



### THREE TERMINAL POSITIVE VOLTAGE REGULATORS 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V.

#### FEATURES

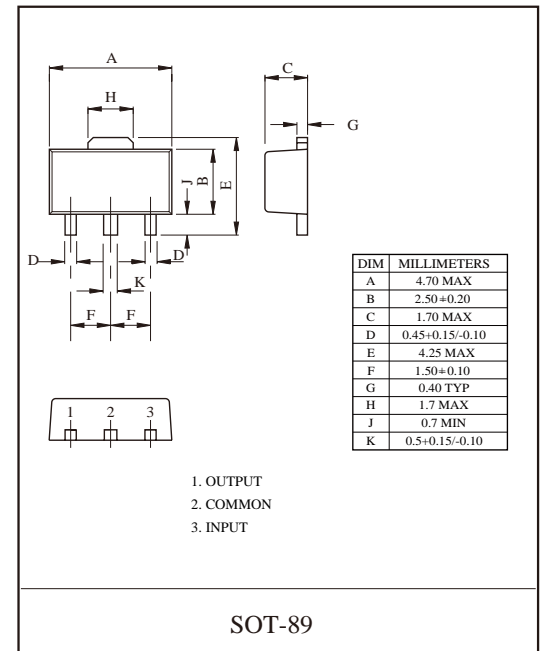
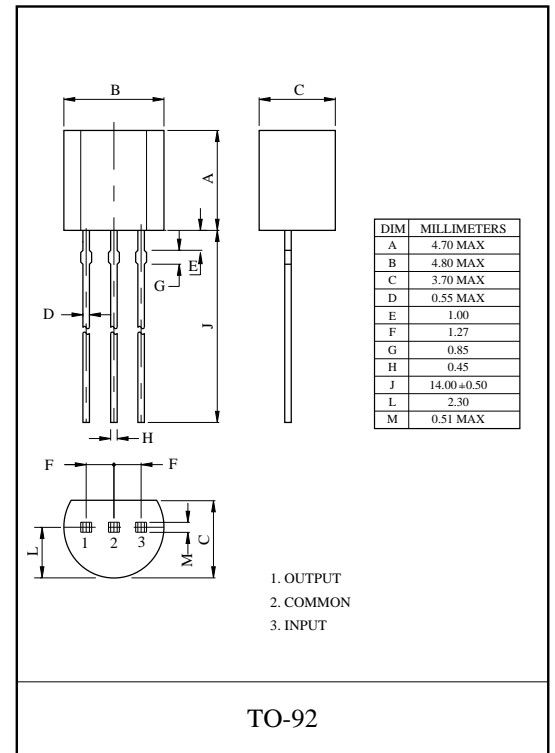
- Best Suited to Power Supply for TTL, C<sup>2</sup>-MOS.
- No External Part Needed.
- Built-in Thermal Protective Circuit.
- Max. Output Current 100mA (T<sub>j</sub>=25°C).

#### MAXIMUM RATINGS (Ta=25°C)

CHARACTERISTIC	SYMBOL	RATING	UNIT
Input Voltage	V <sub>IN</sub>	30	V
		35	
		40	
Power Dissipation	P <sub>D</sub>	500	mW
Operating Junction Temperature	T <sub>j</sub>	-40 ~ 150	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ 150	°C

#### MARK

MWXX (MW : Lot No , XX : Voltage)





# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L05/F

(Unless otherwise specified,  $V_{IN}=10V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	4.75	5.0	5.25	V	
			$7.0V \leq V_{IN} \leq 20V$ , $1.0mA \leq I_{OUT} \leq 40mA$	4.75	-	5.25	V	
			$1.0mA \leq I_{OUT} \leq 70mA$	4.75	-	5.25		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$7.0V \leq V_{IN} \leq 20V$	-	32	150	mV
				$8.0V \leq V_{IN} \leq 20V$	-	26	100	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	15	60	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	8	30	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	3.1	6.0	mA	
			$T_j=125^{\circ}C$	-	-	5.5		
Quiescent Current Change	$\Delta I_B$	1	$9.0V \leq V_{IN} \leq 20V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	42	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $8.0V \leq V_{IN} \leq 20V$ , $T_j=25^{\circ}C$	41	49	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L06/F

