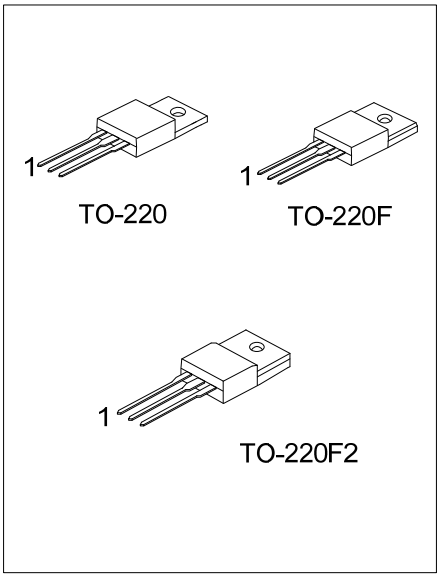
LM78XXA

LINEAR INTEGRATED CIRCUIT

3-TERMINAL 1.5A POSITIVE VOLTAGE REGULATOR



■ DESCRIPTION

The UTC **LM78XXA** family is monolithic fixed voltage regulator integrated circuit. They are suitable for applications requiring supply current up to 1.5 A.

■ FEATURES

* Output current up to 1.5A
* Fixed output voltage of 5V, 6V, 7V, 8V, 9V, 10V, 12V, 15V, 18V and 24V available
* Thermal overload shutdown protection
* Output transistor SOA protection

■ ORDERING INFORMATION

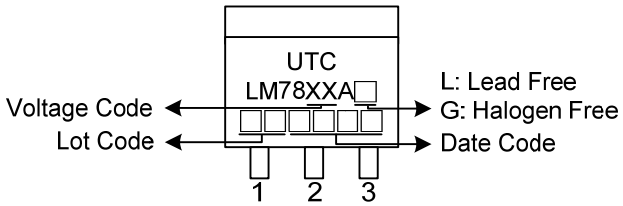
Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
LM78XXAL-TA3-T	LM78XXAG-TA3-T	TO-220	I	G	O	Tube
LM78XXAL-TF3-T	LM78XXAG-TF3-T	TO-220F	I	G	O	Tube
LM78XXAL-TF2-T	LM78XXAG-TF2-T	TO-220F2	I	G	O	Tube

Notes: 1. xx: output voltage, refer to Marking Information
2. Pin Code: I: Input G: GND O: Output

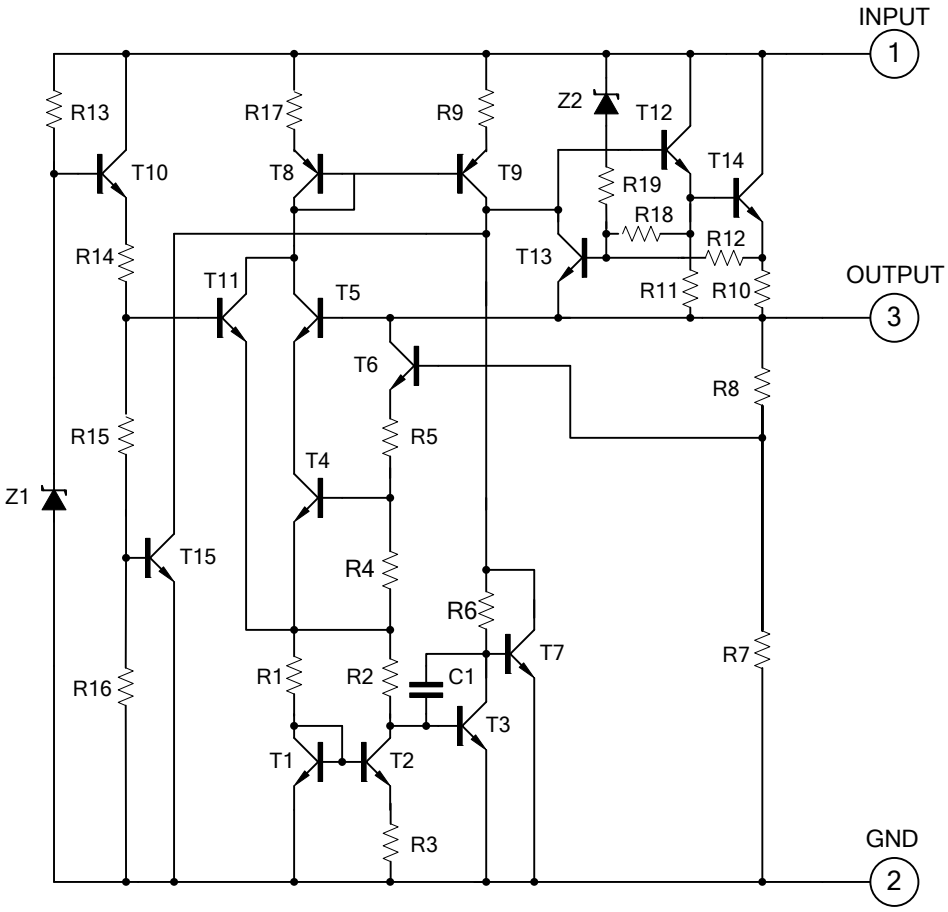
LM78XXAG-TA3-T

(1)Packing Type	(1) T: Tube
(2)Package Type	(2) TA3: TO-220, TF3: TO-220F, TF2: TO-220F2
(3)Green Package	(3) G: Halogen Free and Lead Free, L: Lead Free
(4)Output Voltage Code	(4) XX: refer to Marking Information

