



Solution for Off-Line UPS

Mixed Signal MCU with
8K Bytes Flash Embedded

1. Features

High Performance 8051 μ C Core

Instruction set compatible with standard 8051

High performance processor architecture that executes instructions in one to eight clocks

Memory

8K bytes of program Flash with In-System Programming (ISP) capability

128 bytes of data Flash with In-Application Programming (IAP) and ISP capability

256 bytes of internal data RAM

Flash memory with security protection

Hardware In-System Programming (ISP) without boot code

Digital Peripherals

Two 8-bit general-purpose I/O ports (P1, P3)

Configurable I/O with quasi-bidirectional, input, push-pull, and open-drain modes

16 mA drive capability on all port pins

5 V tolerant I/O

Three 16-bit timers/counters (T0, T1, T2)

Full-Duplex serial port (UART)

Single Master I2C interface

Programmable buzzer output

Two external interrupts

8-vector interrupts structure with 2 levels of priority

Programmable Watchdog Timer (WDT)

Analog Peripherals

10-bit, 6-channel, 100 Ksps A/D Converter for UPS specialized circuit

Internal precision reference voltage: 1.275 V $\pm$ 0.8 %

Power-On Reset (POR)

Low Voltage Detection (LVD)

Oscillation Options

Internal precision oscillator: 12 MHz $\pm$ 3%

External oscillator: Crystal or external clock input



Power Saving Modes

Idle Mode

Power-down Mode

Reset Sources

Power-On Reset (POR)

Low Voltage Reset (LVR)

External Reset

Watchdog Timer Reset

JTAG Reset

JTAG Interface

On-chip Debug Interface

Programming of Flash and Fuse Bytes through the JTAG Interface

Reliability

8 KV ESD

4 KV EFT

Class-B (30dB) EMI

Operating Range

Operating Voltage: 3.3 V (3.0 V to 3.6 V)

Operating Temperature: -40 °C to +85 °C

Packages

28-Pin SOP

32-Pin SOP

36-Pin SSOP

64-Pin LQFP



2. Specialized UPS Features

AC Input Detector

Real time auto AC input monitoring (ADC input channel x 1)

64 sampling / half cycle

Programmable watching range 、 over / under conditions

AC good and fail interrupt 、 programmable continuous event counter to trigger interrupt

“AC Input RMS voltage” registers

Zero-Crossing Detection

“AC period” register

“Time indication of next Zero-Crossing” register 、 time match interrupt

Inverter PWM Controller

Full-Bridge output

Auto generated waveform according to factors: V_{rms} 、 V_m 、 T

Output frequency: 37.4 Hz to 71.4 Hz / 74.8 Hz to 142.8 Hz (2X Mode)

Shutdown control input (from Inverter Over-Current Protection) 、 degauss output

Programmable Dead Time 、 Cold Start control

“Time difference between AC input and Inverter” register 、 updated interrupt

Inverter Over-Current Protection

Inverter current sense input

Over current signal output (to Inverter PWM Controller)

Inverter over current interrupt 、 programmable event counter to trigger interrupt

Output Voltage/Current/Power

Embedded output current rectifier

Output current sense input

Half wave rectifier output

Output voltage sampling and RMS calculating (ADC input channel x 1)

Full or half wave voltage signal input

16 sampling / half cycle

Output current sampling and RMS calculating (ADC input channel x 1)

Full or half wave current signal input

16 sampling / half cycle

Output true power calculating

**Charger and DC Boost PWM Controller**

Two Single-Ended or Push-Pull output for battery charger and battery boost control

Output frequency: 25 KHz to 100 KHz

Two Vout sense inputs 、 current limit sense inputs 、 shutdown control inputs

Soft Start control 、 over current flags

SPWM and PWM

One SPWM output for sine wave generating: SPWM

f_{SPWM} range: 5.08 KHz ~ 9.15 KHz, $f_{SINE} = f_{SPWM} / 128 \rightarrow 39.69 \text{ Hz} \sim 71.46 \text{ Hz}$

Zero-crossing Compare

One PWM output for amplitude control: VOCNT

Duty cycle range: 0% ~ 100%, f_{VOCNT} range: 9.4 KHz to 46.875 KHz

One 50% duty-cycle clock output for triangle wave generating: CARPWM

$f_{CARPWM} = f_{VOCNT} / 2$

Voltage Sense Inputs

Three analog inputs for battery voltage and other voltage sense

Voltage registers (ADC input channel x 3)

Non-volatile System Configuration Parameters (Fuse Bytes)



3. Description

The IN6055 is a single-chip 8-bit microcontroller specifically designed for Off-Line UPS (Uninterruptible Power Supply) applications.

The instruction set of IN6055 are fully compatible with standard 8051 series microcontroller. The device is based on a high performance processor architecture that executes instructions in one to eight clocks, six to twelve times the rate of standard 8051 devices.

