RAIL CURRENT MEASUREMENT IC

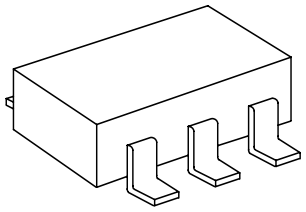
GENERAL DESCRIPTION

The **FP120** is a wide input supply and common mode voltage IC for the high side rail current measurement of the power system such as battery charger or switching power supply applications field. IC includes the differential input of amplifier and an NPN transistor emitter output; user could adjusts any gain very easy from three external resistors and read the converting voltage by a simple by a formula at IC output.

The **FP120** uses the SOT-25 package operating in wide power supply and temperature range

FEATURES

- Independent power supply voltage: 2.7 to 15V
- Wide input common-mode voltage: 2.7 to 15V
- Source current emitter output
- Three resistors gain set-up
- Wide temperature range: 0℃ to +85℃
- Package: SOT-25

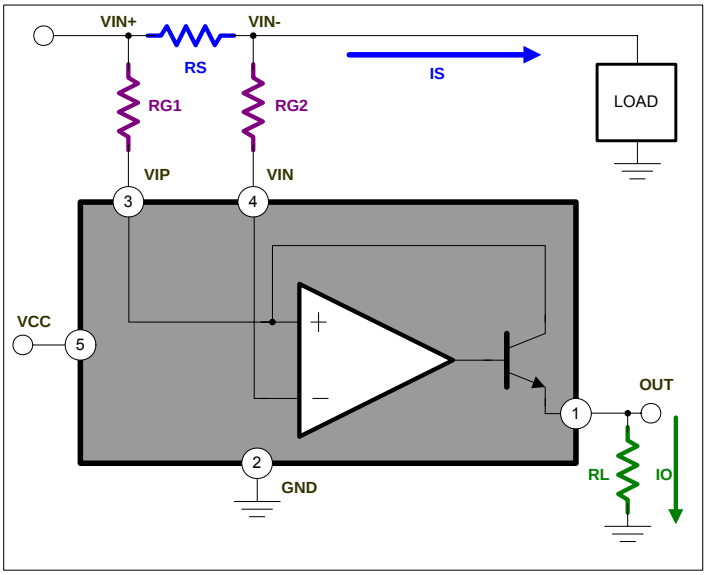


