D2214, JUNE 1976–REVISED SEPTEMBER 1991

- **3-Terminal Regulators**
- **Output Current Up to 500 mA**
- **No External Components**
- **Internal Thermal Overload Protection**
- **High Power Dissipation Capability**
- **Internal Short-Circuit Current Limiting**
- **Output Transistor Safe-Area Compensation**
- **Direct Replacements for Fairchild μA78M00 Series**

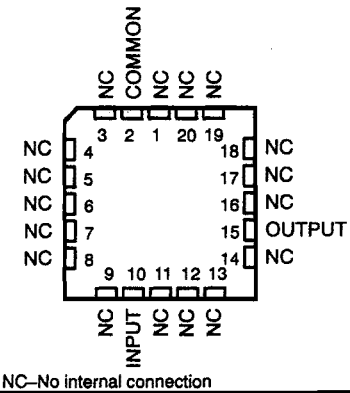
NOMINAL OUTPUT VOLTAGE	0°C TO 125°C OPERATING TEMPERATURE RANGE	–55°C TO 150°C OPERATING TEMPERATURE RANGE
5 V	uA78M05C	uA78M05M
6 V	uA78M06C	
8 V	uA78M08C	
9 V	uA78M09C	
10 V	uA78M10C	
12 V	uA78M12C	uA78M12M
15 V	uA78M15C	
20 V	uA78M20C	
24 V	uA78M24C	
Packages	KC	FK, JG

description

This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. Each of these regulators can deliver up to 500 mA of output current. The internal current limiting and thermal shutdown features of these regulators make them essentially immune to overload. In addition to use as fixed-voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents and also as the power pass element in precision regulators.

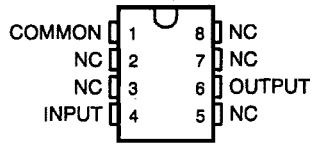
terminal assignments

uA78M_M . . . FK PACKAGE
(TOP VIEW)



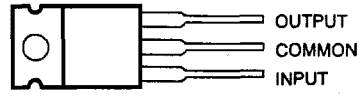
NC–No internal connection

uA78M_M . . . JG PACKAGE
(TOP VIEW)



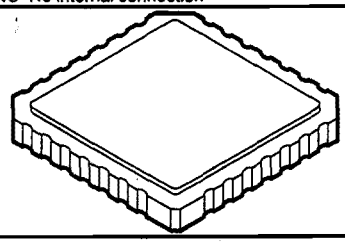
NC–No internal connection

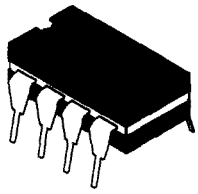
uA78M_C . . . KC PACKAGE
(TOP VIEW)

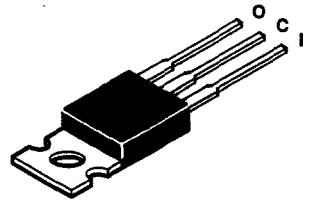


The common terminal is in electrical contact with the mounting base.

