## 1. General Description

The WR78LXX are 0.1A bipolar linear regulators. They are available in TO92-3, SOT89-3, SOP-8 packages. The fixed output voltage of the WR78LXX are set at the factory and trimmed to ± 5%. This family of regulators is very suited for low output current applications.

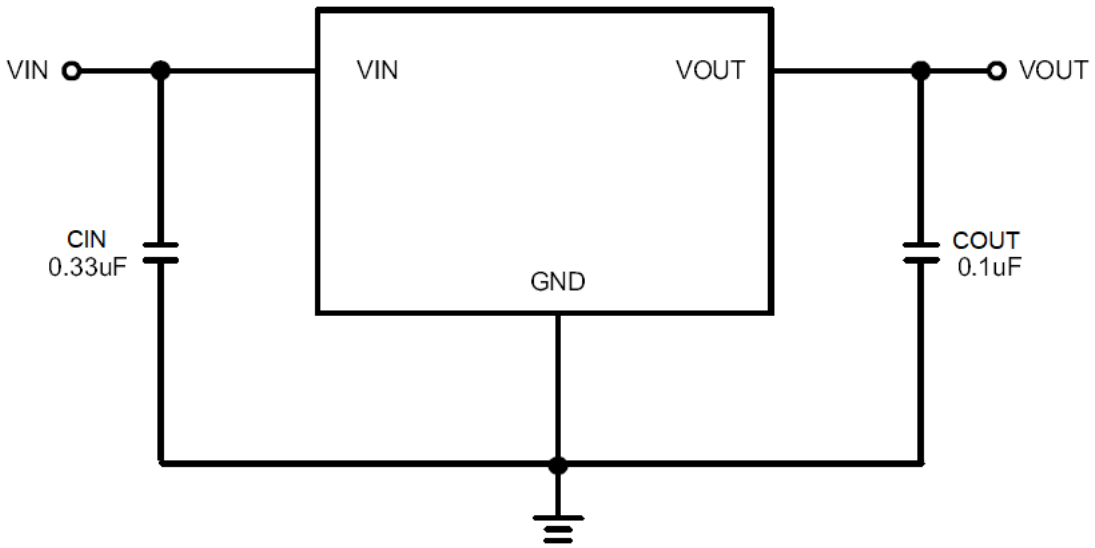
## 2. Features

- Maximum Output Current of 100mA
- Output Voltage Available in 3.3, 5, 6, 8, 9, 10, 12, 15, 18, and 24V
- Short Circuit Protection
- ±5% Output Voltage Tolerance
- Package:TO92-3, SOT89-3, SOP-8

## 3. Applications

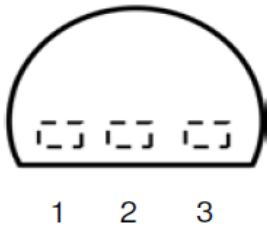
- LCD TV/ Monitors
- Networking Applications
- Communication Devices.
- PC Applications

## 4. Typical Application

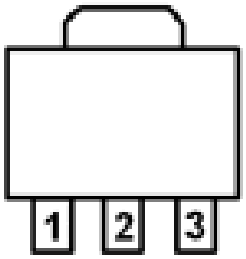


## 5. Pin Configuration

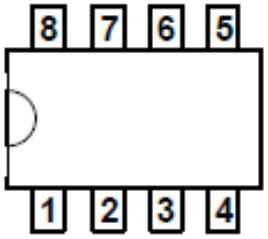
(Top View)




TO92-3




SOT89-3




SOP-8

## 6. Pin Description

| PIN NUMBER | | | PIN NAME | I/O | PIN FUNCTION |
|---|---|---|---|---|---|
| TO92-3 | SOT89-3 | SOP-8 | | | |
| 3 | 3 | 8 | IN | I | Input voltage supply. |
| 2 | 2 | 2,3,6,7 | GND | - | Common ground. |
| 1 | 1 | 1 | OUT | O | Regulated output voltage. |
| - | - | 4,5 | NC | - | No connection |

## 7. Absolute Maximum Ratings

Operate over the “Absolute Maximum Ratings” may cause permanent damage to the device. Exposure to such conditions for extended time may still affect the reliability of the device.

| PARAMETER | | RATING | UNIT |
|---|---|---|---|
| $V_{IN}$ Pin Voltage | $V_O$ = 3.3 V to 10 V | 30 | V |
| | $V_O$ = 12 V to 18 V | 36 | |
| | $V_O$ = 24 V | 40 | |
| Junction Temperature Range[1] | | -40 to +150 | °C |
| Storage Temperature Range | | -40 to +150 | °C |
| Lead Temperature (Soldering,10Seconds) | | 260 | °C |
| Thermal Resistance[2] (Junction to Case) | SOT89-3 | 40 | °C/W |
| | SOP-8 | 60 | |
| | TO92-3 | 80 | |
| Thermal Resistance (Junction to Ambient) | SOT89-3 | 180 | °C/W |
| | SOP-8 | 150 | |
| | TO92-3 | 150 | |
| Power Dissipation | SOT89-3 | 550 | mW |
| | SOP-8 | 810 | |
| | TO92-3 | 625 | |
| Moisture Sensitivity | | Please refer the MSL label on the IC package bag/carton for detail | |

**Note1：** Maximum Junction Temperature is the temperature limit of this device. Over this limit, the IC may be damaged permanently. Operation Junction Temperature Range is the range the device intended to be functional, but specific performance is not guaranteed. For guaranteed specifications and the test conditions, please refer to the Electrical Characteristics.

