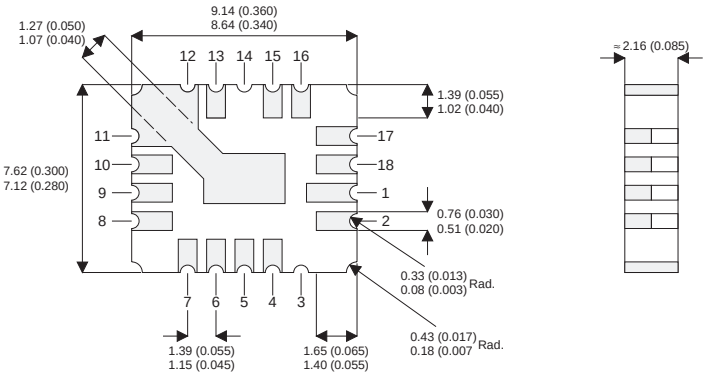
# IP78M00A-LCC4 SERIES
# IP78M00-LCC4 SERIES

## 0.5 AMP POSITIVE VOLTAGE REGULATOR IN A CERAMIC SURFACE MOUNT PACKAGE




Pins 4,5 – $V_{IN}$
6,7,8,9,10,11,12,13 – $V_{OUT}$
Pins 15,16,17,18,1,2 – GND

### FEATURES

- **OUTPUT CURRENT UP TO 0.5A**
- **OUTPUT VOLTAGES OF 5, 12, 15V**
- **0.01% / V LINE REGULATION**
- **0.3% / A LOAD REGULATION**
- **THERMAL OVERLOAD PROTECTION**
- **SHORT CIRCUIT PROTECTION**
- **OUTPUT TRANSISTOR SOA PROTECTION**
- **1% VOLTAGE TOLERANCE (–A VERSIONS)**

### DESCRIPTION

The IP78M00A series of voltage regulators are fixed output regulators intended for local, on-card voltage regulation. These devices are available in 5, 12, and 15 volt options and are capable of delivering in excess of 500mA over temperature.

The A-suffix devices are fully specified at 0.5A, provide 0.01% / V line regulation, 0.3% / A load regulation, and ±1% output voltage tolerance at room temperature. Protection features include safe operating area, current limiting and thermal shutdown.

### ABSOLUTE MAXIMUM RATINGS ($T_C$ = 25°C unless otherwise stated)

| | | | |
|---|---|---|---|
| $V_I$ | DC Input Voltage | (for $V_O$ = 5, 12, 15V) | 35V |
| $I_O$ | Output Current | | Internally limited |
| $P_D$ | Power Dissipation | | Internally limited |
| $T_J$ | Operating Junction Temperature Range | | –55 to 150°C |
| $T_{stg}$ | Storage Temperature | | –65 to 150°C |

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## ELECTRICAL CHARACTERISTICS

