Shanghai Siproin Microelectronics Co.,Ltd.

Three-phase power metering integrated circuits

SSP1880

Date：2021/09/14

Version：1.01

Official Website：http://WWW.SIPROIN.COM

Contents

1.General Description 3

2.Features 3

3.Order Specification 3

4.Block Diagram 4

5.Absolute Maximum Ratings 5

6.Electrical Characteristics 5

7.Timing Characteristics 7

8.Pulse Setting 7

9.Various common phenotype jumper settings and counter selection 8

10.Outline Dimensions 9

1.General Description

The SSP1880 is a highly accurate three-phase power measurement integrated circuit with technical specifications that meet the accuracy requirements specified in IEC62053.。

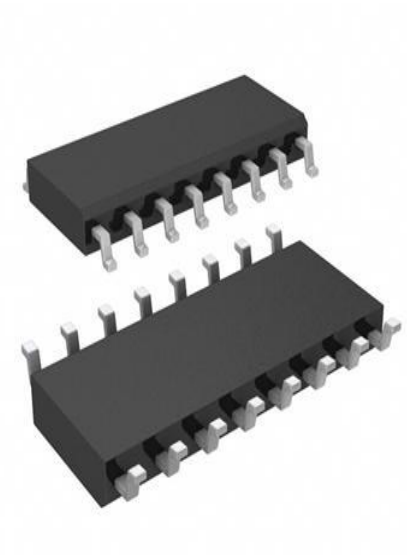
The SSP1880 uses analogue circuitry only for the ADC and reference source, and digital circuitry for all other signal processing (such as multiplication and filtering), which allows the SSP1880 to maintain extremely high accuracy and long-term stability under harsh environmental conditions.

The SSP1880 pins F1 and F2 output the average value of active power at a lower frequency and can be used to directly drive electromechanical meters or to interface with microcontrollers (MCUs). Pin CF outputs an instantaneous value of active power at a higher frequency for calibration or interfacing with an MCU.

The SSP1880 contains an internal monitoring circuit for the VDD power supply pin. The SSP1880 remains in reset until VDD rises to 4V. When VDD falls below 4V, the SSP1880 is also reset, at which point there are no outputs from F1, F2, or CF.

Internal phase matching circuitry enables the voltage and current channels to always be phase-matched, and internal no-load threshold characteristics ensure that the SSP1880 has no latency at no-load.

The SSP1880 is available in a 16-pin SOP package.



2.Features

- High accuracy, supporting the accuracy requirements of the 50Hz/60Hz IEC 62053 standard, with an error of less than 0.1 per cent over a dynamic range of 500:1;
- The active power average is output in frequency from SSP1880 pins F1 and F2;
- The active power instantaneous value is output from pin CF at a higher frequency and can be used for meter calibration;
- FI and F2 can directly drive electromechanical counters and two-phase stepper motors;
- The use of specialised analogue-to-digital converters (ADCs) and digital signal processing (DSPs) ensures a high degree of accuracy even under conditions of highly variable environment and time;
- Power monitoring circuitry is provided on-chip;
- Anti-submarine function (no-load threshold) is included in the chip;
- An on-chip reference voltage of 2.5V±8% (temperature coefficient typical 30ppm/°C) provides a reference for external circuits;
- A high stability oscillator with little sensitivity to temperature is included on the chip.
- +5V single-supply, low-power (15mW typical);
- Low-cost CMOS process.
- SOP16 package

3.Order Specification

Product model	Package	Manner of packing	Min packing quantity
SSP1880	SOP16	Reels	2500PCS

4.Block Diagram

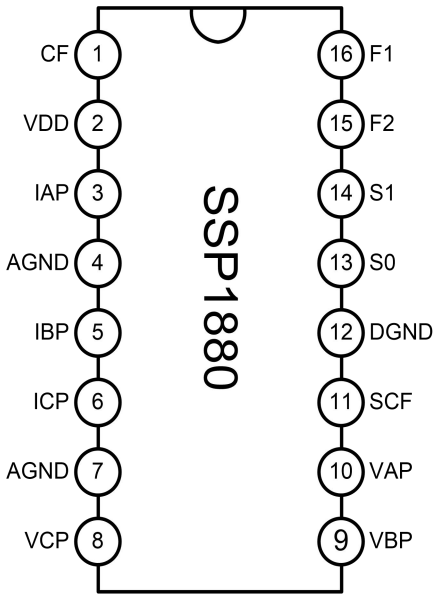


Figure (1) Pin Arrangement (SOP16 Package)

