Lead-free Green

**0.1A Linear Voltage Regulator**

## Description

The YJ78LXX is a voltage regulator with output current at 0.1A and output voltage at 5V, 12V, 15V.

The device is designed to suit wide range of applications where good voltage regulation, current limiting, and thermal overload protection are essential to reliable long-term operations. With adequate heat sink attached, the regulator delivers output current to the maximum value of 100mA.

Packages offered include SOT-89-3L.

## Features and Benefits

- Fixed output voltages at 5/12/15V with accuracy up to ±2% @ 5V
- Output current up to 100mA with foldback style current limiting
- Good immunization from input noise with PSRR at > 62dB typical
- Wide operating temperature range at $T_J$ = -40 ~ 125ºC
- Built-in thermal shut-down to ensure reliable operation
- No external components needed for proper operation
- Lead-free package assembled with 'green' molding compound

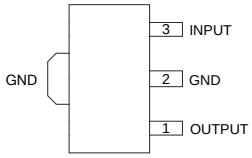
## Applications

- Operating voltage supply to MCU and system ICs used in CE devices, industrial computing peripherals, network & communication systems
- Commonly adopted in e-Bike, 2/4-wheel scooters, toys, power adapters for computer peripherals / set-top boxes / routers, industrial machineries, test equipment

## Pin Assignment

**SOT-89-3L**

(Top View)




## Ordering Information

**YJ78L XX X X XX**

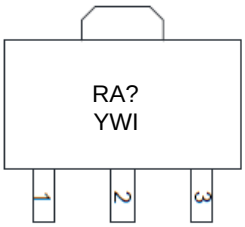
| Product Preffix | Output Voltage | Precision | Package | Packing |
|---|---|---|---|---|
| | 05: 5V<br>12: 12V<br>15: 15V | A: High Precision<br>If Skipped: Standard | Y: SOT-89-3L | TR: Tape & Reel |

| Product Name | Package | Marking | MSL | $T_J$ (ºC) | Media | Quantity (pcs) |
|---|---|---|---|---|---|---|
| YJ78L05Y | SOT-89-3L | RLE | 3 | -40 ~ 125 | 7" T&R | 1,000 |
| YJ78L05AY | | RLA | | | | |
| YJ78L12Y | | RLF | | | | |
| YJ78L15Y | | RLG | | | | |

## Marking Information

**SOT-89-3L**

(Top View)




First Line: Marking (see *Ordering Information*)

Second Line: Date Code
- Y: Year of Molding
- W: Work-week of Molding
- I: Internal Code

