



LR1012

Preliminary

CMOS IC

HIGH OPERATING VOLTAGE CMOS VOLTAGE REGULATOR

DESCRIPTION

The UTC **LR1012** series is high operating voltage regulator using UTC CMOS technology. The max operating voltage of UTC **LR1012L** is 16V so it works best in high-voltage applications. Moreover, it is also suitable in constructing lowpower portable devices including small current consumption, power-off function and short-current protection.

FEATURES

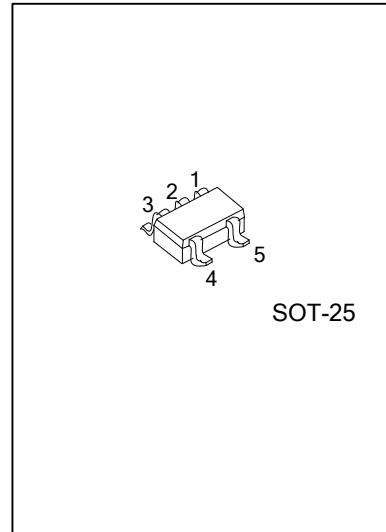
- * Operating current: Max. 1.8 μ A (3.0V)
- * Output voltage: 2.0 ~ 6.0V ,as 0.1V step
- * \pm 2.0% output voltage accuracy
- * Output current:
 - 50mA capable @3.0V output, V_{IN} =5V
 - 75mA capable @5.0V output, V_{IN} =7V
- * Dropout voltage:120mV @ V_{OUT} = 5.0V, I_{OUT} =10mA

ORDERING INFORMATION

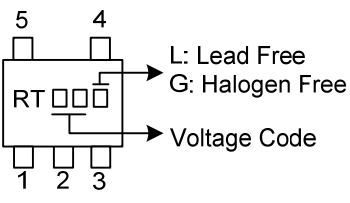
Ordering Number		Package	Packing
Lead Free	Halogen Free		
LR1012L-xx-AF5-R	LR1012G-xx-AF5-R	SOT-25	Tape Reel

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

<p>LR1012L-xx-AF5-R</p> <ul style="list-style-type: none"> (1) Packing Type (2) Package Type (3) Output Voltage Code (4) Lead Free 	<ul style="list-style-type: none"> (1) R: Tape Reel (2) AF3: SOT-25 (3) xx: Refer to Marking Information (4) L: Lead Free, G: Halogen Free
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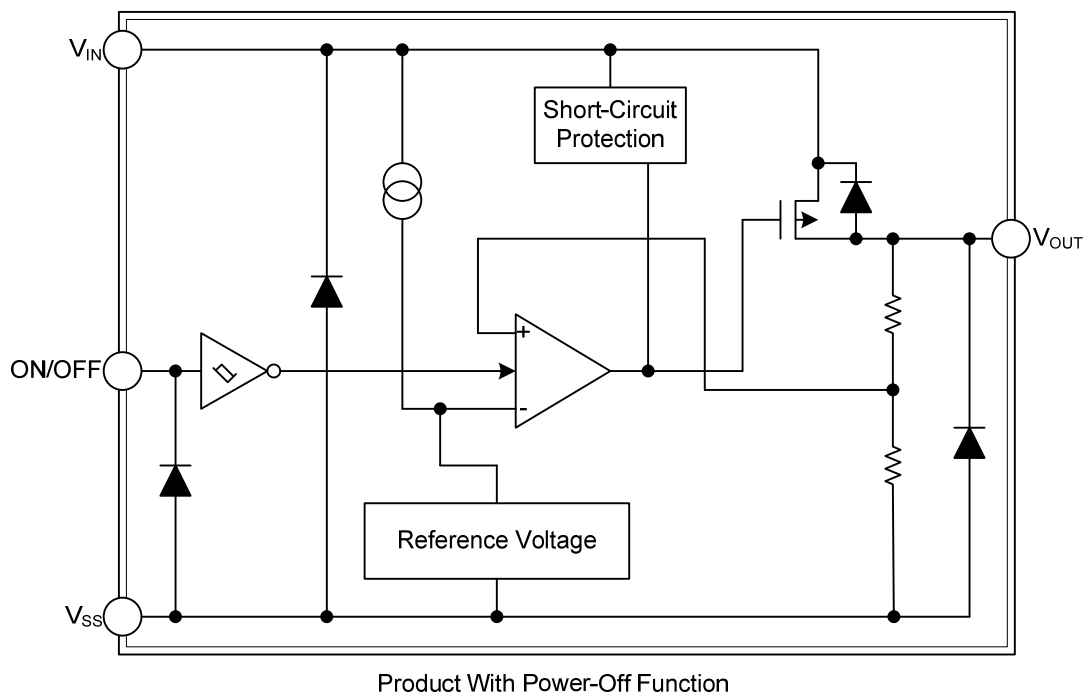
■ PIN CONFIGURATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-25	18:1.8V	 <p>L: Lead Free G: Halogen Free Voltage Code</p>

