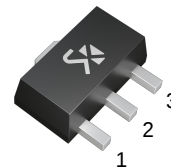


## 3-Terminal Positive Voltage Regulator

### FEATURE

- Maximum output current of 200mA
- Output voltage of 5V/6V/8V/9V/10V/12V/15V
- Thermal overload protection
- Short circuit current limiting



1: OUT 2: GND 3: IN

SOT-89 PLASTIC PACKAGE

### ABSOLUTE MAXIMUM RATINGS (Operating temperature range applies unless otherwise specified)

| Characteristic            | Symbol    | Value    | Units |
|---------------------------|-----------|----------|-------|
| Input voltage             | $V_{IN}$  | 30       | V     |
| Output Current            | $I_{OUT}$ | 200      | mA    |
| Junction Temperature      | $T_J$     | +125     | °C    |
| Operating Temperature     | $T_{OPR}$ | -40~+120 | °C    |
| Storage Temperature Range | $T_{STG}$ | -40~+150 | °C    |

### 78L05A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ ) (Unless otherwise specified, $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ , $V_I = 10\text{ V}$ , $I_O = 80\text{ mA}$ , $C_1 = 0.33\text{ }\mu\text{F}$ , $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                   | MIN  | TYP  | MAX  | Unit          |
|----------------------------------|-------------------------|-----------------------------------------------------------------------------------|------|------|------|---------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                          | 4.8  | 5.0  | 5.2  | V             |
|                                  |                         | $7\text{ V} \leq V_I \leq 20\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 4.75 |      | 5.25 | V             |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                            | 4.75 |      | 5.25 | V<br>(Note 1) |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                    |      | 15   | 60   | mV            |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                     |      | 10   | 30   | mV            |
| Line regulation                  | $\Delta V_O$            | $7\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$                    |      | 10   | 150  | mV            |
|                                  |                         | $8\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$                    |      | 5    | 100  | mV            |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                          |      | 2.0  | 5.5  | mA            |
| Quiescent Current Change         | $\Delta I_q$            | $8\text{ V} \leq V_I \leq 20\text{ V}$                                            |      |      | 1.5  | mA            |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                          |      |      | 0.1  | mA            |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                 |      | 40   |      | $\mu\text{V}$ |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                               |      | 0.65 |      | mV/°C         |
| Ripple Rejection                 | RR                      | $8\text{ V} \leq V_I \leq 18\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 40   | 49   |      | dB            |
| Dropout Voltage                  | $V_d$                   |                                                                                   |      | 1.7  |      | V             |

# 78L05A THRU 78L15A

**78L06A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 12\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                   | MIN  | TYP  | MAX  | Unit                       |
|----------------------------------|-------------------------|-----------------------------------------------------------------------------------|------|------|------|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                          | 5.75 | 6.0  | 6.25 | V                          |
|                                  |                         | $8\text{ V} \leq V_I \leq 21\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 5.7  |      | 6.3  | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                            | 5.7  |      | 6.3  | V<br>(Note 1)              |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                    |      | 18   | 60   | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                     |      | 12   | 30   | mV                         |
| Line regulation                  | $\Delta V_O$            | $8.5\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$                  |      | 12   | 150  | mV                         |
|                                  |                         | $9\text{ V} \leq V_I \leq 20\text{ V}, T_J = 25^\circ\text{C}$                    |      | 6    | 100  | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                          |      | 2.0  | 5.5  | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $9\text{ V} \leq V_I \leq 20\text{ V}$                                            |      |      | 1.5  | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                          |      |      | 0.1  | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                 |      | 50   |      | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                               |      | 0.75 |      | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $9\text{ V} \leq V_I \leq 20\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 38   | 46   |      | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                   |      | 1.7  |      | V                          |

**78L08A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 14\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                    | MIN | TYP | MAX | Unit                       |
|----------------------------------|-------------------------|------------------------------------------------------------------------------------|-----|-----|-----|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                           | 7.7 | 8.0 | 8.3 | V                          |
|                                  |                         | $10\text{ V} \leq V_I \leq 23\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 7.6 |     | 8.4 | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                             | 7.6 |     | 8.4 | V<br>(Note1)               |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                     |     | 24  | 80  | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                      |     | 16  | 40  | mV                         |
| Line regulation                  | $\Delta V_O$            | $10.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                  |     | 16  | 175 | mV                         |
|                                  |                         | $11\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                    |     | 8   | 125 | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                           |     | 2.0 | 5.5 | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $11\text{ V} \leq V_I \leq 23\text{ V}$                                            |     |     | 1.5 | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                           |     |     | 0.1 | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                  |     | 60  |     | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                                |     | 0.8 |     | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $12\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 36  | 45  |     | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                    |     | 1.7 |     | V                          |

