

UTC 78LXX LINEAR INTEGRATED CIRCUIT

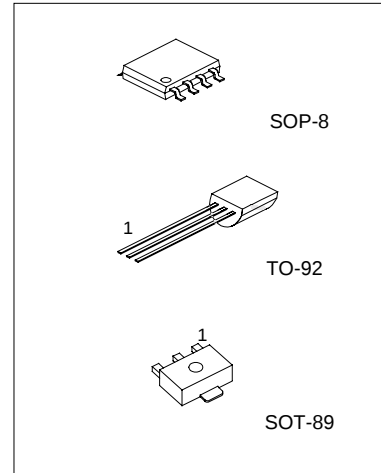
3-TERMINAL 0.1A POSITIVE VOLTAGE REGULATOR

DESCRIPTION

The UTC 78LXX family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that require supply current up to 100mA.

FEATURES

- *Output current up to 100mA
- *Fixed output voltage of 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V available
- *Thermal overload shutdown protection
- *Short circuit current limiting

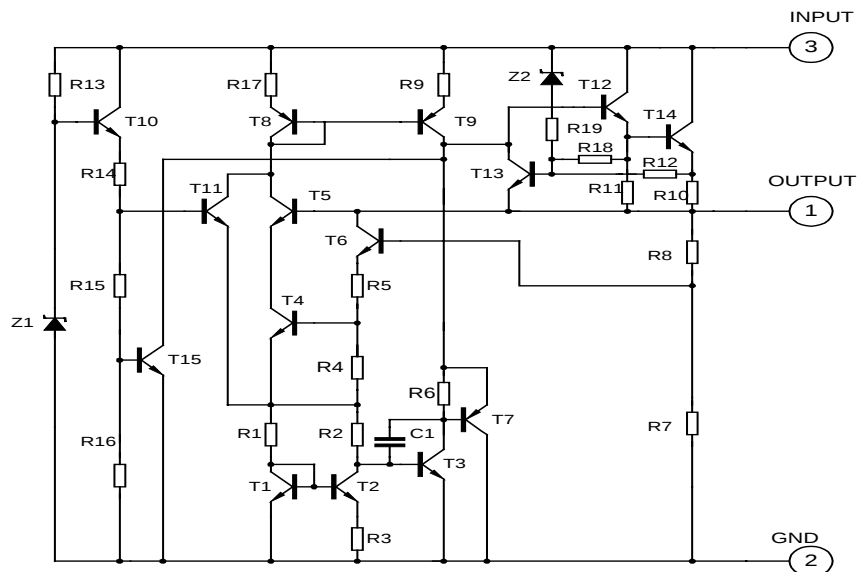


SOP-8 1:Output 2,3,6,7:GND 8:Input
4,5:N.C.

TO-92 1:Output 2:GND; 3:Input

SOT-89 1:Output 2:GND; 3:Input

TEST CIRCUIT



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ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Input voltage (for $V_o=5\sim 9V$) (for $V_o=12\sim 24V$)	V_i		30	V
	V_i		35	V
Output Current	I_o		100	mA
Power Dissipation	PD			mW
SOP-8				
TO-92				
SOT-89				
Operating Junction Temperature Range	T_{opr}	-20	+150	°C
Storage Temperature Range	T_{stg}	-55	+150	°C