## Typical Application Circuit

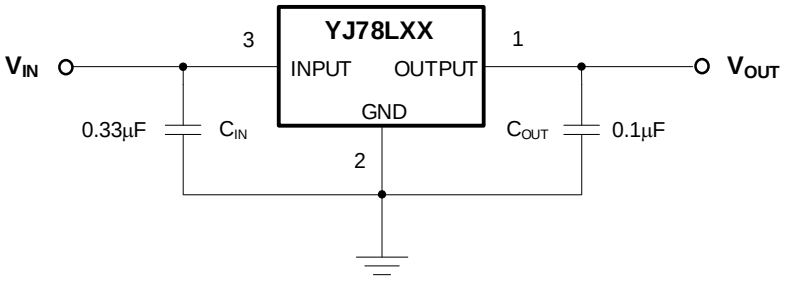



**Fig. 1: Application Circuit**

## Diagram of Functional Blocks

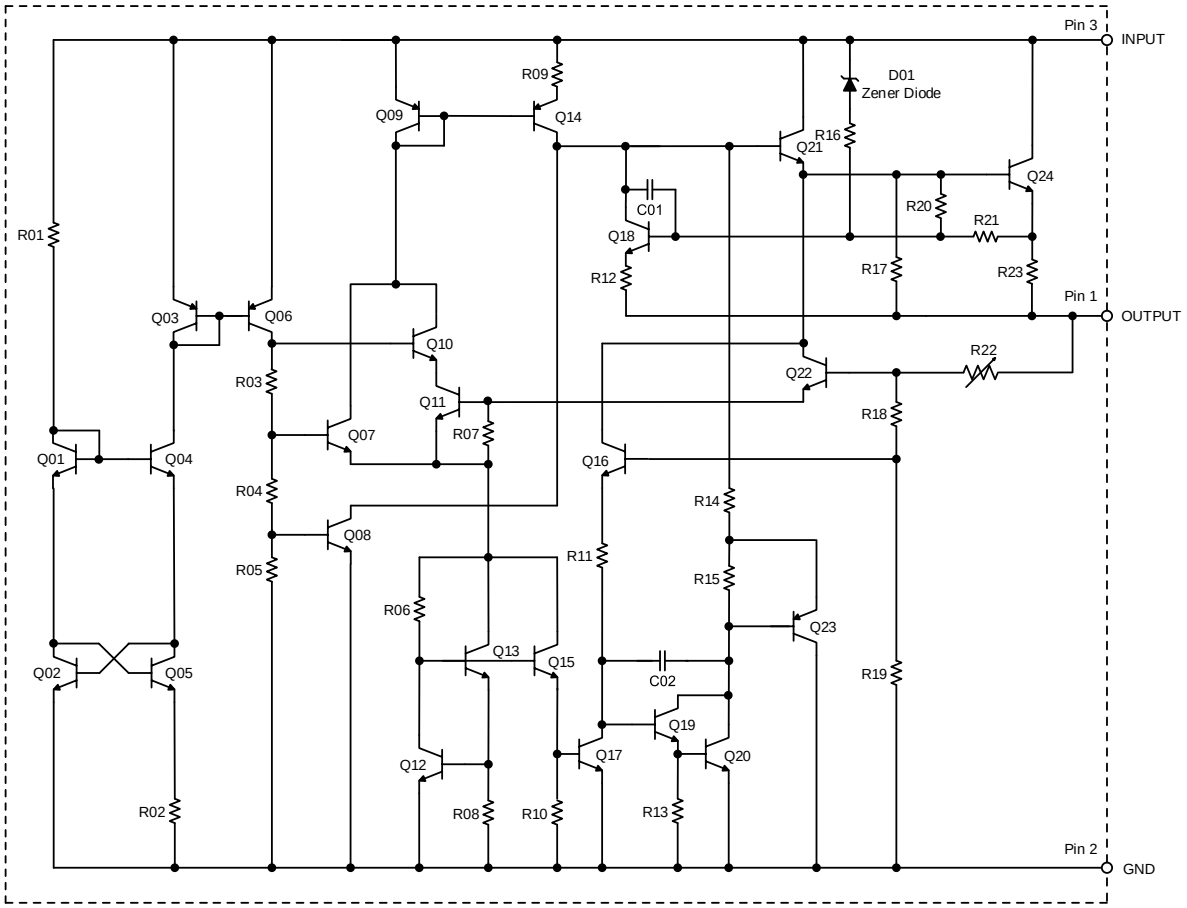



**Fig. 2: Diagram of Internal Functional Blocks**

## Absolute Maximum Ratings *1 (All measurements were made at $T_A$ = 25°C unless stated otherwise)

| Symbol | Parameter | Values | Unit |
|---|---|---|---|
| $V_{IN}$ | Input Voltage | 36 | V |
| $T_J$ | Operating Junction Temperature | 150 | ºC |
| $T_{LEAD}$ | Lead Temperature (soldering, 10s) | 260 | ºC |
| $T_{STG}$ | Storage Temperature Range | -65 ~ 150 | ºC |
| HBM | ESD (Human Body Model) | 2 | kV |
| MM | ESD (Machine Model) | 200 | V |

Note 1: Stresses greater than those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. While these are stress ratings only, functional operation of the device at these or any other conditions beyond those indicated under "Recommended Operating Conditions" are not implied. Exposure to "Absolute Maximum Ratings" for extended periods may affect device reliability.

## Recommended Operating Conditions (All measurements were made at $T_A$ = 25°C unless stated otherwise)

| Symbol | Parameter | Min. | Max. | Unit |
|---|---|---|---|---|
| $V_{IN}$ | Input Voltage | – | 30 | V |
| $T_J$ | Operating Junction Temperature Range | -40 | 125 | ºC |

