

## RAIL CURRENT MEASUREMENT IC

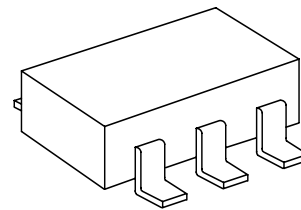
### GENERAL DESCRIPTION

The **FP130A** 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 adjust any gain very easy from three external resistors and read the converting voltage by a simple by a formula at IC output.

The **FP130A** uses the SOT-25 package operating in wide power supply and temperature range

### FEATURES

- Independent power supply voltage: 2.7 to 30V
- Wide input common-mode voltage: 2.7 to 30V
- Source current emitter output
- Three resistors gain set-up
- Wide temperature range: -20°C to +125°C
- Package: SOT-25

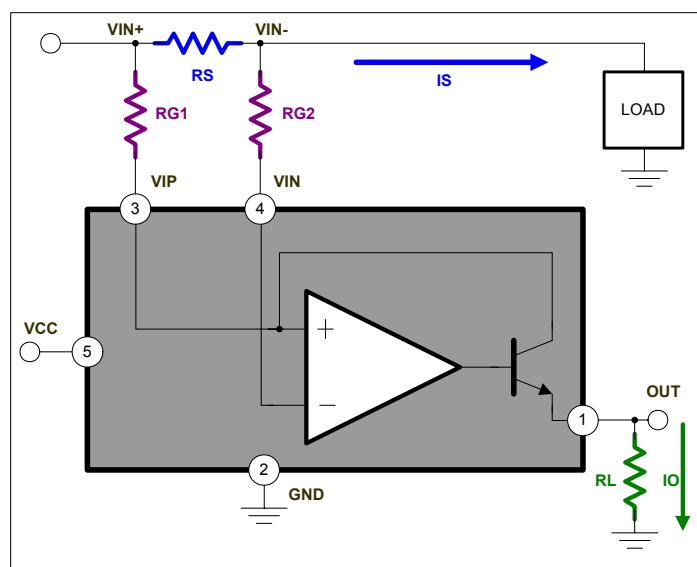


SOT-25

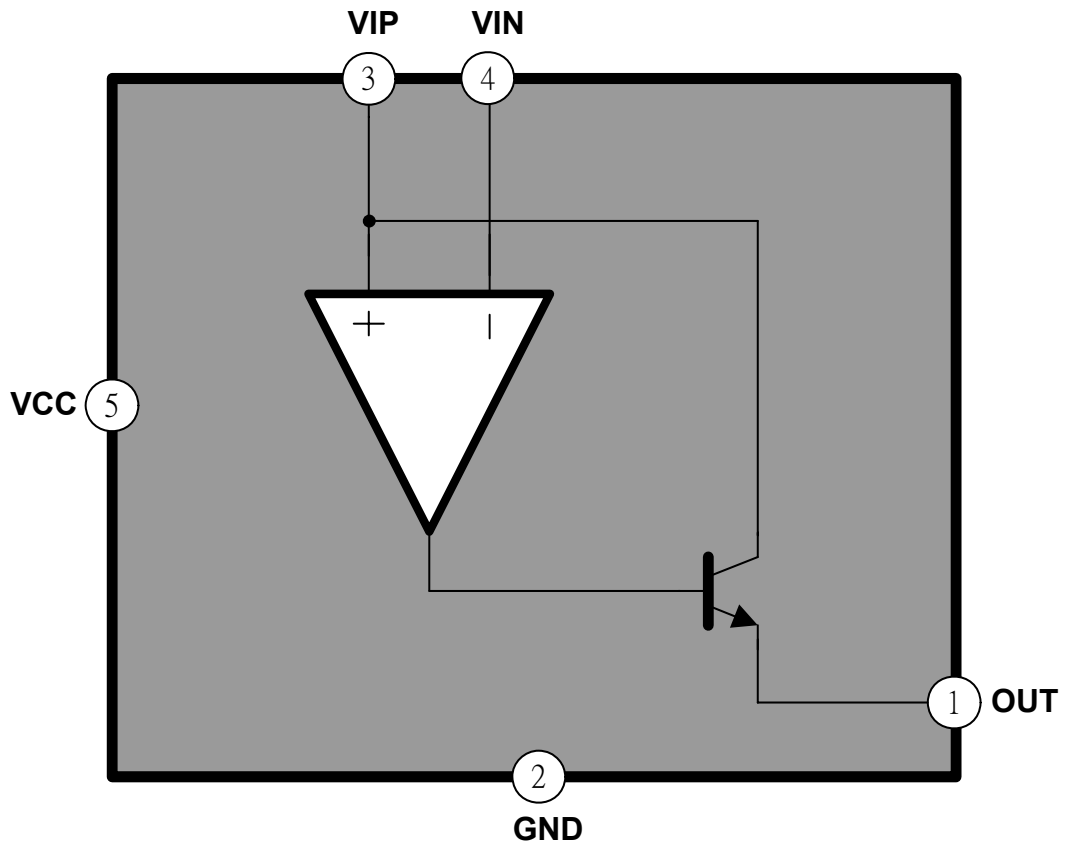
### APPLICATION

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

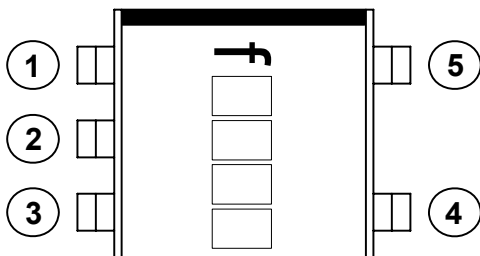
### TYPICAL APPLICATION CIRCUITS



## FUNCTIONAL BLOCK DIAGRAM



### MARK VIEW



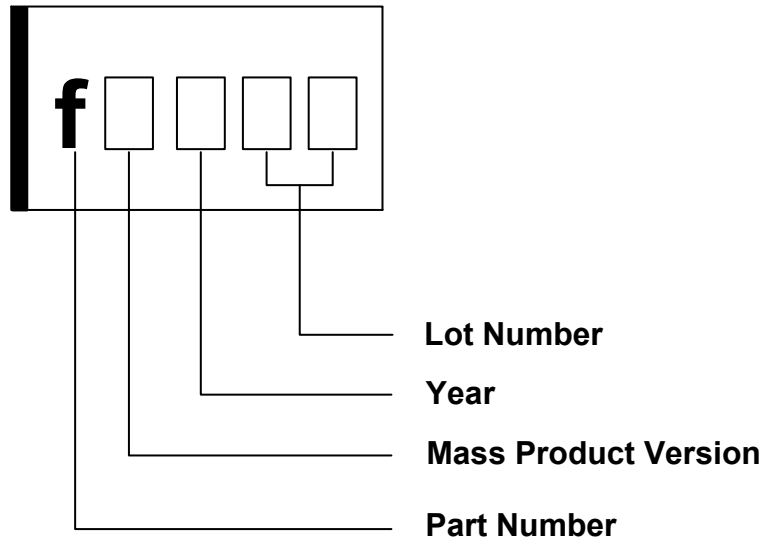
### PIN DESCRIPTION

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
FP130AKR-LF	-20°C ~ +125°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