UTC78L05 ELECTRICAL CHARACTERISTICS

($V_i=10V$, $I_o=40mA$, $0^\circ C < T_j < 125^\circ C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Output Voltage	V_o	$T_j=25^\circ C$	4.80	5.0	5.20	V
		$7V \leq V_i \leq 20V, I_o=1mA-40mA$	4.75		5.25	V
		$7V \leq V_i \leq V_{MAX}, I_o=1mA-70mA$	4.75		5.25	V (note 2)
Load Regulation	V_o	$T_j=25^\circ C, I_o=1mA-100mA$		11	60	mV
		$T_j=25^\circ C, I_o=1mA-40mA$		5.0	30	mV
Line regulation	V_o	$7V \leq V_i \leq 20V, T_j=25^\circ C$		8	150	mV
		$8V \leq V_i \leq 20V, T_j=25^\circ C$		6	100	mV
Quiescent Current	ΔI_q	$V_{in}=10V, I_o=0mA, T_j=25^\circ C$		2.0	5.5	mA
Quiescent Current Change	ΔI_q	$8V \leq V_i \leq 20V$			1.5	mA
	ΔI_q	$1mA \leq V_i \leq 40mA$			0.1	mA
Output Noise Voltage	V_n	$10Hz \leq f \leq 100kHz$		40		uV
Temperature coefficient of V_o	V_o/T	$I_o=5mA$		-0.65		mV/°C
Ripple Rejection	RR	$8V \leq V_i \leq 20V, f=120Hz, T_j=25^\circ C$	41	80		dB
Dropout Voltage	V_d	$T_j=25^\circ C$		1.7		V

UTC78L06 ELECTRICAL CHARACTERISTICS

($V_i=12V$, $I_o=40mA$, $0^\circ C < T_j < 125^\circ C$, $C_1=0.33\mu F$, $C_o=0.1\mu F$, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Output Voltage	V_o	$T_j=25^\circ C$	5.76	6.0	6.24	V
		$8.5V \leq V_i \leq 20V, I_o=1mA-40mA$	5.70		6.30	V
		$8.5V \leq V_i \leq V_{MAX}, I_o=1mA-70mA$	5.70		6.30	V (note 2)
Load Regulation	V_o	$T_j=25^\circ C, I_o=1mA-100mA$		12.8	80	mV
		$T_j=25^\circ C, I_o=1mA-70mA$		5.8	40	mV
Line regulation	V_o	$8.5V \leq V_i \leq 20V, T_j=25^\circ C$		64	175	mV
		$9V \leq V_i \leq 20V, T_j=25^\circ C$		54	125	mV
Quiescent Current	ΔI_q	$V_{in}=12V, I_o=0mA, T_j=25^\circ C$		3.9	6.0	mA
Quiescent Current Change	ΔI_q	$9V \leq V_i \leq 20V$			1.5	mA
	ΔI_q	$1mA \leq V_i \leq 40mA$			0.1	mA

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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP.	MAX	UNIT
Output Noise Voltage	V _N	10Hz<=f<=100kHz		49		μV
Temperature coefficient of V _o	V _o /T	I _o =5mA		0.75		mV/°C
Ripple Rejection	RR	10V<=V _i <=20V, f=120Hz, T _j =25°C	40	46		dB
Dropout Voltage	V _d	T _j =25°C		1.7		V

UTC78L08 ELECTRICAL CHARACTERISTICS

(V_i=14V, I_o=40mA, 0°C<T_j<125°C, C₁=0.33μF, C_o=0.1μF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V _o	T _j =25°C	7.68	8.0	8.32	V
		10.5V<=V _i <=23V, I _o =1mA-40mA	7.60		8.40	V
		10.5V<=V _i <=V _{MAX} , I _o =1mA-70mA	7.60		8.40	V (note 2)
Load Regulation	V _o	T _j =25°C, I _o =1mA-100mA		15	80	mV
		T _j =25°C, I _o =1mA-70mA		8.0	40	mV
Line regulation	V _o	10.5V<=V _i <=23V, T _j =25°C		10	175	mV
		11V<=V _i <=23V, T _j =25°C		8	125	mV
Quiescent Current	ΔI _q	V _i =14V, I _o =0mA, T _j =25°C		2.0	5.5	mA
Quiescent Current Change	ΔI _q	11V<=V _i <=23V			1.5	mA
	ΔI _q	1mA<=V _i <=40mA			0.1	mA
Output Noise Voltage	V _N	10Hz<=f<=100kHz		49		μV
Temperature coefficient of V _o	ΔV _o /ΔT	I _o =5mA		0.75		mV/°C
Ripple Rejection	RR	11V<=V _i <=23V, f=120Hz, T _j =25°C	39	70		dB
Dropout Voltage	V _d	T _j =25°C		1.7		V

