



SUPER LOW ON RESISTANCE/LOW VOLTAGE 1A LDO REGULATOR

DESCRIPTION

The UTC **LR9273** is a typical LDO (linear regulator) with features of super low dropout, 1A output current capability, and -3mV typical load regulation at 1A.

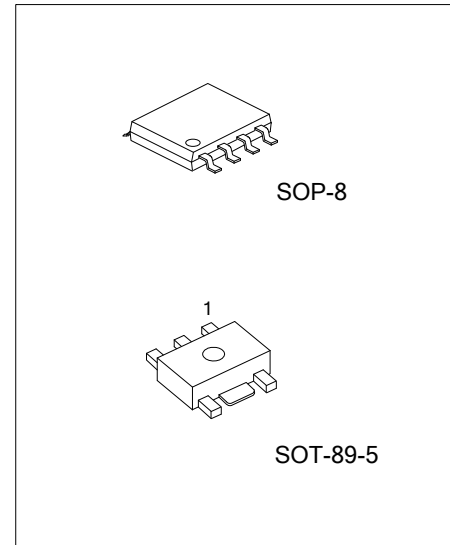
During operation of the UTC **LR9273**, the dropout voltage is very low and the response of line transient and load transient are very well.

Internally, there're many functions of UTC **LR9273** 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 **LR9273**.

The UTC **LR9273** 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: 60 μ A (Typ.)
- * Standby Mode: 0.1 μ A (Typ.)
- * Very Low Dropout Voltage: 0.18V (Typ.)
@ $I_{OUT}=1A, V_{OUT}=2.85V$
- * Ripple Rejection: 70dB (Typ.)
@ $f=1kHz, V_{OUT}=2.85V$
- * Temperature-Drift Coefficient of Output Voltage: $\pm 100ppm/^{\circ}C$ (Typ.)
- * Well Line Regulation: 0.02%/V (Typ.)
- * Output Voltage Accuracy: $\pm 1.5%$ (Typ.)
- * Internal Fold Back Protection Circuit: 250mA (Typ.) @ short mode
- * $C_{IN}=C_{OUT}=4.7\mu F$ or more (Ceramic capacitors) are recommended to be used with this IC



ORDERING INFORMATION

Ordering Number		Package	Packing
Lead Free	Halogen Free		
LR9273xL-xx-S08-T	LR9273xG-xx-S08-T	SOP-8	Tube
LR9273xL-xx-S08-R	LR9273xG-xx-S08-R	SOP-8	Tape Reel
LR9273xL-xx-AB5-R	LR9273xG-xx-AB5-R	SOT-89-5	Tape Reel

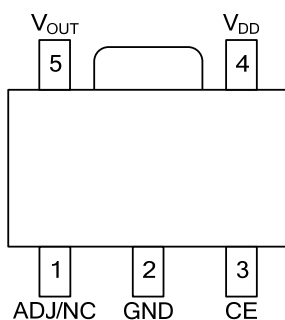
Notes: 1. x: The auto discharge function at off state are options as follows.
 2. xx: Output Voltage, refer to Marking Information.

<p>LR9273xL-xx-AF5-R</p> <p>(1) Packing Type (2) Package Type (3) Output Voltage Code (4) Lead Free (5) Active</p>	<p>(1) T: Tube, R: Tape Reel (2) S08: SOP-8, AB5: SOT-89-5 (3) xx: refer to Marking Information (4) L: Lead Free, G: Halogen Free (5) B: without auto discharge function at off state D: with auto discharge function at off state</p>
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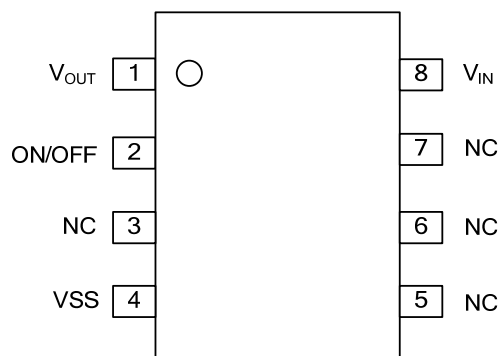
MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
SOT-89-5	28 :2.8V 35 :3.5V AD: ADJ	<p>Date Code ← [][][][] → Voltage Code → XX → Active Code ← [][] → LR9273 [][] → L: Lead Free G: Halogen Free</p>
SOP-8		<p>UTC [][][][] → Date Code → Active Code ← [][] → LR9273 [][] → L: Lead Free G: Halogen Free Voltage Code ← [][] → Lot Code → [][][][]</p>

