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POWER MANAGEMENT

Description

The SC4431 is a four terminal device for regulating an isolated power supply with output voltages down to 1.5V.

It is intended to be used as a replacement for three terminal shunt regulators such as SC431L where the output voltage is too low for the device to function in conjunction with an opto-isolator. SC4431 achieves this by having separate supply and output pins, allowing the output to sink current at voltages as low as 0.1V, while the supply pin still has sufficient voltage for the device to function. In this way, allowing for a 1.4V drop through an opto-isolator diode, regulation down to 1.5V out can be achieved.

The SC4431 shunt regulator is available with three initial reference voltage accuracies (0.5%, 1.0% and 2.0%) in the space saving 5-lead SOT-23 package. The three voltage tolerances allow the designer the opportunity to select the proper cost/tolerance for their application.

Lead free, fully WEEE and ROHS compliant

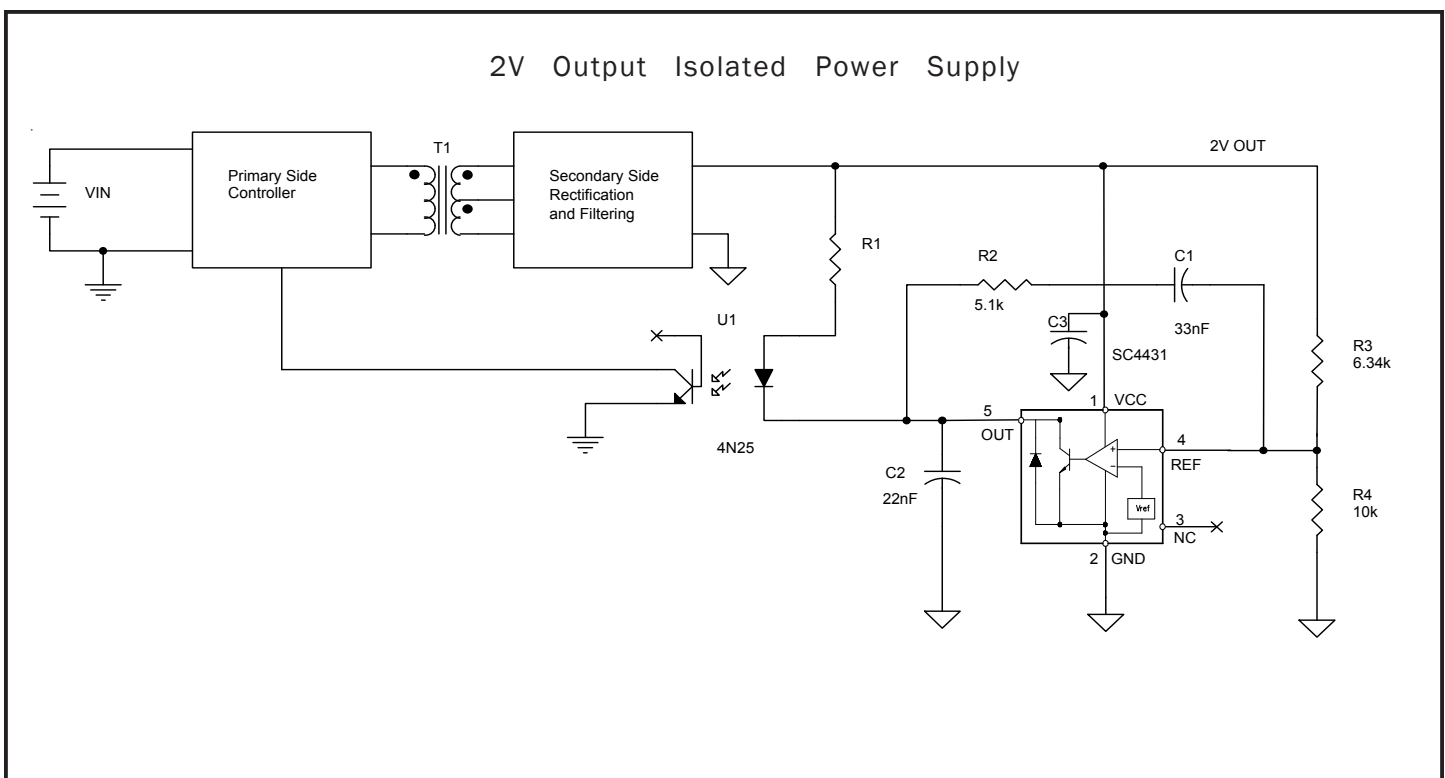
Features

- ◆ Open Collector output drives Optoisolator with as little as 1.5V input voltage
- ◆ Trimmed bandgap design - initial accuracies to $\pm 0.5\%$
- ◆ 40mA drive capability
- ◆ Regulates output as low as 50mV
- ◆ Wide supply voltage range - 1.5V to 15V
- ◆ Low supply current - typically 110 μ A
- ◆ Full industrial temperature range
- ◆ SOT-23-5 package