## Electrical Characteristics

**YJ78L05**: ($V_{IN}$ = 10V, $I_{OUT}$ = 40mA, $C_{IN}$ = 0.33µF, $C_{OUT}$ = 0.1µF, $T_J$ = 25ºC; *Italic* & **Bold** typefaces applies over -40ºC ≤ $T_J$ ≤ 125ºC unless otherwise specified)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | - | 4.8 | 5.0 | 5.2 | V |
| | | 7V ≤ $V_{IN}$ ≤ 20V; 1mA ≤ $I_{OUT}$ ≤ 100mA<br>$P_D$ ≤ 0.75W | ***4.75*** | – | ***5.25*** | |
| $\Delta V_{R\text{-}Load}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 100mA | – | 10 | 60 | mV |
| $\Delta V_{R\text{-}Line}$ | Line Regulation | 7V ≤ $V_{IN}$ ≤ 20V | – | 8 | 150 | mV |
| $I_Q$ | Quiescent Current | - | – | 3.0 | 5.5 | mA |
| $\Delta I_Q$ | Change to Quiescent Current | 8V ≤ $V_{IN}$ ≤ 20V | – | – | ***1.5*** | mA |
| | | 1mA ≤ $I_{OUT}$ ≤ 40mA | – | – | ***0.1*** | |
| PSRR | Power Supply Rejection Ratio | Frequency = 120Hz; 8V ≤ $V_{IN}$ ≤ 18V | 47 | 62 | – | dB |
| $V_{DROP}$ | Drop-out Voltage | $I_{OUT}$ = 40mA | – | 1.7 | 2.0 | V |
| | | $I_{OUT}$ = 100mA | – | 1.8 | 2.3 | |
| $V_{NOISE}$ | Noise over Output Voltage | 10Hz ≤ Frequency ≤ 100kHz *2 | – | 40 | – | µV |
| $\Delta V_{OUT}/\Delta T$ | Temperature Coefficient of Output Voltage | $I_{OUT}$ = 5mA | – | 0.42 | – | mV/ºC |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | – | 84 | – | ppm/ºC |

Note 2: For the purpose of minimizing the high-frequency noise on the application circuit, load capacitance with value of 0.01µF at the very least is recommended.

## Electrical Characteristics (Continued)

**YJ78L05A**: ($V_{IN}$ = 10V, $I_{OUT}$ = 40mA, $C_{IN}$ = 0.33μF, $C_{OUT}$ = 0.1μF, $T_J$ = 25ºC; *Italic* & **Bold** typefaces applies over -40ºC ≤ $T_J$ ≤ 125ºC unless otherwise specified)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | - | 4.9 | 5.0 | 5.1 | V |
| $\Delta V_{R\text{-}Load}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 100mA | – | 10 | 60 | mV |
| $\Delta V_{R\text{-}Line}$ | Line Regulation | 7V ≤ $V_{IN}$ ≤ 20V | – | 8 | 150 | mV |
| $I_Q$ | Quiescent Current | - | – | 3.0 | 5.5 | mA |
| $\Delta I_Q$ | Change to Quiescent Current | 8V ≤ $V_{IN}$ ≤ 20V | – | – | ***1.5*** | mA |
| | | 1mA ≤ $I_{OUT}$ ≤ 40mA | – | – | ***0.1*** | |
| PSRR | Power Supply Rejection Ratio | Frequency = 120Hz; 8V ≤ $V_{IN}$ ≤ 18V | 47 | 62 | – | dB |
| $V_{DROP}$ | Drop-out Voltage | $I_{OUT}$ = 40mA | – | 1.7 | | V |
| | | $I_{OUT}$ = 100mA | – | 1.8 | | |
| $V_{NOISE}$ | Noise over Output Voltage | 10Hz ≤ Frequency ≤ 100kHz [*2] | – | 40 | – | μV |
| $\Delta V_{OUT}/\Delta T$ | Temperature Coefficient of Output Voltage | $I_{OUT}$ = 5mA | – | 0.42 | – | mV/ºC |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | – | 84 | – | ppm/ºC |

Note 3: For the purpose of minimizing the high-frequency noise on the application circuit, load capacitance with value of 0.01μF at the very least is recommended.

