

**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
S78xxPI	S78□□PI	TO-220F-3L

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

**Outline Dimensions** (Unit : mm)

4.70 Max.  
2.70 Max.  
0.60 Max.

**BLOCK DIAGRAM**

**PIN Connections**

1. Input
2. GND
3. Output

**Absolute Maximum Ratings**

Ta=25°C

Characteristic	Symbol	Rating	Unit
Input voltage	V <sub>I</sub>	40 (S7824PI)	V
		35 (ALL Others)	V
Power dissipation	P <sub>D</sub>	2.0	W
Junction temperature	T <sub>J</sub>	150	°C
Storage temperature range	T <sub>stg</sub>	-55 ~ +150	°C

**Device Selection Guide**

Device	Output Voltage
S7805PI	5V
S7806PI	6V
S7808PI	8V
S7809PI	9V
S7810PI	10V
S7812PI	12V
S7815PI	15V
S7824PI	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*		S7805PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 7.0\text{V} \sim 25\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	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*		S7806PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 8.0\text{V} \sim 25\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	1.3	mA
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$		-	-	0.5	
Dropout Voltage	$V_{DROD}$	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	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*		S7808PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 10.5\text{V} \sim 25\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	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*		S7809PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 11.5\text{V} \sim 27\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	1	mA
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$		-	-	0.5	
Dropout Voltage	$V_{DROD}$	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	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*		S7810PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 12.5\text{V} \sim 28\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	1	mA
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$		-	-	0.5	
Dropout Voltage	$V_{DROD}$	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	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*		S7812PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 14.5\text{V} \sim 30\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	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*		S7815PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 17.5\text{V} \sim 30\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	1	mA
		$I_O = 5\text{ mA} \sim 1000\text{ mA}$		-	-	0.5	
Dropout Voltage	$V_{DROD}$	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	-	V
Ripple Rejection Ratio	RR	$f = 120\text{ Hz}$ $V_I = 18.5\text{V} \sim 28.5\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	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*		S7824PI			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
Quiescent Current Change	$\Delta I_{QC}$	$V_I = 27\text{V} \sim 38\text{V}$	$0^{\circ}\text{C} \leq T_J \leq 125^{\circ}\text{C}$	-	-	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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Electrical Characteristic Curves (Continue)

