



**THE DATASHEET OF  
UA78M15CKTPR**



# LINEAR INTEGRATED CIRCUITS

# SERIES $\mu$ A78M00 POSITIVE-VOLTAGE REGULATORS

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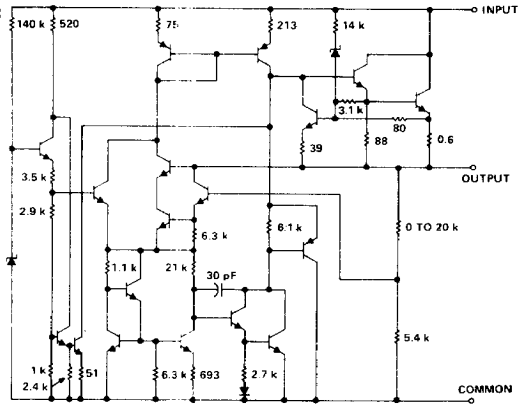
- 3-Terminal Regulators
- Output Current up to 500 mA
- No external components
- Internal Thermal Overload Protection
- Direct Replacements for Fairchild  $\mu$ A78M00 Series and National LM341 Series
- High Power Dissipation Capability
- Internal Short-Circuit Current Limiting
- Output Transistor Safe-Area Compensation

NOMINAL OUTPUT VOLTAGE	-55°C TO 150°C OPERATING TEMPERATURE RANGE	0°C TO 125°C OPERATING TEMPERATURE RANGE
5 V	$\mu$ A78M05M	$\mu$ A78M05C
6 V	$\mu$ A78M06M	$\mu$ A78M06C
8 V	$\mu$ A78M08M	$\mu$ A78M08C
12 V	$\mu$ A78M12M	$\mu$ A78M12C
15 V	$\mu$ A78M15M	$\mu$ A78M15C
20 V	$\mu$ A78M20M	$\mu$ A78M20C
22 V	$\mu$ A78M22M	$\mu$ A78M22C
24 V	$\mu$ A78M24M	$\mu$ A78M24C
PACKAGES	LA	KC, KD, and LA

### description

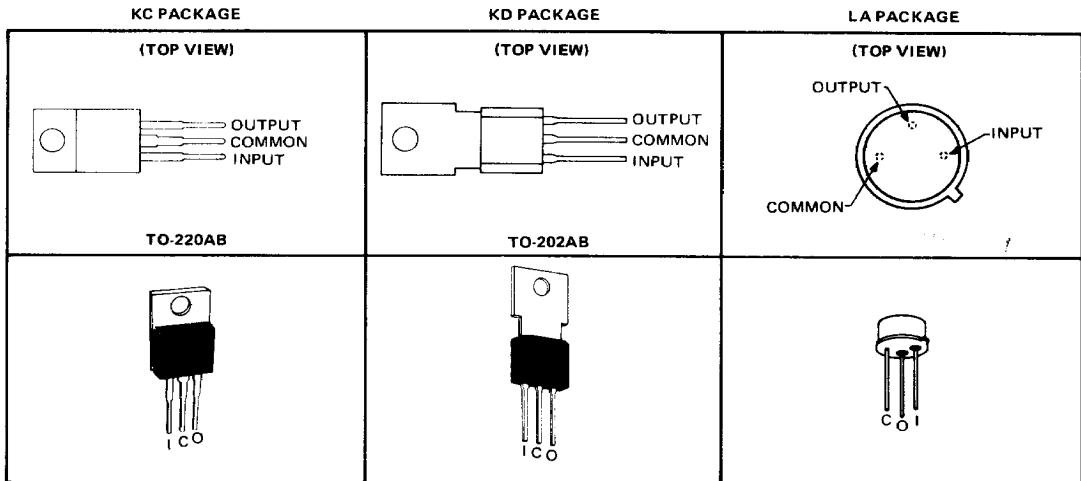
This series of fixed-voltage monolithic integrated-circuit voltage regulators is designed for a wide range of applications. These applications include on-card regulation for elimination of noise and distribution problems associated with single-point regulation. One of these regulators can deliver up to 500 milliamperes 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.

### schematic



Resistor values shown are nominal and in ohms.