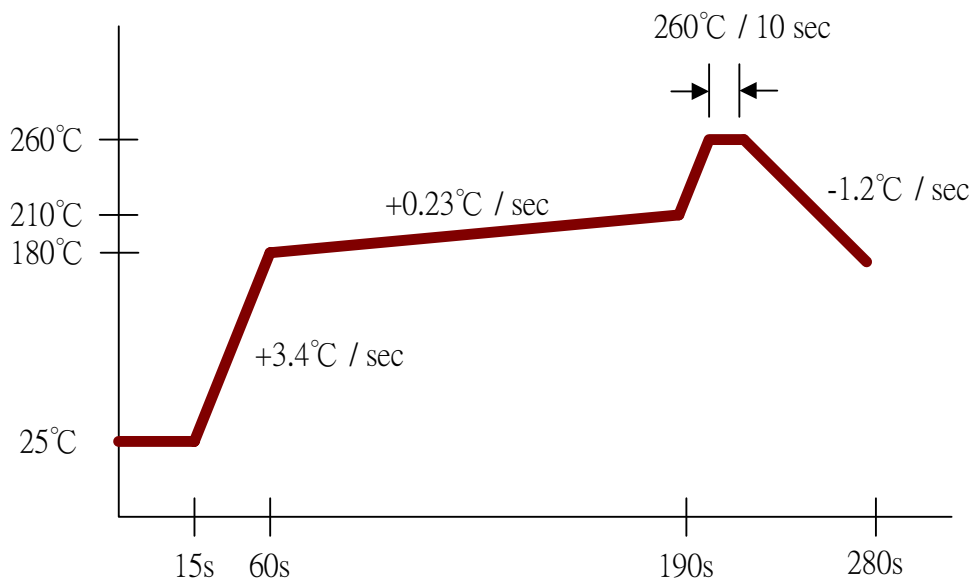
### For example:

A3311C62

→ Lot Number

## ABSOLUTE MAXIMUM RATINGS

Supply Voltage -----	-0.3V ~ 30V
Common Mode Inputs Voltage -----	-0.3V ~ 30V
Differential Inputs Voltage ( $V_{IP} - V_{IN}$ ) -----	-30V ~ 1.5V
OUT Voltage -----	-0.3V ~ 30V
Operating Temperature -----	-20°C ~ +125°C
Storage Temperature -----	-55°C ~ +125°C
Junction Temperature -----	+150°C
Power Dissipation (SOT-25, $T_a=25^\circ\text{C}$ ) -----	220mW
SOT25 Lead Temperature (soldering, 10 sec) -----	+260°C



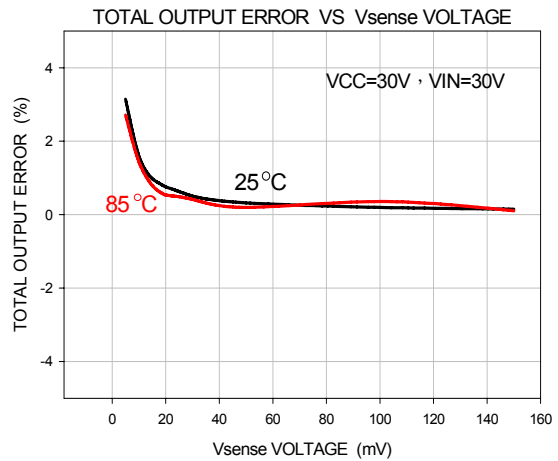
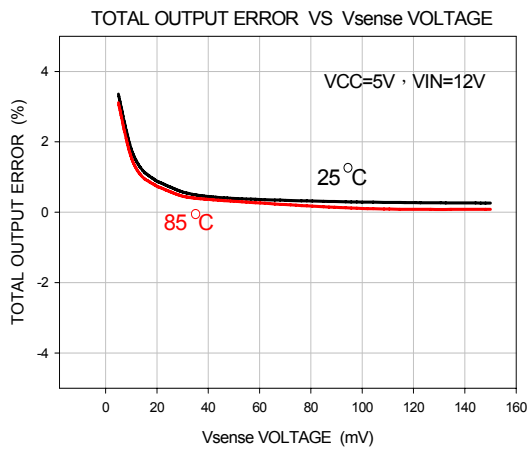
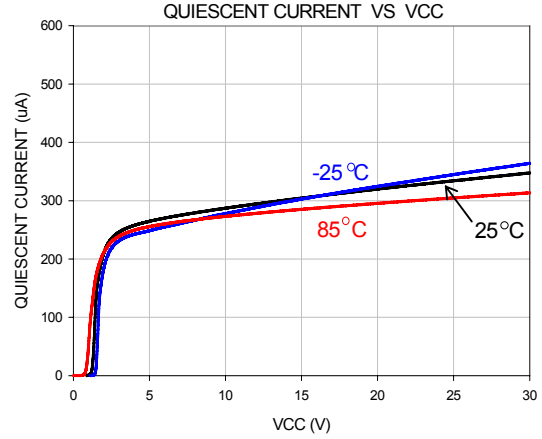
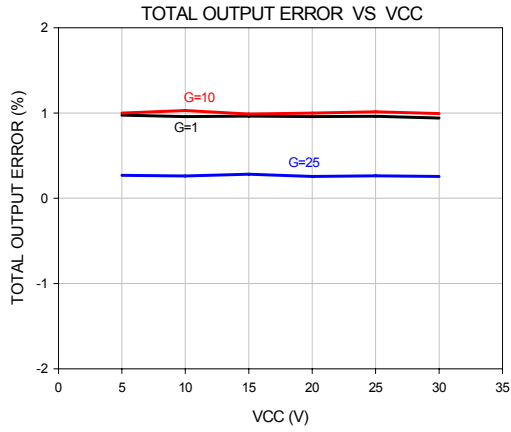
## DC ELECTRICAL CHARACTERISTICS

