

# UTC 78LXXM LINEAR INTEGRATED CIRCUIT

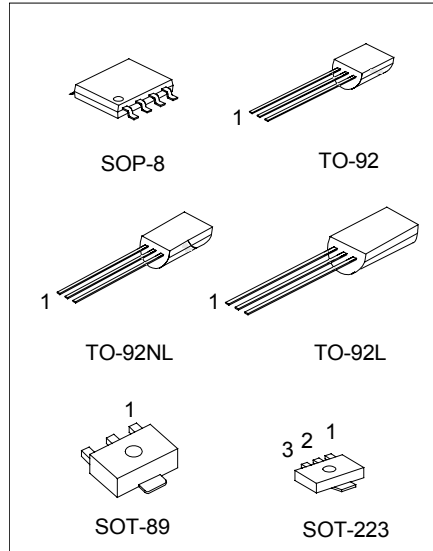
## 3-TERMINAL 0.2A POSITIVE VOLTAGE REGULATOR

### DESCRIPTION

The UTC 78LXXM family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 200mA.

### FEATURES

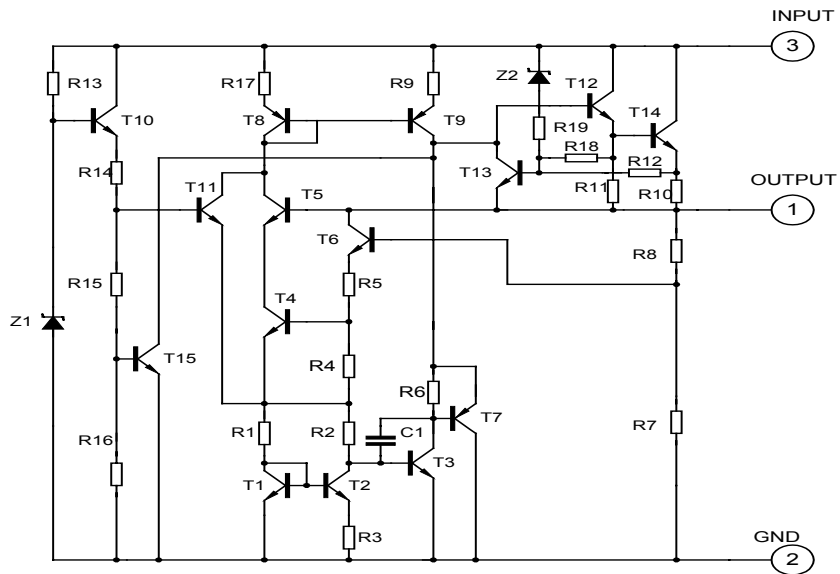
- \*Output current up to 200mA
- \*Fixed output voltage of 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
- \*Thermal overload shutdown protection
- \*Short circuit current limiting



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

TO-92/TO-92L/TO-92NL/SOT-89/SOT-223:  
1:Output 2:GND 3:Input

### TEST CIRCUIT



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QW-R101-002,D

# UTC78LXXM LINEAR INTEGRATED CIRCUIT

## ABSOLUTE MAXIMUM RATINGS

(Operating temperature range applies unless otherwise specified.)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Input voltage (for $V_o=5\sim 9V$ )	$V_i$		30	V
(for $V_o=12\sim 24V$ )	$V_i$		35	V
Output Current	$I_o$		200	mA
Power Dissipation	PD			mW
SOP-8			300	
TO-92			300	
TO-92L			500	
TO-92NL			500	
SOT-89			350	
SOT-223			350	
Operating Junction Temperature Range	$T_{OPR}$	-20	+150	°C
Storage Temperature Range	$T_{STG}$	-55	+150	°C

## UTC78L05M 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
		$7V \leq V_i \leq V_{MAX}$ $I_o=1mA-200mA$	4.75		5.25	V (note 2)
Load Regulation	$\Delta V_o$	$T_j=25^\circ C, I_o=1mA - 100mA$		11	60	mV
		$T_j=25^\circ C, I_o=1mA - 40mA$		5.0	30	mV
Line regulation	$\Delta V_o$	$7V \leq V_i \leq 20V, T_j=25^\circ C$		8	150	mV
		$8V \leq V_i \leq 20V, T_j=25^\circ C$		6	100	mV
Quiescent Current	$I_q$			2.0	5.5	mA
Quiescent Current Change	$\Delta I_q$	$8V \leq V_i \leq 20V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_i \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		40		$\mu V$
Temperature coefficient of $V_o$	$\Delta V_o / \Delta T$	$I_o=5mA$		-0.65		$mV/^\circ C$
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

