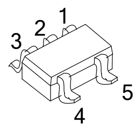
HIGH OPERATING VOLTAGE CMOS VOLTAGE REGULATOR



SOT-25

■ 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. 1.8μA (3.0V)
* Output voltage: 2.0 ~ 6.0V ,as 0.1V step
* ±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

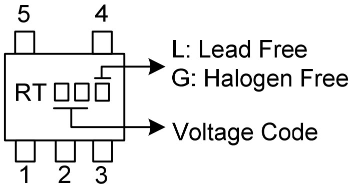
■ ORDERING INFORMATION

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.

LR1012L -xx- AF5 - R	
(1) Packing Type	(1) R: Tape Reel
(2) Package Type	(2) AF3: SOT-25
(3)Output Voltage Code	(3) xx: Refer to Marking Information
(4) Lead Free	(4) L: Lead Free, G: Halogen Free

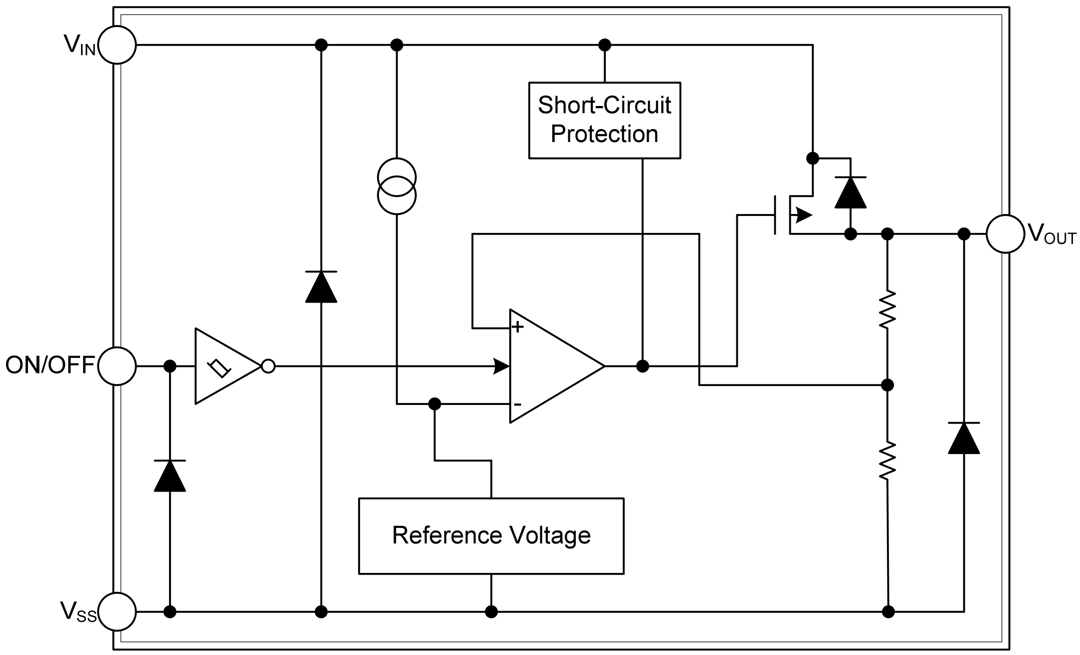
■ PIN CONFIGURATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-25	18:1.8V	

■ 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



Product With Power-Off Function

■ ABSOLUTE MAXIMUM RATING (T_A=25℃, unless otherwise specified)

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

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℃, 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}=10mA		V_{OUT}(S) × 0.98	V_{OUT}(S)	V_{OUT}(S) ×1.02	V
Output Current (Note 2)	I_{OUT}	V_{OUT}(S)+2≤V_{IN}≤16V	2.0V≤V_{OUT}(S)≤2.9V	30			mA
			3.0V≤V_{OUT}(S)≤3.9V	50			mA
			4.0V≤V_{OUT}(S)≤4.9V	65			mA
			5.0V≤V_{OUT}(S)≤5.9V	75			mA
Dropout Voltage (Note 3)	Vdrop	I_{OUT} =10mA	2.0V≤V_{OUT}(S)≤2.4V		0.46	0.95	V
			2.5V≤V_{OUT}(S)≤2.9V		0.32	0.68	V
			3.0V≤V_{OUT}(S)≤3.4V		0.23	0.41	V
			3.5V≤V_{OUT}(S)≤3.9V		0.19	0.35	V
			4.0V≤V_{OUT}(S)≤4.4V		0.16	0.30	V
			4.5V≤V_{OUT}(S)≤4.9V		0.14	0.27	V
			5.0V≤V_{OUT}(S)≤5.4V		0.12	0.25	V
			5.5V≤V_{OUT}(S)≤6.0V		0.11	0.23	V
Line Regulation 1	$\Delta V_{OUT}1$	V_{OUT}(S)+1V≤V_{IN}≤16V, I_{OUT}=1mA			5	30	mV
Line Regulation 2	$\Delta V_{OUT}2$	V_{OUT}(S)+1V≤V_{IN}≤16V, I_{OUT}=1μA			5	40	mV
Load Regulation	$\Delta V_{OUT}3$	V_{IN}=V_{OUT}(S)+2V	2.0V≤V_{OUT}(S)≤2.9V, 1μA≤I_{OUT}≤20mA		6	30	mV
			3.0V≤V_{OUT}(S)≤3.9V, 1μA≤I_{OUT}≤30mA		10	45	mV
			4.0V≤V_{OUT}(S)≤4.9V, 1μA≤I_{OUT}≤40mA		13	65	mV
			5.0V≤V_{OUT}(S)≤5.9V, 1μA≤I_{OUT}≤50mA		17	80	mV
Output Voltage temperature coefficient (Note 4)	$\frac{\Delta V_{OUT}}{\Delta T_A \cdot V_{OUT}}$	V_{IN} = V_{OUT} (S) + 1 V, I_{OUT} = 10mA -40℃≤T_A≤85℃			±100		ppm /℃
Current Consumption	I_{SS}	V_{IN}=V_{OUT}(S)+2V no load	2.0V≤V_{OUT}(S)≤2.7V		0.9	1.6	μA
			2.8V≤V_{OUT}(S)≤3.7V		1.0	1.8	μA
			3.8V≤V_{OUT}(S)≤5.1V		1.2	2.1	μA
			5.2V≤V_{OUT}(S)≤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	$I_{SS}2$	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=1kΩ 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=1kΩ 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 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. Vdrop=V_{IN1}-(V_{OUT}(E)×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/°C] is calculated using the following equation.