**Note2.**: $\theta_{JA}$ is highly dependent on the PCB layout and area.

## 8. Recommended Operating Conditions

| PARAMETER | | RATING | UNIT |
|---|---|---|---|
| $V_{IN}$ Pin Voltage | WR78L33 | 6.3 to 20 | V |
| | WR78L05 | 7 to 20 | |
| | WR78L10 | 12.5 to 25 | |
| | WR78L12 | 14.5 to 27 | |
| | WR78L15 | 17.5 to 30 | |
| Output Current, $I_{OUT}$ [3] | | 0 to 100 | mA |
| Input capacitor | | 0.33 | μF |
| Output capacitor | | 0.1 | |
| Operating Junction Temperature Range, $T_J$ | | -40 to 125 | °C |
| Operating Ambient Temperature Range, $T_A$ | | -40 to 85 | °C |

**Note3:** Output current maybe will be limited to a lower level for thermal consideration.

## 9. Electrical Characteristics

### 9.1 WR78L33

($V_{IN}$=8.3V, $I_{OUT}$=40mA, $C_{IN}$=0.33μF, $C_{OUT}$=0.1μF, $T_A$=25℃, unless otherwise noted)

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | | 3.168 | 3.3 | 3.432 | V |
| | | 6.3V ≤ $V_{IN}$ ≤ 20V, 1mA ≤ $I_{OUT}$ ≤ 100mA, -40℃ ≤ $T_A$ ≤ 85℃, $P_D$ ≤ 0.75W[4] | 3.135 | | 3.465 | |
| $V_{DO}$ | Dropout Voltage[5] | $I_{OUT}$=40mA | | 2.2 | | V |
| | | $I_{OUT}$=100mA | | 2.3 | | |
| $I_{LIM}$ | Output current limit | $V_{IN}$=8.3V | | 200 | | mA |
| $I_{OUT}$ | Maximum output current in the accuracy range | $V_{IN}$=8.3V | 100 | | | mA |
| LNR | Line Regulation[6] | 6.3V ≤ $V_{IN}$ ≤ 20V | | 20 | 150 | mV |
| LDR | Load Regulation[6] | 1mA ≤ $I_{OUT}$ ≤ 100mA | | 20 | 60 | mV |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA ,$T_A$=25℃ | | 3 | 5.5 | mA |
| $\Delta I_Q$ | Quiescent Current Change | -40°C ≤ $T_A$ ≤ 85℃, 6V ≤ $V_{IN}$ ≤ 20V | | | 1.5 | mA |
| | | -40°C ≤ $T_A$ ≤ 85℃, 1mA ≤ $I_{OUT}$ ≤ 40mA | | | 0.1 | |
| PSRR | Power Supply Ripple Rejection | f=120Hz, 7.3V ≤ $V_{IN}$ ≤ 20V, $I_{OUT}$=40mA | 55 | 60 | | dB |
| $V_{NO}$ | Output Noise Voltage[7] | 10Hz ≤ f ≤ 100kHz | | 40 | | μV/$V_O$ |
| $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | Output Voltage Temperature Coefficient[8] | $I_{OUT}$=5mA, -40°C ≤ $T_A$ ≤ 85℃ | | 0.27 | | mV/℃ |
| | | | | 84 | | ppm/℃ |

### 9.2 WR78L05

($V_{IN}$=10V, $I_{OUT}$=40mA, $C_{IN}$=0.33μF, $C_{OUT}$=0.1μF, $T_A$=25°C, unless otherwise noted )

