

**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**

- Internal Short Circuit Current Limiting
- Maximum Output Current (1A Max.)
- Thermal Overload Protection
- Output Transistor Safe Area Protection

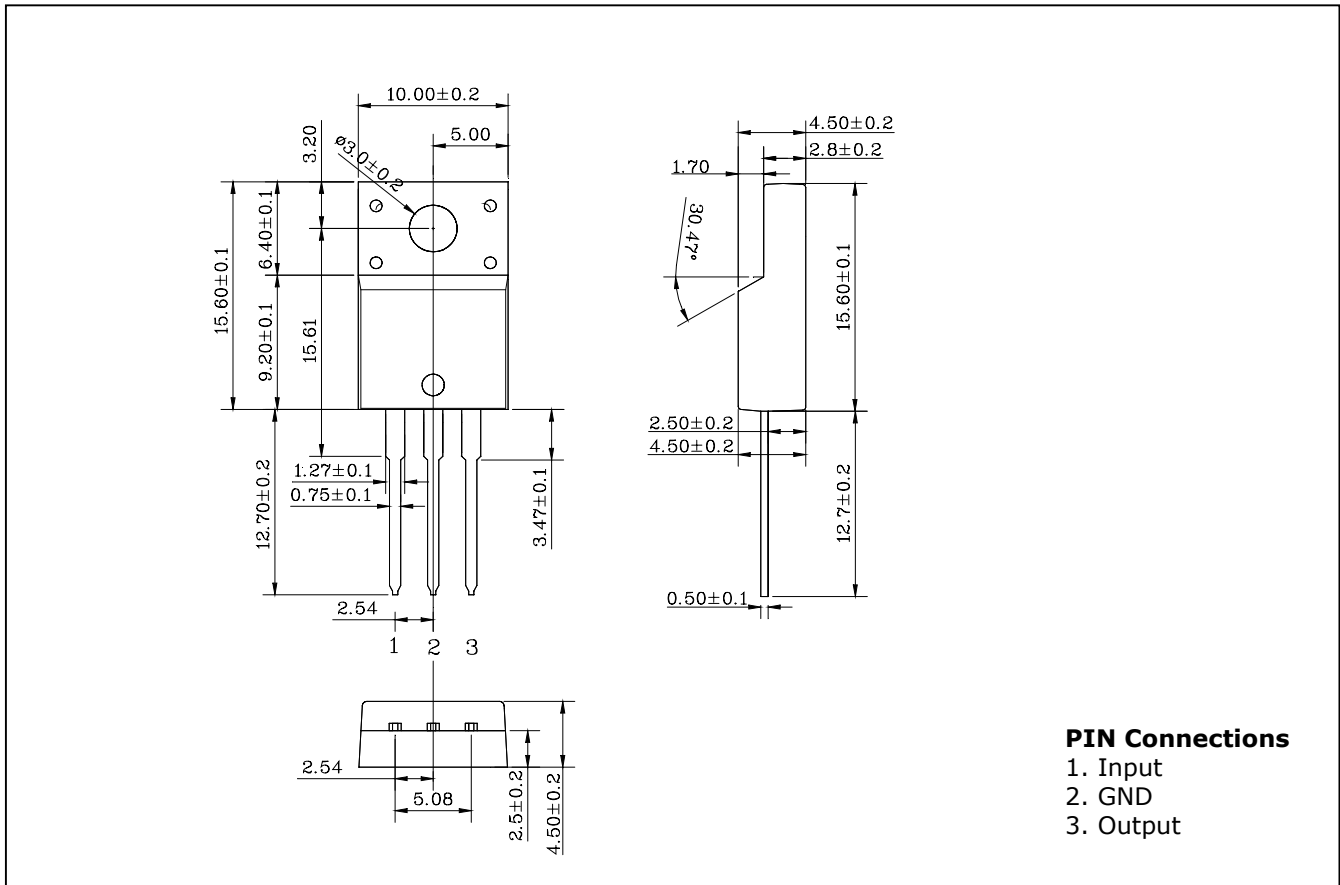
**Ordering Information**

Type NO.	Marking	Package Code
S78xxPI	S78□□PI	TO-220F

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

**Outline Dimensions**

**unit : mm**



## Absolute Maximum Ratings

Ta=25°C

Characteristic	Symbol	Ratings	Unit
Operating Input voltage	V <sub>IN</sub>	40 (S7824PI)	V
		35 (ALL Others)	V
Power Dissipation (T <sub>C</sub> =25°C)	P <sub>D</sub>	20.8	W
Power Dissipation (without Heatsink)	P <sub>D</sub>	2.0	W
Operating Junction Temperature	T <sub>J</sub>	-30 ~ 125	°C
Storage Temperature	T <sub>stg</sub>	-55 ~ 150	°C