# 78L05A THRU 78L15A

**78L09A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 15\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                    | MIN  | TYP  | MAX  | Unit                       |
|----------------------------------|-------------------------|------------------------------------------------------------------------------------|------|------|------|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                           | 8.64 | 9.0  | 9.36 | V                          |
|                                  |                         | $11\text{ V} \leq V_I \leq 24\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 8.55 |      | 9.45 | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                             | 8.55 |      | 9.45 | V<br>(Note 1)              |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                     |      | 27   | 80   | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                      |      | 18   | 40   | mV                         |
| Line regulation                  | $\Delta V_O$            | $11.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                  |      | 18   | 225  | mV                         |
|                                  |                         | $12\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                    |      | 9    | 150  | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                           |      | 2.0  | 5.5  | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $12\text{ V} \leq V_I \leq 23\text{ V}$                                            |      |      | 1.5  | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                           |      |      | 0.1  | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                  |      | 70   |      | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                                |      | 0.85 |      | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $12\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 36   | 44   |      | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                    |      | 1.7  |      | V                          |

**78L10A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 16\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                    | MIN | TYP  | MAX  | Unit                       |
|----------------------------------|-------------------------|------------------------------------------------------------------------------------|-----|------|------|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                           | 9.6 | 10.0 | 10.4 | V                          |
|                                  |                         | $12\text{ V} \leq V_I \leq 25\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 9.5 |      | 10.5 | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                             | 9.5 |      | 10.5 | V<br>(Note 1)              |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                     |     | 30   | 90   | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                      |     | 20   | 45   | mV                         |
| Line regulation                  | $\Delta V_O$            | $12.5\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                  |     | 20   | 230  | mV                         |
|                                  |                         | $13\text{ V} \leq V_I \leq 23\text{ V}, T_J = 25^\circ\text{C}$                    |     | 10   | 170  | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                           |     | 2.0  | 5.5  | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $13\text{ V} \leq V_I \leq 23\text{ V}$                                            |     |      | 1.5  | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                           |     |      | 0.1  | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                  |     | 60   |      | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                                |     | 0.9  |      | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $14\text{ V} \leq V_I \leq 23\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 36  | 45   |      | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                    |     | 1.7  |      | V                          |

# 78L05A THRU 78L15A

**78L12A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 19\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

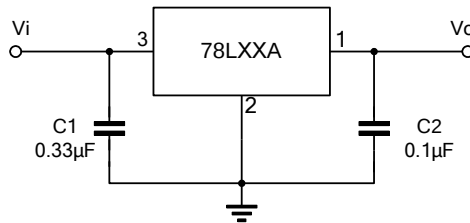
| Characteristic                   | Symbol                  | Test conditions                                                                    | MIN  | TYP | MAX  | Unit                       |
|----------------------------------|-------------------------|------------------------------------------------------------------------------------|------|-----|------|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                           | 11.5 | 12  | 12.6 | V                          |
|                                  |                         | $14\text{ V} \leq V_I \leq 27\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$       | 11.4 |     | 12.6 | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                             | 11.4 |     | 12.6 | V<br>(Note 1)              |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                     |      | 36  | 100  | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                      |      | 24  | 50   | mV                         |
| Line regulation                  | $\Delta V_O$            | $14.5\text{ V} \leq V_I \leq 27\text{ V}, T_J = 25^\circ\text{C}$                  |      | 24  | 250  | mV                         |
|                                  |                         | $16\text{ V} \leq V_I \leq 27\text{ V}, T_J = 25^\circ\text{C}$                    |      | 12  | 200  | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                           |      | 2.0 | 5.5  | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $16\text{ V} \leq V_I \leq 27\text{ V}$                                            |      |     | 1.5  | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                           |      |     | 0.1  | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                  |      | 80  |      | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                                |      | 1.0 |      | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $15\text{ V} \leq V_I \leq 25\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 36   | 42  |      | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                    |      | 1.7 |      | V                          |

**78L15A Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )** (Unless otherwise specified,  $0^\circ\text{C} \leq T_J \leq 125^\circ\text{C}$ ,  $V_I = 21\text{ V}$ ,  $I_O = 80\text{ mA}$ ,  $C_1 = 0.33\text{ }\mu\text{F}$ ,  $C_2 = 0.1\text{ }\mu\text{F}$ )