SOT-25

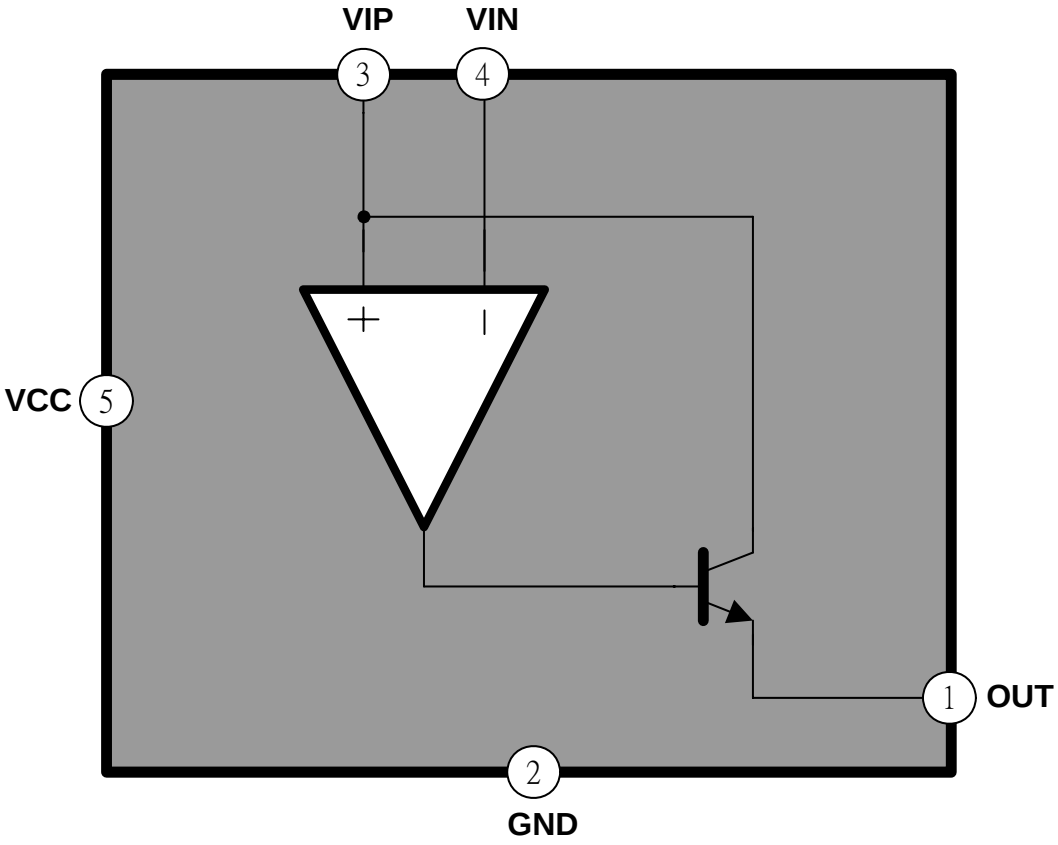
APPLICATION

- Battery charger
- High side rail current detector
- SPS(Adaptor)
- Current sense networking system

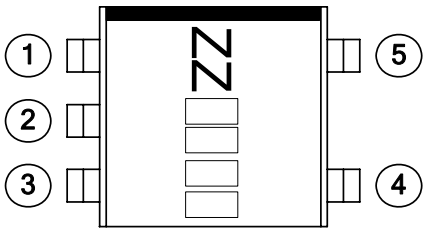
TYPICAL APPLICATION CIRCUITS



FUNCTIONAL BLOCK DIAGRAM



MARK VIEW



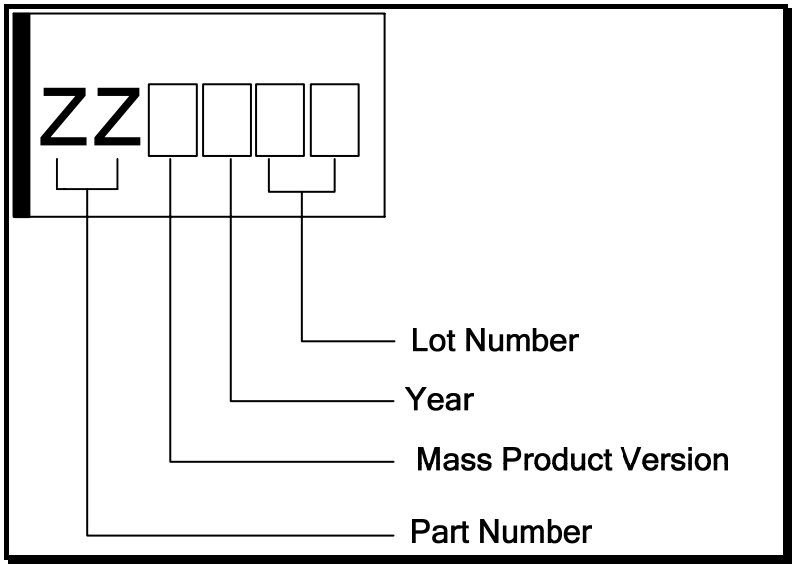
PIN DESCRIPTION

Name	No.	I/O	Description
OUT	1	O	Current detect output
GND	2	P	IC ground
VIP	3	I	Positive input of differential OPA
VIN	4	I	Negative input of differential OPA
VCC	5	P	IC power supply

ORDER INFORMATION

Part Number	Operating Temperature	Package	Description
FP120KR-LF	0°C ~ +85°C	SOT-25	Tape & Reel

IC DATE CODE DISTINGUISH



For example:

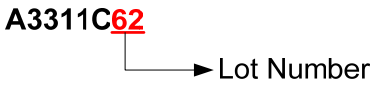
1 – Year 2001

2 – Year 2002

3 – Year 2003 --------- And so on

Lot Number is the last two numbers

For example:



