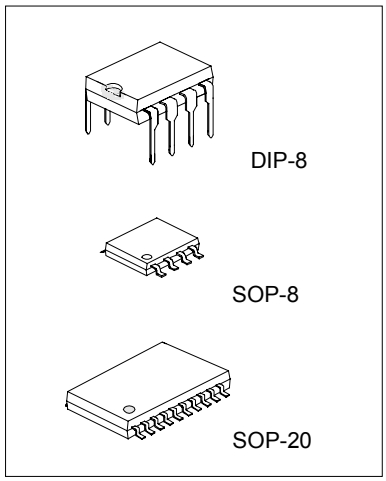
# UTC L2949E LINEAR INTEGRATED CIRCUIT

## MULTIFUNCTION VERY LOW DROP VOLTAGE REGULATOR



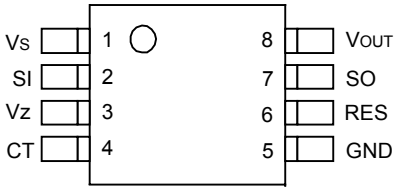

### DESCRIPTION

The UTC L2949E is a monolithic integrated 5V voltage regulator with a very low dropout output and additonal functions as power-on reset and input voltage sense.It is designed for supplying the microcomputer controlled systems especially in automotive applications.

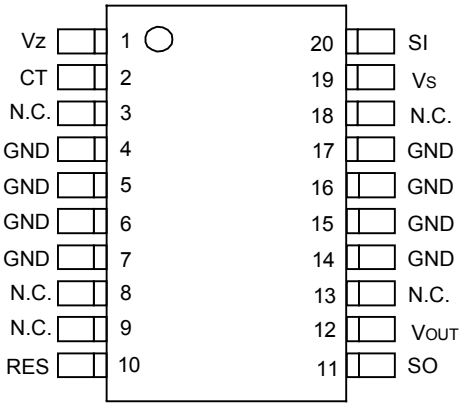
### FEATURES

*Operating dc supply voltage range 5V to 28V.
*Transient supply voltage up to 40V.
*Extremely low quiescent current in standby mode.
*High precision standby output voltage 5V±1%
*Output current capability up to 100mA.
*Very low dropout voltage less than 0.5V.
*Reset circuit sensing the output voltage
*Programmable reset pulse delay with external capacitor
*Voltage sense comparator.
*Thermal shutdown and short circuit protections.

### PIN CONNECTIONS




DIP-8/SOP-8

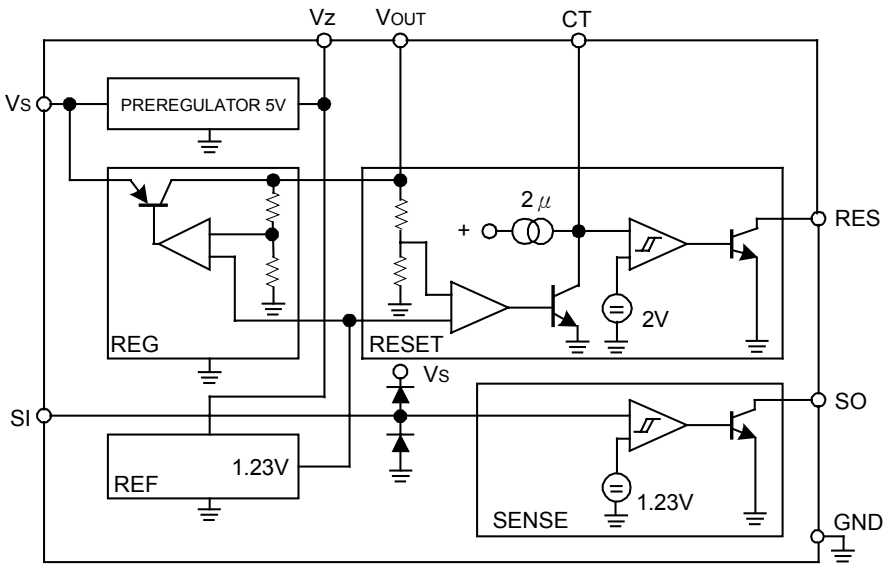



SOP-20



QW-R102-014,A

BLOCK DIAGRAM




ABSOLUTE MAXIMUM RATINGS

| PARAMETER | SYMBOL | RATING | UNIT |
|---|---|---|---|
| DC Operating Supply Voltage | $V_{CC}$ | 28 | V |
| Transient Supply Voltage(T<1s) | $V_{CC\ TR}$ | 40 | V |
| Output Current | Io | Internally Limited | |
| Output Voltage | Vo | 20 | V |
| Output Voltage<br>Reset Output<br>Sense Output | $V_{RES}$<br>Vso | <br>20<br>20 | V |
| Output Current<br>Reset Output<br>Sense Output | $I_{RES}$<br>Iso | <br>5<br>5 | mA |
| Preregulator Output Voltage | Vz | 7 | V |
| Preregulator Output Current | Iz | 5 | mA |
| Junction Temperature | Tj | -40～+150 | ℃ |
| Storage Temperature Range | Tstg | -55～+150 | ℃ |

