

# UTC 78MXX LINEAR INTEGRATED CIRCUIT

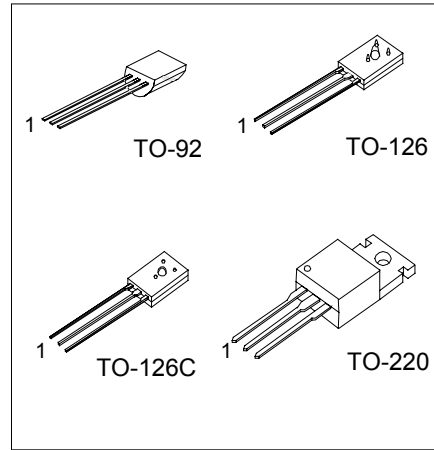
## 3-TERMINAL 0.5A POSITIVE VOLTAGE REGULATOR

### DESCRIPTION

The UTC 78MXX family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications that required supply current up to 0.5 A.

### FEATURES

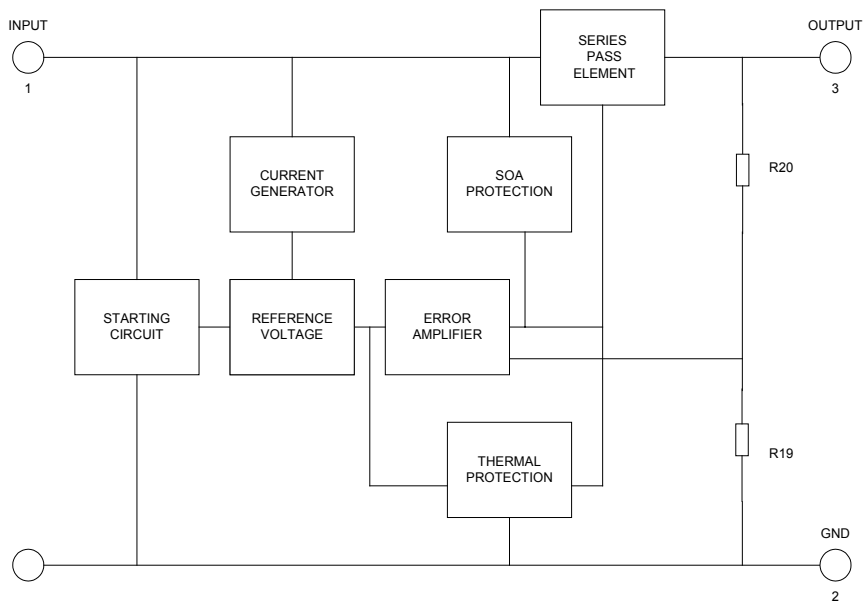
- \*Output current up to 0.5 A
- \*Fixed output voltage of 5V, 6V, 8V, 9V, 12V, 15V, 18V and 24V available
- \*Thermal overload shutdown protection
- \*Short circuit current limiting
- \*Output transistor SOA protection



TO-92                      1: Output 2:GND 3: Input  
 TO-126/TO220        1:Input 2:GND 3:Output

\*Pb-free plating product number: 78MXXL

### TEST CIRCUIT



# UTC 78MXX LINEAR INTEGRATED CIRCUIT

## ABSOLUTE MAXIMUM RATINGS

( Operating temperature range applies unless otherwise specified )

PARAMETER	SYMBOL	VALUE	UNIT
Input voltage (for Vo=5~18V) (for Vo=24V)	VI	35	V
	VI	40	V
Output Current	Io	0.5	A
Power Dissipation	PD	Internally Limited	W
Operating Junction Temperature Range	TOPR	0 +125	°C
Storage Temperature Range	T <sub>STG</sub>	-65 +150	°C