(Unless otherwise specified,  $V_{IN}=12V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	5.75	6.0	6.25	V	
			$8V \leq V_{IN} \leq 20V$ , $1.0mA \leq I_{OUT} \leq 40mA$	5.7	6.0	6.3		
			$1.0mA \leq I_{OUT} \leq 70mA$	5.7	6.0	6.3		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$8.1V \leq V_{IN} \leq 20V$	-	35	175	mV
				$9.0V \leq V_{IN} \leq 20V$	-	29	125	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	16	80	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	9	40	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	3.9	6.0	mA	
			$T_j=125^{\circ}C$	-	-	5.5		
Quiescent Current Change	$\Delta I_B$	1	$T_j=25^{\circ}C$	$9.0V \leq V_{IN} \leq 20V$	-	-	1.5	mA
				$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1	
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	46	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $9.0V \leq V_{IN} \leq 19V$ , $T_j=25^{\circ}C$	40	48	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L08/F

(Unless otherwise specified,  $V_{IN}=14V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	7.7	8.0	8.3	V	
			$10.5V \leq V_{IN} \leq 23V$ , $1.0mA \leq I_{OUT} \leq 40mA$	7.6	-	8.4		
			$1.0mA \leq I_{OUT} \leq 70mA$	7.6	-	8.4		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$10.5V \leq V_{IN} \leq 23V$	-	42	175	mV
				$11V \leq V_{IN} \leq 23V$	-	36	125	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	18	80	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	10	40	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4	6.0	mA	
			$T_j=125^{\circ}C$	-	-	5.5		
Quiescent Current Change	$\Delta I_B$	1	$11V \leq V_{IN} \leq 23V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	54	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $12V \leq V_{IN} \leq 23V$ , $T_j=25^{\circ}C$	37	46	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L09/F

(Unless otherwise specified,  $V_{IN}=14V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	8.6	9.0	9.4	V	
			$12V \leq V_{IN} \leq 24V$ , $1.0mA \leq I_{OUT} \leq 40mA$	8.55	-	9.45		
			$1.0mA \leq I_{OUT} \leq 70mA$	8.55	-	9.45		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$12V \leq V_{IN} \leq 24V$	-	45	175	mV
				$13V \leq V_{IN} \leq 24V$	-	40	125	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	19	90	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	11	45	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.1	6.0	mA	
			$T_j=125^{\circ}C$	-	-	5.5		
Quiescent Current Change	$\Delta I_B$	1	$13V \leq V_{IN} \leq 24V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	58	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $13V \leq V_{IN} \leq 24V$ , $T_j=25^{\circ}C$	38	45	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L10/F

(Unless otherwise specified,  $V_{IN}=16V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	9.6	10	10.4	V	
			$13V \leq V_{IN} \leq 25V$ , $1.0mA \leq I_{OUT} \leq 40mA$	9.5	-	10.5		
			$1.0mA \leq I_{OUT} \leq 70mA$	9.5	-	10.5		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$13V \leq V_{IN} \leq 25V$	-	51	175	mV
				$14V \leq V_{IN} \leq 25V$	-	42	125	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	20	90	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	11	40	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.2	6.0	mA	
			$T_j=125^{\circ}C$	-	-	5.5		
Quiescent Current Change	$\Delta I_B$	1	$T_j=25^{\circ}C$	$14V \leq V_{IN} \leq 25V$	-	-	1.5	mA
				$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1	
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	62	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $15V \leq V_{IN} \leq 24V$ , $T_j=25^{\circ}C$	37	44	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L12/F

(Unless otherwise specified,  $V_{IN}=17V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	11.5	12	12.5	V	
			$14.5V \leq V_{IN} \leq 27V$ , $1.0mA \leq I_{OUT} \leq 40mA$	11.4	-	12.6		
			$1.0mA \leq I_{OUT} \leq 70mA$	11.4	-	12.6		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$14.5V \leq V_{IN} \leq 27V$	-	55	250	mV
				$16V \leq V_{IN} \leq 27V$	-	49	200	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	22	100	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	13	50	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.3	6.5	mA	
			$T_j=125^{\circ}C$	-	-	6.0		
Quiescent Current Change	$\Delta I_B$	1	$16V \leq V_{IN} \leq 27V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	70	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $15V \leq V_{IN} \leq 25V$ , $T_j=25^{\circ}C$	37	42	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L15/F

