

## ABSTRACT

The energy meter is an electrical measuring device, which is used to record Electrical Energy .Consumed over a specified period of time in terms of units.

Every house, small factory, business establishment, shops, offices etc. need at least one energy meter to register power consumption. The supplier of electrical raises the bill on the basis reading shown by this meter. The producer of electricity sale the electricity to the electricity boards and boards has to sale this energy to the consumer. Consumer needs to pay the amount against the bill raised by the supplier. The data generate by the energy meter is the base to raise the bill by power supplier. Because of massive rural and urban electrification programme of Government, there is a good demand for this product. This product is available in single phase and three phases at different current rating as per customer's requirement. Here we are introducing a low cost energy meter using ADE7757.

In our project IC ADE7757 is heart of energy meter. It directly interfaces with the shunt resistor and operates off the AC input. The only analogue circuitry used in IC ADE7757 is in the sigma delta ADC's and reference circuit. All other signal processing is carried out in digital domain.

The power supply for IC ADE7757 is derived directly from mains using the capacitor divider network comprising C13 and C14. Most of the voltage is dropped across C13 (0.47 $\mu$ F polyester capacitor rated for 630V), while resistor R13 (470-ohm, 1W) is used as a current limiter. The output across C14 is limited to 15V DC, which serves as an input to regulator 7805(IC2). The regulated 5V is fed to IC1 at its VDD.

