

# **UTCLR1116/A LINEAR INTEGRATED CIRCUIT**

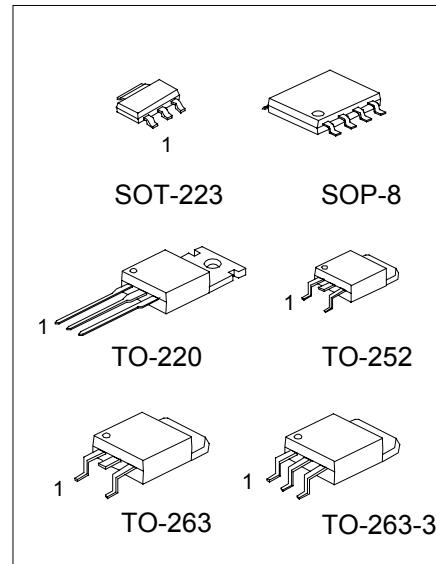
## **LOW DROP FIXED AND ADJUSTABLE POSITIVE VOLTAGE REGULATORS**

### **DESCRIPTION**

The UTC LR1116/A is a LOW DROP Voltage Regulator able to provide up to 0.8/1.0A of Output Current, available even in adjustable version ( $V_{ref}=1.25V$ ). Concerning fixed versions, are offered the following Output Voltages: 1.5V, 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 3.6V and 5.0V. The 2.85V type is ideal for SCSI-2 lines active termination. The device is supplied in: SOT-223, TO-252, TO-263, TO-263-3, SOP-8 and TO-220. The SOT-223, TO-263, TO-263-3 and TO-252 surface mount packages optimize the thermal characteristics even offering a relevant space saving effect. High efficiency is assured by NPN pass transistor. In fact in the case, unlike than PNP one, the Quiescent Current flows mostly into the load. Only a very common  $10\mu F$  minimum capacitor is needed for stability. On chip trimming allows the regulator to reach a very tight output voltage tolerance, within  $\pm 1\%$  at  $25^\circ C$ . The ADJUSTABLE LR1116/A is pin to pin compatible with the other standard Adjustable voltage regulators maintaining the better performances in terms of Drop and Tolerance.

### **FEATURES**

- \*Low dropout voltage (0.6V max.)
- \*2.85V device performances are suitable for SCSI-2 active termination
- \*Output current up to 0.8/1.0A
- \*Fixed output voltage of: 1.5V, 1.8V, 2.5V, 2.85V, 3.0V, 3.3V, 3.6V, 5.0V
- \*Adjustable version availability ( $V_{ref}=1.25V$ )
- \*Internal current and thermal limit
- \*Available in  $\pm 1\%$ (at  $25^\circ C$ ) and 2% in all temperature range
- \*Supply voltage rejection: 75dB (TYP)
- \*Temperature range: 0°C to 125°C



SOP-8      1: GND; 2,3,6,7: Vout;  
                4: Vin;    5,8: NC

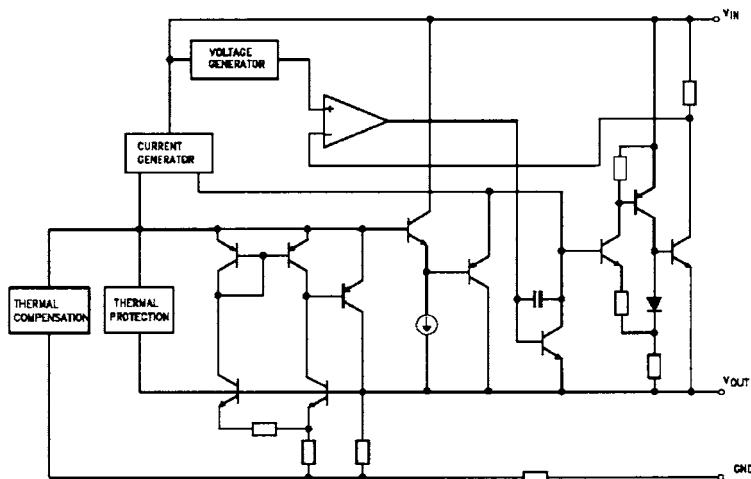
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## MARKING INFORMATION

