

# KA78XXE/KA78XXAE

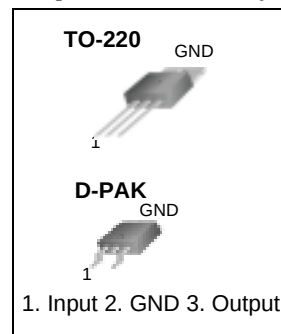
## 3-Terminal 1A Positive Voltage Regulator

### Features

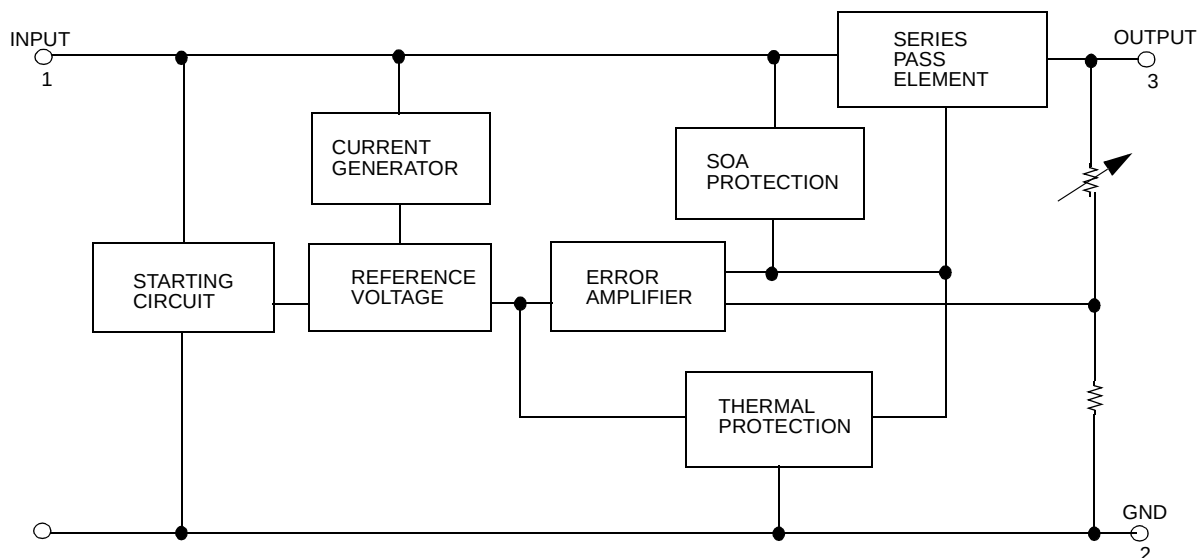
- Output Current up to 1A
- Output Voltages of 5, 6, 8, 9, 12, 15, 18, 24V
- Thermal Overload Protection
- Short Circuit Protection
- Output Transistor Safe Operating Area Protection

### Description

The KA78XXE/KA78XXAE series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible. If adequate heat sinking is provided, they can deliver over 1A output current. Although designed primarily as fixed voltage regulators, these devices can be used with external components to obtain adjustable voltages and currents.



### Internal Block Diagram



Rev. 1.0.0

## Absolute Maximum Ratings

| Parameter                                                      | Symbol          | Value           | Unit          |
|----------------------------------------------------------------|-----------------|-----------------|---------------|
| Input Voltage (for $V_O = 5V$ to $18V$ )<br>(for $V_O = 24V$ ) | $V_I$           | 35              | V             |
|                                                                | $V_I$           | 40              | V             |
| Thermal Resistance Junction-Cases (TO-220)                     | $R_{\theta JC}$ | 5               | $^{\circ}C/W$ |
| Thermal Resistance Junction-Air (TO-220)                       | $R_{\theta JA}$ | 65              | $^{\circ}C/W$ |
| Operating Temperature Range (KA78XXE/AE/ER)                    | $T_{OPR}$       | $0 \sim +125$   | $^{\circ}C$   |
| Storage Temperature Range                                      | $T_{STG}$       | $-65 \sim +150$ | $^{\circ}C$   |

## Electrical Characteristics (KA7805E/KA7805ER)

(Refer to test circuit,  $0^{\circ}C < T_J < 125^{\circ}C$ ,  $I_O = 500mA$ ,  $V_I = 10V$ ,  $C_I = 0.33\mu F$ ,  $C_O = 0.1\mu F$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                         | KA7805E                  |      |      | Unit            |
|------------------------------|-------------------------|--------------------------------------------------------------------|--------------------------|------|------|-----------------|
|                              |                         |                                                                    | Min.                     | Typ. | Max. |                 |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}C$                                               | 4.8                      | 5.0  | 5.2  | V               |
|                              |                         | $5.0mA \leq I_O \leq 1.0A$ , $P_O \leq 15W$<br>$V_I = 7V$ to $20V$ | 4.75                     | 5.0  | 5.25 |                 |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}C$                                               | $V_O = 7V$ to $25V$      |      | -    | mV              |
|                              |                         |                                                                    | $V_I = 8V$ to $12V$      |      | -    |                 |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}C$                                               | $I_O = 5.0mA$ to $1.5A$  |      | -    | mV              |
|                              |                         |                                                                    | $I_O = 250mA$ to $750mA$ |      | -    |                 |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}C$                                               | -                        | 5.0  | 8.0  | mA              |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5mA$ to $1.0A$                                              | -                        | 0.03 | 0.5  | mA              |
|                              |                         | $V_I = 7V$ to $25V$                                                | -                        | 0.3  | 1.3  |                 |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5mA$                                                        | -                        | -0.8 | -    | mV/ $^{\circ}C$ |
| Output Noise Voltage         | $V_N$                   | $f = 10Hz$ to $100kHz$ , $T_A = +25^{\circ}C$                      | -                        | 42   | -    | $\mu V/V_O$     |
| Ripple Rejection (Note2)     | RR                      | $f = 120Hz$<br>$V_O = 8V$ to $18V$                                 | 62                       | 73   | -    | dB              |
| Dropout Voltage              | $V_{Drop}$              | $I_O = 1A$ , $T_J = +25^{\circ}C$                                  | -                        | 2    | -    | V               |
| Output Resistance (Note2)    | $r_O$                   | $f = 1kHz$                                                         | -                        | 15   | -    | m $\Omega$      |
| Short Circuit Current        | $I_{SC}$                | $V_I = 35V$ , $T_A = +25^{\circ}C$                                 | -                        | 230  | -    | mA              |
| Peak Current (Note2)         | $I_{PK}$                | $T_J = +25^{\circ}C$                                               | -                        | 2.2  | -    | A               |

