Mono 1.5W Power Amplifier Low Voltage Operation

FEATURES

- Operation range: 2.5V ~ 6.5V
- Shutdown Current 0.1uA at 5V
- PSRR at 217Hz, 70dB at 5V
- Output power
  THD+N=10%
  R_L=8Ω, 2.1W at 6V, 1.5W at 5V, 0.65W at 3.3V, 0.35W at 2.5V,
  THD+N=1%
  R_L=8Ω, 1.75W at 6V ,1.2W at 5V, 0.5W at 3.3V, 0.25W at 2.5V
  THD+N = 0.2%
  R_L=8Ω, 1.25W at 6V ,0.8W at 5V, 0.4W at 3.3V, 0.2W at 2.5V
- Unity-gain stable
- Space-saving SOP8(TP).

APPLICATIONS

- Portable electronic devices
- PDAs
- Communication headsets

Cross-reference

LM4890, LM4893, TS4890
TPA751, MAX9716

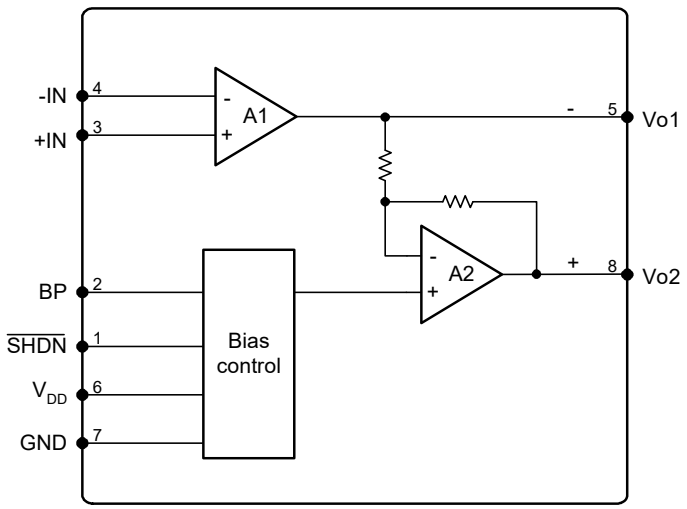
DESCRIPTION

The MS6890 is a low distortion power amplifier that can drive 1.5W of continuous average power into a mono 8Ω bridged-tied load (BTL). Operation with 2.5V supply, it can drive 0.2W into a mono 8Ω. The BTL configuration eliminates the need for external coupling capacitors on the output in most applications. The MS6890 is unity-gain stable and can be configured by external gain-setting resistors.

The MS6890 has good feature for portable equipment, these features include the low voltage operation, micropower consumption shutdown mode, enhance thermal pad small package SOP8(TP), make the MS6890 ideally suited for use in portable electronic equipments.

*TP : Thermal Pad

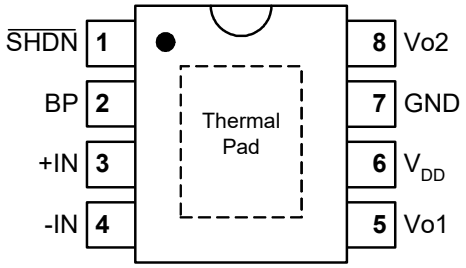
BLOCK DIAGRAM



PIN CONFIGURATION

Symbol	Pin	Description
/SHDN	1	/Shutdown places the entire device in shutdown mode when held low. TTL compatible input.
BP	2	Bypass is the cap to the voltage divider for internal mid-supply bias. This terminal should be connected to a 0.1-μF to 10-μF capacitor C_{BP}.
+IN	3	Non-inverting input
-IN	4	Inverting input
Vo1	5	BTL negative output
V_{DD}	6	Supply voltage
GND	7	Ground
Vo2	8	BTL positive output

SOP8(TP)



ORDERING INFORMATION

Package	Part number	Packaging Marking	Transport Media
8-Pin SOP (lead free)	MS6890GTR	6890G	2.5k Units Tape and Reel
8-Pin SOP (lead free)	MS6890GU	6890G	100 Units Tube