The IN6055 provides the following standard features: 8K bytes of ISP program Flash; 128 bytes of ISP and IAP data Flash; 256 bytes of data RAM; two 8-bit bi-directional I/O ports; three 16-bit timer/counters; two serial ports that include a I²C and a full duplex serial port; a programmable buzzer output; a programmable watchdog timer; an internal precision oscillator; a two-level, eight-vector interrupt system.

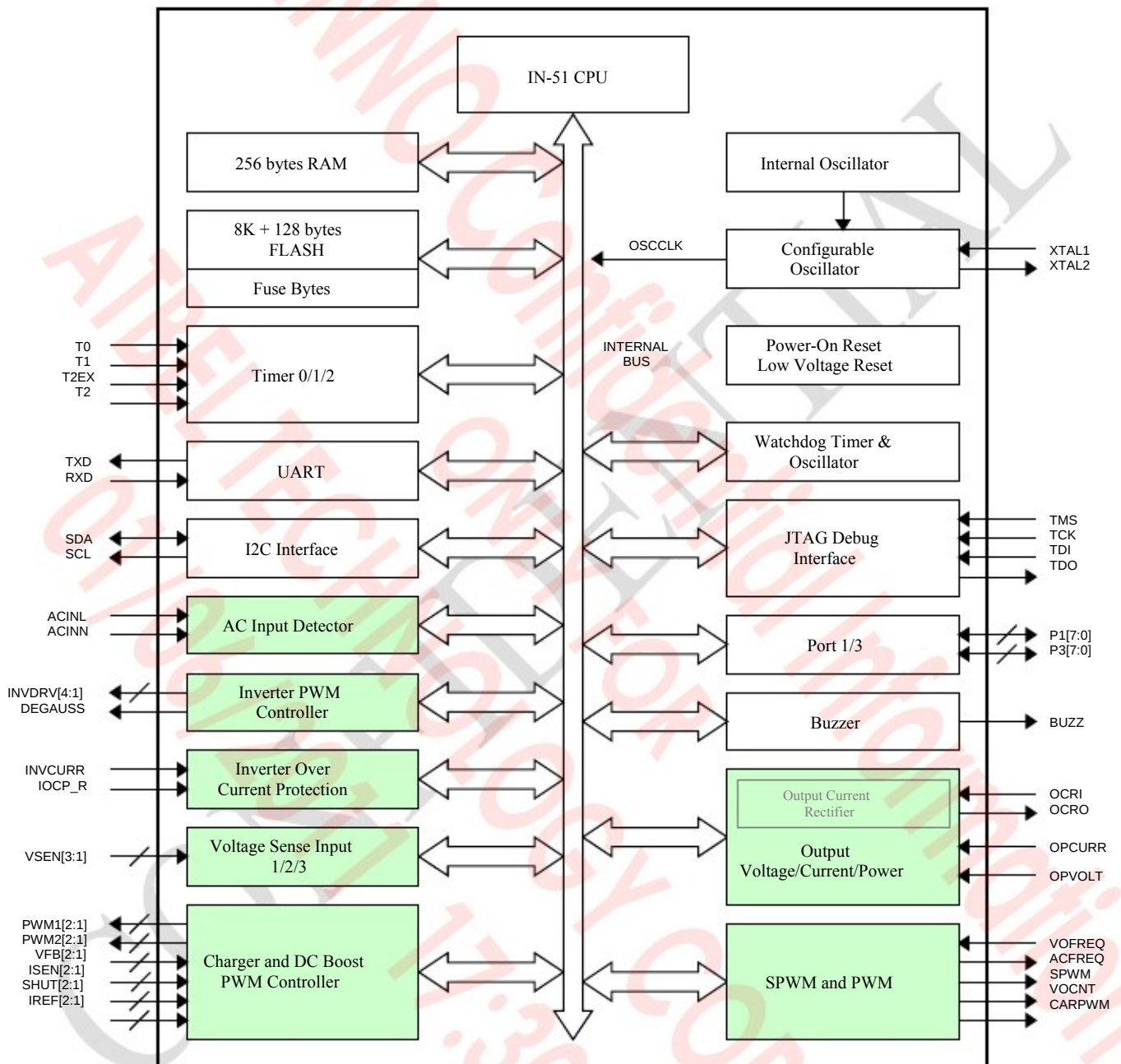
Many system-level functions have been incorporated into the IN6055 in order to reduce component count, board space, and system cost.