UTC78L09 ELECTRICAL CHARACTERISTICS

(V_i=15V, I_o=40mA, 0°C<T_j<125°C, C₁=0.33μF, C_o=0.1μF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V _o	T _j =25°C	8.64	9.0	9.36	V
		11.5V<=V _i <=24V, I _o =1mA-40mA	8.55		9.45	V
		11.5V<=V _i <=V _{MAX} , I _o =1mA-70mA	8.55		9.45	V (note 2)
Load Regulation	V _o	T _j =25°C, I _o =1mA-100mA		20	90	mV
		T _j =25°C, I _o =1mA-40mA		10	45	mV
Line regulation	V _o	11.5V<=V _i <=24V, T _j =25°C		90	200	mV
		13V<=V _i <=24V, T _j =25°C		100	150	mV
Quiescent Current	ΔI _q	V _i =15V, I _o =0mA, T _j =25°C		2.0	6.0	mA
Quiescent Current Change	ΔI _q	13V<=V _i <=24V			1.5	mA
	ΔI _q	1mA<=V _i <=40mA			0.1	mA
Output Noise Voltage	V _N	10Hz<=f<=100kHz		49		μV
Temperature coefficient of V _o	ΔV _o /ΔT	I _o =5mA		0.75		mV/°C
Ripple Rejection	RR	12V<=V _i <=23V, f=120Hz, T _j =25°C	38	44		dB
Dropout Voltage	V _d	T _j =25°C		1.7		V

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UTC78L12 ELECTRICAL CHARACTERISTICS

($V_I=19V$, $I_O=40mA$, $0^\circ C < T_J < 125^\circ C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ C$	11.52	12.0	12.48	V
		$14.5V \leq V_I \leq 27V$, $I_O=1mA-40mA$	11.40		12.60	V
		$14.5V \leq V_I \leq V_{MAX}$, $I_O=1mA-70mA$	11.40		12.60	V (note 2)
Load Regulation	V_O	$T_J=25^\circ C$, $I_O=1mA-100mA$		25	150	mV
		$T_J=25^\circ C$, $I_O=1mA-40mA$		12	75	mV
Line regulation	V_O	$14.5V \leq V_I \leq 27V$, $T_J=25^\circ C$		25	300	mV
		$16V \leq V_I \leq 27V$, $T_J=25^\circ C$		20	250	mV
Quiescent Current	ΔI_Q	$V_{IN}=19V$, $I_O=0mA$, $T_J=25^\circ C$		2.0	6.0	mA
Quiescent Current Change	ΔI_Q	$16V \leq V_I \leq 27V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		80		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		-1.0		$mV/^\circ C$
Ripple Rejection	RR	$15V \leq V_I \leq 25V$, $f=120Hz$, $T_J=25^\circ C$	37	65		dB
Dropout Voltage	V_D	$T_J=25^\circ C$		1.7		V

UTC78L15 ELECTRICAL CHARACTERISTICS

($V_I=23V$, $I_O=40mA$, $0^\circ C < T_J < 125^\circ C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ C$	14.40	15.0	15.60	V
		$17.5V \leq V_I \leq 30V$, $I_O=1mA-40mA$	14.25		15.75	V
		$17.5V \leq V_I \leq V_{MAX}$, $I_O=1mA-70mA$	14.25		15.75	V (note 2)
Load Regulation	V_O	$T_J=25^\circ C$, $I_O=1mA-100mA$		20	150	mV
		$T_J=25^\circ C$, $I_O=1mA-70mA$		25	150	mV
Line regulation	V_O	$17.5V \leq V_I \leq 30V$, $T_J=25^\circ C$		25	150	mV
		$20V \leq V_I \leq 30V$, $T_J=25^\circ C$		15	75	mV
Quiescent Current	ΔI_Q	$V_{IN}=23V$, $I_O=0mA$, $T_J=25^\circ C$		2.2	6.5	mA
Quiescent Current Change	ΔI_Q	$20V \leq V_I \leq 30V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		90		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		-1.3		$mV/^\circ C$
Ripple Rejection	RR	$18.5V \leq V_I \leq 28.5V$, $f=120Hz$, $T_J=25^\circ C$	34	63		dB
Dropout Voltage	V_D	$T_J=25^\circ C$		1.7		V

