

## 3-Terminal 500mA Positive Voltage Regulator

### DESCRIPTION

The TS78M00 Series positive voltage regulators are identical to the popular TS7800 Series devices, except that they are specified for only half the output current. Like the TS7800 devices, the TS78M00 Series 3-Terminal regulators are intended for local, on-card voltage regulation. Internal current limiting, thermal shutdown circuitry and safe-area compensation for the internal pass transistor combine to make these devices remarkably rugged under most operating conditions. Maximum output current with adequate heatsink is 500mA

### FEATURES

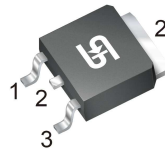
- Output Voltage Range 5V & 12V
- Output current up to 500mA
- No external components required
- Internal thermal overload protection
- Internal short-circuit current limiting
- Output transistor safe-area compensation
- Output voltage offered in 4% tolerance
- Compliant to RoHS Directive 2011/65/EU and WEEE 2002/96/EC
- Halogen-free according to IEC 61249-2-21

### APPLICATION

- Switching power supply
- Home appliance



TO-252 (DPAK)

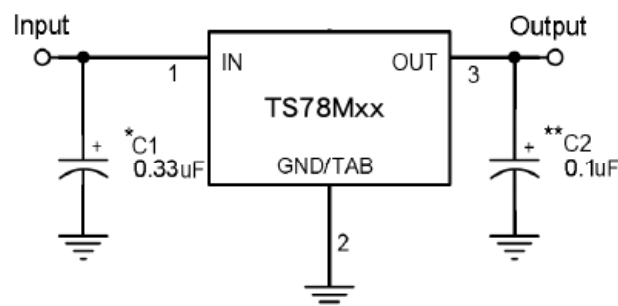


#### Pin Definition:

1. Input
2. Ground (Tab)
3. Output

**Notes:** MSL 3 (Moisture Sensitivity Level) per J-STD-020

### TYPICAL APPLICATION CIRCUIT



A common ground is required between the input and the output voltages. The input voltage must remain typically 2.0V above the output voltage even during the low point on the Input ripple voltage.

XX = these two digits of the type number indicate voltage.

\* = Cin is required if regulator is located an appreciable distance from power supply filter.

\*\* = Co is not needed for stability; however, it does improve transient response.

**ABSOLUTE MAXIMUM RATINGS**

| PARAMETER                            | SYMBOL    | LIMIT              | UNIT |
|--------------------------------------|-----------|--------------------|------|
| DC Input Voltage                     | $V_{IN}$  | 35                 | V    |
| Power Dissipation                    | $P_D$     | Internally Limited | W    |
| Operating Junction Temperature Range | $T_J$     | 0 ~ +150           | °C   |
| Storage Temperature Range            | $T_{STG}$ | -65~+150           | °C   |

**THERMAL PERFORMANCE**

| PARAMETER                              | SYMBOL          | LIMIT | UNIT |
|----------------------------------------|-----------------|-------|------|
| Junction to Case Thermal Resistance    | $R_{\theta JC}$ | 10    | °C/W |
| Junction to Ambient Thermal Resistance | $R_{\theta JA}$ | 100   | °C/W |

**Notes:**  $R_{\theta JA}$  is the sum of the junction-to-case and case-to-ambient thermal resistances. The case thermal reference is defined at the solder mounting surface of the drain pins.  $R_{\theta JA}$  is guaranteed by design while  $R_{\theta CA}$  is determined by the user's board design.  $R_{\theta JA}$  shown below for single device operation on FR-4 PCB in still air.