### Note:

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7806E/KA7806ER)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 11\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol  | Conditions                                      |                    | KA7806E |      |      | Unit  |
|------------------------------|---------|-------------------------------------------------|--------------------|---------|------|------|-------|
|                              |         |                                                 |                    | Min.    | Typ. | Max. |       |
| Output Voltage               | VO      | TJ =+25°C                                       |                    | 5.75    | 6.0  | 6.25 | V     |
|                              |         | 5.0mA ≤ IO ≤ 1.0A, PO ≤ 15W<br>VI = 8.0V to 21V |                    | 5.7     | 6.0  | 6.3  |       |
| Line Regulation (Note1)      | Regline | TJ =+25°C                                       | VI = 8V to 25V     | -       | 5    | 120  | mV    |
|                              |         |                                                 | VI = 9V to 13V     | -       | 1.5  | 60   |       |
| Load Regulation (Note1)      | Regload | TJ =+25°C                                       | IO =5mA to 1.5A    | -       | 9    | 120  | mV    |
|                              |         |                                                 | IO =250mA to 750mA | -       | 3    | 60   |       |
| Quiescent Current            | IQ      | TJ =+25°C                                       |                    | -       | 5.0  | 8.0  | mA    |
| Quiescent Current Change     | ΔIQ     | IO = 5mA to 1A                                  |                    | -       | -    | 0.5  | mA    |
|                              |         | VI = 8V to 25V                                  |                    | -       | -    | 1.3  |       |
| Output Voltage Drift (Note2) | ΔVO/ΔT  | IO = 5mA                                        |                    | -       | -0.8 | -    | mV/°C |
| Output Noise Voltage         | VN      | f = 10Hz to 100kHz, TA =+25°C                   |                    | -       | 45   | -    | μV/VO |
| Ripple Rejection (Note2)     | RR      | f = 120Hz<br>VI = 9V to 19V                     |                    | 59      | 75   | -    | dB    |
| Dropout Voltage              | VDrop   | IO = 1A, TJ =+25°C                              |                    | -       | 2    | -    | V     |
| Output Resistance(Note2)     | ro      | f = 1kHz                                        |                    | -       | 19   | -    | mΩ    |
| Short Circuit Current        | ISC     | VI = 35V, TA=+25°C                              |                    | -       | 250  | -    | mA    |
| Peak Current (Note2)         | IPK     | TJ =+25°C                                       |                    | -       | 2.2  | -    | A     |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7808E/KA7808ER)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 14\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                              |                                       | KA7808E |      |      | Unit                   |
|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------|---------|------|------|------------------------|
|                              |                         |                                                                                                         |                                       | Min.    | Typ. | Max. |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | 7.7     | 8.0  | 8.3  | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 10.5\text{V to } 23\text{V}$ |                                       | 7.6     | 8.0  | 8.4  |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                             | $V_I = 10.5\text{V to } 25\text{V}$   | -       | 5.0  | 160  | mV                     |
|                              |                         |                                                                                                         | $V_I = 11.5\text{V to } 17\text{V}$   | -       | 2.0  | 80   |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                             | $I_O = 5.0\text{mA to } 1.5\text{A}$  | -       | 10   | 160  | mV                     |
|                              |                         |                                                                                                         | $I_O = 250\text{mA to } 750\text{mA}$ | -       | 5.0  | 80   |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 5.0  | 8.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                      |                                       | -       | 0.05 | 0.5  | mA                     |
|                              |                         | $V_I = 10.5\text{A to } 25\text{V}$                                                                     |                                       | -       | 0.5  | 1.0  |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                      |                                       | -       | -0.8 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                       |                                       | -       | 52   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$ , $V_I = 11.5\text{V to } 21.5\text{V}$                                              |                                       | 56      | 73   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                         |                                       | -       | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                       |                                       | -       | 17   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                        |                                       | -       | 230  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7809E/KA7809ER)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 15\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                              |                                       | KA7809E |      |      | Unit                   |
|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------|---------|------|------|------------------------|
|                              |                         |                                                                                                         |                                       | Min.    | Typ. | Max. |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | 8.65    | 9    | 9.35 | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 11.5\text{V to } 24\text{V}$ |                                       | 8.6     | 9    | 9.4  |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                             | $V_I = 11.5\text{V to } 25\text{V}$   | -       | 6    | 180  | mV                     |
|                              |                         |                                                                                                         | $V_I = 12\text{V to } 17\text{V}$     | -       | 2    | 90   |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                             | $I_O = 5\text{mA to } 1.5\text{A}$    | -       | 12   | 180  | mV                     |
|                              |                         |                                                                                                         | $I_O = 250\text{mA to } 750\text{mA}$ | -       | 4    | 90   |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 5.0  | 8.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                      |                                       | -       | -    | 0.5  | mA                     |
|                              |                         | $V_I = 11.5\text{V to } 26\text{V}$                                                                     |                                       | -       | -    | 1.3  |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                      |                                       | -       | -1   | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                       |                                       | -       | 58   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$<br>$V_I = 13\text{V to } 23\text{V}$                                                 |                                       | 56      | 71   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                         |                                       | -       | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                       |                                       | -       | 17   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                        |                                       | -       | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7812E/KA7812ER)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 19\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                              |                                       | KA7812E/KA7812ER |      |      | Unit                   |
|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------|------------------|------|------|------------------------|
|                              |                         |                                                                                                         |                                       | Min.             | Typ. | Max. |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | 11.5             | 12   | 12.5 | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 14.5\text{V to } 27\text{V}$ |                                       | 11.4             | 12   | 12.6 |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                             | $V_I = 14.5\text{V to } 30\text{V}$   | -                | 10   | 240  | mV                     |
|                              |                         |                                                                                                         | $V_I = 16\text{V to } 22\text{V}$     | -                | 3.0  | 120  |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                             | $I_O = 5\text{mA to } 1.5\text{A}$    | -                | 11   | 240  | mV                     |
|                              |                         |                                                                                                         | $I_O = 250\text{mA to } 750\text{mA}$ | -                | 5.0  | 120  |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -                | 5.1  | 8.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                      |                                       | -                | 0.1  | 0.5  | mA                     |
|                              |                         | $V_I = 14.5\text{V to } 30\text{V}$                                                                     |                                       | -                | 0.5  | 1.0  |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                      |                                       | -                | -1   | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                       |                                       | -                | 76   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$<br>$V_I = 15\text{V to } 25\text{V}$                                                 |                                       | 55               | 71   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                         |                                       | -                | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                       |                                       | -                | 18   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                        |                                       | -                | 230  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -                | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7815E)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 23\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                              |                                       | KA7815E |      |       | Unit                   |
|------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------|---------------------------------------|---------|------|-------|------------------------|
|                              |                         |                                                                                                         |                                       | Min.    | Typ. | Max.  |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | 14.4    | 15   | 15.6  | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 17.5\text{V to } 30\text{V}$ |                                       | 14.25   | 15   | 15.75 |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                             | $V_I = 17.5\text{V to } 30\text{V}$   | -       | 11   | 300   | mV                     |
|                              |                         |                                                                                                         | $V_I = 20\text{V to } 26\text{V}$     | -       | 3    | 150   |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                             | $I_O = 5\text{mA to } 1.5\text{A}$    | -       | 12   | 300   | mV                     |
|                              |                         |                                                                                                         | $I_O = 250\text{mA to } 750\text{mA}$ | -       | 4    | 150   |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 5.2  | 8.0   | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                      |                                       | -       | -    | 0.5   | mA                     |
|                              |                         | $V_I = 17.5\text{V to } 30\text{V}$                                                                     |                                       | -       | -    | 1.0   |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                      |                                       | -       | -1   | -     | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                       |                                       | -       | 90   | -     | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$<br>$V_I = 18.5\text{V to } 28.5\text{V}$                                             |                                       | 54      | 70   | -     | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                         |                                       | -       | 2    | -     | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                       |                                       | -       | 19   | -     | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                        |                                       | -       | 250  | -     | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                             |                                       | -       | 2.2  | -     | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7818E)** (Continued)(Refer to test circuit,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 27\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                            |                                       | KA7818E |      |      | Unit                   |
|------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------|---------|------|------|------------------------|
|                              |                         |                                                                                                       |                                       | Min.    | Typ. | Max. |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | 17.3    | 18   | 18.7 | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 21\text{V to } 33\text{V}$ |                                       | 17.1    | 18   | 18.9 |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                           | $V_I = 21\text{V to } 33\text{V}$     | -       | 15   | 360  | mV                     |
|                              |                         |                                                                                                       | $V_I = 24\text{V to } 30\text{V}$     | -       | 5    | 180  |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                           | $I_O = 5\text{mA to } 1.5\text{A}$    | -       | 15   | 360  | mV                     |
|                              |                         |                                                                                                       | $I_O = 250\text{mA to } 750\text{mA}$ | -       | 5.0  | 180  |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | -       | 5.2  | 8.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                    |                                       | -       | -    | 0.5  | mA                     |
|                              |                         | $V_I = 21\text{V to } 33\text{V}$                                                                     |                                       | -       | -    | 1    |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                    |                                       | -       | -1   | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                     |                                       | -       | 110  | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$<br>$V_I = 22\text{V to } 32\text{V}$                                               |                                       | 53      | 69   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                       |                                       | -       | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                     |                                       | -       | 22   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                      |                                       | -       | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | -       | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.