## THERMAL DATA

| DESCRIPTION | SYMBOL | RATING | UNIT |
|---|---|---|---|
| Thermal Resistance Junction-ambient<br>DIP-8<br>SOP-8<br>SOP-20 | Rth j-amb | <br>100<br>200<br>50 | ℃/W |
| Thermal Resistance Junction-pin (SOP-20) | Rth j-pins | 15 | ℃/W |
| Thermal Shutdown Junction temperature | TJSD | 165 | ℃ |

## ELECTRICAL CHARACTERISTICS(Vs=14V;-40℃<Tj<125℃ unless otherwise specified)

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| Output Voltage | Vo | Tj=25℃;Io=1mA | 4.95 | 5 | 5.05 | V |
| Output Voltage | Vo | 6V<$V_{IN}$<28V,1mA<Io<50mA | 4.90 | 5 | 5.10 | V |
| Output Voltage | Vo | $V_{IN}$=40V;<br>T<1s 5mA<Io<100mA | 4.75 | | 5.25 | V |
| Dropout voltage | $V_D$ | Io=10mA<br>Io=50mA<br>Io=100mA | | 0.1<br>0.2<br>0.3 | 0.25<br>0.4<br>0.5 | V<br>V<br>V |
| Input to Output Voltage Difference in Undervoltage Condition | $V_{IO}$ | VIN=4V,Io=35mA | | | 0.4 | V |
| Max Output Leakage | Iouth ** | $V_{IN}$=25V,Vo=5.5V | 20 | 50 | 80 | μA |
| Line Regulation | $V_{OL}$ | 6V<$V_{IN}$<28V, Io=1mA | | | 20 | mV |
| Load Regulation | $V_{OLO}$ | 1mA<Io<100mA | | | 30 | mV |
| Current Limit | $I_{LIM}$ | Vo=4.5V<br>Vo=4.5V,$T_J$=25℃<br>Vo=0V(note 1) | 105<br>120 | 200<br><br>100 | 400<br>400 | mA<br>mA |
| Quiescent Current | $I_{QSE}$ | Io=0.3mA;$T_J$<100℃ | | 200 | 300 | μA |
| Quiescent Current | $I_Q$ | Io=100mA | | | 5 | mV |

** With this test we guarantee that with no output current the output voltage will not exceed 5.5V

## RESET

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| Reset Thereshold Voltage | $V_{RT}$ | | | Vo-0.5V | | V |
| Reset Thereshold Hysteresis | $V_{RTH}$ | | 50 | 100 | 200 | mV |
| Reset Pulse Delay | $t_{RD}$ | CT=100nF;TR≧100μs | 55 | 100 | 180 | ms |
| Reset Output Low Voltage | $V_{RL}$ | RRES=10KΩ to Vs≧1.5V | | | 0.4 | V |
| Reset Output Gigh Leakage Current | IRH | VRES=5V | | | 1 | μA |
| Delay Comparator Thereshold | $V_{CTth}$ | | | 2 | | V |
| Delay Comparator Thereshold Hysteresis | $V_{CTth,hy}$ | | | 100 | | mV |

