

AX78LXXAM/BM

AX78LXXAA/BA

3-Terminal Positive Voltage Regulators

Description

These regulators employ internal current-limiting and thermal-shutdown, making them essentially indestructible. They can deliver up to 100mA output current.

Features

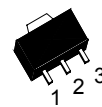
- Maximum Output Current of 100mA ($T_C=25^{\circ}\text{C}$)
- Internal Short-Circuit Current Limiting
- Internal Thermal Overload Protection
- TO-92 & SOT-89 Package

Absolute Maximum Ratings

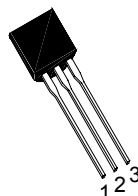
($T_A=25^{\circ}\text{C}$, Unless Otherwise Specified)

Characteristic	Symbol	Rating		Unit
Input Voltage	V_{IN}	40		V
Power Dissipation	P_D	TO-92	700	mW
		SOT-89	500	mW
Operating Temperature	T_{opr}	-30 to 85		$^{\circ}\text{C}$
Storage Temperature	T_{stg}	-55 to 150		$^{\circ}\text{C}$
Junction Temperature	T_j	150		$^{\circ}\text{C}$
Thermal Resistance	$R_{th(j-a)}$	208		$^{\circ}\text{C/W}$

AX78LXX Series Pin Assignment

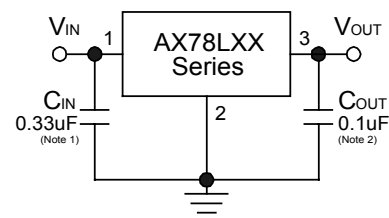


3-Lead Plastic **SOT-89**
Package Code: M
Pin 1: V_{OUT}
Pin 2: GND
Pin 3: V_{IN}



3-Lead Plastic **TO-92**
Package Code: A
Pin 1: V_{OUT}
Pin 2: GND
Pin 3: V_{IN}

Typical Application

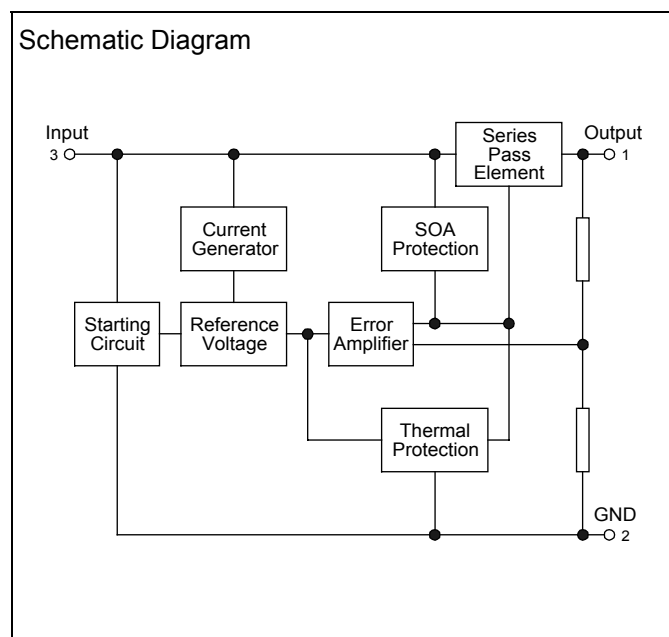


Note 1: C_{IN} is required if regulator is located an appreciable distance from power supply filter.

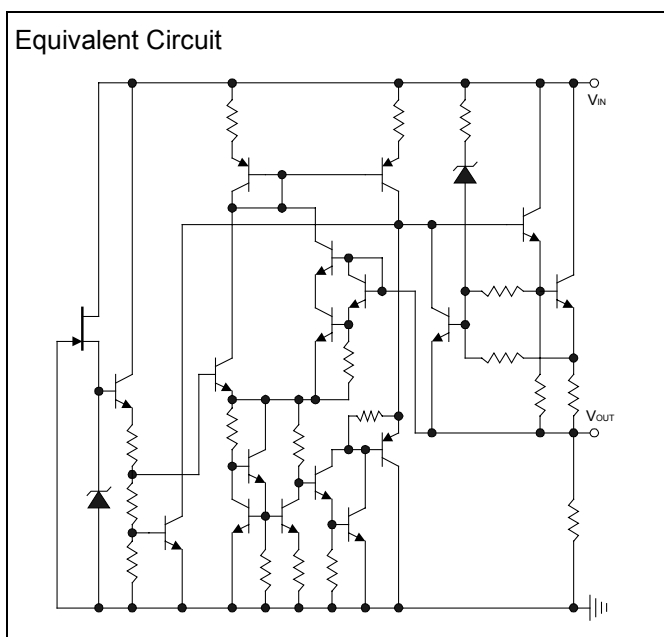
Note 2: C_{OUT} is not needed for stability; however, it does improve transient response. Values of less than 0.1uF could cause instability.

