*SCI7810Y** Series Voltage Regulators*

Technical Manual

(Preliminary)

S-MOS Systems, Inc.
August 1996
Version 1.0 (Preliminary)

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1.0 OVERVIEW

1.1 SUMMARY

The SCI7810Y Series are fixed-voltage, rectifying regulators developed using a CMOS silicon gate process. They are low-power devices comprised of standard voltage circuits, such as differential amplifiers, output control transistors, and voltage control resistors.

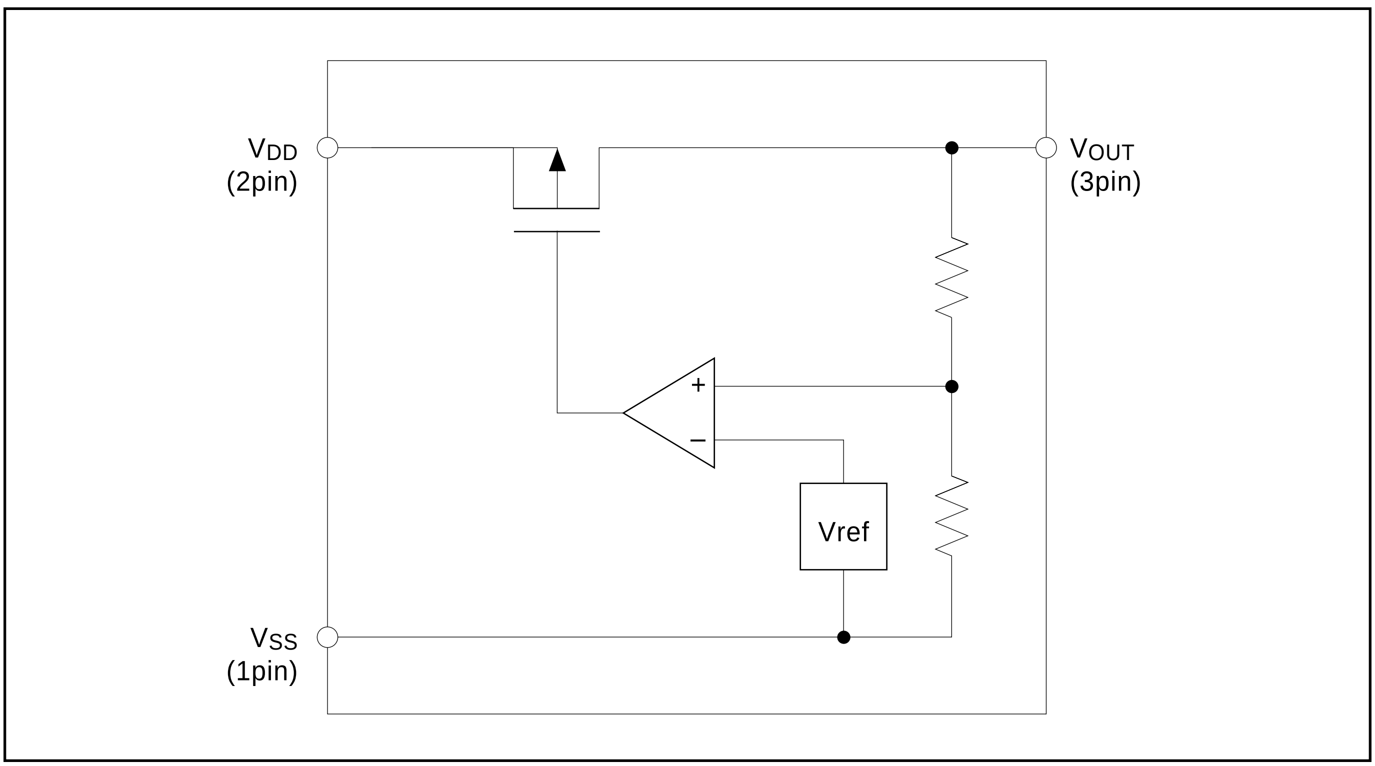
The output voltage is set for each part and there are various standard voltage products available in this series.