| Parameter | | Test Conditions | | IP78M05A-LCC4 Min. | IP78M05A-LCC4 Typ. | IP78M05A-LCC4 Max. | IP78M05-LCC4 Min. | IP78M05-LCC4 Typ. | IP78M05-LCC4 Max. | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $I_O$ = 100mA | $V_{IN}$ = 10V | 4.95 | 5 | 5.05 | 4.8 | 5 | 5.2 | V |
| | | $I_O$ = 5mA to 350mA<br>$P_D \leq P_{MAX}$<br>$V_{IN}$ = 7.5V to 20V | $T_J$ = -55 to 150°C | 4.85 | | 5.15 | 4.75 | | 5.25 | |
| $\Delta V_O$ | Line Regulation | $I_O$ = 200mA | $V_{IN}$ = 7V to 25V | | 3 | 10 | | | 50 | mV |
| | | | $V_{IN}$ = 8V to 25V<br>$T_J$ = -55 to 150°C | | 3 | 10 | | | 25 | |
| | | $I_O$ = 500mA | $V_{IN}$ = 8V to 12V | | 3 | 10 | | | 50 | |
| $\Delta V_O$ | Load Regulation | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 10V | $T_J$ = -55 to 150°C | | 5 | 50 | | | 50 | mV |
| $I_Q$ | Quiescent Current | $V_{IN}$ = 10V | $I_O$ = 350mA<br>$T_J$ = -55 to 150°C | | 4 | 6 | | 4 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 10V | $T_J$ = -55 to 150°C | | 0.1 | 0.5 | | | 0.5 | mA |
| | | $I_O$ = 200mA | $V_{IN}$ = 8V to 25V<br>$T_J$ = -55 to 150°C | | 0.2 | 0.8 | | | 0.8 | |
| $V_N$ | Output Noise Voltage | f = 10Hz to 100kHz | | | 40 | 200 | | 40 | 200 | µV |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ | Ripple Rejection | f = 120Hz<br>$V_{IN}$ = 8V to 18V | $I_O$ = 300mA | 65 | 80 | | 62 | | | dB |
| | | | $I_O$ = 100mA<br>$T_J$ = -55 to 150°C | 65 | 80 | | 62 | | | |
| | Dropout Voltage | $I_O$ = 350mA | | | 2 | 2.5 | | | 2.5 | V |
| $I_{sc}$ | Short Circuit Current | $V_{IN}$ = 35V | | | 300 | 600 | | 300 | 600 | mA |
| $I_{pk}$ | Peak Output Current | $V_{IN}$ = 10V | | 0.7 | 1.0 | 1.4 | 0.7 | 1.0 | 1.6 | A |
| Average Temperature Coefficient of $V_O$ | | $I_O$ = 5mA | | | 0.5 | 2.0 | | 0.5 | | mV/°C |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | | | | | 13 | | | 13 | °C/W |

1) All characteristics are measured with a capacitor across the input of 0.22µF and a capacitor across the output of 0.1µF.

All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_p \leq 10ms$, $\delta \leq 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

## ELECTRICAL CHARACTERISTICS

| Parameter | | Test Conditions | | IP78M12A-LCC4 Min. | IP78M12A-LCC4 Typ. | IP78M12A-LCC4 Max. | IP78M12-LCC4 Min. | IP78M12-LCC4 Typ. | IP78M12-LCC4 Max. | Unit |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $I_O$ = 100mA | $V_{IN}$ = 19V | 11.88 | 12 | 12.12 | 11.50 | 12 | 12.50 | V |
| | | $I_O$ = 5mA to 350mA<br>$P_D \le P_{MAX}$<br>$T_J$ = -55 to 150°C | $V_{IN}$ = 14.8V to 27V | 11.64 | | 12.36 | 11.40 | | 12.60 | |
| $\Delta V_O$ | Line Regulation | $I_O$ = 200mA | $V_{IN}$ = 14.5V to 30V | | 4 | 18 | | | 60 | mV |
| | | | $V_{IN}$ = 16V to 30V<br>$T_J$ = -55 to 150°C | | 4 | 18 | | | 30 | |
| | | $I_O$ = 500mA | $V_{IN}$ = 16V to 22V | | 4 | 18 | | | 120 | |
| $\Delta V_O$ | Load Regulation | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 19V | $T_J$ = -55 to 150°C | | 10 | 60 | | | 120 | mV |
| $I_Q$ | Quiescent Current | $V_{IN}$ = 19V | $I_O$ = 350mA<br>$T_J$ = -55 to 150°C | | 4 | 6 | | 4 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 19V | $T_J$ = -55 to 150°C | | 0.1 | 0.5 | | | 0.5 | mA |
| | | $I_O$ = 200mA | $V_{IN}$ = 14.8V to 30V<br>$T_J$ = -55 to 150°C | | 0.2 | 0.8 | | | 0.8 | |
| $V_N$ | Output Noise Voltage | f = 10Hz to 100kHz | | | 75 | 480 | | 75 | 480 | µV |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ | Ripple Rejection | f = 120Hz<br>$V_{IN}$ = 15V to 25V | $I_O$ = 300mA | 58 | 72 | | 55 | | | dB |
| | | | $I_O$ = 100mA<br>$T_J$ = -55 to 150°C | 58 | 72 | | 55 | | | |
| | Dropout Voltage | $I_O$ = 350mA | | | 2 | 2.5 | | | 2.5 | V |
| $I_{sc}$ | Short Circuit Current | $V_{IN}$ = 35V | | | 300 | 600 | | 300 | 600 | mA |
| $I_{pk}$ | Peak Output Current | $V_{IN}$ = 19V | | 0.7 | 1.0 | 1.4 | 0.7 | 1.0 | 1.6 | A |
| | Average Temperature Coefficient of $V_O$ | $I_O$ = 5mA | | | 1.2 | 4.8 | | 1.2 | | mV/°C |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | | | | | 13 | | | 13 | °C/W |

1) All characteristics are measured with a capacitor across the input of 0.22µF and a capacitor across the output of 0.1µF.