## UTC78L06M 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
		$8.5V \leq V_i \leq 20V, I_o=1mA - 40mA$	5.7		6.3	V
		$8.5V \leq V_i \leq V_{MAX}$ $I_o=1mA - 200mA$	5.7		6.3	V (note 2)
Load Regulation	$\Delta V_o$	$T_j=25^\circ C, I_o=1mA - 100mA$		12.8	80	mV
		$T_j=25^\circ C, I_o=1mA - 70mA$		5.8	40	mV
Line regulation	$\Delta V_o$	$8.5V \leq V_i \leq 20V, T_j=25^\circ C$		64	175	mV

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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
		9V≤Vi≤20V, Tj=25°C		54	125	mV
Quiescent Current	Iq			3.9	6.0	mA
Quiescent Current Change	ΔIq	9V≤Vi≤20V			1.5	mA
	ΔIq	1mA≤Vi≤40mA			0.1	mA
Output Noise Voltage	VN	10Hz≤f≤100kHz		49		μV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		0.75		mV/°C
Ripple Rejection	RR	10V≤Vi≤20V, f=120Hz, Tj=25°C	40	46		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## UTC78L08M ELECTRICAL CHARACTERISTICS

(Vi=14V, Io=40mA, 0°C<Tj<125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	7.68	8.0	8.32	V
		10.5V≤Vi≤23V, Io=1mA - 40mA	7.60		8.40	V
		10.5V≤Vi≤VMAX, Io=1mA - 200mA	7.60		8.40	V (note 2)
Load Regulation	ΔVo	Tj=25°C, IO=1mA - 100mA		15	80	mV
		Tj=25°C, IO=1mA - 70mA		8.0	40	mV
Line regulation	ΔVo	10.5V≤Vi≤23V, Tj=25°C		10	175	mV
		11V≤Vi≤23V, Tj=25°C		8	125	mV
Quiescent Current	Iq			2.0	5.5	mA
Quiescent Current Change	ΔIq	11V≤Vi≤23V			1.5	mA
	ΔIq	1mA≤Vi≤40mA			0.1	mA
Output Noise Voltage	VN	10Hz≤f≤100kHz		49		μV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		0.75		mV/°C
Ripple Rejection	RR	11V≤Vi≤23V, f=120Hz, Tj=25°C	39	70		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## UTC78L09M ELECTRICAL CHARACTERISTICS

(Vi=15V, Io=40mA, 0°C<Tj<125°C, C1=0.33μF, Co=0.1μF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	8.64	9.0	9.36	V
		11.5V≤Vi≤24V, Io=1mA - 40mA	8.55		9.45	V
		11.5V≤Vi≤VMAX, Io=1mA - 200mA	8.55		9.45	V (note 2)
Load Regulation	ΔVo	Tj=25°C, IO=1mA - 100mA		20	90	mV
		Tj=25°C, IO=1mA - 40mA		10	45	mV
Line regulation	ΔVo	11.5V≤Vi≤24V, Tj=25°C		90	200	mV
		13V≤Vi≤24V, Tj=25°C		100	150	mV
Quiescent Current	Iq			2.0	6.0	mA
Quiescent Current Change	ΔIq	13V≤Vi≤24V			1.5	mA
	ΔIq	1mA≤Vi≤40mA			0.1	mA
Output Noise Voltage	VN	10Hz≤f≤100kHz		49		μV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		0.75		mV/°C

# UTC78LXXM LINEAR INTEGRATED CIRCUIT

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Ripple Rejection	RR	12V<=Vi<=23V, f=120Hz, Tj=25°C	38	44		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## UTC78L10M ELECTRICAL CHARACTERISTICS

(Vi=16V, Io=40mA, 0°C < Tj < 125°C, C1=0.33uF, Co=0.1uF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	9.6	10.0	10.4	V
		12.5V<=Vi<=23V, Io=1mA - 40mA	9.5		10.5	V
		12.5V<=Vi<=VMAX, Io=1mA - 200mA	9.5		10.5	V (note 2)
Load Regulation	ΔVo	Tj=25°C, IO=1mA - 100mA		20	94	mV
		Tj=25°C, IO=1mA - 70mA		10	47	mV
Line regulation	ΔVo	12.5V<=Vi<=23V, Tj=25°C		100	220	mV
		14V<=Vi<=23V, Tj=25°C		200	170	mV
Quiescent Current	Iq			4.2	6.5	mA
Quiescent Current Change	ΔIq	12.5V<=Vi<=23V			1.5	mA
		1mA<=Vi<=40mA			0.1	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		74		uV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		0.95		mV/°C
Ripple Rejection	RR	15V<=Vi<=23V, f=120Hz, Tj=25°C	38	43		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

