



LR9102

CMOS IC

LOW NOISE 300mA LDO REGULATOR

DESCRIPTION

The UTC **LR9102** is a typical LDO (linear regulator) with the features of high output voltage accuracy, low supply current, low ON-resistance, and high ripple rejection.

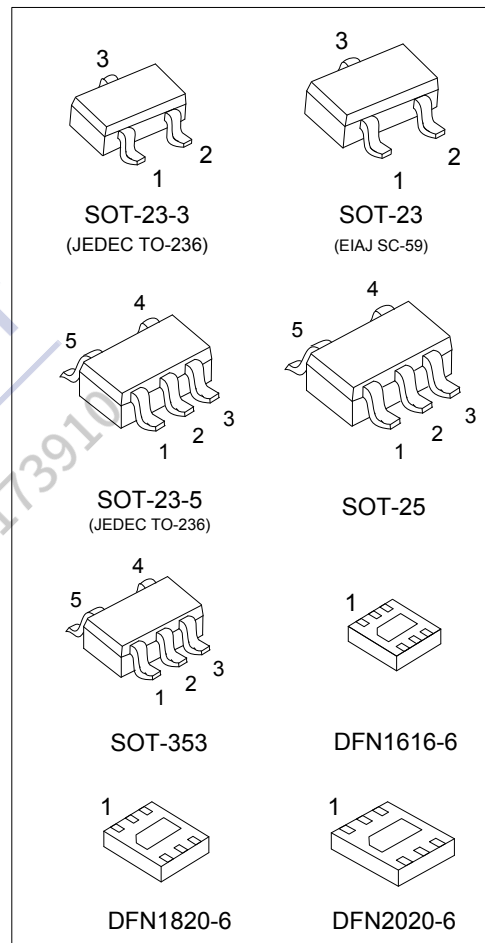
During operation of the UTC **LR9102**, the dropout voltage is very low and the response of line transient and load transient are very well.

Internally, there're many functions of UTC **LR9102** which can be seen in the block figure. There are a voltage reference unit, an error amplifier, resistor-net for voltage setting, a current limit circuit, and a chip enable circuit in each UTC **LR9102**, with auto discharge function at off state.

The UTC **LR9102** can be used as an ideal of the power supply for hand-held communication equipment, such as: power source for portable communication equipment, power source for electrical appliances, for example, cameras, VCRs and camcorders and power source for battery-powered equipment.

FEATURES

- * Ultra Supply Current: LR9102: 50 μ A (Typ.)
- * Standby Mode: 0.1 μ A (Typ.)
- * Very Low Dropout Voltage: 0.12V (Typ.)
- * Ripple Rejection: @ $I_{OUT}=300mA, V_{OUT}=2.85V$
75dB (Typ.)
@ $f=1kHz, V_{OUT}=2.85V$
- * Temperature-Drift Coefficient of Output Voltage: $\pm 50ppm/^{\circ}C$ (Typ.)
- * Well Line Regulation: 0.02%/ V (Typ.)
- * Output Voltage Accuracy: $\pm 1.0\%$
- * Internal Fold Back Protection 50mA (Typ.) @ short mode Circuit:
- * $C_{IN}=C_{OUT}=1\mu F$ or more (Ceramic capacitors) are recommended to be used with this IC



ORDERING INFORMATION

| Ordering Number | | Package | Packing |
|-----------------------|-----------------------|-----------|-----------|
| Lead Free | Halogen Free | | |
| LR9102L-xx-AE2-R | LR9102G-xx-AE2-R | SOT-23-3 | Tape Reel |
| LR9102L-xx-AE3-R | LR9102G-xx-AE3-R | SOT-23 | Tape Reel |
| LR9102L-xx-AE5-R | LR9102G-xx-AE5-R | SOT-23-5 | Tape Reel |
| LR9102L-xx-AF5-R | LR9102G-xx-AF5-R | SOT-25 | Tape Reel |
| LR9102L-xx-AF5-Z-R | LR9102G-xx-AF5-Z-R | SOT-25 | Tape Reel |
| LR9102L-xx-AL5-R | LR9102G-xx-AL5-R | SOT-353 | Tape Reel |
| LR9102L-xx-K06-1616-R | LR9102G-xx-K06-1616-R | DFN1616-6 | Tape Reel |
| LR9102L-xx-K06-1820-R | LR9102G-xx-K06-1820-R | DFN1820-6 | Tape Reel |
| LR9102L-xx-K06-2020-R | LR9102G-xx-K06-2020-R | DFN2020-6 | Tape Reel |

