ES736

True RMS-to-DC Converters

Features

- True RMS-to-DC Conversion
- Fast settling time for all input levels
- **Input level is specified up to 400mV$_{RMS}$ (Crest factor ≤ 3 at ±3V power)**
- **Averaging capacitor is typically 22uF**
- **Positive output voltage**
- Computes RMS of AC and DC Signals
- Single or Dual Supply Operation
- Low Cost
- **Low Power: 250 μA typically**
- **Wide power supply range : from ± 2.5V(CF ≤ 2) to ±6V**

  Note: Input level up to 600mV$_{RMS}$ (CF ≤ 2) if minimum power supply range ±3V.
- **8-pin SOP package**

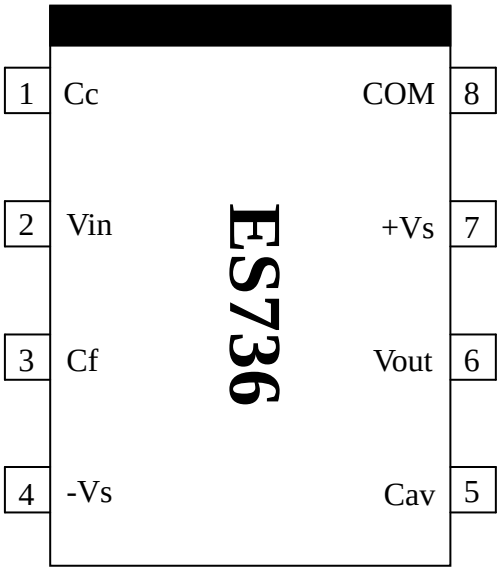
Description

The ES736 series are designed for the true RMS-to-DC conversion. ES736 accept low-level input signals from 0 to 400 mV RMS complex input waveforms. ES736 can be operated form either a single supply or dual supplies. The device draws 0.25mA typically of quiescent supply current, furthermore, making it ideal for battery-powered applications.

Application

* Digital Multi-Meters
* Battery-Powered Instruments
* Panel Meter

Pin Assignment: ES736



SOP 8 Pin Package

Pin Description

Pin No	Symbol	Type	Description
1	Cc	I	Low-Z measurement input
2	Vin	I	High-Z measurement input.
3	Cf	I	Connected to offset adjustment or kept open
4	-Vs	P	Negative supply voltage.
5	Cav	I/O	Averaging capacitor
6	Vout	O	Measurement output.
7	+Vs	P	Positive supply voltage.
8	COM	P	Power ground

I: input, O: output, P: power

Absolute Maximum Ratings

Supply Voltage: Dual Supplies ..... ±6V

Single Supply .....+12V

Input Voltage: ..... ±6V

Power Dissipation (Package)

SOP.....450mW

Operating Temperature Range .....-20℃ to +70℃

Storage Temperature Range.....-55℃ to +150℃

Lead Temperature (Soldering, 10sec).....300℃

Electrical Characteristics-ES736

(T_A= +25℃, Vs = +3V, -Vs = -3V, unless otherwise noted.)

PARAMETER	CONDITIONS			MIN	TYP	MAX	UNITS
Transfer Equation					$V_{OUT} = \sqrt{avg.[(V_{IN})^2]}$		
Averaging Time Constant					6		ms/μF C_{AV}
CONVERSION ACCURACY							
Total Error, Internal Trim **(Notes 1)**	ES736					±0.5 ± 1.5	mV ±% of Reading
Total Error vs. Temperature (-20℃ to + 70℃)					±0.1 ±0.01		mV ±% of Reading/℃
Total Error vs. Supply					±0.1 ±0.01		mV ±% of Reading/V
Total Error vs. DC Reversal	VIN=±400mV					±2.5	±% of Reading
Total Error, External trim					0.1/0.2		mV ±% of Reading
Additional Error **(Note 2)**	Cav=22μF	Crest Factor = 1	400mV		Specified Accuracy		±% of Reading
		Crest Factor = 2	200mV		0.5	1.0	
			400mV		0.5	1.0	
		Crest Factor = 3	200mV		1.0	2.0	
			400mV		1.0	2.0	
FREQUENCY RESPONSE							
Bandwidth for 1% Additional Error (0.09dB)	10mV				6		kHz
	100mV				40		
	200mV				60		
	400mV				70		

Electrical Characteristics-ES736 (continued)

(T_A= +25℃, Vs = +3V, -Vs = -3V, unless otherwise noted.)