## Electrical Characteristics

(V<sub>IN</sub> = 10V, I<sub>OUT</sub> = 500mA, T<sub>J</sub> = 0°C ~ 125°C, Unless otherwise noted)

Characteristic	Symbol	Test Condition	S7805PI			Unit	
			Min.	Typ.	Max.		
Output Voltage	V <sub>OUT</sub>	T <sub>J</sub> = 25°C	4.8	5.0	5.2	V	
		I <sub>OUT</sub> = 5mA ~ 1A V <sub>IN</sub> = 7.0V ~ 20V, P <sub>O</sub> ≤ 15W	4.75	5.0	5.25		
Line Regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> = 7.0V ~ 25V	-	3	100	mV	
		V <sub>IN</sub> = 8.0V ~ 12V	-	1	50		
Load Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> = 5mA ~ 1.5A	-	15	100	mV	
		I <sub>OUT</sub> = 250mA ~ 750mA	-	5	50		
Quiescent Current	I <sub>B</sub>	T <sub>J</sub> = 25°C	-	4.2	8.0	mA	
Quiescent Current Change	ΔI <sub>B</sub>	V <sub>IN</sub> = 7.0V ~ 25V	-	-	1.3	mA	
		I <sub>OUT</sub> = 5mA ~ 1A	-	-	0.5		
Output Noise Voltage	V <sub>N</sub>	f = 10Hz ~ 100KHz	T <sub>J</sub> = 25°C	-	40	-	uV <sub>rms</sub>
Ripple Rejection Ratio	RR	f = 120Hz, V <sub>IN</sub> = 8.0V ~ 18V		62	78	-	dB
Dropout Voltage	V <sub>D</sub>	I <sub>OUT</sub> = 1A	T <sub>J</sub> = 25°C	-	2.0	-	V
Short Circuit Current Limit	I <sub>SC</sub>		T <sub>J</sub> = 25°C	-	0.75	-	A
Output Voltage Drift	TC <sub>VO</sub>	I <sub>OUT</sub> = 5mA	T <sub>J</sub> = 25°C	-	-1.1	-	mV/°C
Peak Output Current	I <sub>PK</sub>		T <sub>J</sub> = 25°C	-	2.2	-	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.

## Electrical Characteristics

( $V_{IN} = 11V$ ,  $I_{OUT} = 500mA$ ,  $T_j = 0^\circ C \sim 125^\circ C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition		S7806PI			Unit
				Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$		$T_j = 25^\circ C$	5.75	6.0	6.25	V
		$I_{OUT} = 5mA \sim 1A$ $V_{IN} = 8.0V \sim 21V$ , $P_O \leq 15W$		5.7	6.0	6.3	
Line Regulation	$\Delta V_{OUT}$	$V_{IN} = 8.0V \sim 25V$	$T_j = 25^\circ C$	-	5	120	mV
		$V_{IN} = 9.0V \sim 13V$		-	1.5	60	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT} = 5mA \sim 1.5A$	$T_j = 25^\circ C$	-	14	120	mV
		$I_{OUT} = 250mA \sim 750mA$		-	4	60	
Quiescent Current	$I_B$		$T_j = 25^\circ C$	-	4.3	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 8.0V \sim 25V$		-	-	1.3	mA
		$I_{OUT} = 5mA \sim 1A$		-	-	0.5	
Output Noise Voltage	$V_N$	$f = 10Hz \sim 100KHz$	$T_j = 25^\circ C$	-	45	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f = 120Hz$ , $V_{IN} = 9.0V \sim 19V$		59	75	-	dB
Dropout Voltage	$V_D$	$I_{OUT} = 1A$	$T_j = 25^\circ C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$		$T_j = 25^\circ C$	-	0.55	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT} = 5mA$	$T_j = 25^\circ C$	-	-0.8	-	$mV/^\circ C$
Peak Output Current	$I_{PK}$		$T_j = 25^\circ C$	-	2.2	-	A

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## Electrical Characteristics