■ PIN CONFIGURATION



SOT-89-5



SOP-8

■ PIN DESCRIPTION

SOT-89-5

PIN NO.	PIN NAME	DESCRIPTION
1	ADJ	ADJUST Pin (For Adjustable Version)
	NC	No Connection (For Fixed Version)
2	GND	Ground Pin
3	CE	Chip Enable Pin. Active when this Pin is high.
4	V _{IN}	Input Pin
5	V _{OUT}	Output Pin

HSOP-8J

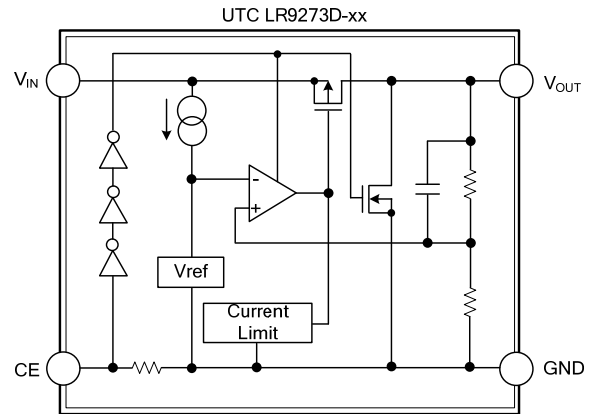
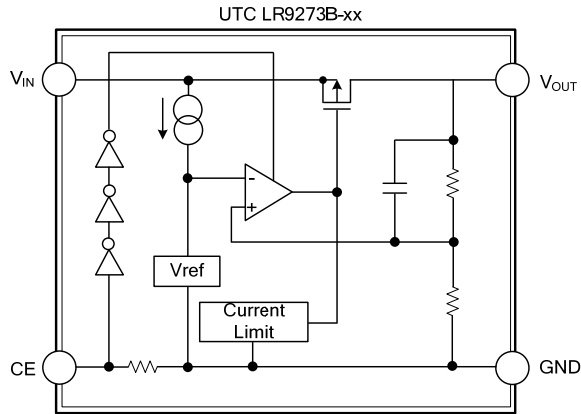
PIN NO.	PIN NAME	DESCRIPTION
1	V _{OUT}	Output Pin
2	ON/OFF	ON/OFF Pin
3, 5, 6, 7	NC	No connection (Note)
4	VSS	GND Pin
8	V _{IN}	Input Pin

Note: The NC pin is electrically open.

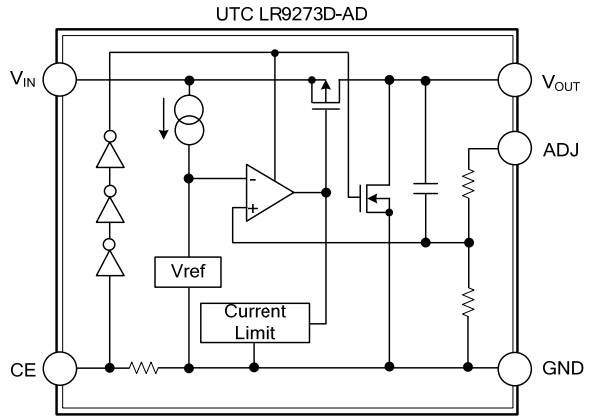
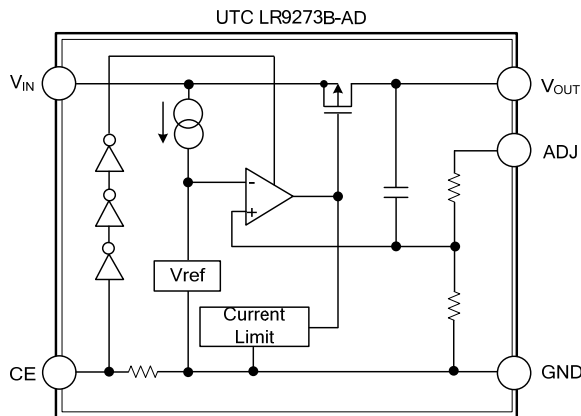
The NC pin can be connected to V_{IN} or V_{SS}.