The SCI7810Y regulators come in SOT89 3-pin plastic packages.

1.2 FEATURES

- Generous lineup: The SCI7810Y series includes 12 different devices in a 2V to 6V range.
- Low current consumption .... Typ. 1.5 µA (V_{DD} = 5.0V)
- Low input/output voltage differential .... Typ. 0.20V (I/O = 10 mA, Vout = 5.0V)
- High-stability standard internal voltage power supply .... Typ. 1.0V
- Low dependence of output voltage on temperature .... Typ. –100 ppm/˚C
- Broad range of operating voltages .... Max. 15V

1.3 BLOCK DIAGRAM

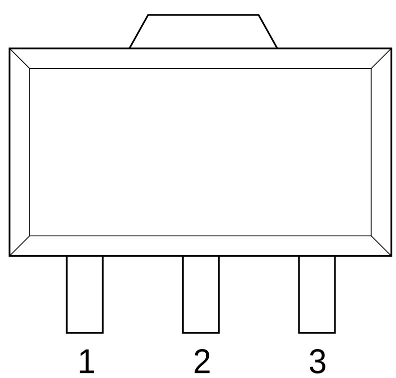


2.0 PIN OUT

2.1 PIN OUT

Pin No.	Pin Name	Pin Function
1	V_{SS}	Input voltage terminal (negative side)
2	V_{DD}	Input voltage terminal (positive side)
3	V_{OUT}	Output voltage terminal