Fig. 1  $V_O$  vs.  $V_I$

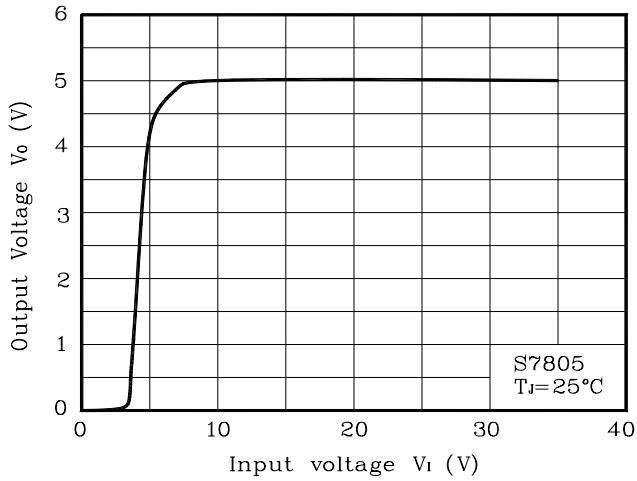


Fig. 2  $I_{QC}$  vs.  $V_I$

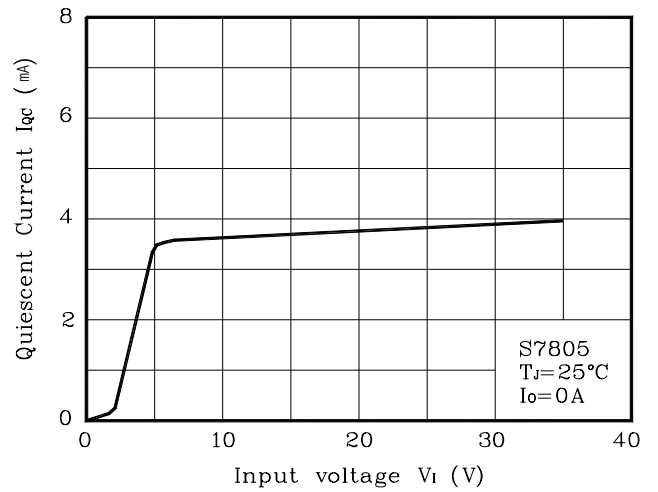


Fig. 3  $V_O$  vs.  $T_J$

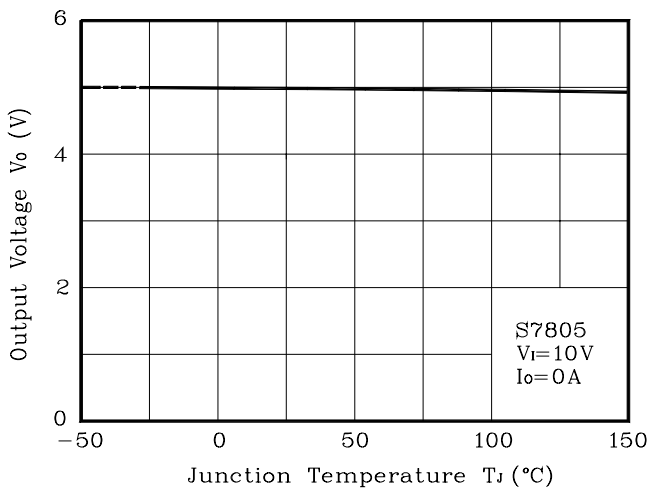


Fig. 4  $I_{QC}$  vs.  $T_J$

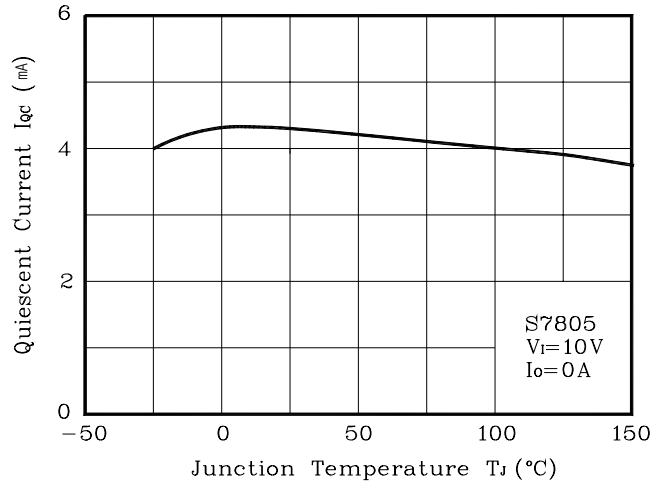


Fig. 5  $V_{DROP}$  vs.  $T_J$

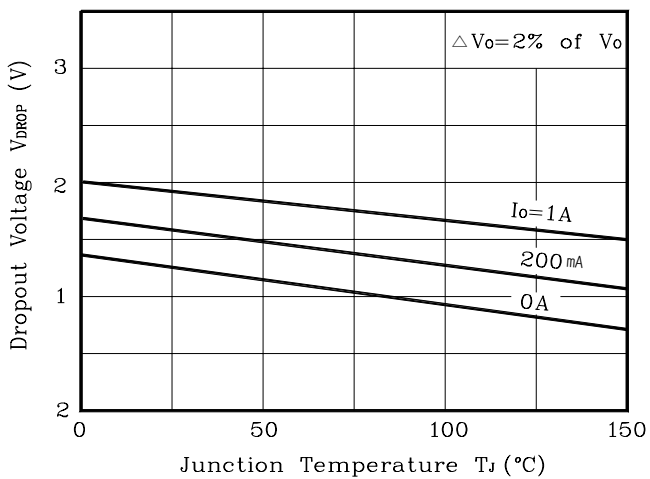