■ BLOCK DIAGRAM

For Fixed Version



For Adjustable Version



■ ABSOLUTE MAXIMUM RATING

PARAMETER	SYMBOL	RATINGS	UNIT
Input Voltage	V_{IN}	6.5	V
Input Voltage (CE Pin)	V_{CE}	-0.3~6.5	V
Output Voltage	V_{OUT}	-0.3~ $V_{IN}+0.3$	V
Power Dissipation	P_D	900	mW
Operating Temperature	T_{OPT}	-40~+85	°C
Storage Temperature	T_{STG}	-55~+125	°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

LR9273B/D-xx (Fixed Output Voltage Type)

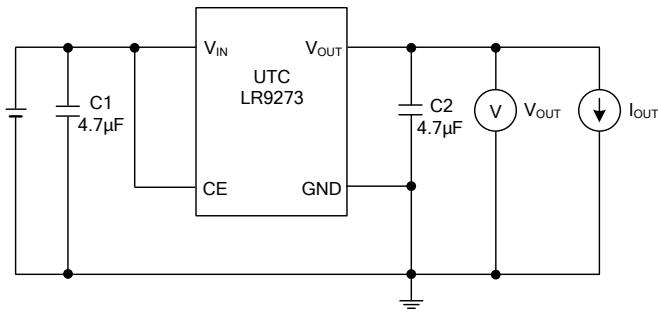
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Input Voltage	V_{IN}		1.4		6.0	V	
Supply Current	I_{SS}	$V_{IN}-V_{OUT}=1.0V$, $V_{CE}=V_{IN}$, $I_{OUT}=0A$		60	100	μA	
Standby Current	$I_{standby}$	$V_{IN}=6.0V$, $V_{CE}=0V$		0.1	1.0	μA	
Output Voltage	V_{OUT}	$V_{IN}-V_{OUT}=1.0V$, $I_{OUT}=100mA$	$V_{OUT}>1.5V$	$\times 0.98$	$\times 1.02$	V	
			$V_{OUT}\leq 1.5V$	-30		+30	mV
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	$V_{IN}-V_{OUT}=0.3V$, $1mA\leq I_{OUT}\leq 300mA$, If $V_{OUT}\leq 1.1V$, then $V_{IN}=1.4V$		-15	-2	15	mV
			$V_{IN}-V_{OUT}=0.3V$, $1mA\leq I_{OUT}\leq 1A$, If $V_{OUT}\leq 1.1V$, then $V_{IN}=1.7V$			-3	
Dropout Voltage ($T_{OPT}=25^\circ C$)	V_{DIF}	$I_{OUT}=300mA$	$0.8\leq V_{OUT}<0.9$		0.33	0.57	V
			$0.9\leq V_{OUT}<1.0$		0.22	0.47	V
			$1.0\leq V_{OUT}<1.5$		0.18	0.32	V
			$1.5\leq V_{OUT}<2.6$		0.10	0.15	V
			$2.6\leq V_{OU}$		0.05	0.10	V
		$I_{OUT}=1A$	$0.8\leq V_{OUT}<0.9$		0.72		V
			$0.9\leq V_{OUT}<1.0$		0.64		V
			$1.0\leq V_{OUT}<1.5$		0.56		V
			$1.5\leq V_{OUT}<2.6$		0.32		V
			$2.6\leq V_{OU}$		0.18		V
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$I_{OUT}=100mA$, $V_{OUT}+0.5V\leq V_{IN}\leq 6.0V$, If $V_{OUT}\leq 0.9V$, $1.4V\leq V_{IN}\leq 6.0V$		0.05	0.20	%/V	
Ripple Rejection	RR	$f=1kHz$ ($V_{OUT}\leq 4.0V$)		70		dB	
		$f=1kHz$ ($V_{OUT}>4.0V$) Ripple 0.5Vp-p, $V_{IN}-V_{OUT}=1.0V$, $I_{OUT}=100mA$, If $V_{OUT}\leq 1.2V$, $V_{IN}-V_{OUT}=1.5V$, $I_{OUT}=100mA$		60		dB	
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T_{OPT}}$	$I_{OUT}=100mA$, $-40^\circ C\leq T_{OPT}\leq 85^\circ C$		± 100		ppm/°C	
Output Current	I_{LIM}	$V_{IN}-V_{OUT}=1.0V$	1			A	
Short Current Limit	I_{SC}	$V_{OUT}=0V$		250		mA	
Pull-Down Resistance for CE Pin	R_{PD}		1.9	5.0	15.0	M Ω	
CE Input Voltage	High	V_{CEH}	1.0		6.0	V	
	Low	V_{CEL}	0		0.4	V	
Thermal Shutdown Detector Threshold Temperature	T_{TSD}	Junction temperature		150		°C	
Thermal Shutdown Released Temperature	T_{TSR}	Junction temperature		120		°C	
Output Noise	en	BW=10Hz~100kHz		30		μV_{rms}	

