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April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (<http://www.renesas.com>)

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THREE TERMINAL POSITIVE VOLTAGE REGULATORS

DESCRIPTION

μPC78M00A series are monolithic three terminal positive regulators which employ internally current limiting, thermal shut down, output transistor safe operating area protection make them essentially indestructible.

They are improved for load regulation, as comparison of conventional μPC78M00 series.

FEATURES

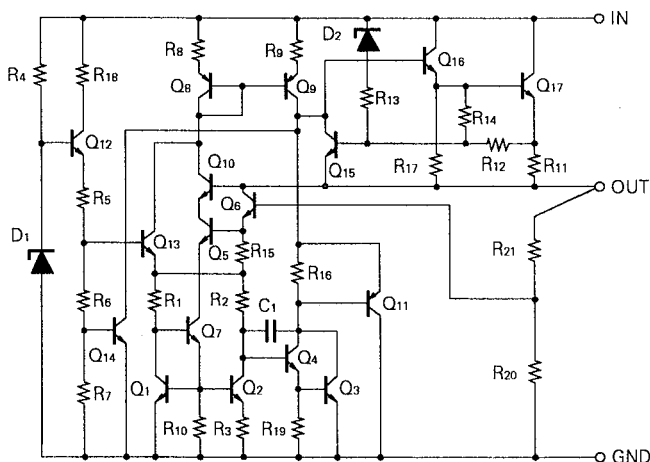
- Wide operation temperature range.
- Good regulation (line, load).
- Built-in some protection circuits.
 (over current protection, SOA protection and thermal shut down)

ORDER INFORMATION

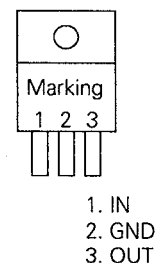
| TYPE NUMBER | OUTPUT VOLTAGE | PACKAGE | QUALITY GRADE |
|-------------|----------------|--------------------------|---------------|
| μPC78M05AHF | 5 V | MP-45G (ISOLATED TO-220) | Standard |
| μPC78M06AHF | 6 V | | |
| μPC78M07AHF | 7 V | | |
| μPC78M08AHF | 8 V | | |
| μPC78M09AHF | 9 V | | |
| μPC78M10AHF | 10 V | | |
| μPC78M12AHF | 12 V | | |
| μPC78M15AHF | 15 V | | |
| μPC78M18AHF | 18 V | | |
| μPC78M24AHF | 24 V | | |

Please refer to "Quality grade on NEC Semiconductor Devices" (Document number IEI-1209) published by NEC Corporation to know the specification of quality grade on the devices and its recommended applications.

EQUIVALENT CIRCUIT



CONNECTION DIAGRAM



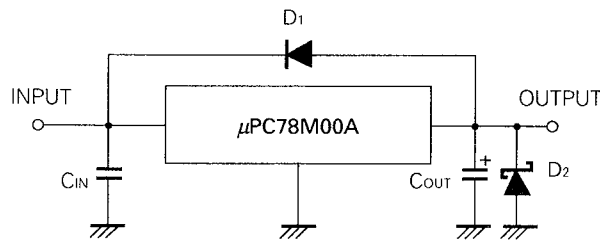
ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

| CHARACTERISTIC | SYMBOL | RATING | UNIT |
|--|----------------------|---------------|------|
| Input Voltage | V _{IN} | 35/40 (Note1) | V |
| Internal Power Dissipation | P _T | 15 (Note2) | W |
| Operating Ambient Temperature Range | T _{opt} | - 30 to + 85 | °C |
| Operating Junction Temperature Range | T _{opt(j)} | - 30 to + 150 | °C |
| Storage Temperature Range | T _{stg} | - 55 to + 150 | °C |
| Thermal Resistance (junction to case) | R _{th(j-c)} | 7 | °C/W |
| Thermal Resistance (junction to ambient) | R _{th(j-a)} | 65 | °C/W |

(Note1) μPC78M05A, 06, 07, 08, 09, 10, 12, 15, 18 : 35 V, μPC78M24A : 40 V

(Note2) Internally limited

TYPICAL CONNECTION



C₁: Required if regulator is located an appreciable distance from power supply filter.