SOT89-3 pin

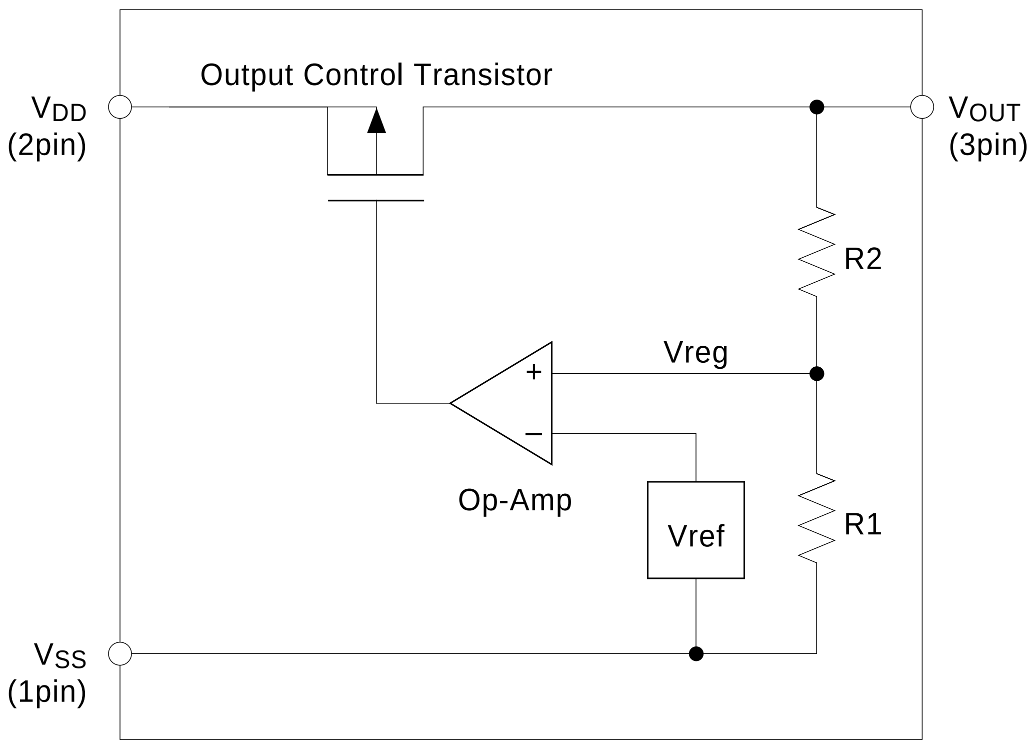


3.0 FUNCTIONAL DESCRIPTION

3.1 FUNCTIONAL DESCRIPTION

The SCI7810Y series is a set of series-regulator-type fixed positive-output voltage regulators that have MOS transistors between the input and the output to control the output voltage. The SCI7810Y series regulators feed a voltage (Vreg), which is generated by a voltage divider made of two internal resistors R1 and R2, (which are connected between V_{OUT} and V_{SS}), and feed it back into the op-amp. Vreg is then compared to a reference voltage (Vref), and an output voltage (VO) is generated by an output control transistor gate that is independent of the input voltage. The output voltage is determined internally, based on the formula below:

$$V_{OUT} = \frac{R1 + R2}{R1} \bullet V_{ref}$$



4.0 TABLE OF SERIES PRODUCTS

4.1 TABLE OF SERIES PRODUCTS

Product Name	Output Voltage		
	MIN	TYP	MAX
SCI7810YAA	5.75	6.00	6.25
SCI7810YBA	4.90	5.00	5.10
SCI7810YMA	4.40	4.50	4.60
SCI7810YPA	3.90	4.00	4.10
SCI7810YKA	3.80	3.90	4.00
SCI7810YNA	3.43	3.50	3.57
SCI7810YTA	3.23	3.30	3.37
SCI7810YCA	3.13	3.20	3.27
SCI7810YDA	2.93	3.00	3.07
SCI7810YRA	2.73	2.80	2.87
SCI7810YLA	2.53	2.60	2.67
SCI7810YFA	2.15	2.20	2.25

5.0 ABSOLUTE MAXIMUM RATINGS

5.1 ABSOLUTE MAXIMUM RATINGS

Parameter	Symbol	Rating	Units
Input voltage	$V_{DD} – V_{SS}$	18	V
Output voltage	V_O	V_{DD} + 0.3 ~ V_{SS} – 0.3	
Output current	I_O	100	mA
Allowable loss	P_D	200	mW
Operating temperature	T_{OPR}	–30 ~ + 85	°C
Storage temperature	T_{STG}	–65 ~ + 150	
Soldering time/Soldering temperature	T_{SOL}	10 seconds (lead) 260°C	—

6.0 ELECTRICAL CHARACTERISTICS

6.1 SCI7810YAA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 8.0V, IO = –10 mA Ta = 25°C	5.75	6.00	6.25	V
Consumption Current	IOP	V_{DD} = 6.0V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 6.0V, IO = –10 mA	—	0.16	0.32	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 7.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 8.0V IO = –1 mA ~ –50 mA	—	50	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 8.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.2 SCI7810YBA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 7.0V, IO = –10 mA Ta = 25°C	4.90	5.00	5.10	V
Consumption Current	IOP	V_{DD} = 5.0V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 5.0V, IO = –10 mA	—	0.17	0.34	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 6.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 7.0V IO = –1 mA ~ –50 mA	—	50	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 7.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.3 SCI7810YMA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 6.0V, IO = –10 mA Ta = 25°C	4.40	4.50	4.60	V