Schematic Diagram & Equivalent Circuit

Schematic Diagram



Equivalent Circuit



AX78L05XX Electrical Characteristics

$V_{IN}=10V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	AX78L05AM/AA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	4.85	5	5.15	V
		1mA≤I _{OUT} ≤70mA	4.85	5	5.15	
		7V≤V _{IN} ≤20V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 7V≤V _{IN} ≤20V	-	15	150	mV
		T _j =25°C, 8V≤V _{IN} ≤20V	-	15	100	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	11	60	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	5	30	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	8V≤V _{IN} ≤20V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	40	-	uVrms
RR	Ripple Rejection	8V≤V _{IN} ≤18V, f=120Hz, T _j =25°C	41	49	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	V _{IN} =10V, T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.6	mV/°C

Symbol	Parameter	Conditions	AX78L05BM/BA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	4.75	5	5.25	V
		1mA≤I _{OUT} ≤70mA	4.75	5	5.25	
		7V≤V _{IN} ≤20V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 7V≤V _{IN} ≤20V	-	15	150	mV
		T _j =25°C, 8V≤V _{IN} ≤20V	-	15	100	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	11	60	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	5	30	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	8V≤V _{IN} ≤20V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	40	-	uVrms
RR	Ripple Rejection	8V≤V _{IN} ≤18V, f=120Hz, T _j =25°C	41	49	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	V _{IN} =10V, T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.6	mV/°C

AX78L06XX Electrical Characteristics

$V_{IN}=11V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	AX78L06AM/AA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	5.82	6	6.18	V
		1mA≤I _{OUT} ≤70mA	5.82	6	6.18	
		8V≤V _{IN} ≤22V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 8V≤V _{IN} ≤22V	-	15	155	mV
		T _j =25°C, 9V≤V _{IN} ≤12V	-	20	105	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	15	70	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	5	35	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	9V≤V _{IN} ≤22V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	50	-	uVrms
RR	Ripple Rejection	9V≤V _{IN} ≤19V, f=120Hz, T _j =25°C	39	47	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	V _{IN} =10V, T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.7	mV/°C

Symbol	Parameter	Conditions	AX78L06BM/BA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	5.7	6	6.3	V
		1mA≤I _{OUT} ≤70mA	5.7	6	6.3	
		8V≤V _{IN} ≤22V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 8V≤V _{IN} ≤22V	-	15	155	mV
		T _j =25°C, 9V≤V _{IN} ≤12V	-	20	105	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	15	70	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	5	35	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	9V≤V _{IN} ≤22V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	50	-	uVrms
RR	Ripple Rejection	9V≤V _{IN} ≤19V, f=120Hz, T _j =25°C	39	47	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	V _{IN} =10V, T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.7	mV/°C

AX78L08XX Electrical Characteristics

$V_{IN}=14V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	AX78L08AM/AA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	7.76	8	8.24	V
		1mA≤I _{OUT} ≤70mA	7.76	8	8.24	
		10.5V≤V _{IN} ≤23V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 10.5V≤V _{IN} ≤23V	-	20	175	mV
		T _j =25°C, 11V≤V _{IN} ≤23V	-	20	125	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	15	80	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	7	40	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	11V≤V _{IN} ≤23V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	60	-	uVrms
RR	Ripple Rejection	12V≤V _{IN} ≤23V, f=120Hz, T _j =25°C	37	45	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.9	mV/°C