C₂: More than 0.1 μF

D₁: Needed for V_{IN} < V_o

D₂: Needed for V_o < GND

RECOMMENDED OPERATING CONDITIONS

| CHARACTERISTIC | SYMBOL | | MIN. | TYP. | MAX. | UNIT |
|--------------------------------------|---------------------|-------------|------|------|-------|------|
| Input Voltage | V _{IN} | μPC78M05AHF | 7 | 10 | 25 | V |
| | | μPC78M06AHF | 8.5 | 11 | 25 | |
| | | μPC78M07AHF | 9.5 | 12 | 25 | |
| | | μPC78M08AHF | 10.5 | 14 | 25 | |
| | | μPC78M09AHF | 11.5 | 15 | 25 | |
| | | μPC78M10AHF | 12.5 | 17 | 28 | |
| | | μPC78M12AHF | 14.5 | 19 | 30 | |
| | | μPC78M15AHF | 17.5 | 23 | 30 | |
| | | μPC78M18AHF | 21 | 27 | 30 | |
| | | μPC78M24AHF | 27 | 33 | 38 | |
| Output Current | I _o | All | 5 | | 350 | mA |
| Operating Junction Temperature Range | T _{opt(j)} | All | - 30 | | + 125 | °C |

ELECTRICAL CHARACTERISTICS μPC78M05A

($V_{IN} = 10\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|-----------------------|---|------|------|------|----------------------|
| Output Voltage | V_o | $T_j = 25\text{ °C}$ | 4.8 | 5.0 | 5.2 | V |
| | | $7\text{ V} \leq V_{IN} \leq 20\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 4.75 | | 5.25 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 4.75 | | 5.25 | |
| Line Regulation | REG _{IN} | $T_j = 25\text{ °C}$, $7\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | 3 | 20 | mV |
| | | $T_j = 25\text{ °C}$, $8\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | 1 | 15 | |
| Load Regulation | REG _L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 3 | 20 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 1 | 10 | |
| Quiescent Current | I _{BIAS} | $T_j = 25\text{ °C}$ | | 4 | 6.0 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $8\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 40 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $8\text{ V} \leq V_{IN} \leq 18\text{ V}$, $I_o = 300\text{ mA}$ | 68 | 84 | | dB |
| Dropout Voltage | V _{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I _o short | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I _o peak | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_o/\Delta T$ | $I_o = 5\text{ mA}$ | | -0.8 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M06A

($V_{IN} = 11\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|-----------------------|---|------|------|------|----------------------|
| Output Voltage | V_o | $T_j = 25\text{ °C}$ | 5.76 | 6.0 | 6.24 | V |
| | | $8.5\text{ V} \leq V_{IN} \leq 21\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 5.7 | | 6.3 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 5.7 | | 6.3 | |
| Line Regulation | REG _{IN} | $T_j = 25\text{ °C}$, $8.5\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | 4 | 20 | mV |
| | | $T_j = 25\text{ °C}$, $9\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | 1.2 | 15 | |
| Load Regulation | REG _L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 4.8 | 25 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 2.4 | 15 | |
| Quiescent Current | I _{BIAS} | $T_j = 25\text{ °C}$ | | 4 | 6.0 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $9\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 200\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 45 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $9\text{ V} \leq V_{IN} \leq 19\text{ V}$, $I_o = 300\text{ mA}$ | 67 | 83 | | dB |
| Dropout Voltage | V _{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I _o short | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I _o peak | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_o/\Delta T$ | $I_o = 5\text{ mA}$ | | -1.0 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M07A

($V_{IN} = 12\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|---|------|-------|------|----------------------|
| Output Voltage | V _o | T _j = 25 °C | 6.72 | 7.0 | 7.28 | V |
| | | 9.5 V ≤ V _{IN} ≤ 22 V, 5 mA ≤ I _o ≤ 350 mA | 6.65 | | 7.35 | |
| | | - 30 °C ≤ T _j ≤ + 125 °C | 6.65 | | 7.35 | |
| Line Regulation | REG _{IN} | T _j = 25 °C, 9.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 5 | 25 | mV |
| | | T _j = 25 °C, 10 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 1.5 | 20 | |
| Load Regulation | REG _L | T _j = 25 °C, 5 mA ≤ I _o ≤ 500 mA | | 5.6 | 30 | mV |
| | | T _j = 25 °C, 5 mA ≤ I _o ≤ 200 mA | | 2.8 | 15 | |
| Quiescent Current | I _{BIAS} | T _j = 25 °C | | 4 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | 9.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | | 0.8 | mA |
| | | 5 mA ≤ I _o ≤ 350 mA | | | 0.5 | |
| Output Noize Voltage | V _n | T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 50 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | T _j = 25 °C, f = 120 Hz, 10 V ≤ V _{IN} ≤ 20 V, I _o = 300 mA | 66 | 82 | | dB |
| Dropout Voltage | V _{DIF} | T _j = 25 °C | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | T _j = 25 °C, V _{IN} = 35 V | | 430 | | mA |
| Peak Output Current | I _{Opeak} | T _j = 25 °C | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | I _o = 5 mA | | - 1.1 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M08A