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | | 4.8 | 5.0 | 5.2 | V |
| | | 7V ≤ $V_{IN}$ ≤ 20V, 1mA ≤ $I_{OUT}$ ≤ 100mA, -40°C ≤ $T_A$ ≤ 85°C, $P_D$ ≤ 0.75W[4] | 4.75 | | 5.25 | |
| $V_{DO}$ | Dropout Voltage[5] | $I_{OUT}$=40mA | | 1.7 | | V |
| | | $I_{OUT}$=100mA | | 1.8 | | |
| $I_{LIM}$ | Output current limit | $V_{IN}$=10V | | 200 | | mA |
| $I_{OUT}$ | Maximum output current in the accuracy range | $V_{IN}$=10V | 100 | | | mA |
| LNR | Line Regulation[6] | 7V ≤ $V_{IN}$ ≤ 20V | | 20 | 150 | mV |
| LDR | Load Regulation[6] | 1mA ≤ $I_{OUT}$ ≤ 100mA | | 20 | 60 | mV |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA ,$T_A$=25℃ | | 3 | 5.5 | mA |
| $\Delta I_Q$ | Quiescent Current Change | -40°C ≤ $T_A$ ≤ 85°C, 7V ≤ $V_{IN}$ ≤ 20V | | | 1.5 | mA |
| | | -40°C ≤ $T_A$ ≤ 85°C, 1mA ≤ $I_{OUT}$ ≤ 40mA | | | 0.1 | |
| PSRR | Power Supply Ripple Rejection | f=120Hz, 8V ≤ $V_{IN}$ ≤ 20V, $I_{OUT}$=40mA | 60 | 65 | | dB |
| $V_{NO}$ | Output Noise Voltage[7] | 10Hz ≤ f ≤ 100kHz | | 40 | | μV/$V_O$ |
| $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | Output Voltage Temperature Coefficient[8] | $I_{OUT}$=5mA, -40°C ≤ $T_A$ ≤ 85°C | | 0.27 | | mV/°C |
| | | | | 84 | | ppm/°C |

### 9.3 WR78L10

($V_{IN}$=17V, $I_{OUT}$=40mA, $C_{IN}$=0.33μF, $C_{OUT}$=0.1μF, $T_A$=25°C, unless otherwise noted )

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | | 9.6 | 10.0 | 10.4 | V |
| | | 12.5V ≤ $V_{IN}$ ≤ 25V,<br>1mA ≤ $I_{OUT}$ ≤ 100mA,<br>-40°C ≤ $T_A$ ≤ 85°C,<br>$P_D$ ≤ 0.75W[4] | 9.5 | | 10.5 | |
| $V_{DO}$ | Dropout Voltage[5] | $I_{OUT}$=40mA | | 1.7 | | V |
| | | $I_{OUT}$=100mA | | 1.8 | | |
| $I_{LIM}$ | Output current limit | $V_{IN}$=17V | | 200 | | mA |
| $I_{OUT}$ | Maximum output current in the accuracy range | $V_{IN}$=17V | 100 | | | mA |
| LNR | Line Regulation[6] | 12.5V ≤ $V_{IN}$ ≤ 25V | | 30 | 250 | mV |
| LDR | Load Regulation[6] | 1mA ≤ $I_{OUT}$ ≤ 100mA | | 30 | 120 | mV |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA ,$T_A$=25°C | | 3 | 5.5 | mA |
| $\Delta I_Q$ | Quiescent Current Change | -40°C ≤ $T_A$ ≤ 85°C,<br>12.5V ≤ $V_{IN}$ ≤ 25V | | | 1.5 | mA |
| | | -40°C ≤ $T_A$ ≤ 85°C,<br>1mA ≤ $I_{OUT}$ ≤ 40mA | | | 0.1 | |
| PSRR | Power Supply Ripple Rejection | f=120Hz, 14V ≤ $V_{IN}$ ≤ 25V,<br>$I_{OUT}$=40mA | 50 | 60 | | dB |
| $V_{NO}$ | Output Noise Voltage[7] | 10Hz ≤ f ≤ 100kHz | | 60 | | μV/$V_O$ |
| $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | Output Voltage Temperature Coefficient[8] | $I_{OUT}$=5mA,<br>-40°C ≤ $T_A$ ≤ 85°C | | 0.27 | | mV/°C |
| | | | | 84 | | ppm/°C |

### 9.4 WR78L12

($V_{IN}$=19V, $I_{OUT}$=40mA, $C_{IN}$=0.33μF, $C_{OUT}$=0.1μF, $T_A$=25°C, unless otherwise noted )

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | | 11.5 | 12.0 | 12.5 | V |
| | | 14.5V ≤ $V_{IN}$ ≤ 27V, 1mA ≤ $I_{OUT}$ ≤ 100mA, -40℃ ≤ $T_A$ ≤ 85℃, $P_D$ ≤ 0.75W[4] | 11.4 | | 12.6 | |
| $V_{DO}$ | Dropout Voltage[5] | $I_{OUT}$=40mA | | 1.7 | | V |
| | | $I_{OUT}$=100mA | | 1.8 | | |
| $I_{LIM}$ | Output current limit | $V_{IN}$=19V | | 200 | | mA |
| $I_{OUT}$ | Maximum output current in the accuracy range | $V_{IN}$=19V | 100 | | | mA |
| LNR | Line Regulation[6] | 14.5V ≤ $V_{IN}$ ≤ 27V | | 45 | 250 | mV |
| LDR | Load Regulation[6] | 1mA ≤ $I_{OUT}$ ≤ 100mA | | 45 | 150 | mV |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA ,$T_A$=25℃ | | 3 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | -40°C ≤ $T_A$ ≤ 85℃, 14.5V ≤ $V_{IN}$ ≤ 27V | | | 1.5 | mA |
| | | -40°C ≤ $T_A$ ≤ 85℃, 1mA ≤ $I_{OUT}$ ≤ 40mA | | | 0.1 | |
| PSRR | Power Supply Ripple Rejection | f=120Hz, 16V ≤ $V_{IN}$ ≤ 27V, $I_{OUT}$=40mA | 40 | 55 | | dB |
| $V_{NO}$ | Output Noise Voltage[7] | 10Hz ≤ f ≤ 100kHz | | 80 | | μV/$V_O$ |
| $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | Output Voltage Temperature Coefficient[8] | $I_{OUT}$=5mA, -40°C ≤ $T_A$ ≤ 85℃ | | 1 | | mV/℃ |
| | | | | 84 | | ppm/℃ |