Symbol	Parameter	Conditions	AX78L08BM/BA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	7.6	8	8.4	V
		1mA≤I _{OUT} ≤70mA	7.6	8	8.4	
		10.5V≤V _{IN} ≤23V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 10.5V≤V _{IN} ≤23V	-	20	175	mV
		T _j =25°C, 11V≤V _{IN} ≤23V	-	20	125	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	15	80	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	7	40	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	11V≤V _{IN} ≤23V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	60	-	uVrms
RR	Ripple Rejection	12V≤V _{IN} ≤23V, f=120Hz, T _j =25°C	37	45	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{sc}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	0.9	mV/°C

AX78L09XX Electrical Characteristics

$V_{IN}=15V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	AX78L09AM/AA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	8.73	9	9.27	V
		1mA≤I _{OUT} ≤70mA	8.73	9	9.27	
		11.4V≤V _{IN} ≤24V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 11.4V≤V _{IN} ≤24V	-	80	200	mV
		T _j =25°C, 12V≤V _{IN} ≤24V	-	20	160	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	17	90	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	8	45	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	12V≤V _{IN} ≤24V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	65	-	uVrms
RR	Ripple Rejection	12V≤V _{IN} ≤24V, f=120Hz, T _j =25°C	36	44	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	1	mV/°C

Symbol	Parameter	Conditions	AX78L09BM/BA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	8.55	9	9.45	V
		1mA≤I _{OUT} ≤70mA	8.55	9	9.45	
		11.4V≤V _{IN} ≤24V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 11.4V≤V _{IN} ≤24V	-	80	200	mV
		T _j =25°C, 12V≤V _{IN} ≤24V	-	20	160	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	17	90	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	8	45	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	12V≤V _{IN} ≤24V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	65	-	uVrms
RR	Ripple Rejection	12V≤V _{IN} ≤24V, f=120Hz, T _j =25°C	36	44	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{sc}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	1	mV/°C

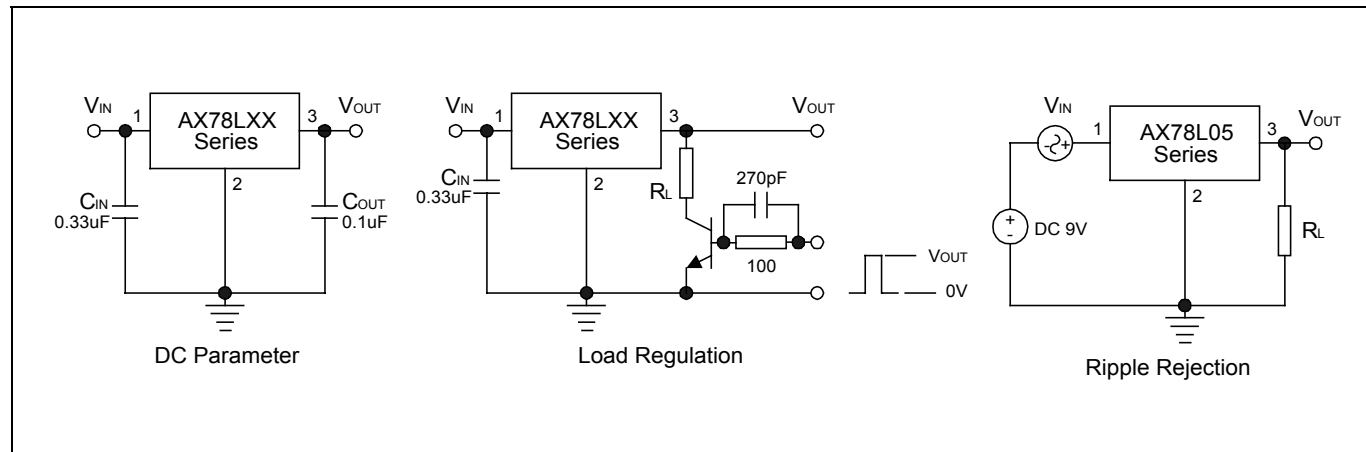
AX78L12XX Electrical Characteristics

$V_{IN}=19V$, $I_{OUT}=40mA$, $C_{IN}=0.33\mu F$, $C_{OUT}=0.1\mu F$, $0^{\circ}C \leq T_J \leq 125^{\circ}C$ (unless otherwise specified)