### terminal assignments



# SERIES $\mu$ A78M00

## POSITIVE-VOLTAGE REGULATORS

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

		$\mu$ A78M05M THRU $\mu$ A78M24M	$\mu$ A78M05C THRU $\mu$ A78M24C	UNIT
Input voltage	$\mu$ A78M20 thru $\mu$ A78M24	40	40	V
	All others	35	35	
Continuous total dissipation at 25°C free-air temperature (see Note 1)	KC (TO-220AB) package	2	2	W
	KD(TO-202AB) package	1.5	1.5	
	LA package	0.6	0.6	
Continuous total dissipation at (or below) 25°C case temperature (see Note 1)	KC and KD packages	7.5	7.5	W
	LA package	5	5	
Operating free-air, case, or virtual junction temperature range		-65 to 150	0 to 150	°C
Storage temperature range		-65 to 150	-65 to 150	°C
Lead temperature 1/16 inch from case for 10 seconds		KC and KD packages		°C
Lead temperature 1/16 inch from case for 60 seconds		LA package		°C

NOTE 1: For operation above 25°C free-air or case temperature, refer to Dissipation Derating Curves, Figures 1 through 4, page 188.

### recommended operating conditions

		MIN	MAX	UNIT
Input voltage, $V_I$	$\mu$ A78M05M, $\mu$ A78M05C	7	25	V
	$\mu$ A78M06M, $\mu$ A78M06C	8	25	
	$\mu$ A78M08M, $\mu$ A78M08C	10.5	25	
	$\mu$ A78M12M, $\mu$ A78M12C	14.5	30	
	$\mu$ A78M15M, $\mu$ A78M15C	17.5	30	
	$\mu$ A78M20M, $\mu$ A78M20C	23	35	
	$\mu$ A78M22M, $\mu$ A78M22C	24	38	
Output current, $I_O$		500		mA
Operating virtual junction temperature, $T_J$	$\mu$ A78M05M thru $\mu$ A78M24M	-55	150	°C
	$\mu$ A78M05C thru $\mu$ A78M24C	0	125	

# TYPES $\mu$ A78M05M, $\mu$ A78M05C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M05M,  $\mu$ A78M05C electrical characteristics at specified virtual junction temperature,  
 $V_I = 10\text{ V}$ ,  $I_O = 350\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M05M			$\mu$ A78M05C			UNIT		
		MIN	TYP	MAX	MIN	TYP	MAX			
Output voltage	$I_O = 5\text{ mA}$ to $350\text{ mA}$	25°C		4.8	5	5.2	4.8	5	5.2	
		-55°C to 150°C		4.7		5.3				
		0°C to 125°C						4.75		5.25
Input regulation	$I_O = 200\text{ mA}$	25°C			3	50		3	100	
		-55°C to 150°C			1	25		1	50	
		0°C to 125°C								
		25°C		62						
Ripple rejection	$V_I = 8\text{ V}$ to $18\text{ V}$ , $f = 120\text{ Hz}$	-55°C to 150°C					62			
		0°C to 125°C		62	80	80	62	80		
Output regulation	$I_O = 5\text{ mA}$ to $500\text{ mA}$ $I_O = 5\text{ mA}$ to $200\text{ mA}$	25°C			20	50		20	100	
		-55°C to 150°C			10	25		10	50	
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$	-55°C to 150°C								
		0°C to 125°C			-1			-1		
Output noise voltage	$f = 10\text{ Hz}$ to $100\text{ kHz}$	25°C			40			40		
		-55°C to 150°C			2			2		
Dropout voltage		25°C			4.5	6		4.5	6	
		-55°C to 150°C				0.8				
Bias current	$I_O = 200\text{ mA}$ , $V_I = 8\text{ V}$ to $25\text{ V}$	0°C to 125°C							0.8	
		-55°C to 150°C				0.5				
Short-circuit output current	$V_I = 35\text{ V}$	25°C			300			300		
		-55°C to 150°C			700			700		
Peak output current		25°C							A	