## 9.5 WR78L15

($V_{IN}$=23V, $I_{OUT}$=40mA, $C_{IN}$=0.33μF, $C_{OUT}$=0.1μF, $T_A$=25°C, unless otherwise noted )

| SYMBOL | PARAMETER | TEST CONDITIONS | MIN | TYP. | MAX | UNIT |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | | 14.4 | 15.0 | 15.6 | V |
| | | 17.5V ≤ $V_{IN}$ ≤ 30V, 1mA ≤ $I_{OUT}$ ≤ 100mA, -40℃ ≤ $T_A$ ≤ 85℃, $P_D$ ≤ 0.75W[4] | 14.25 | | 15.75 | |
| $V_{DO}$ | Dropout Voltage[5] | $I_{OUT}$=40mA | | 1.7 | | V |
| | | $I_{OUT}$=100mA | | 1.8 | | |
| $I_{LIM}$ | Output current limit | $V_{IN}$=23V | | 200 | | mA |
| $I_{OUT}$ | Maximum output current in the accuracy range | $V_{IN}$=23V | 100 | | | mA |
| LNR | Line Regulation[6] | 17.5V ≤ $V_{IN}$ ≤30V | | 60 | 250 | mV |
| LDR | Load Regulation[6] | 1mA ≤ $I_{OUT}$ ≤ 100mA | | 60 | 200 | mV |
| $I_Q$ | Quiescent Current | $I_{OUT}$=0mA ,$T_A$=25℃ | | 3 | 6 | mA |
| $\Delta I_Q$ | Quiescent Current Change | -40°C ≤ $T_A$ ≤ 85℃, 17.5V ≤ $V_{IN}$ ≤30V | | | 1.5 | mA |
| | | -40°C ≤ $T_A$ ≤ 85℃, 1mA ≤ $I_{OUT}$ ≤ 40mA | | | 0.1 | |
| PSRR | Power Supply Ripple Rejection | f=120Hz, 19V ≤ $V_{IN}$ ≤ 30V, $I_{OUT}$=40mA | 40 | 50 | | dB |
| $V_{NO}$ | Output Noise Voltage[7] | 10Hz ≤ f ≤ 100kHz | | 90 | | μV/$V_O$ |
| $\frac{\Delta V_{OUT}}{\Delta T_A \times V_{OUT}}$ | Output Voltage Temperature Coefficient[8] | $I_{OUT}$=5mA, -40°C ≤ $T_A$ ≤ 85℃ | | 1.25 | | mV/℃ |
| | | | | 84 | | ppm/℃ |

**Note4:** Power Dissipation ($P_D$) ≤ 0.75W.

**Note5:** The dropout voltage is defined as ($V_{IN}$-$V_{OUT}$) when $V_{OUT}$ is $V_{OUT(NOM)}$*95%.

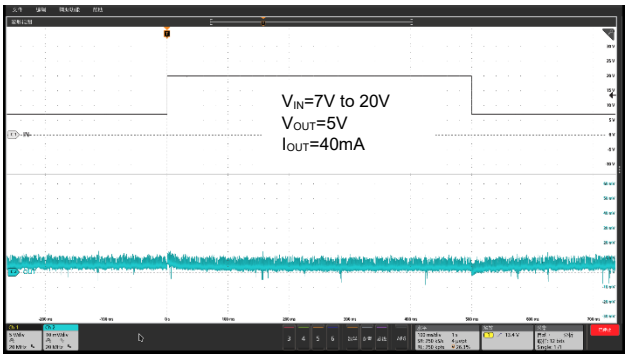
**Note6:** The maximum steady state usable output current and input voltage are very dependent on the heat sinking and/or lead length of the package. The data above represent pulse test conditions with junction temperature as indicated at the initiation of tests.

**Note7:** A 0.01μF minimum output capacitor is recommended to reduce high frequency noise.

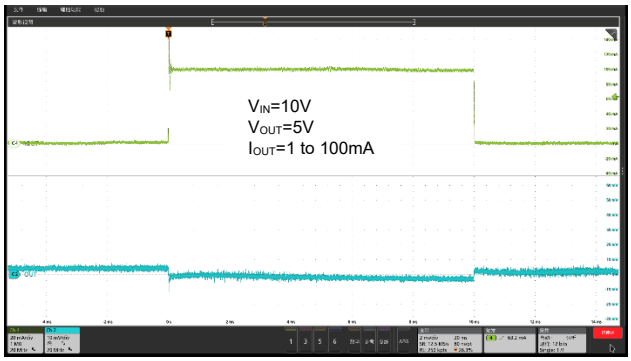
**Note8:** Since products are not screened at high and low temperature, the specification for this temperature range is guaranteed by design, not tested in production.