Project Associates

T.Abhinay

B.Ravi Jain

S.Srikanth

S.Sirish Kumar

## CIRCUIT DIAGRAM

<http://mskrao.weebly.com>

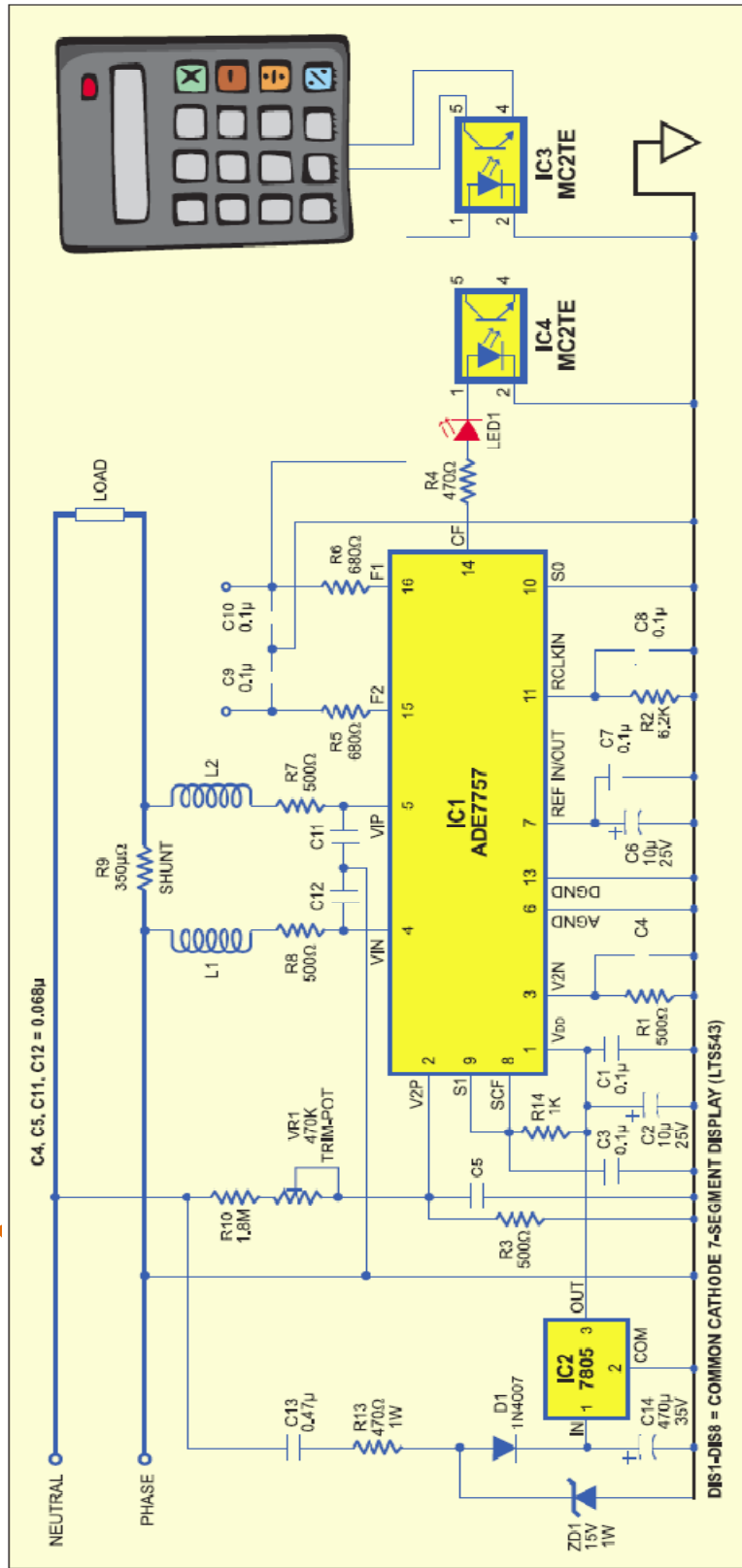


Fig. 1. Schematic of Low-cost Energy meter Using calculator

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## HARDWARE COMPONENTS

### Semiconductors:

IC1 - ADE7757 metering IC

IC2 - 7805 5V regulator

IC3, IC4 - MCT2E optocoupler

D1 - 1N4007 rectifier diode

ZD1 - 15V, 1W zener diode

LED1 - Red LED

### Resistors (all ¼-watt, ±5% carbon):

R1, R3, R7,

R8 - 500-ohm

R2 - 6.2-kilo-ohm

R4 - 470-ohm

R5, R6 - 680-ohm

R9 - 350-micro-ohm (shunt)

