AUK Semiconductor

# S78xxD

**Fixed Voltage Regulator**

## Descriptions

The S78xx series are three-terminal positive regulators providing over 1A output current with internal current limiting, thermal shutdown and safe area protection. These regulators are useful in a wide range of applications. Although they are just fixed voltage regulators, the S78xx series can be used with external components to obtain adjustable voltages and currents.

## Features

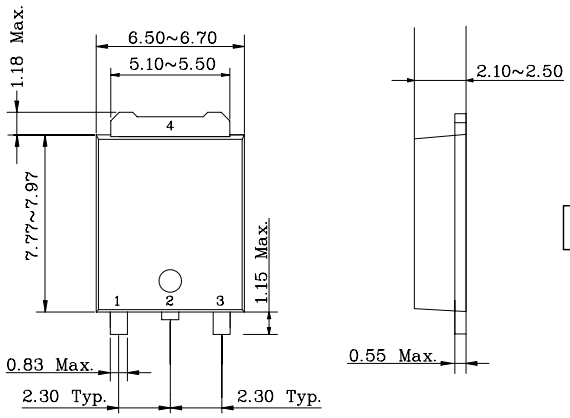
- Output Current of 1A
- Short Circuit Current Limit Protection
- Thermal Shutdown Protection
- Output Transistor Safe Area Protection

## Ordering Information

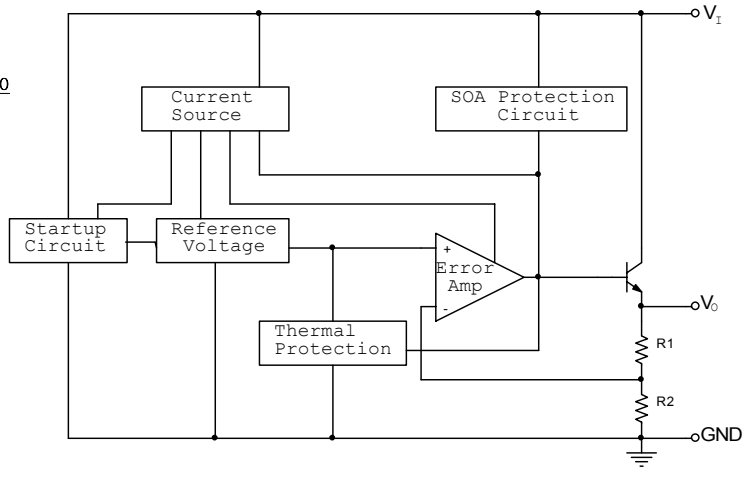
| Type NO. | Marking | Package Code |
|---|---|---|
| S78xxD | S78□□D | D-Pak |

□□:Voltage Code (05:5V, 06:6V, 08:8V, 09:9V, 10:10V,12:12V,15:15V,24:24V)

## Outline Dimensions (Unit : mm )




## BLOCK DIAGRAM




**PIN Connections**

1. Input
2,4. GND
3. Output

## Absolute Maximum Ratings

Ta=25°C

| Characteristic | Symbol | Rating | Unit |
|---|---|---|---|
| Input voltage | $V_I$ | 40 (S7824D) | V |
| | | 35 (ALL Others) | V |
| Power dissipation | $P_D1$ (Note1) | 4.5 | W |
| | $P_D2$ (Note2) | 1.5 | |
| Operating temperature range | $T_{opr}$ | -40 ~ +85 | °C |
| Junction temperature | $T_J$ | 150 | °C |
| Storage temperature range | $T_{stg}$ | -55 ~ +150 | °C |

Note 1 : Mounted on a glass epoxy circuit board of 50.8 x 50.8mm. (at 1oz copper area)

Note 2 : No Heat sink

## Device Selection Guide

| Device | Output Voltage |
|---|---|
| S7805D | 5V |
| S7806D | 6V |
| S7808D | 8V |
| S7809D | 9V |
| S7810D | 10V |
| S7812D | 12V |
| S7815D | 15V |
| S7824D | 24V |

## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=10V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7805D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 4.80 | 5.0 | 5.20 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=7.0V ~ 20V | 0℃≤$T_J$≤125℃ | 4.75 | 5.0 | 5.25 | |
| Line Regulation | $\Delta V_{O(\triangle VI)}$ | $V_I$=7.0V ~ 25V | $T_J$ =25℃ | - | 3 | 100 | ㎷ |
| | | $V_I$=8.0V ~ 12V | | - | 1 | 50 | |
| Load Regulation | $\Delta V_{O(\triangle IL)}$ | $I_O$=5mA ~ 1000 ㎃ | $T_J$ =25℃ | - | 15 | 100 | ㎷ |
| | | $I_O$=250mA ~ 750mA | | - | 5 | 50 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.2 | 8.0 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.1 | - | ㎷/℃ |
| Quiescent Current Change | $\Delta I_{QC}$ | $V_I$ = 7.0V ~ 25V | 0℃≤$T_J$≤125℃ | - | - | 1.3 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =8.0V ~ 18V | 0℃≤$T_J$≤125℃ | 62 | 78 | - | dB |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.75 | - | A |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into separately.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

## Electrical Characteristics

(Electrical Characteristics at $0℃ \leq T_J \leq 125℃$ and $V_I$=11V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7806D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 5.75 | 6 | 6.25 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=8.0V ~ 21V | 0℃≤$T_J$≤125℃ | 5.70 | 6 | 6.30 | |
| Line Regulation | $\triangle V_{O(\triangle VI)}$ | $V_I$=8.0V ~ 25V | $T_J$ =25℃ | - | 5 | 120 | ㎷ |
| | | $V_I$=9.0V ~ 13V | | - | 1.5 | 60 | |
| Load Regulation | $\triangle V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 14 | 120 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 60 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -0.8 | - | ㎷/℃ |
| Quiescent Current Change | $\triangle I_{QC}$ | $V_I$ = 8.0V ~ 25V | 0℃≤$T_J$≤125℃ | - | - | 1.3 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =9.0V ~ 19V | 0℃≤$T_J$≤125℃ | 59 | 75 | - | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.55 | - | A |

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** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=14V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7808D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 7.70 | 8 | 8.30 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=10.5V ~ 23V | 0℃≤$T_J$≤125℃ | 7.60 | 8 | 8.40 | |
| Line Regulation | $\Delta V_{O(\triangle VI)}$ | $V_I$=10.5V ~ 25V | $T_J$ =25℃ | - | 6 | 160 | ㎷ |
| | | $V_I$=11V ~ 17V | | - | 2 | 80 | |
| Load Regulation | $\Delta V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 160 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 80 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -0.8 | - | ㎷/℃ |
| Quiescent Current Change | $\Delta I_{QC}$ | $V_I$ = 10.5V ~ 25V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =11.5V ~ 21.5V | 0℃≤$T_J$≤125℃ | 55 | 72 | - | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.45 | - | A |

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## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=16V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7809D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 8.65 | 9 | 9.35 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=11.5V ~ 24V | 0℃≤$T_J$≤125℃ | 8.55 | 9 | 9.45 | |
| Line Regulation | $\triangle V_{O(\triangle VI)}$ | $V_I$=11.5V ~ 27V | $T_J$ =25℃ | - | 7 | 180 | ㎷ |
| | | $V_I$=13V ~ 19V | | - | 2 | 90 | |
| Load Regulation | $\triangle V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 180 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 90 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.0 | - | ㎷/℃ |
| Quiescent Current Change | $\triangle I_{QC}$ | $V_I$ = 11.5V ~ 27V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =12V ~ 22V | 0℃≤$T_J$≤125℃ | 55 | 70 | - | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.4 | - | A |

* Pulse testing techniques are used to maintain the junction temperature as close to the ambient temperature as possible. Thermal effects must be taken into separately.

** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=17V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7810D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 9.60 | 10 | 10.4 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=12.5V ~ 25V | 0℃≤$T_J$≤125℃ | 9.50 | 10 | 10.5 | |
| Line Regulation | $\triangle V_{O(\triangle VI)}$ | $V_I$=12.5V ~ 28V | $T_J$ =25℃ | - | 7 | 200 | ㎷ |
| | | $V_I$=14V ~ 20V | | - | 2 | 100 | |
| Load Regulation | $\triangle V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 200 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 100 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.0 | - | ㎷/℃ |
| Quiescent Current Change | $\triangle I_{QC}$ | $V_I$ = 12.5V ~ 28V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =13V ~ 23V | 0℃≤$T_J$≤125℃ | 55 | 71 | - | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.4 | - | A |

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** This specification applies only for dc power dissipation permitted by absolute maximum ratings.

## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=19V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7812D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 11.5 | 12 | 12.5 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=14.5V ~ 27V | 0℃≤$T_J$≤125℃ | 11.4 | 12 | 12.6 | |
| Line Regulation | $\triangle V_{O(\triangle VI)}$ | $V_I$=14.5V ~ 30V | $T_J$ =25℃ | - | 10 | 240 | ㎷ |
| | | $V_I$=16V ~ 22V | | - | 3 | 120 | |
| Load Regulation | $\triangle V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 240 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 120 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.0 | - | ㎷/℃ |
| Quiescent Current Change | $\triangle I_{QC}$ | $V_I$ = 14.5V ~ 30V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection | RR | f=120 ㎐<br>$V_I$ =15V ~ 25V | 0℃≤$T_J$≤125℃ | 55 | 71 | - | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.35 | - | A |

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## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=23V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7815D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 14.40 | 15 | 15.60 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=17.5V ~ 30V | 0℃≤$T_J$≤125℃ | 14.25 | 15 | 15.75 | |
| Line Regulation | $\Delta V_{O(\triangle VI)}$ | $V_I$=17.5V ~ 30V | $T_J$ =25℃ | - | 12 | 300 | ㎷ |
| | | $V_I$=20V ~ 26V | | - | 3 | 150 | |
| Load Regulation | $\Delta V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 300 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 150 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.3 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.0 | - | ㎷/℃ |
| Quiescent Current Change | $\Delta I_{QC}$ | $V_I$ = 17.5V ~ 30V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection Ratio | RR | f=120 ㎐<br>$V_I$ =18.5V ~ 28.5V | 0℃≤$T_J$≤125℃ | 54 | 70 | | ㏈ |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.23 | - | A |

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## Electrical Characteristics

(Electrical Characteristics at 0℃≤$T_J$≤125℃ and $V_I$=33V, $I_O$=500 ㎃, Unless otherwise specified)

| Characteristic | Symbol | Test Condition* | | S7824D | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | Min. | Typ. | Max. | |
| Output Voltage** | $V_O$ | | $T_J$ =25℃ | 23.0 | 24 | 25.0 | V |
| | | $I_O$=5 ㎃ ~ 1000 ㎃<br>$V_I$=27V ~ 38V | 0℃≤$T_J$≤125℃ | 22.8 | 24 | 25.2 | |
| Line Regulation | $\Delta V_{O(\triangle VI)}$ | $V_I$=27V ~ 38V | $T_J$ =25℃ | - | 18 | 480 | ㎷ |
| | | $V_I$=30V ~ 36V | | - | 6 | 240 | |
| Load Regulation | $\Delta V_{O(\triangle IL)}$ | $I_O$=5 ㎃ ~ 1000 ㎃ | $T_J$ =25℃ | - | 12 | 480 | ㎷ |
| | | $I_O$=250 ㎃ ~ 750 ㎃ | | - | 4 | 240 | |
| Quiescent Current | $I_{QC}$ | | $T_J$ =25℃ | - | 4.6 | 8 | ㎃ |
| Temperature coefficient of Output voltage | $\triangle V_O$/ $\triangle$Temp | $I_O$=5 ㎃ | 0℃≤$T_J$≤125℃ | - | -1.5 | - | ㎷/℃ |
| Quiescent Current Change | $\Delta I_{QC}$ | $V_I$ = 27V ~ 38V | 0℃≤$T_J$≤125℃ | - | - | 1 | ㎃ |
| | | $I_O$ = 5 ㎃ ~ 1000 ㎃ | | - | - | 0.5 | |
| Dropout Voltage | $V_{DROP}$ | $I_O$=1000 ㎃ | $T_J$ =25℃ | - | 2.0 | - | V |
| Ripple Rejection Ratio | RR | f=120 Hz<br>$V_I$ =28V ~ 38V | 0℃≤$T_J$≤125℃ | 50 | 66 | - | dB |
| Short-Circuit Current Limit | $I_{SO}$ | | $T_J$ =25℃ | - | 0.15 | - | A |

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