PARAMETER	CONDITIONS		MIN	TYP	MAX	UNITS
INPUT CHARACTERISTICS						
Input Signal range	Continuous RMS, All Supplies			0 to 400		mV_{RMS}
	Peak Transient	±2.5V Supplies			0.9	V_{PK}
		±3V Supplies			1.4	
		±5V Supplies			2.8	
Input Resistance	Pin2			100		MΩ
Input Offset Voltage **(Note3)**	ES736				±0.5	mV
OUTPUT CHARACTERISTICS						
Output Voltage Swing	+3V, -3V Supplies		1			V_{RMS}
	±5V Supplies		1	1.5		
Power SUPPLY						
Rated Performance				±3		V
Dual Supplies			±2.5		±6	V
Single Supply			+5		+10	V
Supply Current	±3V Supply. Vin connects to COM			250	-	μA

Note 1: Accuracy is specified for 0 to 400mV, 1kHz sine-wave input. Accuracy is degraded at higher RMS signal levels.

Note 2: Error vs. crest factor is specified as an additional error for 200mV_{RMS} and 400mV_{RMS} rectangular pulse input, pulse width = 200μs

Note 3: The input offset voltage can be reduced or canceled by an external 500kohm variable resistor shown in Figure 2.

Standard Connection for ES736 (Figure 1)

The standard RMS connection requires only two external components, Rin and C_{av}. Other components shown in figure 2 are optional. In this configuration, ES736 measure the RMS of the AC and DC levels present at the input, but shows an error for low-frequency inputs as a function of the C_{av} filter capacitor. If the DC error can be rejected, a capacitor Cc should be connected in series with the input, as would typically be the case in single-supply operation.

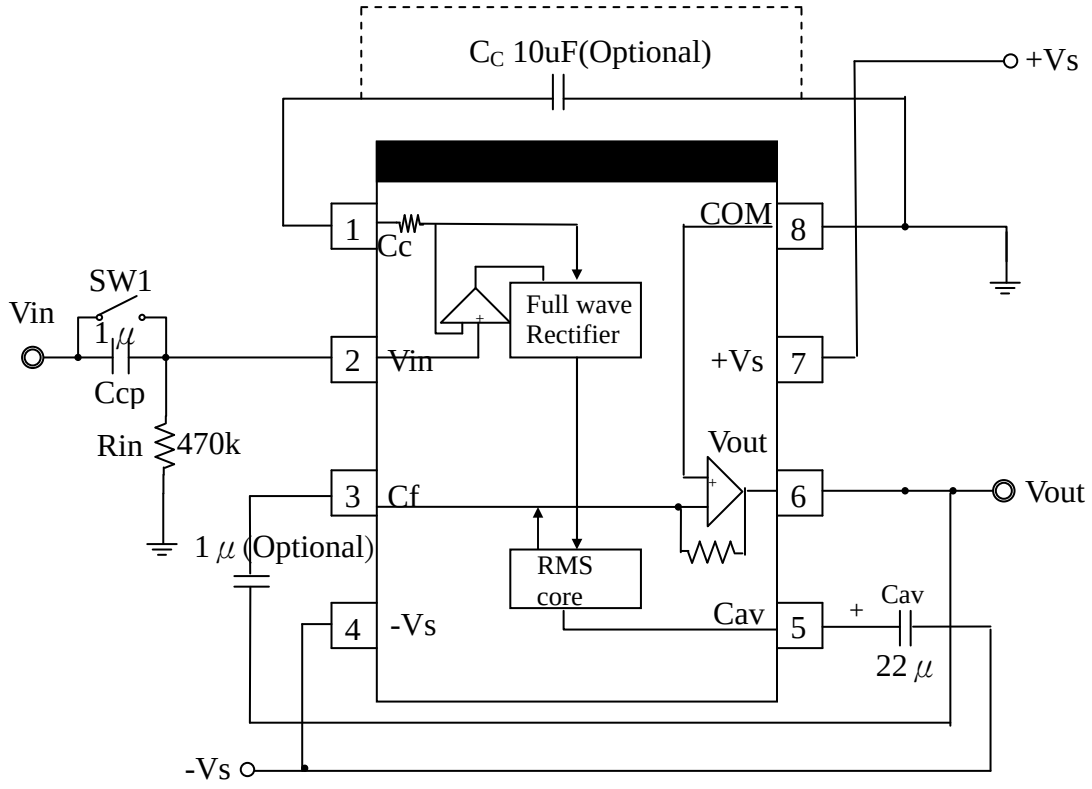


Figure 1. Standard connection for ES736.