Applications

- ◆ Telecom Power Supplies
- ◆ Opto driver for very low output voltage (1.5V) isolated power supplies
- ◆ Battery operated applications
- ◆ Point of use power supplies

Typical Application Circuit



POWER MANAGEMENT

Absolute Maximum Rating

| Parameter | Symbol | Maximum | Units |
|---|---------------|-------------|-------|
| Input Supply Voltage | V_{CC} | -0.5 to +16 | V |
| Vcc pin current | I_{CC} | 8 | mA |
| Output Voltage | V_{OUT} | -0.5 to VCC | V |
| Reference Voltage ⁽¹⁾ | V_{REF} | -0.5 to +4 | V |
| Continuous Output Current | I_{OUT} | 40 | mA |
| Reference Input Current | I_{REF} | 5 | mA |
| Operating Ambient Temperature Range | T_A | -40 to +85 | °C |
| Operating Junction Temperature Range | T_J | -40 to +150 | °C |
| Storage Temperature Range | T_{STG} | -65 to +150 | °C |
| Thermal Impedance Junction to Ambient | θ_{JA} | 256 | °C/W |
| Thermal Impedance Junction to Case | θ_{JC} | 81 | °C/W |
| Power Dissipation at $T_A = 25^\circ\text{C}$ | P_D | 475 | mW |
| Lead Temperature (Soldering) 10 seconds | T_{LEAD} | 300 | °C |
| ESD Rating (Human Body Model) | ESD | 2 | kV |

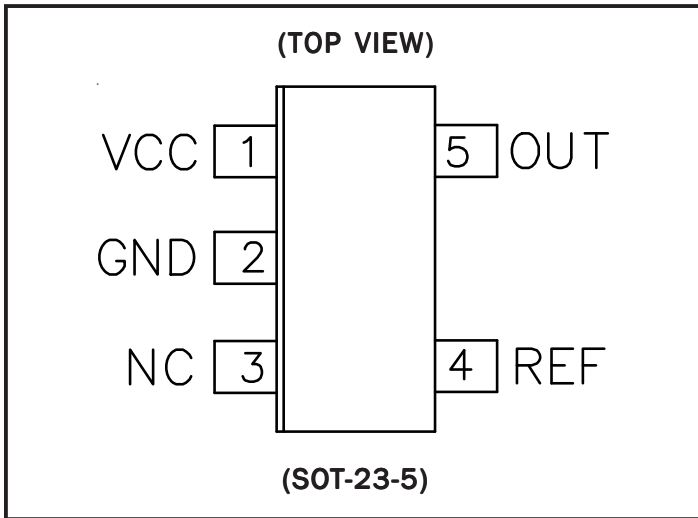
(1) If Vref will be forced above 1.224V, a resistor must be placed in series with the Vcc to limit the Icc current below 5mA.

Electrical Characteristics

| Unless specified, $T_A = 25^\circ\text{C}$, $V_{CC} = 2\text{V}$, $I_{OUT} = 2\text{mA}$. Values in bold apply over full operating temperature range. | | | | | | |
|---|---------------------|---|--------------|-------|--------------|---------------|
| Parameter | Symbol | Test Conditions | MIN | TYP | MAX | Units |
| VCC | | | | | | |
| Input Supply Voltage | V_{CC} | | 1.5 | | 15 | V |
| Input Supply Current | I_{CC} | $V_{REF} = V_{OUT}$ | | 110 | 200 | μA |
| Off State Input Supply Current | $I_{CC(OFF)}$ | $V_{REF} = 1.187\text{V}$, $V_{OUT} = 2\text{V}$ | | 65 | 100 | μA |
| | | | | | 150 | |
| REF | | | | | | |
| Reference Voltage | V_{REF} | SC4431-.5, $V_{REF} = V_{OUT}$ | 1.219 | 1.224 | 1.231 | V |
| | | | 1.207 | | 1.243 | |
| | | SC4431-1, $V_{REF} = V_{OUT}$ | 1.212 | 1.224 | 1.236 | V |
| | | | 1.200 | | 1.250 | |
| | | SC4431-2, $V_{REF} = V_{OUT}$ | 1.200 | 1.224 | 1.250 | V |
| | | | 1.187 | | 1.261 | |
| Change in V_{REF} due to change in V_{CC} | dV_{REF}/dV_{CC} | $V_{CC} = 1.5\text{V to }15\text{V}$ | | 8 | 15 | mV |
| | | | | | 20 | |
| Change in V_{REF} due to change in I_{OUT} | dV_{REF}/dI_{OUT} | $I_{OUT} = 0.1\text{mA to }40\text{mA}$ | | 8 | 28 | mV |
| | | | | | 36 | |
| Reference Input Current | I_{REF} | $0.1\text{mA} \leq I_{OUT} \leq 10\text{mA}$ | | 0.3 | 0.5 | μA |
| | | | | | 1.0 | |
| OUT | | | | | | |
| Saturation Voltage | $V_{OUT(SAT)}$ | $I_{OUT} = 5\text{mA}$, $I_{CC} = 500\mu\text{A}$ | | 50 | 75 | mV |
| | | | | | 100 | |
| | | $V_{REF} = 1.261\text{V}$, $I_{OUT} = 32\text{mA}$ | | 275 | 300 | mV |
| | | | | | 400 | |
| Off State Output Current | $I_{OUT(OFF)}$ | $V_{REF} = 1.187\text{V}$, $V_{OUT} = 2\text{V}$ | | 0.50 | 1 | μA |
| | | | | | 10 | |