## 10. Typical Performance Characteristics

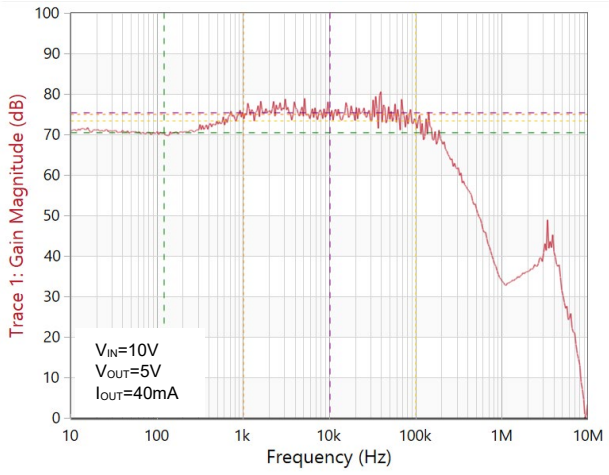
($T_A$ = -40 to 85℃, $C_{IN}$ =0.33μF, $C_{OUT}$=0.1μF, unless otherwise noted)



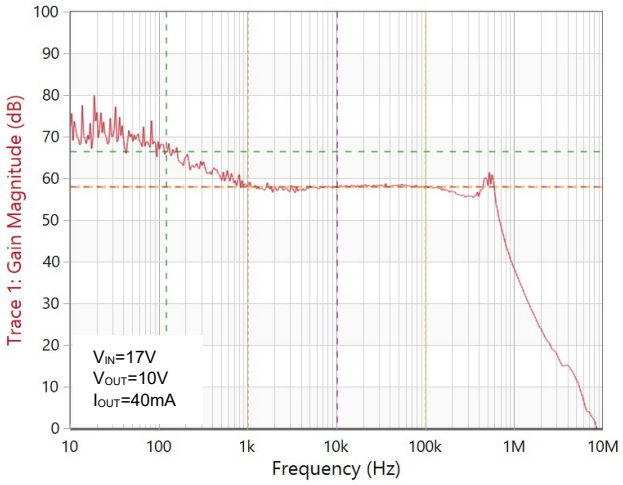

WR78L05 Line Transient



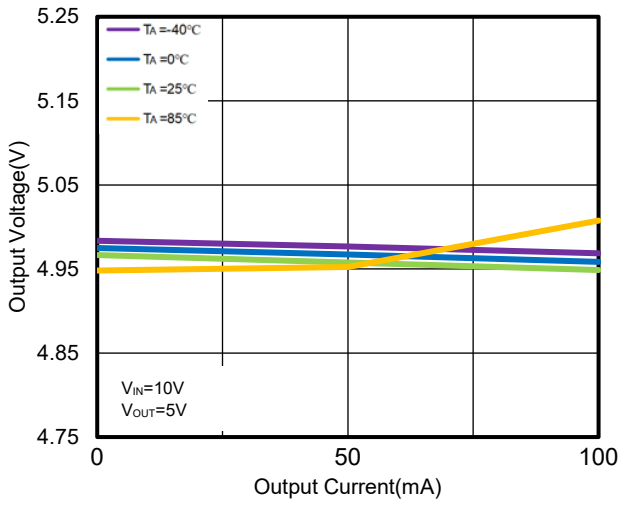

WR78L05 Load Transient




WR78L05 PSRR

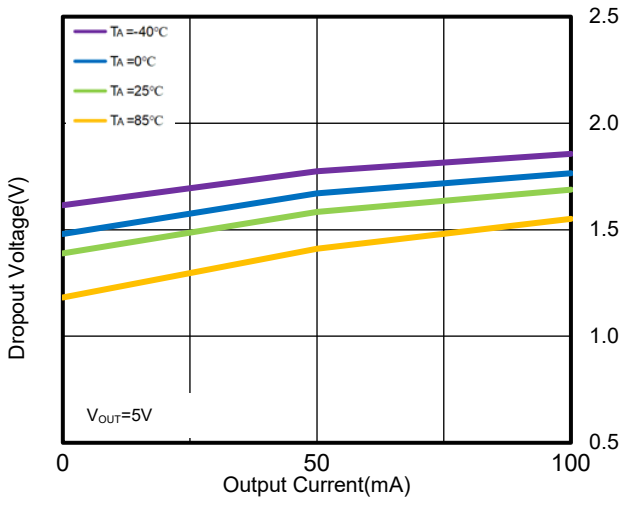