| PACKAGE                                | VOLTAGE CODE | PIN CODE | PIN 1 | PIN 2 | PIN 3 | MARKING  |
|--|--------------|----------|-------|-------|-------|--|
| SOT-223                                | 15:1.5V      | A        | GND   | OUT   | IN    | <p>The marking diagram shows the top view of the SOT-223 package with pins 1, 2, and 3 labeled. Pin 1 is GND, Pin 2 is OUT, and Pin 3 is IN. To the right, two examples of markings are shown. The first example shows 'LR1116' in the center, with 'CURRENT CODE' at the top, 'VOLTAGE CODE' below it, and 'PIN CODE' at the bottom. Below these are 'DATE CODE' and three small squares. The second example shows 'UTC LR1116' in the center, with 'VOLTAGE CODE' at the top, 'CURRENT CODE' below it, and 'PIN CODE' at the bottom. Below these are 'DATE CODE' and three small squares.</p>    |
|  | 18:1.8V      | B        | OUT   | GND   | IN    |  |
|  | 25:2.5V      | C        | GND   | IN    | OUT   |  |
|  | 28:2.85V     | D        | IN    | GND   | OUT   |  |
|  | 30:3.0V      |          |       |       |       |  |
|  | 33:3.3V      |          |       |       |       |  |
| TO-220<br>TO-252<br>TO-263<br>TO-263-3 | 36:3.6V      | A        | GND   | OUT   | IN    | <p>The marking diagram shows the top view of the TO-220 package with pins 1, 2, and 3 labeled. Pin 1 is GND, Pin 2 is OUT, and Pin 3 is IN. To the right, two examples of markings are shown. The first example shows 'UTC LR1116' in the center, with 'VOLTAGE CODE' at the top, 'CURRENT CODE' below it, and 'PIN CODE' at the bottom. Below these are 'DATE CODE' and three small squares. The second example shows 'UTC LR1116' in the center, with 'VOLTAGE CODE' at the top, 'CURRENT CODE' below it, and 'PIN CODE' at the bottom. Below these are 'DATE CODE' and three small squares.</p> |
|  | 50:5.0V      | B        | OUT   | GND   | IN    |  |
|  | AD:ADJ       | C        | GND   | IN    | OUT   |  |
|  |              | D        | IN    | GND   | OUT   |  |

Note: The current code "A" means output current up to 1.0A, while without "A" means output current up to 0.8A.

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

| PARAMETER                      | SYMBOL           | RATINGS    | UNIT |
|--------------------------------|------------------|------------|------|
| DC Input Voltage               | V <sub>IN</sub>  | 15         | V    |
| Power Dissipation              | P <sub>tot</sub> | 12         | W    |
| Storage temperature            | T <sub>stg</sub> | -65 ~ +150 | °C   |
| Operating Junction Temperature | T <sub>op</sub>  | 0 ~ +125   | °C   |

Note: Absolute Maximum Ratings are those values beyond which damage to the device may occur. Functional operation under these conditions is not implied. Over the above suggested Max Power Dissipation a Short Circuit could definitely damage the device.