POWER MANAGEMENT

Pin Configurations



Ordering Information

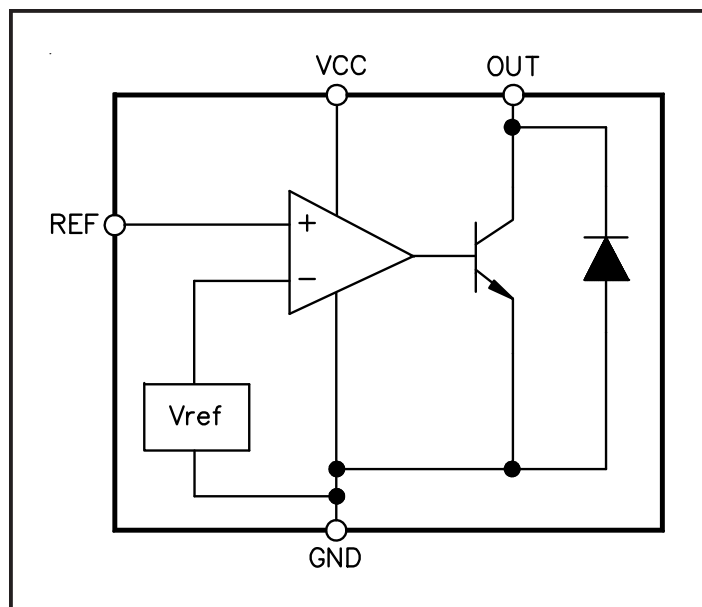
| Part Number ⁽¹⁾⁽²⁾ | Package |
|-------------------------------|----------|
| SC4431CSK-X | SOT-23-5 |

Notes: (1) Only available in tape and reel packaging. (Suffix '.TRT' e.g. SC4431CSK-X.TRT).
 (2) Where "-X" denotes initial reference voltage tolerance. Available options are $\pm 0.5\%$ (-.5), $\pm 1\%$ (-1) and $\pm 2\%$ (-2).

Pin Descriptions

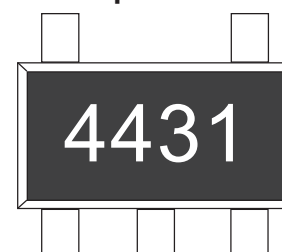
| Pin# | Pin Name | Pin Function |
|------|----------|---|
| 1 | VCC | This is the input supply pin for the SC4431. A low ESR capacitor should be used to bypass this pin to GND right at the IC. |
| 2 | GND | Logic and power ground. |
| 3 | NC | No connection. |
| 4 | REF | This is connected to the non-inverting input of the error amplifier. |
| 5 | OUT | This is the output pin of the device, essentially an open collector. Note: A 22nF low ESR (ceramic) capacitor is required from this pin to GND for stable operation. |