**YJ78L12**: ($V_{IN}$ = 19V, $I_{OUT}$ = 40mA, $C_{IN}$ = 0.33μF, $C_{OUT}$ = 0.1μF, $T_J$ = 25ºC; *Italic* & **Bold** typefaces applies over -40ºC ≤ $T_J$ ≤ 125ºC unless otherwise stated)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| $V_{OUT}$ | Output Voltage | - | 11.5 | 12.0 | 12.5 | V |
| | | 14.5V ≤ $V_{IN}$ ≤ 27.0V<br>1mA ≤ $I_{OUT}$ ≤ 100mA; $P_D$ ≤ 0.75W | ***11.4*** | – | ***12.6*** | |
| $\Delta V_{R\text{-}Load}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 100mA | – | 20 | 100 | mV |
| $\Delta V_{R\text{-}Line}$ | Line Regulation | 14.5V ≤ $V_{IN}$ ≤ 27V | – | 20 | 250 | mV |
| $I_Q$ | Quiescent Current | - | – | 3.0 | 6.0 | mA |
| $\Delta I_Q$ | Change to Quiescent Current | 16V ≤ $V_{IN}$ ≤ 27V | – | – | ***1.5*** | mA |
| | | 1mA ≤ $I_{OUT}$ ≤ 40mA | – | – | ***0.1*** | |
| PSRR | Power Supply Rejection Ratio | Frequency = 120Hz; 15V ≤ $V_{IN}$ ≤ 25V | 37 | 42 | – | dB |
| $V_{DROP}$ | Drop-out Voltage | $I_{OUT}$ = 40mA | – | 1.7 | – | V |
| | | $I_{OUT}$ = 100mA | – | 1.8 | – | |
| $V_{NOISE}$ | Noise over Output Voltage | 10Hz ≤ Frequency ≤ 100kHz [*3] | – | 80 | – | μV |
| $\Delta V_{OUT}/\Delta T$ | Temperature Coefficient of Output Voltage | $I_{OUT}$ = 5mA | – | 1 | – | mV/ºC |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | – | 84 | – | ppm/ºC |

Note 4: For the purpose of minimizing the high-frequency noise on the application circuit, load capacitance with value of 0.01μF at the very least is recommended.

## Electrical Characteristics (Continued)

**YJ78L15**: ($V_{IN}$ = 23V, $I_{OUT}$ = 40mA, $C_{IN}$ = 0.33μF, $C_{OUT}$ = 0.1μF, $T_J$ = 25ºC; *Italic* & **Bold** typefaces applies over -40ºC ≤ $T_J$ ≤ 125ºC unless otherwise stated)

| Symbol | Parameter | 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<br>$P_D$ ≤ 0.75W | ***14.25*** | – | ***15.75*** | |
| $\Delta V_{R\text{-}Load}$ | Load Regulation | 1mA ≤ $I_{OUT}$ ≤ 100mA | – | 25 | 100 | mV |
| $\Delta V_{R\text{-}Line}$ | Line Regulation | 17.5V ≤ $V_{IN}$ ≤ 30.0V | – | 25 | 250 | mV |
| $I_Q$ | Quiescent Current | - | – | 3.0 | 6.0 | mA |
| $\Delta I_Q$ | Change to Quiescent Current | 20V ≤ $V_{IN}$ ≤ 30V | – | – | ***1.5*** | mA |
| | | 1mA ≤ $I_{OUT}$ ≤ 40mA | – | – | ***0.1*** | |
| PSRR | Power Supply Rejection Ratio | Frequency = 120Hz; 18.5V ≤ $V_{IN}$ ≤ 28.5V | 34 | 39 | – | dB |
| $V_{DROP}$ | Drop-out Voltage | $I_{OUT}$ = 40mA | – | 1.7 | – | V |
| | | $I_{OUT}$ = 100mA | – | 1.8 | – | |
| $V_{NOISE}$ | Noise over Output Voltage | 10Hz ≤ Frequency ≤ 100kHz [*4] | – | 90 | – | μV |
| $\Delta V_{OUT}/\Delta T$ | Temperature Coefficient of Output Voltage | $I_{OUT}$ = 5mA | – | 1.25 | – | mV/ºC |
| $(\Delta V_{OUT}/V_{OUT})/\Delta T$ | | | – | 84 | – | ppm/ºC |

Note 5: For the purpose of minimizing the high-frequency noise on the application circuit, load capacitance with value of 0.01μF at the very least is recommended.