Note:

1. SW1 is opened for AC-coupled (Cc is necessary for this case) operation, or closed for direct input.
2. The AC error component may be easily removed by using a post filtering capacitor Cf. (Optional, usually not necessary)

To Adjust the zero-offset & scale factor trim of ES736 (Figure 2)

The output of some ES736 ICs may have an offset voltage when the input is zero. The amount of this offset voltage might be different in every ES736. We provide pin1-Cc to achieve the reduction of zero offset voltage. The test circuit is shown as below. The 500kohm VR and 1M ohm resistor are used to reduce zero offset voltage. Adjusting the 500kohm VR can reduce the zero offset voltage.

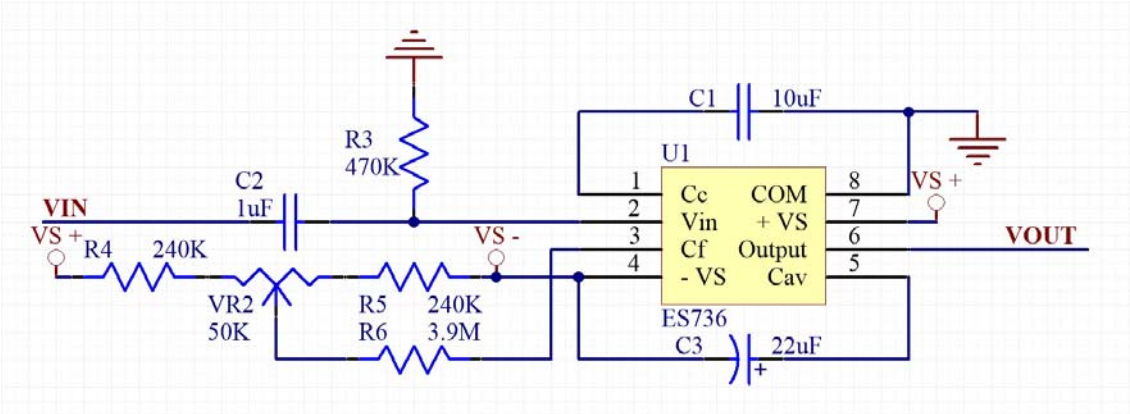


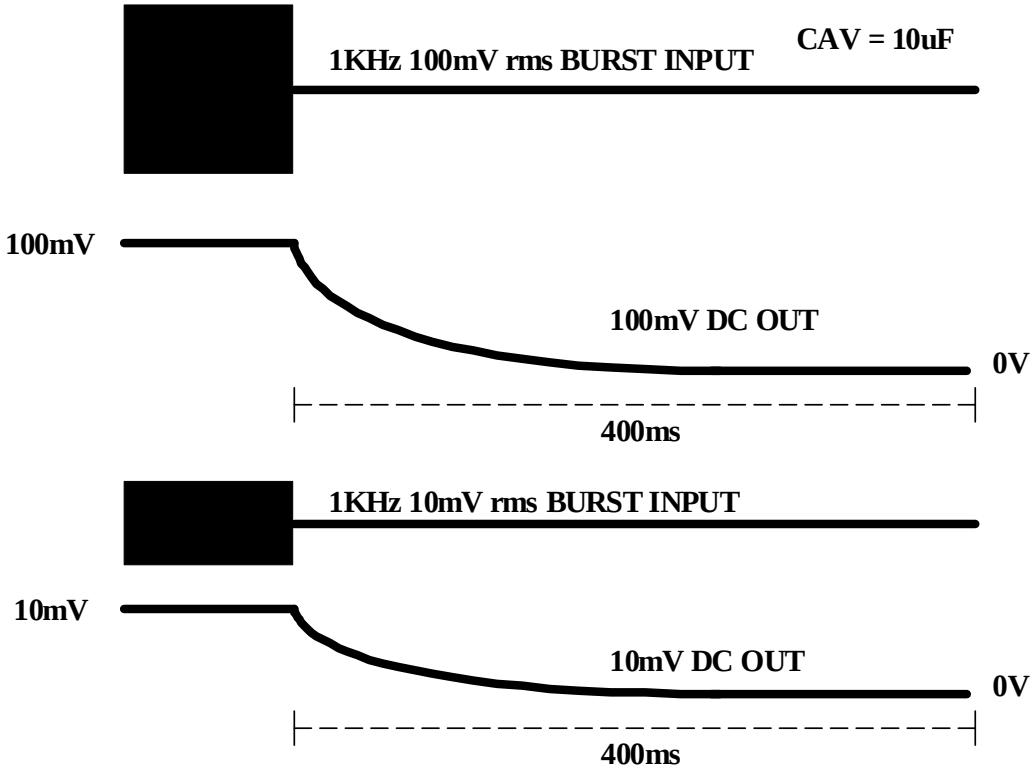
Figure 2. Adjust the zero-offset

Note: `

1. The 500k ohm variable resistor can be used to adjust the zero-offset voltage.

Fast setting time for all input levels

There is almost no effect of signal input level on the settling time.