**ELECTRICAL SPECIFICATIONS TS78M05**

( $V_{IN}=10V$ ,  $I_{OUT}=350mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                             | CONDITION                                                |                             | MIN  | TYP  | MAX  | UNIT  |
|-------------------------------------------|------------------------------------|----------------------------------------------------------|-----------------------------|------|------|------|-------|
| Output voltage                            | V <sub>OUT</sub>                   | T <sub>J</sub> =25°C                                     |                             | 4.80 | 5    | 5.20 | V     |
|                                           |                                    | 7.5V≤V <sub>IN</sub> ≤20V<br>5mA≤I <sub>OUT</sub> ≤350mA |                             | 4.75 | 5    | 5.25 |       |
| Line Regulation                           | REG <sub>LINE</sub>                | T <sub>J</sub> =25°C                                     | 7.5V≤V <sub>IN</sub> ≤25V   | --   | 3    | 100  | mV    |
|                                           |                                    |                                                          | 8V≤V <sub>IN</sub> ≤12V     | --   | 1    | 50   |       |
| Load Regulation                           | REG <sub>LOAD</sub>                | T <sub>J</sub> =25°C                                     | 5mA≤I <sub>OUT</sub> ≤500mA | --   | 15   | 100  |       |
|                                           |                                    |                                                          | 5mA≤I <sub>OUT</sub> ≤200mA | --   | 5    | 50   |       |
| Quiescent Current                         | I <sub>Q</sub>                     | I <sub>OUT</sub> =0, T <sub>J</sub> =25°C                |                             | --   | 3    | 6    | mA    |
| Quiescent Current Change                  | ΔI <sub>Q</sub>                    | 7.5V≤V <sub>IN</sub> ≤25V                                |                             | --   | --   | 0.8  |       |
|                                           |                                    | 5mA≤I <sub>OUT</sub> ≤350mA                              |                             | --   | --   | 0.5  |       |
| Output Noise Voltage                      | V <sub>N</sub>                     | 10Hz≤f≤100KHz, T <sub>J</sub> =25°C                      |                             | --   | 40   | --   | μV    |
| Ripple Rejection Ratio                    | RR                                 | f=120Hz, 8V≤V <sub>IN</sub> ≤18V                         |                             | 62   | 78   | --   | dB    |
| Voltage Drop                              | V <sub>DROP</sub>                  | I <sub>OUT</sub> =500mA, T <sub>J</sub> =25°C            |                             | --   | 2    | --   | V     |
| Output Resistance                         | R <sub>OUT</sub>                   | f=1kHz                                                   |                             | --   | 17   | --   | mΩ    |
| Output Short Circuit Current              | I <sub>OS</sub>                    | T <sub>J</sub> =25°C                                     |                             | --   | 50   | --   | mA    |
| Peak Output Current                       | I <sub>O</sub> peak                | T <sub>J</sub> =25°C                                     |                             | --   | 0.7  | --   | A     |
| Temperature Coefficient of Output Voltage | ΔV <sub>OUT</sub> /ΔT <sub>J</sub> | I <sub>OUT</sub> = 5mA, 0°C≤T <sub>J</sub> ≤125°C        |                             | --   | -0.2 | --   | mV/°C |

**Note:**

- Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible, and thermal effects must be taken into account separately
- This specification applies only for DC power dissipation permitted by absolute maximum ratings.

**ELECTRICAL SPECIFICATIONS TS78M05**

 ( $V_{IN}=19V$ ,  $I_{OUT}=350mA$ ,  $0^{\circ}C \leq T_J \leq 125^{\circ}C$ ,  $C_{IN}=0.33\mu F$ ,  $C_{OUT}=0.1\mu F$ , unless otherwise noted)

| PARAMETER                                 | SYMBOL                      | CONDITION                                               | MIN   | TYP  | MAX   | UNIT           |
|-------------------------------------------|-----------------------------|---------------------------------------------------------|-------|------|-------|----------------|
| Output voltage                            | $V_{OUT}$                   | $T_J=25^{\circ}C$                                       | 11.53 | 12   | 12.48 | V              |
|                                           |                             | $14.5V \leq V_{IN} \leq 27V$                            | 11.42 | 12   | 12.60 |                |
|                                           |                             | $5mA \leq I_{OUT} \leq 350mA$                           |       |      |       |                |
| Line Regulation                           | $REG_{LINE}$                | $T_J=25^{\circ}C$                                       |       |      |       | mV             |
|                                           |                             | $14.5V \leq V_{IN} \leq 30V$                            | --    | 10   | 240   |                |
| Load Regulation                           | $REG_{LOAD}$                | $T_J=25^{\circ}C$                                       |       |      |       |                |
|                                           |                             | $5mA \leq I_{OUT} \leq 500mA$                           | --    | 12   | 240   |                |
| Quiescent Current                         | $I_Q$                       | $I_{OUT}=0$ , $T_J=25^{\circ}C$                         | --    | 3    | 6     | mA             |
|                                           |                             | $14.5V \leq V_{IN} \leq 27V$                            | --    | --   | 0.8   |                |
| Quiescent Current Change                  | $\Delta I_Q$                | $5mA \leq I_{OUT} \leq 350mA$                           | --    | --   | 0.5   |                |
|                                           |                             |                                                         | --    | --   |       |                |
| Output Noise Voltage                      | $V_N$                       | $10Hz \leq f \leq 100KHz$ , $T_J=25^{\circ}C$           | --    | 75   | --    | $\mu V$        |
| Ripple Rejection Ratio                    | RR                          | $f=120Hz$ , $15V \leq V_{IN} \leq 25V$                  | --    | 80   | --    | dB             |
| Voltage Drop                              | $V_{DROP}$                  | $I_{OUT}=500mA$ , $T_J=25^{\circ}C$                     | --    | 2    | --    | V              |
| Output Resistance                         | $R_{OUT}$                   | $f=1kHz$                                                | --    | 18   | --    | $m\Omega$      |
| Output Short Circuit Current              | $I_{OS}$                    | $T_J=25^{\circ}C$                                       | --    | 50   | --    | mA             |
| Peak Output Current                       | $I_O \text{ peak}$          | $T_J=25^{\circ}C$                                       | --    | 0.7  | --    | A              |
| Temperature Coefficient of Output Voltage | $\Delta V_{OUT}/\Delta T_J$ | $I_{OUT}=5mA$ , $0^{\circ}C \leq T_J \leq 125^{\circ}C$ | --    | -0.3 | --    | $mV/^{\circ}C$ |