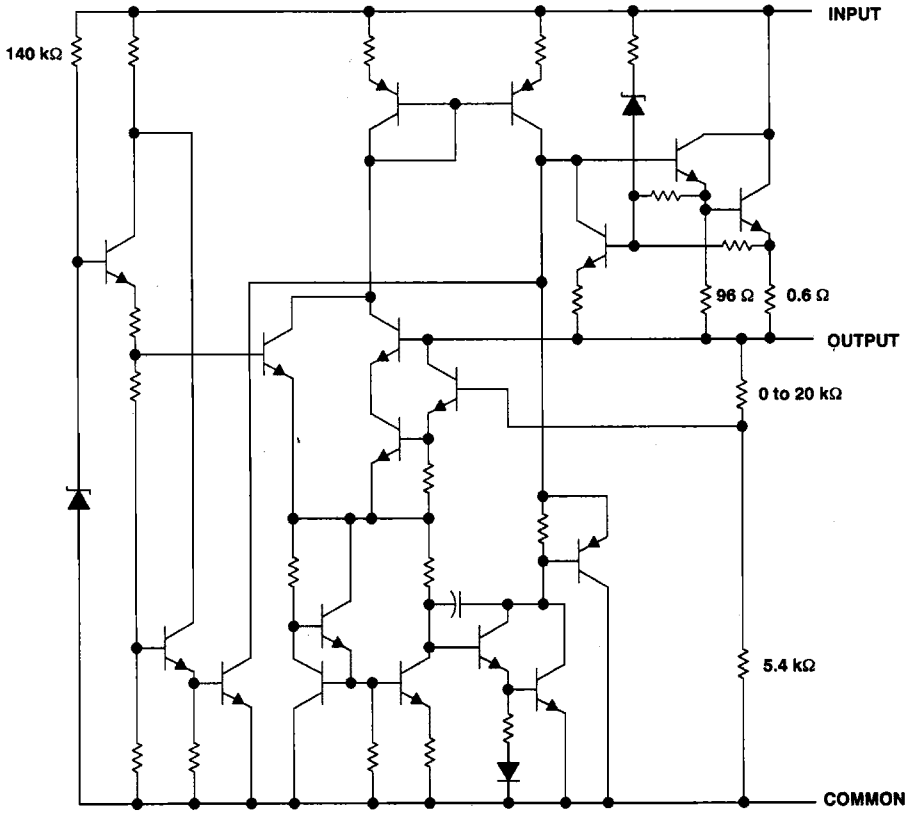
TO–220AB







schematic



Resistor values shown are nominal.

absolute maximum ratings over operating temperature range (unless otherwise noted)

			uA78M05C THRU uA78M24C	uA78M05M uA78M12M	UNIT
Input voltage	uA78M20, uA78M24		−40		V
	All others		35	35	
Continuous total dissipation (see Note 1)			See Dissipation Rating Tables 1 and 2		
Operating free-air, case, or virtual junction temperature range			0 to 150	−55 to 150	°C
Storage temperature range			−65 to 150	−65 to 150	°C
Case temperature for 60 seconds		FK package		260	°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds		JG package		300	°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds		KC package	260		°C

NOTE 1: To avoid exceeding the design maximum virtual junction temperature, these ratings should not be exceeded. Due to variations in individual device electrical characteristics and thermal resistance, the built-in thermal overload protection may be activated at power levels slightly above or below the rated dissipation.

DISSIPATION RATING TABLE 1 – FREE-AIR TEMPERATURE

PACKAGE	$T_A \le 25°C$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25°C$	$T_A = 70°C$ POWER RATING
FK	1375 mW	11.0 mW/°C	880 mW
JG	1050 mW	8.4 mW/°C	672 mW
KC	2000 mW	16 mW/°C	1280 mW

DISSIPATION RATING TABLE 2 – CASE TEMPERATURE

PACKAGE	$T_C \le 50°C$ POWER RATING	DERATING FACTOR ABOVE $T_C = 50°C$	$T_C = 125°C$ POWER RATING
KC	20 W	200 mW/°C	5 W

recommended operating conditions

		MIN	MAX	UNIT
Input voltage, V_I	uA78M05C, uA78M05M	7	25	V
	uA78M06C	8	25	
	uA78M08C	10.5	25	
	uA78M09C	11.5	26	
	uA78M10C	12.5	28	
	uA78M12C, uA78M12M	14.5	30	
	uA78M15C	17.5	30	
	uA78M20C	23	35	
	uA78M24C	27	38	
Output current, I_O	All devices		500	mA
Operating virtual junction temperature, T_J	uA78M05C thru uA78M24C	0	125	°C
	uA78M05M and uA78M12M	−55	150	

uA78M05C, uA78M05M electrical characteristics at specified virtual junction temperature, V_I = 10 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	uA78M05C			uA78M05M			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage‡			25°C	4.8	5	5.2	4.8	5	5.2	V
	I_O = 5 mA to 350 mA	V_I = 8 V to 20 V	−55°C to 150°C				4.7		5.3	
		V_I = 7 V to 20 V	0°C to 125°C	4.75		5.25				
Input regulation	I_O = 200 mA	V_I = 7 V to 25 V	25°C		3	100		3	50	mV
		V_I = 8 V to 20 V						1	25	
		V_I = 8 V to 25 V			1	50				
Ripple rejection	V_I = 8 V to 18 V, f = 120 Hz	I_O = 100 mA	−55°C to 150°C				62*			dB
			0°C to 125°C	62						
		I_O = 300 mA	25°C	62	80		62*	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		20	100		20	50	mV
	I_O = 5 mA to 200 mA				10	50		10	25	
Temperature coefficient of output voltage	I_O = 5 mA		−55°C to 25°C						−2*	mV/°C
			25°C to 150°C						−1.5*	
			0°C to 125°C		−1					
Output noise voltage	f = 10 Hz to 100 kHz		25°C		40	200		40	200*	μV
Dropout voltage			25°C		2	2.5		2	2.5	V
Bias current			25°C		4.5	6		4.5	7	mA
Bias current change	I_O = 200 mA, V_I = 8 V to 25 V		−55°C to 150°C						0.8	mA
			0°C to 125°C			0.8				
	I_O = 5 mA to 350 mA		−55°C to 150°C						0.5	
			0°C to 125°C			0.5				
Short-circuit output current	V_I = 35 V		25°C		300			300	600	mA
Peak output current			25°C		0.7		0.5*	0.7	1.4*	A

* On products compliant to MIL-STD-883, Class B, this parameter is not production tested.