Block Diagram

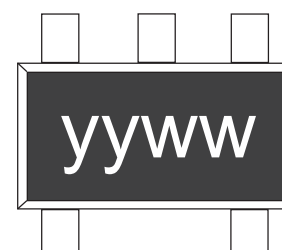


Marking Information

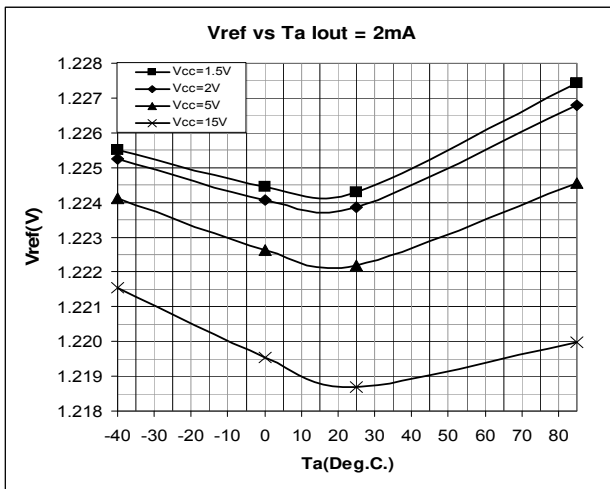
Top Mark



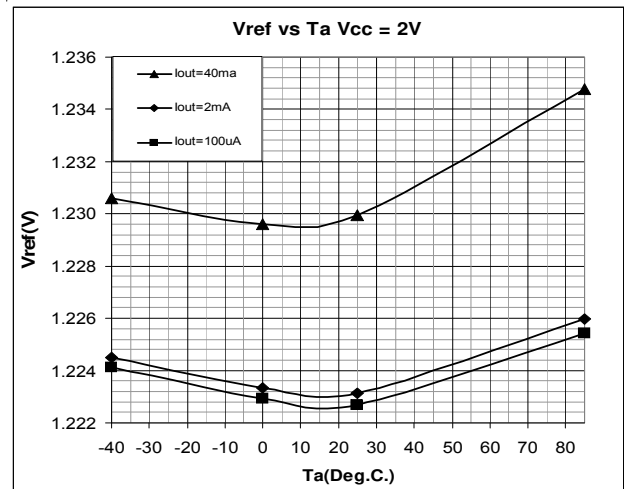
Bottom Mark



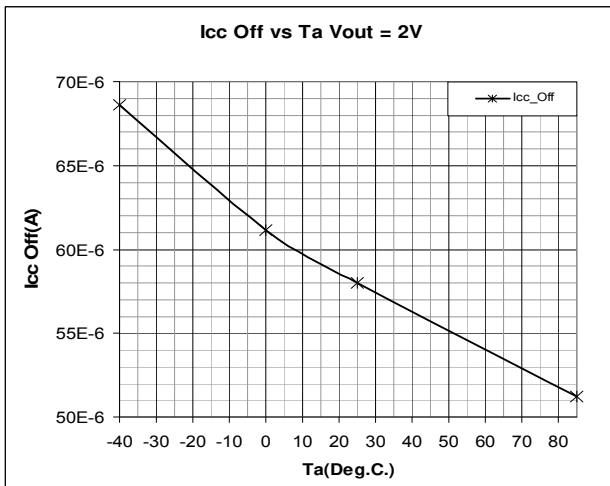
yyww = Datecode (Example: 9908)