Consumption Current	IOP	V_{DD} = 4.5V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 4.5V, IO = –10 mA	—	0.18	0.36	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 6.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 6.0V IO = –1 mA ~ –40 mA	—	40	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 6.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.4 SCI7810YPA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 6.0V, IO = –10 mA Ta = 25°C	3.90	4.00	4.10	V
Consumption Current	IOP	V_{DD} = 4.0V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 4.0V, IO = –10 mA	—	0.19	0.38	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 6.0V IO = –1 mA ~ –40 mA	—	40	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 6.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.5 SCI7810YKA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 6.0V, IO = –10 mA Ta = 25°C	3.80	3.90	4.00	V
Consumption Current	IOP	V_{DD} = 3.9V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 3.9V, IO = –10 mA	—	0.19	0.38	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 6.0V IO = –1 mA ~ –40 mA	—	40	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 6.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.6 SCI7810YNA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	3.43	3.50	3.57	V
Consumption Current	IOP	V_{DD} = 3.5V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 3.5V, IO = –10 mA	—	0.21	0.42	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	∆VO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.7 SCI7810YTA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	3.23	3.30	3.37	V
Consumption Current	IOP	V_{DD} = 3.3V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 3.3V, IO = –10 mA	—	0.22	0.44	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 4.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.8 SCI7810YCA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	3.13	3.20	3.27	V
Consumption Current	IOP	V_{DD} = 3.2V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 3.2V, IO = –10 mA	—	0.22	0.44	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 4.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.9 SCI7810YDA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	2.93	3.00	3.07	V
Consumption Current	IOP	V_{DD} = 3.0V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 3.0V, IO = –10 mA	—	0.23	0.46	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 4.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.10 SCI7810YRA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	2.73	2.80	2.87	V
Consumption Current	IOP	V_{DD} = 2.8V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 2.8V, IO = –10 mA	—	0.24	0.48	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 4.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.11 SCI7810YLA