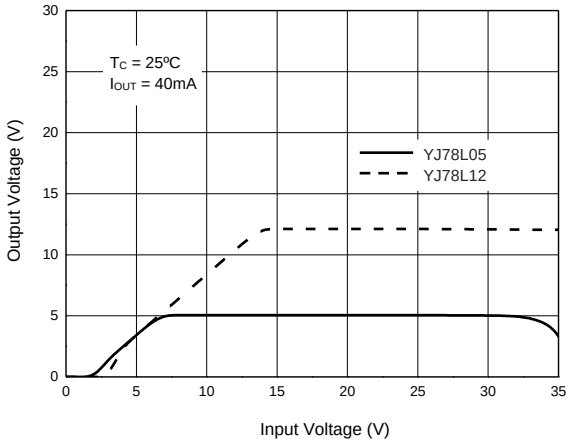
## Thermal Properties

Test Condition: Device mounted on FR-4 substrate, 2-layer PCB, 2oz copper, with minimum recommended cooling pad to dissipate heat

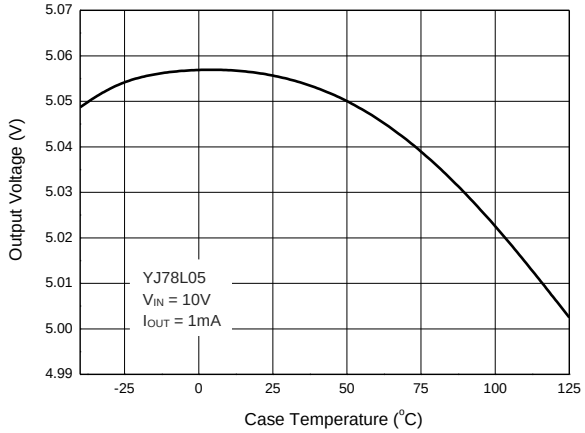
| Symbol | Parameter | Package | Rating | Unit |
|---|---|---|---|---|
| $R_{\Theta JC}$ | Thermal Resistance (junction-to-case) | SOT-89-3L | 28.3 | °C/W |

## Typical Performance Characteristics

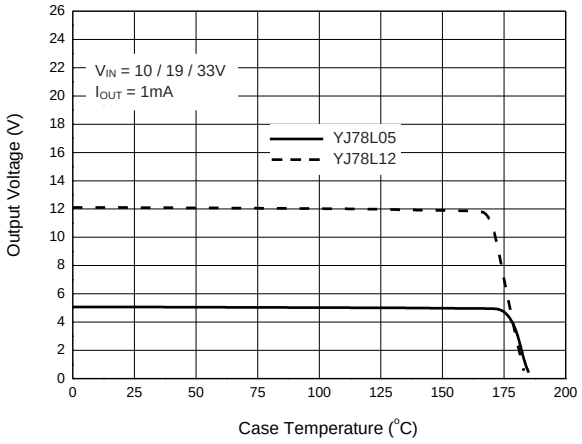
### Graph 1: Output Voltage vs. Input Voltage



