



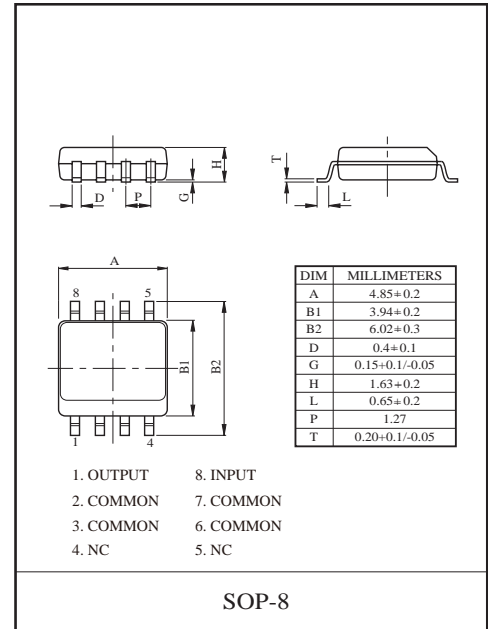
THREE TERMINAL POSITIVE VOLTAGE REGULATORS 5V, 6V, 8V, 9V, 10V, 12V, 15V, 18V, 24V.

FEATURES

- Best Suited to Power Supply for TTL, C²-MOS.
- No External Part Needed.
- Built-in Thermal Protective Circuit.
- Max. Output Current 100mA (T_j=25°C).

MAXIMUM RATINGS (T_a=25°C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|--------------------------------|------------------|-----------|------|
| Input Voltage | V _{IN} | 30 | V |
| | | 35 | |
| | | 40 | |
| Power Dissipation | P _D | 500 | mW |
| Operating Junction Temperature | T _j | -30 ~ 150 | °C |
| Storage Temperature | T _{stg} | -55 ~ 150 | °C |





FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L05SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L06SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L08SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L09SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L10SOP

(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 | ΔI_B | 1 | $14V \leq V_{IN} \leq 25V$ | - | - | 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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L12SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L15SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

ELECTRICAL CHARACTERISTICS

FR78L18SOP

(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 | ΔI_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 | - | μV_{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 | |



FR78L05SOP ~ FR78L24SOP

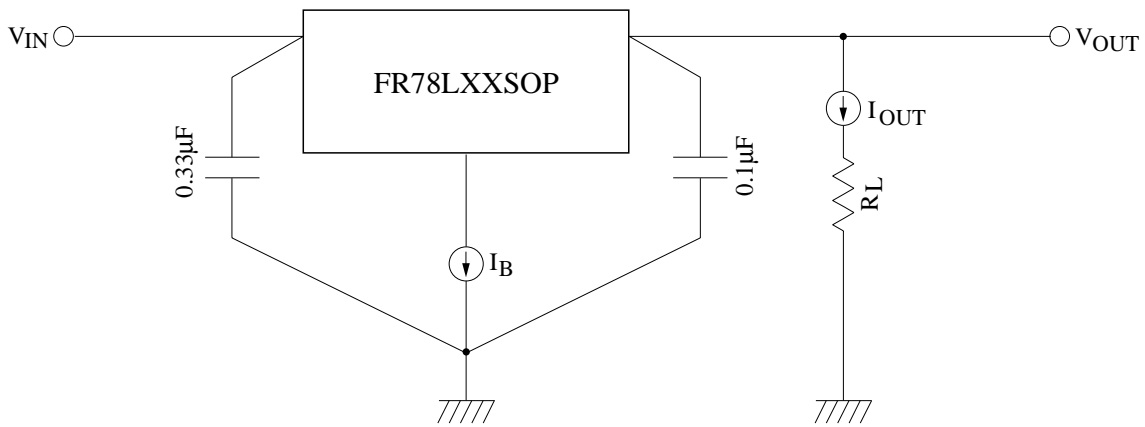
ELECTRICAL CHARACTERISTICS

FR78L24SOP

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

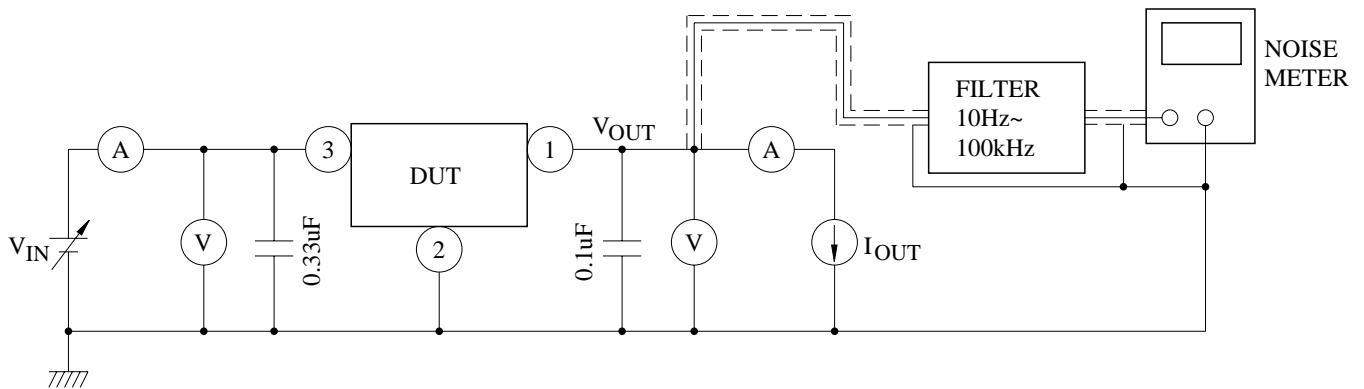
| CHARACTERISTIC | SYMBOL | TEST CIRCUIT | TEST CONDITION | MIN. | TYP. | MAX. | UNIT | |
|--------------------------|--------------|--------------|---|---------------------------------|------|------|---------------|----|
| Output Voltage | V_{OUT} | 1 | $T_j=25^{\circ}C$ | 23 | 24 | 25 | V | |
| | | | $26.5V \leq V_{IN} \leq 39V$, $1.0mA \leq I_{OUT} \leq 40mA$ | 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 | ΔI_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 | - | μV_{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 , ΔI_B , V_{NO} , $\Delta V_{OUT} / \Delta t$, $|V_{IN} - V_{OUT}|$, TC_{VO}



2. RR

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