WR78L10 PSRR



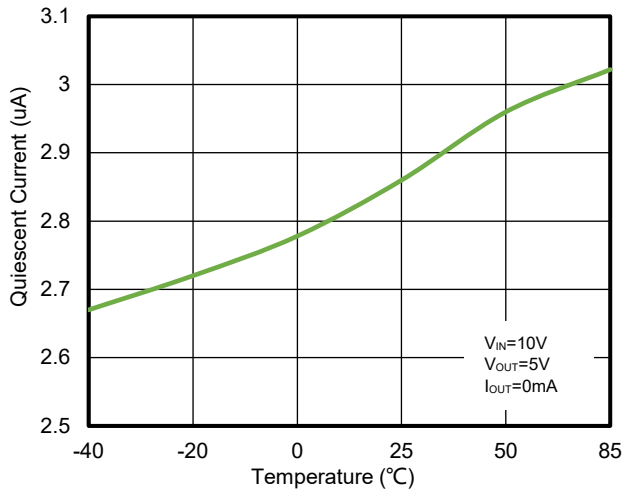

WR78L05

Load Regulation vs. $I_{OUT}$ & Ambient Temperature



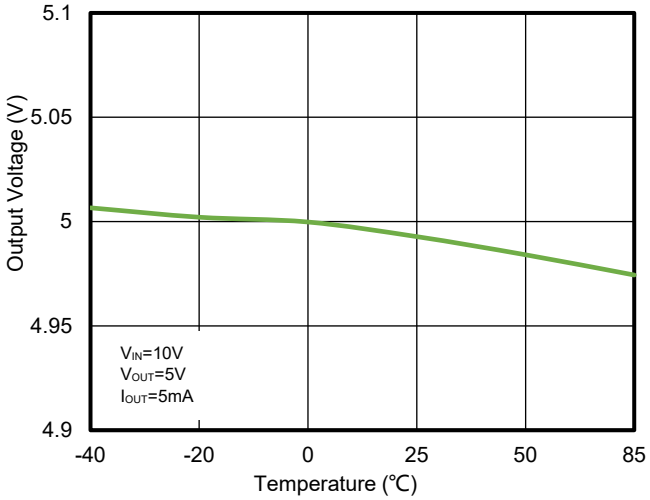

WR78L05

Dropout Voltage vs. $I_{OUT}$ & Ambient Temperature




WR78L05

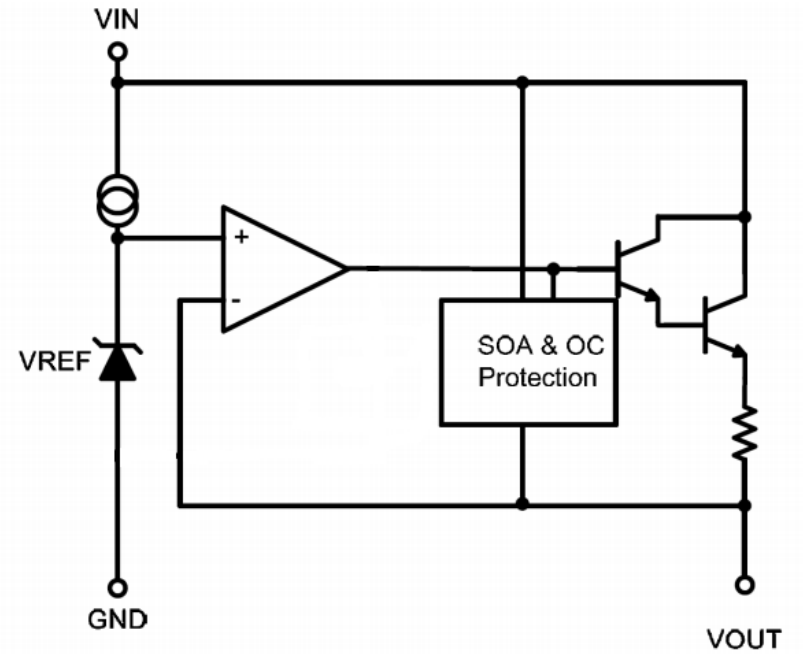
Quiescent Current vs. Ambient Temperature