ABSOLUTE MAXIMUM RATINGS

Supply Voltage ..... –0.3V ~ 15V

Common Mode Inputs Voltage ..... –0.3V ~ 15V

Differential Inputs Voltage (V_{IP} – V_{IN}) ..... –15V ~ 1.5V

OUT Voltage ..... –0.3V ~ 15V

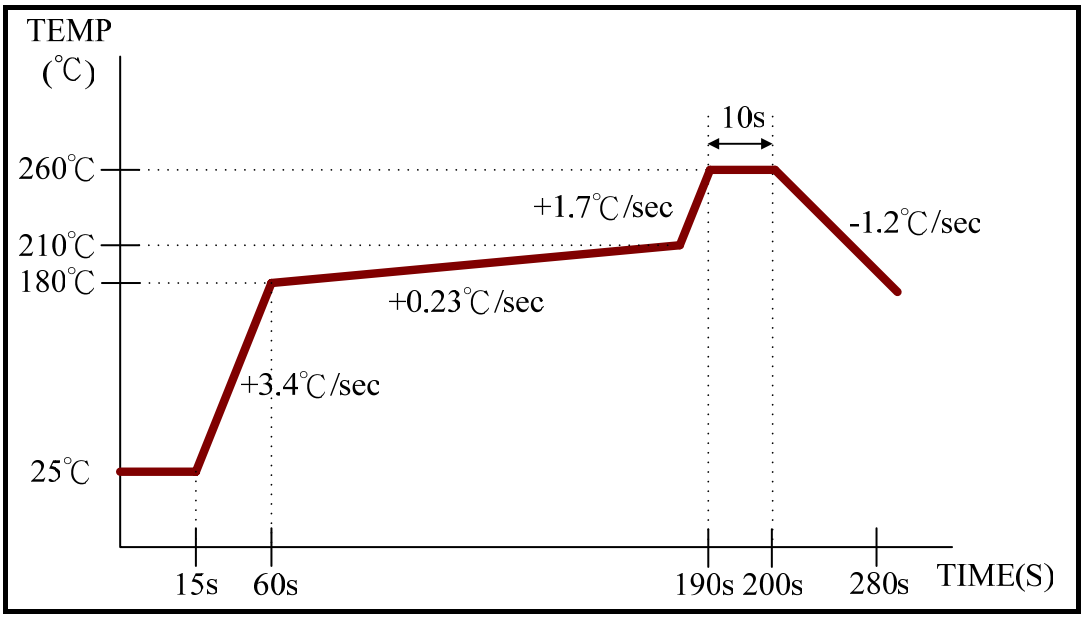
Operating Temperature ..... 0℃ ~ +85℃

Storage Temperature ..... –55℃ ~ +125℃

Junction Temperature ..... +125℃

Power Dissipation (SOT-25, Ta=25℃) 220mW

SOT25 Lead Temperature (soldering, 10 sec) ..... +260℃



IR Re-flow Temperature vs. Second Curve

Note:

1. **Suggest IR Reflow Soldering Profile Condition**

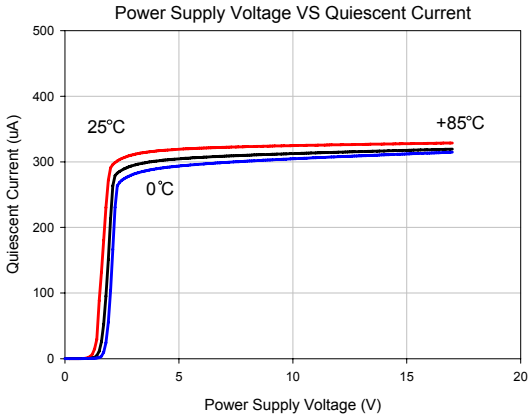
DC ELECTRICAL CHARACTERISTICS

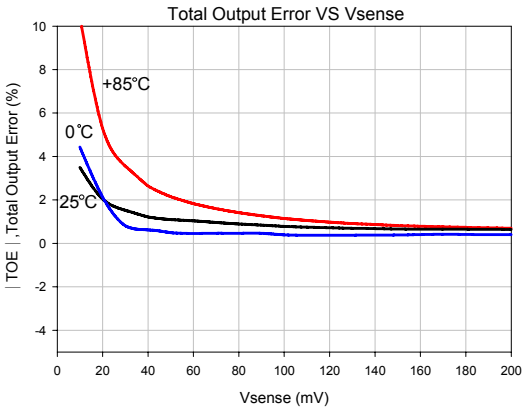
Test conditions: Ta= 0℃~+85℃, V_{CC}=5V, V_{IN}^+=12V, R_{OUT}=125KΩ, unless otherwise noted