Pin number	Symbol	Description
1	CF	Frequency calibration output pin. Its output frequency reflects the magnitude of instantaneous active power and is commonly used for instrument calibration, see IV table for description.
2	VDD	Power supply pin. This pin provides the power supply for the SSP1880, and the normal operating power supply voltage should be maintained at 5V ± 5%, and the pin should be decoupled using a 10μF capacitor in parallel with a 100nF ceramic dielectric capacitor.
3，5，6	IAP，IBP，ICP	Phase A, B, and C current channel inputs, respectively, with a maximum signal level of ±500 mV for normal operation. these three pins have internal ESD protection circuits, and these two pins can withstand ±6V overvoltage without causing permanent damage.
8，9，10	VCP，VBP，VAP	Respectively for the C-phase, B-phase, A-phase voltage channel inputs, the normal operation of the maximum signal level of ± 500 mV. these three pins have internal ESD protection circuitry, these two pins can withstand ± 6V over-voltage, without causing permanent damage.
4，7	AGND	This is the ground reference point for the SSP1880 analogue circuits and this pin is connected to the analogue ground of the printed circuit board. The analogue ground plane is the ground reference point for all analogue circuits, such as anti-alias filters, current and voltage sensors, and so on. For effective noise suppression, the analogue ground plane should be connected to the digital ground plane at only one point.
11	SCF	Check Frequency Selection. The logic input level of this pin determines the output frequency of the CF pin, see Table IV for how to select the calibration frequency.

13，14	S1，S0	The logic inputs to these two pins are used to select the digital/frequency conversion factor, which provides a great deal of flexibility in meter design, as detailed in the Selecting Frequency for Meter Applications section.
15，16	F2，F1	The low frequency logic output pin, the output frequency responds to the amount of average active power. These two logic outputs can directly drive electromechanical meters or two-phase stepper motors, as detailed in the Transfer Functions section.

5.Absolute Maximum Ratings

Parameter name	Symbolic	Value	Unit
Chip Supply Voltage	VDD	-0.3～+7	V
Analogue Signal Inputs	IAP, IBP, ICP, VAP, VBP, VCP to GND Voltage	-6～+6	V
Reference Input Voltage		-0.3～VDD+0.3	V
Digital Input Voltage		-0.3～VDD+0.3	V
Digital Output Voltages		-0.3～VDD+0.3	V
Operating Temperature Range	T	-40～+85	℃
Storage Temperature Range	Tstg	-40～+85	℃
Junction Temperature	Tj	+150	℃
SSOP24Package Power Dissipation	Pd	450	mW
Thermal Resistance	θJA	112	℃/W
Vapour Phase Welding（60S）		+215	℃
Infrared Welding（15S）		+220	℃

Note：Unless otherwise specified, TA = 25℃.

6.Electrical Characteristics

Measurement items	Symbolic	**Measurement Conditions**	**Min**	**Typical**	**Max**	**Unit**
Chip Operating Voltage	VDD		4.75	5	5.25	V
Chip Working Current	I_{DD}		5	6.5	8	mA
Measurement error of the current channel		Channel 2 is full input (±500mV), +25℃, dynamic range 500:1		0.1		%
Phase error between current and voltage channels		Line frequency 45-65Hz, V1 overrun by 37°（PF=0.8 capacitive）		±0.1		%
		Line frequency 45-65Hz,, V1 hysteresis 60° (PF = 0.5 inductive)		±0.1		%