(Unless otherwise specified,  $V_{IN}=19V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	14.4	15	15.6	V	
			$17.5V \leq V_{IN} \leq 30V$ , $1.0mA \leq I_{OUT} \leq 40mA$	14.25	-	15.75		
			$1.0mA \leq I_{OUT} \leq 70mA$	14.25	-	15.75		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$17.5V \leq V_{IN} \leq 30V$	-	65	300	mV
				$19V \leq V_{IN} \leq 30V$	-	58	250	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	25	150	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	12	75	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.2	6.5	mA	
			$T_j=125^{\circ}C$	-	-	6.0		
Quiescent Current Change	$\Delta I_B$	1	$19V \leq V_{IN} \leq 30V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	82	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $18.5V \leq V_{IN} \leq 28.5V$ , $T_j=25^{\circ}C$	34	40	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	





# FR78L05/F ~ FR78L24/F

## ELECTRICAL CHARACTERISTICS

FR78L18/F

(Unless otherwise specified,  $V_{IN}=23V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	17.3	18	18.7	V	
			$21.5V \leq V_{IN} \leq 33V$ , $1.0mA \leq I_{OUT} \leq 40mA$	17.1	-	18.9		
			$1.0mA \leq I_{OUT} \leq 70mA$	17.1	-	18.9		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$20.5V \leq V_{IN} \leq 33V$	-	70	360	mV
				$22V \leq V_{IN} \leq 33V$	-	64	300	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	27	180	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	19	90	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.7	6.5	mA	
			$T_j=125^{\circ}C$	-	-	6.0		
Quiescent Current Change	$\Delta I_B$	1		$22V \leq V_{IN} \leq 33V$	-	-	1.5	mA
				$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1	
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	150	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $21.5V \leq V_{IN} \leq 31.5V$ , $T_j=25^{\circ}C$	32	36	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	



# FR78L05/F ~ FR78L24/F

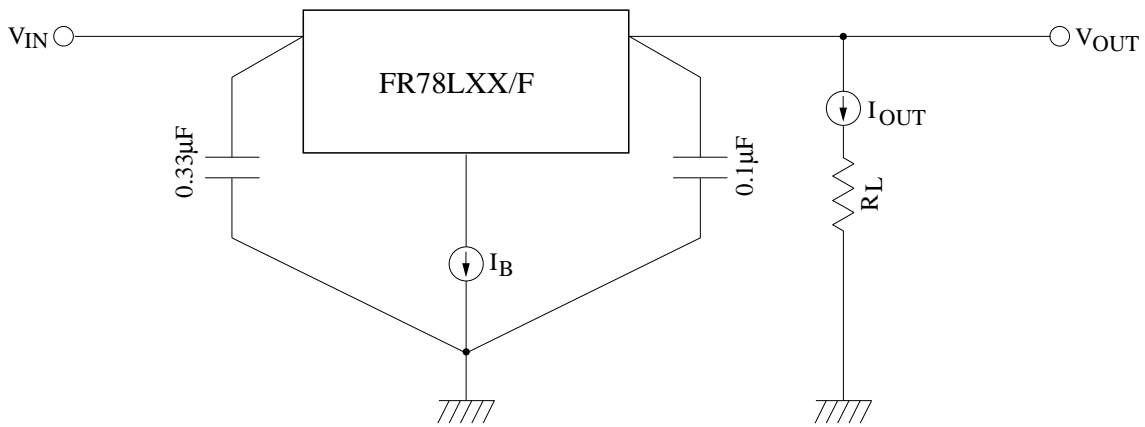
## ELECTRICAL CHARACTERISTICS

FR78L24/F

(Unless otherwise specified,  $V_{IN}=26V$ ,  $I_{OUT}=40mA$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ ,  $0^{\circ}C \leq T_j \leq 125^{\circ}C$ )