All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_p \le 10$ms, $\delta \le 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.

## ELECTRICAL CHARACTERISTICS

| Parameter | | Test Conditions | | IP78M15A-LCC4 Min. | IP78M15A-LCC4 Typ. | IP78M15A-LCC4 Max. | IP78M15-LCC4 Min. | IP78M15-LCC4 Typ. | IP78M15-LCC4 Max. | Units |
|---|---|---|---|---|---|---|---|---|---|---|
| $V_O$ | Output Voltage | $I_O$ = 100mA | $V_{IN}$ = 23V | 14.85 | 15 | 15.15 | 14.40 | 15 | 15.60 | V |
| | | $I_O$ = 5mA to 350mA<br>$P_D \le P_{MAX}$<br>$V_{IN}$ = 18V to 30V | $T_J$ = -55 to 150°C | 14.55 | | 15.45 | 14.25 | | 15.75 | |
| $\Delta V_O$ | Line Regulation | $I_O$ = 200mA | $V_{IN}$ = 17.5V to 30V | | 4 | 22 | | | 60 | mV |
| | | | $V_{IN}$ = 20V to 30V<br>$T_J$ = -55 to 150°C | | 4 | 22 | | | 30 | |
| | | $I_O$ = 500mA | $V_{IN}$ = 20V to 26V | | 4 | 22 | | | 150 | |
| $\Delta V_O$ | Load Regulation | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 23V | $T_J$ = -55 to 150°C | | 12 | 75 | | | 150 | mV |
| $I_Q$ | Quiescent Current | $V_{IN}$ = 23V | $I_O$ = 350mA<br>$T_J$ = -55 to 150°C | | 4 | 6 | | 4 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | $I_O$ = 5mA to 500mA<br>$V_{IN}$ = 23V | $T_J$ = -55 to 150°C | | 0.1 | 0.5 | | | 0.5 | mA |
| | | $I_O$ = 200mA | $V_{IN}$ = 18V to 30V<br>$T_J$ = -55 to 150°C | | 0.2 | 0.8 | | | 0.8 | |
| $V_N$ | Output Noise Voltage | f = 10Hz to 100kHz | | | 90 | 600 | | 90 | 600 | µV |
| $\frac{\Delta V_{IN}}{\Delta V_O}$ | Ripple Rejection | f = 120Hz<br>$V_{IN}$ = 18.5V to 28.5V | $I_O$ = 300mA | 57 | 70 | | 54 | | | dB |
| | | | $I_O$ = 100mA<br>$T_J$ = -55 to 150°C | 57 | 70 | | 54 | | | |
| | Dropout Voltage | $I_O$ = 350mA | | | 2 | 2.5 | | | 2.5 | V |
| $I_{sc}$ | Short Circuit Current | $V_{IN}$ = 35V | | | 300 | 600 | | 300 | 600 | mA |
| $I_{pk}$ | Peak Output Current | $V_{IN}$ = 23V | | 0.7 | 1.0 | 1.4 | 0.7 | 1.0 | 1.6 | A |
| | Average Temperature Coefficient of $V_O$ | $I_O$ = 5mA | | | 1.5 | 6.0 | | 1.5 | | mV/°C |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | | | | | 13 | | | 13 | °C/W |

1) All characteristics are measured with a capacitor across the input of 0.22µF and a capacitor across the output of 0.1µF.

All characteristics except noise voltage and ripple rejection ratio are measured using pulse techniques ($t_p \le 10ms$, $\delta \le 5\%$). Output voltage changes due to changes in internal temperature must be taken into account separately.