Test conditions:  $T_a = -20^{\circ}\text{C} \sim +125^{\circ}\text{C}$ ,  $V_{CC} = 5\text{V}$ ,  $V_{IN}^{+} = 12\text{V}$ ,  $R_{OUT} = 125\text{K}\Omega$ , unless otherwise noted

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Full Scale Sense Voltage	$V_{SENSE}$	$V_{SENSE} = V_{IN}^{+} - V_{IN}^{-}$	-	100	500	mV
Common-Mode Input Voltage	$V_{CM}$		2.7	-	28	V
Common-Mode Rejection	CMRR	$V_{IN}^{+} = 2.7\text{V to } 30\text{V}$ , $V_{SENSE} = 50\text{mV}$	100	120	-	dB
Input Offset Voltage vs temp	$V_{OFFSET(ta)}$	$t_{MIN}$ to $t_{MAX}$	-	4	-	$\mu\text{V}/^{\circ}\text{C}$
Input Offset Voltage vs $V_{CC}$	$V_{OFFSET(vcc)}$	$V_{CC} = 2.7\text{V to } 30\text{V}$ , $V_{SENSE} = 50\text{mV}$	-	2.5	10	$\mu\text{V}/\text{V}$
Input Bias Current	$I_{BIAS}$	$V_{IP}, V_{IN}$	-	2	-	$\mu\text{A}$
Non-linearity Error	NLE	$V_{SENSE} = 10\text{mV to } 150\text{mV}$	-	-	$\pm 1$	%
Total Output Error	TOE	$V_{SENSE} = 100\text{mV}$	-	-	$\pm 2$	%
Output Impedance	$R_{OUT}$		-	1  5	-	$\text{G}\Omega    \text{pF}$
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	$R_{OUT} = 125\text{K}\Omega$	-	32	-	kHz
Settling Time	$t_s$	5V Setp, $R_{OUT} = 125\text{K}\Omega$	-	30	-	$\mu\text{s}$
Total Output-Current Noise	$I_{NOISE}$	BW=100KHz	-	3	-	nA
Operating Voltage Range	$V_{CC}$		2.7	-	28	V
Quiescent Current	$I_{CC}$	$V_{SENSE} = 0, V_{CC} = 30\text{V}$	-	400	-	$\mu\text{A}$
Operating Temperature Range	$T_a$		-20		+125	$^{\circ}\text{C}$