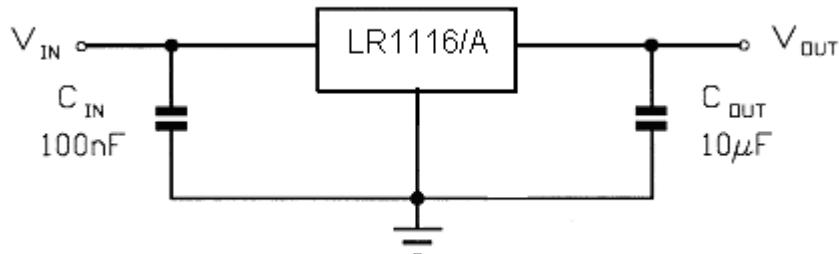
**UTC UNISONIC TECHNOLOGIES CO., LTD.**

# UTCLR1116/A LINEAR INTEGRATED CIRCUIT

## THERMAL DATA

| PARAMETER                           | SYMBOL   | VALUE | UNIT |
|-------------------------------------|----------|-------|------|
| Thermal Resistance Junction-case    |          |       |      |
| SOT-223                             | Rth-case | 15    | °C/W |
| SOP-8                               |          | 20    | °C/W |
| TO-252                              |          | 8     | °C/W |
| TO-220                              |          | 3     | °C/W |
| TO-263                              |          | 3     | °C/W |
| Thermal Resistance Junction-ambient | Rthj-amb |       |      |
| TO-220                              |          | 50    | °C/W |

## APPLICATION CIRCUIT



## UTC LR1116/A-XX ELECTRICAL CHARACTERISTICS

(refer to the test circuits,  $T_j=0$  to  $125^\circ\text{C}$ ,  $C_o=10\mu\text{F}$  unless otherwise specified)

| PARAMETER                | SYMBOL       | TEST CONDITIONS  | MIN.  | TYP.  | MAX.                     | UNIT |
|--------------------------|--------------|--|-------|-------|--------------------------|------|
| Output Voltage           | $V_o$        | $V_{in}=V_o+1.5\text{V}$ , $I_o=10\text{mA}$ , $T_j=25^\circ\text{C}$  | 1.485 | 1.500 | 1.515                    | V    |
| Output Voltage           | $V_o$        | $I_o=0$ to $800/1000\text{mA}$<br>$V_{in}=(V_o+1\text{V}) \sim 15\text{V}$   | 1.470 | 1.500 | 1.530                    | V    |
| Line Regulation          | $\Delta V_o$ | $V_{in}=(V_o+1\text{V}) \sim 15\text{V}$ , $I_o=0\text{mA}$  |       | 1     | 6                        | mV   |
| Load Regulation          | $\Delta V_o$ | $V_{in}=(V_o+1\text{V}) \sim 15\text{V}$<br>$I_o=0$ to $800/1000\text{mA}$   |       | 1     | 10                       | mV   |
| Temperature stability    | $\Delta V_o$ |  |       | 0.5   |                          | %    |
| Long Term Stability      | $\Delta V_o$ | 1000 hrs, $T_j=125^\circ\text{C}$  |       | 0.3   |                          | %    |
| Operating Input Voltage  | $V_{in}$     | $I_o=100\text{mA}$   |       |       | 15                       | V    |
| Quiescent Current        | $I_d$        | $V_{in}\leq 10\text{V}$  |       | 5     | 10                       | mA   |
| Output Current           | $I_o$        | $V_{in}=V_o+4.5\text{V}$ , $T_j=25^\circ\text{C}$  | 800   | 950   | 1200                     | mA   |
| Output Noise Voltage     | $e_N$        | $B=10\text{Hz}$ to $10\text{KHz}$ , $T_j=25^\circ\text{C}$   |       | 100   |                          | μV   |
| Supply Voltage Rejection | SVR          | $I_o=40\text{mA}$ , $f=120\text{Hz}$ , $T_j=25^\circ\text{C}$<br>$V_{in}=V_o+2.5\text{V}$ , $V_{ripple}=1\text{Vpp}$ | 60    | 75    |                          | dB   |
| Dropout Voltage          | $V_d$        | $I_o=100\text{mA}$<br>$I_o=500\text{mA}$<br>$I_o=800\text{mA}$<br>$I_o=1000\text{ mA}$                               |       |       | 0.3<br>0.4<br>0.6<br>0.6 | V    |
| Thermal Regulation       |              | $T_a=25^\circ\text{C}$ , 30ms Pulse  |       | 0.01  | 0.10                     | %/W  |