($V_{IN} = 14\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|---|------|-------|------|----------------------|
| Output Voltage | V _o | T _j = 25 °C | 7.7 | 8.0 | 8.3 | V |
| | | 10.5 V ≤ V _{IN} ≤ 23 V, 5 mA ≤ I _o ≤ 350 mA | 7.6 | | 8.4 | |
| | | - 30 °C ≤ T _j ≤ + 125 °C | 7.6 | | 8.4 | |
| Line Regulation | REG _{IN} | T _j = 25 °C, 10.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 6 | 30 | mV |
| | | T _j = 25 °C, 11 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 2 | 25 | |
| Load Regulation | REG _L | T _j = 25 °C, 5 mA ≤ I _o ≤ 500 mA | | 6.4 | 35 | mV |
| | | T _j = 25 °C, 5 mA ≤ I _o ≤ 200 mA | | 3.2 | 20 | |
| Quiescent Current | I _{BIAS} | T _j = 25 °C | | 4.2 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | 10.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | | 0.8 | mA |
| | | 5 mA ≤ I _o ≤ 350 mA | | | 0.5 | |
| Output Noize Voltage | V _n | T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 55 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | T _j = 25 °C, f = 120 Hz, 11.5 V ≤ V _{IN} ≤ 21.5 V, I _o = 300 mA | 66 | 81 | | dB |
| Dropout Voltage | V _{DIF} | T _j = 25 °C | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | T _j = 25 °C, V _{IN} = 35 V | | 430 | | mA |
| Peak Output Current | I _{Opeak} | T _j = 25 °C | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | I _o = 5 mA | | - 1.3 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M09A
 (V_{IN} = 15 V, I_o = 350 mA, 0 °C ≤ T_j ≤ + 125 °C)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|---|------|-------|------|----------------------|
| Output Voltage | V _o | T _j = 25 °C | 8.64 | 9.0 | 9.36 | V |
| | | 11.5 V ≤ V _{IN} ≤ 24 V, 5 mA ≤ I _o ≤ 350 mA | 8.55 | | 9.45 | |
| | | - 30 °C ≤ T _j ≤ + 125 °C | 8.55 | | 9.45 | |
| Line Regulation | REG _{IN} | T _j = 25 °C, 11.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 6.5 | 35 | mV |
| | | T _j = 25 °C, 12 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | 2 | 30 | |
| Load Regulation | REG _L | T _j = 25 °C, 5 mA ≤ I _o ≤ 500 mA | | 7.2 | 40 | mV |
| | | T _j = 25 °C, 5 mA ≤ I _o ≤ 200 mA | | 3.6 | 20 | |
| Quiescent Current | I _{BIAS} | T _j = 25 °C | | 4.2 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | 11.5 V ≤ V _{IN} ≤ 25 V, I _o = 200 mA | | | 0.8 | mA |
| | | 5 mA ≤ I _o ≤ 350 mA | | | 0.5 | |
| Output Noise Voltage | V _n | T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 60 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | T _j = 25 °C, f = 120 Hz, 12 V ≤ V _{IN} ≤ 22 V, I _o = 300 mA | 65 | 80 | | dB |
| Dropout Voltage | V _{DIF} | T _j = 25 °C | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | T _j = 25 °C, V _{IN} = 35 V | | 430 | | mA |
| Peak Output Current | I _{Opeak} | T _j = 25 °C | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | I _o = 5 mA | | - 1.4 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M10A
 (V_{IN} = 17 V, I_o = 350 mA, 0 °C ≤ T_j ≤ + 125 °C)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|---|------|-------|------|----------------------|
| Output Voltage | V _o | T _j = 25 °C | 9.6 | 10.0 | 10.4 | V |
| | | 12.5 V ≤ V _{IN} ≤ 25 V, 5 mA ≤ I _o ≤ 350 mA | 9.5 | | 10.5 | |
| | | - 30 °C ≤ T _j ≤ + 125 °C | 9.5 | | 10.5 | |
| Line Regulation | REG _{IN} | T _j = 25 °C, 12.5 V ≤ V _{IN} ≤ 28 V, I _o = 200 mA | | 7 | 35 | mV |
| | | T _j = 25 °C, 14 V ≤ V _{IN} ≤ 28 V, I _o = 200 mA | | 2 | 30 | |
| Load Regulation | REG _L | T _j = 25 °C, 5 mA ≤ I _o ≤ 500 mA | | 8 | 40 | mV |
| | | T _j = 25 °C, 5 mA ≤ I _o ≤ 200 mA | | 4 | 20 | |
| Quiescent Current | I _{BIAS} | T _j = 25 °C | | 4.3 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | 12.5 V ≤ V _{IN} ≤ 28 V | | | 0.8 | mA |
| | | 5 mA ≤ I _o ≤ 350 mA | | | 0.5 | |
| Output Noise Voltage | V _n | T _j = 25 °C, 10 Hz ≤ f ≤ 100 kHz | | 65 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | T _j = 25 °C, f = 120 Hz, 13 V ≤ V _{IN} ≤ 23 V, I _o = 300 mA | 64 | 79 | | dB |
| Dropout Voltage | V _{DIF} | T _j = 25 °C | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | T _j = 25 °C, V _{IN} = 35 V | | 430 | | mA |
| Peak Output Current | I _{Opeak} | T _j = 25 °C | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | I _o = 5 mA | | - 1.6 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M12A