## TYPICAL CHARACTERISTICS

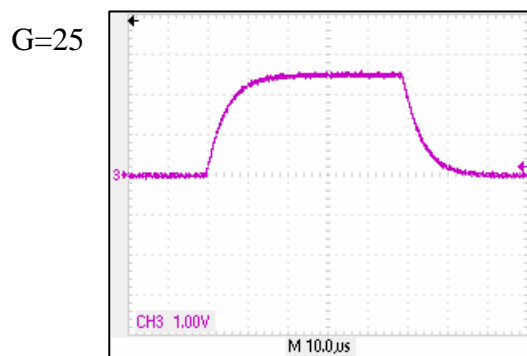
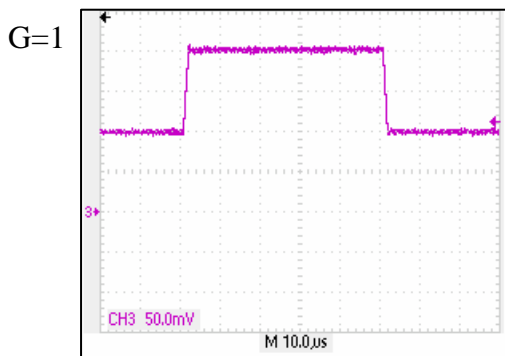
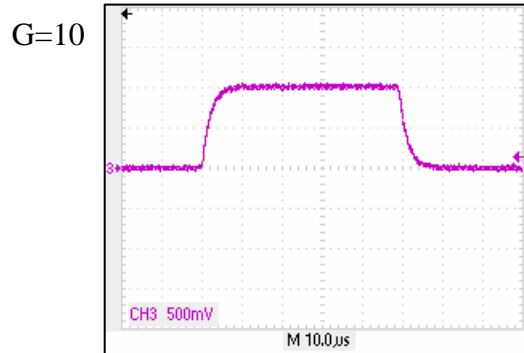
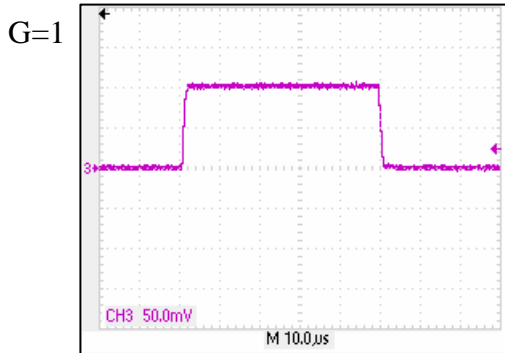
Ta=+25°C, VCC=5V, VIN=+12V



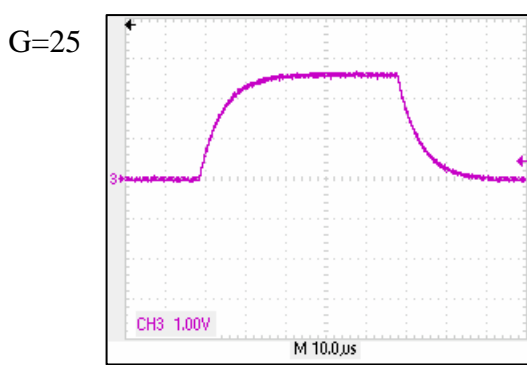
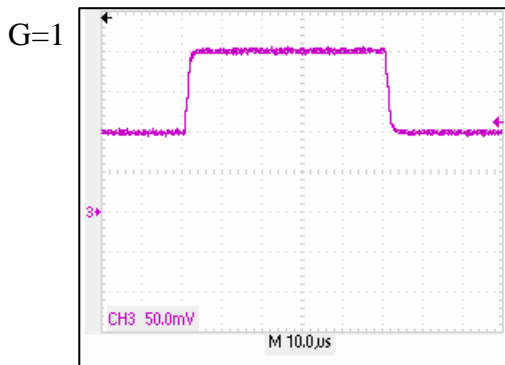
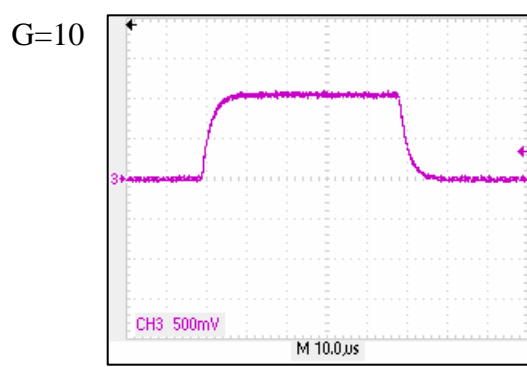
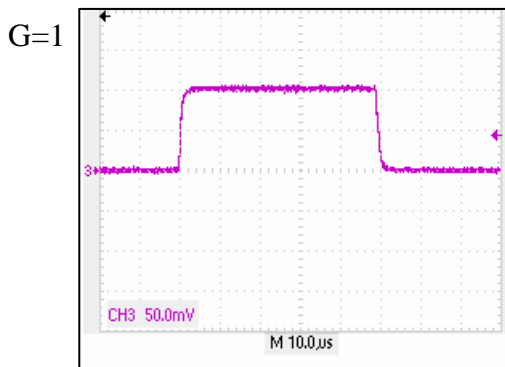
## TYPICAL CHARACTERISTICS(Cont.)