Unless otherwise noted, Ta = –30˚C to +85˚C

Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 5.0V, IO = –10 mA Ta = 25°C	2.53	2.60	2.67	V
Consumption Current	IOP	V_{DD} = 2.6V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 2.6V, IO = –10 mA	—	0.25	0.50	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 4.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	ΔVO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 5.0V IO = –1 mA ~ –30 mA	—	30	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 5.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

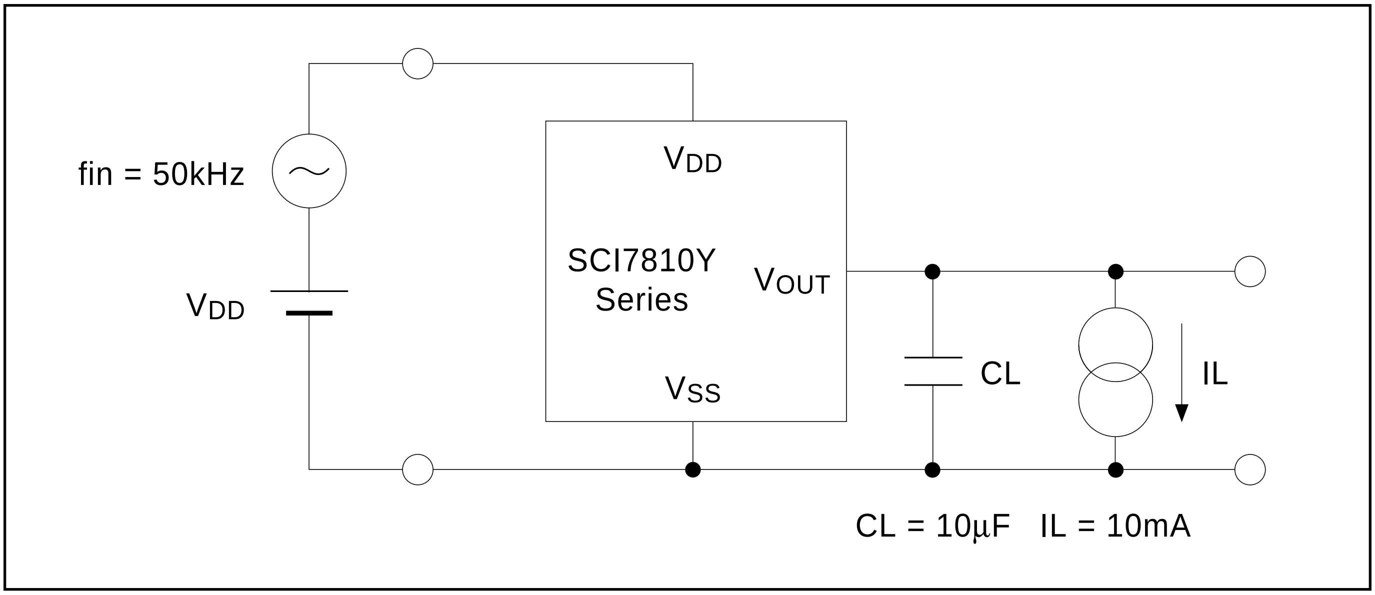
6.12 SCI7810YFA

Unless otherwise noted, Ta = –30˚C to +85˚C

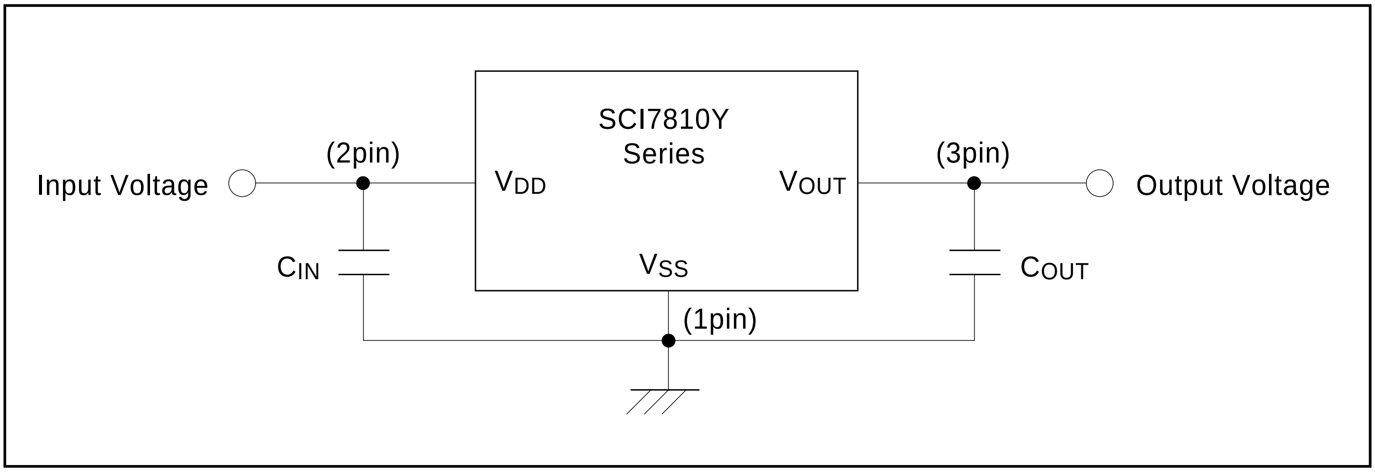
Parameter	Symbol	Conditions (V_{SS} = 0.0V)	MIN	TYP	MAX	Units
Input Voltage	VI	—	—	—	15	V
Output voltage	VO	V_{DD} = 3.0V, IO = –10 mA Ta = 25°C	2.15	2.20	2.25	V
Consumption Current	IOP	V_{DD} = 2.2V ~ 15.0V No load	—	1.5	5.0	µA
Voltage differential between input and output	VI – VO	VOUT = 2.2V, IO = –10 mA	—	0.28	0.56	V
Output voltage temperature dependency	$\frac{\Delta VOUT}{VOUT}$	—	–300	–100	+100	ppm/°C
Input stability	$\frac{dVO}{dVI \cdot VO}$	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 3.0 V ~ 15.0V IO = –10 mA	—	0.1	—	%/V
Load Stability	∆VO	Ta = –30°C ~ +85°C (under the identical temperature conditions) V_{DD} = 3.0V IO = –1 mA ~ –10 mA	—	20	—	mV
Power supply fluctuation attenuation rate	PSRR	V_{DD} = 3.0V, fin = 50 KHz CL = 10 µF, IOUT = –10 mA	—	–40	—	dB

6.13 MEASUREMENT CIRCUIT DIAGRAM

The power supply voltage fluctuation attenuation characteristics can be obtained as shown below.