($V_{IN} = 19\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|-------------------------|--|------|------|------|----------------------|
| Output Voltage | V_o | $T_j = 25\text{ °C}$ | 11.5 | 12.0 | 12.5 | V |
| | | $14.5\text{ V} \leq V_{IN} \leq 27\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 11.4 | | 12.6 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 11.4 | | 12.6 | |
| Line Regulation | REG_{IN} | $T_j = 25\text{ °C}$, $14.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | 8 | 40 | mV |
| | | $T_j = 25\text{ °C}$, $16\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | 2 | 30 | |
| Load Regulation | REG_L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 9.6 | 50 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 4.8 | 25 | |
| Quiescent Current | I_{BIAS} | $T_j = 25\text{ °C}$ | | 4.3 | 6.0 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $14.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 70 | | μV _{r.m.s.} |
| Ripple Rejection | $R \cdot R$ | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $15\text{ V} \leq V_{IN} \leq 25\text{ V}$, $I_o = 300\text{ mA}$ | 62 | 78 | | dB |
| Dropout Voltage | V_{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I_{Oshort} | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I_{Opeak} | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_o / \Delta T$ | $I_o = 5\text{ mA}$ | | -1.9 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M15A

($V_{IN} = 23\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|-------------------------|--|-------|------|-------|----------------------|
| Output Voltage | V_o | $T_j = 25\text{ °C}$ | 14.4 | | 15.6 | V |
| | | $17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 14.25 | | 15.75 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 14.25 | | 15.75 | |
| Line Regulation | REG_{IN} | $T_j = 25\text{ °C}$, $17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | 10 | 50 | mV |
| | | $T_j = 25\text{ °C}$, $20\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | 3 | 40 | |
| Load Regulation | REG_L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 12 | 60 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 6 | 30 | |
| Quiescent Current | I_{BIAS} | $T_j = 25\text{ °C}$ | | 4.4 | 6.0 | mA |
| Quiescent Current Change | ΔI_{BIAS} | $17.5\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 300\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V_n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 85 | | μV _{r.m.s.} |
| Ripple Rejection | $R \cdot R$ | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $18.5\text{ V} \leq V_{IN} \leq 28.5\text{ V}$, $I_o = 300\text{ mA}$ | 60 | 75 | | dB |
| Dropout Voltage | V_{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I_{Oshort} | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I_{Opeak} | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | $\Delta V_o / \Delta T$ | $I_o = 5\text{ mA}$ | | -2.4 | | mV/°C |