## UTC78M05 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, T<sub>min</sub>≤T<sub>j</sub>≤125°C, I<sub>o</sub>=350mA, V<sub>i</sub>=10V, unless otherwise specified, C<sub>i</sub>=0.33μF, C<sub>o</sub>=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA to 350mA V <sub>i</sub> =7 to 20V	4.80	5.0	5.20	V
			4.75		5.25	V
Load Regulation	ΔVo	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA-0.5A			100	mV
		T <sub>j</sub> =25°C, I <sub>o</sub> =5mA-200mA			50	mV
Line regulation	ΔVo	V <sub>i</sub> =7 to 25V, T <sub>j</sub> =25°C, I <sub>o</sub> =200mA			100	mV
		V <sub>i</sub> =8 to 25V, T <sub>j</sub> =25°C, I <sub>o</sub> =200mA			50	mV
Quiescent Current	I <sub>q</sub>	T <sub>j</sub> =25°C		4.0	6.0	mA
Quiescent Current Change	ΔI <sub>q</sub>	V <sub>i</sub> =8 to 25V, I <sub>o</sub> =200mA			0.8	mA
	ΔI <sub>q</sub>	I <sub>o</sub> =5mA-350mA			0.5	mA
Output Noise Voltage	V <sub>N</sub>	10Hz≤f≤100KHz		40		μV
Ripple Rejection	RR	V <sub>i</sub> =8 to 18V, f=120Hz I <sub>o</sub> =300mA	62			dB
Peak Output Current	IPK	T <sub>j</sub> =25°C		700		mA
Short-Circuit Current	ISC	V <sub>i</sub> =35V, T <sub>j</sub> =25°C		300		mA
Dropout Voltage	V <sub>d</sub>	T <sub>j</sub> =25°C, I <sub>o</sub> =500mA		2.0		V

## UTC78M06 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, T<sub>min</sub>≤T<sub>j</sub>≤125°C, I<sub>o</sub>=350mA, V<sub>i</sub>=11V, unless otherwise specified, C<sub>i</sub>=0.33μF, C<sub>o</sub>=0.1μF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	T <sub>j</sub> =25°C, I <sub>o</sub> =5-350mA V <sub>i</sub> =8 to 21V, I <sub>o</sub> =5mA-350mA	5.76	6.0	6.24	V
			5.70		6.30	V
Load Regulation	ΔVo	T <sub>j</sub> =25°C, I <sub>o</sub> =5mA-0.5A			120	mV
		T <sub>j</sub> =25°C, I <sub>o</sub> =5mA-200mA			60	mV
Line regulation	ΔVo	V <sub>i</sub> =8V to 25V, T <sub>j</sub> =25°C, I <sub>o</sub> =200mA			100	mV
		V <sub>i</sub> =9V to 25V, T <sub>j</sub> =25°C, I <sub>o</sub> =200mA			50	mV
Quiescent Current	I <sub>q</sub>	T <sub>j</sub> =25°C		4.0	6	mA
Quiescent Current Change	ΔI <sub>q</sub>	I <sub>o</sub> =5mA to 350mA			0.5	mA
	ΔI <sub>q</sub>	V <sub>i</sub> =9V to 25V, I <sub>o</sub> =200mA			0.8	mA
Output Noise Voltage	V <sub>N</sub>	10Hz≤f≤100kHz		45		μV
Ripple Rejection	RR	V <sub>i</sub> =9V to 19V, f=120Hz, T <sub>j</sub> =25°C I <sub>o</sub> =300mA	59			dB

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PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Peak Output Current	IPK	Tj=25°C		700		mA
Short-Circuit Current	ISC	Vi=35V, Tj=25°C		300		mA
Dropout Voltage	Vd	Tj=25°C		2.0		V