**Electrical Characteristics (KA7824E)** (Continued)(Refer to test circuit ,  $0^{\circ}\text{C} < T_J < 125^{\circ}\text{C}$ ,  $I_O = 500\text{mA}$ ,  $V_I = 33\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol                  | Conditions                                                                                            |                                       | KA7824E |      |       | Unit                   |
|------------------------------|-------------------------|-------------------------------------------------------------------------------------------------------|---------------------------------------|---------|------|-------|------------------------|
|                              |                         |                                                                                                       |                                       | Min.    | Typ. | Max.  |                        |
| Output Voltage               | $V_O$                   | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | 23      | 24   | 25    | V                      |
|                              |                         | $5.0\text{mA} \leq I_O \leq 1.0\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 27\text{V to } 38\text{V}$ |                                       | 22.8    | 24   | 25.25 |                        |
| Line Regulation (Note1)      | Regline                 | $T_J = +25^{\circ}\text{C}$                                                                           | $V_I = 27\text{V to } 38\text{V}$     | -       | 17   | 480   | mV                     |
|                              |                         |                                                                                                       | $V_I = 30\text{V to } 36\text{V}$     | -       | 6    | 240   |                        |
| Load Regulation (Note1)      | Regload                 | $T_J = +25^{\circ}\text{C}$                                                                           | $I_O = 5\text{mA to } 1.5\text{A}$    | -       | 15   | 480   | mV                     |
|                              |                         |                                                                                                       | $I_O = 250\text{mA to } 750\text{mA}$ | -       | 5.0  | 240   |                        |
| Quiescent Current            | $I_Q$                   | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | -       | 5.2  | 8.0   | mA                     |
| Quiescent Current Change     | $\Delta I_Q$            | $I_O = 5\text{mA to } 1.0\text{A}$                                                                    |                                       | -       | 0.1  | 0.5   | mA                     |
|                              |                         | $V_I = 27\text{V to } 38\text{V}$                                                                     |                                       | -       | 0.5  | 1     |                        |
| Output Voltage Drift (Note2) | $\Delta V_O / \Delta T$ | $I_O = 5\text{mA}$                                                                                    |                                       | -       | -1.5 | -     | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$                   | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                                     |                                       | -       | 60   | -     | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                      | $f = 120\text{Hz}$<br>$V_I = 28\text{V to } 38\text{V}$                                               |                                       | 50      | 67   | -     | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$       | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                       |                                       | -       | 2    | -     | V                      |
| Output Resistance (Note2)    | $r_O$                   | $f = 1\text{kHz}$                                                                                     |                                       | -       | 28   | -     | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$         | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                      |                                       | -       | 230  | -     | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$         | $T_J = +25^{\circ}\text{C}$                                                                           |                                       | -       | 2.2  | -     | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Changes in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7805AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 10\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                     | Min.                               | Typ. | Max. | Unit                   |
|------------------------------|---------------------|------------------------------------------------------------------------------------------------|------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                    | 4.9                                | 5    | 5.1  | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 7.5\text{V to } 20\text{V}$ | 4.8                                | 5    | 5.2  |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 7.5\text{V to } 25\text{V}$<br>$I_O = 500\text{mA}$                                     | -                                  | 5    | 50   | mV                     |
|                              |                     | $V_I = 8\text{V to } 12\text{V}$                                                               | -                                  | 3    | 50   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                    | $V_I = 7.3\text{V to } 20\text{V}$ | -    | 5    | 50                     |
|                              |                     |                                                                                                | $V_I = 8\text{V to } 12\text{V}$   | -    | 1.5  | 25                     |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$<br>$I_O = 5\text{mA to } 1.5\text{A}$                              | -                                  | 9    | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$                                                               | -                                  | 9    | 100  |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                          | -                                  | 4    | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                    | -                                  | 5.0  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $I_O = 5\text{mA to } 1\text{A}$                                                               | -                                  | -    | 0.5  | mA                     |
|                              |                     | $V_I = 8\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                        | -                                  | -    | 0.8  |                        |
|                              |                     | $V_I = 7.5\text{V to } 20\text{V}$ , $T_J = +25^{\circ}\text{C}$                               | -                                  | -    | 0.8  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                             | -                                  | -0.8 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$<br>$T_A = +25^{\circ}\text{C}$                             | -                                  | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 8\text{V to } 18\text{V}$                  | -                                  | 68   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                | -                                  | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                              | -                                  | 17   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                               | -                                  | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                    | -                                  | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7806AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 11\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                     | Min.                               | Typ. | Max. | Unit                   |
|------------------------------|---------------------|------------------------------------------------------------------------------------------------|------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                    | 5.58                               | 6    | 6.12 | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 8.6\text{V to } 21\text{V}$ | 5.76                               | 6    | 6.24 |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 8.6\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                      | -                                  | 5    | 60   | mV                     |
|                              |                     | $V_I = 9\text{V to } 13\text{V}$                                                               | -                                  | 3    | 60   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                    | $V_I = 8.3\text{V to } 21\text{V}$ | 5    | 60   |                        |
|                              |                     |                                                                                                | $V_I = 9\text{V to } 13\text{V}$   | 1.5  | 30   |                        |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA to } 1.5\text{A}$                               | -                                  | 9    | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$                                                               | -                                  | 4    | 100  |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                          | -                                  | 5.0  | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                    | -                                  | 4.3  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $I_O = 5\text{mA to } 1\text{A}$                                                               | -                                  | -    | 0.5  | mA                     |
|                              |                     | $V_I = 9\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                        | -                                  | -    | 0.8  |                        |
|                              |                     | $V_I = 8.5\text{V to } 21\text{V}$ , $T_J = +25^{\circ}\text{C}$                               | -                                  | -    | 0.8  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                             | -                                  | -0.8 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                              | -                                  | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 9\text{V to } 19\text{V}$                  | -                                  | 65   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                | -                                  | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                              | -                                  | 17   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                               | -                                  | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                    | -                                  | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7808AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 14\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                      | Min.                                | Typ. | Max. | Unit                   |
|------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                     | 7.84                                | 8    | 8.16 | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 10.6\text{V to } 23\text{V}$ | 7.7                                 | 8    | 8.3  |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 10.6\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                      | -                                   | 6    | 80   | mV                     |
|                              |                     | $V_I = 11\text{V to } 17\text{V}$                                                               | -                                   | 3    | 80   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                     | $V_I = 10.4\text{V to } 23\text{V}$ | -    | 6    | 80                     |
|                              |                     |                                                                                                 | $V_I = 11\text{V to } 17\text{V}$   | -    | 2    | 40                     |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA to } 1.5\text{A}$                                | -                                   | 12   | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$                                                                | -                                   | 12   | 100  |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                           | -                                   | 5    | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 5.0  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $I_O = 5\text{mA to } 1\text{A}$                                                                | -                                   | -    | 0.5  | mA                     |
|                              |                     | $V_I = 11\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                        | -                                   | -    | 0.8  |                        |
|                              |                     | $V_I = 10.6\text{V to } 23\text{V}$ , $T_J = +25^{\circ}\text{C}$                               | -                                   | -    | 0.8  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                              | -                                   | -0.8 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                               | -                                   | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 11.5\text{V to } 21.5\text{V}$              | -                                   | 62   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                 | -                                   | 2    | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                               | -                                   | 18   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                | -                                   | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7809AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 15\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                      | Min.                                | Typ. | Max. | Unit                   |
|------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                     | 8.82                                | 9.0  | 9.18 | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 11.2\text{V to } 24\text{V}$ | 8.65                                | 9.0  | 9.35 |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 11.7\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                      | -                                   | 6    | 90   | mV                     |
|                              |                     | $V_I = 12.5\text{V to } 19\text{V}$                                                             | -                                   | 4    | 45   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                     | $V_I = 11.5\text{V to } 24\text{V}$ | -    | 6    | 90                     |
|                              |                     |                                                                                                 | $V_I = 12.5\text{V to } 19\text{V}$ | -    | 2    | 45                     |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA to } 1.0\text{A}$                                | -                                   | 12   | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   | 12   | 100  |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                           | -                                   | 5    | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 5.0  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $V_I = 11.7\text{V to } 25\text{V}$ , $T_J = +25^{\circ}\text{C}$                               | -                                   | -    | 0.8  | mA                     |
|                              |                     | $V_I = 12\text{V to } 25\text{V}$ , $I_O = 500\text{mA}$                                        | -                                   | -    | 0.8  |                        |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   | -    | 0.5  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                              | -                                   | -1.0 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                               | -                                   | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 12\text{V to } 22\text{V}$                  | -                                   | 62   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                 | -                                   | 2.0  | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                               | -                                   | 17   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                | -                                   | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7812AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 19\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                      | Min.                                | Typ. | Max.  | Unit                   |
|------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|------|-------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                     | 11.75                               | 12   | 12.25 | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 14.8\text{V to } 27\text{V}$ | 11.5                                | 12   | 12.5  |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 14.8\text{V to } 30\text{V}$ , $I_O = 500\text{mA}$                                      | -                                   | 10   | 120   | mV                     |
|                              |                     | $V_I = 16\text{V to } 22\text{V}$                                                               | -                                   | 4    | 120   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                     | $V_I = 14.5\text{V to } 27\text{V}$ | -    | 10    | 120                    |
|                              |                     |                                                                                                 | $V_I = 16\text{V to } 22\text{V}$   | -    | 3     | 60                     |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA to } 1.5\text{A}$                                | -                                   | 12   | 100   | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   | 12   | 100   |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                           | -                                   | 5    | 50    |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 5.1  | 6.0   | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $V_I = 15\text{V to } 30\text{V}$ , $T_J = +25^{\circ}\text{C}$                                 | -                                   |      | 0.8   | mA                     |
|                              |                     | $V_I = 14\text{V to } 27\text{V}$ , $I_O = 500\text{mA}$                                        | -                                   |      | 0.8   |                        |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   |      | 0.5   |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                              | -                                   | -1.0 | -     | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                               | -                                   | 10   | -     | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 14\text{V to } 24\text{V}$                  | -                                   | 60   | -     | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                 | -                                   | 2.0  | -     | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                               | -                                   | 18   | -     | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                | -                                   | 250  | -     | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 2.2  | -     | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7815AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 23\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                      | Min.                                | Typ. | Max. | Unit                   |
|------------------------------|---------------------|-------------------------------------------------------------------------------------------------|-------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                     | 14.7                                | 15   | 15.3 | V                      |
|                              |                     | $I_O = 5\text{mA to } 1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 17.7\text{V to } 30\text{V}$ | 14.4                                | 15   | 15.6 |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 17.9\text{V to } 30\text{V}$ , $I_O = 500\text{mA}$                                      | -                                   | 10   | 150  | mV                     |
|                              |                     | $V_I = 20\text{V to } 26\text{V}$                                                               | -                                   | 5    | 150  |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                     | $V_I = 17.5\text{V to } 30\text{V}$ | -    | 11   | 150                    |
|                              |                     |                                                                                                 | $V_I = 20\text{V to } 26\text{V}$   | -    | 3    | 75                     |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA to } 1.5\text{A}$                                | -                                   | 12   | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   | 12   | 100  |                        |
|                              |                     | $I_O = 250\text{mA to } 750\text{mA}$                                                           | -                                   | 5    | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 5.2  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $V_I = 17.5\text{V to } 30\text{V}$ , $T_J = +25^{\circ}\text{C}$                               | -                                   | -    | 0.8  | mA                     |
|                              |                     | $V_I = 17.5\text{V to } 30\text{V}$ , $I_O = 500\text{mA}$                                      | -                                   | -    | 0.8  |                        |
|                              |                     | $I_O = 5\text{mA to } 1.0\text{A}$                                                              | -                                   | -    | 0.5  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                              | -                                   | -1.0 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz to } 100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                               | -                                   | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 18.5\text{V to } 28.5\text{V}$              | -                                   | 58   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                 | -                                   | 2.0  | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                               | -                                   | 19   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                | -                                   | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                     | -                                   | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