# UTCLR1116/A LINEAR INTEGRATED CIRCUIT

## UTC LR1116/A-ADJUSTABLE ELECTRICAL CHARACTERISTICS

(refer to the test circuits,  $T_j=0$  to  $125^\circ\text{C}$ ,  $C_o=10\mu\text{F}$  unless otherwise specified)

| PARAMETER                     | SYMBOL           | TEST CONDITIONS   | MIN.  | TYP.  | MAX.                     | UNIT   |
|-------------------------------|------------------|---|-------|-------|--------------------------|--|
| Reference Voltage             | $V_{ref}$        | $V_{in}-V_o=1.5\text{V}$ , $I_o=10\text{mA}$ , $T_j=25^\circ\text{C}$   | 1.238 | 1.25  | 1.262                    | $\text{V}$   |
| Reference Voltage             | $V_{ref}$        | $I_o=10$ to $800/1000\text{mA}$ , $V_{in}-V_o=1\text{V}$ to $10\text{V}$  | 1.225 |       | 1.275                    | $\text{V}$   |
| Line Regulation               | $\Delta V_o$     | $V_{in}-V_o=1\text{V}$ to $13.75\text{V}$ , $I_o=10\text{mA}$   |       | 0.035 | 0.200                    | %  |
| Load Regulation               | $\Delta V_o$     | $V_{in}-V_o=1\text{V}$ , $I_o=10$ to $800/1000\text{mA}$  |       | 0.10  | 0.400                    | %  |
| Temperature stability         | $\Delta V_o$     |   |       | 0.50  |                          | %  |
| Long Term Stability           | $\Delta V_o$     | 1000 hrs, $T_j=125^\circ\text{C}$   |       | 0.3   |                          | %  |
| Operating Input Voltage       | $V_{in}$         |   |       |       | 15                       | $\text{V}$   |
| Adjustment Pin Current        | $I_{adj}$        | $V_{in}\leq 15\text{V}$   |       | 60    | 120                      | $\mu\text{A}$  |
| Adjustment Pin Current Change | $\Delta I_{adj}$ | $V_{in}-V_o=1\text{V}$ to $10\text{V}$ , $I_o=10$ to $800/1000\text{mA}$  |       | 1     | 5                        | $\mu\text{A}$  |
| Minimum Load Current          | $I_o(\min)$      | $V_{in}=15\text{V}$   |       | 2     | 5                        | $\text{mA}$  |
| Output Current                | $I_o$            | $V_{in}-V_o=4.5\text{V}$ , $T_j=25^\circ\text{C}$   | 800   | 950   | 1200                     | $\text{mA}$  |
| Output Noise (% $V_o$ )       | $e_N$            | $B=10\text{Hz}$ to $10\text{KHz}$ , $T_j=25^\circ\text{C}$  |       | 0.003 |                          | %  |
| Supply Voltage Rejection      | $SVR$            | $I_o=40\text{mA}$ , $f=120\text{Hz}$ , $T_j=25^\circ\text{C}$ , $V_{in}-V_o=2.5\text{V}$ , $V_{ripple}=1\text{Vpp}$ | 60    | 75    |                          | $\text{dB}$  |
| Dropout Voltage               | $V_d$            | $I_o=100\text{mA}$<br>$I_o=500\text{mA}$<br>$I_o=800\text{mA}$<br>$I_o=1000\text{mA}$                               |       |       | 0.3<br>0.4<br>0.6<br>0.6 | $\text{V}$<br>$\text{V}$<br>$\text{V}$<br>$\text{V}$ |
| Thermal Regulation            |                  | $T_a=25^\circ\text{C}$ , 30ms Pulse   |       | 0.01  | 0.10                     | %/ $\text{W}$  |