■ PIN DESCRIPTION

PIN NO.	PIN NAME	FUNCTION
1	V_{SS}	GND
2	V_{IN}	Input voltage
3	V_{OUT}	Output voltage
4	N.C.	N.C. pin is electrically open. N.C. pin can be connected to V_{IN} or V_{SS} .
5	ON/OFF	ON/OFF select

■ BLOCK DIAGRAM



■ ABSOLUTE MAXIMUM RATING ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	18	V
	$V_{ON/OFF}$	$V_{SS}-0.3 \sim 18$	V
Output Voltage	V_{OUT}	$V_{SS}-0.3 \sim V_{IN}+0.3$	V
Power Dissipation	P_D	250	mW
Operating Temperature	T_{OPR}	-40~+85	$^\circ\text{C}$
Storage Temperature Range	T_{STG}	-40~+125	$^\circ\text{C}$

Note: 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.

■ ELECTRICAL CHARACTERISTICS ($T_A=25^\circ\text{C}$, unless otherwise specified)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Output Voltage (Note 1)	$V_{OUT(E)}$	$V_{IN}=V_{OUT(S)}+2V$, $I_{OUT}=10\text{mA}$	$V_{OUT(S)} \times 0.98$	$V_{OUT(S)}$	$V_{OUT(S)} \times 1.02$	V	
Output Current (Note 2)	I_{OUT}	$V_{OUT(S)}+2 \leq V_{IN} \leq 16V$	$2.0V \leq V_{OUT(S)} \leq 2.9V$	30		mA	
			$3.0V \leq V_{OUT(S)} \leq 3.9V$	50		mA	
			$4.0V \leq V_{OUT(S)} \leq 4.9V$	65		mA	
			$5.0V \leq V_{OUT(S)} \leq 5.9V$	75		mA	
Dropout Voltage (Note 3)	V_{drop}	$I_{OUT}=10\text{mA}$	$2.0V \leq V_{OUT(S)} \leq 2.4V$		0.46	0.95	V
			$2.5V \leq V_{OUT(S)} \leq 2.9V$		0.32	0.68	V
			$3.0V \leq V_{OUT(S)} \leq 3.4V$		0.23	0.41	V
			$3.5V \leq V_{OUT(S)} \leq 3.9V$		0.19	0.35	V
			$4.0V \leq V_{OUT(S)} \leq 4.4V$		0.16	0.30	V
			$4.5V \leq V_{OUT(S)} \leq 4.9V$		0.14	0.27	V
			$5.0V \leq V_{OUT(S)} \leq 5.4V$		0.12	0.25	V
		$5.5V \leq V_{OUT(S)} \leq 6.0V$		0.11	0.23	V	
Line Regulation 1	ΔV_{OUT1}	$V_{OUT(S)}+1V \leq V_{IN} \leq 16V$, $I_{OUT}=1\text{mA}$		5	30	mV	
Line Regulation 2	ΔV_{OUT2}	$V_{OUT(S)}+1V \leq V_{IN} \leq 16V$, $I_{OUT}=1\mu\text{A}$		5	40	mV	
Load Regulation	ΔV_{OUT3}	$V_{IN}=V_{OUT(S)}+2V$	$2.0V \leq V_{OUT(S)} \leq 2.9V$, $1\mu\text{A} \leq I_{OUT} \leq 20\text{mA}$		6	30	mV
			$3.0V \leq V_{OUT(S)} \leq 3.9V$, $1\mu\text{A} \leq I_{OUT} \leq 30\text{mA}$		10	45	mV
			$4.0V \leq V_{OUT(S)} \leq 4.9V$, $1\mu\text{A} \leq I_{OUT} \leq 40\text{mA}$		13	65	mV
			$5.0V \leq V_{OUT(S)} \leq 5.9V$, $1\mu\text{A} \leq I_{OUT} \leq 50\text{mA}$		17	80	mV
Output Voltage temperature coefficient (Note 4)	$\frac{\Delta V_{OUT}}{\Delta T_A \cdot V_{OUT}}$	$V_{IN} = V_{OUT(S)} + 1V$, $I_{OUT} = 10\text{mA}$ $-40^\circ\text{C} \leq T_A \leq 85^\circ\text{C}$		± 100		ppm $^\circ\text{C}$	
Current Consumption	I_{SS}	$V_{IN}=V_{OUT(S)}+2V$ no load	$2.0V \leq V_{OUT(S)} \leq 2.7V$		0.9	1.6	μA
			$2.8V \leq V_{OUT(S)} \leq 3.7V$		1.0	1.8	μA
			$3.8V \leq V_{OUT(S)} \leq 5.1V$		1.2	2.1	μA
			$5.2V \leq V_{OUT(S)} \leq 6.0V$		1.5	2.5	μA