† All characteristics are measured with a capacitor across the input of  $0.33\ \mu\text{F}$  and a capacitor across the output of  $0.1\ \mu\text{F}$ . All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_w \leq 10\text{ ms}$ , duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M06M, $\mu$ A78M06C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M06M,  $\mu$ A78M06C electrical characteristics at specified virtual junction temperature,  
 $V_I = 11\text{ V}$ ,  $I_O = 350\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M06M			$\mu$ A78M06C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$I_O = 5\text{ mA to }350\text{ mA}$	25°C						V
		-55°C to 150°C						
		0°C to 125°C						
Input regulation	$I_O = 200\text{ mA}$	25°C						mV
		$V_I = 9\text{ V to }21\text{ V}$						
		$V_I = 8\text{ V to }21\text{ V}$						
		$V_I = 9\text{ V to }20\text{ V}$						
Ripple rejection	$V_I = 9\text{ V to }19\text{ V}$ , $f = 120\text{ Hz}$	25°C						dB
		-55°C to 150°C						
Output regulation	$I_O = 5\text{ mA to }500\text{ mA}$ $I_O = 5\text{ mA to }200\text{ mA}$	25°C						mV
		-55°C to 150°C						
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$	25°C						mV/°C
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	25°C						$\mu$ V
Dropout voltage		25°C						V
		-55°C to 150°C						
Bias current		25°C						mA
		-55°C to 150°C						
Bias current change	$I_O = 200\text{ mA}$ , $V_I = 9\text{ V to }25\text{ V}$	25°C						mA
		0°C to 125°C						
		-55°C to 150°C						
Short-circuit output current	$V_I = 35\text{ V}$	25°C						mA
		-55°C to 150°C						
Peak output current		25°C						A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_{pw} \leq 10\text{ ms}$ , duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

# TYPES $\mu$ A78M08M, $\mu$ A78M08C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M08M,  $\mu$ A78M08C electrical characteristics at specified virtual junction temperature,  
 $V_I = 14$  V,  $I_O = 350$  mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M08M			$\mu$ A78M08C			UNIT		
		MIN	TYP	MAX	MIN	TYP	MAX			
Output voltage	$I_O = 5$ mA to 350 mA	25°C		7.7	8	8.3	7.7	8	8.3	V
		-55°C to 150°C		7.6		8.4				
Input regulation	$I_O = 200$ mA	0°C to 125°C			6	60	7.6	6	100	mV
		-55°C to 150°C								
		25°C			2	30				
		-55°C to 150°C		56				2	50	
Ripple rejection	$V_I = 11.5$ V to 21.5 V, $f = 120$ Hz	0°C to 125°C					56			dB
		-55°C to 150°C		56	80		56	80		
Output regulation	$I_O = 5$ mA to 500 mA $I_O = 5$ mA to 200 mA	25°C			25	80		25	160	mV
		-55°C to 150°C			10	40		10	80	
Temperature coefficient of output voltage	$I_O = 5$ mA	-55°C to 150°C								mV/°C
Output noise voltage	$f = 10$ Hz to 100 kHz	0°C to 125°C								$\mu$ V
Dropout voltage		25°C			52			52		V
		-55°C to 150°C								
Bias current		25°C			2			2		mA
		-55°C to 150°C			4.6	6		4.6	6	
Bias current change	$I_O = 200$ mA	0°C to 125°C								mA
		-55°C to 150°C				0.8				
		0°C to 125°C					0.5			
Short-circuit output current	$V_I = 35$ V	25°C			250			250		mA
		-55°C to 150°C								
Peak output current		25°C			700			700		A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_w \leq 10$  ms, duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M12M, $\mu$ A78M12C

## POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M12M,  $\mu$ A78M12C electrical characteristics at specified virtual junction temperature,  
 $V_I = 19\text{ V}$ ,  $I_O = 350\text{ mA}$  (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		$\mu$ A78M12M			$\mu$ A78M12C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$I_O = 5\text{ mA to }350\text{ mA}$	$V_I = 15.5\text{ V to }27\text{ V}$	11.5	12	12.5	11.5	12	12.5	V
		$V_I = 14.5\text{ V to }27\text{ V}$	11.4		12.6	11.4		12.6	
		$V_I = 14.5\text{ V to }30\text{ V}$				8	60	8	
Input regulation	$I_O = 200\text{ mA}$	$V_I = 16\text{ V to }25\text{ V}$		2	30		2	50	mV
		$V_I = 16\text{ V to }30\text{ V}$							
Ripple rejection	$V_I = 15\text{ V to }25\text{ V}$ , $f = 120\text{ Hz}$	$I_O = 100\text{ mA}$	55			55			dB
		$I_O = 300\text{ mA}$	55	80		55	80		
Output regulation	$I_O = 5\text{ mA to }500\text{ mA}$	$I_O = 5\text{ mA to }200\text{ mA}$		25	120		25	240	mV
			10	60		10	120		
Temperature coefficient of output voltage	$I_O = 5\text{ mA}$	$-55^\circ\text{C to }150^\circ\text{C}$						-1	mV/°C
		$0^\circ\text{C to }125^\circ\text{C}$							
Output noise voltage	$f = 10\text{ Hz to }100\text{ kHz}$	$25^\circ\text{C}$		75			75		$\mu\text{V}$
		$25^\circ\text{C}$		2			2		
Dropout voltage		$25^\circ\text{C}$		4.8	6		4.8	6	mA
		$25^\circ\text{C}$			0.8				
Bias current	$V_I = 15\text{ V to }30\text{ V}$	$V_I = 15\text{ V to }30\text{ V}$							mA
		$V_I = 14.5\text{ V to }30\text{ V}$			0.5			0.5	
Short-circuit output current	$V_I = 35\text{ V}$	$25^\circ\text{C}$		240			240		mA
		$25^\circ\text{C}$		700			700		
Peak output current								A	