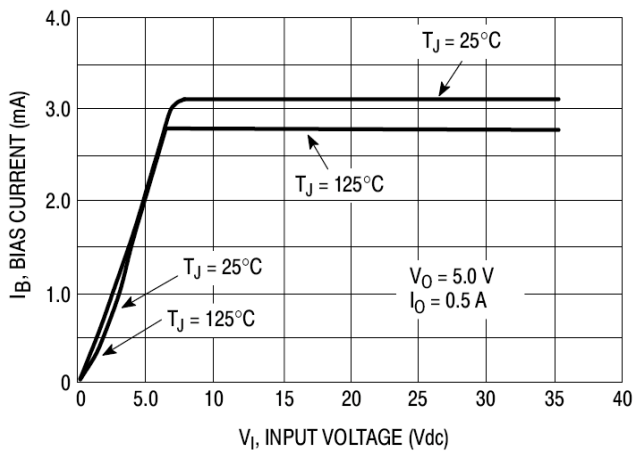
**Note:**

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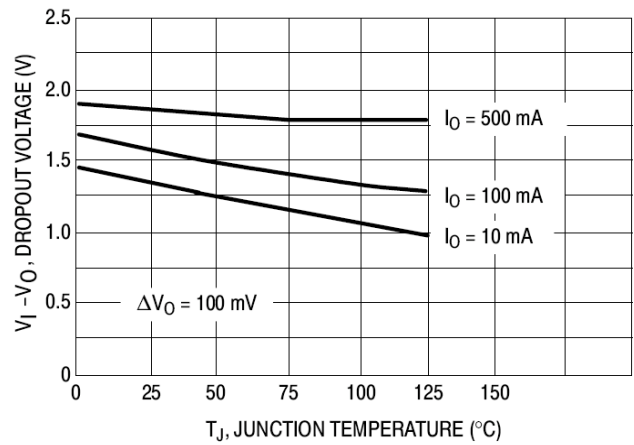
**ORDERING INFORMATION**

| OUTPYT VOLTAGE | PART NO.      | PACKAGE       | PACKING             |
|----------------|---------------|---------------|---------------------|
| 5V             | TS78M05CP ROG | TO-252 (DPAK) | 2,500pcs / 13" Reel |
| 12V            | TS78M12CP ROG | TO-252 (DPAK) | 2,500pcs / 13" Reel |