WR78L05

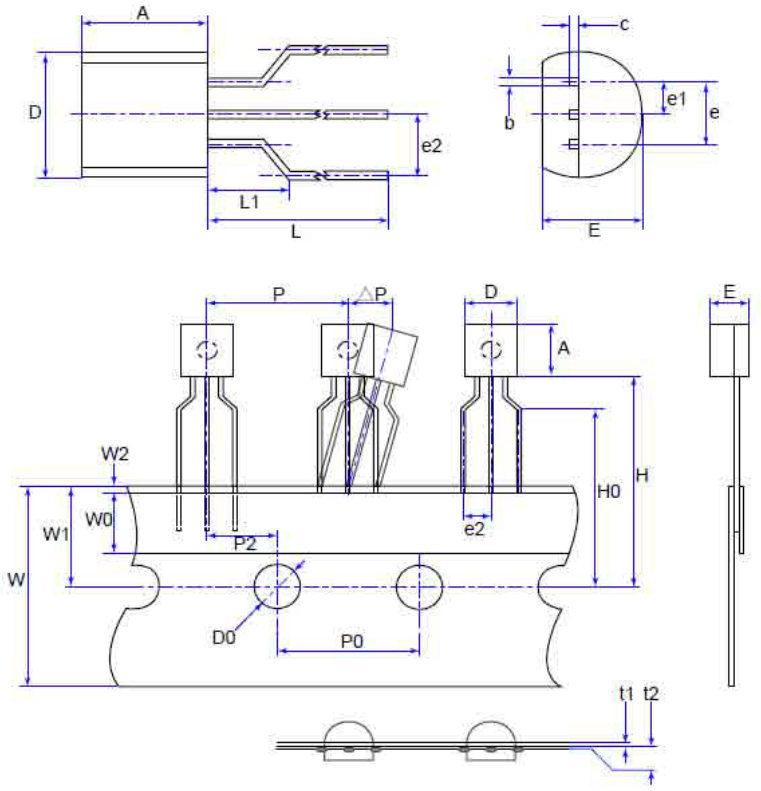
Output Voltage vs. Ambient Temperature

## 11. Block Diagram



## 12. Package Information

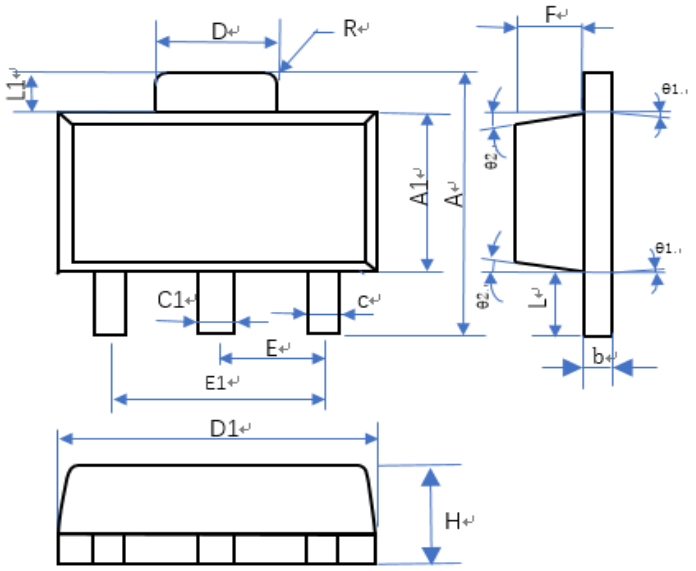
**TO92-3**




| SYMBOL | DIMENSIONS IN MILLIMETERS | |
|---|---|---|
| | MIN | MAX |
| **A** | 4.30 | 4.70 |
| **b** | 0.38 | 0.55 |
| **c** | 0.36 | 0.51 |
| **D** | 4.30 | 4.70 |
| **D0** | 3.80 | 4.20 |
| **E** | 3.30 | 3.70 |
| **e** | 2.44 | 2.64 |
| **e1** | 1.27TYP | |

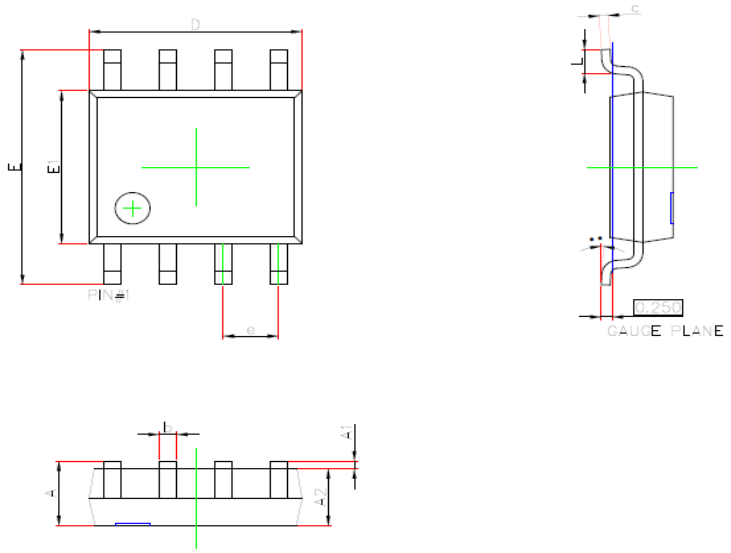
| SYMBOL | DIMENSIONS IN MILLIMETERS | |
|---|---|---|
| | MIN | MAX |
| **e2** | 2.20 | 2.96 |
| **H** | 18.00 | 21.00 |
| **H0** | 15.50 | 16.50 |
| **L** | 12.70 | - |
| **L1** | 2.50 | 4.50 |
| **p** | 12.40 | 13.00 |
| **p0** | 12.50 | 12.90 |
| **p2** | 6.05 | 6.65 |
| **t1** | 0.35 | 0.45 |
| **t2** | 0.15 | 0.25 |
| **W** | 17.50 | 19.00 |
| **W0** | 5.50 | 6.50 |
| **W1** | 8.50 | 9.50 |
| **W2** | - | 1.00 |
| **Δp** | - | 1.00 |