■ ELECTRICAL CHARACTERISTICS

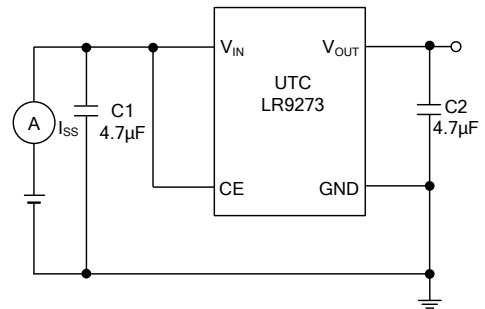
LR9273B/D-xx (Adjustable Output Voltage Type)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Input Voltage	V_{IN}		1.4		6.0	V
Supply Current	I_{SS}	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0$, $V_{CE}=V_{IN}$		60	100	μ A
Standby Current	$I_{standby}$	$V_{IN}=6.0V$, $V_{CE}=0V$		0.1	1.0	μ A
Reference Voltage for Adjustable Voltage Regulator	V_{OUT}	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0V$, $I_{OUT}=100mA$	0.970	1.000	1.030	V
Output Voltage Range	RV_{OUT}		1.0		V_{IN}	V
Load Regulation	$\frac{\Delta V_{OUT}}{\Delta I_{OUT}}$	$V_{IN}=1.4V$, $1mA \leq I_{OUT} \leq 300mA$	-15	-2	15	mV
		$V_{IN}=1.7V$, $1mA \leq I_{OUT} \leq 1A$		-3		mV
Dropout Voltage	V_{DIF}	$V_{OUT}=V_{ADJ}$		0.18	0.32	V
		$I_{OUT}=300mA$ $I_{OUT}=1A$		0.56		V
Line Regulation	$\frac{\Delta V_{OUT}}{\Delta V_{IN}}$	$V_{OUT}=V_{ADJ}$, $I_{OUT}=100mA$, $1.5V \leq V_{IN} \leq 6.0V$		0.05	0.20	%/V
Ripple Rejection	RR	$f=1kHz$ Ripple $0.5Vp-p$, $V_{OUT}=V_{ADJ}$, $V_{IN}=2.5V$, $I_{OUT}=100mA$		70		dB
Output Voltage Temperature Coefficient	$\frac{\Delta V_{OUT}}{\Delta T_{OPT}}$	$I_{OUT}=100mA$, $-40^{\circ}C \leq T_{OPT} \leq 85^{\circ}C$		± 100		ppm/ $^{\circ}C$
Output Current	I_{LIM}	$V_{OUT}=V_{ADJ}$, $V_{IN}=2.0$	1			A
Short Current Limit	I_{SC}	$V_{OUT}=V_{ADJ}=0V$		250		mA
Pull-Down Resistance for CE Pin	R_{PD}		1.9	5.0	15.0	M Ω
CE Input Voltage	High	V_{CEH}	1.0		6.0	V
	Low	V_{CEL}	0		0.4	V
Thermal Shutdown Detector Threshold Temperature	T_{TSD}	Junction temperature		150		$^{\circ}C$
Thermal Shutdown Released Temperature	T_{TSR}	Junction temperature		120		$^{\circ}C$
Output Noise	en	$BW=10Hz \sim 100kHz$		30		μ Vrms