Symbol	Parameter	Conditions	AX78L12AM/AA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	11.64	12	12.36	V
		1mA≤I _{OUT} ≤70mA	11.64	12	12.36	
		14.5V≤V _{IN} ≤27V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 14.5V≤V _{IN} ≤27V	-	120	250	mV
		T _j =25°C, 16V≤V _{IN} ≤27V	-	100	200	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	20	100	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	10	50	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	16V≤V _{IN} ≤27V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	80	-	uVrms
RR	Ripple Rejection	15V≤V _{IN} ≤25V, f=120Hz, T _j =25°C	36	41	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{SC}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	1.4	mV/°C

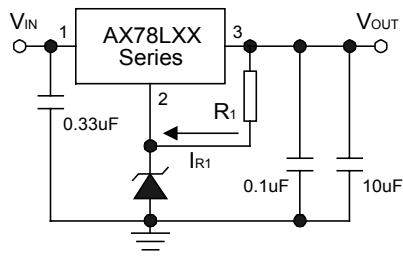
Symbol	Parameter	Conditions	AX78L12BM/BA			Units
			Min	Typ	Max	
V _O	Output Voltage	T _j =25°C	11.4	12	12.6	V
		1mA≤I _{OUT} ≤70mA	11.4	12	12.6	
		14.5V≤V _{IN} ≤27V, 1mA≤I _{OUT} ≤40mA				
Reg _{line}	Line Regulation	T _j =25°C, 14.5V≤V _{IN} ≤27V	-	120	250	mV
		T _j =25°C, 16V≤V _{IN} ≤27V	-	100	200	
Reg _{load}	Load Regulation	T _j =25°C, 1mA≤I _{OUT} ≤100mA	-	20	100	mV
		T _j =25°C, 1mA≤I _{OUT} ≤40mA	-	10	50	
I _B	Quiescent Current	I _{OUT} =5mA, T _j =25°C	-	3.9	6	mA
ΔI _B	Quiescent Current Change	16V≤V _{IN} ≤27V, T _j =25°C	-	-	1.5	mA
		1mA≤I _{OUT} ≤40mA, T _j =25°C	-	-	0.1	
V _N	Output Noise Voltage	10Hz≤f≤100KHz, T _j =25°C	-	80	-	uVrms
RR	Ripple Rejection	15V≤V _{IN} ≤25V, f=120Hz, T _j =25°C	36	41	-	dB
V _D	Dropout Voltage	T _j =25°C, I _{OUT} =100mA	-	1.7	2.5	V
R _O	Output Resistance	f=1KHz	-	17	-	mΩ
I _{sc}	Short Circuit Current	T _j =25°C	-	1.5	2	A
T _{cvo}	Average Temperature Coefficient of Output Voltage	I _{OUT} =5mA	-	-	1.4	mV/°C