AC power supply suppresses output frequency variations（CF）		SCF=0，S1=S0=1， IA=IB=IC=100mVrms，50Hz VA=VB=VC=100mVrms，50Hz VDD plus 200 mV rms, 100Hz ripple		0.2		%
DC power supply suppresses output frequency variations（CF）		S1=1，S0=SCF=0 IA=IB=IC=100mV rms，50Hz VA=VB=VC=100mVrms，50Hz VDD =5V±250mV		±0.3		%
Analogue Inputs						
Max Signal Level		VA, VB, VC, IA, IB, IC voltage to GND			±0.5	V
DC Input Resistance		CLKOSC=10MHz	390			kΩ
-3dB bandwidths		CLKOSC/256，CLKOSC=10MHz		14		KHZ
ADC misalignment error					±16	mV
Gain error		External Reference Source 2.5V， IAP=IBP=ICP=500mV ，dc		±9		%
On-chip Reference Source						
Reference Voltage Error		Nominal Value 2.5V			±200	mV
Temperature Coefficient		Nominal Value 2.5V		30		ppm/°C
Clock Input						
Input Clock Frequency		All indicator CLKOSCs are 10MHz	8	10	12	MHZ
logical input SCF，S0，S1，AC/DC，RESET，G0 and G1						
Input High Level	V_{INH}	VDD=5V±5%	2.4			
Input Low Level	V_{INL}	VDD=5V±5%			0.8	
Input Current		V_{IN}=0V~VDD		0.01	±3	μA
Input capacitance					10	pF
logical output F1，F2						
Output High Level	V_{OH}	I_{SOURCE}=10mA，VDD=5V	4.5			V
Output Low Level	V_{OL}	I_{SINK}=10mA，VDD=5V			0.5	V
CF，REVP						
Output High Level	V_{OH}	I_{SOURCE}=10mA，VDD=5V	4			V
Output Low Level	V_{OL}	I_{SINK}=10mA，VDD=5V			0.5	V

Noted：Unless otherwise specified, TA = 25°C.

All voltage values use the GND terminal potential as a reference point.

VDD= 5V±5%, GND=0V, using on-chip reference source, CLKOSC=10MHz.

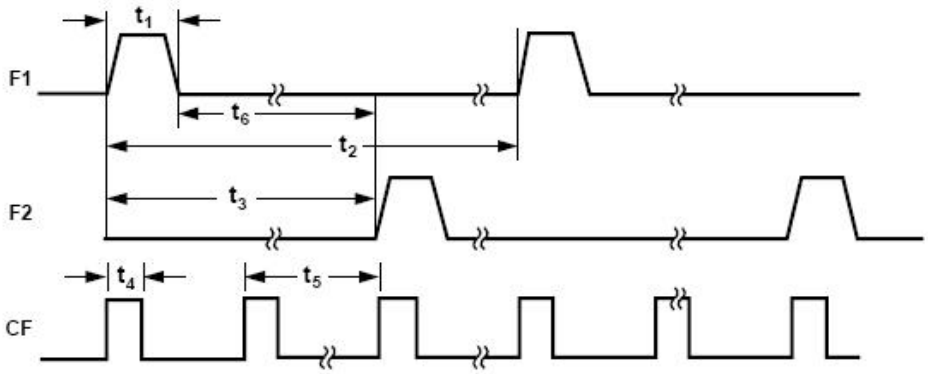
7.Timing Characteristics

（VDD= 5V±5%, GND=0V, using on-chip reference source, CLKOSC=10MHz, temperature range=-40 to +85℃）

Parameters	tail mark A，B	unit	Test conditions and notes
T_1 Note(1)	275	ms	Bottom level pulse widths of F1 and F2
T_2	See table 1 below	s	Output pulse period, see transfer function section
T_3	1/2 T_2	s	Time between F1 falling edge and F2 falling edge
T_4 Note(1, 2)	96	ms	High level pulse width of CF output
T_5	See table 1 below	s	CF output pulse period, see transfer function section
T_6	CLKOSC/4	s	Min time between F1 and F2 pulses

Note:(1) The pulse widths of F1, F2 and CF are not fixed at higher output frequencies.

(2) In the high frequency mode, the CF pulse width is always 18μs.



Frequency output timing diagram

8.Pulse Setting

SCF	S1	S0	$F_{1\sim7}$ (Hz)	Max output frequency of CF(Hz)	Counter scale (C=Calibration constants)
0	0	0	1.27	160×F1，F2=81.87	C/80
1	0	0	1.19	8×F1，F2=3.83	C/4
0	0	1	5.09	160×F1，F2=327.46	C/80
1	0	1	4.77	16×F1，F2=30.70	C/8
0	1	0	19.07	16×F1，F2=122.81	C/8
1	1	0	19.07	8×F1，F2=61.40	C/4
0	1	1	76.29	8×F1，F2=245.61	C/4
1	1	1	0.6	16×F1，F2=3.84	C/8