RoHS Compliance

ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Rating	Unit
VDD	Supply voltage	6.5	V
V_{ESD}	Electrostatic handling	3500	V
T_{STG}	Storage temperature range	-65 to 150	℃
T_A	Operating ambient temperature range	-40 to 85	℃
T_J	Maximum junction temperature	150	℃
T_S	Soldering temperature, 10 seconds	260	℃
R_{THJA}	Thermal resistance from junction to ambient in free air SOP8(enhance thermal pad)	156.5	℃/W

OPERATING RATINGS

Symbol	Parameter	Min	Typ	Max	Unit
V_{DD}	Supply voltage	2.5	5	6.5	V

6V ELECTRICAL CHARACTERISTICS

Ta = 25°C, V_{DD}=6V, f=1kHz, BW<30kHz。

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_Q	Quiescent current	V_{IN}=0V, I_O=0A	-	3	-	mA
I_{SHDN}	Shutdown current	$V_{/SHDN}$= GND	-	0.1	-	uA
V_{SDH}	Shutdown input voltage high		2.0	-	-	V
V_{SDL}	Shutdown input voltage low		-	-	0.8	V
PSRR	Power supply rejection ratio	R_L=8Ω, C_{BP}=10uF, f=217Hz	-	60	-	dB
THD+N	Total harmonic distortion plus noise	R_L=8Ω, 1.25W	-	-55	-52	dB
				0.17	0.251	%
S/N	Signal-to-noise ratio	R_L=8Ω, 1.25W	95	108	-	dB
Po	Output power	R_L=8Ω, THD+N = 10%	-	2.1	-	W
		R_L=8Ω, THD+N = 1%	-	1.75	-	W

5V ELECTRICAL CHARACTERISTICS

Ta = 25°C, V_{DD}=5V, f=1kHz, BW<30kHz, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_Q	Quiescent current	V_{IN}=0V, I_O=0A	-	2.7	-	mA
I_{SHDN}	Shutdown current	$V_{/SHDN}$ = GND	-	0.1	-	uA
V_{SDH}	Shutdown input voltage high		2.0	-	-	V
V_{SDL}	Shutdown input voltage low		-	-	0.8	V
PSRR	Power supply rejection ratio	R_L=8Ω, C_{BP}=10uF, f=217Hz	-	70	-	dB
THD+N	Total harmonic distortion plus noise	R_L=8Ω, 0.8W	-	-55	-54	dB
				0.17	0.2	%
S/N	Signal-to-noise ratio	R_L=8Ω, 0.8W	90	103	-	dB
Po	Output power	R_L=8Ω, THD+N = 10%	-	1.5	-	W
		R_L=8Ω, THD+N = 1%	-	1.2	-	W

3.3V ELECTRICAL CHARACTERISTICS

Ta = 25°C, V_{DD}=3.3V, f=1kHz, BW<30kHz, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_Q	Quiescent current	V_{IN}=0V, I_O=0A	-	2.3	-	mA
I_{SD}	Shutdown current	$V_{/SHDN}$ = GND	-	0.1	-	uA
PSRR	Power supply rejection ratio	R_L=8Ω, C_{BP}=10uF, f=217Hz	-	75	-	dB
THD+N	Total harmonic distortion plus noise	R_L=8Ω, 0.5W	-	-55	-54	dB
				0.17	0.2	%
S/N	Signal-to-noise ratio	R_L=8Ω, 0.5W	90	100	-	dB
Po	Output power	R_L=8Ω, THD+N = 10%	-	0.65	-	W
		R_L=8Ω, THD+N = 1%	-	0.5	-	W

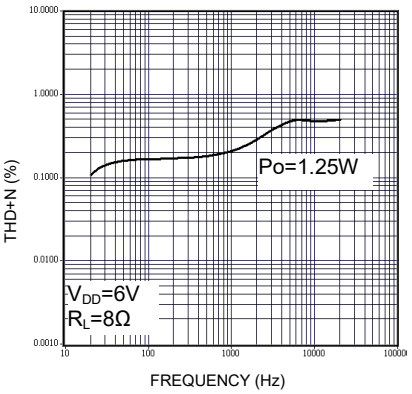
2.5V ELECTRICAL CHARACTERISTICS

Ta = 25°C, V_{DD}=2.5V, f=1kHz, BW<30kHz, unless otherwise specified.