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UTC78L18 ELECTRICAL CHARACTERISTICS

($V_I=27V$, $I_O=40mA$, $0^\circ C < T_J < 125^\circ C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ C$	17.28	18.0	18.72	V
		$21V \leq V_I \leq 33V$, $I_O=1mA-40mA$	17.10		18.90	V
		$21V \leq V_I \leq V_{MAX}$, $I_O=1mA-70mA$	17.10		18.90	V (note 2)
Load Regulation	V_O	$T_J=25^\circ C$, $I_O=1mA-100mA$		30	170	mV
		$T_J=25^\circ C$, $I_O=1mA-40mA$		15	85	mV
Line regulation	V_O	$21V \leq V_I \leq 33V$, $T_J=25^\circ C$		145	300	mV
		$22V \leq V_I \leq 33V$, $T_J=25^\circ C$		135	250	mV
Quiescent Current	ΔI_Q	$V_{IN}=27V$, $I_O=0mA$, $T_J=25^\circ C$		2.0	6.0	mA
Quiescent Current Change	ΔI_Q	$21V \leq V_I \leq 33V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		150		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		-1.8		$mV/^\circ C$
Ripple Rejection	RR	$23V \leq V_I \leq 33V$, $f=120Hz$, $T_J=25^\circ C$	34	48		dB
Dropout Voltage	V_D	$T_J=25^\circ C$		1.7		V

UTC78L24 ELECTRICAL CHARACTERISTICS

($V_I=33V$, $I_O=40mA$, $0^\circ C < T_J < 125^\circ C$, $C_1=0.33\mu F$, $C_O=0.1\mu F$, unless otherwise specified)(Note 1)

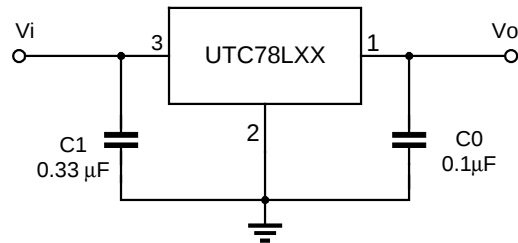
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_O	$T_J=25^\circ C$	23.04	24.0	24.96	V
		$27V \leq V_I \leq 38V$, $I_O=1mA-40mA$	22.8		25.2	V
		$27V \leq V_I \leq V_{MAX}$, $I_O=1mA-70mA$	22.8		25.2	V (note 2)
Load Regulation	V_O	$T_J=25^\circ C$, $I_O=1mA-100mA$		40	200	mV
		$T_J=25^\circ C$, $I_O=1mA-40mA$		20	100	mV
Line regulation	V_O	$27V \leq V_I \leq 38V$, $T_J=25^\circ C$		160	300	mV
		$28V \leq V_I \leq 38V$, $T_J=25^\circ C$		150	250	mV
Quiescent Current	ΔI_Q	$V_{IN}=33V$, $I_O=0mA$, $T_J=25^\circ C$		2.2	6.0	mA
Quiescent Current Change	ΔI_Q	$27V \leq V_I \leq 38V$			1.5	mA
	ΔI_Q	$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	V_N	$10Hz \leq f \leq 100kHz$		200		μV
Temperature coefficient of V_O	$\Delta V_O / \Delta T$	$I_O=5mA$		-2.0		$mV/^\circ C$
Ripple Rejection	RR	$27V \leq V_I \leq 38V$, $f=120Hz$, $T_J=25^\circ C$	34	45		dB
Dropout Voltage	V_D	$T_J=25^\circ C$		1.7		V

Note 1: The Maximum steady state usable output current is dependent on input voltage, heat sinking, lead length of the package and copper pattern of PCB. The data above represent pulse test conditions with junction temperatures specified at the initiation of test.