**SOT89-3**




| SYMBOLS | TOLERENCE | DIMENSIONS IN MILLIMETERS | | |
|---|---|---|---|---|
| | | MIN | NOM | MAX |
| *A | 0.15 | 4.00 | 4.15 | 4.30 |
| A1 | 0.10 | 2.40 | 2.50 | 2.60 |
| b | 0.05 | 0.36 | 0.41 | 0.46 |
| C | 0.045 | 0.38 | 0.425 | 0.47 |
| *C1 | 0.05 | 0.45 | 0.50 | 0.55 |
| D | 0.10 | 1.60 | 1.70 | 1.80 |
| *D1 | 0.10 | 4.40 | 4.50 | 4.60 |
| E | 0.50 | 1.00 | 1.50 | 2.00 |
| *E1 | 0.05 | 2.95 | 3.00 | 3.05 |
| *L | 0.10 | 0.80 | 0.90 | 1.00 |
| *L1 | 0.05 | 0.65 | 0.70 | 0.75 |
| F | 0.10 | 0.98 | 1.08 | 1.18 |
| H | 0.10 | 1.40 | 1.50 | 1.60 |
| R | | | | 0.20 |
| e1 | | | | 3° |
| e2 | | | | 6° |

## SOP-8




| SYMBOLS | DIMENSIONS IN MILLIMETERS | |
|---|---|---|
| | MIN | MAX |
| A | 1.350 | 1.750 |
| A1 | 0.100 | 0.250 |
| A2 | 1.350 | 1.550 |
| b | 0.330 | 0.510 |
| c | 0.170 | 0.250 |
| D | 4.800 | 5.000 |
| e | 1.270(BSC) | |
| E | 5.800 | 6.200 |
| E1 | 3.800 | 4.000 |
| L | 0.400 | 1.270 |
| θ | 0° | 8° |

## 13. Ordering Information

| PART NUMBER | OUTPUT VOLTAGE | PACKAGE | PACKING QUANTITY |
|---|---|---|---|
| WR78L33- NM1B | 3.3V | TO92-3 | 2k/Tape box |
| WR78L05-NM1B | 5.0V | TO92-3 | 2k/Tape box |
| WR78L06- NM1B | 6.0V | TO92-3 | 2k/Tape box |
| WR78L08- NM1B | 8.0V | TO92-3 | 2k/Tape box |
| WR78L09- NM1B | 9.0V | TO92-3 | 2k/Tape box |
| WR78L10- NM1B | 10V | TO92-3 | 2k/Tape box |
| WR78L12- NM1B | 12V | TO92-3 | 2k/Tape box |
| WR78L15- NM1B | 15V | TO92-3 | 2k/Tape box |
| WR78L18- NM1B | 18V | TO92-3 | 2k/Tape box |
| WR78L24- NM1B | 24V | TO92-3 | 2k/Tape box |
| WR78L33-A20R | 3.3V | SOT89-3 | 1k/Reel |
| WR78L05-A20R | 5.0V | SOT89-3 | 1k/Reel |
| WR78L06-A20R | 6.0V | SOT89-3 | 1k/Reel |
| WR78L08-A20R | 8.0V | SOT89-3 | 1k/Reel |
| WR78L09-A20R | 9.0V | SOT89-3 | 1k/Reel |
| WR78L10-A20R | 10V | SOT89-3 | 1k/Reel |
| WR78L12-A20R | 12V | SOT89-3 | 1k/Reel |
| WR78L15-A20R | 15V | SOT89-3 | 1k/Reel |
| WR78L18-A20R | 18V | SOT89-3 | 1k/Reel |
| WR78L24-A20R | 24V | SOT89-3 | 1k/Reel |
| WR78L33-S80R | 3.3V | SOP-8 | 4k/Reel |
| WR78L05-S80R | 5.0V | SOP-8 | 4k/Reel |
| WR78L06-S80R | 6.0V | SOP-8 | 4k/Reel |
| WR78L08-S80R | 8.0V | SOP-8 | 4k/Reel |
| WR78L09-S80R | 9.0V | SOP-8 | 4k/Reel |
| WR78L10-S80R | 10V | SOP-8 | 4k/Reel |
| WR78L12-S80R | 12V | SOP-8 | 4k/Reel |
| WR78L15-S80R | 15V | SOP-8 | 4k/Reel |
| WR78L18-S80R | 18V | SOP-8 | 4k/Reel |
| WR78L24-S80R | 24V | SOP-8 | 4k/Reel |

## STATEMENTS

WAY-ON provides data sheets based on the actual performance of the device, and users should verify actual device performance in their specific applications. The device characteristics and parameters in this data sheet can and do vary from application to application, and actual device performance may change over time. This information is intended for developers designing with WAY-ON products. Users are responsible for selecting the appropriate WAY-ON product for their application and for designing and verifying the application to ensure that your application meets the appropriate standards or other requirements, and users are responsible for all consequences. Specifications are subject to change without notice.

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*Specifications are subject to change without notice.*
*The device characteristics and parameters in this data sheet can and do vary in different applications and actual device performance may vary over time.*
*Users should verify actual device performance in their specific applications.*