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

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uA78M06C electrical characteristics at specified virtual junction temperature, V_I = 11 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	5.75	6	6.25	V
	I_O = 5 mA to 350 mA	V_I = 8 V to 21 V	0°C to 125°C	5.7		6.3	
Input regulation	I_O = 200 mA	V_I = 8 V to 25 V	25°C		5	100	mV
		V_I = 9 V to 25 V			1.5	50	
Ripple rejection	V_I = 9 V to 19 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	59			dB
		I_O = 300 mA	25°C	59	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		20	120	mV
	I_O = 5 mA to 200 mA				10	60	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		45		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.5	6	mA
Bias current change	I_O = 200 mA,	V_I = 9 V to 25 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		270		mA
Peak output current			25°C		0.7		A

uA78M08C electrical characteristics at specified virtual junction temperature, V_I = 14 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	7.7	8	8.3	V
	I_O = 5 mA to 350 mA	V_I = 10.5 V to 23 V	0°C to 125°C	7.6		8.4	
Input regulation	I_O = 200 mA	V_I = 10.5 V to 25 V	25°C		6	100	mV
		V_I = 11 V to 25 V			2	50	
Ripple rejection	V_I = 11.5 V to 21.5 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	56			dB
		I_O = 300 mA	25°C	56	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		25	160	mV
	I_O = 5 mA to 200 mA				10	80	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		52		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.6	6	mA
Bias current change	I_O = 200 mA,	V_I = 10.5 V to 25 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		250		mA
Peak output current			25°C		0.7		A

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

uA78M09C electrical characteristics at specified virtual junction temperature, V_I = 16 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	8.6	9	9.4	V
	I_O = 5 mA to 350 mA	V_I = 11.5 V to 24 V	0°C to 125°C	8.5		9.5	
Input regulation	I_O = 200 mA	V_I = 11.5 V to 26 V	25°C		6	100	mV
		V_I = 12 V to 26 V			2	50	
Ripple rejection	V_I = 13 V to 23 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	56			dB
		I_O = 300 mA	25°C	56	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		25	180	mV
	I_O = 5 mA to 200 mA				10	90	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		58		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.6	6	mA
Bias current change	I_O = 200 mA,	V_I = 11.5 V to 26 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		250		mA
Peak output current			25°C		0.7		A

uA78M10C electrical characteristics at specified virtual junction temperature, V_I = 17 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	9.6	10	10.4	V
	I_O = 5 mA to 350 mA	V_I = 12.5 V to 25 V	0°C to 125°C	9.5		10.5	
Input regulation	I_O = 200 mA	V_I = 12.5 V to 28 V	25°C		7	100	mV
		V_I = 14 V to 28 V			2	50	
Ripple rejection	V_I = 15 V to 25 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	59			dB
		I_O = 300 mA	25°C	55	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		25	200	mV
	I_O = 5 mA to 200 mA				10	100	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		64		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.7	6	mA
Bias current change	I_O = 200 mA	V_I = 13.5 V to 28 V	0°C to 125°C			0.8	mA
		V_I = 12.5 V to 28 V					
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		245		mA
Peak output current			25°C		0.7		A