## TYPICAL APPLICATIONS

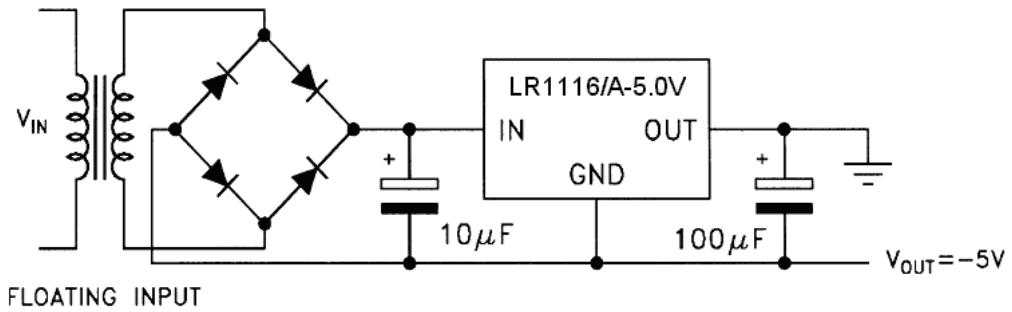


FIG.1 Negative Supply

## UTCLR1116/A LINEAR INTEGRATED CIRCUIT

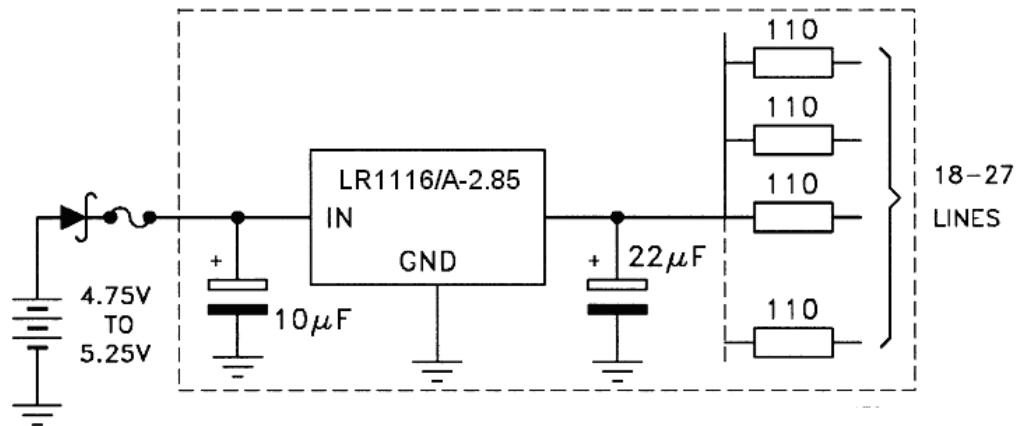


FIG.2 Active Terminator for SCSI-2 BUS

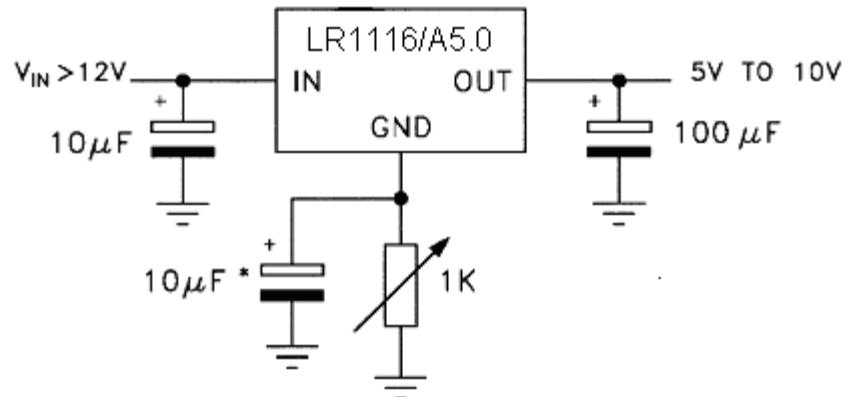


FIG.3 Circuit for Increasing Output Voltage

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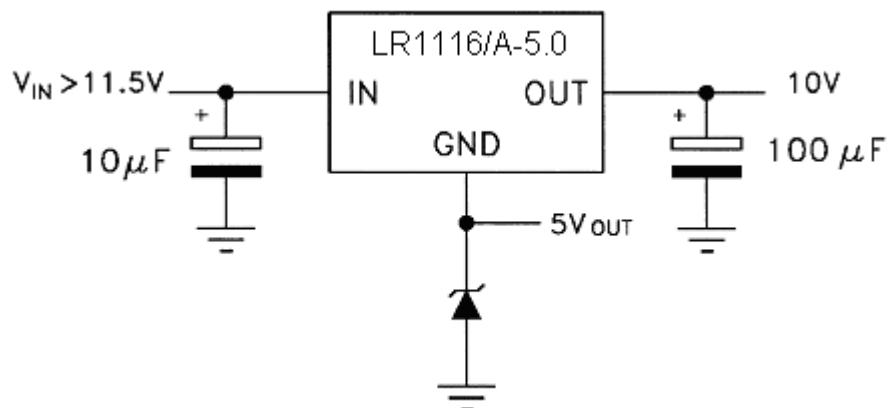