† All characteristics are measured with a capacitor across the input of  $0.33\ \mu\text{F}$  and a capacitor across the output of  $0.1\ \mu\text{F}$ . All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_W \leq 10\text{ ms}$ , duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M15M, $\mu$ A78M15C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M15M,  $\mu$ A78M15C electrical characteristics at specified virtual junction temperature,  
 $V_I = 23$  V,  $I_O = 350$  mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M15M			$\mu$ A78M15C			UNIT	
		MIN	TYP	MAX	MIN	TYP	MAX		
Output voltage	$I_O = 5$ mA to 350 mA $V_I = 18.5$ V to 30 V	25°C		14.4	15	15.6	14.4	15	V
		-55°C to 150°C		14.25		15.75			
Input regulation	$I_O = 200$ mA $V_I = 17.5$ V to 30 V	25°C					14.25	15.75	mV
		-55°C to 150°C							
Ripple rejection	$V_I = 18.5$ V to 28.5 V, $f = 120$ Hz	25°C		54			54		dB
		-55°C to 150°C							
Output regulation	$I_O = 5$ mA to 500 mA $I_O = 5$ mA to 200 mA	25°C		54	70		54	70	mV
		-55°C to 150°C			25	150		25	
Temperature coefficient of output voltage	$I_O = 5$ mA $f = 10$ Hz to 100 kHz	25°C							mV/°C
		-55°C to 150°C			-1			-1	
Dropout voltage		25°C			90			90	$\mu$ V
		-55°C to 150°C			2			2	
Bias current	$I_O = 5$ mA to 350 mA	25°C			4.8	6		4.8	mA
		-55°C to 150°C				0.8			
Bias current change	$I_O = 200$ mA $I_O = 5$ mA to 350 mA	25°C							mA
		-55°C to 150°C				0.5		0.8	
Short-circuit output current	$V_I = 35$ V	25°C			240			240	mA
		-55°C to 150°C							
Peak output current		25°C			700			700	A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_w \leq 10$  ms, duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M20M, $\mu$ A78M20C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M20M,  $\mu$ A78M20C electrical characteristics at specified virtual junction temperature,  
 $V_I = 29$  V,  $I_O = 350$  mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M20M			$\mu$ A78M20C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$I_O = 5$ mA to 350 mA	25°C		19	20	20.8	20.8	V
		-55°C to 150°C		19	20	20.8	21	
		0°C to 125°C		19	20	20.8	21	
Input regulation	$I_O = 200$ mA	25°C		5	5	5	5	mV
		-55°C to 150°C		53	53	53	53	
		0°C to 125°C		53	53	53	53	
Ripple rejection	$V_I = 24$ V to 34 V, $f = 120$ Hz	25°C		53	53	53	53	dB
		-55°C to 150°C		53	53	53	53	
Output regulation	$I_O = 5$ mA to 500 mA	25°C		30	30	30	30	mV
		-55°C to 150°C		10	10	10	10	
Temperature coefficient of output voltage	$I_O = 5$ mA	25°C		-1.1	-1.1	-1.1	-1.1	mV/°C
		-55°C to 150°C		-1.1	-1.1	-1.1	-1.1	
Output noise voltage	$f = 10$ Hz to 100 kHz	25°C		110	110	110	110	$\mu$ V
		-55°C to 150°C		110	110	110	110	
Dropout voltage		25°C		2	2	2	2	V
		-55°C to 150°C		4.9	4.9	4.9	4.9	
Bias current	$I_O = 200$ mA	25°C		6	6	6	6	mA
		-55°C to 150°C		0.8	0.8	0.8	0.8	
Bias current change	$I_O = 200$ mA	25°C		0.5	0.5	0.5	0.5	mA
		-55°C to 150°C		0.5	0.5	0.5	0.5	
Short-circuit output current	$V_I = 35$ V	25°C		240	240	240	240	mA
		-55°C to 150°C		700	700	700	700	
Peak output current		25°C		700	700	700	700	A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_w \leq 10$  ms, duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M22M, $\mu$ A78M22C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M22M,  $\mu$ A78M22C electrical characteristics at specified virtual junction temperature,  
 $V_I = 31$  V,  $I_O = 350$  mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS†		$\mu$ A78M22M			$\mu$ A78M22C			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$I_O = 5$ mA to 350 mA	25°C	21.1	22	22.9	21.1	22	22.9	V
		-55°C to 150°C							
		0°C to 125°C	20.9		23.1	20.9		23.1	
Input regulation	$I_O = 200$ mA	25°C		10	60		10	100	mV
		-55°C to 150°C							
		0°C to 125°C	51		30	51		50	
Ripple rejection	$V_I = 26$ V to 36 V, $f = 120$ Hz	-55°C to 150°C							dB
		0°C to 125°C	51			51			
		25°C	51	70		51	70		
Output regulation	$I_O = 5$ mA to 500 mA $I_O = 5$ mA to 200 mA	25°C		30	220		30	440	mV
		-55°C to 150°C							
		0°C to 125°C	-1.1		110	-1.1		220	
Temperature coefficient of output voltage	$I_O = 5$ mA	-55°C to 150°C							mV/°C
Output noise voltage	$f = 10$ Hz to 100 kHz	25°C		160			160		$\mu$ V
		-55°C to 150°C							
		0°C to 125°C							
Dropout voltage		25°C		2			2		V
		-55°C to 150°C							
		0°C to 125°C		4.9	6		4.9	6	
Bias current		25°C		4.9	6		4.9	6	mA
		-55°C to 150°C			0.8			0.8	
		0°C to 125°C							
Riak current change	$I_O = 200$ mA	25°C							mA
		-55°C to 150°C			0.5			0.5	
		0°C to 125°C							
Short-circuit output current	$I_O = 5$ mA to 350 mA	25°C		240			240		mA
		-55°C to 150°C							
		0°C to 125°C							
Peak output current	$V_I = 35$ V	25°C		700			700		A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_{pw} \leq 10$  ms, duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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# TYPES $\mu$ A78M24M, $\mu$ A78M24C POSITIVE-VOLTAGE REGULATORS