Note 2: Power dissipation $< 0.5W$

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APPLICATION CIRCUIT



Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

UTC78LXX LINEAR INTEGRATED CIRCUIT

TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Ambient temperature vs. Power dissipation

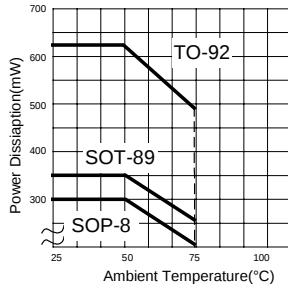


Fig.2 UTC78L05 Output Voltage vs. Ambient temperature

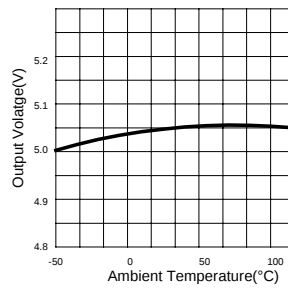


Fig.3 UTC78L12 Output Voltage vs. Ambient temperature

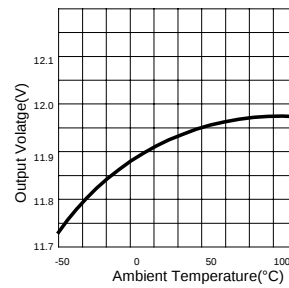


Fig.4 Output Characteristics ($I_p=0mA, T_j=25^{\circ}C$)

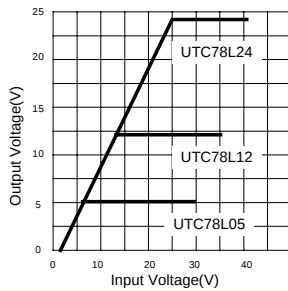


Fig.5 UTC78L05 Dropout Characteristics ($T_j=25^{\circ}C$)

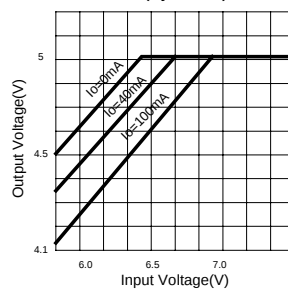


Fig.6 Short Circuit output current ($T_j=25^{\circ}C$)

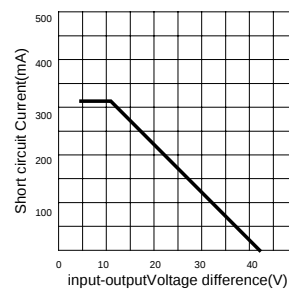


Fig.7 UTC78L12/24 quiescent current vs output current ($T_j=25^{\circ}C$)

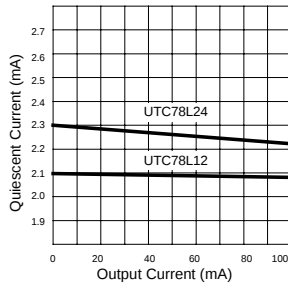


Fig.8 UTC78L05 Quiescent Current vs. Input Voltage ($I_o=0mA, T_j=25^{\circ}C$)

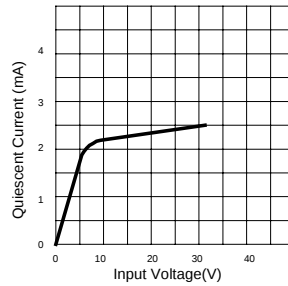


Fig.9 Peak output current vs Dropout voltage difference

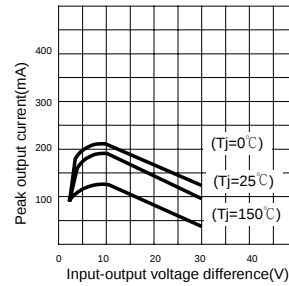


Fig.10 Dropout Voltage