FIG.4 Voltage Regulator With Reference

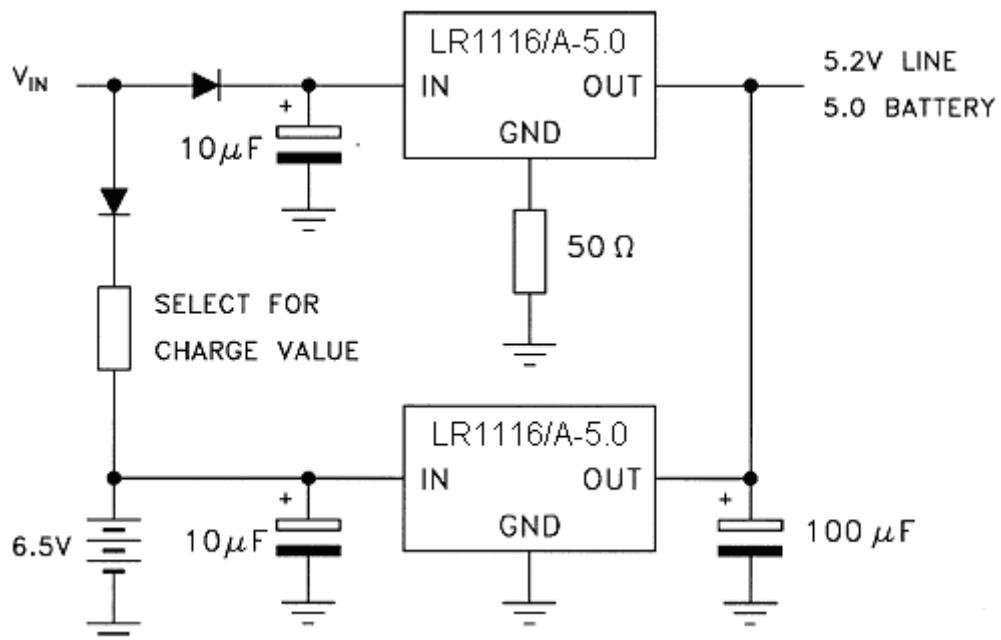


FIG.5 Battery Backed-up Regulated Supply  
FEEDBACK PATH

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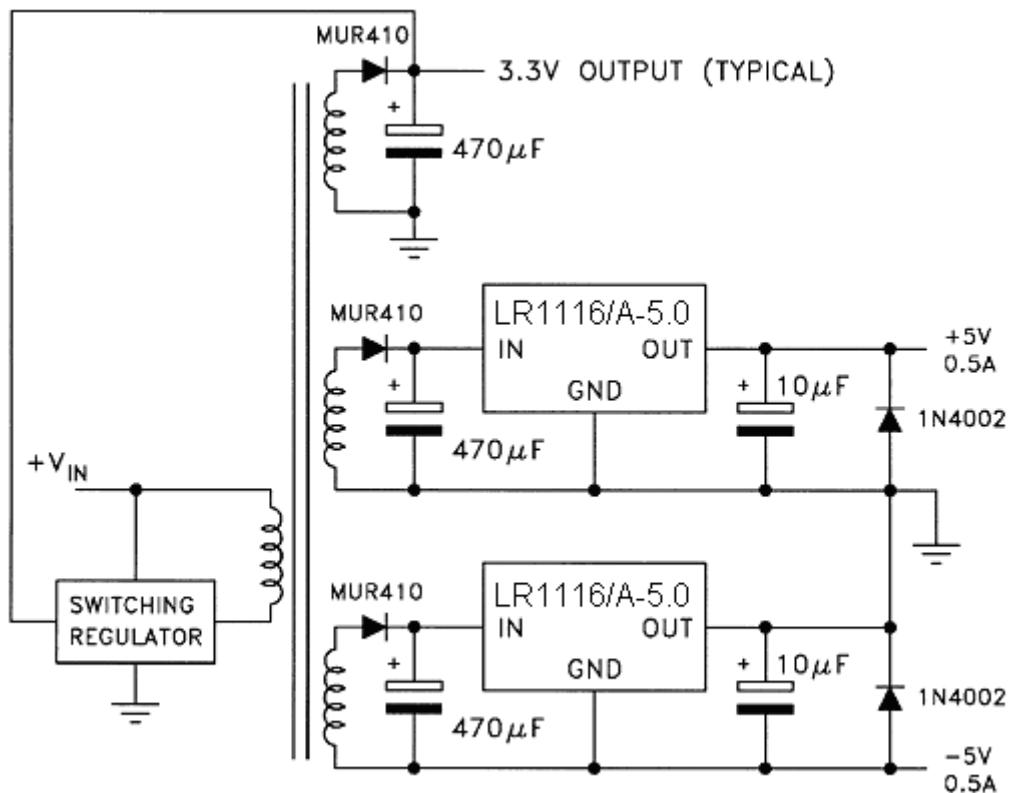


FIG.6 Post-Regulated Dual Supply

# UTCLR1116/A LINEAR INTEGRATED CIRCUIT

## LR1116/A ADJUSTABLE APPLICATION NOTE

The LR1116/A ADJUSTABLE has a thermal stabilized  $1.25 \pm 0.012V$  reference voltage between the OUT and ADJ pins.  $I_{ADJ}$  is  $60\mu A$  typ. ( $120\mu A$  max.) and  $\Delta I_{ADJ}$  is  $1\mu A$  typ. ( $5\mu A$  max.).

R1 is normally fixed to  $120\Omega$ . From figure 7 we obtain:

$$V_{OUT} = V_{REF} + R2(I_{ADJ} + I_{R1}) = V_{REF} + R2(I_{ADJ} + V_{REF} / R1) = V_{REF}(1 + R2/R1) + R2 \times I_{ADJ}$$

In normal application R2 value is in the range of few Kohm., so the  $R2 \times I_{ADJ}$  product could not be considered in the  $V_{OUT}$  calculation; then the above expression becomes:  $V_{OUT} = V_{REF}(1 + R2/R1)$

In order to have the better load regulation it is important to realize a good Kelvin connection of R1 and R2 resistors. In particular R1 connection must be realized very close to OUT and ADJ pin, while R2 ground connection must be placed as near as possible to the negative Load pin. Ripple rejection can be improved by introducing a  $10\mu F$  electrolytic capacitor placed in parallel to the R2 resistor (See Fig. 8)