**Electrical Characteristics (KA7818AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 27\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                      | Min.                                 | Typ. | Max.  | Unit                   |
|------------------------------|---------------------|-------------------------------------------------------------------------------------------------|--------------------------------------|------|-------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                     | 17.64                                | 18   | 18.36 | V                      |
|                              |                     | $I_O = 5\text{mA}$ to $1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 21\text{V}$ to $33\text{V}$ | 17.3                                 | 18   | 18.7  |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 21\text{V}$ to $33\text{V}$ , $I_O = 500\text{mA}$                                       | -                                    | 15   | 180   | mV                     |
|                              |                     | $V_I = 21\text{V}$ to $33\text{V}$                                                              | -                                    | 5    | 180   |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                     | $V_I = 20.6\text{V}$ to $33\text{V}$ | 15   | 180   |                        |
|                              |                     |                                                                                                 | $V_I = 24\text{V}$ to $30\text{V}$   | 5    | 90    |                        |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA}$ to $1.5\text{A}$                               | -                                    | 15   | 100   | mV                     |
|                              |                     | $I_O = 5\text{mA}$ to $1.0\text{A}$                                                             | -                                    | 15   | 100   |                        |
|                              |                     | $I_O = 250\text{mA}$ to $750\text{mA}$                                                          | -                                    | 7    | 50    |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                     | -                                    | 5.2  | 6.0   | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $V_I = 21\text{V}$ to $33\text{V}$ , $T_J = +25^{\circ}\text{C}$                                | -                                    | -    | 0.8   | mA                     |
|                              |                     | $V_I = 21\text{V}$ to $33\text{V}$ , $I_O = 500\text{mA}$                                       | -                                    | -    | 0.8   |                        |
|                              |                     | $I_O = 5\text{mA}$ to $1.0\text{A}$                                                             | -                                    | -    | 0.5   |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                              | -                                    | -1.0 | -     | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz}$ to $100\text{kHz}$ , $T_A = +25^{\circ}\text{C}$                              | -                                    | 10   | -     | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 22\text{V}$ to $32\text{V}$                 | -                                    | 57   | -     | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                 | -                                    | 2.0  | -     | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                               | -                                    | 19   | -     | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                | -                                    | 250  | -     | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                     | -                                    | 2.2  | -     | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.



