



YOUSHANG SEMICONDUCTOR

设计研发新型功率器件

各类小信号开关

中低压及高压大电流等场效应管

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Description

The NK-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 NK-AP2132 have features of large current, low dropout voltage, high output voltage accuracy, and low input voltage. The NK-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 NK-AP2132 ADJ pin is unique as it has two specific modes.

Internal Mode:

The ADJ pin is grounded the internal resistors are used and the output voltages can be 1.2V, 1.5V, 1.8V, or 2.5V as ordered by a specific part number.

External Mode:

The ADJ pin is not grounded but connected to an external resistor divider. In this mode the device is truly adjustable and the internal resistors are ignored. This is true for all of the versions.

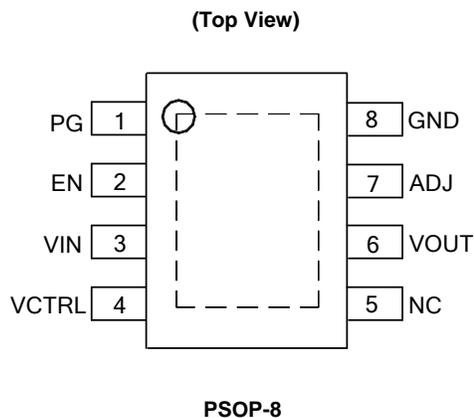
The NK-AP2132 are available in 1.2V, 1.5V, 1.8V, 2.5V fixed output voltage versions and adjustable output voltage version. The fixed versions integrate the adjust resistors. It is also available in an adjustable version, which can set the output voltage with external resistor. If the pin of adjustable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

The NK-AP2132 series are available in PSOP-8 package.

Applications

- Notebook

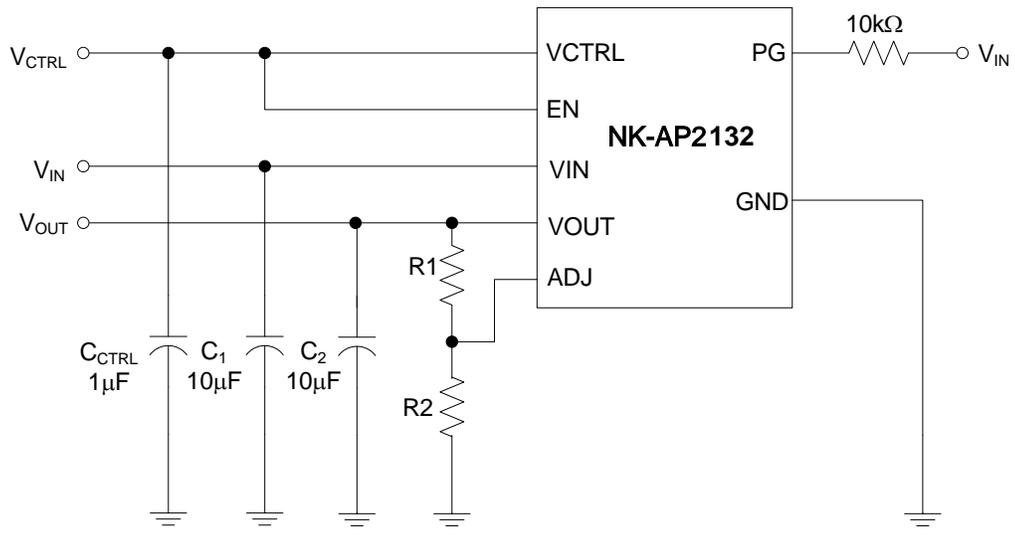
Pin Assignments



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

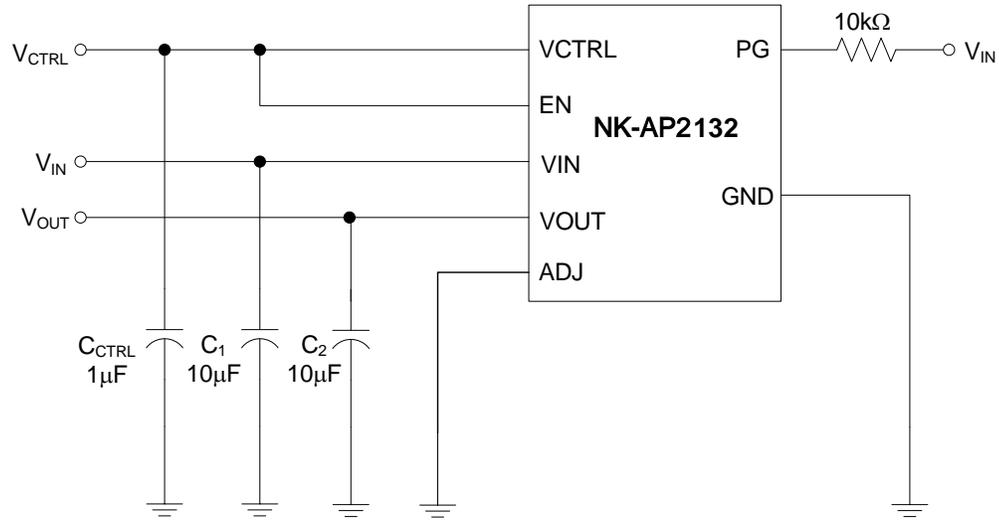
Typical Applications Circuit



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

Do not program below 0.6V

Typical Application of NK-AP2132 for Adjustable Version

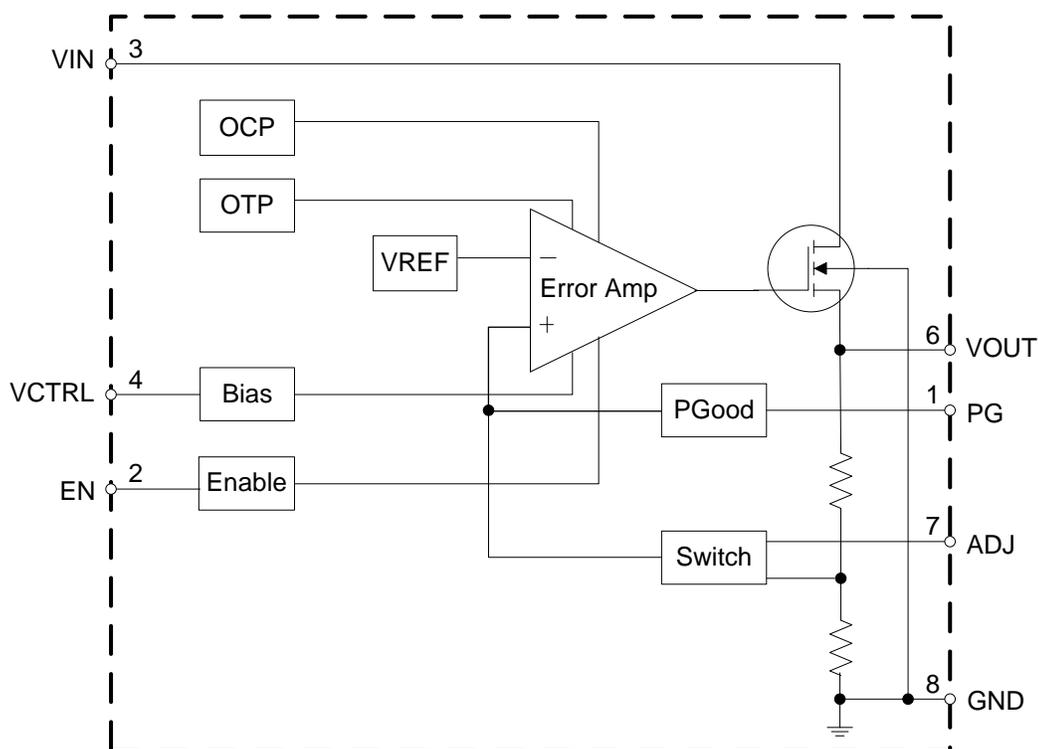


Typical Application of NK-AP2132 for Fixed Version

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	Internal Mode ADJ is connected to ground. The output voltage is set by internal resistors External Mode ADJ is connected to external feedback resistors. The output voltage will be $V_{OUT} = 0.6 (R1+R2)/R2$. Do not program below 0.6V
8	GND	Ground
Thermal Pad	GND or Open	The pad may be grounded or left open. This does not replace the need for ground on Pin 8.

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	°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)	200	V
—	ESD (Human Body Model)	2000	V

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

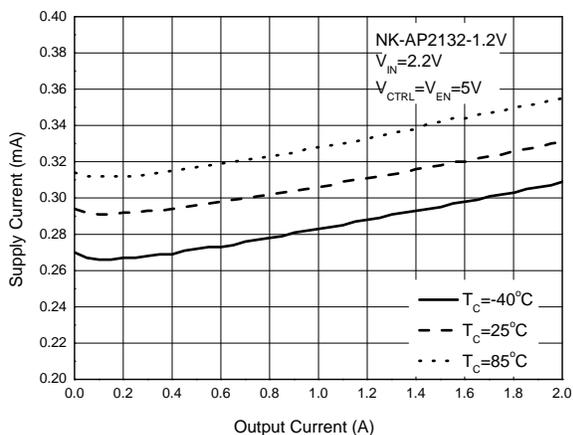
Symbol	Parameter	Min	Max	Unit
V _{IN}	Input Voltage	1.4	5.5	V
V _{CTRL}	Input Voltage for Controlling Circuit	4.5	5.5	V
T _A	Operating Ambient Temperature Range	-40	+85	°C

Electrical Characteristics (@ $V_{IN} = V_{OUT} + 0.5V$, $V_{CTRL} = V_{EN} = 5V$, $T_A = +25^\circ C$, $C_{IN} = C_{OUT} = 10\mu F$, $C_{CTRL} = 1\mu F$, $I_{OUT} = 10mA$, **Bold** typeface applies $-40^\circ C \leq T_A \leq +85^\circ C$ unless otherwise specified.)

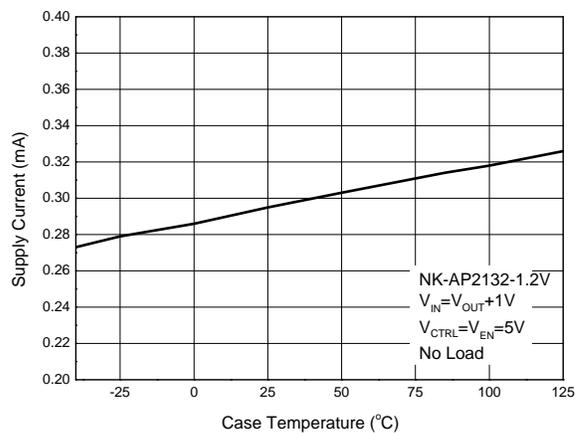
Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
V_{OUT}	Output Voltage	$V_{IN} = V_{OUT} + 0.5V$, $I_{OUT} = 10mA$	$V_{OUT} \times 98\%$	—	$V_{OUT} \times 102\%$	V	
V_{IN}	Input Voltage	—	1.4	—	5.5	V	
$I_{OUT(max)}$	Max. Output Current	$V_{IN} - V_{OUT} = 1V$, $V_{OUT} = 98\% \times V_{OUT}$	2	—	—	A	
V_{RLOAD}	Load Regulation	$V_{IN} = V_{OUT} + 0.5V$, $10mA \leq I_{OUT} \leq 2A$	—	10	—	mV	
V_{RLINE}	Line Regulation	$V_{OUT} + 0.5V \leq V_{IN} \leq 5V$, $I_{OUT} = 10mA$	—	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	
$I_{CTRL L}$		$V_{IN} = V_{OUT} + 0.5V$, $V_{CTRL} = 5V$, $V_{EN} = 0V$	—	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
$\frac{\Delta V_{OUT}}{V_{OUT} \times \Delta T}$	Output Voltage Temperature Coefficient	$I_{OUT} = 10mA$, $-40^\circ C \leq T_A \leq +85^\circ C$	—	± 100	—	ppm/ $^\circ C$	
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	—	$^\circ C$	
—	Thermal Shutdown Hysteresis	—	—	+20	—	$^\circ C$	
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	—	$^\circ C/W$	

Performance Characteristics

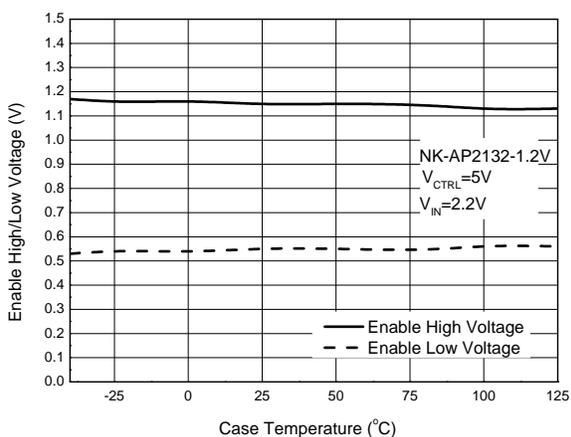
Supply Current vs. Output Current



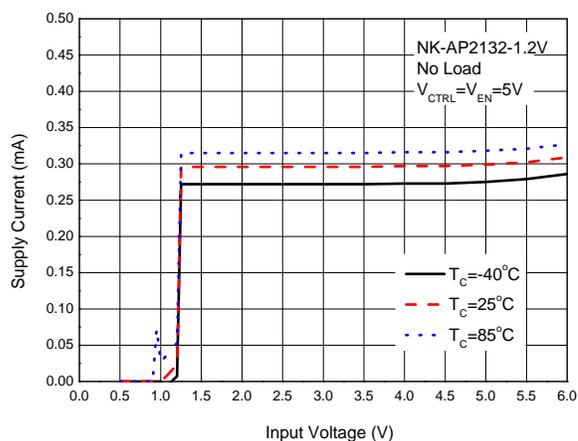
Supply Current vs. Case Temperature



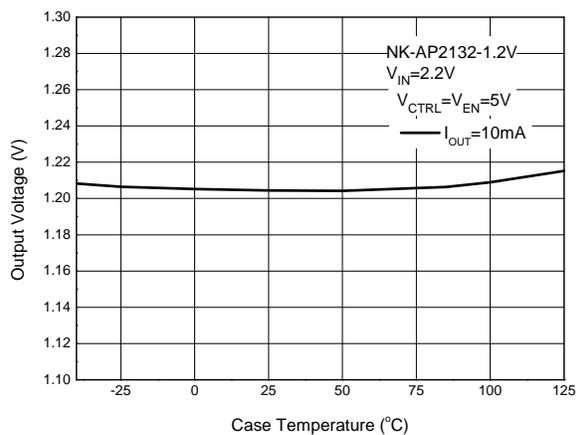
Enable High/Low Voltage vs. Case Temperature



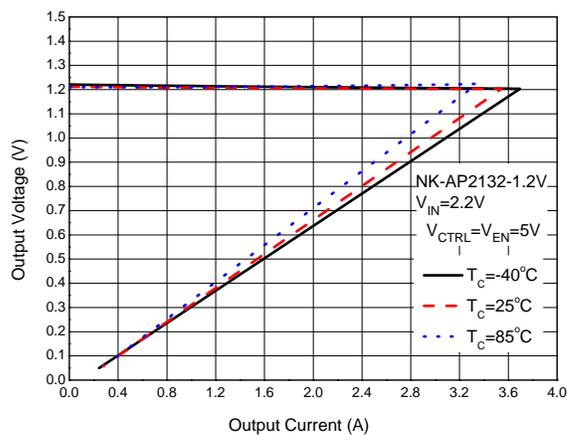
Supply Current vs. Input Voltage



Output Voltage vs. Case Temperature

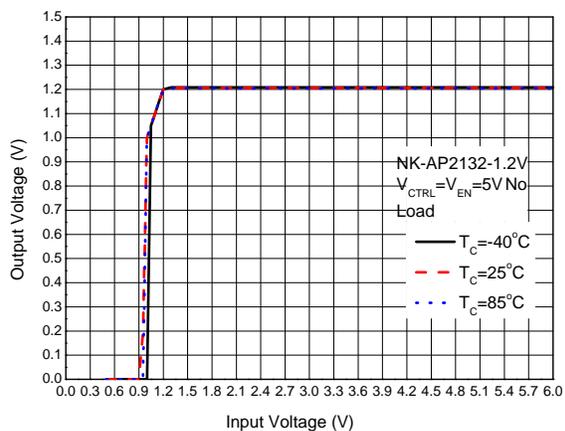


Output Voltage vs. Output Current

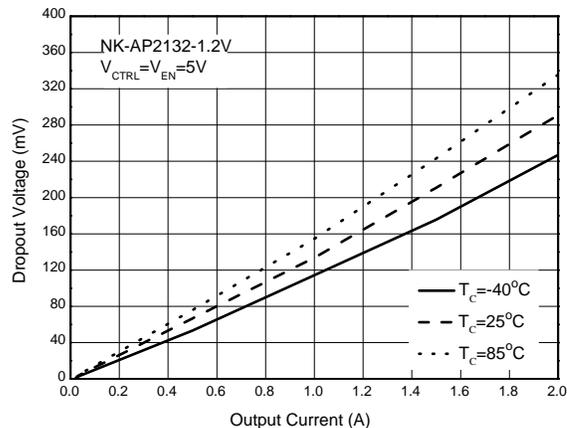


Performance Characteristics (continued)

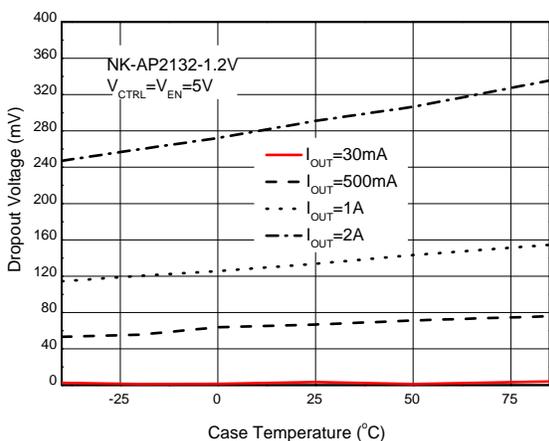
Output Voltage vs. Input Voltage



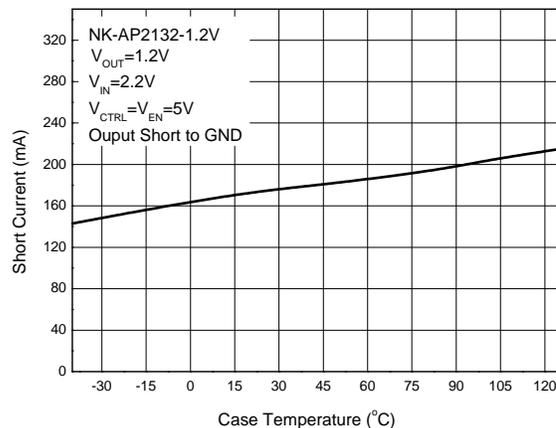
Dropout Voltage vs. Output Current



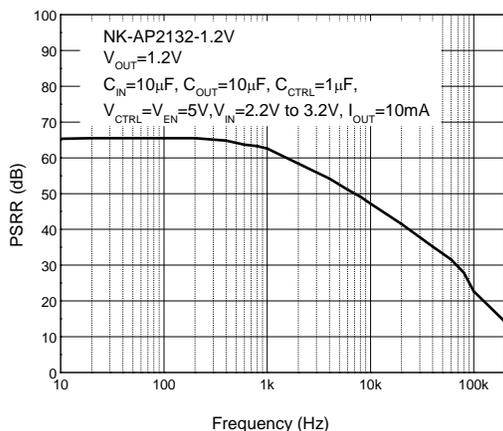
Dropout Voltage vs. Case Temperature



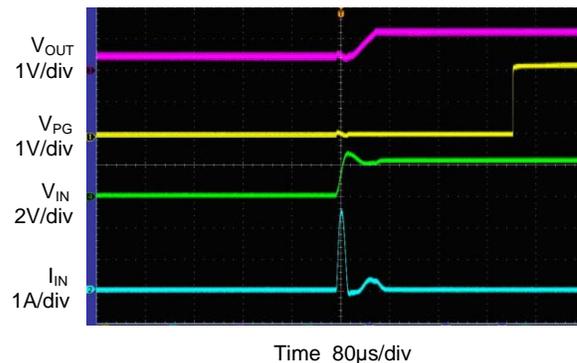
Short Current vs. Case Temperature



PSRR vs. Frequency

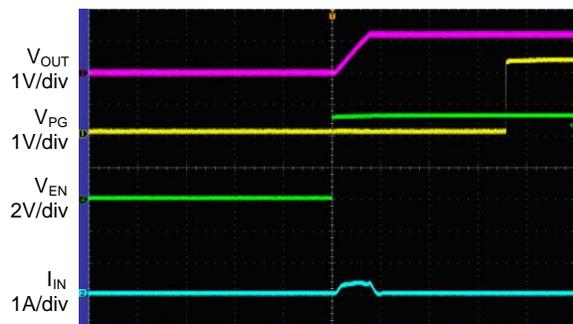


VIN Start up Waveform
(VCTRL=VEN=5V, VIN=0 to 2.2V, No Load)



Performance Characteristics (continued)

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



Time 80 μ s/div

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



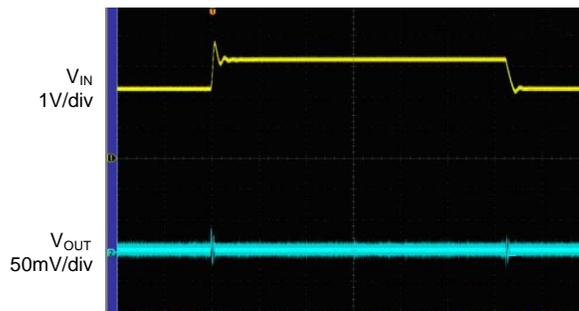
Time 80 μ s/div

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



Time 80 μ s/div

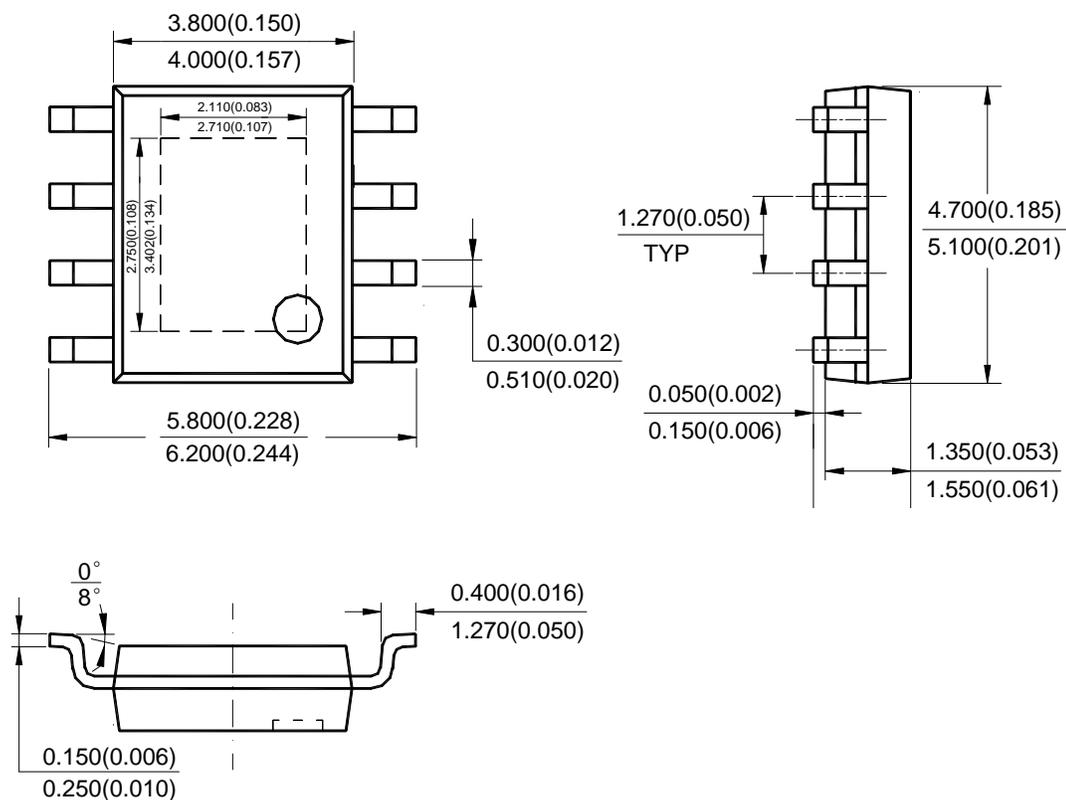
Line Transient
($V_{CTRL}=V_{EN}=5V$, $C_{IN}=C_{CTRL}=1\mu F$, $C_{OUT}=10\mu F$,
 $V_{IN}=2.2V$ to $3.2V$, $I_{OUT}=10mA$)



Time 80 μ s/div

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

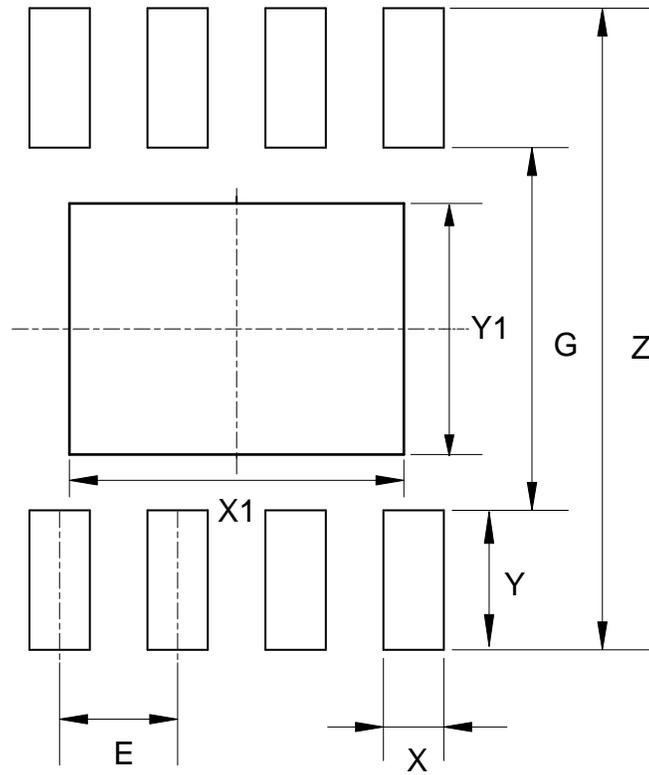
(1) Package Type: PSOP-8



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