( $V_{IN} = 14V$ ,  $I_{OUT} = 500mA$ ,  $T_j = 0^{\circ}C \sim 125^{\circ}C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition		S7808PI			Unit
				Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$		$T_j = 25^{\circ}C$	7.7	8.0	8.3	V
		$I_{OUT} = 5mA \sim 1A$ $V_{IN} = 10.5V \sim 23V$ , $P_O \leq 15W$		7.6	8.0	8.4	
Line Regulation	$\Delta V_{OUT}$	$V_{IN} = 10.5V \sim 25V$	$T_j = 25^{\circ}C$	-	6	160	mV
		$V_{IN} = 11.0V \sim 17V$		-	2	80	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT} = 5mA \sim 1.5A$	$T_j = 25^{\circ}C$	-	12	160	mV
		$I_{OUT} = 250mA \sim 750mA$		-	4	80	
Quiescent Current	$I_B$		$T_j = 25^{\circ}C$	-	4.3	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 10.5V \sim 25V$		-	-	1.0	mA
		$I_{OUT} = 5mA \sim 1A$		-	-	0.5	
Output Noise Voltage	$V_N$	$f = 10Hz \sim 100KHz$	$T_j = 25^{\circ}C$	-	52	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f = 120Hz$ , $V_{IN} = 11.5V \sim 21.5V$		55	72	-	dB
Dropout Voltage	$V_D$	$I_{OUT} = 1A$	$T_j = 25^{\circ}C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$		$T_j = 25^{\circ}C$	-	0.45	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT} = 5mA$	$T_j = 25^{\circ}C$	-	-0.8	-	$mV/^{\circ}C$
Peak Output Current	$I_{PK}$		$T_j = 25^{\circ}C$	-	2.2	-	A

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## Electrical Characteristics

( $V_{IN} = 16V$ ,  $I_{OUT} = 500mA$ ,  $T_j = 0^\circ C \sim 125^\circ C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition		S7809PI			Unit
				Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$		$T_j = 25^\circ C$	8.65	9.0	9.35	V
		$I_{OUT} = 5mA \sim 1A$ $V_{IN} = 11.5V \sim 24V$ , $P_O \leq 15W$		8.55	9.0	9.45	
Line Regulation	$\Delta V_{OUT}$	$V_{IN} = 11.5V \sim 27V$	$T_j = 25^\circ C$	-	7	180	mV
		$V_{IN} = 13.0V \sim 19V$		-	2	90	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT} = 5mA \sim 1.5A$	$T_j = 25^\circ C$	-	12	180	mV
		$I_{OUT} = 250mA \sim 750mA$		-	4	90	
Quiescent Current	$I_B$		$T_j = 25^\circ C$	-	4.3	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 11.5V \sim 27V$		-	-	1.0	mA
		$I_{OUT} = 5mA \sim 1A$		-	-	0.5	
Output Noise Voltage	$V_N$	$f = 10Hz \sim 100KHz$ ,	$T_j = 25^\circ C$	-	60	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f = 120Hz$ , $V_{IN} = 12V \sim 22V$		55	70	-	dB
Dropout Voltage	$V_D$	$I_{OUT} = 1A$	$T_j = 25^\circ C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$		$T_j = 25^\circ C$	-	0.4	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT} = 5mA$	$T_j = 25^\circ C$	-	-1.0	-	$mV/^\circ C$
Peak Output Current	$I_{PK}$		$T_j = 25^\circ C$	-	2.2	-	A

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## Electrical Characteristics

(V<sub>IN</sub> = 17V, I<sub>OUT</sub> = 500mA, T<sub>j</sub> = 0°C ~ 125°C, Unless otherwise noted)

Characteristic	Symbol	Test Condition	S7810PI			Unit
			Min.	Typ.	Max.	
Output Voltage	V <sub>OUT</sub>	T <sub>j</sub> = 25°C	9.6	10.0	10.4	V
		I <sub>OUT</sub> = 5mA ~ 1A V <sub>IN</sub> = 12.5V ~ 25V, P <sub>O</sub> ≤ 15W	9.5	10.0	10.5	
Line Regulation	ΔV <sub>OUT</sub>	V <sub>IN</sub> = 12.5V ~ 28V	-	7	200	mV
		V <sub>IN</sub> = 14.0V ~ 20V	-	2	100	
Load Regulation	ΔV <sub>OUT</sub>	I <sub>OUT</sub> = 5mA ~ 1.5A	-	12	200	mV
		I <sub>OUT</sub> = 250mA ~ 750mA	-	4	100	
Quiescent Current	I <sub>B</sub>	T <sub>j</sub> = 25°C	-	4.3	8.0	mA
Quiescent Current Change	ΔI <sub>B</sub>	V <sub>IN</sub> = 12.5V ~ 28V	-	-	1.0	mA
		I <sub>OUT</sub> = 5mA ~ 1A	-	-	0.5	
Output Noise Voltage	V <sub>N</sub>	f = 10Hz ~ 100KHz, T <sub>j</sub> = 25°C	-	70	-	uV <sub>rms</sub>
Ripple Rejection Ratio	RR	f = 120Hz, V <sub>IN</sub> = 13V ~ 23V	55	71	-	dB
Dropout Voltage	V <sub>D</sub>	I <sub>OUT</sub> = 1A, T <sub>j</sub> = 25°C	-	2.0	-	V
Short Circuit Current Limit	I <sub>SC</sub>	T <sub>j</sub> = 25°C	-	0.4	-	A
Output Voltage Drift	TC <sub>VO</sub>	I <sub>OUT</sub> = 5mA, T <sub>j</sub> = 25°C	-	-1.0	-	mV/°C
Peak Output Current	I <sub>PK</sub>	T <sub>j</sub> = 25°C	-	2.2	-	A

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## Electrical Characteristics

( $V_{IN}=19V$ ,  $I_{OUT}=500mA$ ,  $T_j = 0^{\circ}C \sim 125^{\circ}C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition		S7812PI			Unit
				Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$		$T_j = 25^{\circ}C$	11.5	12.0	12.5	V
		$I_{OUT}=5mA \sim 1A$ $V_{IN}=14.5V \sim 30V$ , $P_o \leq 15W$		11.4	12.0	12.6	
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=14.5V \sim 30V$	$T_j = 25^{\circ}C$	-	10	240	mV
		$V_{IN}=16.0V \sim 22V$		-	3	120	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA \sim 1.5A$	$T_j = 25^{\circ}C$	-	12	240	mV
		$I_{OUT}=250mA \sim 750mA$		-	4	120	
Quiescent Current	$I_B$		$T_j = 25^{\circ}C$	-	4.3	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 14.5V \sim 30V$		-	-	1.0	mA
		$I_{OUT} = 5mA \sim 1A$		-	-	0.5	
Output Noise Voltage	$V_N$	$f=10Hz \sim 100KHz$ ,	$T_j = 25^{\circ}C$	-	75	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f=120Hz$ , $V_{IN}=15V \sim 25V$		55	71	-	dB
Dropout Voltage	$V_D$	$I_{OUT}=1A$	$T_j = 25^{\circ}C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$		$T_j = 25^{\circ}C$	-	0.35	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT}=5mA$	$T_j = 25^{\circ}C$	-	-1.0	-	$mV/^{\circ}C$
Peak Output Current	$I_{PK}$		$T_j = 25^{\circ}C$	-	2.2	-	A

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## Electrical Characteristics

( $V_{IN}=23V$ ,  $I_{OUT}=500mA$ ,  $T_j = 0^{\circ}C \sim 125^{\circ}C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition		S7815PI			Unit
				Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$		$T_j = 25^{\circ}C$	14.4	15.0	15.6	V
		$I_{OUT}=5mA \sim 1A$ $V_{IN}=17.5V \sim 30V$ , $P_o \leq 15W$		14.25	15.0	15.75	
Line Regulation	$\Delta V_{OUT}$	$V_{IN}=17.5V \sim 30V$	$T_j = 25^{\circ}C$	-	12	300	mV
		$V_{IN}=20V \sim 26V$		-	3	150	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT}=5mA \sim 1.5A$	$T_j = 25^{\circ}C$	-	12	300	mV
		$I_{OUT}=250mA \sim 750mA$		-	4	150	
Quiescent Current	$I_B$		$T_j = 25^{\circ}C$	-	4.3	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 17.5V \sim 30V$		-	-	1.0	mA
		$I_{OUT} = 5mA \sim 1A$		-	-	0.5	
Output Noise Voltage	$V_N$	$f=10Hz \sim 100KHz$ ,	$T_j = 25^{\circ}C$	-	90	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f=120Hz$ , $V_{IN} = 18.5V \sim 28.5V$		54	70	-	dB
Dropout Voltage	$V_D$	$I_{OUT}=1A$	$T_j = 25^{\circ}C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$		$T_j = 25^{\circ}C$	-	0.23	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT}=5mA$	$T_j = 25^{\circ}C$	-	-1.0	-	$mV/^{\circ}C$
Peak Output Current	$I_{PK}$		$T_j = 25^{\circ}C$	-	2.1	-	A

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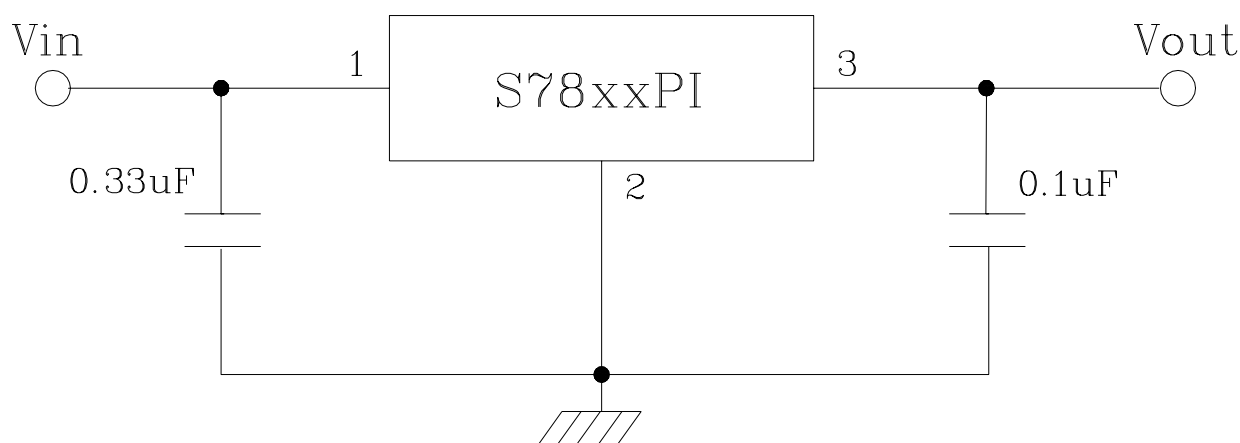
## Electrical Characteristics

( $V_{IN} = 33V$ ,  $I_{OUT} = 500mA$ ,  $T_j = 0^\circ C \sim 125^\circ C$ , Unless otherwise noted)

Characteristic	Symbol	Test Condition	S7824PI			Unit
			Min.	Typ.	Max.	
Output Voltage	$V_{OUT}$	$T_j = 25^\circ C$	23.0	24.0	25.0	V
		$I_{OUT} = 5mA \sim 1A$ $V_{IN} = 27V \sim 38V$ , $P_O \leq 15W$	22.8	24.0	25.2	
Line Regulation	$\Delta V_{OUT}$	$V_{IN} = 27V \sim 38V$	-	18	480	mV
		$V_{IN} = 30V \sim 36V$	-	6	240	
Load Regulation	$\Delta V_{OUT}$	$I_{OUT} = 5mA \sim 1.5A$	-	12	480	mV
		$I_{OUT} = 250mA \sim 750mA$	-	4	240	
Quiescent Current	$I_B$	$T_j = 25^\circ C$	-	4.6	8.0	mA
Quiescent Current Change	$\Delta I_B$	$V_{IN} = 27V \sim 38V$	-	-	1.0	mA
		$I_{OUT} = 5mA \sim 1A$	-	-	0.5	
Output Noise Voltage	$V_N$	$f = 10Hz \sim 100KHz$ , $T_j = 25^\circ C$	-	170	-	$\mu V_{rms}$
Ripple Rejection Ratio	RR	$f = 120Hz$ , $V_{IN} = 28V \sim 38V$	50	66	-	dB
Dropout Voltage	$V_D$	$I_{OUT} = 1A$ , $T_j = 25^\circ C$	-	2.0	-	V
Short Circuit Current Limit	$I_{SC}$	$T_j = 25^\circ C$	-	0.15	-	A
Output Voltage Drift	$TC_{VO}$	$I_{OUT} = 5mA$ , $T_j = 25^\circ C$	-	-1.5	-	$mV/^\circ C$
Peak Output Current	$I_{PK}$	$T_j = 25^\circ C$	-	2.1	-	A