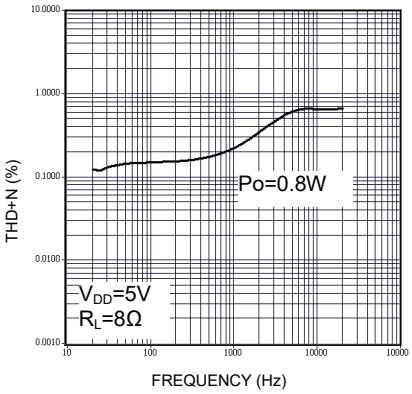
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
I_Q	Quiescent current	V_{IN}=0V, I_O=0A	-	2.2	-	mA
I_{SD}	Shutdown current	$V_{/SHDN}$ = GND	-	0.1	-	uA
PSRR	Power supply rejection ratio	R_L=8Ω, C_{BP} =10uF, f=217Hz	-	70	-	dB
THD+N	Total harmonic distortion plus noise	R_L=8Ω, 0.2W	-	-55	-50	dB
			-	0.17	0.316	%
S/N	Signal-to-noise ratio	R_L=8Ω, 0.2W	90	98	-	dB
Po	Output power	R_L=8Ω, THD+N = 10%	-	0.35	-	W
		R_L=8Ω, THD+N = 1%	-	0.25	-	W

TYPICAL PERFORMANCE CHARACTERISTICS

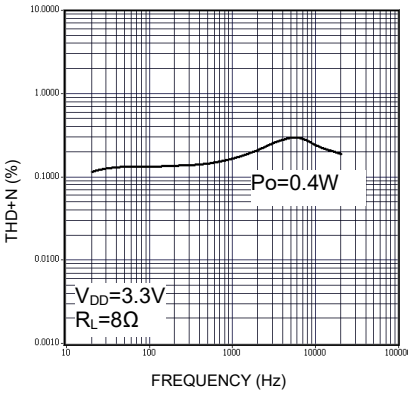
Ta = 25°C, BW<30kHz, unless otherwise specified.