ELECTRICAL CHARACTERISTICS μPC78M18A

($V_{IN} = 27\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

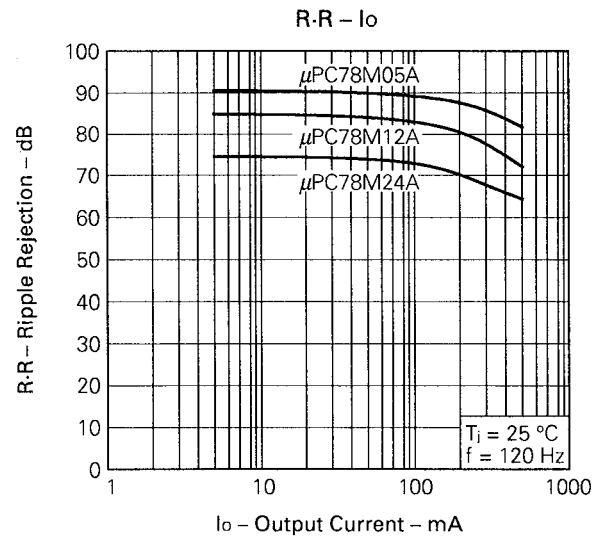
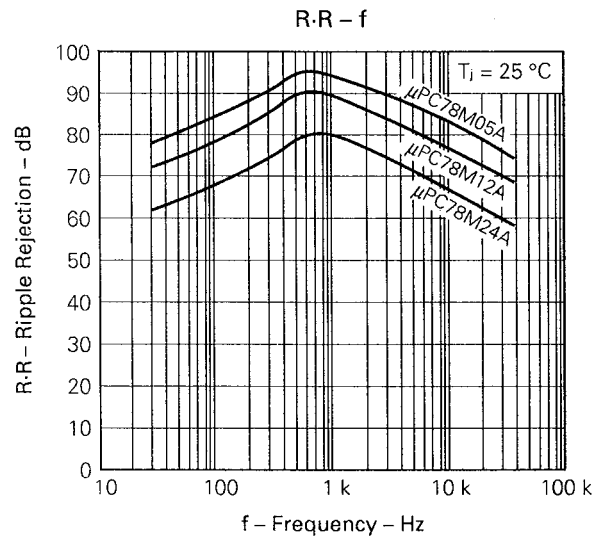
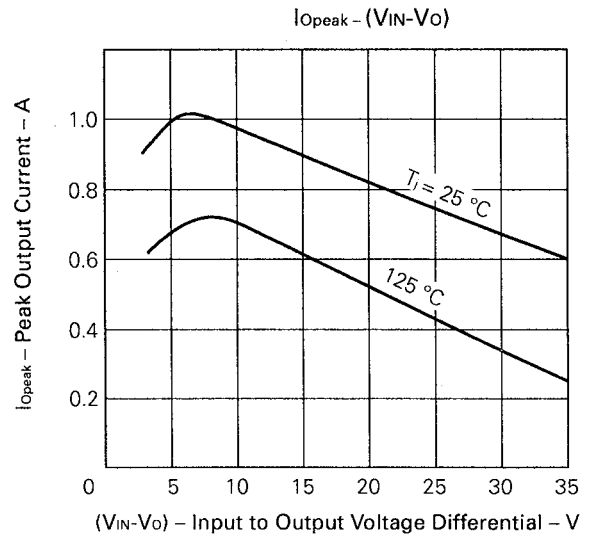
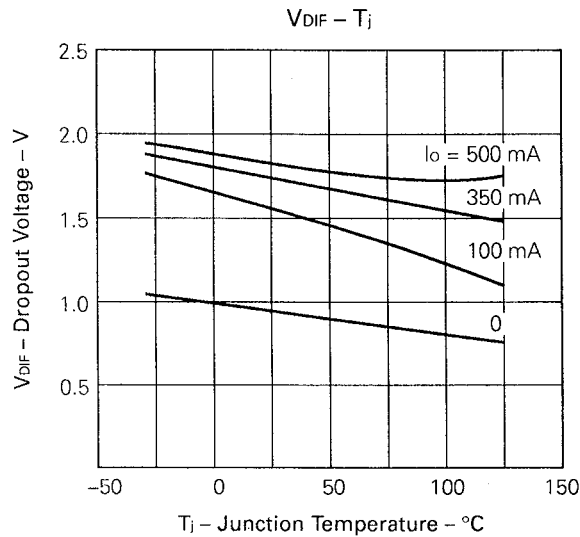
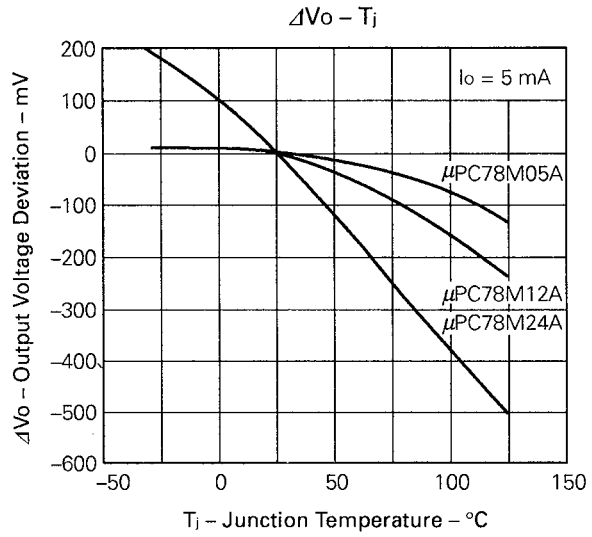
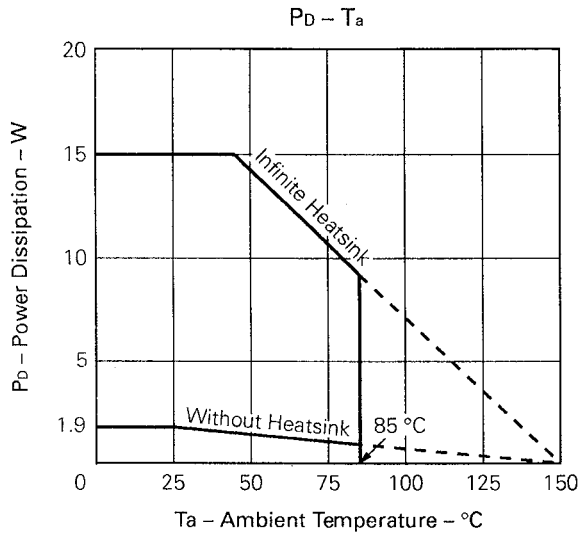
| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|--|------|------|------|----------------------|
| Output Voltage | Vo | $T_j = 25\text{ °C}$ | 17.3 | 18.0 | 18.7 | V |
| | | $21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 17.1 | | 18.9 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 17.1 | | 18.9 | |
| Line Regulation | REG _{IN} | $T_j = 25\text{ °C}$, $21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $I_o = 200\text{ mA}$ | | 10 | 50 | mV |
| | | $T_j = 25\text{ °C}$, $24\text{ V} \leq V_{IN} \leq 30\text{ V}$, $I_o = 200\text{ mA}$ | | 4 | 40 | |
| Load Regulation | REG _L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 14.4 | 75 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 7.2 | 40 | |
| Quiescent Current | I _{BIAS} | $T_j = 25\text{ °C}$ | | 4.6 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | $21\text{ V} \leq V_{IN} \leq 33\text{ V}$, $I_o = 200\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V _n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 100 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $22\text{ V} \leq V_{IN} \leq 32\text{ V}$, $I_o = 300\text{ mA}$ | 57 | 73 | | dB |
| Dropout Voltage | V _{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I _{Opeak} | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | $I_o = 5\text{ mA}$ | | -2.9 | | mV/°C |