Additional key features for UPS include:

- AC Input Detector
- Inverter PWM Controller
- Inverter Over-Current Protection
- Output Voltage/Current/Power
- Charger and DC Boost PWM Controller
- SPWM and PWM
- Voltage Sense Inputs
- Non-volatile System Configuration Parameters

4. Block Diagram

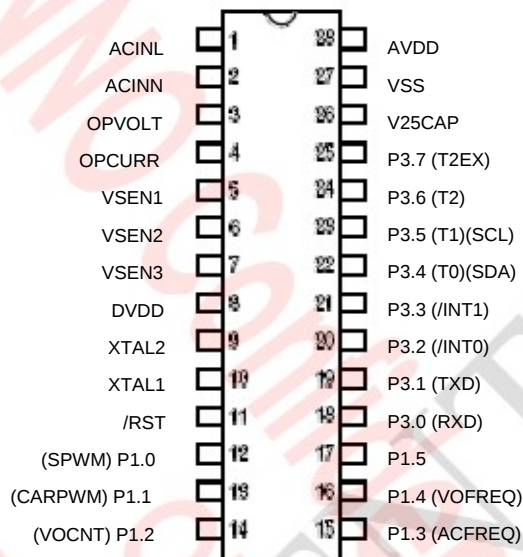
Figure 1. Block Diagram



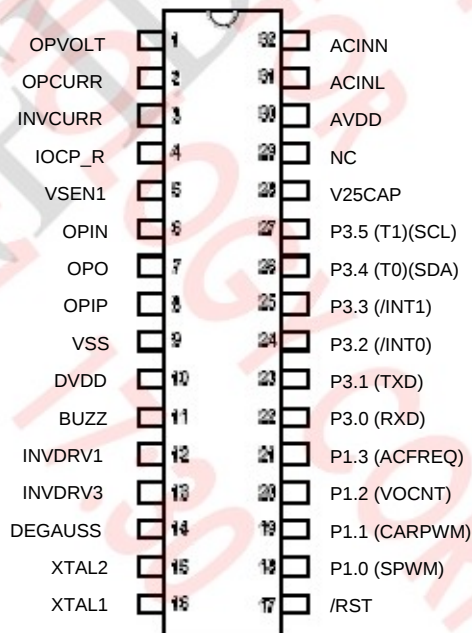


5. Pin Configuration

28-Pin SOP

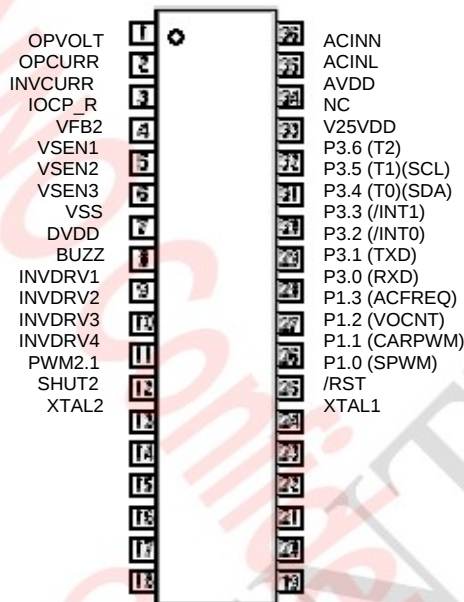


32-Pin SOP

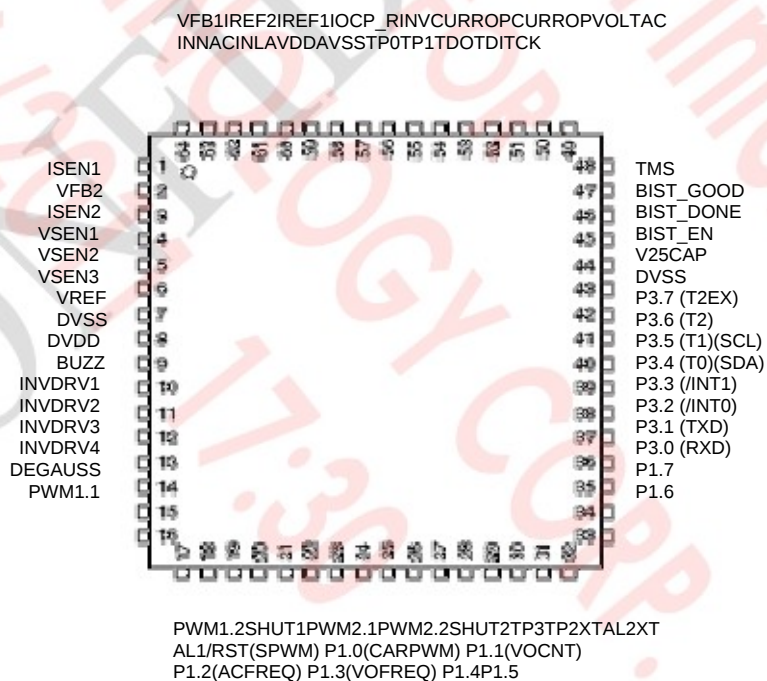




36-Pin SSOP



64-Pin LQFP



**6. Pin Description**

Name	Type	Description
/RST	SH	External Active-Low Reset input.
XTAL1	I	Crystal oscillator input.
XTAL2	O	Crystal oscillator output.
DVDD DVSS (VSS)	-	Digital supply voltage.
AVDD AVSS (VSS)	-	Analog supply voltage.
V25CAP	AO	2.5 V regulator output. Connect a 0.1uF capacitor to V25CAP and DVSS.
VREF	AO	Internal voltage reference output.
P1[7:0]	I/O	Port 1 is an 8-bit I/O port with a user-configurable output type. The operation of Port 1 pins as inputs and outputs depends upon the port configuration selected. Each port pin is configured independently. Refer to Section 5.1 for details. Port 1[4:0] also provides various special functions as described below:
	I/O	P1.0: User-configurable I/O Port 1 bit 0.
	O	SPWM: SPWM output.
	I/O	P1.1: User-configurable I/O Port 1 bit 1.
	I	CARPWM: PWM 50% duty-cycle clock output.
	I/O	P1.2: User-configurable I/O Port 1 bit 2.
	O	VOCNT: PWM output.
	I/O	P1.3: User-configurable I/O Port 1 bit 3.
	O	ACFREQ: AC Zero-crossing output.
	I/O	P1.4: User-configurable I/O Port 1 bit 4.
	O	VOFREQ: External Zero-crossing input.
P3[7:0]	I/O	Port 3 is an 8-bit I/O port with a user-configurable output type. The operation of Port 3 pins as inputs and outputs depends upon the port configuration selected. Each port pin is configured independently. Refer to Section 5.1 for details. Port 3 also provides various special functions as described below:
	I/O	P3.0: User-configurable I/O Port 3 bit 0.
	I	RXD: Serial port receiver input.
	I/O	P3.1: User-configurable I/O Port 3 bit 1.
	O	TXD: Serial port transmitter output.