## UTC78L12M ELECTRICAL CHARACTERISTICS

(Vi=19V, Io=40mA, 0°C < Tj < 125°C, C1=0.33uF, Co=0.1uF, unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	11.52	12	12.48	V
		14.5V<=Vi<=27V, Io=1mA - 40mA	11.40		12.60	V
		14.5V<=Vi<=VMAX, Io=1mA - 200mA	11.40		12.60	V (note 2)
Load Regulation	ΔVo	Tj=25°C, IO=1mA - 100mA		25	150	mV
		Tj=25°C, IO=1mA - 40mA		12	75	mV
Line regulation	ΔVo	14.5V<=Vi<=27V, Tj=25°C		25	300	mV
		16V<=Vi<=27V, Tj=25°C		20	250	mV
Quiescent Current	Iq			2.0	6.0	mA
Quiescent Current Change	ΔIq	16V<=Vi<=27V			1.5	mA
		1mA<=Vi<=40mA			0.1	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		80		uV
Temperature coefficient of Vo	ΔVo/ΔT	Io=5mA		-1.0		mV/°C
Ripple Rejection	RR	15V<=Vi<=25V, f=120Hz, Tj=25°C	37	65		dB
Dropout Voltage	Vd	Tj=25°C		1.7		V

# UTC78LXXM LINEAR INTEGRATED CIRCUIT

## UTC78L15M 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	15.60	V
		$17.5V \leq V_I \leq 30V, I_O=1mA - 40mA$	14.25		15.75	V
		$17.5V \leq V_I \leq V_{MAX}, I_O=1mA - 200mA$	14.25		15.75	V (note 2)
Load Regulation	$\Delta V_O$	$T_J=25^\circ C, I_O=1mA - 100mA$		20	150	mV
		$T_J=25^\circ C, I_O=1mA - 70mA$		25	150	mV
Line regulation	$\Delta V_O$	$17.5V \leq V_I \leq 30V, T_J=25^\circ C$		25	150	mV
		$20V \leq V_I \leq 30V, T_J=25^\circ C$		15	75	mV
Quiescent Current	$I_Q$			2.2	6.5	mA
Quiescent Current Change	$\Delta I_Q$	$20V \leq V_I \leq 30V$			1.5	mA
		$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		90		$\mu V$
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

## UTC78L18M 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	18.72	V
		$21V \leq V_I \leq 33V, I_O=1mA - 40mA$	17.10		18.90	V
		$21V \leq V_I \leq V_{MAX}, I_O=1mA - 200mA$	17.10		18.90	V (note 2)
Load Regulation	$\Delta V_O$	$T_J=25^\circ C, I_O=1mA - 100mA$		30	170	mV
		$T_J=25^\circ C, I_O=1mA - 40mA$		15	85	mV
Line regulation	$\Delta V_O$	$21V \leq V_I \leq 33V, T_J=25^\circ C$		145	300	mV
		$22V \leq V_I \leq 33V, T_J=25^\circ C$		135	250	mV
Quiescent Current	$I_Q$			2.0	6.0	mA
Quiescent Current Change	$\Delta I_Q$	$21V \leq V_I \leq 33V$			1.5	mA
		$1mA \leq V_I \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		150		$\mu V$
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

# UTC 78LXXM LINEAR INTEGRATED CIRCUIT

## UTC78L24M ELECTRICAL CHARACTERISTICS

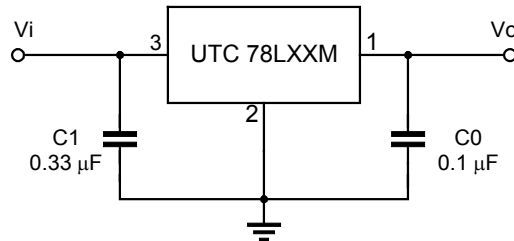
( $V_i=33V, I_o=40mA, 0^\circ C < T_j < 125^\circ C, C_1=0.33\mu F, C_o=0.1\mu F$ , unless otherwise specified)(Note 1)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j=25^\circ C$	23.04	24	24.96	V
		$27V \leq V_i \leq 38V, I_o=1mA - 40mA$	22.80		25.20	V
		$27V \leq V_i \leq V_{MAX}, I_o=1mA - 200mA$	22.80		25.20	V (note 2)
Load Regulation	$\Delta V_o$	$T_j=25^\circ C, I_o=1mA - 100mA$		40	200	mV
		$T_j=25^\circ C, I_o=1mA - 40mA$		20	100	mV
Line regulation	$\Delta V_o$	$27V \leq V_i \leq 38V, T_j=25^\circ C$		160	300	mV
		$28V \leq V_i \leq 38V, T_j=25^\circ C$		150	250	mV
Quiescent Current	$I_q$			2.2	6.0	mA
Quiescent Current Change	$\Delta I_q$	$27V \leq V_i \leq 38V$			1.5	mA
	$\Delta I_q$	$1mA \leq V_i \leq 40mA$			0.1	mA
Output Noise Voltage	$V_N$	$10Hz \leq f \leq 100kHz$		200		$\mu V$
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 are 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  $< 0.5W$