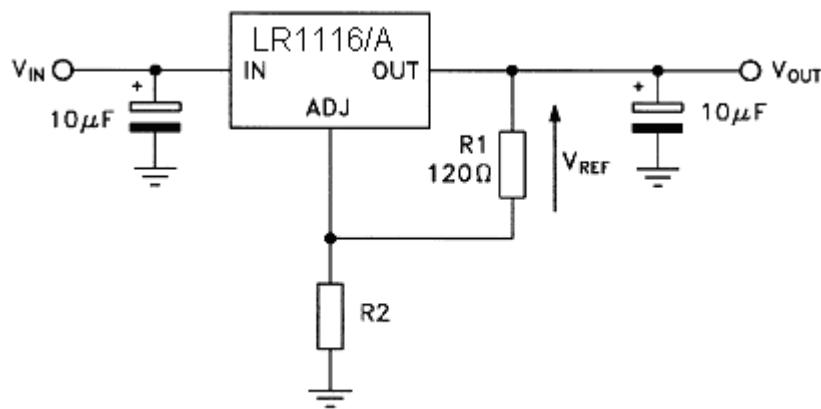


FIG.7 Adjustable Output Voltage Application Circuit

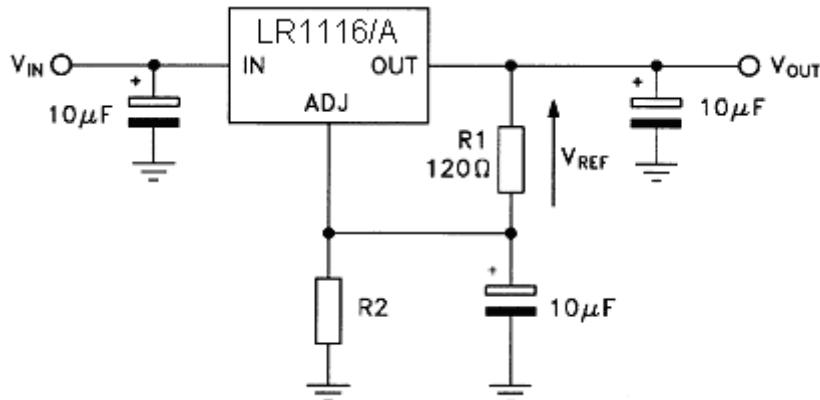


FIG.8 Adjustable Output Voltage Application with improved Ripple Rejection.

# UTCLR1116/A LINEAR INTEGRATED CIRCUIT

## TYPICAL CHARACTERISTICS

Fig.1 Reference Voltge vs. Temperature

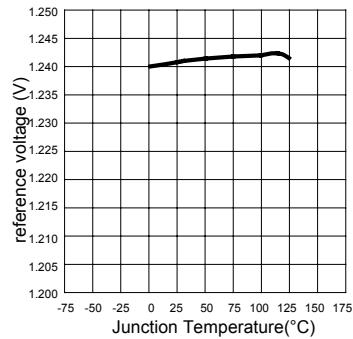


Fig.2 Output Voltage vs. Temperautre

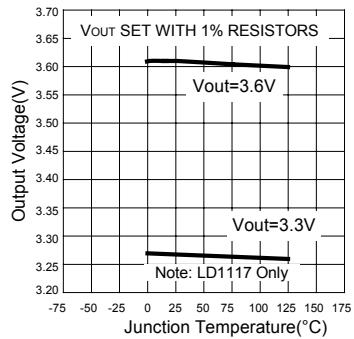
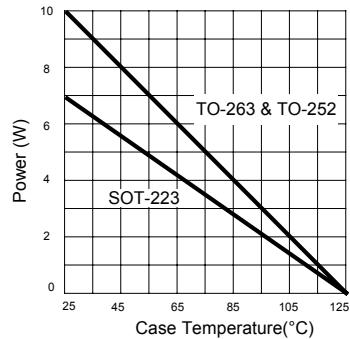


Fig.3 Maximum Power Dissipation



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