## SENSE

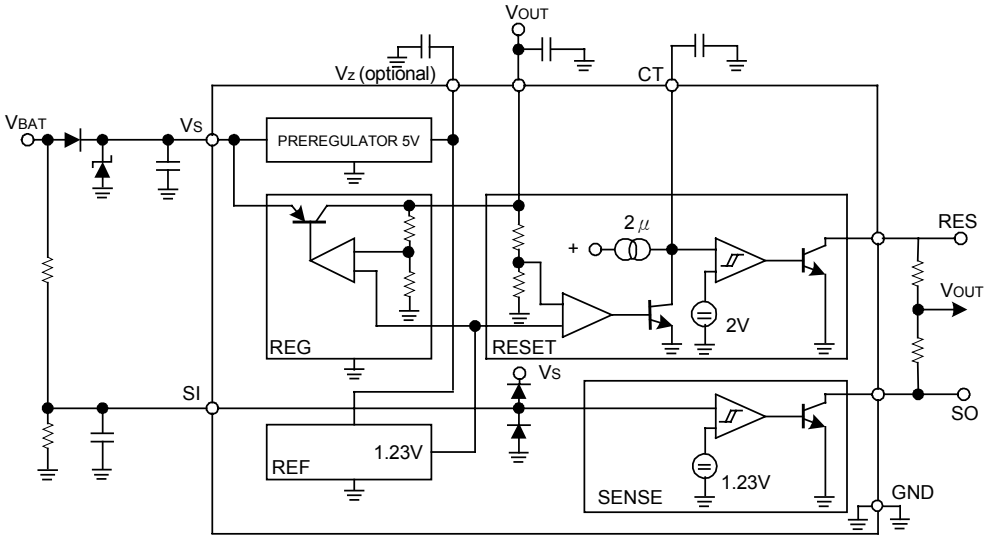
| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| Sense Low Thereshold | Vst | | 1.16 | 1.23 | 1.35 | V |
| Sense Thereshold Hysteresis | Vsth | | 20 | 100 | 200 | mV |
| Sense Output Low Voltage | $V_{SL}$ | $V_{SI} \leqq 1.16V$;Vs≧3V<br>Rso=10KΩ to Vo | | | 0.4 | V |
| Sense Output Leakage | $I_{SH}$ | Vso=5V;$V_{SI} \geqq 1.5V$ | | | 1 | μA |
| Sense Input Current | $I_{SI}$ | $V_{SI}$=0 | -20 | -8 | -3 | μA |

## PREREGULATOR

| PARAMETER | SYMBOL | CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| Preregulator Output Voltage | Vz | Iz=10μA | 4.5 | 5 | 6 | V |
| Preregulator Output Current | Iz | | | | 10 | μA |

Note 1:Foldback characteristic

## APPLICATION CIRCUIT




For stability:Cs≧1μF, Co ≧4.7μF, ESR<10Ω at 10KHz

Recommended for application:Cs=Co=10μF to 100μF

## APPLICATION INFORMATION

Suppl Voltage Transient

High supply voltage transients can cause a reset output signal disturbation.

For supply voltage greater than 8V the circuit shows a high immunity of the reset output against supply transients of the reset output against supply transients of more than100V/μs.

For supply voltages less than 8V supply transients of more than 0.4V/μs can cause a reset signal disturbation.

To improve the transient behaviour for supply voltages less than 8V a capacitor at pin 3 can be used.

A capacitor at pin 3(C3≧1μF ) reduces also the output noise.

## FUNCTIONAL DESCRIPTION

The UTC L2949E is a monolithic integrated voltage regulator,based on the STM modular voltage regulator approch.Several outstanding features and auxiliary functions are implemented to meet the requirements of supplying microprocessor systems in automotive applications.Nevertheless,It is suitable also in other applications where the present functions are required.The modular approach of this device allows to get easily also other features and functions when required.

### Voltage Regulator

The voltage regulator uses an Isolated Collector Vertical PNP transistor as a regulating element.

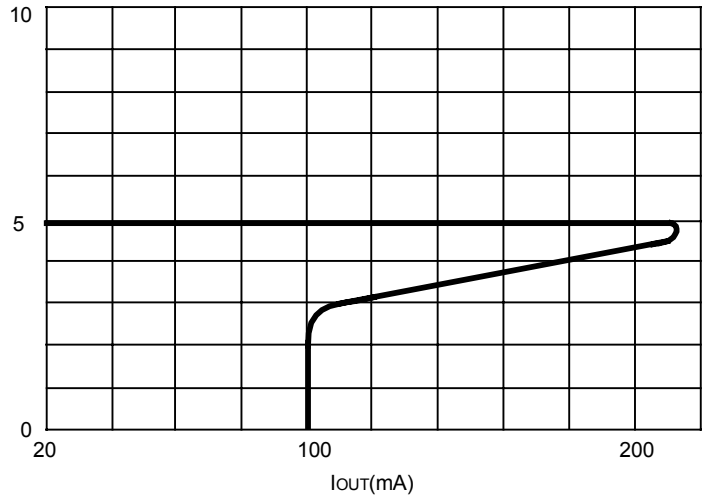



Figure 1: Foldback Characteristic of Vo

With this structure very low dropout voltage at currents up to 100mA is obtained.The dropout operation of the standby regulator is maintained down to 3V input supply voltage.The output voltage is regulated up to the transient input supply voltage of 4V.With this feature no functional interruption due to overvoltage pulses is generated.The typical cuve showing the standby.output voltage as a function of the input supply voltage is shown in Fig.2. The current consumption of the device(quiescent current) is less than 300 μ A.

To reduce the quiescent current peak in the undervoltage region and to improve the transient response inthis region.the dropout voltage is controlled,the quiescent current as a function of the supply input voltage is shown in Fig.3.