**Electrical Characteristics (KA7824AE)** (Continued)(Refer to the test circuits.  $0^{\circ}\text{C} < T_J < +125^{\circ}\text{C}$ ,  $I_O = 1\text{A}$ ,  $V_I = 33\text{V}$ ,  $C_I = 0.33\mu\text{F}$ ,  $C_O = 0.1\mu\text{F}$ , unless otherwise specified)

| Parameter                    | Symbol              | Conditions                                                                                        | Min.                                 | Typ. | Max. | Unit                   |
|------------------------------|---------------------|---------------------------------------------------------------------------------------------------|--------------------------------------|------|------|------------------------|
| Output Voltage               | $V_O$               | $T_J = +25^{\circ}\text{C}$                                                                       | 23.5                                 | 24   | 24.5 | V                      |
|                              |                     | $I_O = 5\text{mA}$ to $1\text{A}$ , $P_O \leq 15\text{W}$<br>$V_I = 27.3\text{V}$ to $38\text{V}$ | 23                                   | 24   | 25   |                        |
| Line Regulation (Note1)      | Regline             | $V_I = 27\text{V}$ to $38\text{V}$ , $I_O = 500\text{mA}$                                         | -                                    | 18   | 240  | mV                     |
|                              |                     | $V_I = 21\text{V}$ to $33\text{V}$                                                                | -                                    | 6    | 240  |                        |
|                              |                     | $T_J = +25^{\circ}\text{C}$                                                                       | $V_I = 26.7\text{V}$ to $38\text{V}$ | -    | 18   | 240                    |
|                              |                     |                                                                                                   | $V_I = 30\text{V}$ to $36\text{V}$   | -    | 6    | 120                    |
| Load Regulation (Note1)      | Regload             | $T_J = +25^{\circ}\text{C}$ , $I_O = 5\text{mA}$ to $1.5\text{A}$                                 | -                                    | 15   | 100  | mV                     |
|                              |                     | $I_O = 5\text{mA}$ to $1.0\text{A}$                                                               | -                                    | 15   | 100  |                        |
|                              |                     | $I_O = 250\text{mA}$ to $750\text{mA}$                                                            | -                                    | 7    | 50   |                        |
| Quiescent Current            | $I_Q$               | $T_J = +25^{\circ}\text{C}$                                                                       | -                                    | 5.2  | 6.0  | mA                     |
| Quiescent Current Change     | $\Delta I_Q$        | $V_I = 27.3\text{V}$ to $38\text{V}$ , $T_J = +25^{\circ}\text{C}$                                | -                                    | -    | 0.8  | mA                     |
|                              |                     | $V_I = 27.3\text{V}$ to $38\text{V}$ , $I_O = 500\text{mA}$                                       | -                                    | -    | 0.8  |                        |
|                              |                     | $I_O = 5\text{mA}$ to $1.0\text{A}$                                                               | -                                    | -    | 0.5  |                        |
| Output Voltage Drift (Note2) | $\Delta V/\Delta T$ | $I_O = 5\text{mA}$                                                                                | -                                    | -1.5 | -    | mV/ $^{\circ}\text{C}$ |
| Output Noise Voltage         | $V_N$               | $f = 10\text{Hz}$ to $100\text{kHz}$ , $T_A = 25^{\circ}\text{C}$                                 | -                                    | 10   | -    | $\mu\text{V}/V_O$      |
| Ripple Rejection (Note2)     | RR                  | $f = 120\text{Hz}$ , $I_O = 500\text{mA}$<br>$V_I = 28\text{V}$ to $38\text{V}$                   | -                                    | 54   | -    | dB                     |
| Dropout Voltage              | $V_{\text{Drop}}$   | $I_O = 1\text{A}$ , $T_J = +25^{\circ}\text{C}$                                                   | -                                    | 2.0  | -    | V                      |
| Output Resistance (Note2)    | $r_O$               | $f = 1\text{kHz}$                                                                                 | -                                    | 20   | -    | $\text{m}\Omega$       |
| Short Circuit Current        | $I_{\text{SC}}$     | $V_I = 35\text{V}$ , $T_A = +25^{\circ}\text{C}$                                                  | -                                    | 250  | -    | mA                     |
| Peak Current (Note2)         | $I_{\text{PK}}$     | $T_J = +25^{\circ}\text{C}$                                                                       | -                                    | 2.2  | -    | A                      |

**Note:**

1. Load and line regulation are specified at constant junction temperature. Change in  $V_O$  due to heating effects must be taken into account separately. Pulse testing with low duty is used.
2. These parameters, although guaranteed, are not 100% tested in production.

