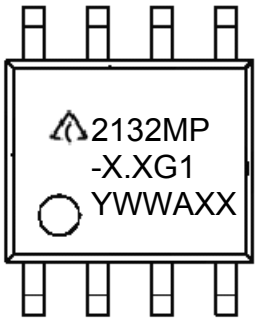


Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

Package	Temperature Range	Version Description	Part Number	Marking ID	Packing
PSOP-8	-40 to +85°C	Each fixed output version integrates ADJ version	AP2132MP-1.2G1	2132MP-1.2G1	100/Tube
			AP2132MP-1.2TRG1	2132MP-1.2G1	4000/Tape & Reel
			AP2132MP-1.5G1	2132MP-1.5G1	100/Tube
			AP2132MP-1.5TRG1	2132MP-1.5G1	4000/Tape & Reel
			AP2132MP-1.8G1	2132MP-1.8G1	100/Tube
			AP2132MP-1.8TRG1	2132MP-1.8G1	4000/Tape & Reel
			AP2132MP-2.5G1	2132MP-2.5G1	100/Tube
			AP2132MP-2.5TRG1	2132MP-2.5G1	4000/Tape & Reel

Marking Information

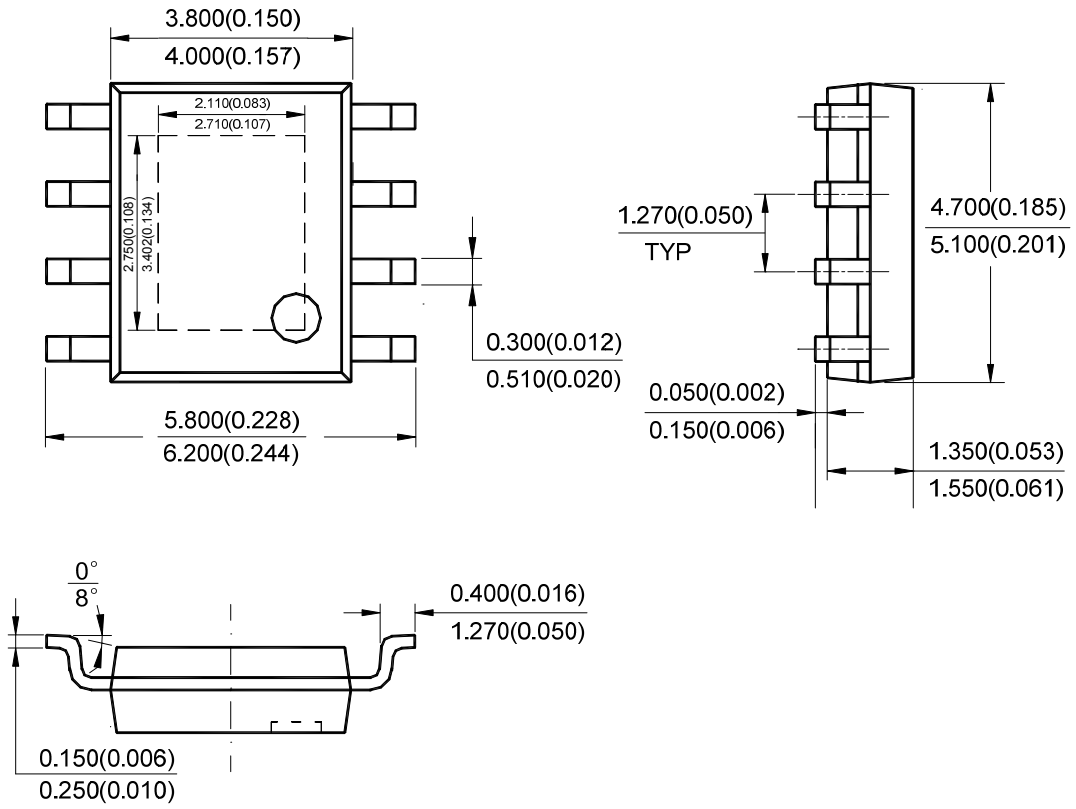
(Top View)



First and Second Lines: Logo and Marking ID
(See Ordering Information)
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: 7th and 8th Digits of Batch No.

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

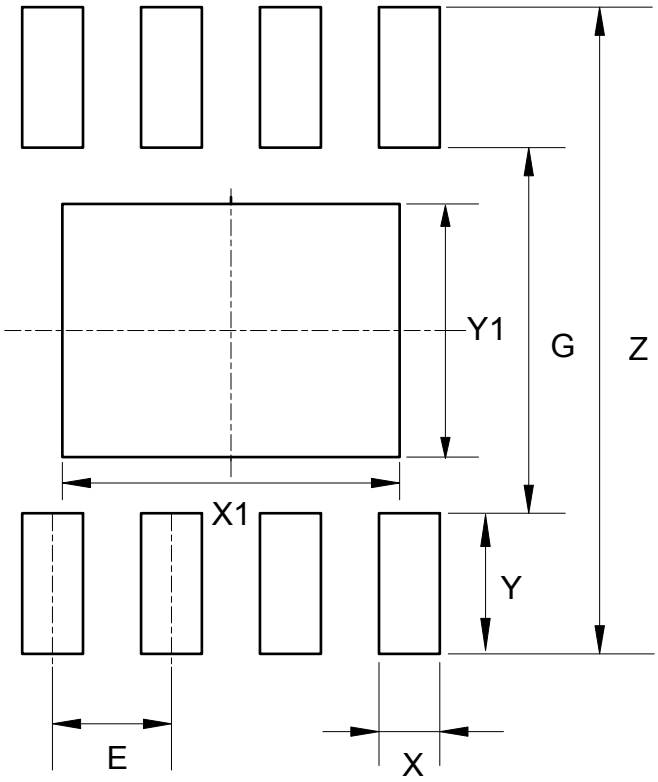
(1) Package Type: PSOP-8



Note: Eject hole, oriented hole and mold mark is optional.

Suggested Pad Layout

(1) Package Type: PSOP-8



Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	X1 (mm)/(inch)	Y1 (mm)/(inch)	E (mm)/(inch)
Value	6.900/0.272	3.900/0.154	0.650/0.026	1.500/0.059	3.600/0.142	2.700/0.106	1.270/0.050

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