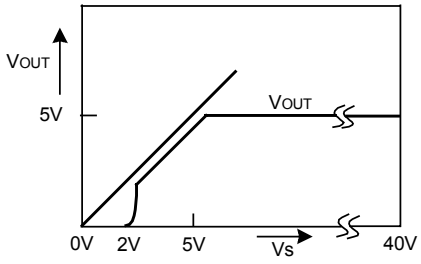



Figure 2: Output Voltage vs.Input voltage

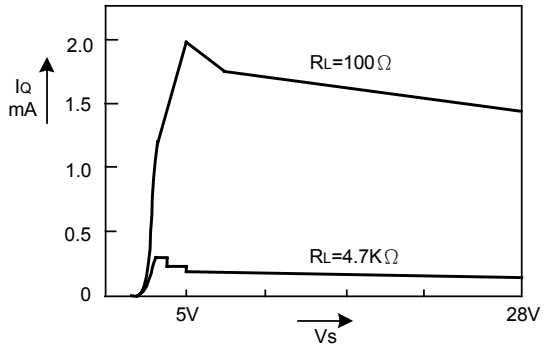



Figure 3: Quiescent Current vs.Supply Voltage

Preregulator

To improve the transient immunity a preregulator stabilized the internal supply voltage to 5V.This internal voltage is present at Pin3(Vz).This voltage should not be used as an output because the output capability is very small(≦10μA).

This output may be used as an option when a better transient behaviour for supply voltages less than 8V is required(see also application note).

In this case a capacitor(100nF - 1μF) must be connected between Pin3 and GND.If this feature is not used Pin3 must be left open.

Reset Circuit

The block circuit diagram of the reset circuit is shown in Fig.4. the reset circuit supervises the output voltage.

The reset thereshold of 4.5V is defined with the internal reference voltage and standby output drivider.

The reset pulse delay time $t_{RD}$,is defined with the charge time of an external capacitor $C_T$:

$$TRD = \frac{CT \bullet 2V}{2\mu A}$$

The reaction time of the reset circuit originates from the discharge time limitation of the reset capacitor $C_T$ and is proportional of the reset capacitor $C_T$ and is proportional to the value of $C_T$.

The reactioin time of the reset circuit increases the noise immunity.Standby output voltagedrops below the reset threshold only a bit longer than th reaction time results in a shorter reset delay time.

The nominal reset delay time will be generated for standby output voltage drops longer than approximately 50μs.

The typical reset output waveforms are shown in Fig.5.

Sense Comparator

The sense comparator compares an input signal with an internal voltage reference of typical 1.23V.The use of an external voltage divider makes this comparator flexible in th application.

It can be used to supervise the input voltage either before or after the protection diode and to give additional informations to the microprocessor like low voltage warnings.

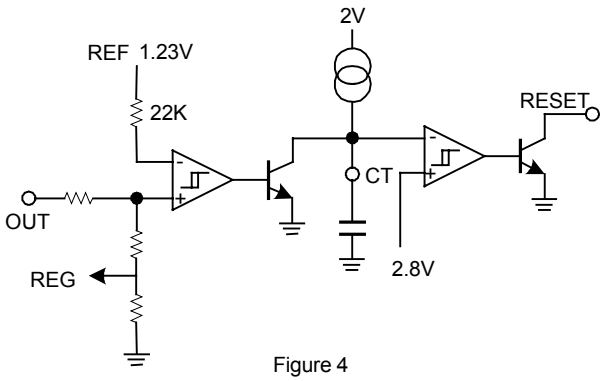



Figure 4

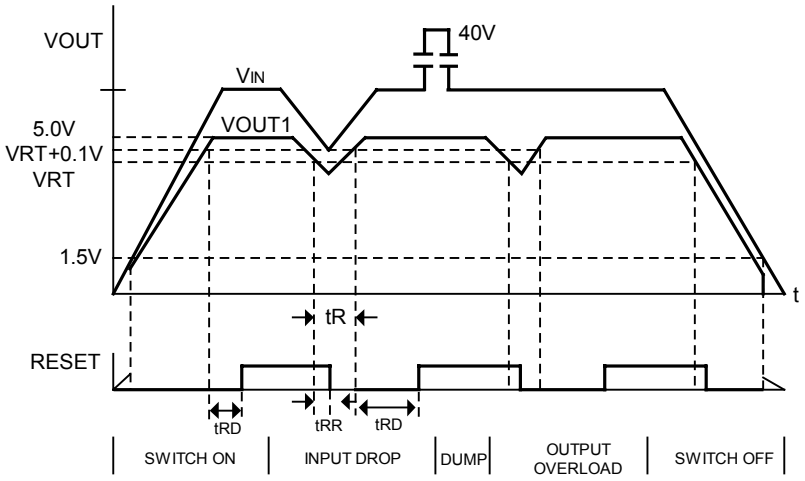



Figure 5