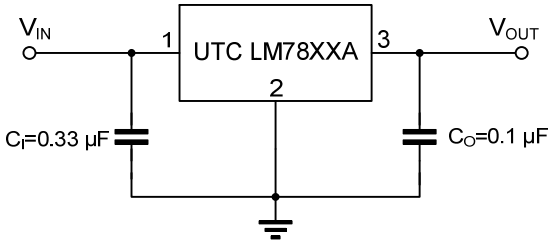
■ MARKING INFORMATION

PACKAGE	VOLTAGE CODE	MARKING
TO-220 TO-220F TO-220F2	05: 5.0 V 06: 6.0 V 07: 7.0 V 08: 8.0 V 09: 9.0 V 10: 1.0 V 12: 1.2 V 15: 1.5 V 18: 1.8 V 24: 2.4 V	

■ TEST CIRCUIT



■ APPLICATION CIRCUIT



Note 1: To specify an output voltage, substitute voltage value for "XX".
2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

■ ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified)

PARAMETER		SYMBOL	RATING	UNIT
Input voltage	V_{OUT}=5~18V	V_{IN}	35	V
	V_{OUT}=24V		40	V
Output Current		I_{OUT}	1.5	A
Power Dissipation		P_D	Internally Limited	W
Junction Temperature		T_J	+150	°C
Operating Junction Temperature		T_{OPR}	-40 ~ +125	°C
Storage Temperature		T_{STG}	-55 ~ +150	°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.

■ THERMAL DATA

PARAMETER		SYMBOL	RATING	UNIT
Junction to Ambient		θ_{JA}	65	°C/W
Junction to Case	TO-220	θ_{JC}	5	°C/W
	TO-220F/TO-220F2		8	

■ ELECTRICAL CHARACTERISTICS

(I_{OUT}=0.5A, T_J= 0°C~125°C, C_I =0.33μF, C_O=0.1μF, unless otherwise specified)(Note 1)

For UTC LM7805A (V_{IN}=10V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	4.90	5.0	5.10	V
		V_{IN} =7.5V ~ 20V, I_{OUT}=5mA ~ 1.0A	4.85		5.15	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			100	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			50	mV
Line regulation	ΔV_{OUT}	V_{IN} =7V ~ 25V, T_J =25°C			50	mV
		V_{IN} =7.5V ~ 20V, T_J =25°C, I_{OUT}=1.0A			50	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =7.5V ~ 20V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		40		μV
Ripple Rejection	RR	V_{IN} =8V ~ 18V,f=120Hz, T_J =25°C	59	80		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC LM7806A (V_{IN}=11V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	5.88	6.0	6.12	V
		V_{IN} =8.5V ~ 21V, I_{OUT}=5mA ~ 1.0A	5.82		6.18	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			120	mV
		T_J =25°C, I_{OUT}=0.25A~ 0.75A			60	mV
Line regulation	ΔV_{OUT}	V_{IN} =8V ~ 25V, T_J =25°C			60	mV
		V_{IN} =8.5V ~ 21V, T_J =25°C,I_{OUT}=1.0A			60	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =8.5V ~ 21V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		45		μV
Ripple Rejection	RR	V_{IN} =9V ~ 19V,f=120Hz, T_J =25°C	56	75		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

■ ELECTRICAL CHARACTERISTICS (Cont.)

For UTC LM7807A (V_{IN}=13V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA - 1.0A	6.86	7.0	7.14	V
		V_{IN} =9.5V ~ 22V, I_{OUT}=5mA ~ 1.0A	6.79		7.21	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			140	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			70	mV
Line regulation	ΔV_{OUT}	V_{IN} =9V ~ 25V, T_J =25°C			70	mV
		V_{IN} =9.5V ~ 22V, T_J =25°C,I_{OUT}=1.0A			70	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =9.5V ~ 22V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		50		μV
Ripple Rejection	RR	V_{IN} =10V ~ 20V,f=120Hz, T_J =25°C	56	75		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.7		A