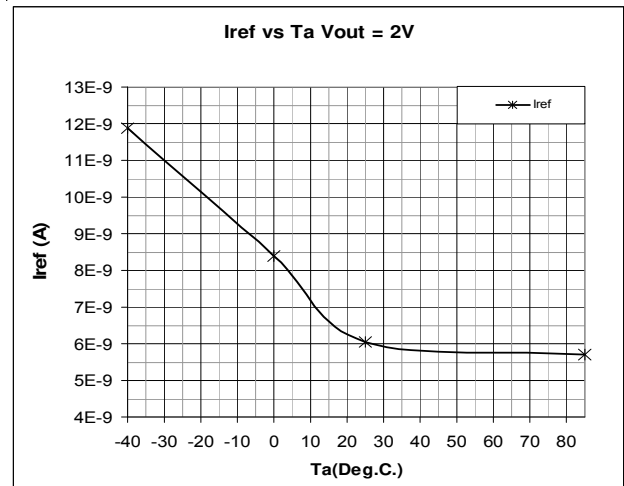
Typical Vref vs Ta I_o = 2mA



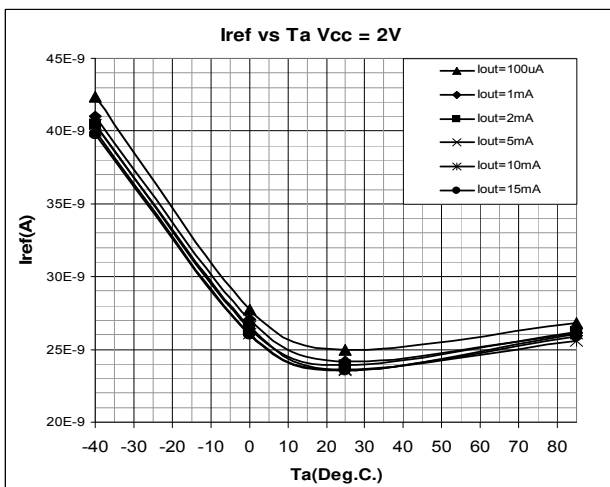
Typical Vref vs Ta V_{cc} = 2V



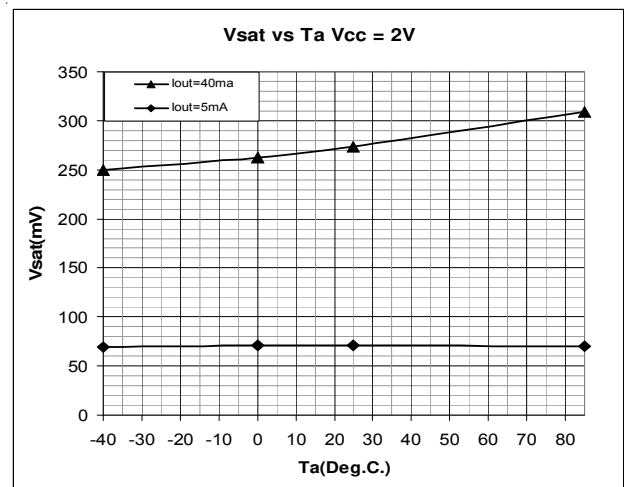
Typical I_{cc} Off vs Ta V_o = 2V



Typical I_{ref} vs Ta V_o = 2V



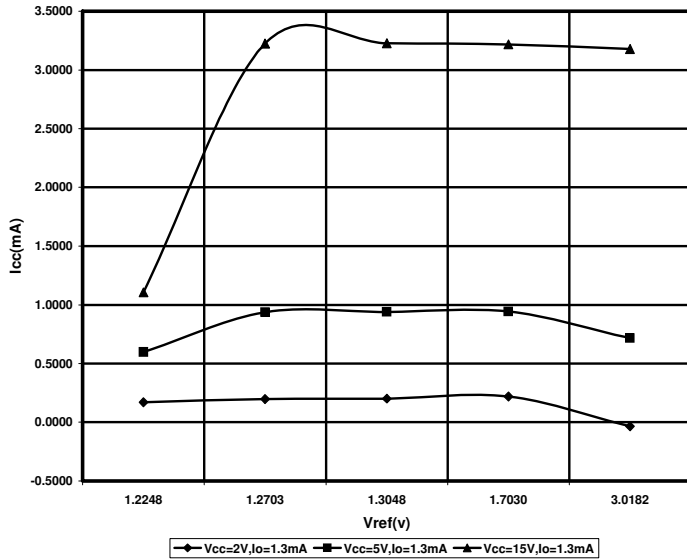
Typical I_{ref} vs Ta V_{cc} = 2V



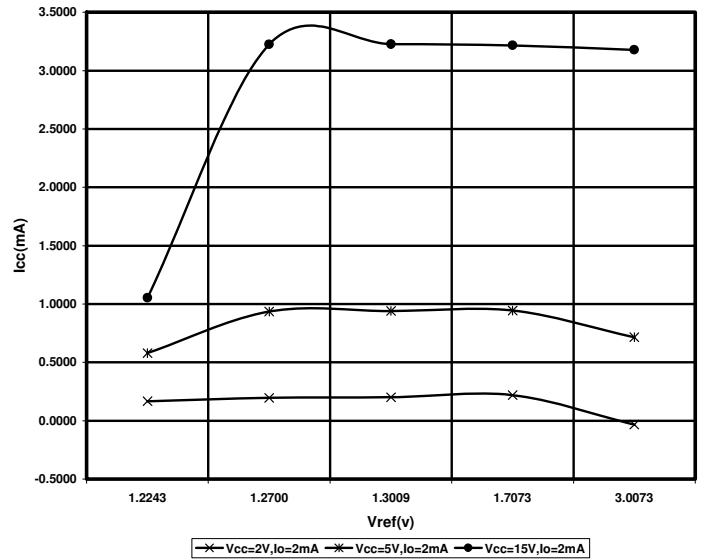