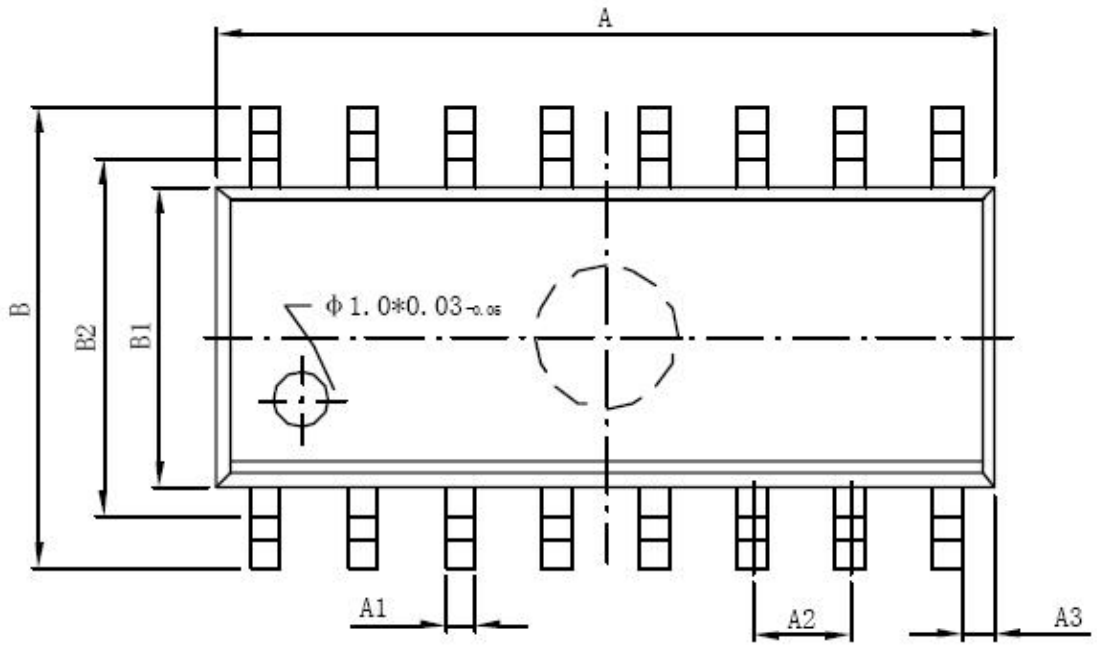
Table 1 Maximum output frequency of CF (AC signal)

9.Various common phenotype jumper settings and counter selection

Max current（A）	Transformer ratio	Sampling Resistance（Ω）	Constant	Counter Ratio	SCF		S0		S1	
					0	1	0	1	0	1
					J1	J2	J3	J4	J5	J6
10 (Be applicable to 1.5~6.0 2.0~8.0 2.0~10.0)	300:1	10	1600	200		●		●		●
		10		400		●	●		●	
		15*	3200	400		●		●		●
		15*		800		●	●		●	
50 (Be applicable to 10~40 20~50)	1000:1	5.1	160	20		●		●		●
		5.1		40		●	●		●	
		6	320	40		●		●		●
		6		80		●	●		●	
		9.1	400	50		●		●		●
		9.1		100		●	●		●	
100 (Be applicable to 15~60 20~80 20~100)	1000:1	3	160	20		●		●		●
		3		40		●	●		●	
		4.7	320	40		●		●		●
		4.7		80		●	●		●	
	2000:1	6.2	160	20		●		●		●
		6.2		40		●	●		●	
		9.1	320	40		●		●		●
		9.1		80		●	●		●	

Note：Depends on the maximum load resistance of the CT.

10.Outline Dimensions



尺寸 / 标注	最小（mm）	最大（mm）	尺寸 / 标注	最小（mm）	最大（mm）
A	9.9	10.10	C4	0.2TYP	
A1	0.356	0.456	D	1.05TYP	
A2	1.27TYP		D1	0.40	0.70
A3	0.35TYP		D2	0.22	0.42
B	5.84	6.24	R1	0.15TYP	
B1	3.84	4.04	R2	0.15TYP	
B2	5.0TYP		θ1	8° TYP	
C	1.35	1.55	θ2	8° TYP	
C1	0.61	0.71	θ3	4° TYP	
C2	0.54	0.64	θ4	15° TYP	
C3	0.10	0.30			

SPECIAL EXPLANATION

The final interpretation right of this specification belongs to our company

DESCRIPTION OF VERSION CHANGE

Version：V1.01　　Author：Lifeng Liu　　Date：2021.9.14

Amendment record：

1.Instruction manu Al reformatted, some data checked