Fig. 6  $V_O$  vs.  $I_O$

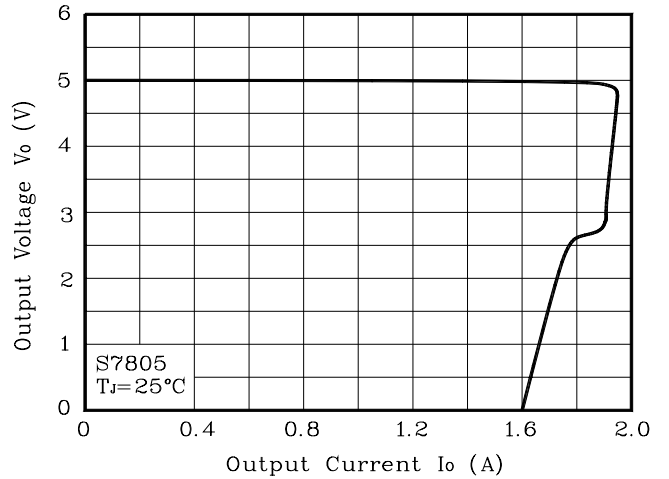


Fig. 7 R.R vs. I<sub>o</sub>

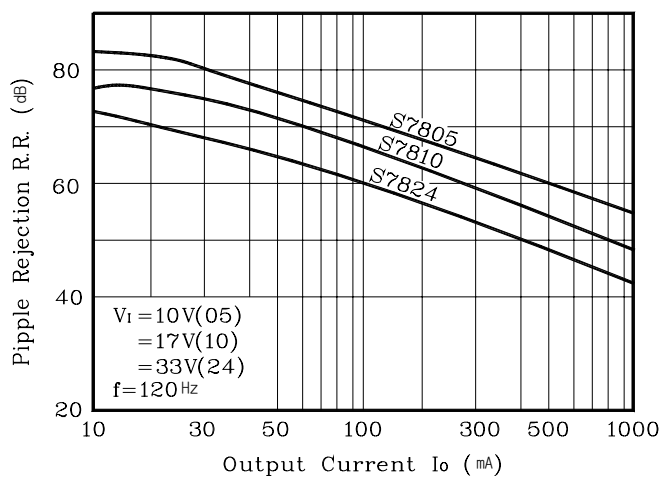


Fig. 8 I<sub>SO</sub> vs. V<sub>i</sub>

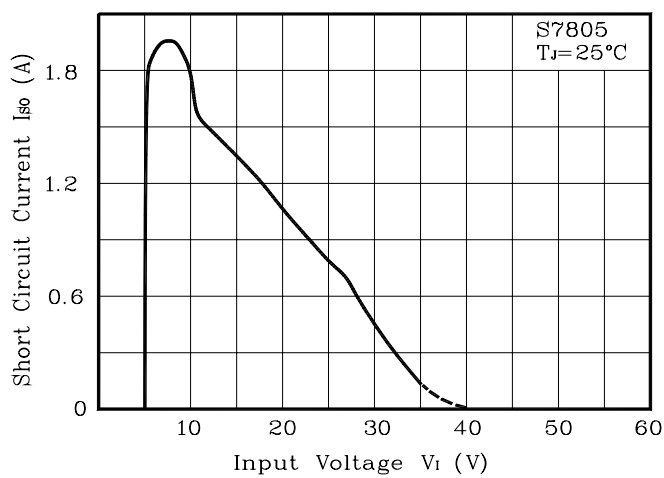
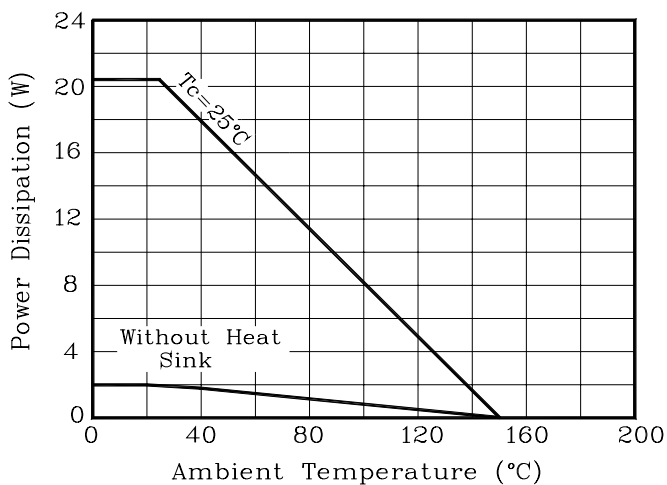


Fig. 9 P<sub>D</sub> vs. T<sub>a</sub>



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