For UTC LM7808A (V_{IN}=14V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA~ 1.0A	7.84	8.0	8.16	V
		V_{IN} =10.5V ~ 23V, I_{OUT}=5mA ~ 1.0A	7.76		8.24	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			160	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			80	mV
Line regulation	ΔV_{OUT}	V_{IN} =10.5V ~ 25V, T_J =25°C			80	mV
		V_{IN} =10.5V ~ 23V, T_J =25°C,I_{OUT}=1.0A			80	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =10.5V ~ 23V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =11.5V ~ 21.5V, f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC LM7809A (V_{IN}=15V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	8.82	9.0	9.18	V
		V_{IN} =11.5V ~ 24V, I_{OUT}=5mA ~ 1.0A	8.73		9.27	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			180	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			90	mV
Line regulation	ΔV_{OUT}	V_{IN} =11.5V ~ 25 V, T_J =25°C			90	mV
		V_{IN} =11.5V ~ 24V, T_J =25°C, I_{OUT}=1.0A			90	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =11.5V ~ 24V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =12.5V ~ 22.5V,f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC LM7810A (V_{IN}=16V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	9.8	10.0	10.2	V
		V_{IN} =12.5V ~ 25V, I_{OUT}=5mA ~ 1.0A	9.7		10.3	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA - 1.5A			200	mV
		T_J =25°C, I_{OUT}=0.25A - 0.75A			100	mV
Line regulation	ΔV_{OUT}	V_{IN} =13V ~ 25V, T_J =25°C			100	mV
		V_{IN} =13V ~ 25V, T_J =25°C,I_{OUT}=1.0A			100	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =12.6V ~ 25V			1.0	mA
		I_{OUT}=5mA - 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		58		μV
Ripple Rejection	RR	V_{IN} =13V - 23V,f=120Hz, T_J =25°C	53	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC LM7812A (V_{IN}=19V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	11.76	12.0	12.24	V
		V_{IN} =14.5V ~ 27V, I_{OUT}=5mA ~ 1.0A	11.64		12.36	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			240	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			120	mV
Line regulation	ΔV_{OUT}	V_{IN} =14.5V ~ 30V, T_J =25°C			120	mV
		V_{IN} =14.6V ~ 27V, T_J =25°C, I_{OUT}=1.0A			120	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =14.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		75		μV
Ripple Rejection	RR	V_{IN} =15V - 25V,f=120Hz, T_J =25°C	52	72		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC LM7815A (V_{IN}=23V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	14.70	15.0	15.30	V
		V_{IN} =17.5V ~ 30V, I_{OUT}=5mA ~ 1.0A	14.55		15.45	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			300	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			150	mV
Line regulation	ΔV_{OUT}	V_{IN} =18.5V ~ 30V, T_J =25°C			150	mV
		V_{IN} =17.7V ~ 30V, T_J =25°C, I_{OUT} =1.0A			150	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =17.5V ~ 30V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		90		μV
Ripple Rejection	RR	V_{IN} =18.5V ~ 28.5V,f=120Hz, T_J =25°C	51	70		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

■ ELECTRICAL CHARACTERISTICS(Cont.)

For UTC LM7818A (V_{IN}=27V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	17.64	18.0	18.36	V
		V_{IN} =21V ~ 33V, I_{OUT}=5mA ~ 1.0A	17.46		18.54	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			360	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			180	mV
Line regulation	ΔV_{OUT}	V_{IN} =21V ~ 33V, T_J =25°C			180	mV
		V_{IN} =21V ~ 33V, T_J =25°C, I_{OUT} =1.0A			180	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =21.5V ~ 33V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		110		μV
Ripple Rejection	RR	V_{IN} =22V ~ 32V,f=120Hz, T_J =25°C	50	69		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

For UTC LM7824A (V_{IN}=33V)

PARAMETER	SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
Output Voltage	V_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.0A	23.52	24.0	24.48	V
		V_{IN} =27V ~ 38V, I_{OUT}=5mA ~ 1.0A	23.28		24.72	V
Dropout Voltage	V_D	T_J =25°C, I_{OUT}=1.5A		2.5		V
Load Regulation	ΔV_{OUT}	T_J =25°C, I_{OUT}=5mA ~ 1.5A			480	mV
		T_J =25°C, I_{OUT}=0.25A ~ 0.75A			240	mV
Line regulation	ΔV_{OUT}	V_{IN} =27V ~ 38V, T_J =25°C			240	mV
		V_{IN} =27V ~ 38V, T_J =25°C,I_{OUT}=1.0A			240	mV
Quiescent Current	I_Q	T_J =25°C, I_{OUT}≤1.0A			8.0	mA
Quiescent Current Change	ΔI_Q	V_{IN} =28V ~ 38V			1.0	mA
		I_{OUT}=5mA ~ 1.0A			0.5	mA
Output Noise Voltage	eN	10Hz≤f≤100kHz		170		μV
Ripple Rejection	RR	V_{IN} =28V ~ 38V, f=120Hz, T_J =25°C	47	66		dB
Peak Output Current	I_{PEAK}	T_J =25°C		1.8		A

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.

2. Power dissipation<0.5W.

■ TYPICAL CHARACTERISTICS