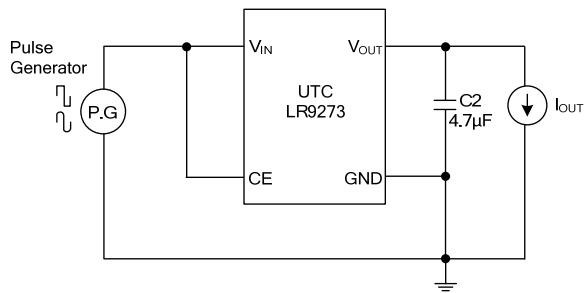
■ TEST CIRCUIT



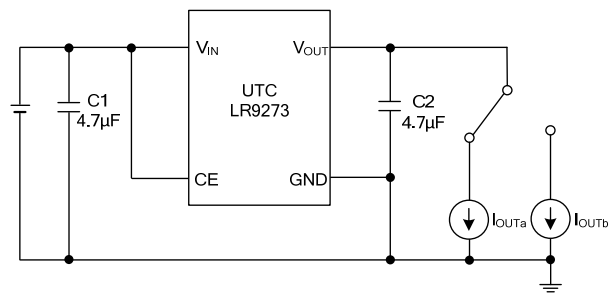
Basic Test Circuit



Test Circuit for Supply Current

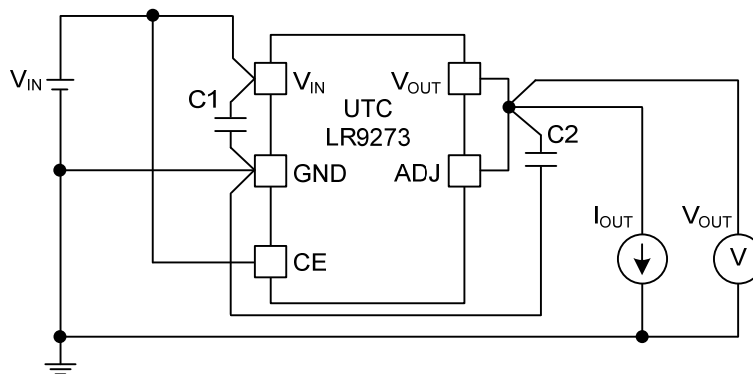
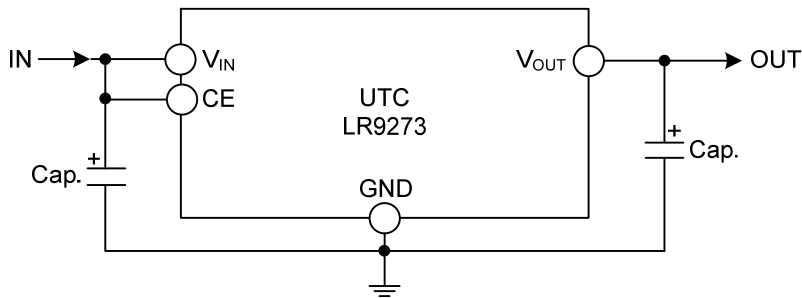