$\mu$ A78M24M,  $\mu$ A78M24C electrical characteristics at specified virtual junction temperature,  
 $V_I = 33$  V,  $I_O = 350$  mA (unless otherwise noted)

PARAMETER	TEST CONDITIONS†	$\mu$ A78M24M			$\mu$ A78M24C			UNIT
		MIN	TYP	MAX	MIN	TYP	MAX	
Output voltage	$V_I = 28$ V to 38 V $I_O = 5$ mA to 350 mA	23	24	25	23	24	25	V
	$V_I = 27$ V to 38 V $I_O = 200$ mA	22.8		25.2	22.8		25.2	
Input regulation	$V_I = 27$ V to 38 V		10	60		10	100	mV
	$V_I = 30$ V to 36 V		5	30		5	50	
	$V_I = 28$ V to 38 V							
	$V_I = 28$ V to 38 V, $f = 120$ Hz	50			50			
Ripple rejection	$V_I = 28$ V to 38 V, $f = 120$ Hz	50	70		50	70		dB
	$I_O = 100$ mA	50	30	240	50	30	480	
Output regulation	$I_O = 5$ mA to 500 mA		10	120		10	240	mV
	$I_O = 5$ mA to 200 mA							
Temperature coefficient of output voltage	$I_O = 5$ mA							mV/°C
Output noise voltage	$f = 10$ Hz to 100 kHz		170			170		$\mu$ V
			2			2		
Dropout voltage			5	6		5	6	mV
Bias current								mA
Bias current change	$V_I = 28$ V to 38 V			0.8				mA
	$V_I = 27$ V to 38 V						0.8	
Short-circuit output current								mA
	$V_I = 35$ V		240			240		
Peak output current			700			700		A

† All characteristics are measured with a capacitor across the input of 0.33  $\mu$ F and a capacitor across the output of 0.1  $\mu$ F. All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ( $t_w \leq 10$  ms, duty cycle  $\leq 5\%$ ). Output voltage changes due to changes in internal temperature must be taken into account separately.

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