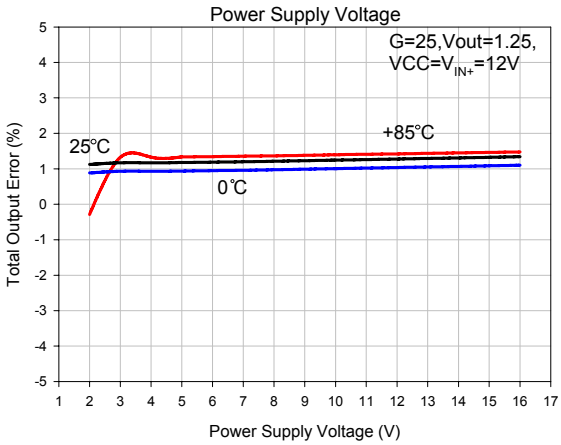
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Full Scale Sense Voltage	V_{SENSE}	$V_{SENSE}=V_{IN}^+-V_{IN}^-$		150	500	mV
Common-Mode Input Voltage	V_{CM}		2.7		15	V
Common-Mode Rejection	CMRR	V_{IN}^+=2.7V to 15V, V_{SENSE}=50mV	100	120		dB
Input Offset Voltage vs temp	$V_{OFFSET(ta)}$	t_{MIN} to t_{MAX}		4		μV/℃
Input Offset Voltage vs V_{CC}	$V_{OFFSET(vcc)}$	V_{CC}=2.7V to 15V, V_{SENSE}=50mV		2.5	10	μV/V
Input Bias Current	I_{BIAS}	V_{IP},V_{IN}		2		μA
Non-linearity Error	NLE	V_{SENSE}=10mV to 150mV			±1	%
Total Output Error	TOE	V_{SENSE}=100mV			±3	%
Output Impedance	R_{OUT}			1||5		GΩ||pF
Voltage Swing to V_{CC}	V_{SCC}			V_{CC}-0.8		V
Voltage Swing to V_{CM}	V_{SCM}			V_{CM}-0.5		V
Bandwidth	BW	R_{OUT}=125KΩ		32		kHz
Settling Time	ts	5V Setp,R_{OUT}=125KΩ		30		μS
Total Output-Current Noise	I_{NOISE}	BW=100KHz		3		nA
Operating Voltage Range	V_{CC}		2.7		15	V
Quiescent Current	I_{CC}	V_{SENSE}=0,Io=0		400	600	μA
Operating Temperature Range	T_a		0		+85	℃

TYPICAL CHARACTERISTICS

Ta=+25℃,VCC=5V,V_{IN}=+12V



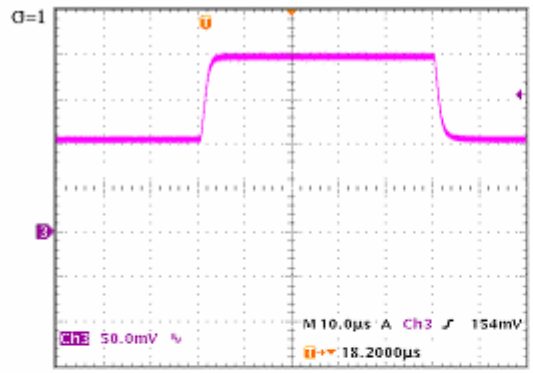


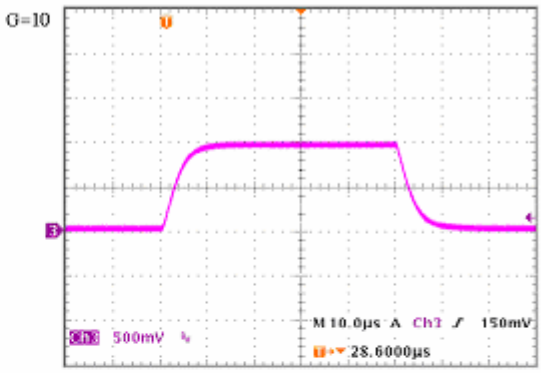


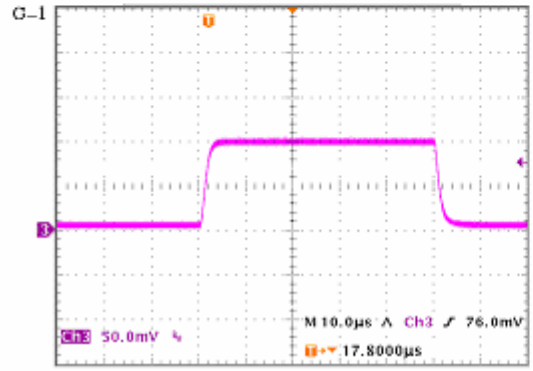
TYPICAL CHARACTERISTICS(Cont.)