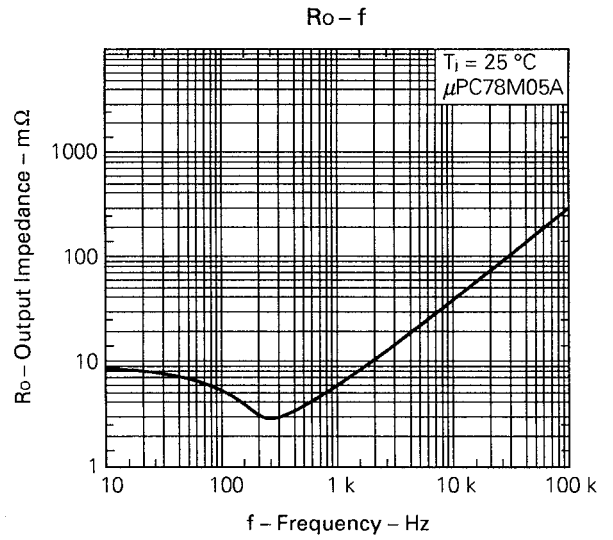
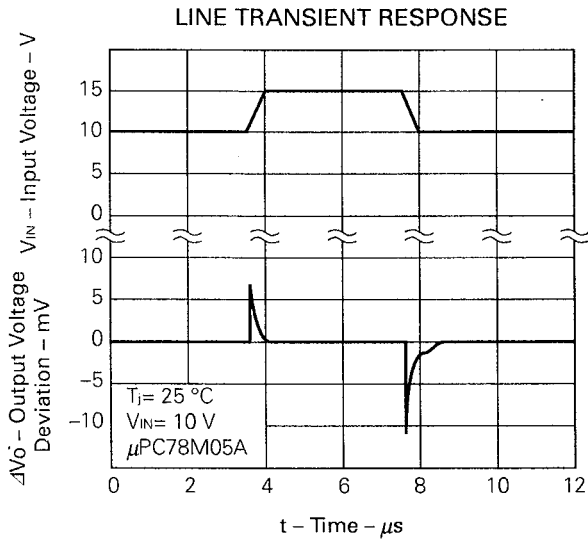
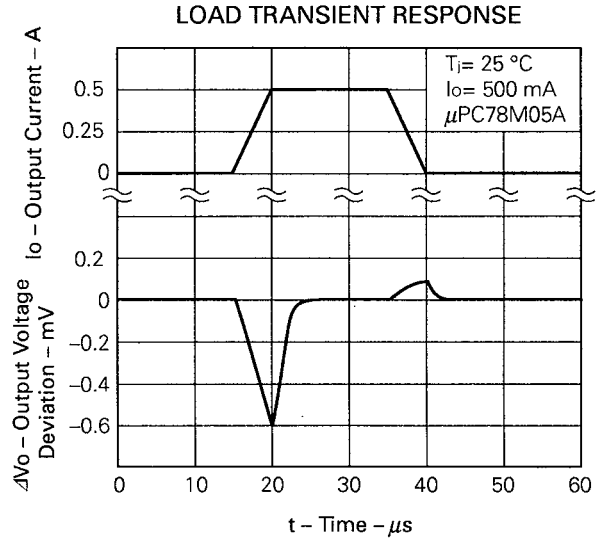
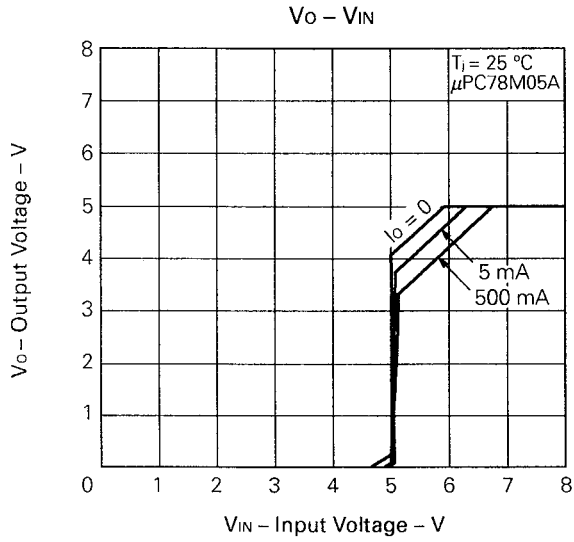
ELECTRICAL CHARACTERISTICS μPC78M24A