## UTC78M08 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, Tmin<=Tj<=125°C, Io=350mA, Vi=14V, unless otherwise specified, Ci=0.33uF, Co=0.1uF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	7.68	8.0	8.32	V
		Vi =10.5V to 23V, Io=5mA-350mA	7.60		8.40	V
Load Regulation	ΔVo	Tj=25°C, Io=5mA-0.5A			160	mV
		Tj=25°C, Io=5mA-200mA			80	mV
Line regulation	ΔVo	Vi =10.5V to 25V Tj=25°C, Io=200mA			100	mV
		Vi =11V to 25V Tj=25°C, Io=200mA			50	mV
Quiescent Current	Iq	Tj=25°C		4.0	6	mA
Quiescent Current Change	ΔIq	Vi =10.5V to 25V, Io=200mA			0.8	mA
	ΔIq	Io=5mA to 350mA			0.5	mA
Output Noise Voltage	VN	10Hz<=f<=100KHz		52		uV
Ripple Rejection	RR	Vi =11.5V to 21.5V, f=120Hz, Io=300mA	56			dB
Peak Output Current	IPK	Tj=25°C		700		mA
Short-Circuit Current	ISC	Vi=35V, Tj=25°C		300		mA
Dropout Voltage	Vd	Tj=25°C, Io=500mA		2.0		V

## UTC78M09 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits, Tmin<=Tj<=125°C, Io=350mA, Vi=17V, unless otherwise specified, Ci=0.33uF, Co=0.1uF)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	Vo	Tj=25°C	8.64	9	9.36	V
		Vi =12.5V to 25V, Io=5mA-350mA	8.55		9.45	V
Load Regulation	ΔVo	Tj=25°C, Io=5mA-0.5A			200	mV
		Tj=25°C, Io=5mA-200mA			100	mV
Line regulation	ΔVo	Vi =12.5V to 25 V Tj=25°C, Io=200mA			100	mV
		Vi =13V to 25V Tj=25°C, Io=200mA			50	mV
Quiescent Current	Iq	Tj=25°C		4.1	6	mA
Quiescent Current Change	ΔIq	Vi =12.5V to 25V, Io=200mA			0.8	mA
	ΔIq	Io=5mA-350mA			0.5	mA
Output Noise Voltage	VN	10Hz<=f<=100kHz		65		uV
Ripple Rejection	RR	Vi =13V to 23V, f=120Hz Io=300mA	55			dB
Peak Output Current	IPK	Tj=25°C		700		mA
Short-Circuit Current	ISC	Vi=35V, Tj=25°C		300		mA
Dropout Voltage	Vd	Tj=25°C, Io=500mA		2.0		V

# UTC 78MXX LINEAR INTEGRATED CIRCUIT

## UTC78M12 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits,  $T_{min} \leq T_j \leq 125^\circ\text{C}$ ,  $I_o = 350\text{mA}$ ,  $V_i = 19\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o = 0.1\mu\text{F}$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j = 25^\circ\text{C}$	11.52	12.0	12.48	V
		$V_i = 14.5\text{V to } 27\text{V}$ , $I_o = 5\text{mA} - 350\text{mA}$	11.40		12.60	V
Load Regulation	$\Delta V_o$	$T_j = 25^\circ\text{C}$ , $I_o = 5\text{mA} - 0.5\text{A}$			240	mV
		$T_j = 25^\circ\text{C}$ , $I_o = 5\text{mA} - 2\text{A}$			120	mV
Line regulation	$\Delta V_o$	$V_i = 14.5\text{V to } 30\text{V}$ $T_j = 25^\circ\text{C}$ , $I_o = 200\text{mA}$			100	mV
		$V_i = 16\text{V to } 30\text{V}$ $T_j = 25^\circ\text{C}$ , $I_o = 200\text{mA}$			50	mV
Quiescent Current	$I_q$	$T_j = 25^\circ\text{C}$		4.1	6.0	mA
Quiescent Current Change	$\Delta I_q$	$V_i = 14.5\text{V to } 30\text{V}$ , $I_o = 200\text{mA}$			0.8	mA
	$\Delta I_q$	$I_o = 5\text{mA} - 350\text{mA}$			0.5	mA
Output Noise Voltage	VN	$10\text{Hz} \leq f \leq 100\text{kHz}$		75		$\mu\text{V}$
Ripple Rejection	RR	$V_i = 15\text{V to } 25\text{V}$ , $f = 120\text{Hz}$ $I_o = 300\text{mA}$	55			dB
Peak Output Current	IPK	$T_j = 25^\circ\text{C}$		700		mA
Short-Circuit Current	ISC	$V_i = 35\text{V}$ , $T_j = 25^\circ\text{C}$		300		mA
Dropout Voltage	Vd	$T_j = 25^\circ\text{C}$ , $I_o = 500\text{mA}$		2.0		V