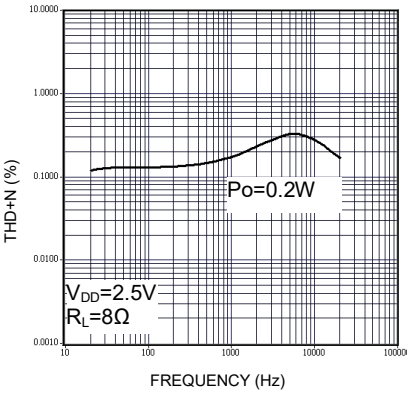
THD+N vs. frequency



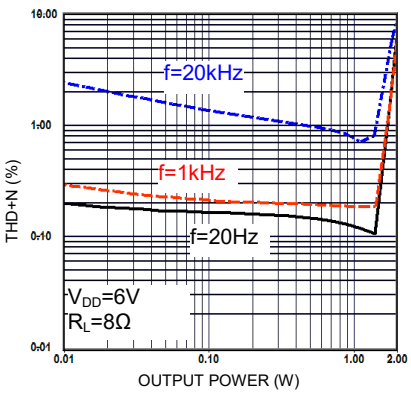
THD+N vs. frequency



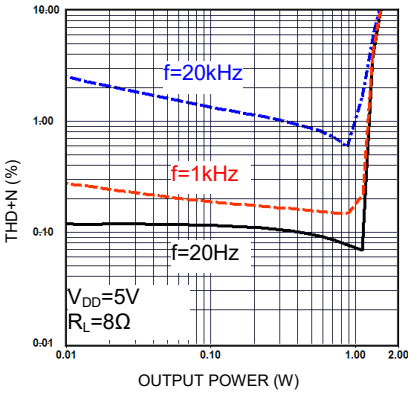
THD+N vs. frequency



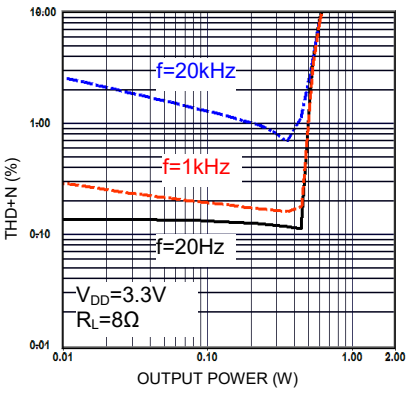
THD+N vs. frequency



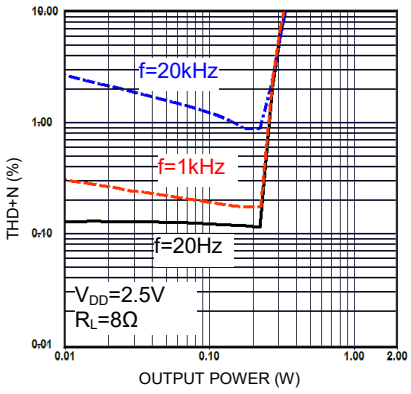
THD+N vs. output power



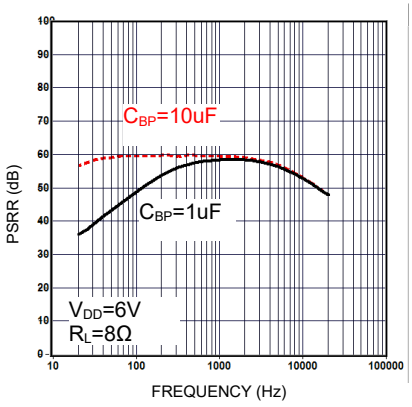
THD+N vs. output power



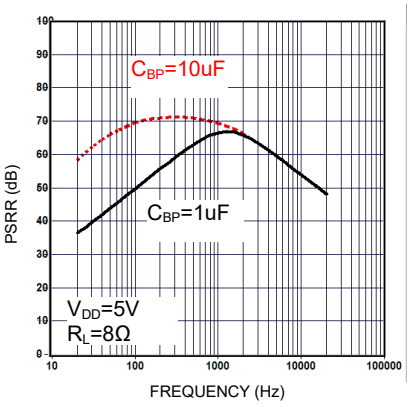
THD+N vs. output power



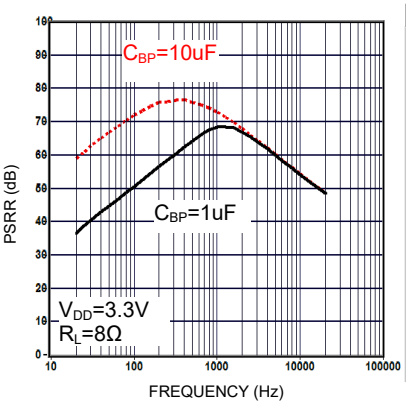
THD+N vs. output power



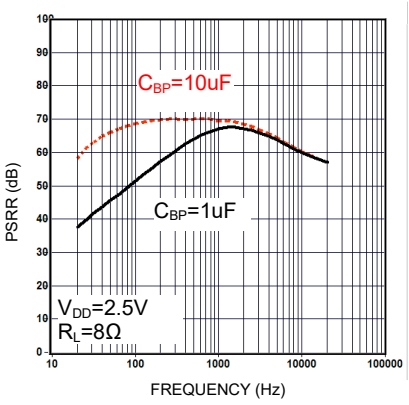
PSRR vs. frequency



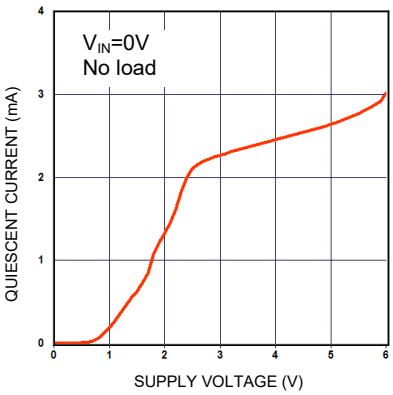
PSRR vs. frequency



PSRR vs. frequency



PSRR vs. frequency



Quiescent current vs. supply voltage

APPLICATION INFORMATION

Basic application example

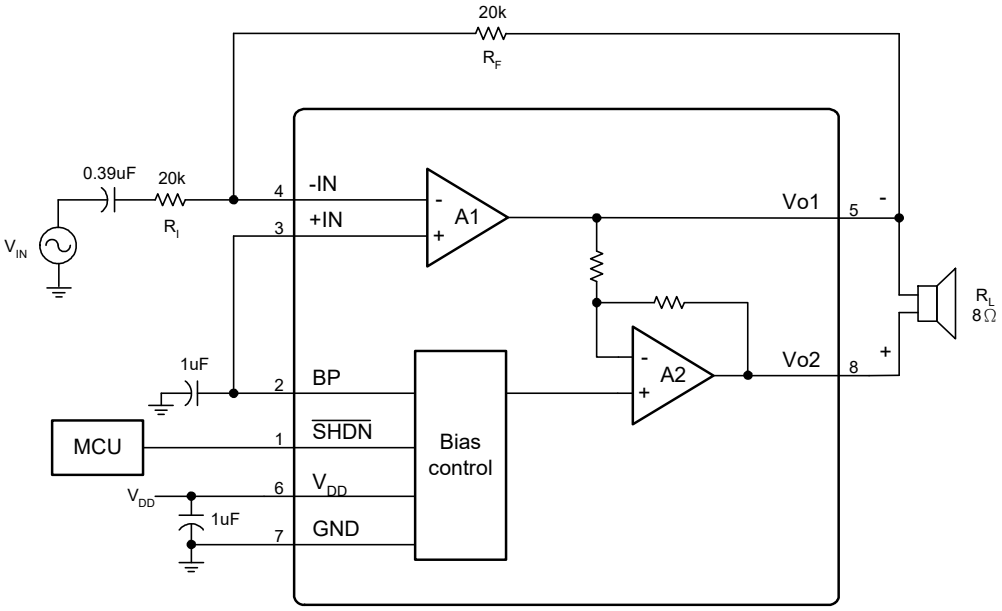


Fig.1 A audio amplifier application circuit.

External gain-setting