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

uA78M12C, uA78M12M electrical characteristics at specified virtual junction temperature, V_I = 9 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	uA78M12C			uA78M12M			UNIT
				MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage‡			25°C	11.5	12	12.5	11.5	12	12.5	V
	I_O = 5 mA to 350 mA	V_I = 15.5 V to 27 V	−55°C to 150°C				11.4		12.6	
		V_I = 14.5 V to 27 V	0°C to 125°C	11.4		12.6				
Input regulation	I_O = 200 mA	V_I = 14.5 V to 30 V	25°C		8	100		8	60	mV
		V_I = 16 V to 25 V						2	30	
		V_I = 16 V to 30 V			2	50				
Ripple rejection	V_I = 15 V to 25 V, f = 120 Hz	I_O = 100 mA	−55°C to 150°C				55*			dB
			0°C to 125°C	55						
		I_O = 300 mA	25°C	55	80		55*	80		
Output regulation	I_O = 5 mA to 500 mA		25°C		25	240		25	120	mV
	I_O = 5 mA to 200 mA				10	120		10	60	
Temperature coefficient of output voltage	I_O = 5 mA		−55°C to 25°C						−4.8*	mV/°C
			25°C to 150°C						−3.6*	
			0°C to 125°C		−1					
Output noise voltage	f = 10 Hz to 100 kHz		25°C		75			75	480*	μV
Dropout voltage			25°C		2			2	2.5	V
Bias current			25°C		4.8	6		4.8	7	mA
Bias current change	I_O = 200 mA	V_I = 15 V to 30 V	−55°C to 150°C						0.8	mA
		V_I = 14.5 V to 30 V	0°C to 125°C			0.8				
	I_O = 5 mA to 350 mA		−55°C to 150°C						0.5	
			0°C to 125°C			0.5				
Short-circuit output current	V_I = 35 V		25°C		240			240	600	mA
Peak output current			25°C		0.7		0.5*	0.7	1.4*	A

* On products compliant to MIL-STD-883, Class B, this parameter is not production tested.

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

uA78M15C electrical characteristics at specified virtual junction temperature, V_I = 23 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	14.4	15	15.6	V
	I_O = 5 mA to 350 mA	V_I = 17.5 V to 30 V	0°C to 125°C	14.25		15.75	
Input regulation	I_O = 200 mA	V_I = 17.5 V to 30 V	25°C		10	100	mV
		V_I = 20 V to 30 V			3	50	
Ripple rejection	V_I = 18.5 V to 28.5 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	54			dB
		I_O = 300 mA	25°C	54	70		
Output regulation	I_O = 5 mA to 500 mA		25°C		25	300	mV
	I_O = 5 mA to 200 mA				10	150	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		90		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.8	6	mA
Bias current change	I_O = 200 mA,	V_I = 17.5 V to 30 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		240		mA
Peak output current			25°C		0.7		A

uA78M20C electrical characteristics at specified virtual junction temperature, V_I = 29 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	19.2	20	20.8	V
	I_O = 5 mA to 350 mA	V_I = 23 V to 35 V	0°C to 125°C	19		21	
Input regulation	I_O = 200 mA	V_I = 23 V to 35 V	25°C		10	100	mV
		V_I = 24 V to 35 V			5	50	
Ripple rejection	V_I = 24 V to 34 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	53			dB
		I_O = 300 mA	25°C	53	70		
Output regulation	I_O = 5 mA to 500 mA		25°C		30	400	mV
	I_O = 5 mA to 200 mA				10	200	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1.1		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		110		μV
Dropout voltage			25°C		2		V
Bias current			25°C		4.9	6	mA
Bias current change	I_O = 200 mA,	V_I = 23 V to 35 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		240		mA
Peak output current			25°C		0.7		A

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.

uA78M24C electrical characteristics at specified virtual junction temperature, V_I = 33 V, I_O = 350 mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS		T_J†	MIN	TYP	MAX	UNIT
Output voltage‡			25°C	23	24	25	V
	I_O = 5 mA to 350 mA	V_I = 27 V to 38 V	0°C to 125°C	22.8		25.2	
Input regulation	I_O = 200 mA	V_I = 27 V to 38 V	25°C		10	100	mV
		V_I = 28 V to 38 V			5	50	
Ripple rejection	V_I = 28 V to 38 V, f = 120 Hz	I_O = 100 mA	0°C to 125°C	50			dB
		I_O = 300 mA	25°C	50	70		
Output regulation	I_O = 5 mA to 500 mA		25°C		30	480	mV
	I_O = 5 mA to 200 mA				10	240	
Temperature coefficient of output voltage	I_O = 5 mA		0°C to 125°C		−1.2		mV/°C
Output noise voltage	f = 10 Hz to 100 kHz		25°C		170		μV
Dropout voltage			25°C		2		V
Bias current			25°C		5	6	mA
Bias current change	I_O = 200 mA,	V_I = 27 V to 38 V	0°C to 125°C			0.8	mA
	I_O = 5 mA to 350 mA		0°C to 125°C			0.5	
Short-circuit output current	V_I = 35 V		25°C		240		mA
Peak output current			25°C		0.7		A

† All characteristics are measured with a 0.33-μF capacitor across the input and a 0.1-μF capacitor across the output. Pulse-testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into account separately.

‡ This specification applies only for dc power dissipation permitted by absolute maximum ratings.