## UTC78M15 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits,  $T_{min} \leq T_j \leq 125^\circ\text{C}$ ,  $I_o = 350\text{mA}$ ,  $V_i = 23\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o = 0.1\mu\text{F}$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j = 25^\circ\text{C}$	14.40	15.0	15.60	V
		$V_i = 17.5\text{V to } 30\text{V}$ , $I_o = 5\text{mA} - 350\text{mA}$	14.25		15.75	V
Load Regulation	$\Delta V_o$	$T_j = 25^\circ\text{C}$ , $I_o = 5\text{mA} - 0.5\text{A}$			300	mV
		$T_j = 25^\circ\text{C}$ , $I_o = 5\text{mA} - 200\text{mA}$			150	mV
Line regulation	$\Delta V_o$	$V_i = 17.5\text{V to } 30\text{V}$ $T_j = 25^\circ\text{C}$ , $I_o = 200\text{mA}$			100	mV
		$V_i = 20\text{V to } 30\text{V}$ $T_j = 25^\circ\text{C}$ , $I_o = 200\text{mA}$			50	mV
Quiescent Current	$I_q$	$T_j = 25^\circ\text{C}$		4.1	6.0	mA
Quiescent Current Change	$\Delta I_q$	$V_i = 17.5\text{V to } 30\text{V}$ , $I_o = 200\text{mA}$			0.8	mA
	$\Delta I_q$	$I_o = 5\text{mA} - 350\text{mA}$			0.5	mA
Output Noise Voltage	VN	$10\text{Hz} \leq f \leq 100\text{kHz}$		90		$\mu\text{V}$
Ripple Rejection	RR	$V_i = 18.5\text{V to } 28.5\text{V}$ $f = 120\text{Hz}$ , $I_o = 300\text{mA}$	54			dB
Peak Output Current	IPK	$T_j = 25^\circ\text{C}$		700		mA
Short-Circuit Current	ISC	$V_i = 35\text{V}$ , $T_j = 25^\circ\text{C}$		300		mA
Dropout Voltage	Vd	$T_j = 25^\circ\text{C}$ , $I_o = 500\text{mA}$		2.0		V

# UTC 78MXX LINEAR INTEGRATED CIRCUIT

## UTC78M18 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits,  $T_{min} \leq T_j \leq 125^\circ\text{C}$ ,  $I_o = 350\text{mA}$ ,  $V_i = 26\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o = 0.1\mu\text{F}$ )