Test Circuit for Ripple Rejection



Test Circuit for Load Transient Response

■ TYPICAL APPLICATION CIRCUIT



Example of the Typical Application of UTC LR9273 (Fixed Output Type)

Phase Compensation

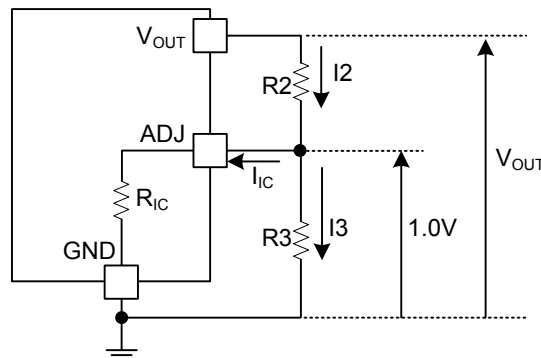
In these ICs, phase compensation is made with the output capacitor for securing stable operation even if the load current is varied. For this purpose, use as much as a capacitor as C2. Recommendation value is as follows:

Mounting on PCB

Make V_{DD} and GND lines sufficient. If their impedance is high, a current flows, the noise picked up or unstable operation may result. Further use a 4.7μF or more value capacitor between V_{DD} pin and GND pin as close as possible.

Set an Output capacitor between V_{OUT} pin and GND pin for phase compensation as close as possible.

Technical Notes on Output Voltage Setting of Adjustable Output type



■ TYPICAL APPLICATION CIRCUIT(Cont.)

The Output Voltage may be adjustable for any output voltage between its 1.0V reference and its V_{DD} setting level. An external pair of resistors is required, as shown above.

The complete equation for the output voltage is described step by step as follows;

$$I_2 = I_{IC} + I_3 \dots\dots\dots (1)$$

$$I_3 = 1.0/R_3 \dots\dots\dots (2)$$

Thus,

$$I_2 = I_{IC} + 1.0/R_3 \dots\dots\dots (3)$$

Therefore,

$$V_{OUT} = 1.0 + R_2 \times I_2 \dots\dots\dots (4)$$

Put Equation (3) into Equation (4), then

$$\begin{aligned} V_{OUT} &= 1.0 + R_2(I_{IC} + 1.0/R_3) \\ &= 1.0(1 + R_2/R_3) + R_2 \times I_{IC} \dots\dots\dots (5) \end{aligned}$$

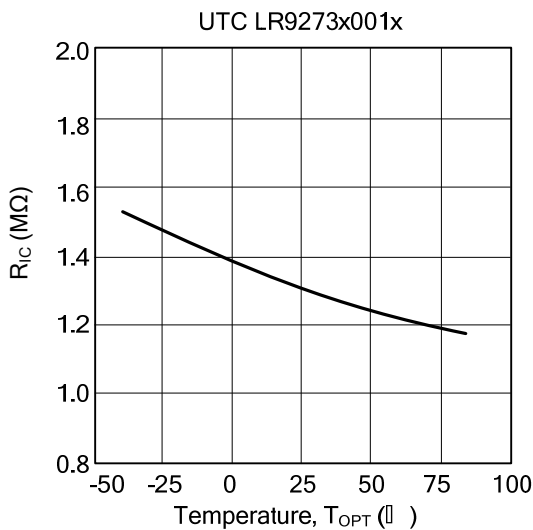
In 2nd term, or R₂×I_{IC} will produce an error in V_{OUT}.

In Equation (5),

$$I_{IC} = 1.0/R_{IC} \dots\dots\dots (6)$$

$$\begin{aligned} R_2 \times I_{IC} &= R_2 \times 1.0/R_{IC} \\ &= 1.0 \times R_2/R_{IC} \dots\dots\dots (7) \end{aligned}$$

For better accuracy, choosing R₂ (<< R_{IC}) reduces this error.



The graph is a typical characteristic , please evaluate the circuit with an actual condition.

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