Ta=+25°C, VCC=5V, VIN=+12V

RG1=RG2=1KΩ



RG1=RG2=5KΩ



## DETAILED DESCRIPTION

Figure 7 shows the **FP130A** 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 **FP130A** transfer function is:

$$I_O = \frac{V_{IN}^+ - V_{IN}^-}{R_{G1}} \quad \text{---- (1)}$$

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:

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

$$G = R_L / R_{G1} \quad \text{---- (3)}$$

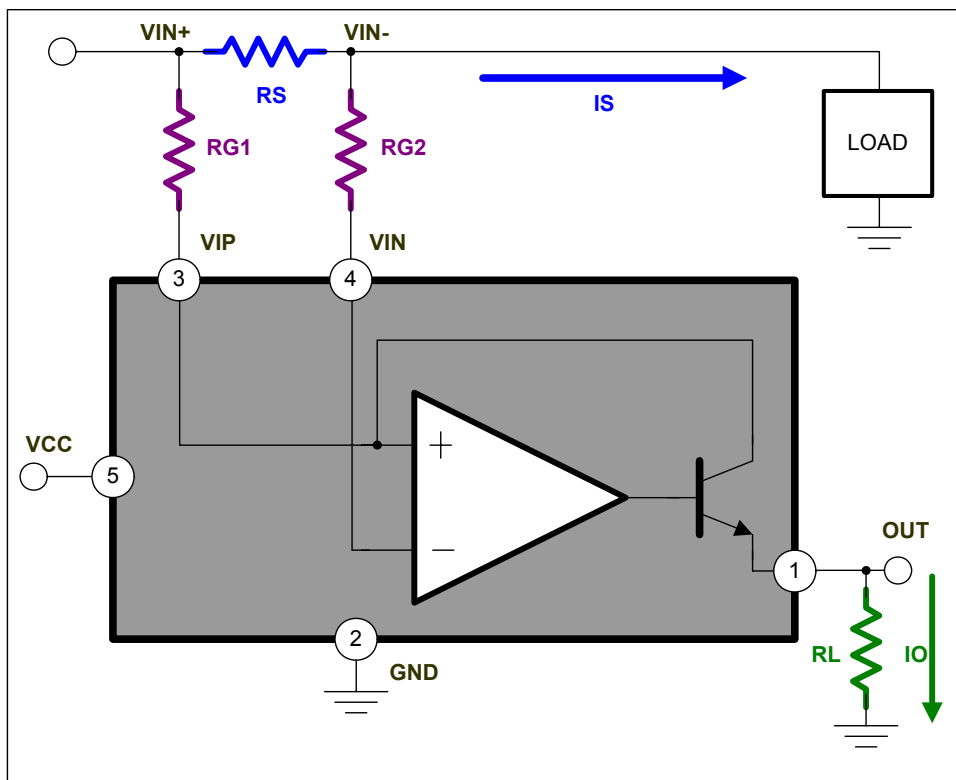
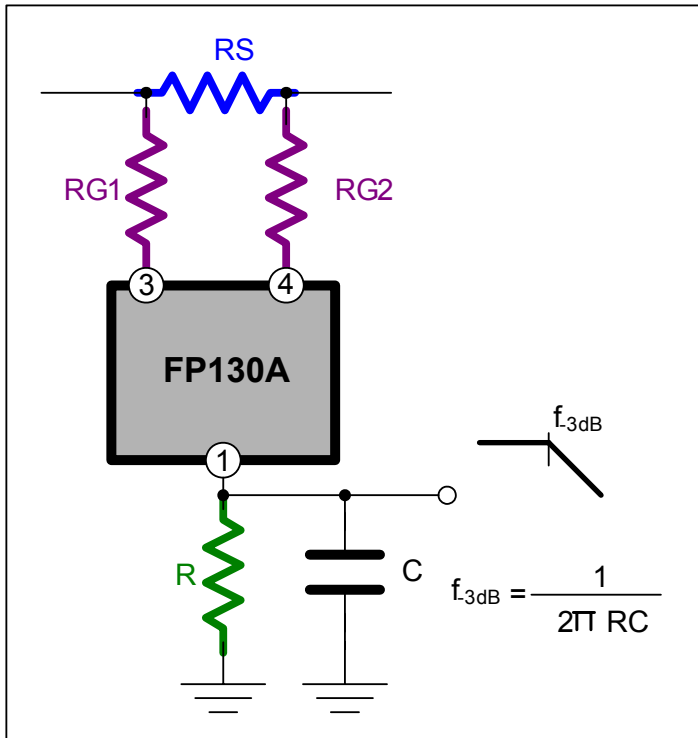


