

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)

BLOCK DIAGRAM

PIN Connections

1. Input
2. GND
3. Output

Absolute Maximum Ratings

Ta=25°C

Characteristic	Symbol	Rating	Unit
Input voltage	V_I	40 (S7824PI)	V
		35 (ALL Others)	V
Power dissipation	P_{D1}	2.0	W
	$P_{D2} [T_C=25^\circ\text{C}]$	20	
Operating temperature range	T_{opr}	-40 ~ +85	°C
Junction temperature	T_J	150	°C
Storage temperature range	T_{stg}	-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
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	4.0	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
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_{DROD}	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	4.0	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
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_{DROP}	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	4.0	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
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_{DROD}	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	4.0	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
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_{DROD}	$I_O = 1000\text{ mA}$	$T_J = 25^{\circ}\text{C}$	-	2.0	4.0	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
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	4.0	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
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	4.0	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
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	4.0	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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Fig.1 Quiescent Current

vs. Junction Temperature

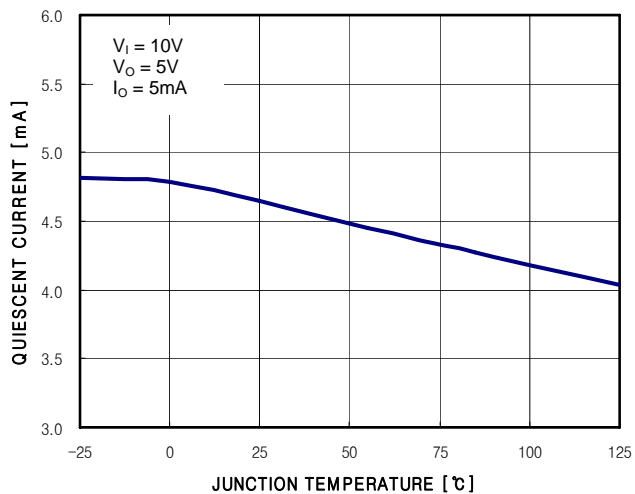


Fig.2 Peak Output Current

vs. Input to Output Current

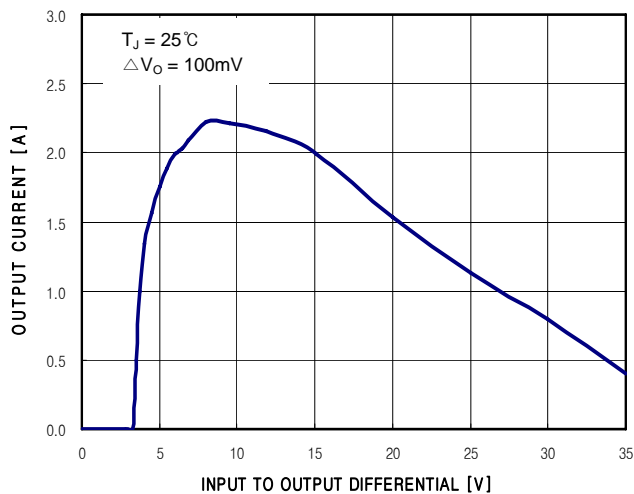


Fig.3 Normalized Output Voltage

vs. Junction Temperature

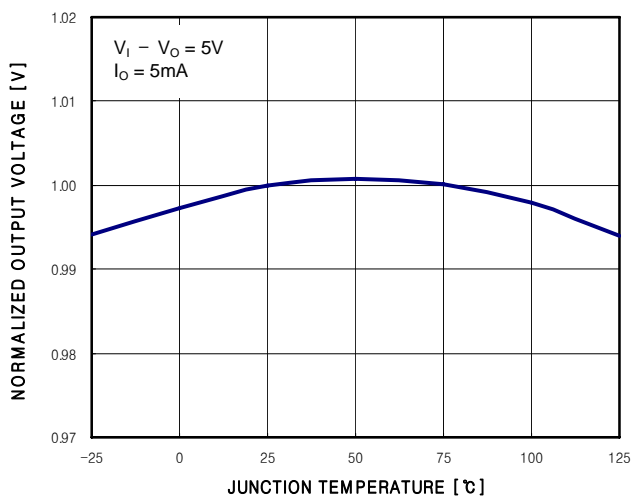


Fig.4 Quiescent Current

vs. Input Voltage

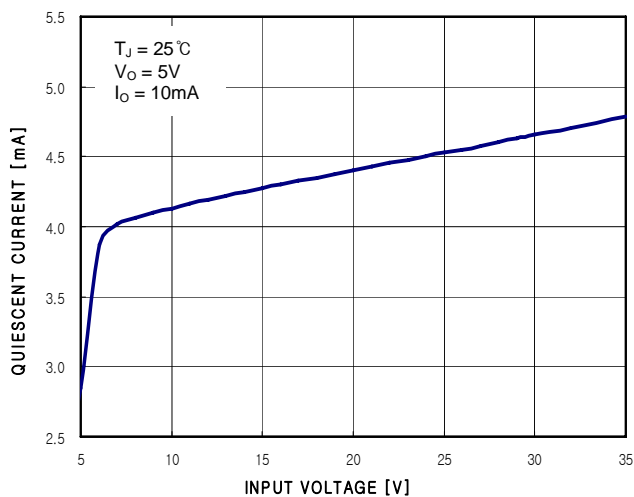
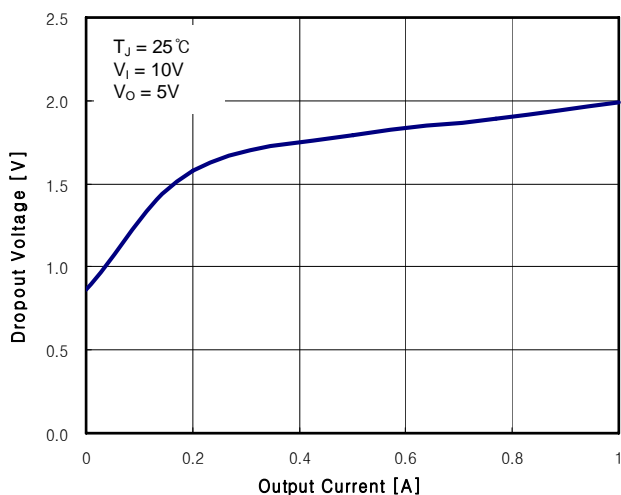


Fig.5 Dropout Voltage

vs. Output Current



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