Typical Performance Characteristics

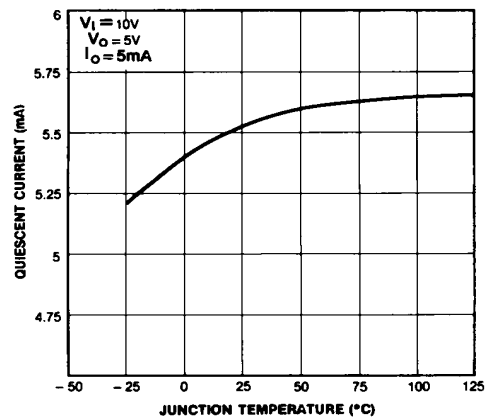


Figure 1. Quiescent Current

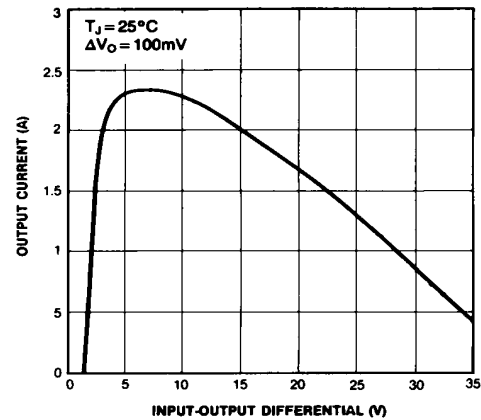


Figure 2. Peak Output Current

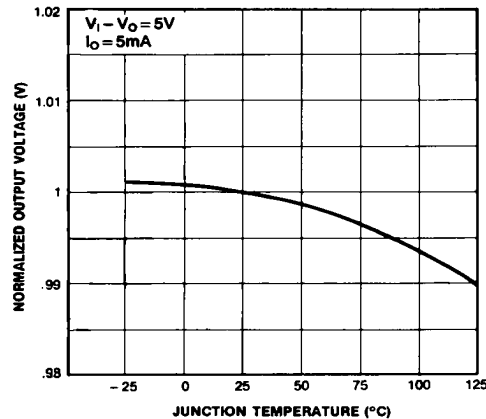


Figure 3. Output Voltage

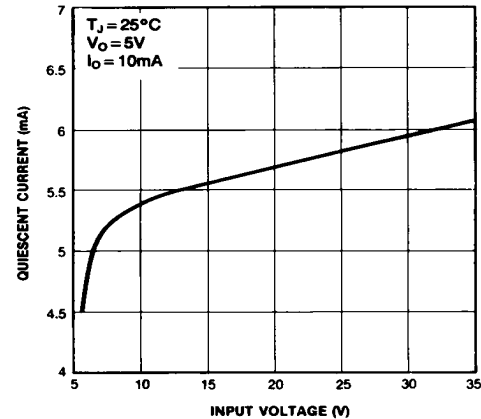


Figure 4. Quiescent Current

## Typical Applications

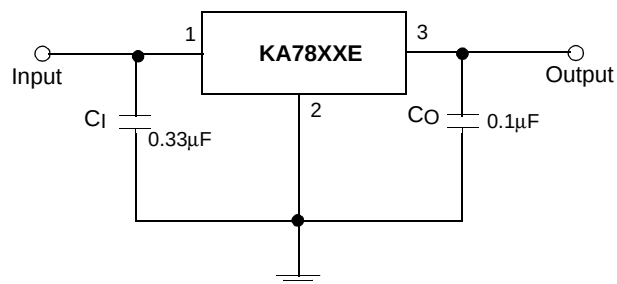


Figure 5. DC Parameters

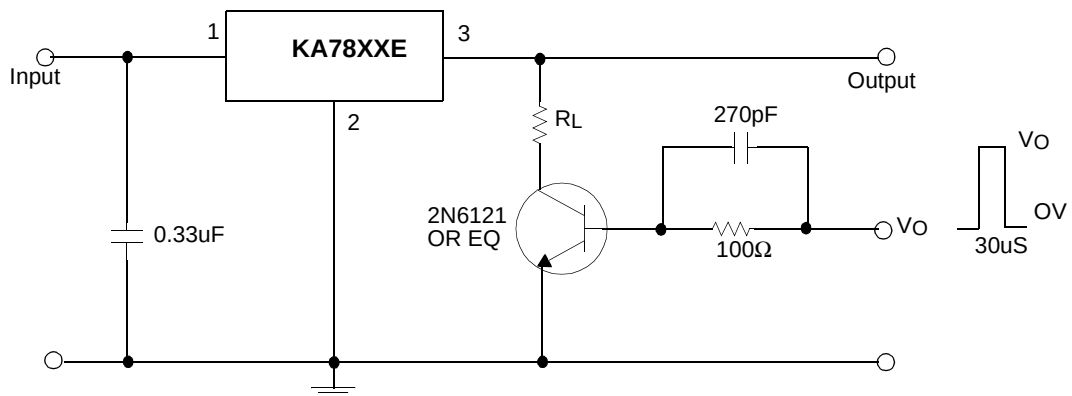


Figure 6. Load Regulation

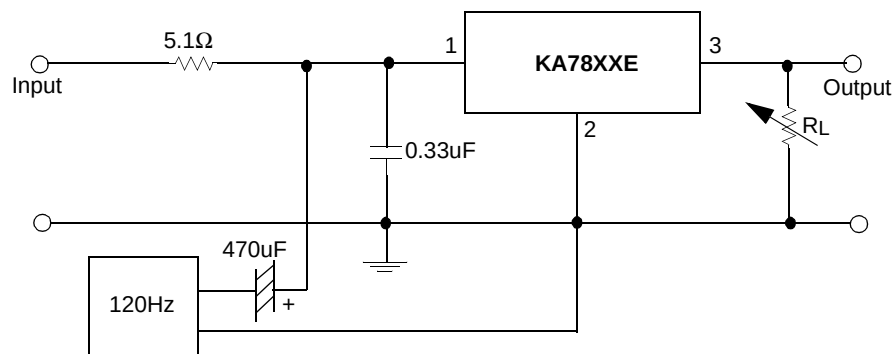


Figure 7. Ripple Rejection

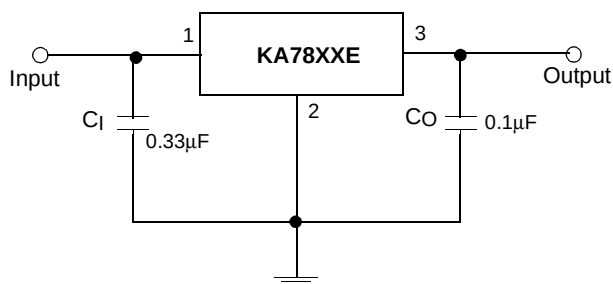


Figure 8. Fixed Output Regulator

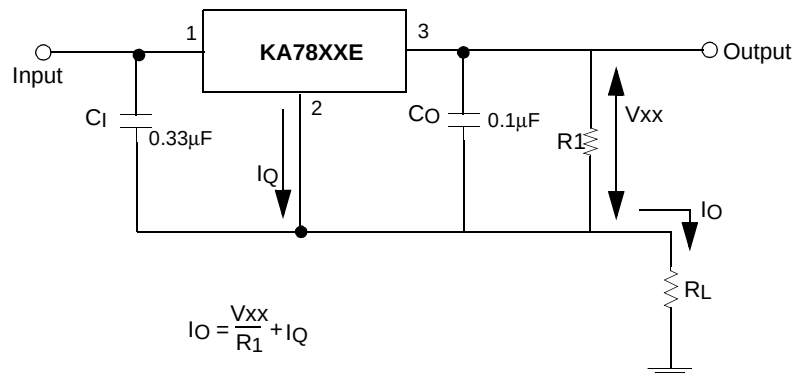
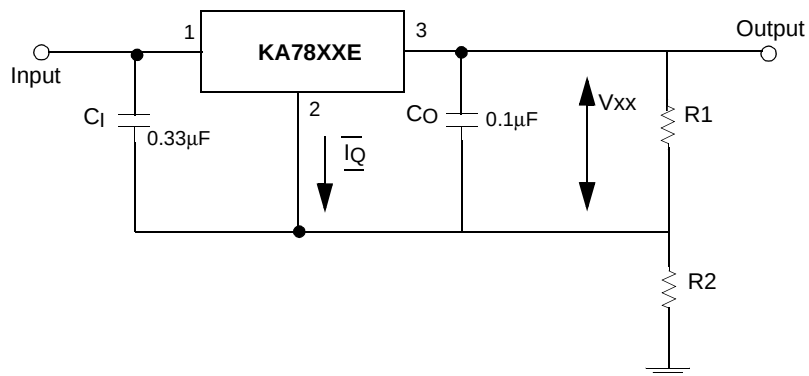


Figure 9. Constant Current Regulator

**Notes:**

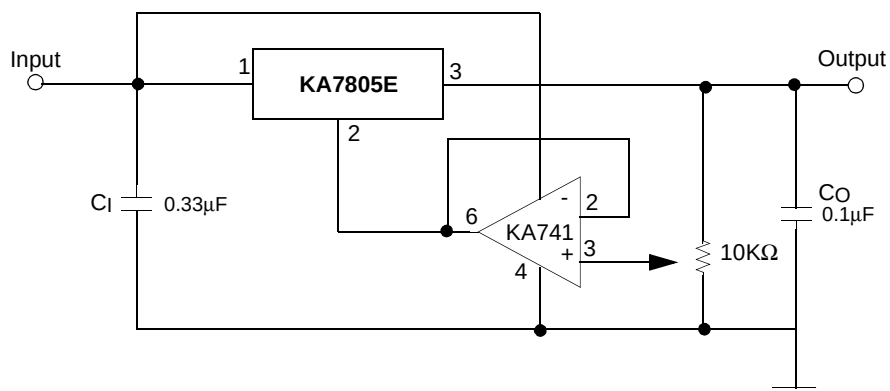
1. To specify an output voltage, substitute voltage value for "XX." A common ground is required between the input and the Output voltage. The input voltage must remain typically 2.0V above the output voltage even during the low point on the input ripple voltage.
2. C<sub>1</sub> is required if regulator is located an appreciable distance from power Supply filter.
3. C<sub>0</sub> improves stability and transient response.



$$I_{R1} \geq 5I_Q$$

$$V_O = V_{xx}(1+R_2/R_1) + I_Q R_2$$

Figure 10. Circuit for Increasing Output Voltage



$$I_{R1} \geq 5I_Q$$

$$V_O = V_{xx}(1+R_2/R_1) + I_Q R_2$$

Figure 11. Adjustable Output Regulator (7 to 30V)