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j = 25^\circ\text{C}$	17.28	18.0	18.72	V
		$V_i = 20.5\text{V to } 33\text{V}$ $I_o = 5\text{mA-}350\text{mA}$	17.10		18.90	V
Load Regulation	$\Delta V_o$	$T_j = 25^\circ\text{C}, I_o = 5\text{mA-}0.5\text{A}$			360	mV
		$T_j = 25^\circ\text{C}, I_o = 5\text{mA-}200\text{mA}$			180	mV
Line regulation	$\Delta V_o$	$V_i = 21\text{V to } 33\text{V}$ $T_j = 25^\circ\text{C}, I_o = 200\text{mA}$			100	mV
		$V_i = 24\text{V to } 33\text{V}$ , $T_j = 25^\circ\text{C}, I_o = 200\text{mA}$			50	mV
Quiescent Current	$I_q$	$T_j = 25^\circ\text{C}$		4.2	6	mA
Quiescent Current Change	$\Delta I_q$	$V_i = 21\text{V to } 33\text{V}, I_o = 200\text{mA}$			0.8	mA
	$\Delta I_q$	$I_o = 5\text{mA-}350\text{mA}$			0.5	mA
Output Noise Voltage	VN	$10\text{Hz} < f < 100\text{KHz}$		100		$\mu\text{V}$
Ripple Rejection	RR	$V_i = 22\text{V to } 32\text{V}, f = 120\text{Hz}$ $I_o = 300\text{mA}$	53			dB
Peak Output Current	IPK	$T_j = 25^\circ\text{C}$		700		mA
Short-Circuit Current	ISC	$V_i = 35\text{V}, T_j = 25^\circ\text{C}$		300		mA
Dropout Voltage	Vd	$T_j = 25^\circ\text{C}$		2.0		V

## UTC78M24 ELECTRICAL CHARACTERISTICS

(Refer to the test circuits,  $T_{min} \leq T_j \leq 125^\circ\text{C}$ ,  $I_o = 350\text{mA}$ ,  $V_i = 33\text{V}$ , unless otherwise specified,  $C_i = 0.33\mu\text{F}$ ,  $C_o = 0.1\mu\text{F}$ )

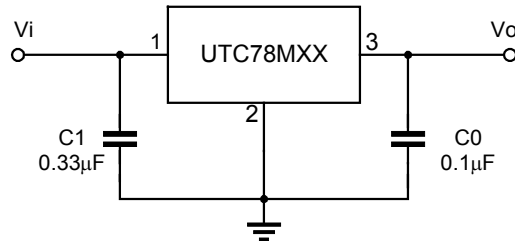
PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	$V_o$	$T_j = 25^\circ\text{C}$	23.04	24.0	24.96	V
		$V_i = 27\text{V to } 38\text{V}$ $I_o = 5\text{mA-}350\text{mA}$	22.80		25.20	V
Load Regulation	$\Delta V_o$	$T_j = 25^\circ\text{C}, I_o = 5\text{mA-}0.5\text{A}$			480	mV
		$T_j = 25^\circ\text{C}, I_o = 5\text{mA-}200\text{mA}$			240	mV
Line regulation	$\Delta V_o$	$V_i = 27\text{V to } 38\text{V}$ $T_j = 25^\circ\text{C}, I_o = 200\text{mA}$			100	mV
		$V_i = 28\text{V to } 38\text{V}$ $T_j = 25^\circ\text{C}, I_o = 200\text{mA}$			50	mV
Quiescent Current	$I_q$	$T_j = 25^\circ\text{C}$ ,		4.2	6.0	mA
Quiescent Current Change	$\Delta I_q$	$V_i = 27\text{V to } 38\text{V}, I_o = 200\text{mA}$			0.8	mA
	$\Delta I_q$	$I_o = 5\text{mA-}350\text{mA}$			0.5	mA
Output Noise Voltage	VN	$10\text{Hz} < f < 100\text{KHz}$		170		$\mu\text{V}$
Ripple Rejection	RR	$V_i = 28\text{V to } 38\text{V}, f = 120\text{Hz}$ $I_o = 300\text{mA}$	50			dB
Peak Output Current	IPK	$T_j = 25^\circ\text{C}$		700		mA
Short-Circuit Current	ISC	$V_i = 35\text{V}, T_j = 25^\circ\text{C}$		300		mA
Dropout Voltage	Vd	$T_j = 25^\circ\text{C}$		2.0		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 represents pulse test conditions with junction temperatures specified at the initiation of test.

Note 2: Power dissipation  $< 0.5\text{W}$

# UTC78MXX LINEAR INTEGRATED CIRCUIT

## APPLICATION CIRCUIT



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

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

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