R10 - 1.8-mega-ohm

R13 - 470-ohm, 1W

R14 - 1-kilo-ohm

VR1 - 470-kilo-ohm trim pot

### Capacitors:

C1, C3, C7,

C8-C10 - 0.1µF ceramic disk

C2, C6 - 10µF, 25V electrolytic

C4, C5, C11,

C12 - 0.068µF ceramic disk

C13 - 0.47µF, 630V polyester

C14 - 470µF, 35V electrolytic

### Miscellaneous:

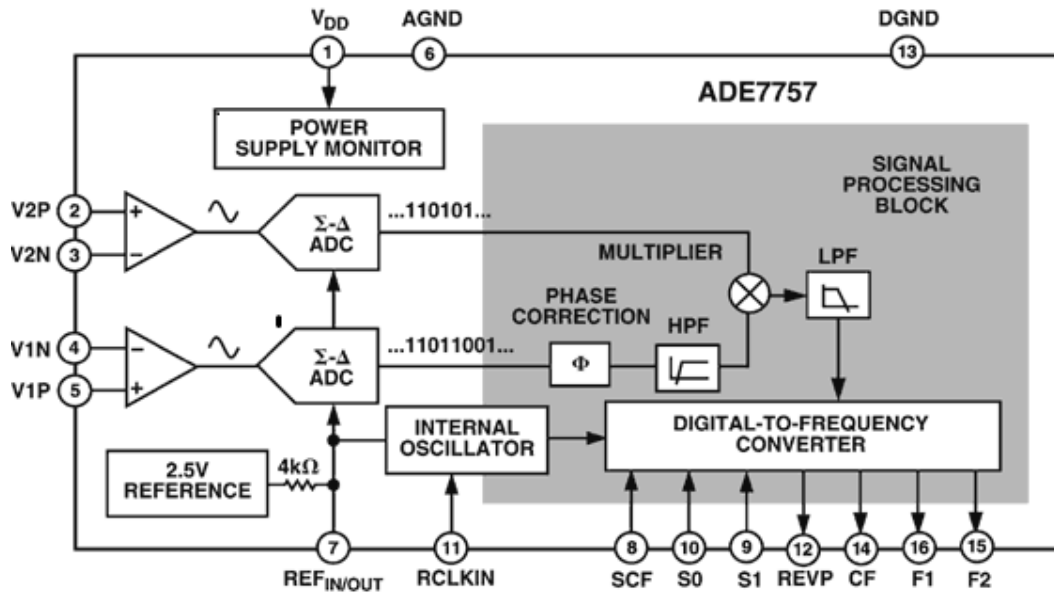
Two 6-pin IC base

L1, L2 - 2 turn on 22/24 SWG on ferrite bead inductor.

Calculator - 8-digit, LCD based calculator (with coin cell).

J1, J2, J3 - 3-pin SIP connector with a shorting link each.

### METERING IC –ADE 7757



IC ADE7757 (IC1) is at the heart of the energy meter. It directly interfaces with the shunt resistor and operates off the AC input. The only analogue circuitry used in IC ADE7757 is in the sigma delta ADCs and reference circuit. All the other signal processing is carried out in digital domain. The power supply for IC ADE 7757 is derived directly from mains using the capacitor divider network comprising C13 and C14. Most of the voltage is dropped across C13 (0.47 $\mu$ F polyester capacitor rated for 630V), while resistor R13 (470-ohm, 1W) is used as a current limiter. C14 is limited to 15V DC, which serves as an input to regulator 7805 (IC2). The regulated 5V is fed to IC1 at its VDD.

It is available in 16-lead SOIC narrow-body package. In our PCB layout, it is to be soldered on the conductor side of the PCB. The IC has an on-chip oscillator, so it requires no external crystal or resonator, thus reducing the overall cost of building a watt-hour meter. It operates off a 5V power supply. In operation, the chip directly interfaces with a shunt resistor (used as the current sensor) and AC analogue voltage sensing input. It has two analogue input

channels designated as V1 and V2, respectively. Channel V1 (also called ‘current channel’) is used for current sensing and channel V2 (also called ‘voltage channel’) is

used for voltage sensing. The differential output from the current-sensing resistor is connected between V1P and V1N inputs, while the differential output signal proportional to the AC line voltage, obtained through a resistor divider, is connected between pins V2P and V2N. IC ADE7757 also has a reference circuit and a fixed DSP function for calculation of the real power. A

highly stable oscillator integrated into the chip provides the necessary clock for the chip. IC ADE7757 supplies the average real-power information on the F1 and F2 low-frequency outputs. These outputs may be used to directly drive a stepper motor-based electromechanical counter or any other suitable counter. IC ADE7757 also provides a high-frequency output at the calibration frequency (CF) pin for a selected meter constant (here, it is 3200 impulses/kWh). This high frequency output provides instantaneous real-power

Information, which is used to speed up the calibration process. It also provides a means for quickly verifying the meter's functionality and accuracy in a production environment.

### **REGULATOR IC-7085**

A linear regulator is a voltage regulator based on an active device (such as a bipolar junction transistor, field effect transistor or vacuum tube) operating in its "linear region" (in contrast, a switching regulator is based on a transistor forced to act as an on/off switch) or passive devices like zener diodes operated in their breakdown region. The regulating device is made to act like a variable resistor, continuously adjusting a voltage divider network to maintain a constant output voltage. It is very inefficient compared to a switched-mode power supply, since it sheds the difference voltage by dissipating heat.

The KA78XX/KA78XXA series of three-terminal positive regulator are available in the TO-220/D-PAK package and with several fixed output voltages, making them useful in a wide range of applications. Each type employs internal current limiting, thermal shut down and safe operating area protection, making it essentially indestructible