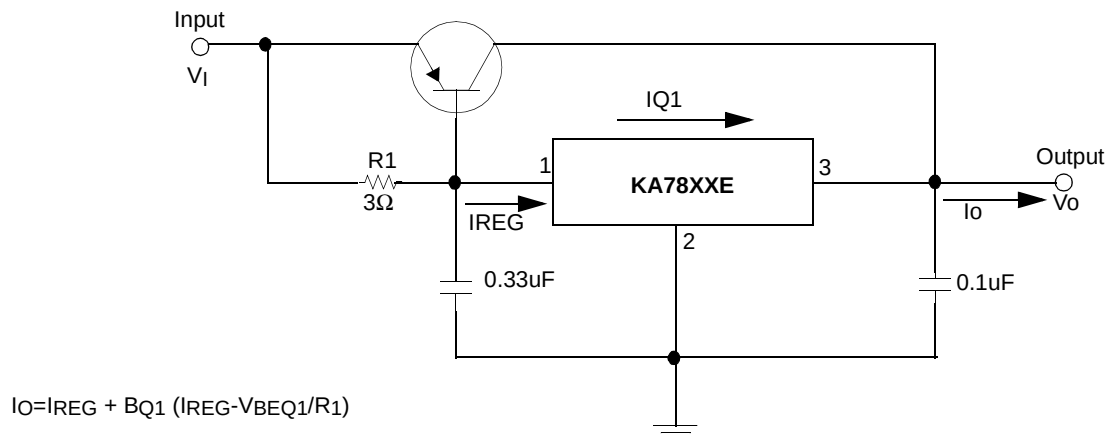


Figure 12. High Current Voltage Regulator

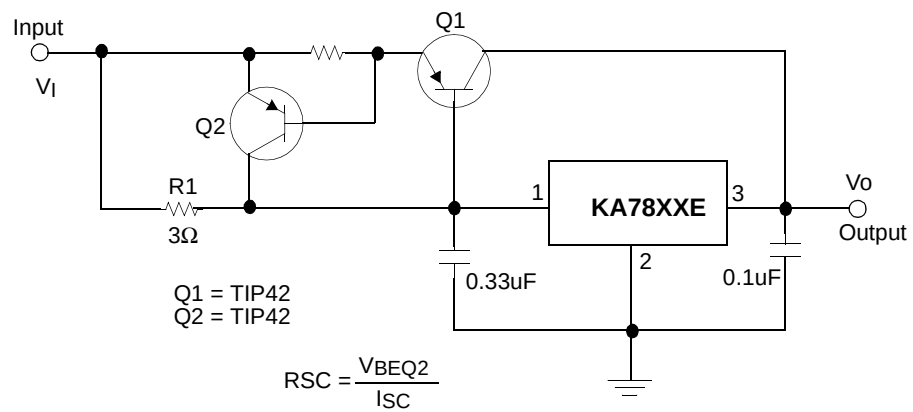


Figure 13. High Output Current with Short Circuit Protection

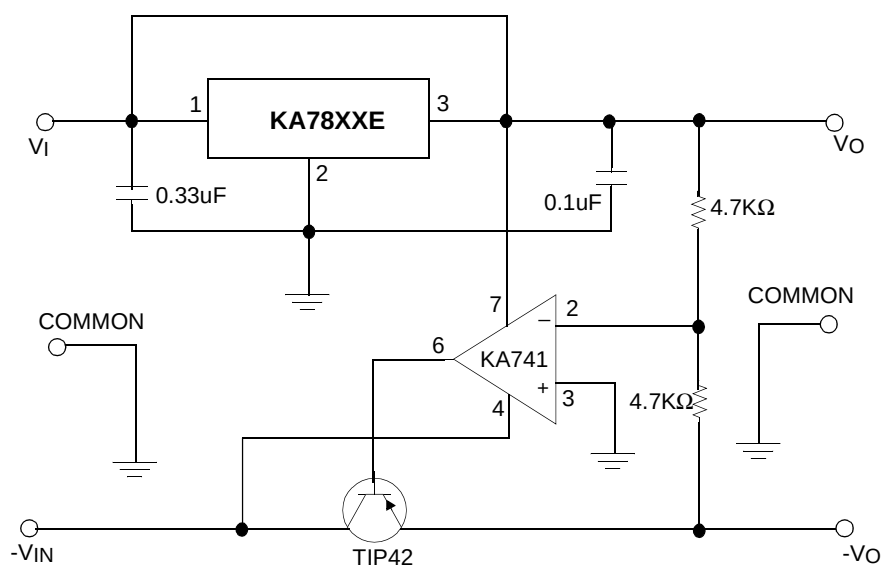


Figure 14. Tracking Voltage Regulator

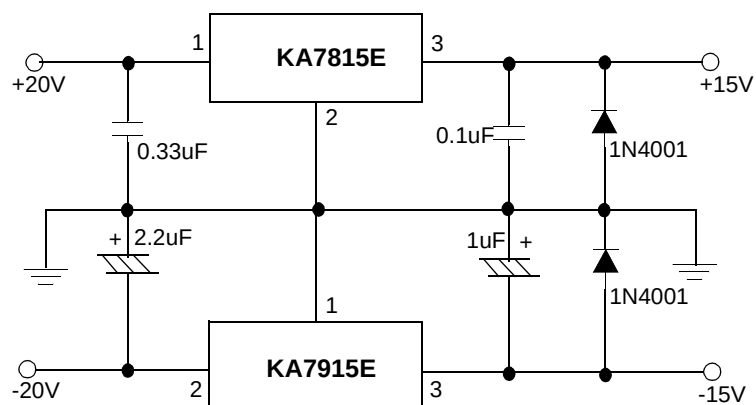


Figure 15. Split Power Supply (±15V-1A)