Test Circuits



Application Circuits

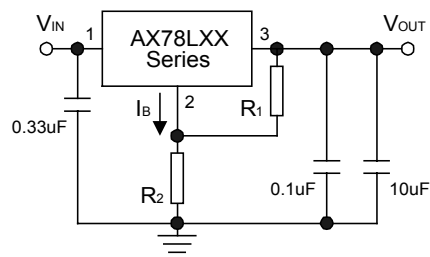
Constant Current Regulator



$$V_{OUT} = V_{OUT(IC)} + V_Z$$

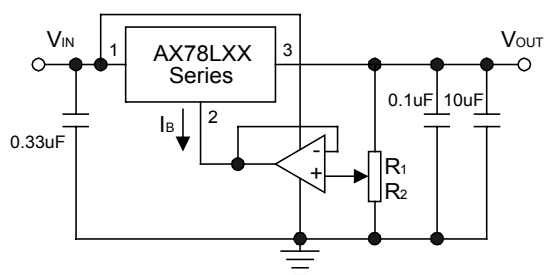
$$I_1 = V_{OUT(IC)} / R_1$$

Circuit for Increasing Output Voltage



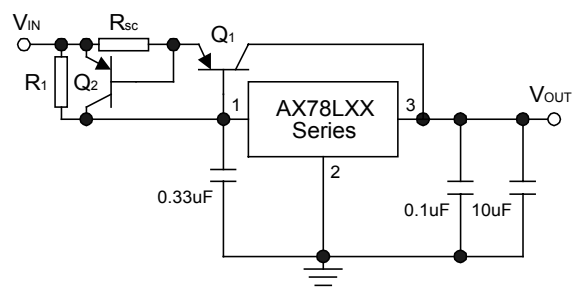
$$V_{OUT} = V_{OUT(IC)}(1 + R_2/R_1) + R_2 \cdot I_B$$