## APPLICATION CIRCUIT



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

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

# UTC78LXXM LINEAR INTEGRATED CIRCUIT

## TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 Ambient temperature vs. Power dissipation

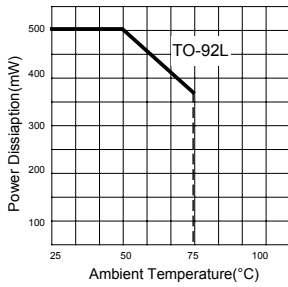


Fig.2 UTC78L05M Output Voltage vs. Ambient temperature

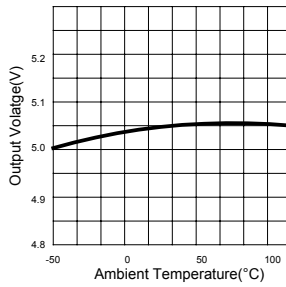


Fig.3 UTC78L12M Power dissipation vs. Ambient temperature

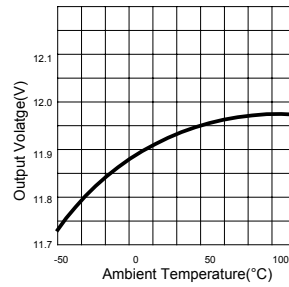


Fig.4 Output Characteristics (I<sub>p</sub>=0mA, T<sub>j</sub>=25°C)

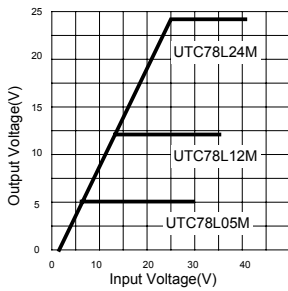


Fig.5 UTC78L05M Dropout Characteristics (T<sub>j</sub>=25°C)

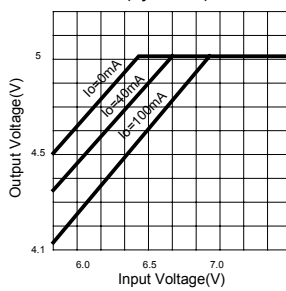


Fig.6 Short Circuit output current (T<sub>j</sub>=25°C)

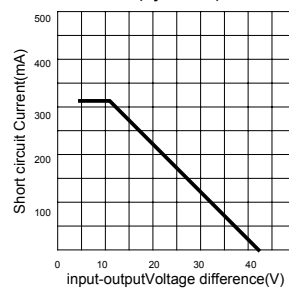


Fig.7 UTC78L12/24M quiescent current vs output current (T<sub>j</sub>=25°C)

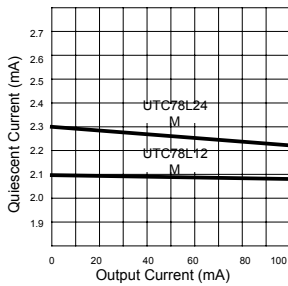


Fig.8 UTC78L05M Quiescent Current vs. Input Voltage (I<sub>o</sub>=0mA, T<sub>j</sub>=25°C)

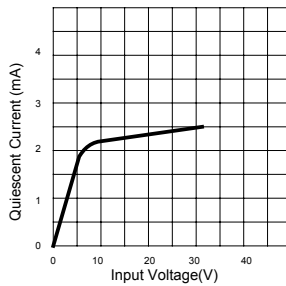
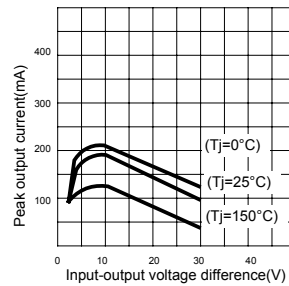


Fig.9 Peak output current vs Dropout voltage difference



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