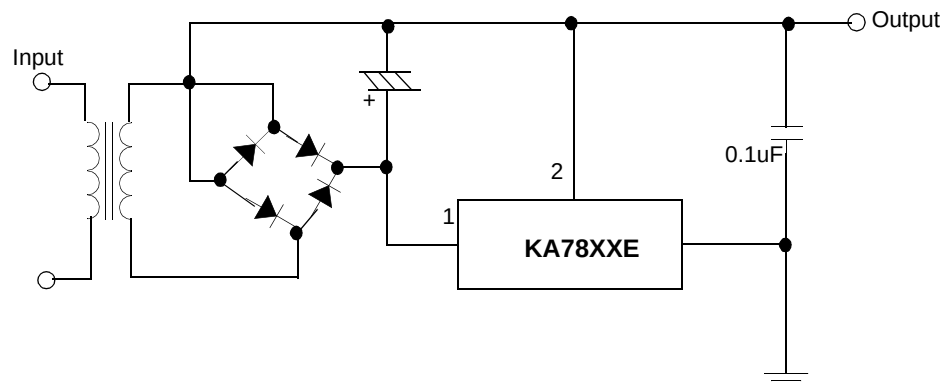


Figure 16. Negative Output Voltage Circuit

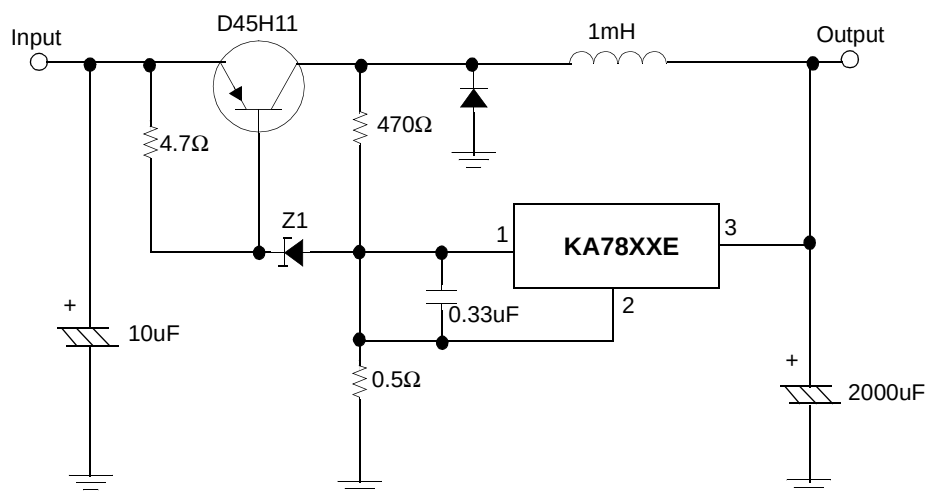


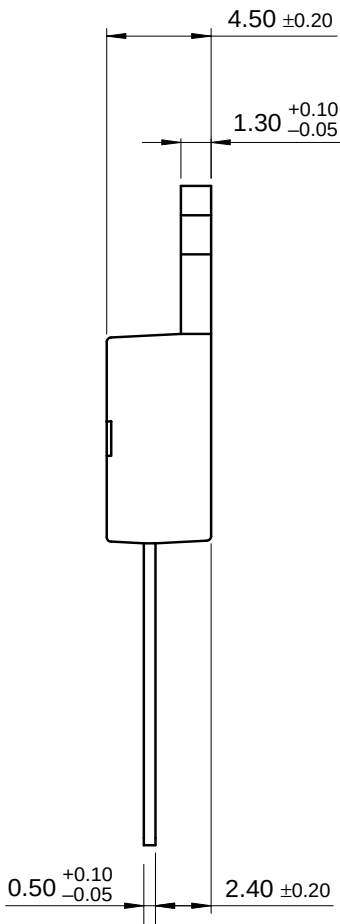
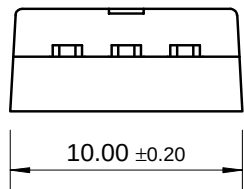
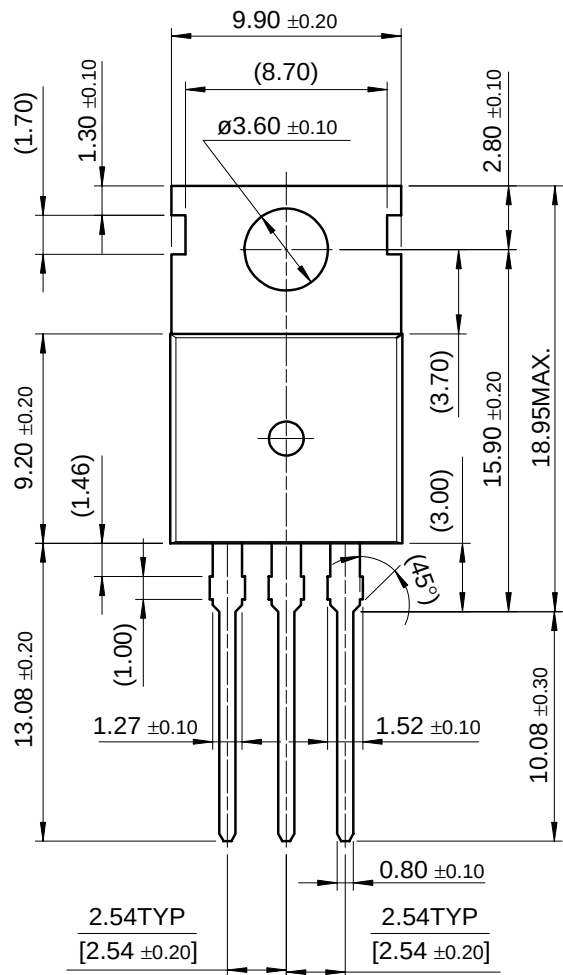
Figure 17. Switching Regulator

Mechanical Dimensions

Package

Dimensions in millimeters

TO-220

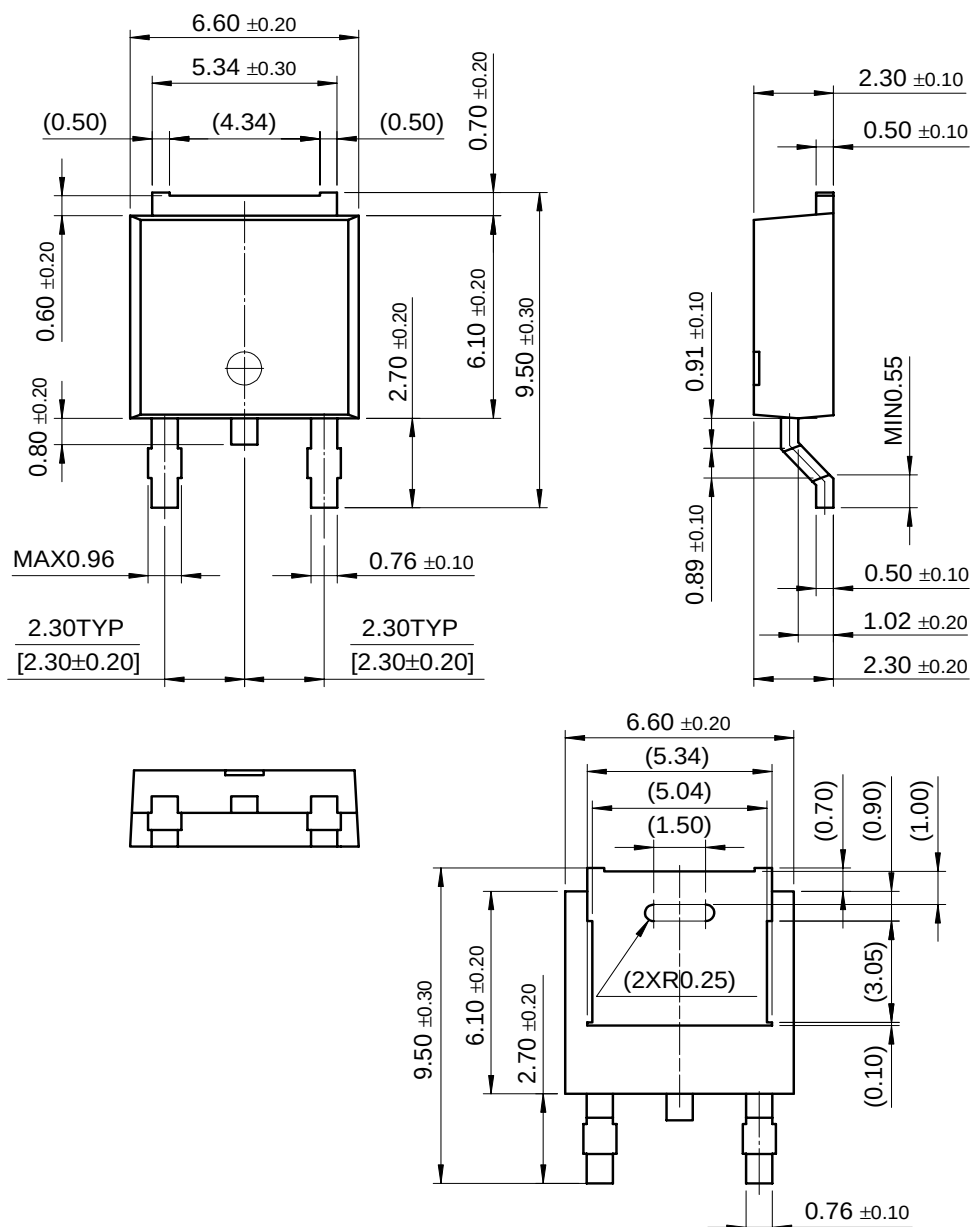


# Mechanical Dimensions (Continued)

## Package

Dimensions in millimeters

### D-PAK





## Ordering Information

| Product Number      | Output Voltage Tolerance | Package | Operating Temperature |
|---------------------|--------------------------|---------|-----------------------|
| KA7805E / KA7806E   | ±4%                      | TO-220  | 0 ~ +125°C            |
| KA7808E / KA7809E   |                          |         |                       |
| KA7812E / KA7815E   |                          |         |                       |
| KA7818E / KA7824E   |                          |         |                       |
| KA7805AE / KA7806AE | ±2%                      |         |                       |
| KA7808AE / KA7809AE |                          |         |                       |
| KA7812AE/KA7815AE   |                          |         |                       |
| KA7818AE/KA7824AE   |                          |         |                       |
| KA7805ER / KA7806ER | ±4%                      | D-PAK   |                       |
| KA7808ER / KA7809ER |                          |         |                       |
| KA7812ER            |                          |         |                       |

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2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.