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

■ 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}, $\Delta V_{OU}T2$ (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.

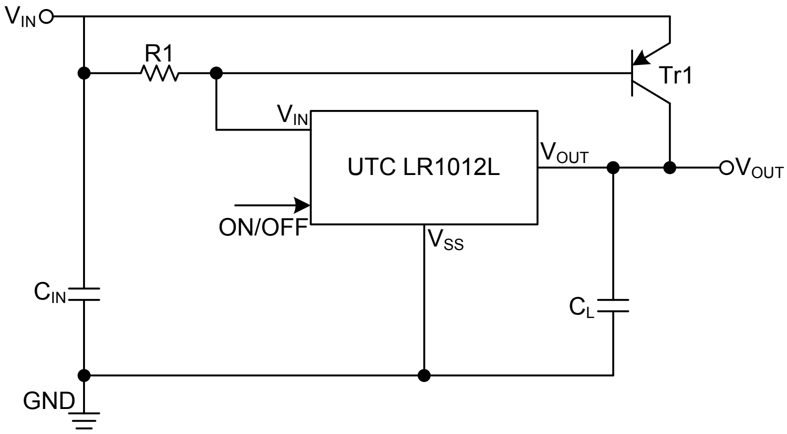
$\Delta V_{OUT}3$ (Load regulation)

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

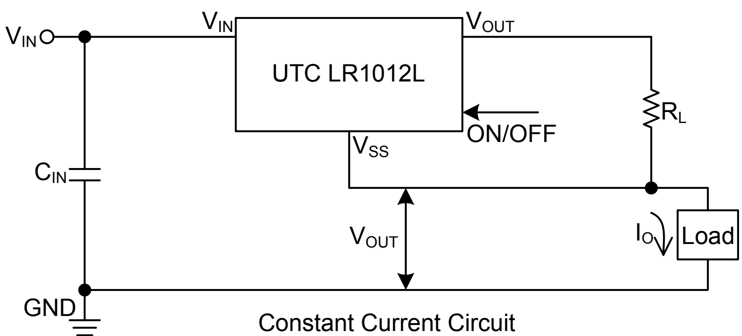
Dropout voltage (Vdrop)

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 ($V_{IN}1$) and the output voltage. Vdrop=$V_{IN}1-[V_{OUT}(E)\times0.98]$

■ APPLICATION CIRCUIT

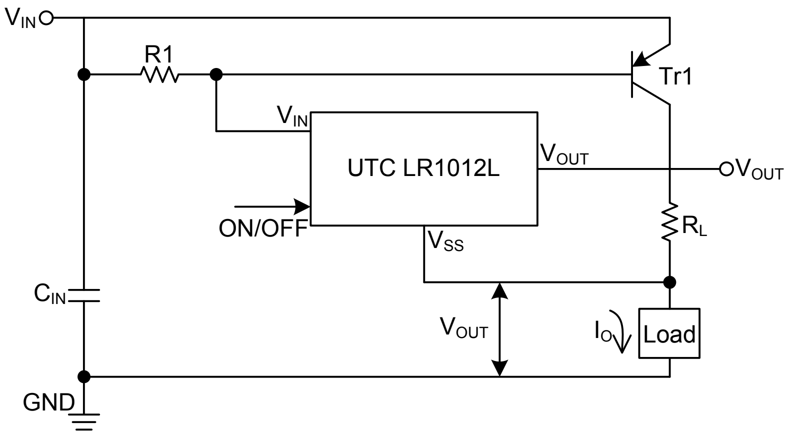


Output Current Boost Circuit

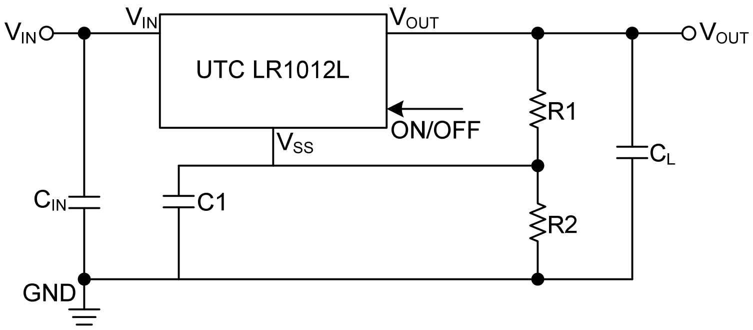


Constant Current Circuit

■ APPLICATION CIRCUIT(Cont.)



Constant Current Boost Circuit



Voltage Adjustment Circuit