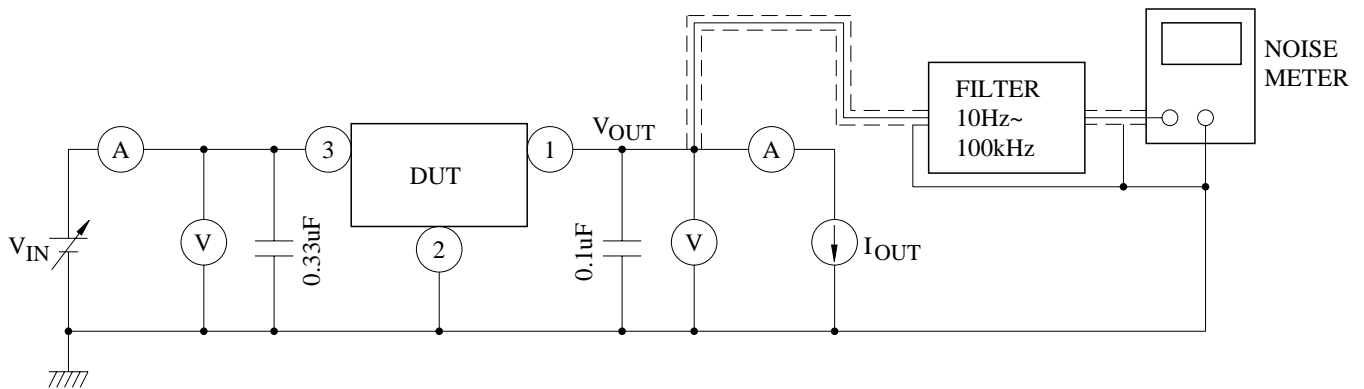
CHARACTERISTIC	SYMBOL	TEST CIRCUIT	TEST CONDITION	MIN.	TYP.	MAX.	UNIT	
Output Voltage	$V_{OUT}$	1	$T_j=25^{\circ}C$	23	24	25	V	
			$26.5V \leq V_{IN} \leq 39V$ , $1.0mA \leq I_{OUT} \leq 40mA$	22.8	-	25.2		
			$1.0mA \leq I_{OUT} \leq 70mA$	22.8	-	25.2		
Line Regulation	Reg line	1	$T_j=25^{\circ}C$	$27.5V \leq V_{IN} \leq 38V$	-	35	350	mV
				$28V \leq V_{IN} \leq 38V$	-	30	300	
Load Regulation	Reg load	1	$T_j=25^{\circ}C$	$1.0mA \leq I_{OUT} \leq 100mA$	-	40	200	mV
				$1.0mA \leq I_{OUT} \leq 40mA$	-	20	100	
Quiescent Current	$I_B$	1	$T_j=25^{\circ}C$	-	4.8	6.5	mA	
			$T_j=125^{\circ}C$	-	-	6.0		
Quiescent Current Change	$\Delta I_B$	1	$28V \leq V_{IN} \leq 39V$	-	-	1.5	mA	
			$1.0mA \leq I_{OUT} \leq 40mA$	-	-	0.1		
Output Noise Voltage	$V_{NO}$	1	$T_a=25^{\circ}C$ , $10Hz \leq f \leq 100kHz$	-	82	-	$\mu V_{rms}$	
Ripple Rejection Ratio	RR	2	$f=120Hz$ , $27.5V \leq V_{IN} \leq 37.5V$ , $T_j=25^{\circ}C$	30	33	-	dB	
Dropout Voltage	$V_D$	1	$T_j=25^{\circ}C$	-	1.7	-	V	

## TEST CIRCUIT / STANDARD APPLICATION CIRCUIT



## TEST CIRCUIT

1.  $V_{OUT}$  ,  $R_{eg} \cdot line$  ,  $R_{eg} \cdot load$  ,  $V_{OUT}$  ,  $I_B$  ,  $\Delta I_B$  ,  $V_{NO}$  ,  $\Delta V_{OUT} / \Delta t$  ,  $|V_{IN} - V_{OUT}|$  ,  $TC_{VO}$



## 2. RR

- $e_i = 1V_{p-p}$   
 $f = 120Hz$   
 $l \leq 30cm$