| Characteristic                   | Symbol                  | Test conditions                                                                        | MIN   | TYP | MAX   | Unit                       |
|----------------------------------|-------------------------|----------------------------------------------------------------------------------------|-------|-----|-------|----------------------------|
| Output Voltage                   | $V_O$                   | $T_J = 25^\circ\text{C}$                                                               | 14.4  | 15  | 15.6  | V                          |
|                                  |                         | $17\text{ V} \leq V_I \leq 30\text{ V}, I_O = 1\text{ mA} \sim 80\text{ mA}$           | 14.25 |     | 15.75 | V                          |
|                                  |                         | $I_O = 1\text{ mA} \sim 140\text{ mA}$                                                 | 14.25 |     | 15.75 | V<br>(Note 1)              |
| Load Regulation                  | $\Delta V_O$            | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 200\text{ mA}$                         |       | 45  | 150   | mV                         |
|                                  |                         | $T_J = 25^\circ\text{C}, I_O = 1\text{ mA} \sim 80\text{ mA}$                          |       | 30  | 75    | mV                         |
| Line regulation                  | $\Delta V_O$            | $17.5\text{ V} \leq V_I \leq 30\text{ V}, T_J = 25^\circ\text{C}$                      |       | 30  | 300   | mV                         |
|                                  |                         | $20\text{ V} \leq V_I \leq 30\text{ V}, T_J = 25^\circ\text{C}$                        |       | 15  | 250   | mV                         |
| Quiescent Current                | $I_q$                   | $T_J = 25^\circ\text{C}$                                                               |       | 2.2 | 6.0   | mA                         |
| Quiescent Current Change         | $\Delta I_q$            | $20\text{ V} \leq V_I \leq 30\text{ V}$                                                |       |     | 1.5   | mA                         |
|                                  | $\Delta I_q$            | $1\text{ mA} \leq V_I \leq 80\text{ mA}$                                               |       |     | 0.1   | mA                         |
| Output Noise Voltage             | $V_N$                   | $10\text{ Hz} \leq f \leq 100\text{ kHz}, T_J = 25^\circ\text{C}$                      |       | 90  |       | $\mu\text{V}$              |
| Temperature coefficient of $V_O$ | $\Delta V_O / \Delta T$ | $I_O = 5\text{ mA}$                                                                    |       | 1.3 |       | $\text{mV}/^\circ\text{C}$ |
| Ripple Rejection                 | RR                      | $18.5\text{ V} \leq V_I \leq 28.5\text{ V}, f = 120\text{ Hz}, T_J = 25^\circ\text{C}$ | 33    | 39  |       | dB                         |
| Dropout Voltage                  | $V_d$                   |                                                                                        |       | 1.7 |       | V                          |

Note 1: Power dissipation  $< 0.75\text{ W}$ .

## TYPICAL APPLICATION



Note 1: To specify an output voltage, substitute voltage value for "XX".

Note 2: Bypass capacitors are recommended for optimum stability and transient response and should be located as close as possible to the regulators.

## TYPICAL PERFORMANCE CHARACTERISTICS

Fig.1 78L33A Output Voltage vs Ambient Temperature

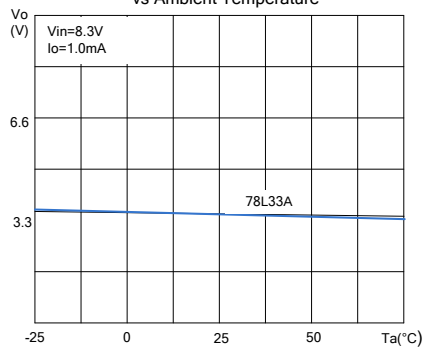


Fig.2 78L33A Quiescent Current vs Output Current

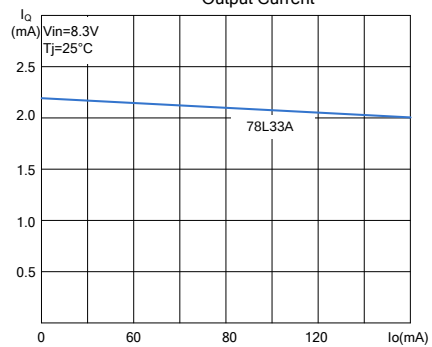


Fig.3 78L33A Quiescent Current vs Input

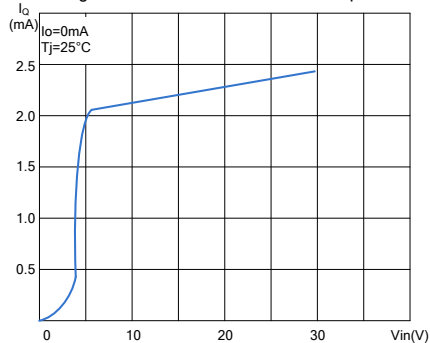


Fig.4 78L33A Thermal Shutdown

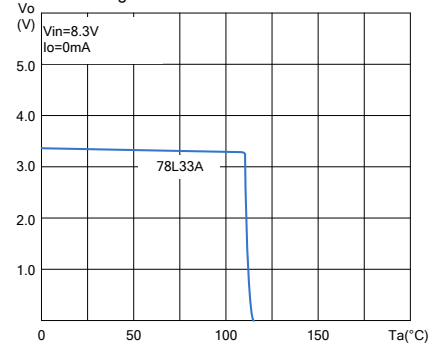


Fig.5 78L33A Output Characteristics

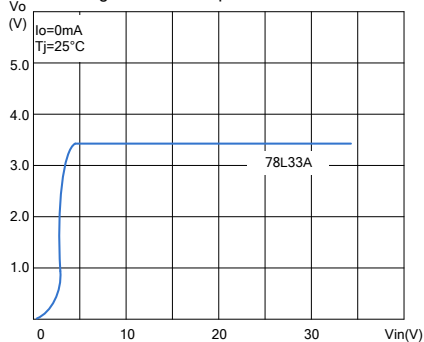


Fig.6 78L33A Dropout Characteristics