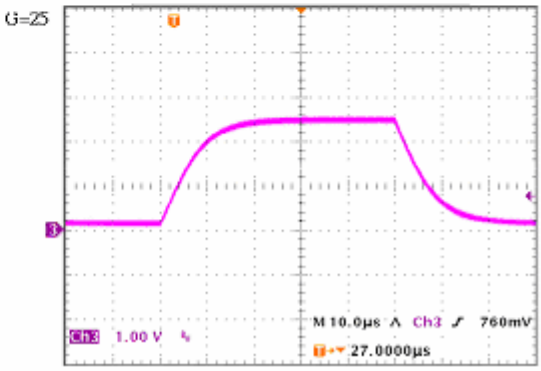
Ta=+25℃,VCC=5V,V_{IN}=+12V

RG1=RG2=1KΩ

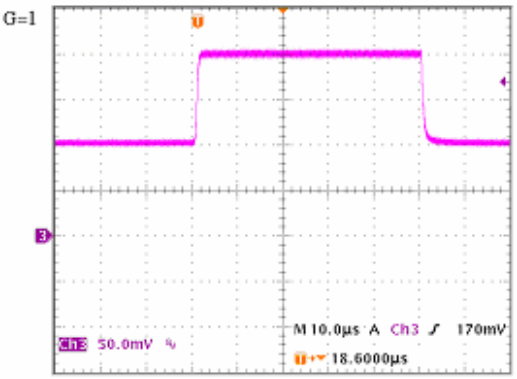


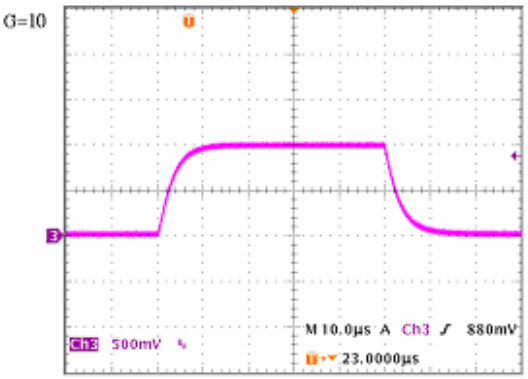


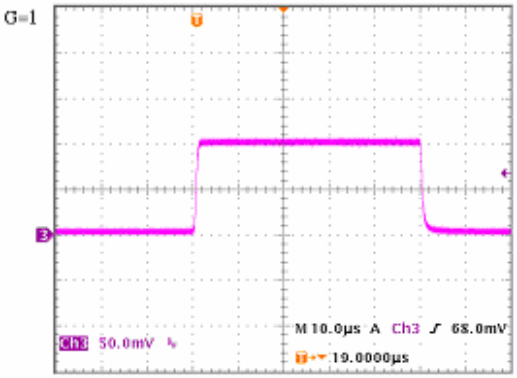


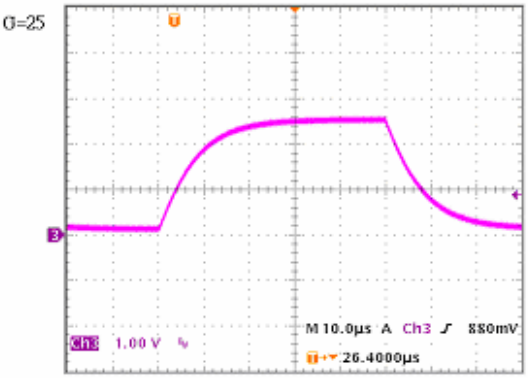


RG1=RG2=5KΩ









DETAILED DESCRIPTION

Figure 7 shows the **FP120** basic application circuit, the load current (I_S) flows from power supply and generates a voltage (V_{IN}^+-V_{IN}^-) at the sense resistor (R_S).

Assume internal NPN transistor collector current is same as emitter current (I_O) and V_{IP} is very close V_{IN}, the **FP120** transfer function is:

$$I_O = \frac{V_{IN}^{+} - V_{IN}^{-}}{RG1} \quad \text{----- (1)}$$

In the circuit of Figure 7, the (V_{IN}^+-V_{IN}^-), is equal to $I_S \cdot R_S$ and the output voltage (OUT) is equal to $I_O \cdot R_L$. The final transfer function for rail current measurement in this application is:

$$V_{OUT} = G * I_S * R_S \quad \text{----- (2)}$$

$$G = R_L / RG1 \quad \text{---- (3)}$$

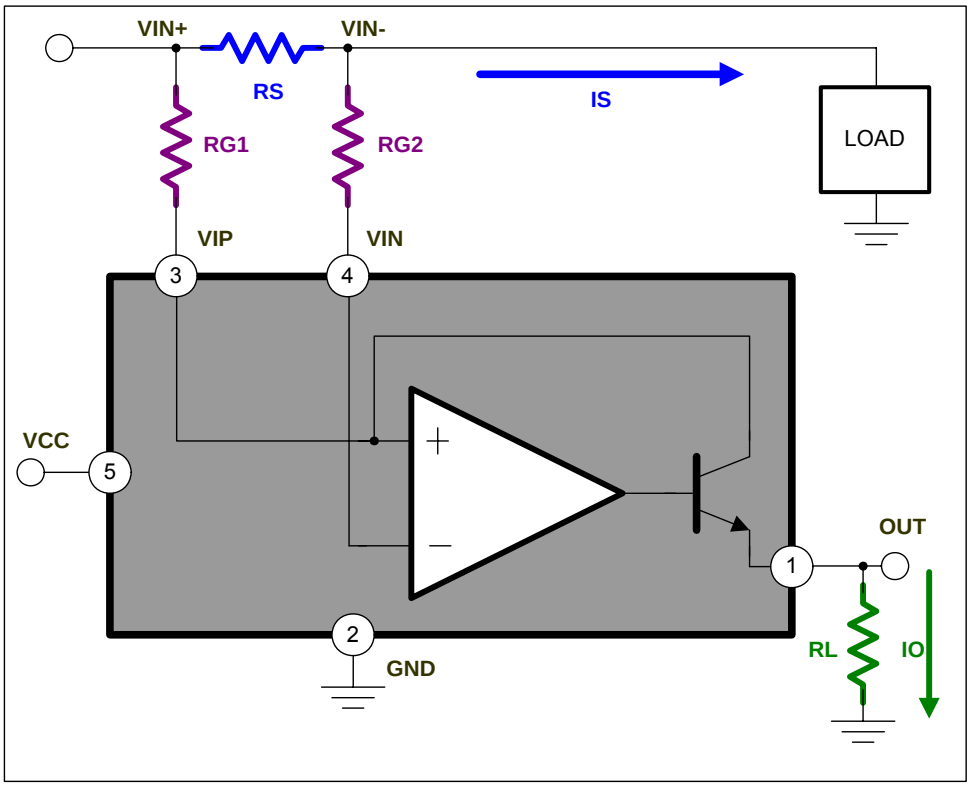


Figure 7 Current measurement circuit

NOTE

1. The minimum operating voltages of VCC, VIP and VIN are 2.7V, if these supply voltages are low than 2.7V, the transfer function at output of **FP120** isn't correct.
2. Don't force a VIN voltage that is over 15V than VIP, this condition would generate a leakage current and an incorrect voltage at **FP120** output.

APPLICATION NOTE

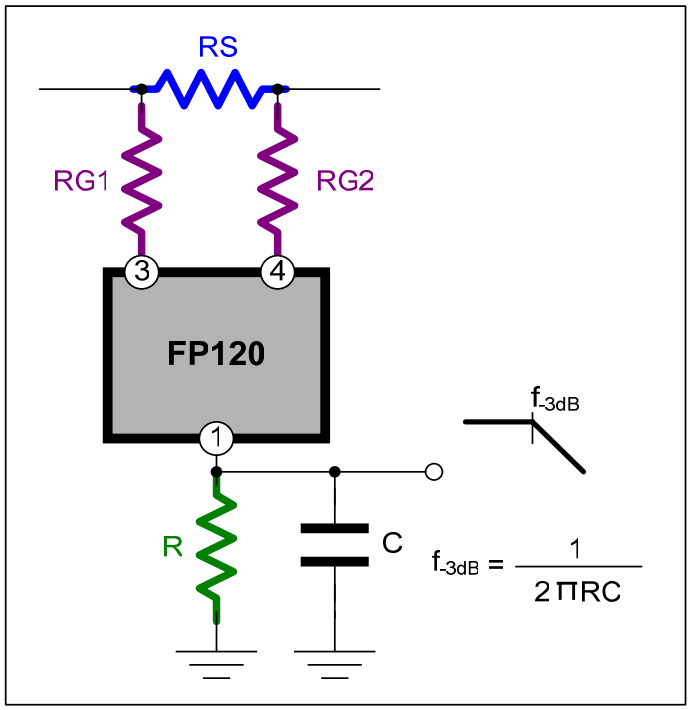


Figure 8 Output R-C delay circuit

Figure 8 shows a simple method to delay the converting time, when a transient voltage happens at sense resistor (R_S), the output voltage would approach the set point and transfer function would source a current (I_O) to the output, the RC circuit will delay a time during output change. The capacitor is also a filter function when the signal has a frequency response.

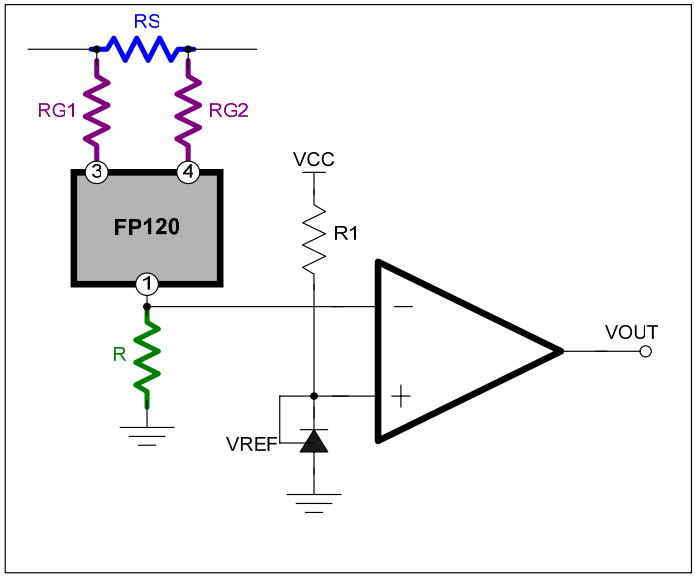
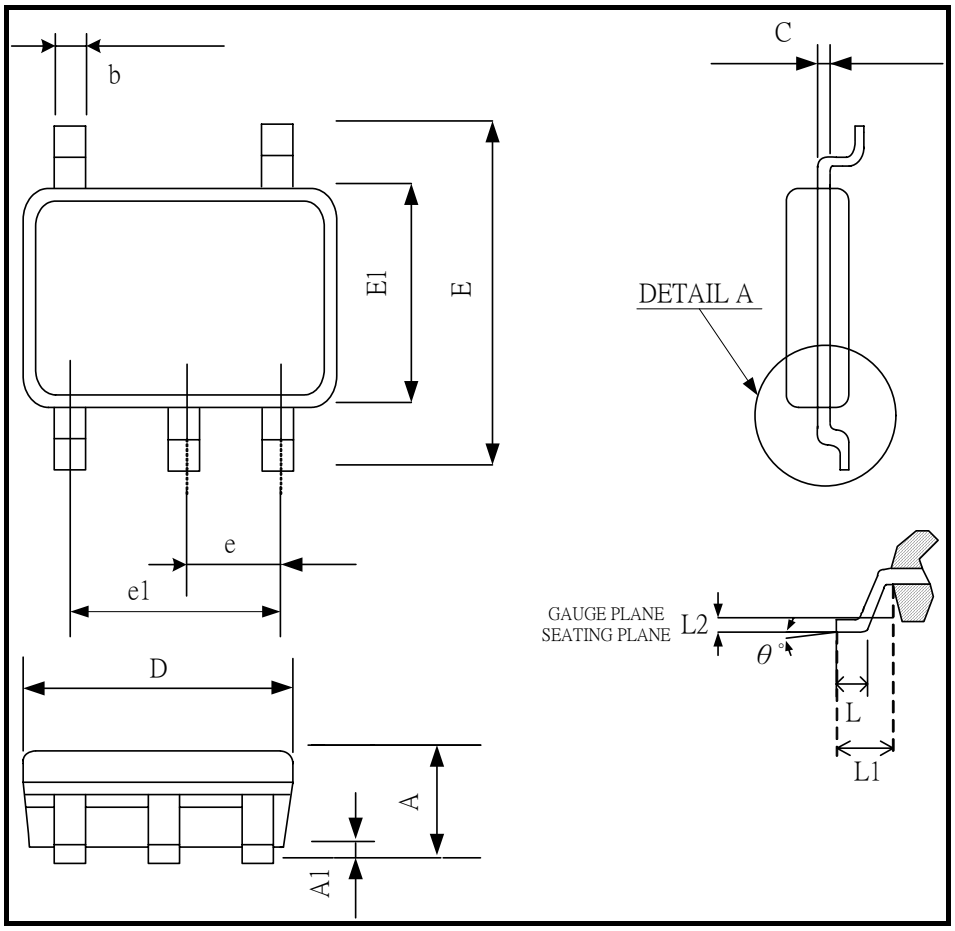


Figure 9 Comparator detection circuit

Figure 9 shows a detection circuit using 1.25V reference regulator and comparator. At initial stage, the non-inverting input of comparator which is connecting with 1.25V regulator and it is higher than inverting input, so the comparator output is high until the sense current transfers the IC output voltage is higher than setup voltage 1.25V, the comparator output will change to low.

PACKAGE OUTLINE

SOT-25



SYMBOLS	MIN	MAX
A	1.05	1.35
A1	0.05	0.15
A2	1.00	1.20
b	0.25	0.50
c	0.08	0.20
D	2.70	3.00
E	2.60	3.00
E1	1.50	1.70
e	0.95 BSC.	
e1	1.90 BSC.	
L	0.30	0.55
L1	0.60 REF.	
L2	0.25 BSC.	
θ°	0	10

UNIT:mm

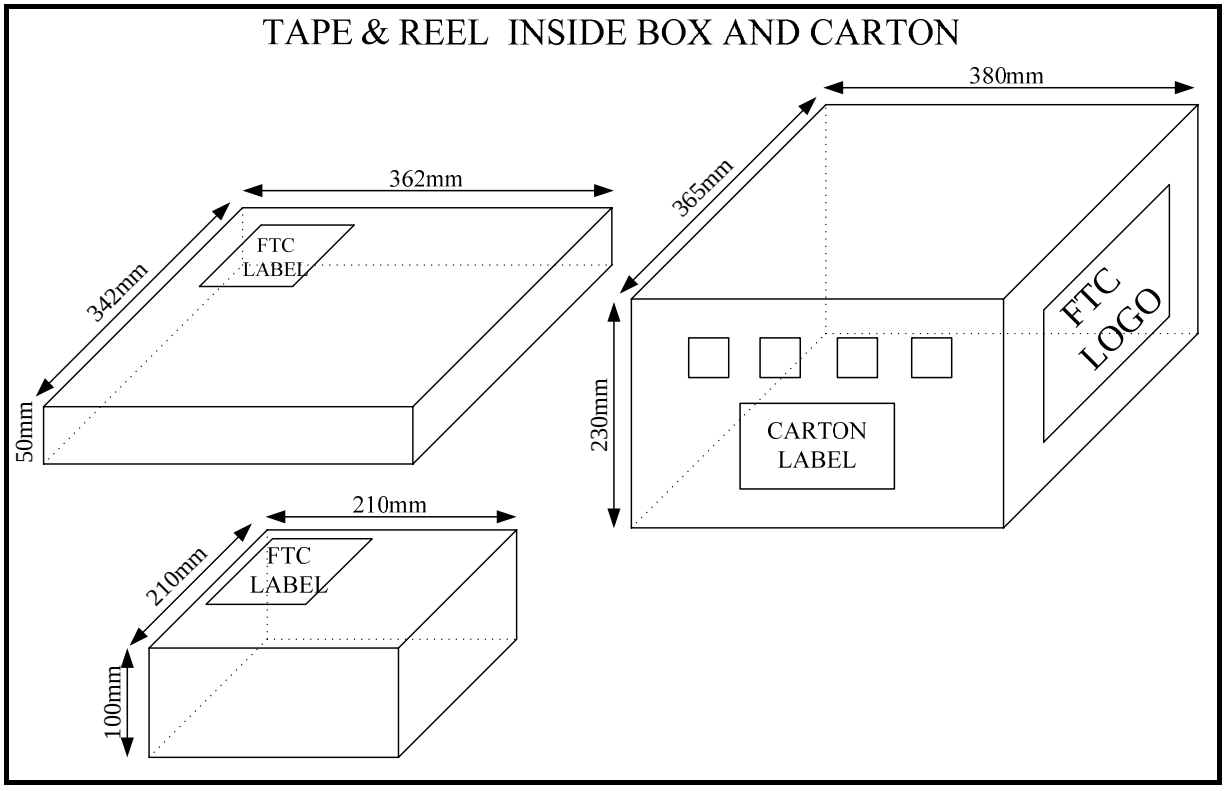
NOTE:

1. JEDEC OUTLINE:MO-178 AA。

PACKING SPECIFICATIONS

BOX & CARTON DIMENSION

SOT-25



PACKING QUANTITY SPECIFICATIONS

SOT-25
2500 EA / REEL
4 REELS / INSIDE BOX
4 INSIDE BOXES / CARTON

LABEL SPECIFICATIONS

TAPPING & REEL

Feeling Technology Corp
Product:FP120KR-LF
Lot NO: A3311C62-L
D/C: ZZxxxx
Q`ty: 2500
無鉛
Lead Free

CARTON

Feeling Technology Corp
Product Type: FP120KR-LF
Lot No: A3311C62-L
Date Code: ZZxxxx
Package Type:SOT-25L
Marking Type:Laser
Total Q`ty: 10,000
無鉛
Lead Free

CARRIER TAPE AND REEL DIMENSIONS

SOT-25