As shown in Fig.1, The amplifier A1 is independent amplifiers with an externally configured gain of $A_V = - R_F/R_I$. The amplifier A2 is a closed-loop gain of $A_V = -1$ fixed by two internal resistors. The outputs of A1 and A2 are used to drive the mono bridged-tied load (BTL).

High Pass Filter

The input capacitor C_{IN} and resister R_{IN} are decided the cut-off frequency of the HPF. The equation is as follows:

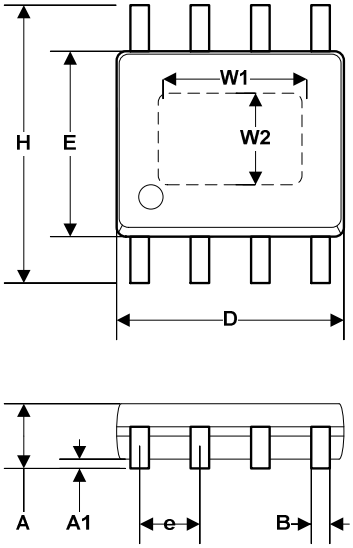
$f_{cut\text{-}off} = 1 / (2 \pi * R_{IN} * C_{IN})$

Thermal pad considerations

The thermal pad must be connected to ground. The package with thermal pad of the MS6890 requires special attention on thermal design. The thermal pad on the bottom of the MS6890 should be soldered down to a copper pad on the circuit board. Heat can be conducted away from the thermal pad through the copper plane to ambient. If the copper plane is not on the top surface of the circuit board, 9 vias of 13 mil or smaller in diameter should be used to thermally couple the thermal pad to the bottom plane. For good thermal conduction, the vias must be plated through and solder filled.