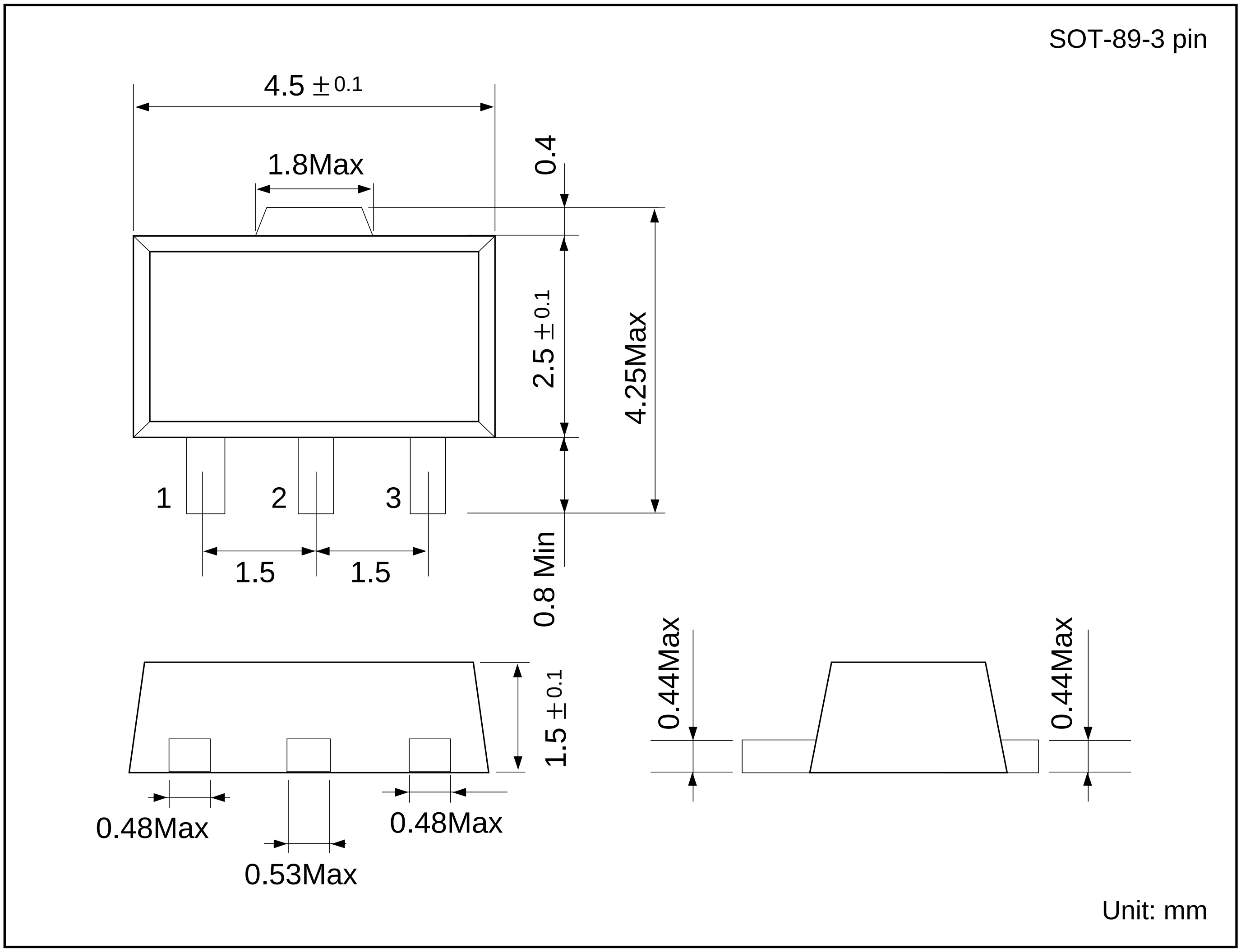


6.14 EXTERNAL CONNECTION EXAMPLE (REFERENCE)



7.0 EXTERNAL DIMENSION DIAGRAM

7.1 EXTERNAL DIMENSION DIAGRAM



Note: This information is subject to change without notice for the purpose of making improvements.