Adjustable Output Regulator



$$V_{OUT} = V_{OUT(IC)}(1 + R_2/R_1)$$

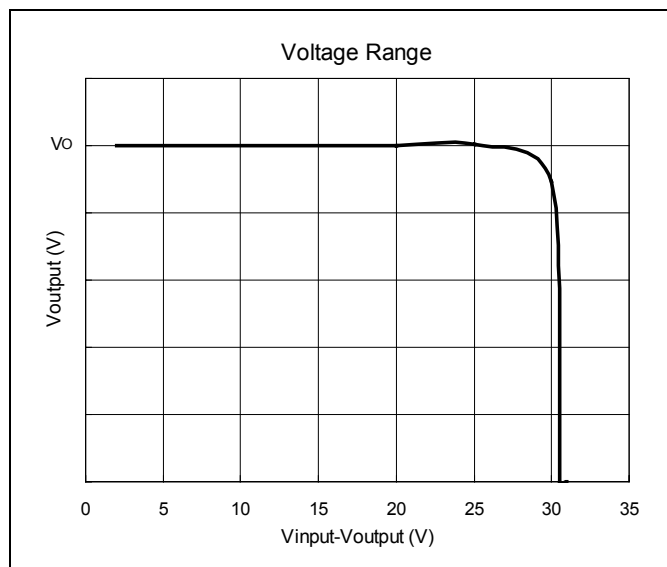
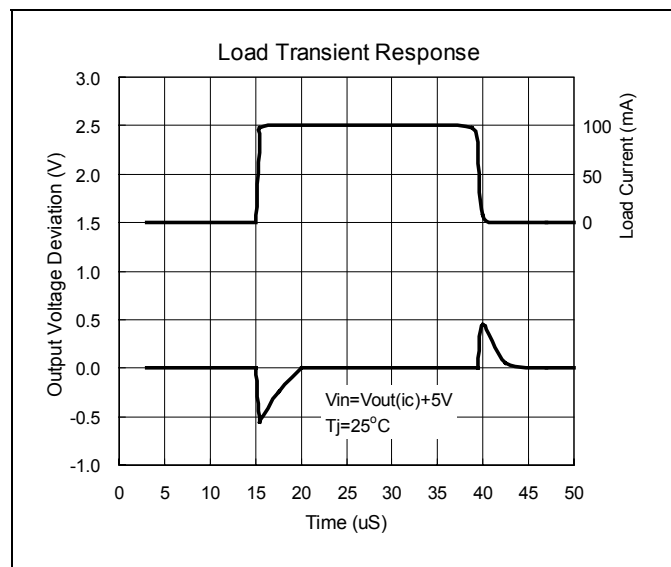
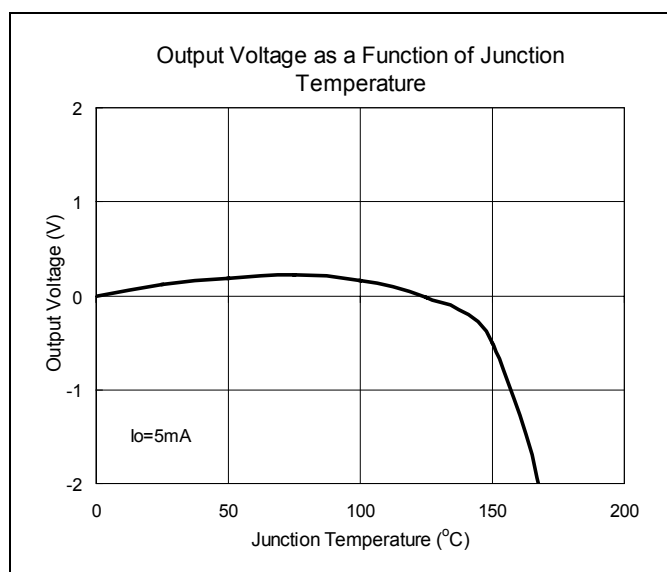
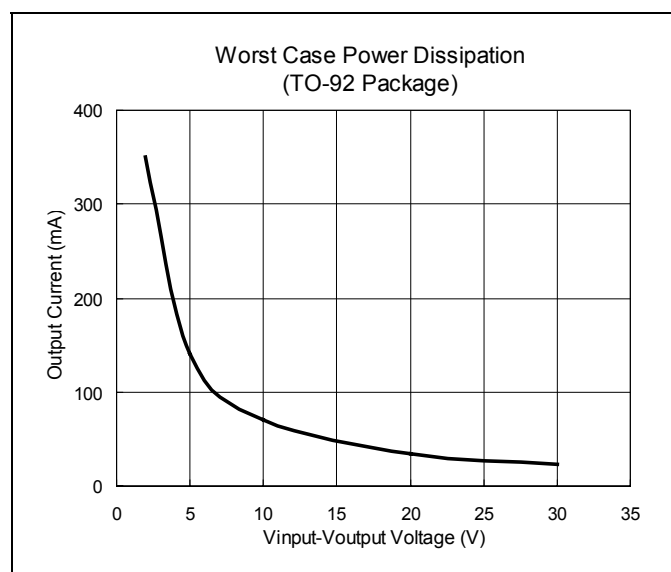
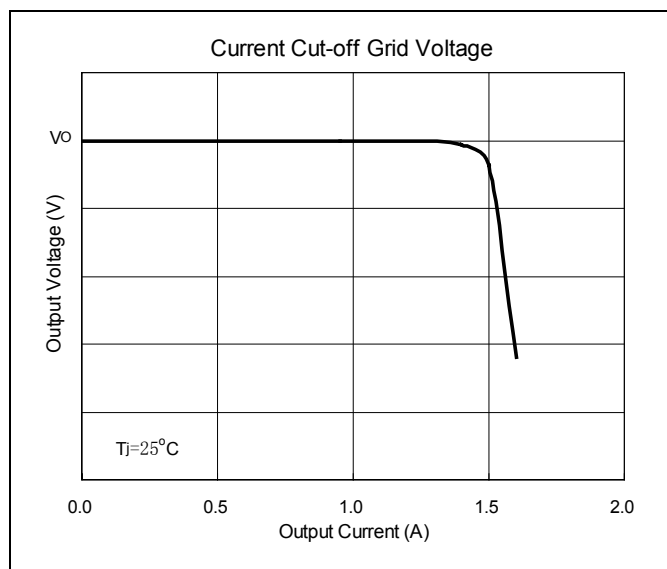
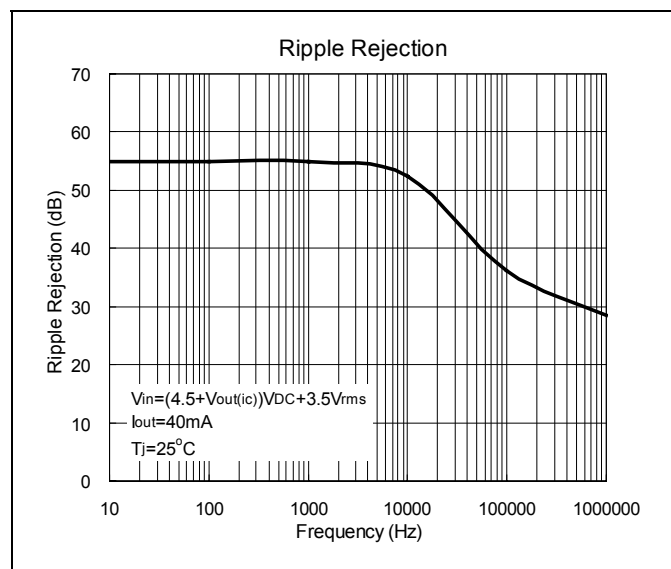
High Output Current with Short-circuit Protection