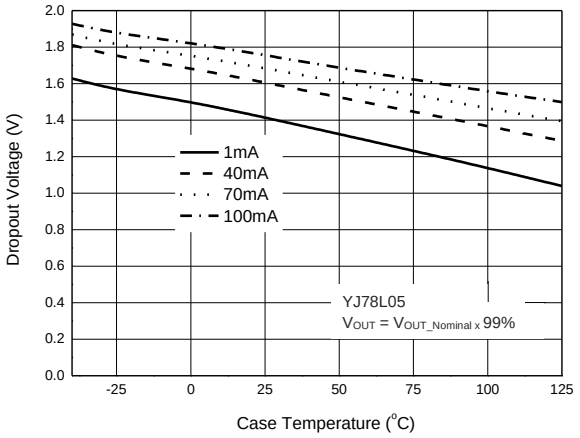

### Graph 2: Output Voltage vs. Case Temperature



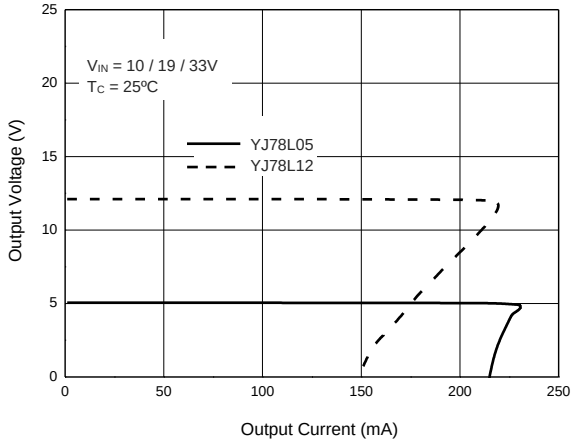

### Graph 3: Over Temperature Protection



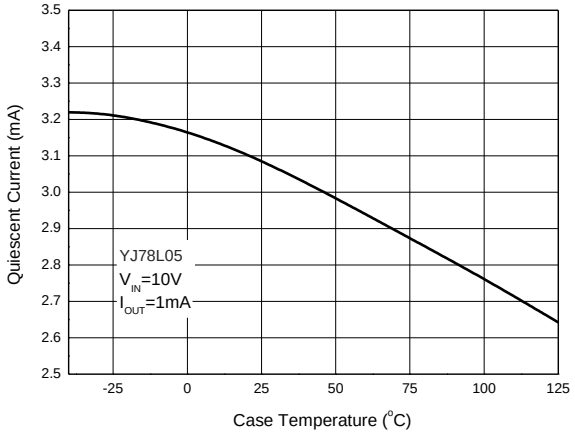

### Graph 4: Drop-out Voltage vs. Case Temperature




### Graph 5: Output Voltage vs. Output Current

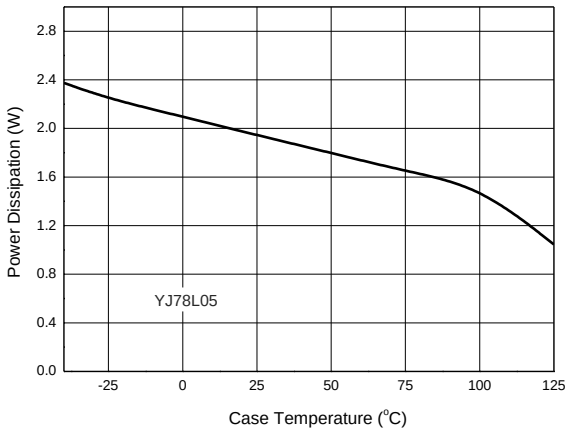



### Graph 6: Quiescent Current vs. Case Temperature

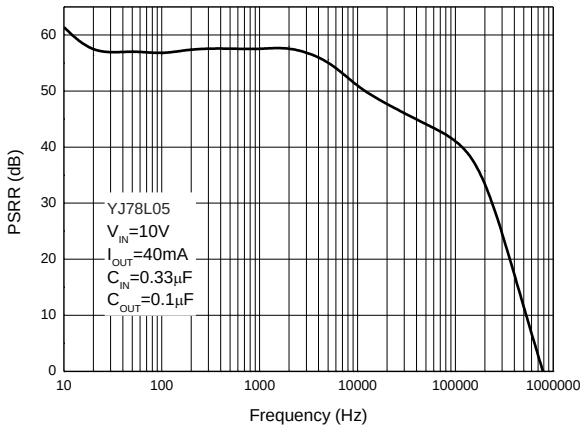


## Typical Performance Characteristics (Continued)

### Graph 7: Power Dissipation vs. Case Temperature

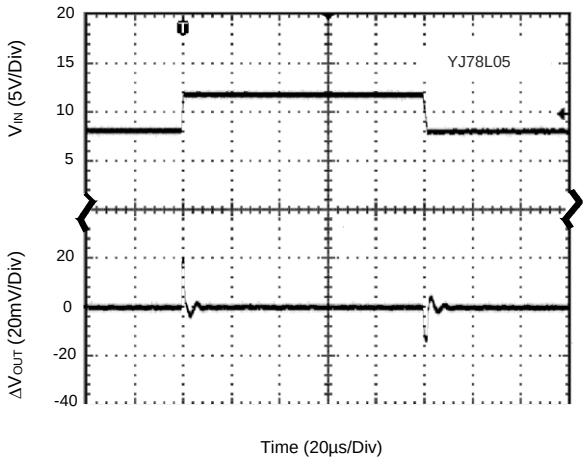



### Graph 8: PSRR vs. Frequency



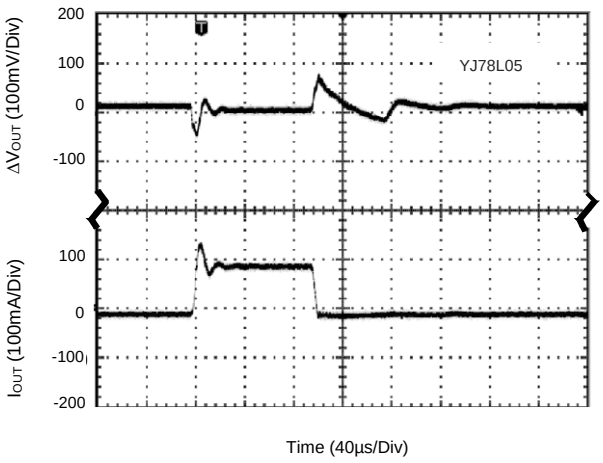

### Graph 9: Line Transient

(Conditions: $I_{OUT}$ = 40mA, $C_{IN}$ = 0.33µF, $C_{OUT}$ = 0.1µF)



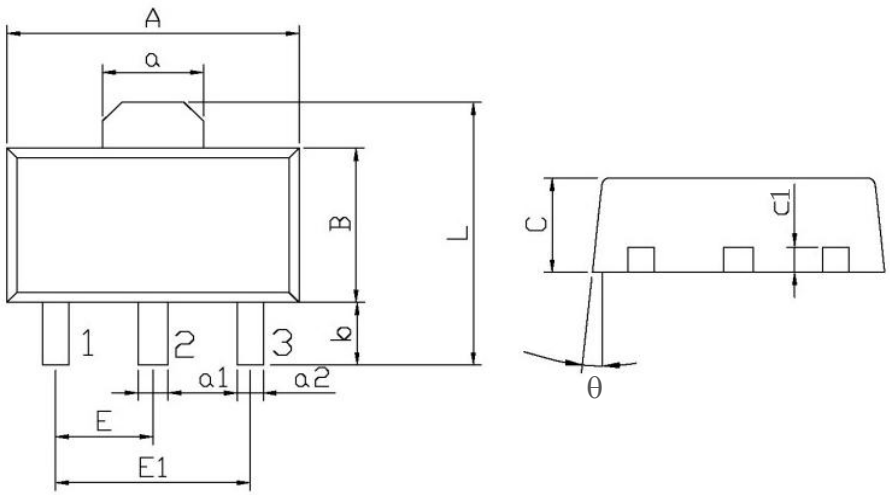

### Graph 10: Load Transient

(Conditions: $V_{IN}$ = 10V, $C_{IN}$ = 0.33µF, $C_{OUT}$ = 0.1µF)



## Package Outline (All measurements in mm & inch)

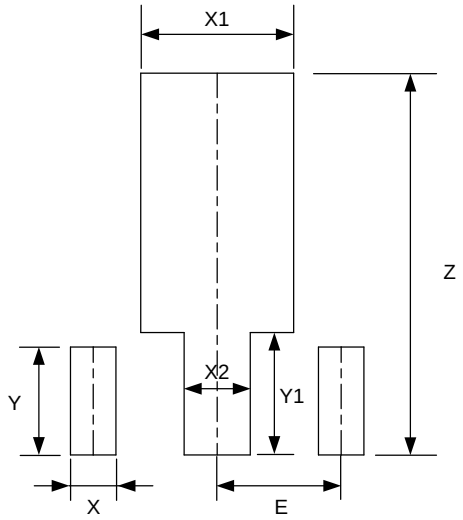
### Package Type: SOT-89-3L (J2)




| SOT-89-3L (J2) | | |
|---|---|---|
| Dimension | Min. | Max. |
| A | 1.40 | 1.60 |
| B | 0.45 | 0.55 |
| L | 0.38 | 0.48 |
| a | 0.36 | 0.46 |
| E | 4.40 | 4.60 |
| E1 | 1.60 | 1.80 |
| b | 2.40 | 2.60 |
| a1 | 4.00 | 4.30 |
| a2 | 1.00 | 2.00 |
| C | 2.95 | 3.05 |
| c1 | 0.80 | 1.00 |
| Θ | 6º | |
| All measurements in "mm" | | |

## Suggested Pad Layout (All measurements in mm & inch)

### Package Type: SOT-89-3L (J2)




| Dimension | Z (mm) / (inch) | X (mm) / (inch) | X1 (mm) / (inch) | X2 (mm) / (inch) | Y (mm) / (inch) | Y1 (mm) / (inch) | E (mm) / (inch) |
|---|---|---|---|---|---|---|---|
| Value | 4.600 / 0.181 | 0.550 / 0.022 | 1.850 / 0.073 | 0.800 / 0.031 | 1.300 / 0.051 | 1.475 / 0.058 | 1.500 / 0.059 |

## Disclaimer

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