■ ELECTRICAL CHARACTERISTICS(Cont.)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}				16	V
Current Consumption at Poweroff	I_{SS2}	$V_{IN}=V_{OUT}(S)+2V$, $V_{ON/OFF}=0V$, no load		0.1	0.5	μA
ON/OFF Pin Input Voltage For High Level	V_{SH}	$V_{IN}=V_{OUT}(S)+2V$, $R=1k\Omega$ judged by V_{OUT} output level	2.0			V
ON/OFF Pin Input Voltage For Low Level	V_{SL}	$V_{IN}=V_{OUT}(S)+2V$, $R_L=1k\Omega$ judged by V_{OUT} output level			0.4	V
ON/OFF pin Input Current at high Level	I_{SH}	$V_{IN}=V_{OUT}(S)+2V$, $V_{ON/OFF}=7V$			0.1	μA
ON/OFF Pin Input Current at Low Level	I_{SL}	$V_{IN}=V_{OUT}(S)+2V$, $V_{ON/OFF}=0V$			-0.1	μA
Short-Circuit Current	I_{OS}	$V_{IN}=V_{OUT}(S)+2V$, V_{OUT} pin=0 V		40		mA

Notes:

1. $V_{OUT}(S)$ =Specified output voltage

$V_{OUT}(E)$ =Effective output voltage, i.e., the output voltage when fixing $I_{OUT}(=10\text{ mA})$ and inputting $V_{OUT}(S)+2.0V$.

2. Output current at which output voltage becomes 95% of $V_{OUT}(E)$ after gradually increasing output current.

3. $V_{drop}=V_{IN1}-(V_{OUT}(E)\times 0.98)$, where V_{IN1} is the Input voltage at which output voltage becomes 98% of $V_{OUT}(E)$ after gradually decreasing input voltage.

4. Temperature change ratio for the output voltage [$mV/^{\circ}C$] is calculated using the following equation.

$$\frac{\Delta V_{OUT}}{\Delta T_A} [mV/^{\circ}C] = V_{OUT}(S)[V] \times \frac{\Delta V_{OUT}}{\Delta T_A \cdot V_{OUT}} [ppm/^{\circ}C] \div 1000$$

■ TERMS

C_L (Output capacitors)

Cause the UTC LR1012L series can provide stable operation without C_L. So the C_L are used only to improve transient response characteristics. And when C_L is used, a low ESR (Equivalent Series Resistance) capacitor like ceramic capacitor can also be used. C_L can hence be removed in applications when transient response can be negligible.

V_{OUT} (Output voltage)

Unless the under conditions change, the accuracy of the output voltage is ±2.0% guaranteed under the specified conditions for input voltage, which differs depending upon the product items, output current, and temperature.

ΔV_{OUT1}, ΔV_{OUT2} (Line regulations 1 and 2)

After a change in the input voltage with the output current remained unchanged, these values show how much the output voltage changes.