($V_{IN} = 33\text{ V}$, $I_o = 350\text{ mA}$, $0\text{ °C} \leq T_j \leq +125\text{ °C}$)

| CHARACTERISTIC | SYMBOL | TEST CONDITIONS | MIN. | TYP. | MAX. | UNIT |
|---|---------------------|--|------|------|------|----------------------|
| Output Voltage | Vo | $T_j = 25\text{ °C}$ | 23.0 | 24.0 | 25.0 | V |
| | | $27\text{ V} \leq V_{IN} \leq 38\text{ V}$, $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | 22.8 | | 25.2 | |
| | | $-30\text{ °C} \leq T_j \leq +125\text{ °C}$ | 22.8 | | 25.2 | |
| Line Regulation | REG _{IN} | $T_j = 25\text{ °C}$, $27\text{ V} \leq V_{IN} \leq 38\text{ V}$, $I_o = 200\text{ mA}$ | | 10 | 50 | mV |
| | | $T_j = 25\text{ °C}$, $28\text{ V} \leq V_{IN} \leq 38\text{ V}$, $I_o = 200\text{ mA}$ | | 5 | 40 | |
| Load Regulation | REG _L | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 500\text{ mA}$ | | 19.2 | 100 | mV |
| | | $T_j = 25\text{ °C}$, $5\text{ mA} \leq I_o \leq 200\text{ mA}$ | | 9.6 | 50 | |
| Quiescent Current | I _{BIAS} | $T_j = 25\text{ °C}$ | | 4.8 | 6.0 | mA |
| Quiescent Current Change | ΔI _{BIAS} | $27\text{ V} \leq V_{IN} \leq 38\text{ V}$, $I_o = 200\text{ mA}$ | | | 0.8 | mA |
| | | $5\text{ mA} \leq I_o \leq 350\text{ mA}$ | | | 0.5 | |
| Output Noise Voltage | V _n | $T_j = 25\text{ °C}$, $10\text{ Hz} \leq f \leq 100\text{ kHz}$ | | 120 | | μV _{r.m.s.} |
| Ripple Rejection | R•R | $T_j = 25\text{ °C}$, $f = 120\text{ Hz}$, $28\text{ V} \leq V_{IN} \leq 38\text{ V}$, $I_o = 300\text{ mA}$ | 52 | 68 | | dB |
| Dropout Voltage | V _{DIF} | $T_j = 25\text{ °C}$ | | 2.0 | | V |
| Short Circuit Current | I _{Oshort} | $T_j = 25\text{ °C}$, $V_{IN} = 35\text{ V}$ | | 430 | | mA |
| Peak Output Current | I _{Opeak} | $T_j = 25\text{ °C}$ | | 1.0 | | A |
| Temperature Coefficient of Output Voltage | ΔV _o /ΔT | $I_o = 5\text{ mA}$ | | -3.8 | | mV/°C |