Application notes

1. AC-coupled operation

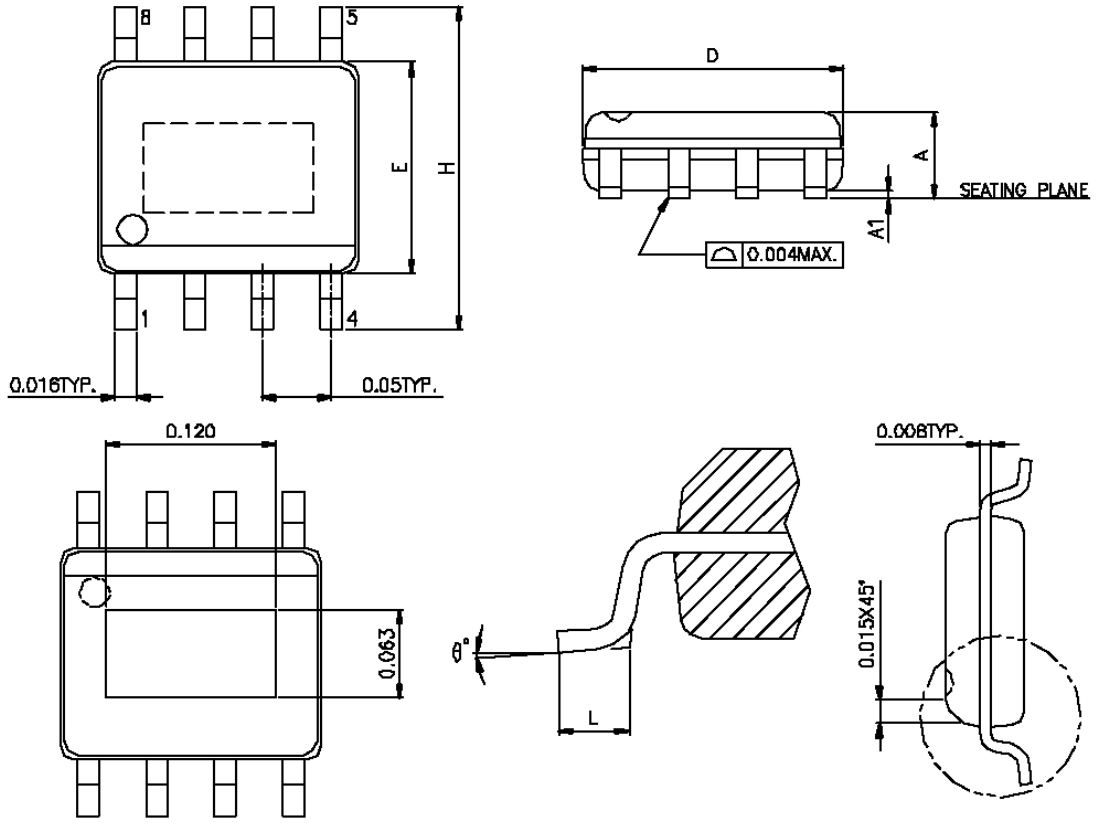
Refer to the standard circuit of ES736 shown in Figure 1~2. ES736 will work in an AC-coupled operation when the SW1 is opened. In AC-coupled operation, an AC-coupled capacitor (Ccp, see Fig1.) and bias resistors Rin must be required. The pin1 connected to Cc capacitor is necessary for this case.

2. Post Filter C_F

To reduce the output ripple of ES736, a post filter capacitor C_F is required. This capacitor should be connected as shown in figure 1 or 2. With post filter, the value of Cav (22uF) should be just large enough to give the maximum dc error at the lowest frequency of interest. And the output ripple will be removed by the post filter (1uF).

Packaging

8 Pin SOP Package



Dimension Parameters

SYMBOLS	MIN.	MAX.
A	0.053	0.069
A1	0.004	0.010
D	0.189	0.196
E	0.150	0.157
H	0.228	0.244
L	0.016	0.050
θ°	0	8

UNIT : INCH

NOTES:
1.JEDEC OUTLINE : MS-012 AA
2.DIMENSIONS "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS.MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED .15mm (.006in) PER SIDE.
3.DIMENSIONS "E" DOES NOT INCLUDE INTER-LEAD FLASH, OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED .25mm (.010in) PER SIDE.