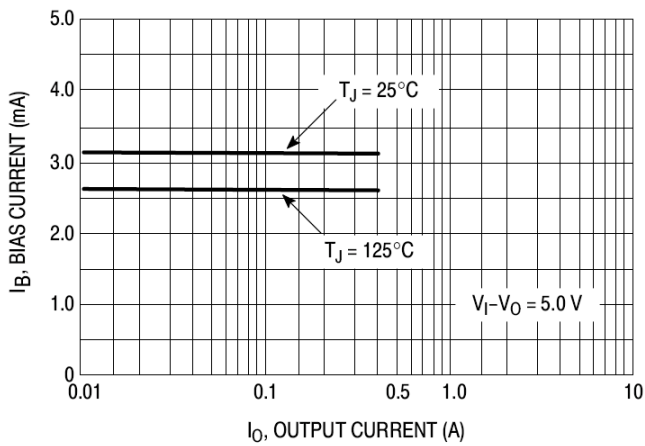
## ELECTRICAL CHARACTERISTIC CURVE



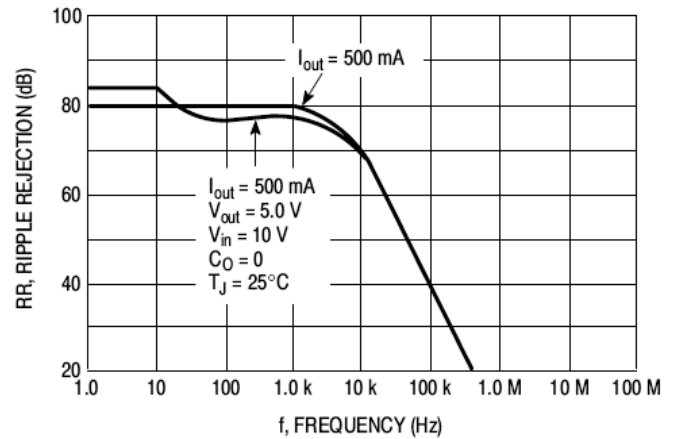
**Figure 1. Bias Current vs. Input Voltage**



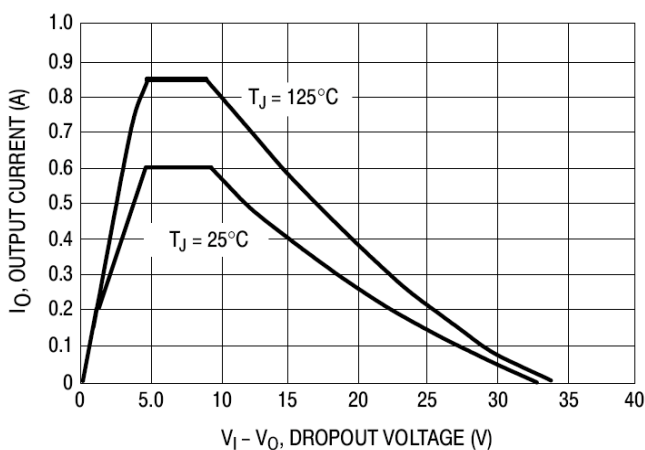
**Figure 2. Dropout Voltage vs. Junction Temperature**



**Figure 3. Bias Current vs. Output Current**



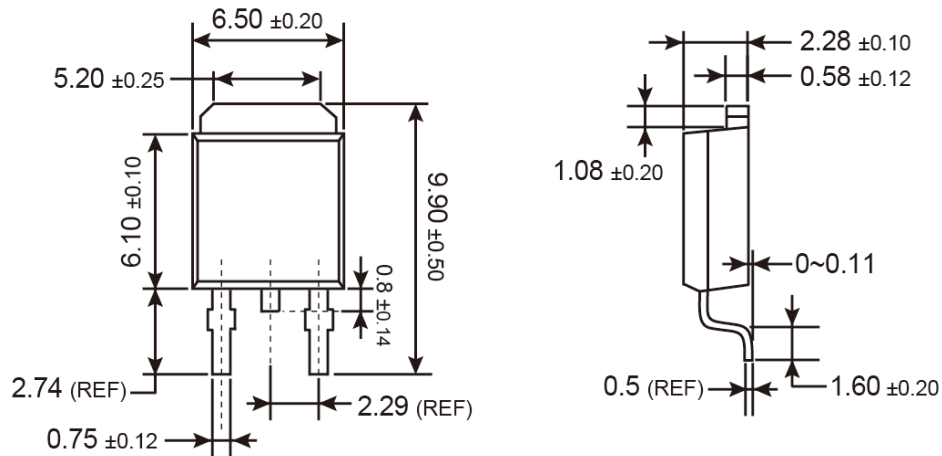
**Figure 4. Ripple Rejection vs. Frequency**



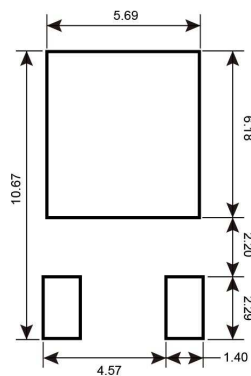
**Figure 6. Peak Output Current vs. Dropout Voltage**

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

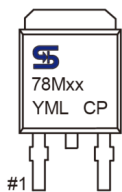
**TO-252 (DPAK)**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**MARKING DIAGRAM**



**XX** = Output Voltage  
**05** =5V **12** =12V  
**Y** = Year Code  
**M** = Month Code for Halogen Free Product  
**O** =Jan **P** =Feb **Q** =Mar **R** =Apr  
**S** =May **T** =Jun **U** =Jul **V** =Aug  
**W** =Sep **X** =Oct **Y** =Nov **Z** =Dec  
**L** = Lot Code

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