Typical V_{sat} vs Ta V_{cc} = 2V

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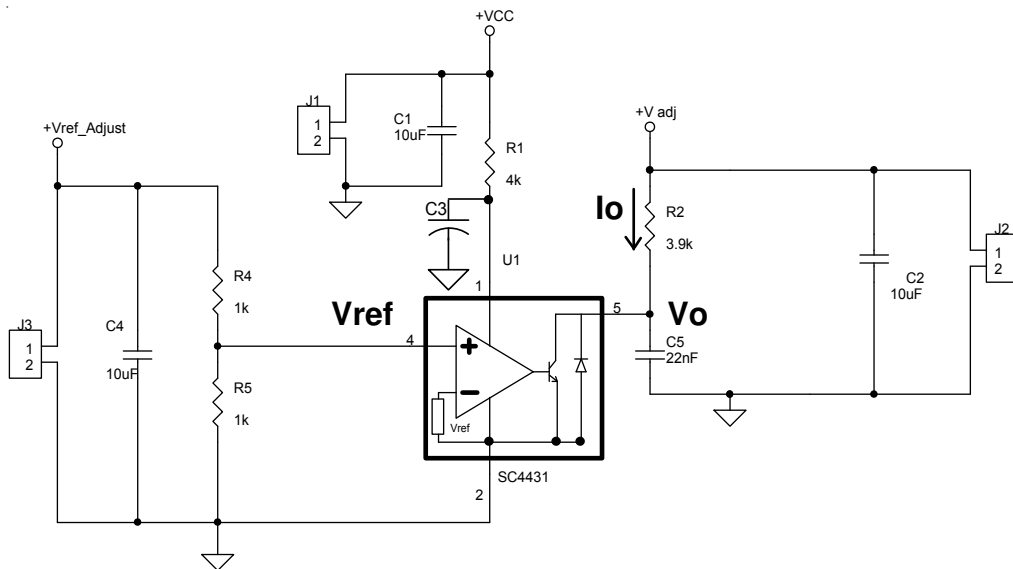
Typical Characteristics



Typical Icc vs Vref, Io = 1.3mA, Ta = 25 Deg.C.



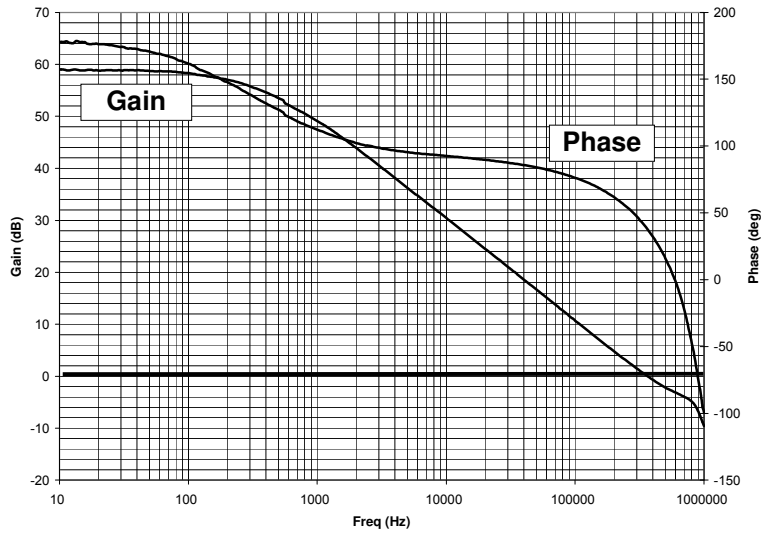
Typical Icc vs Vref, Io = 2mA, Ta = 25 Deg.C.



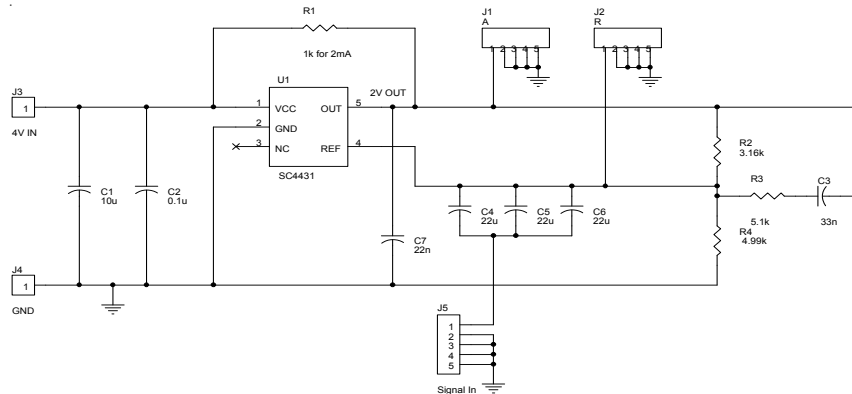
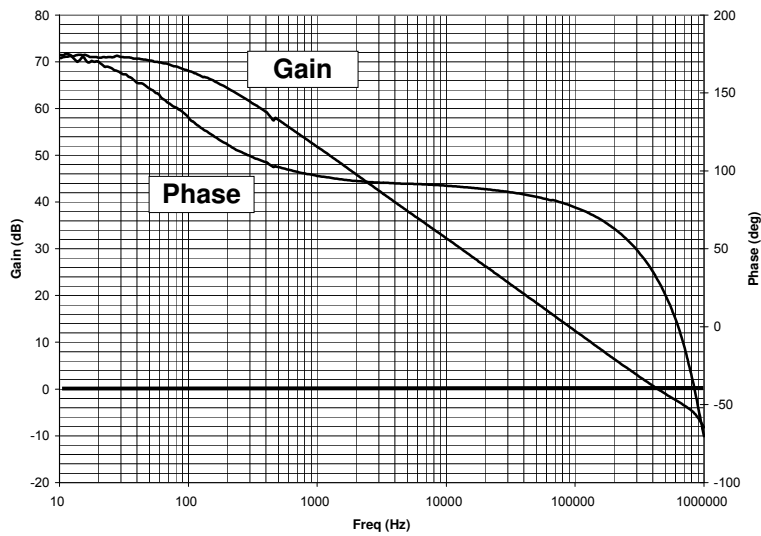
Icc vs Vref Test Circuit

