

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 $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 10\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

Characteristic	Symbol	Test Condition*		S7805D			Unit
				Min.	Typ.	Max.	
Output Voltage**	V_O		$T_J = 25^{\circ}\text{C}$	4.80	5.0	5.20	V
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$ $V_I = 7.0\text{V} \sim 20\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	4.75	5.0	5.25	
Line Regulation	$\Delta V_{O(\Delta V_I)}$	$V_I = 7.0\text{V} \sim 25\text{V}$	$T_J = 25^{\circ}\text{C}$	-	3	100	mV
		$V_I = 8.0\text{V} \sim 12\text{V}$		-	1	50	
Load Regulation	$\Delta V_{O(\Delta I_L)}$	$I_O = 5\text{ mA} \sim 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	15	100	mV
		$I_O = 250\text{ mA} \sim 750\text{ mA}$		-	5	50	
Quiescent Current	I_{QC}		$T_J = 25^{\circ}\text{C}$	-	4.2	8.0	mA
Temperature coefficient of Output voltage	$\frac{\Delta V_O}{\Delta \text{Temp}}$	$I_O = 5\text{ mA}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-1.1	-	mV/ $^{\circ}\text{C}$
Quiescent Current Change	ΔI_{QC}	$V_I = 7.0\text{V} \sim 25\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	1.3	mA
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$		-	-	0.5	
Dropout Voltage	V_{DROD}	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	-	V
Ripple Rejection	RR	$f = 120\text{ Hz}$ $V_I = 8.0\text{V} \sim 18\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	62	78	-	dB
Short-Circuit Current Limit	I_{SO}		$T_J = 25^{\circ}\text{C}$	-	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 $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 11\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 14\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 16\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 17\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 19\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 23\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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Electrical Characteristics

(Electrical Characteristics at $0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$ and $V_I = 33\text{V}$, $I_O = 500\text{ mA}$, Unless otherwise specified)

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

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