	I/O	P3.2: User-configurable I/O Port 3 bit 2.
	I	/INT0: External interrupt 0 input/timer 0 gate control input.



	I/O	P3.3: User-configurable I/O Port 3 bit 3.
	I	/INT1: External interrupt 1 input/timer 1 gate control input.
	I/O	P3.4: User-configurable I/O Port 3 bit 4.
	I	T0: Timer/counter 0 external count input
	I/O	SDA: I2C serial data input/output.
	I/O	P3.5: User-configurable I/O Port 3 bit 5.
	I	T1: Timer/counter 1 external count input
	O	SCL: I2C serial clock output.
	I/O	P3.6: User-configurable I/O Port 3 bit 6.
	I	T2: Timer/counter 2 external count input
	I/O	P3.7: User-configurable I/O Port 3 bit 7.
	I	T2EX: Timer/counter 2 external trigger input
BUZZ	O	Buzzer output.
TMS	IH	JTAG Test Mode Select with internal pull-up.
TCK	IH	JTAG Test Clock with internal pull-up.
TDI	IH	JTAG Test Data Input with internal pull-up. TDI is latched on the rising edge of TCK.
TDO	OH	JTAG Test Data Output with internal pull-up. Data is shifted out on TDO on the falling edge of TCK. TDO output is a tri-state driver.
BIST_EN BIST_DONE BIST_GOOD TP[3:0]	-	Reserved for function test.
AC Input Detector		
ACINL ACINN	AI	Scaled AC voltage input.
Inverter PWM Controller		
INVDRV[4:1]	O	Full-Bridge Inverter driver output.
DEGAUSS	O	Degauss signal output.
Inverter Over-Current Protection		
INVCURR	AI	Inverter current sense input.
IOCP_R	AI	Reference resistor connect pin.
Output Voltage/Current/Power		
OCRI	AI	Output current sense input.
OCRO	AO	Internal half wave rectifier output.
OPCURR	AI	Full or half wave current signal input.
OPVOLT	AI	Full or half wave voltage signal input.



Charger and DC Boost PWM Controller		
PWM1[2:1]	O	PWM output 1
VFB1	AI	Scaled output DC feedback 1
ISEN1	AI	Current limit sense input 1
SHUT1	IL	Shutdown control input 1
IREF1	AI	PWM #1 reference resistor connect pin.
PWM2[2:1]	O	PWM output 2
VFB2	AI	Scaled output DC feedback 2
ISEN2	AI	Current limit sense input 2
SHUT2	IL	Shutdown control input 2
IREF2	AI	PWM #2 reference resistor connect pin.
Voltage Sense Inputs		
VSEN[3:1]	AI	Voltage sense input 1/2/3.

Note: Type I: input, O: output, I/O: bi-directional, S: Schmitt trigger input, H: pull-high, L: pull-low, A: analog