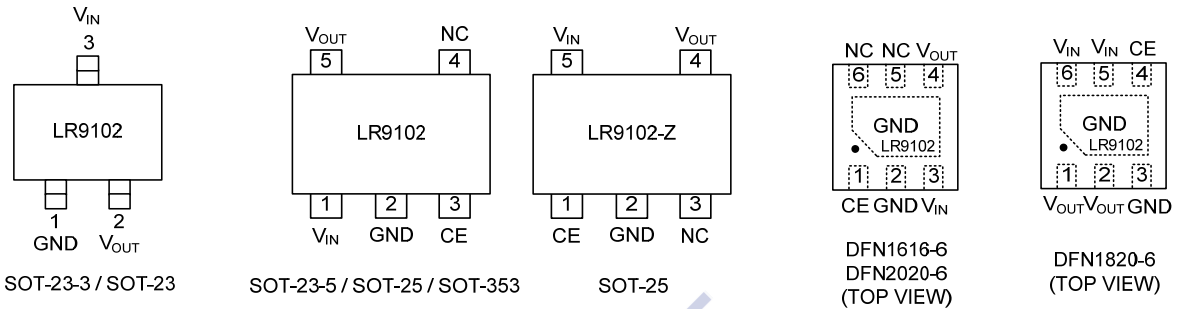
Note: xx: Output Voltage, refer to Marking Information.

| | |
|---|--|
| <p>LR9102G-xx-AF5-Z-R</p> <p>(1) Packing Type (2) Pin Code (3) Package Type (4) Output Voltage Code (5) Green Package</p> | <p>(1) R: Tape Reel (2) refer to Pin Assignment (3) AE2: SOT-23-3, AE3: SOT-23, AE5: SOT-23-5, AF5: SOT-25, AL5: SOT-353, K06-1616: DFN1616-6, K06-1820: DFN1820-6, K06-2020: DFN2020-6 (4) xx: refer to Marking Information (5) G: Halogen Free and Lead Free, L: Lead Free</p> |
|---|--|

MARKING INFORMATION

| PACKAGE | VOLTAGE CODE | MARKING |
|-------------------------------------|--|--|
| SOT-23-3 SOT-23 | | <p>L: Lead Free G: Halogen Free Voltage Code</p> |
| SOT-23-5 SOT-25 SOT-353 | 10: 1.0V 11: 1.1V 12: 1.2V 13: 1.3V 15: 1.5V 18: 1.8V 25: 2.5V | <p>L: Lead Free G: Halogen Free Voltage Code</p> |
| SOT-25 (LR9102-Z) | 27: 2.7V 28: 2.8V 2J: 2.85V 29: 2.9V 30: 3.0V 33: 3.3V | <p>Pin Code Voltage Code</p> |
| DFN1616-6 DFN1820-6 DFN2020-6 | 36: 3.6V | <p>Voltage Code</p> |

PIN CONFIGURATION



PIN DESCRIPTION

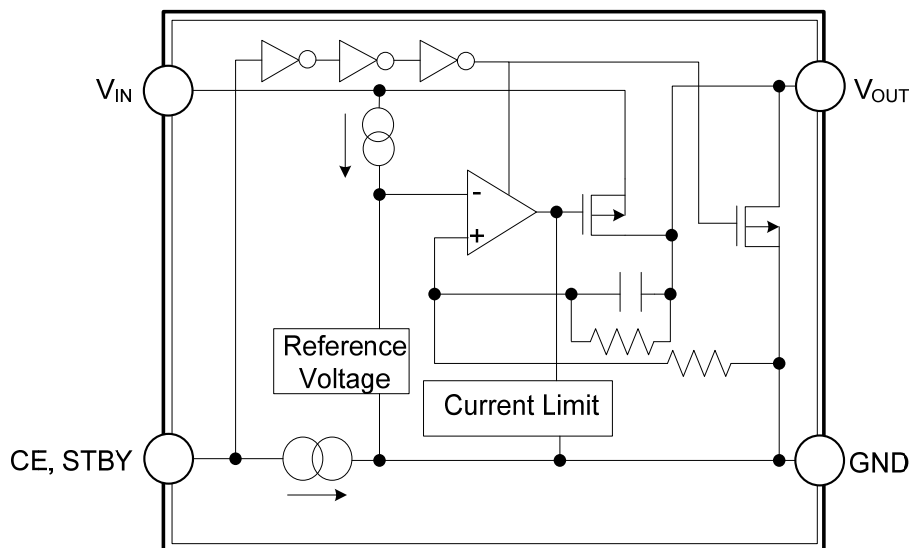
For LR9102

| PIN NO. | | | | PIN NAME | DESCRIPTION |
|--------------------|-------------------------------|------------------------|-------------|------------------|--|
| SOT-23-3 SOT-23 | SOT-23-5 SOT-25 SOT-353 | DFN1616-6 DFN2020-6 | DFN1820-6 | | |
| 3 | 1 | 3 | 5, 6 | V _{IN} | Input Pin |
| 1 | 2 | 2 | 3 | GND | Ground Pin |
| - | 3 | 1 | 4 | CE | Chip Enable Pin. Active when this Pin is high. |
| - | 4 | 5, 6 | - | NC | No Connection |
| 2 | 5 | 4 | 1, 2 | V _{OUT} | Output Pin |
| - | - | Exposed Pad | Exposed Pad | GND | Connect exposed pad to GND. |

For LR9102-Z

| PIN NO. | PIN NAME | DESCRIPTION |
|---------|------------------|--|
| 1 | CE | Chip Enable Pin. Active when this Pin is high. |
| 2 | GND | Ground Pin |
| 3 | NC | No Connection |
| 4 | V _{OUT} | Output Pin |
| 5 | V _{IN} | Input Pin |

BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|------------------------|-----------------|-----------|---------------|------|
| Input Voltage | | V_{IN} | 6 | V |
| Input Voltage (CE Pin) | | V_{CE} | 6 | V |
| Output Voltage | | V_{OUT} | $V_{IN}+0.3$ | V |
| Output Current | | I_{OUT} | 400 | mA |
| Power Dissipation | SOT-23-3/SOT-23 | P_D | 330 | mW |
| | SOT-23-5/SOT-25 | | 355 | mW |
| | SOT-353 | | 250 | mW |
| | DFN1616-6 | | 850 (Note 2) | mW |
| | DFN1820-6 | | 1000 (Note 2) | mW |
| | DFN2020-6 | | 1100 (Note 2) | mW |
| Junction Temperature | | T_J | +125 | °C |
| Operating Temperature | | T_{OPR} | -40 ~ +125 | °C |
| Storage Temperature | | T_{STG} | -55 ~ +125 | °C |

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. The data tested by surface mounted on a 2 inch² FR-4 board with 2OZ copper.

■ THERMAL DATA

| PARAMETER | | SYMBOL | RATINGS | UNIT |
|---------------------|-----------------|---------------|------------|------|
| Junction to Ambient | SOT-23-3/SOT-23 | θ_{JA} | 300 | °C/W |
| | SOT-23-5/SOT-25 | | 280 | °C/W |
| | SOT-353 | | 400 | °C/W |
| | DFN1616-6 | | 118 (Note) | °C/W |
| | DFN1820-6 | | 100 (Note) | °C/W |
| | DFN2020-6 | | 91 (Note) | °C/W |
| Junction to Case | SOT-23-3/SOT-23 | θ_{JC} | 120 | °C/W |
| | SOT-23-5/SOT-25 | | 90 | °C/W |
| | SOT-353 | | 130 | °C/W |
| | DFN1616-6 | | 32 | °C/W |
| | DFN1820-6 | | 30 | °C/W |
| | DFN2020-6 | | 28 | °C/W |

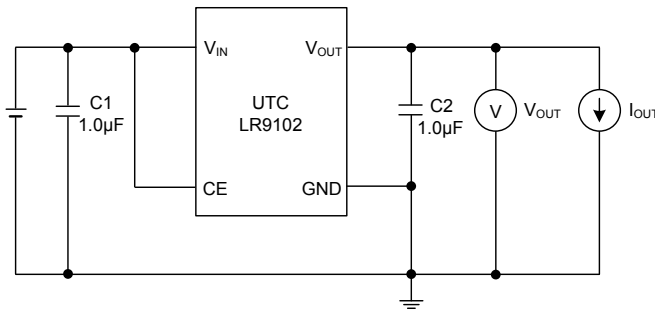
Note: The data tested by surface mounted on a 2 inch² FR-4 board with 2OZ copper.

■ ELECTRICAL CHARACTERISTICS

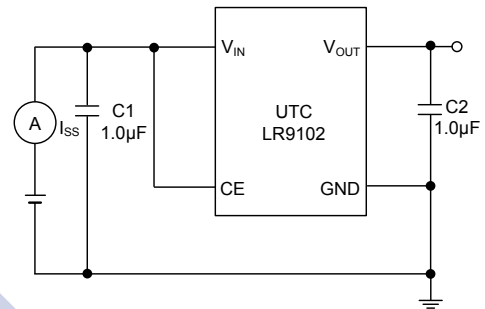
($T_A=25^\circ\text{C}$, $V_{IN}=\text{Set } V_{OUT}+1\text{V}$, $I_{OUT}=1\text{mA}$, $C_I=C_O=1\mu\text{F}$, unless otherwise specified)

| PARAMETER | | SYMBOL | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|--|------|--|---|---|---------------|---------------|-----------------------|
| Output Voltage | | V_{OUT} | $V_{IN} = \text{Set } V_{OUT}+1\text{V}$ | $V_{OUT} > 2.0\text{V}$ | $\times 0.99$ | $\times 1.01$ | V |
| | | | $V_{OUT} \leq 2.0\text{V}$ | -20 | +20 | mV | |
| Input Voltage | | V_{IN} | | | | 6 | V |
| Load Regulation | | ΔV_{OUT} | $1\text{mA} \leq I_{OUT} \leq 150\text{mA}$ | | 20 | 40 | mV |
| Output Current | | I_{OUT} | | 300 | | | mA |
| Supply Current | | I_{SS} | $I_{OUT}=0\text{A}$ | | 50 | 90 | μA |
| Supply Current (Standby) | | I_{ST-BY} | $V_{CE}=0\text{V}$ | | 0.1 | 2 | μA |
| Short Current Limit | | I_{LIMIT} | $V_{OUT}=0\text{V}$ | | 50 | | mA |
| CE Pull-down Current | | I_{PD} | | | 0.3 | | μA |
| CE Input Voltage | High | V_{CEH} | | 1.2 | | | V |
| | Low | V_{CEL} | | | | 0.3 | V |
| Output Noise | | eN | $B_W=10\text{Hz to } 100\text{kHz}$, $I_{OUT}=30\text{mA}$ | | 30 | | μVrms |
| Ripple Rejection | | RR | $f=1\text{kHz}$, Ripple $0.2V_{P-P}$ $V_{IN}=\text{Set } V_{OUT}+1\text{V}$, $I_{OUT}=30\text{mA}$ (In case that $V_{OUT}=2.0\text{V}$, $V_{IN}=3\text{V}$) | | 75 | | dB |
| Dropout Voltage | | V_D | $I_{OUT}=300\text{mA}$ | $1.0\text{V} \leq V_{OUT} < 1.2\text{V}$ | 0.60 | 1.00 | V |
| | | | | $1.2\text{V} \leq V_{OUT} < 1.5\text{V}$ | 0.38 | 0.70 | |
| | | | | $1.5\text{V} \leq V_{OUT} < 1.7\text{V}$ | 0.30 | 0.40 | |
| | | | | $1.7\text{V} \leq V_{OUT} < 2.0\text{V}$ | 0.20 | 0.28 | |
| | | | | $2.0\text{V} \leq V_{OUT} < 2.5\text{V}$ | 0.17 | 0.24 | |
| | | | | $2.5\text{V} \leq V_{OUT} < 2.8\text{V}$ | 0.14 | 0.20 | |
| | | | | $2.8\text{V} \leq V_{OUT} \leq 5.0\text{V}$ | 0.12 | 0.19 | |
| Line Regulation | | $\frac{\Delta V_{OUT}}{\Delta V_{IN}}$ | $1.0\text{V} \leq V_{OUT} \leq 4.0\text{V}$, $V_{SET}+0.5\text{V} \leq V_{IN} \leq 5\text{V}$ | | 0.02 | 0.10 | %V |
| | | | $4.0\text{V} < V_{OUT} \leq 5.0\text{V}$, $V_{SET}+0.5\text{V} \leq V_{IN} \leq 6.5\text{V}$ | | | | |
| Output Voltage Temperature Coefficient | | $\frac{\Delta V_{OUT}}{\Delta T}$ | $-40^\circ\text{C} \leq T_{OPR} \leq 85^\circ\text{C}$ | | ± 50 | | ppm/ $^\circ\text{C}$ |
| Low Output Nch Tr. ON Resistance | | R_{LOW} | $V_{IN}=4.0\text{V}$, $V_{CE}=0\text{V}$ | | 70 | | Ω |