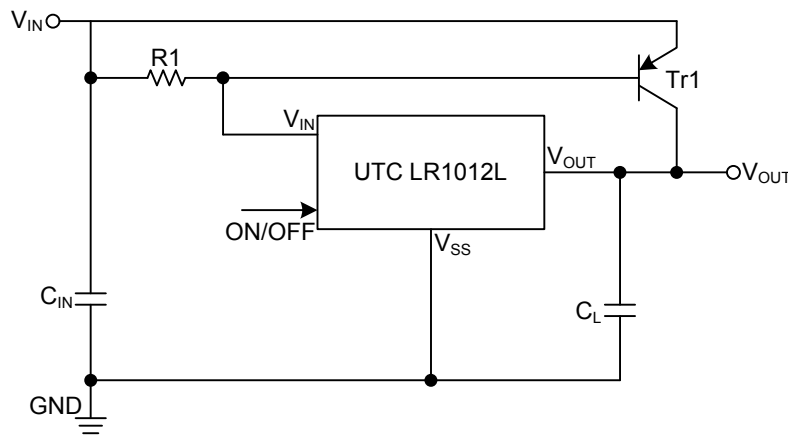
ΔV_{OUT3} (Load regulation)

After a change in the output current with the input voltage remained unchanged, these values show how much the output voltage changes.

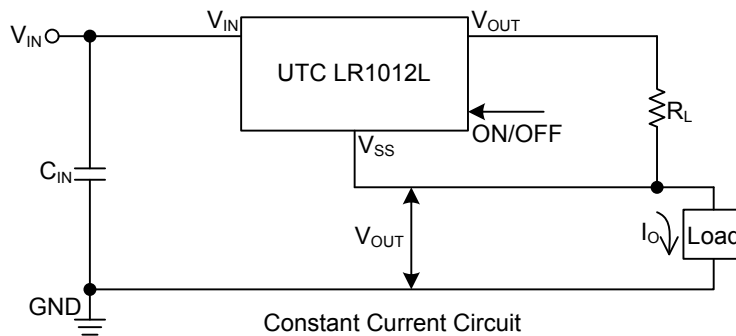
Dropout voltage (Vdrop)

When output voltage falls to 98% of V_{OUT} (E) by gradually decreasing the input voltage (V_{IN}), this value shows the difference between the input voltage (V_{IN1}) and the output voltage. $V_{drop} = V_{IN1} - [V_{OUT} (E) \times 0.98]$

■ APPLICATION CIRCUIT

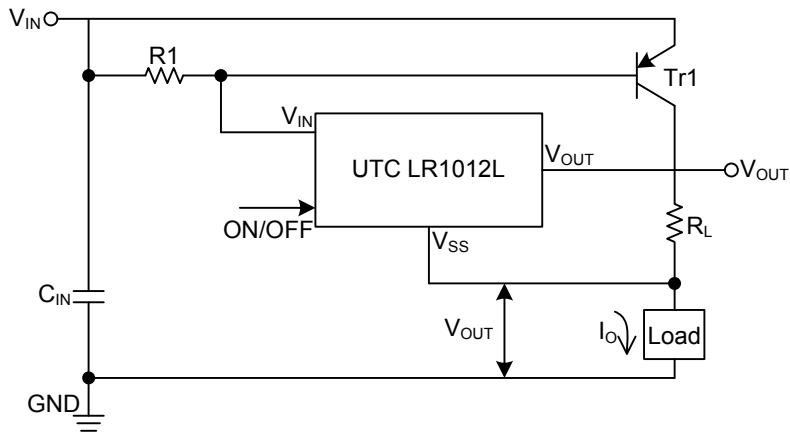


Output Current Boost Circuit

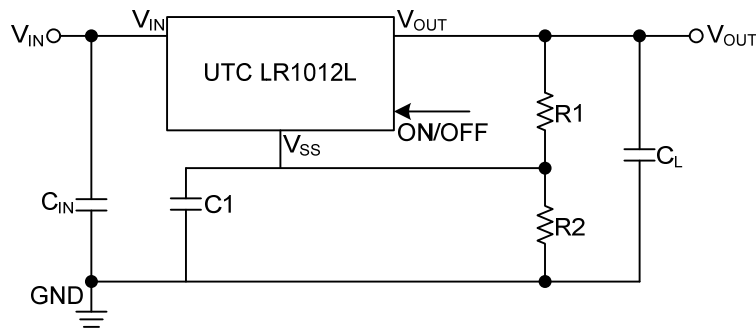


Constant Current Circuit

■ APPLICATION CIRCUIT(Cont.)



Constant Current Boost Circuit



Voltage Adjustment Circuit

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