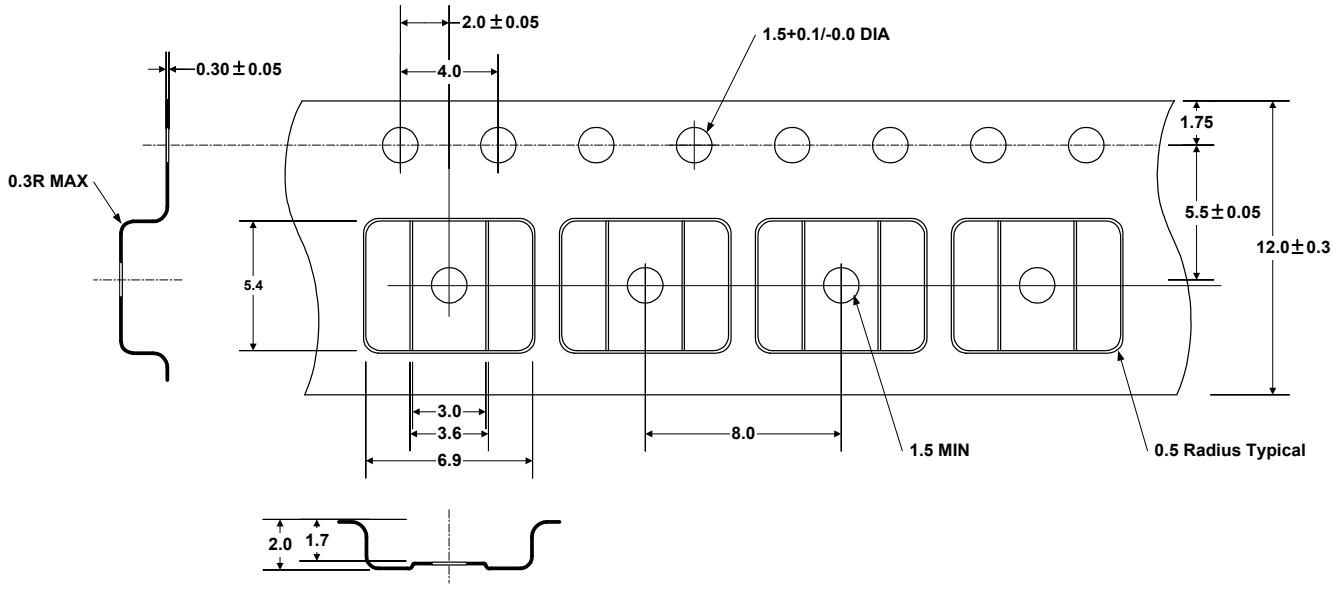
EXTERNAL DIMENSIONS

SOP8 (Thermal Pad)



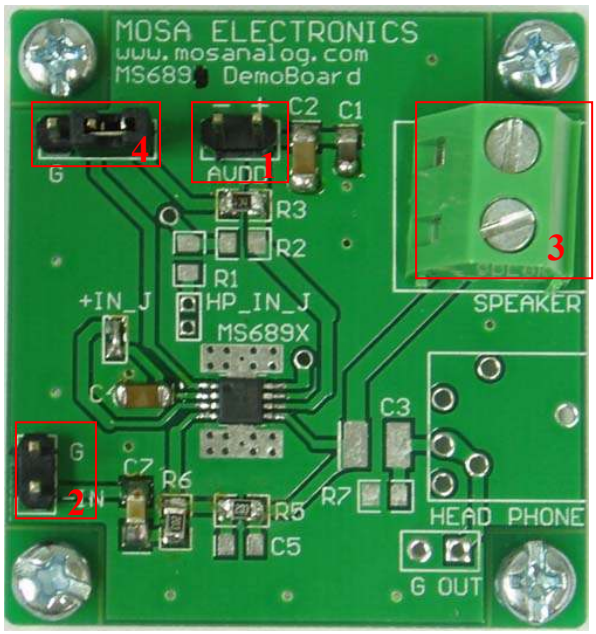
Symbol	Dimension in mm		Dimension in inch	
	Min	Max	Min	Max
A	1.35	1.75	0.0532	0.0688
A1	0.10	0.25	0.0040	0.0098
B	0.33	0.51	0.013	0.020
C	0.19	0.25	0.0075	0.0098
D	4.80	5.00	0.1890	0.1968
H	5.80	6.20	0.2284	0.2440
E	3.80	4.00	0.1497	0.1574
e	1.27 BSC		0.050 BSC	
L	0.40	1.27	0.016	0.050
W1	3.048	3.302	0.120.	0.130
W2	2.159	2.413	0.085	0.095

TAPE AND REEL (Unit : mm)



SOP8

DEMO BOARD



Function description

Label 1: Supply Voltage
Supply voltage range is 2.5V to 6.5V, the left of jump is positive and the right of jump is negative.

Label 2: Signal Input
Connected to audio signals.

Label 3: Speaker Output
Connected to speaker with 8ohm or 4 ohm

Label 4: Shutdown Control
The system is active mode when the jump is placed left, the shutdown pin of MS6890 is connected to GND.
The system enters shutdown mode when the jump is placed right, the shutdown pin of MS6890 is connected to V_{DD}.

Circuit