Figure 7 Current measurement circuit

## 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 **FP130A** 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 **FP130A** output.

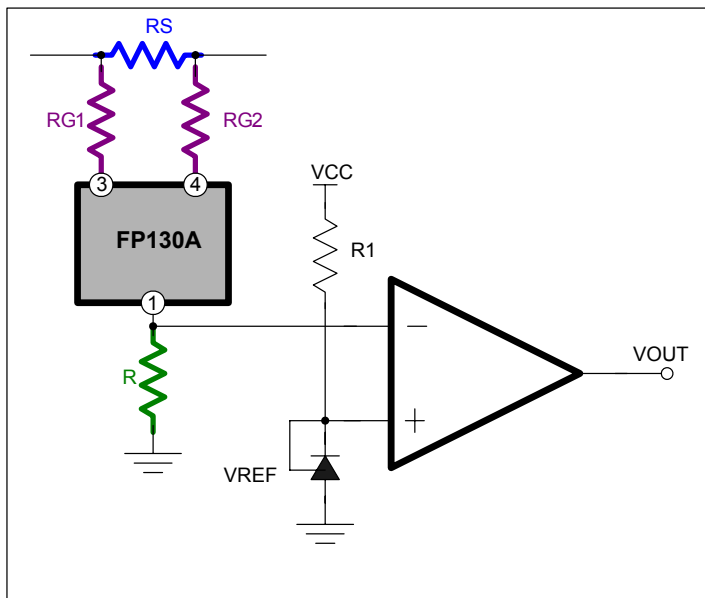
**APPLICATION NOTE**



**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.

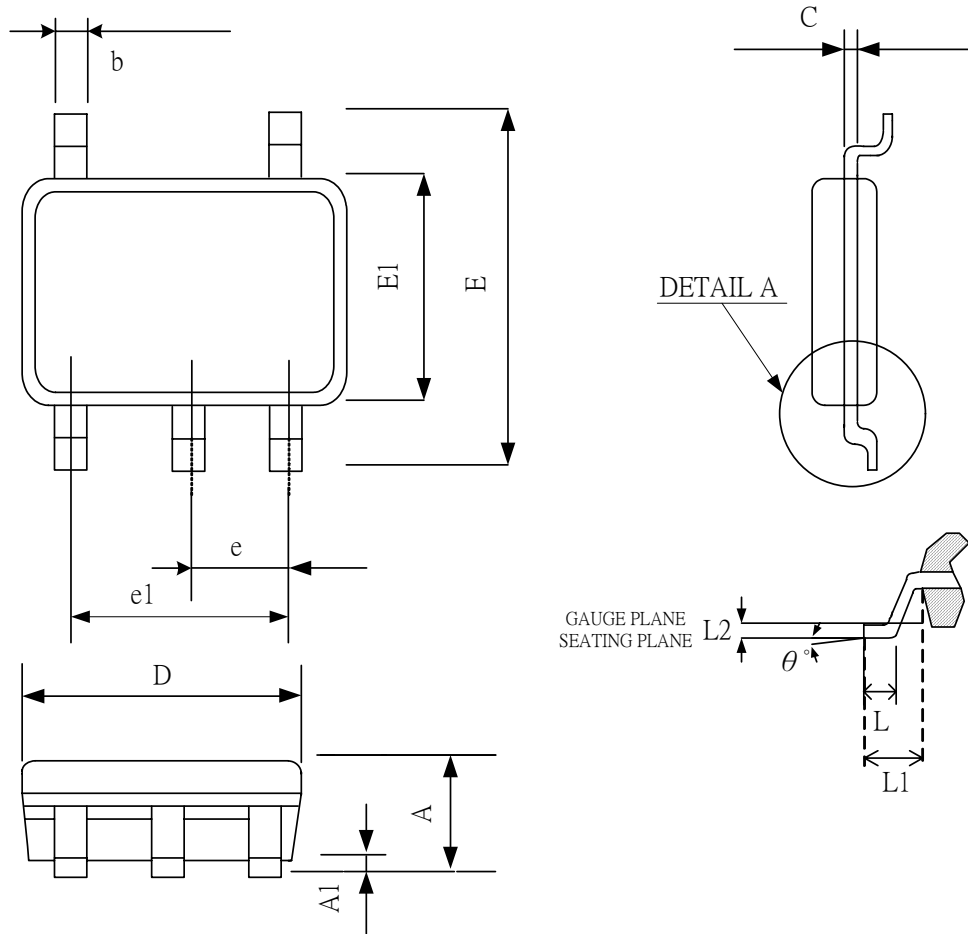
The capacitor is also a filter function when the signal has a frequency response.



**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.

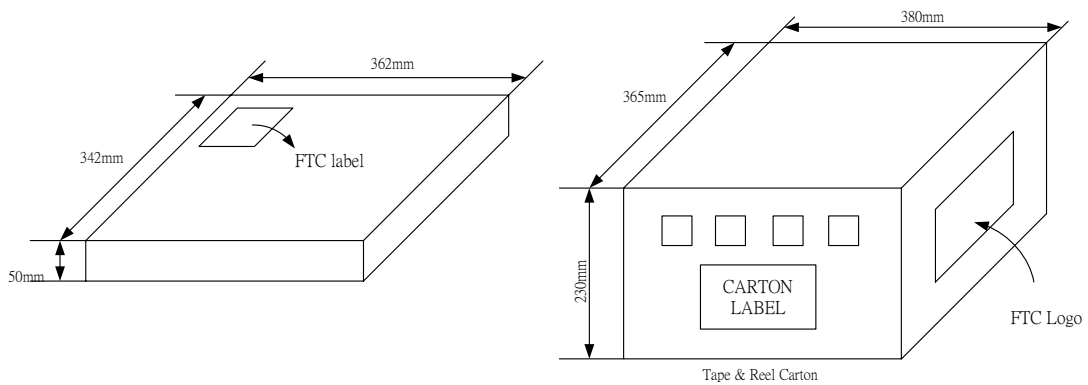
## PACKAGE OUTLINE



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.	
$\theta^\circ$	0	10

## PACKING SPECIFICATIONS BOX DIMENSION

### TAPE AND REEL INSIDE BOX AND CARTON



## PACKING QUANTITY SPECIFICATIONS

2500 EA / REEL
4 INSIDE BOXES / CARTON

## LABEL SPECIFICATIONS TAPPING & REEL

<b>Feeling Technology Corp</b>		
<b>Product:FP130AKR-LF</b>		
<b>Lot NO: A3311C62-L</b>		
<b>D/C:</b>	<b>fxxxx</b>	
<b>Q`ty:</b>	<b>2500</b>	
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