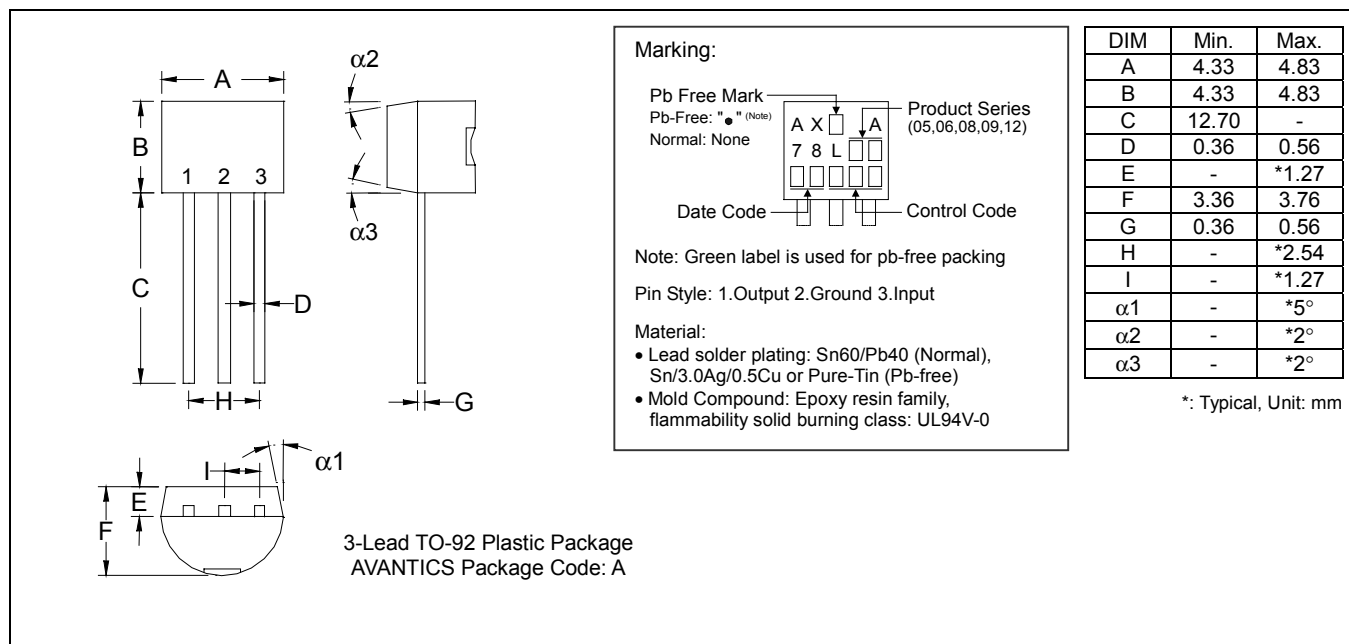
$$R_1 \leq V_{BE1} / I_{B(max)}$$

$$R_{SC} = V_{BE2} / I_{SC}, I_{SC}: \text{Short-Circuit Current}$$

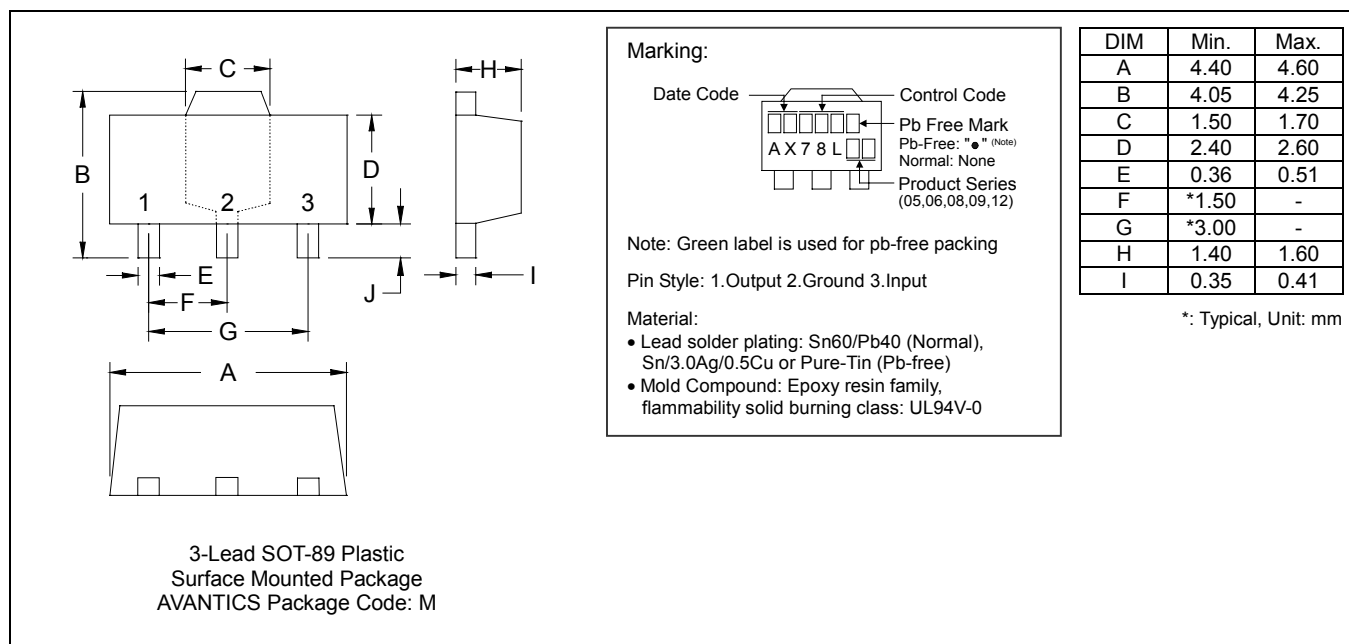
Characteristics Curve



TO-92 Dimension



SOT-89 Dimension



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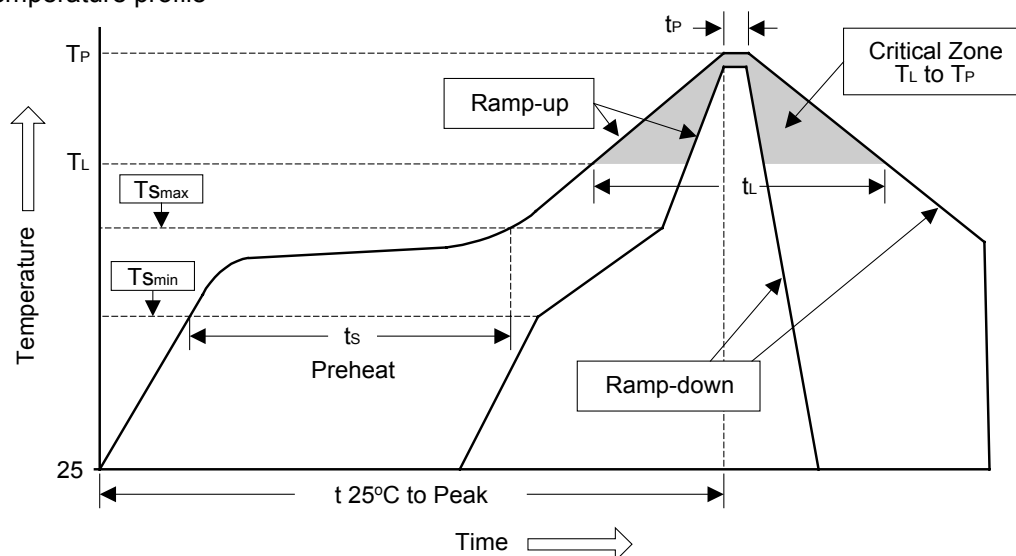
- AVANTICS Microelectronics Corp: No. 255, Cai Lun Rd. Zhangjiang Technology Industrial Park Pudong, Shanghai, China
 Tel: 86-021-58955599 Fax: 86-021-58558038

Soldering Methods for AVANTICS's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat		
- Temperature Min (T_{smin})	100°C	150°C
- Temperature Max (T_{smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec