Dual OPA Circuit with Precision Shunt Regulator

Halogen Free

General Description

The FP115 incorporates dual operation amplifier and a precision shunt regulator (typ. 1.25V). The main function of FP115 is CV control and OC sense for low power RCC circuits. The small package SOT-23-5L is suitable for mini-size AC-DC power supply or adapter applications.

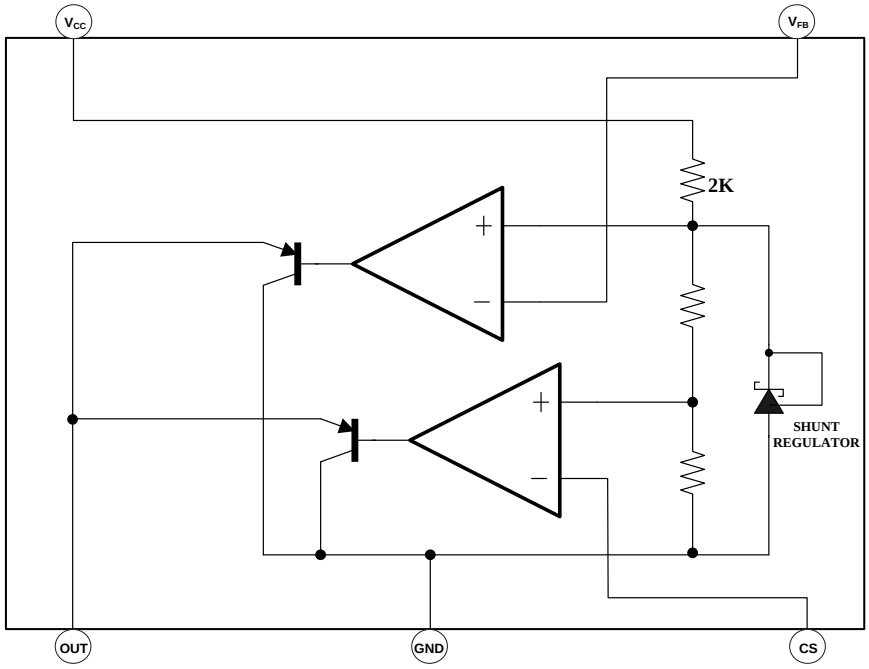
Features

- Fixed Reference Voltage: 1.25V
- Reference Voltage Precision: 2%
- Output Sink Current: 5mA
- Current Consumption: 2.4mA
- Output Inverting Voltage Deviation: OPA1: 3mV, OPA2: 1mV
- Wide Operation Voltage Range: 2.5V ~ 20V
- Package: SOT23-5L

Applications

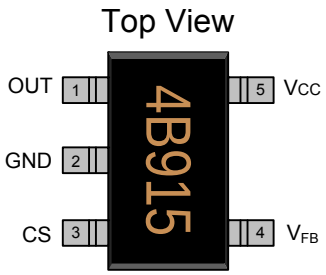
- Charger
- Switching Power Supply
- AC Adapter

Function Block Diagram



Pin Descriptions

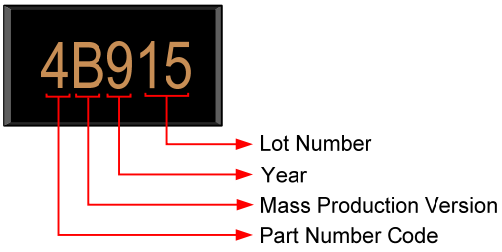
SOT23-5L



Name	No.	I / O	Description
OUT	1	I	Open Emitter
GND	2	P	Ground
CS	3	I	Current Sense Input
V_{FB}	4	I	Voltage Feedback Sense Input
V_{CC}	5	P	IC Power Supply

IC Date Code Identification

SOT23-5L



Lot Number: Wafer lot number's last two digits

For Example: 132386TB → 86

Year: Production year's last digit

Mass Production Version: Mass production mask version

Part Number Code: Part number identification code for this product. It should be always "4".

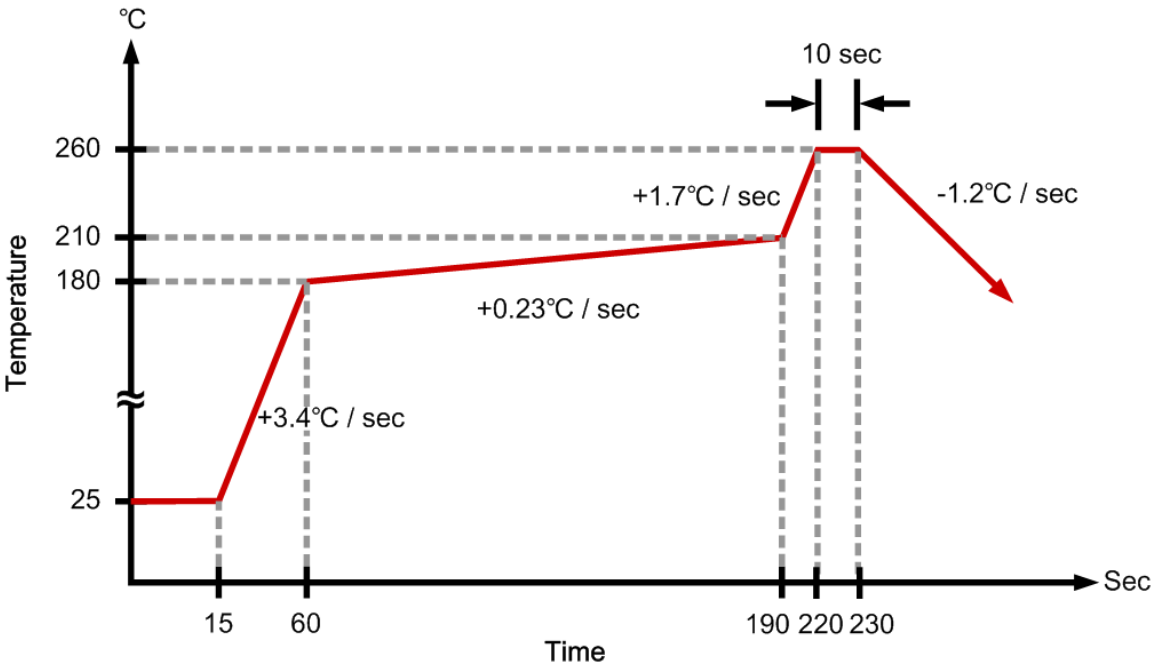
Ordering Information

Part Number	Operating Temperature	Package	MOQ	Description
FP115KR-LF	-20°C ~ +85°C	SOT23-5L	2500EA	Tape & Reel

Absolute Maximum Ratings

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{cc}		2.5		20	V
Input Voltage On Other Pins	V_i		-0.3		V_{cc}	V
Power Dissipation		T_A=25°C			250	mW
Storage Temperature			-40		+125	°C
Maximum Junction Temperature	T_J				+150	°C
Lead Temperature (soldering, 10 sec)					+250	°C / W

IR Re-flow Soldering Curve



Recommended Operating Conditions

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Supply Voltage	V_{cc}		2.5		20	V
Operating Temperature			-20		+85	°C

DC Electrical Characteristics (V_{cc}=5V, T_A= 25°C, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
OPA1 Section						
Output Inverting Voltage	V_{FB}	V_{CS}=0V, R_L=4.3K, V_{CC}=5K	1.225	1.25	1.275	V
Input Bisa Current	I_{B1}	V_{CS}=0V, R_L=4.3K		30	150	nA
PSRR	$PSRR_1$	V_{CS}=0V, R_L=4.3K	50			dB
Output Sink Current	I_{O1}	V_{FB}=1.35V, V_{CS}=0V, V_{OUT}=1.5V	5			mA
Output Inverting Voltage Deviation	$\triangle V_{FB}$	V_{cs}=0V, R_L=4.3V, V_{CC}=2.5V~5V		3		mV
Output Inverting Voltage Temperature Coefficient				±100		ppm / ℃
OPA2 section						
Output Inverting Voltage	V_{CS}	V_{FB}=0V, R_L=4.3K, V_{CC}=5V	150	156	162	mV
Input Bias Current	I_{B2}	V_{FB}=0V, R_L=4.3K		30	150	nA
PSRR	$PSRR_2$	V_{FB}=0V, R_L=4.3K	50			dB
Output Sink Current	I_{O2}	V_{CS}=0.17V, V_{FB}=0V, V_{OUT}=1.5V	5			mA
Output Inverting Voltage Deviation	$\triangle V_{CS}$	V_{FB}=0V, R_L =4.3K, V_{CC}=2.5~5V		1		mV
Output Inverting Voltage Temperature Coefficient				±100		ppm/℃
Total Device						
Current Consumption	I_{CC}	V_{FB}=0V, V_{CS}=0V, R_L=∞		2.4	3.4	mA

Typical Operating Characteristics

(T_A=25°C, unless otherwise noted)

Figure 1
V_{OB} Voltage VS VCC

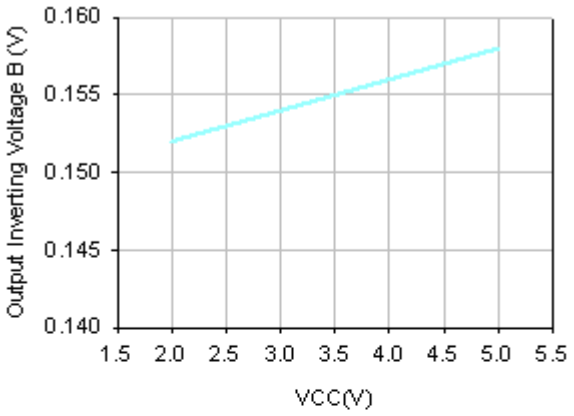


Figure 2
V_{OA} Voltage VS VCC

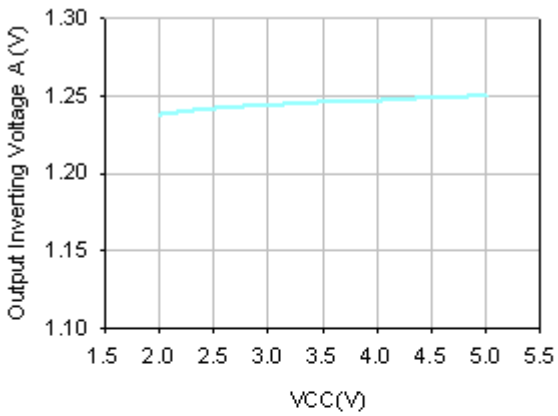


Figure 3
V_{OB} Voltage VS VCC

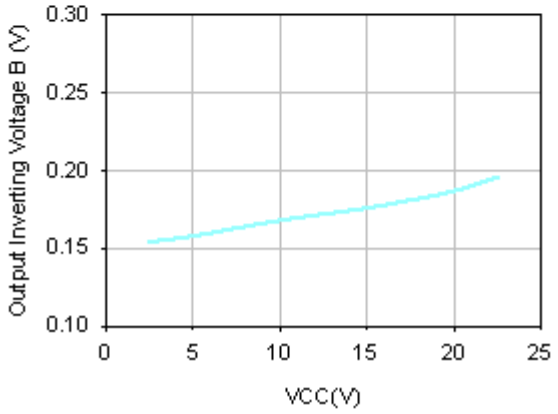
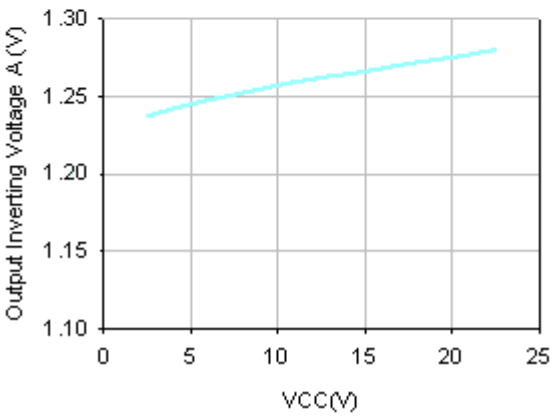


Figure 4
V_{OA} Voltage VS VCC



Function Description

Internal Reference Regulator

The FP115 includes a 1.25V high precision shut regulator to reduce application circuit external part number. This 1.25V reference voltage is divided down by resistor string to 156mV then connects to OPA1 and OPA2's non-inverting input for comparison. Applications with V_{CC} voltage higher than 20V are not suitable for this chip as an internal 2KΩ resistor which connected between Vcc and 1.25V reference will draw too much current and increase power loss.

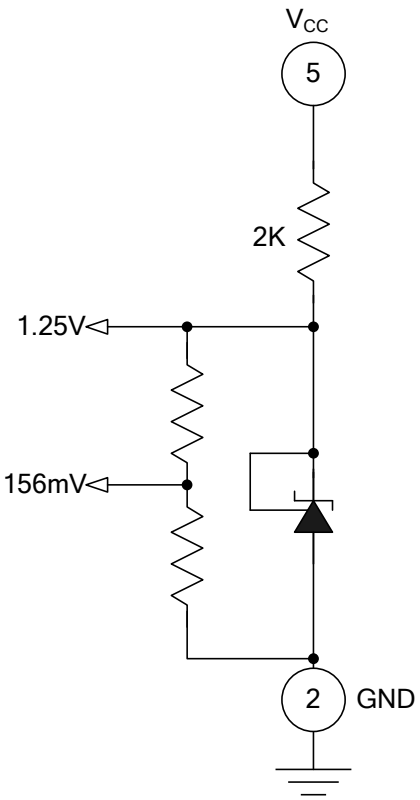


Figure 5 1.25V Reference Regulator With Resistor Divider

For example:

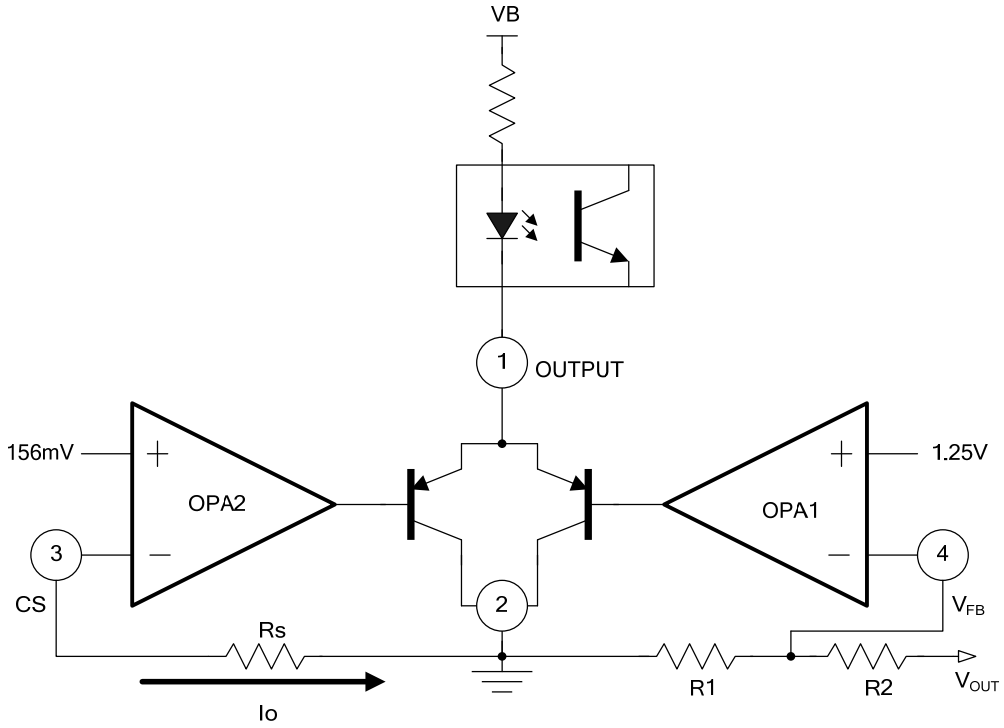
If V_{CC} is 6V, the power loss of the 2KΩ resistor is $(6-1.25)^2/2K\Omega=11.3mW$. When V_{CC} is 12V, the power loss of the 2KΩ resistor is $(12-1.25)^2/2K\Omega=57.8mW$.

Operation Amplifier 1 and Operation Amplifier 2

FP115 includes two operation amplifiers. Their outputs are tied together to implement wired-NOR function. When the inverting input voltage of OPA is lower than non-inverting reference voltage, the output transistor is turn-off; otherwise the output transistor is turn-on. The output total sink current ability is near 10mA

When apply FP115 in an AC-DC converter circuit, connect FP115's output (pin1) to a photo-coupler. The output will drive photo diode turning-on or off depending on the FB and CS pin voltage to adjust AC-DC converter's output voltage.

In general, OPA1 is used for voltage feedback and OPA2 is used for over current feedback. Please check FP115 application note for detail design reference circuits.



Voltage feedback equation:

$$V_{OUT} = \left(1 + \frac{R2}{R1}\right) \times 1.25V$$

Current feedback equation:

$$156mV = Io \times Rs$$

Application Circuit

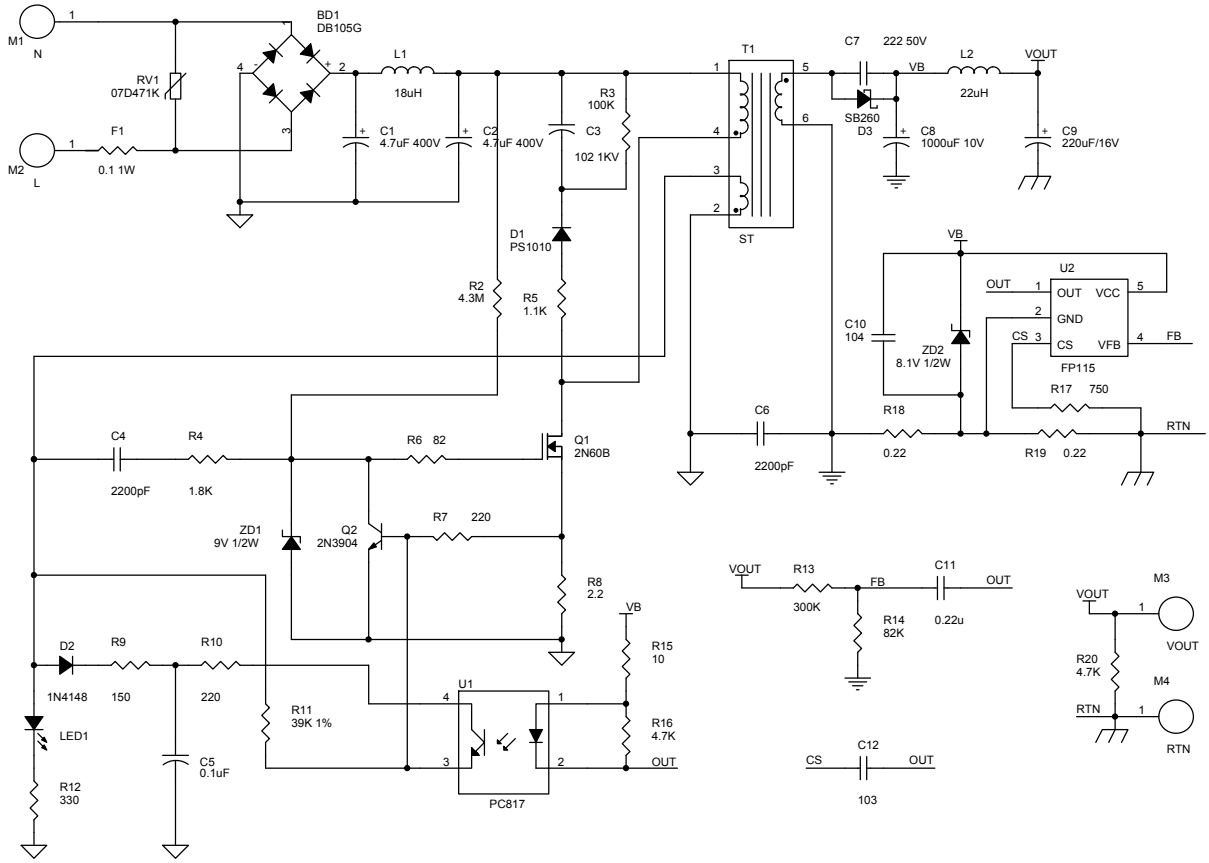
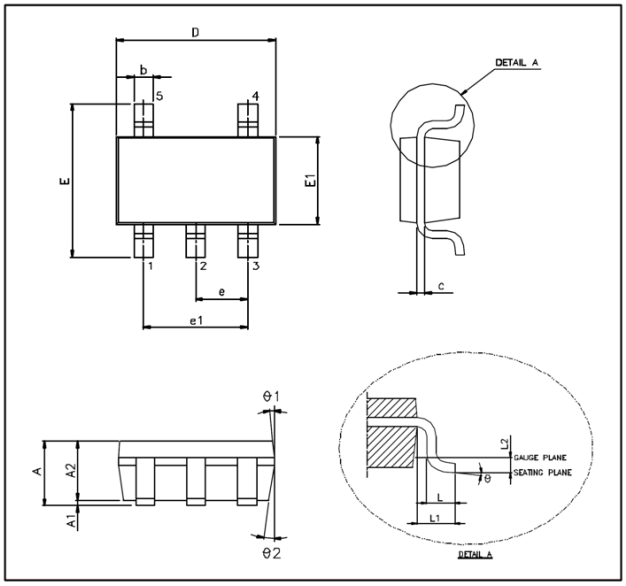


Figure 6 3.5W RCC Adapter Application Circuit

Package Outline

SOT23-5L



UNIT: mm

Symbols	Min. (mm)	Max.(mm)
A	1.050	1.350
A1	0.050	0.150
A2	1.000	1.200
b	0.250	0.500
c	0.080	0.200
D	2.700	3.000
E	2.600	3.000
E1	1.500	1.700
e	0.950 BSC	
e1	1.900 BSC	
L	0.300	0.550
L1	0.600 REF	
L2	0.250 BSC	
θ°	0°	10°
θ1°	3°	7°
θ2°	6°	10°

Note:

1. Package dimensions are in compliance with JEDEC outline: MO-178 AA.
2. Dimension “D” does not include molding flash, protrusions or gate burrs.
3. Dimension “E1” does not include inter-lead flash or protrusions.