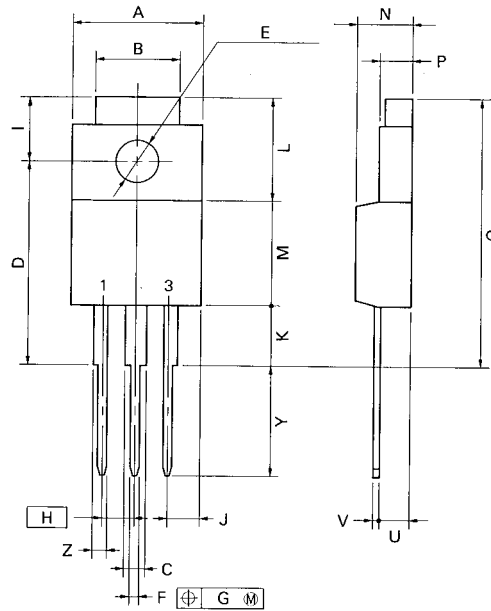
TYPICAL CHARACTERISTICS (T_a = 25 °C)





PACKAGE DIMENSIONS

3PIN PLASTIC SIP (MP-45G)



P3HF-254B-1

NOTE

Each lead centerline is located within 0.25 mm (0.01 inch) of its true position (T.P.) at maximum material condition.

| ITEM | MILLIMETERS | INCHES |
|------|-----------------------|---|
| A | 10.4 MAX. | 0.410 MAX. |
| B | 7.0 | 0.276 |
| C | 1.2 MIN. | 0.047 MIN. |
| D | 17.0 ^{±0.3} | 0.669 ^{+0.013} _{-0.012} |
| E | φ3.3 ^{±0.2} | φ0.130 ^{±0.008} |
| F | 0.75 ^{±0.10} | 0.030 ^{+0.004} _{-0.005} |
| G | 0.25 | 0.010 |
| H | 2.54 (T.P.) | 0.100 (T.P.) |
| I | 5.0 ^{±0.3} | 0.197 ^{±0.012} |
| J | 2.66 MAX. | 0.105 MAX. |
| K | 4.8 MIN. | 0.188 MIN. |
| L | 8.5 | 0.335 |
| M | 8.5 | 0.335 |
| N | 4.5 ^{±0.2} | 0.177 ^{±0.008} |
| P | 2.8 ^{±0.2} | 0.110 ^{+0.009} _{-0.008} |
| Q | 22.4 MAX. | 0.882 MAX. |
| U | 2.4 ^{±0.5} | 0.094 ^{+0.021} _{-0.020} |
| V | 0.65 ^{±0.10} | 0.026 ^{+0.004} _{-0.005} |
| Y | 8.9 ^{±0.7} | 0.350 ^{±0.028} |
| Z | 1.0 MIN. | 0.039 MIN. |

RECOMMENDED SOLDERING CONDITIONS

The following conditions (see table below) must be met when soldering this product.
 Please consult with our sales offices in case other soldering process is used, or in case soldering is done under different conditions.

TYPES OF THROUGH HOLE MOUNT DEVICE

μPC78M00AHF Series

| Soldering process | Soldering conditions | Symbol |
|-------------------|---|--------|
| Wave soldering | Solder temperature : 260 °C or below. Flow time : 10 seconds or below. | |

[MEMO]

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Application examples recommended by NEC Corporation.

Standard: Computer, Office equipment, Communication equipment, Test and Measurement equipment, Machine tools, Industrial robots, Audio and Visual equipment, Other consumer products, etc.

Special: Automotive and Transportation equipment, Traffic control systems, Antidisaster systems, Anticrime systems, etc.