Typical Gain Phase

SC4431 Gain / Phase Vin = 2V, Iout = 2mA, Vout = 1.6V



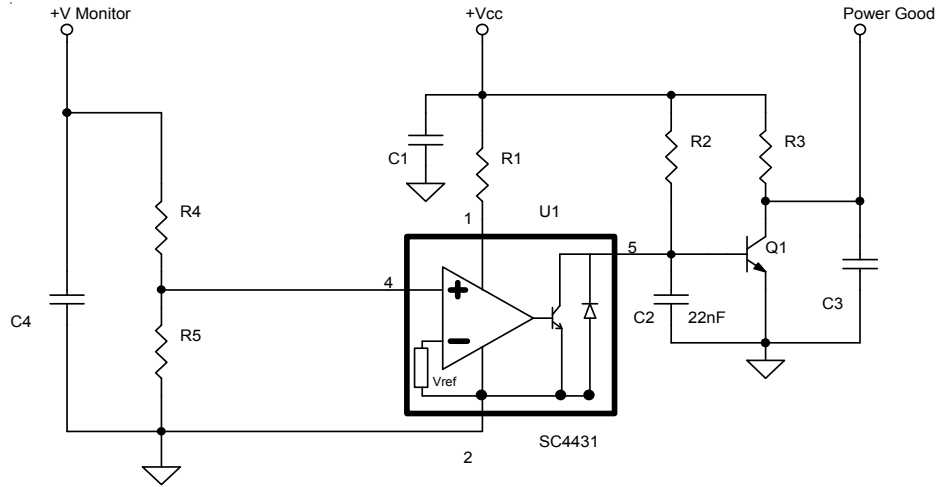
SC4431 Gain / Phase Vin = 4V, Iout = 2mA, Vout = 2V