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### Test circuit



## Electrical Characteristic Curves

Fig. 1  $V_{DVS}$  vs  $T_j$

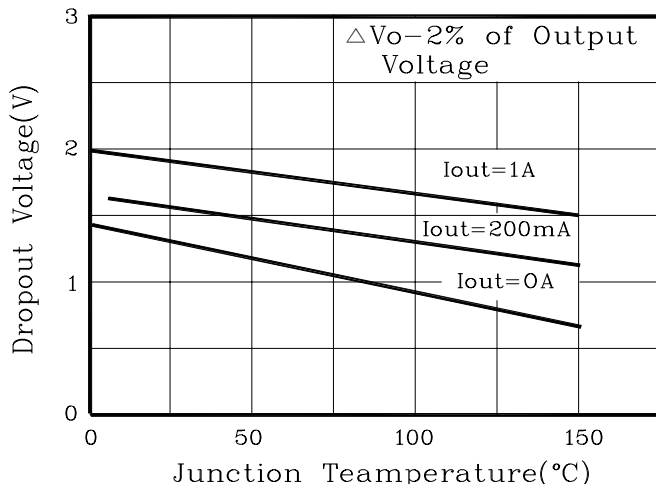


Fig. 2  $I_{OUT}$  vs  $|V_{in} - V_{OUT}|$

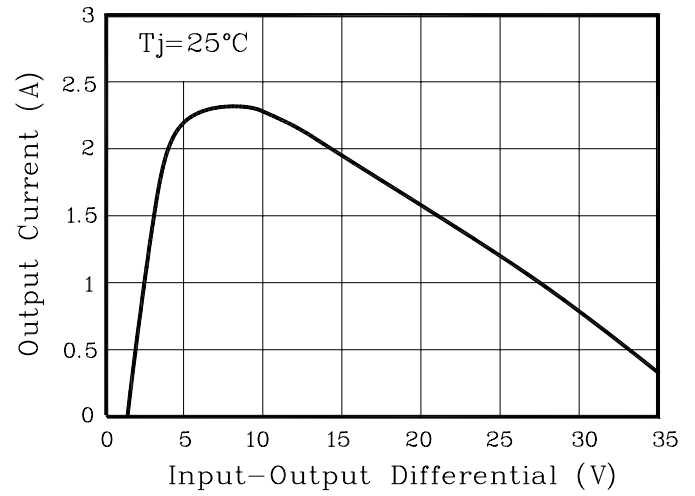


Fig. 3  $P_D$  vs  $T_a$

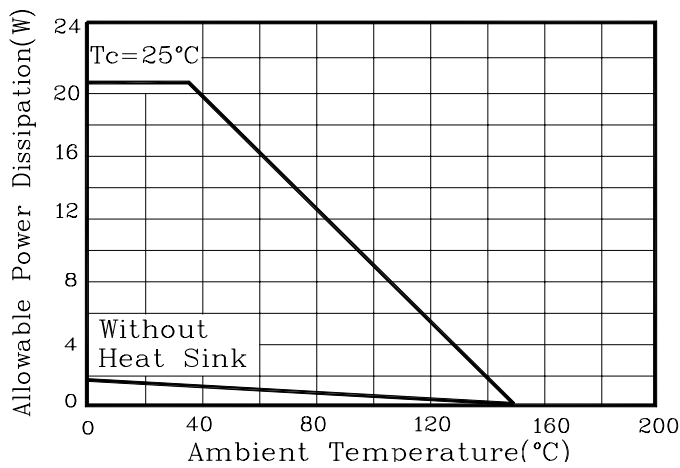


Fig. 4  $I_{QC}$  vs  $V_{in}$

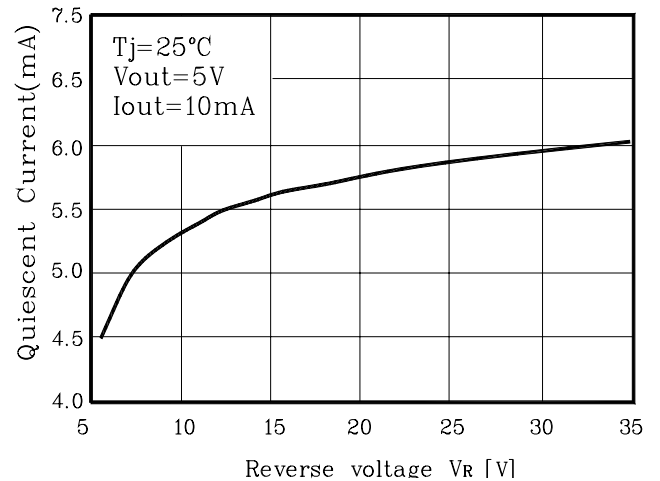


Fig. 5 Ripple Rejection