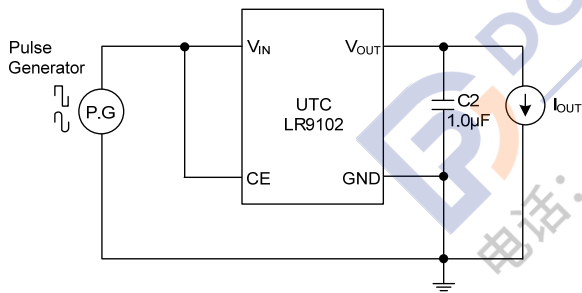
■ TEST CIRCUIT



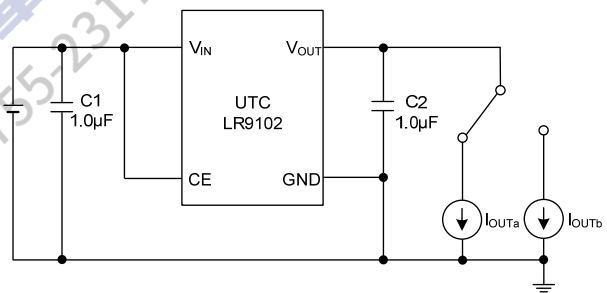
Basic Test Circuit



Test Circuit for Supply Current

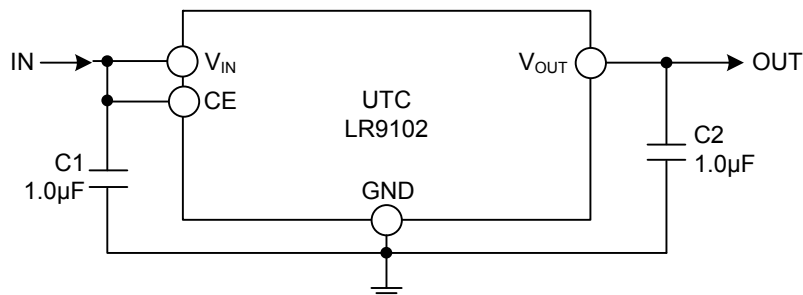


Test Circuit for Ripple Rejection



Test Circuit for Load Transient Response

■ TYPICAL APPLICATION CIRCUIT



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