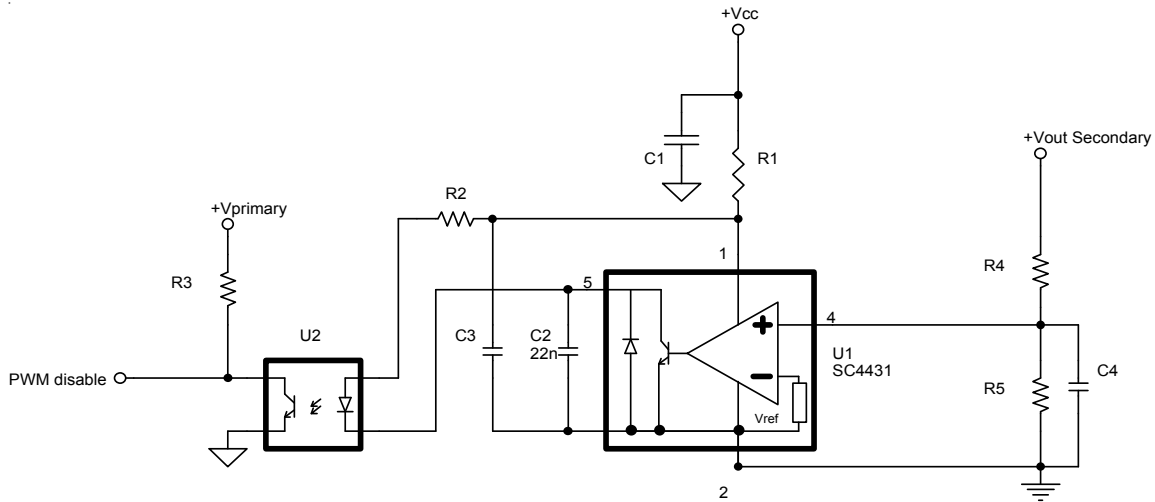
Gain Phase Test Circuit

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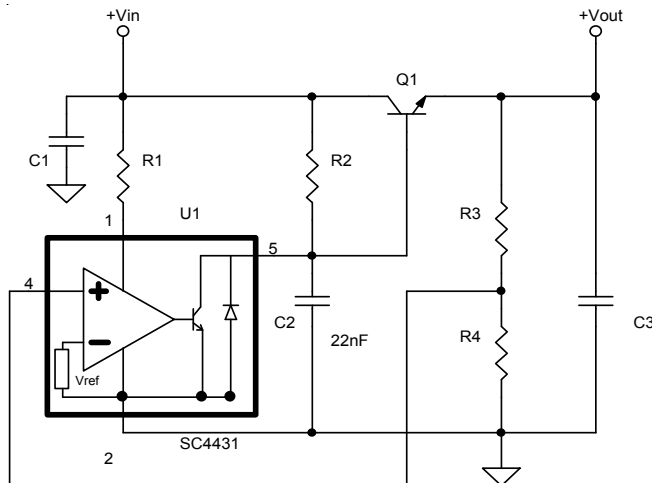
Typical Applications



Power good Circuit



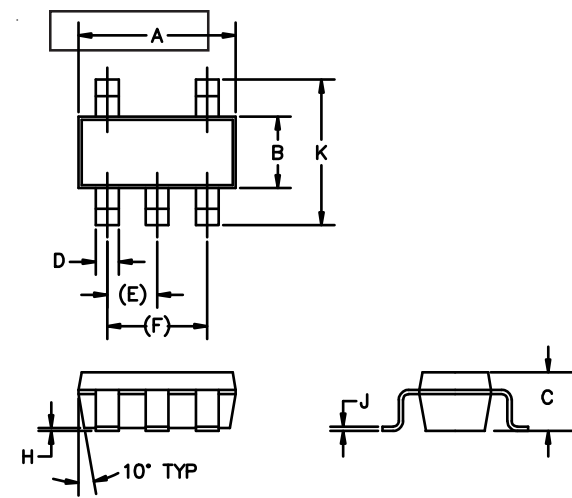
Isolated OVP Circuit



Linear Regulator Circuit

POWER MANAGEMENT

Outline Drawing

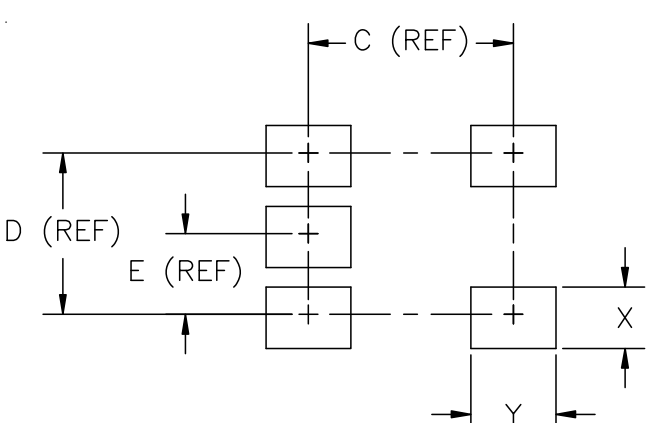


SOT-23- 5L ECN00 - 881

| DIM ^N | INCHES | | MM | | NOTE |
|------------------|--------|------|------|------|------|
| | MIN | MAX | MIN | MAX | |
| A | .110 | .120 | 2.80 | 3.05 | — |
| B | .059 | .070 | 1.50 | 1.75 | — |
| C | .036 | .051 | .90 | 1.30 | — |
| D | .014 | .020 | .35 | .50 | — |
| E | — | .037 | — | 0.95 | REF |
| F | — | .075 | — | 1.90 | REF |
| H | — | .006 | — | .150 | — |
| J | .0035 | .008 | .090 | .20 | — |
| K | .102 | .118 | 2.6 | 3.00 | — |

CONTROLLING DIMENSIONS: MILLIMETERS.

Land Pattern



SOT- 23- 5L ECN00 - 881

| DIM ^N | INCHES | | MM | | NOTE |
|------------------|--------|-----|----|------|------|
| | INCHES | MM | MM | NOTE | |
| C | .094 | 2.4 | — | — | |
| D | .074 | 1.9 | — | — | |
| E | .037 | .95 | — | — | |
| X | .028 | .7 | — | — | |
| Y | .039 | 1.0 | — | — | |

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