LIST PROGRAM

This program was produced by the
CodeWizardAVR V1.25.3 Professional
Automatic Program Generator
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http://www.hpinfotech.com

Project : 
Version : 
Date : 2/14/2009 
Author : HERDY 
Company : 
Comments:

Chip type : ATmega8535 
Program type : Application 
Clock frequency : 4.000000 MHz 
Memory model : Small 
External SRAM size : 0 
Data Stack size : 128 

#include <mega8535.h>
#include <stdio.h>
unsigned char BuffADC;
int BuffLed=0;
#include <delay.h>
#define ADC_VREF_TYPE 0x60
#define Led PORTD.7
#define PortDataLCD PORTB
#define ISD_addr PORTC
#define PR PORTA.4
#define EOM PINA.5
#define PD PORTA.6
#define CE PORTA.7
#define RLY PORTD.4
#define SW1 PIND.5
#define SW2 PIND.6
// Alphanumeric LCD Module functions 
#asm
.equ __lcd_port=0x18 ;PORTB
#endasm
#include <lcd.h>

unsigned char read_adc(unsigned char adc_input);

// Timer 0 overflow interrupt service routine
interrupt [TIM0_OVF] void timer0_ovf_isr(void)
{ // Place your code here
  BuffADC = read_adc(0);
  if (++BuffLed >= 100) {
    BuffLed = 0;
    Led = !Led;
  }
}

void Play_Record() {
  PD = 0;
  PR = 1;
  CE = 0;
  delay_ms(3000);
  CE = 1;
  while (EOM);
  PD = 1;
}

void Record_Voice() {
  lcd_clear();
  lcd_putsf(" Merekam Suara ");
  delay_ms(2000);
  lcd_clear();
  lcd_putsf(" Tekan SW2 ");
  lcd_gotoxy(0,1);
  lcd_putsf(" Untuk Memulai ");
  while (SW2);
  PD = 0;
  PR = 0;
  CE = 0;
  lcd_clear();
  lcd_putsf(" Tekan SW1 ");
  lcd_gotoxy(0,1);
  lcd_putsf("Untuk Mengakhiri ");
  while (SW1);
  PD = 1;
  PR = 1;
  CE = 1;
}

// Read the 8 most significant bits
// of the AD conversion result
unsigned char read_adc(unsigned char adc_input) {
  ADMUX=adc_input | (ADC_VREF_TYPE & 0xff);
  // Start the AD conversion
  ADCSRA|=0x40;
  // Wait for the AD conversion to complete
  while ((ADCSRA & 0x10)==0);
}
APPENDICES

ADCSRA|=0x10;
return ADCH;
}

// Declare your global variables here

void main(void)
{
// Declare your local variables here

// Input/Output Ports initialization
// Port A initialization
// Func7=Out Func6=Out Func5=In Func4=Out Func3=In Func2=In Func1=In Func0=In
// State7=1 State6=1 State5=P State4=1 State3=T State2=T State1=T State0=T
PORTA=0xF0;
DDRA=0xD0;

// Port B initialization
// Func7=In Func6=In Func5=In Func4=In Func3=In Func2=In Func1=In Func0=In
// State7=T State6=T State5=T State4=T State3=T State2=T State1=T State0=T
PORTB=0x00;
DDRB=0x00;

// Port C initialization
// Func7=Out Func6=Out Func5=Out Func4=Out Func3=Out Func2=Out Func1=Out Func0=Out
// State7=0 State6=0 State5=0 State4=0 State3=0 State2=0 State1=0 State0=0
PORTC=0x00;
DDRC=0xFF;

// Port D initialization
// Func7=Out Func6=In Func5=In Func4=Out Func3=In Func2=In Func1=In Func0=In
// State7=0 State6=T State5=T State4=0 State3=T State2=T State1=T State0=T
PORTD=0x00;
DDRD=0x90;

// Timer/Counter 0 initialization
// Clock source: System Clock
// Clock value: 62.500 kHz
// Mode: Normal top=FFh
// OC0 output: Disconnected
TCCR0=0x03;
TCNT0=0x00;
OCR0=0x00;

// Timer/Counter 1 initialization
// Clock source: System Clock
// Clock value: Timer 1 Stopped
// Mode: Normal top=FFFFh
// OC1A output: Discon.
// OC1B output: Discon.
// Noise Canceler: Off
// Input Capture on Falling Edge
// Timer 1 Overflow Interrupt: Off
// Input Capture Interrupt: Off
// Compare A Match Interrupt: Off
// Compare B Match Interrupt: Off
TCCR1A=0x00;
TCCR1B=0x00;
TCNT1H=0x00;
TCNT1L=0x00;
ICR1H=0x00;
ICR1L=0x00;
OCR1AH=0x00;
OCR1AL=0x00;
OCR1BH=0x00;
OCR1BL=0x00;

// Timer/Counter 2 initialization
// Clock source: System Clock
// Clock value: Timer 2 Stopped
// Mode: Normal top=FFh
// OC2 output: Disconnected
ASSR=0x00;
TCCR2=0x00;
TCNT2=0x00;
OCR2=0x00;

// External Interrupt(s) initialization
// INT0: Off
// INT1: Off
// INT2: Off
MCUCR=0x00;
MCUCSR=0x00;

// Timer(s)/Counter(s) Interrupt(s) initialization
TIMSK=0x01;

// Analog Comparator initialization
// Analog Comparator: Off
// Analog Comparator Input Capture by Timer/Counter 1: Off
ACSR=0x80;
SFIOR=0x00;

// ADC initialization
// ADC Clock frequency: 1000.000 kHz
// ADC Voltage Reference: AVCC pin
// ADC High Speed Mode: Off
// ADC Auto Trigger Source: Free Running
// Only the 8 most significant bits of
// the AD conversion result are used
ADMUX=ADC_VREF_TYPE & 0xff;
ADCSRA=0xA2;
SFIO&=0x0F;

// LCD module initialization
lcd_init(16);

// Global enable interrupts
#asm("sei")
PD = 1;
PR = 1;
ISD_addr = 0;
RLY = 0;
delay_ms(2000);
if (!SW1 && !SW2) {
    Record_Voice();
}

awal:
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Sistem ");
lcd_gotoxy(0,1);
lcd_putsf(" Siap Digunakan");
delay_ms(2000);
lcd_clear();
while (1)
{
    if (!SW1 && !SW2) {
        lcd_clear();
lcd_putsf("Mode Standby");
delay_ms(500);
ulang:
if (!SW1 && !SW2)
goto selesai;
delay_ms(500);
goto ulang;
selesai:
lcd_clear();
    }
if (!SW1) {
    delay_ms(1000);
if (!SW1) {
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Penyiraman ");
lcd_gotoxy(0,1);
lcd_putsf(" Manual ");
Play_Record();
lcd_clear();
    }
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```c
RLY = 1;
delay_ms(15000);
RLY = 0;
lcd_clear();
}
goto awal;
}
if (BuffADC >= 29) {
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Selamat Datang ");
delay_ms(5000);
if (BuffADC >= 29) {
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Pengguna ");
lcd_gotoxy(0,1);
lcd_putsf(" Terdeteksi ");
while (BuffADC >= 29);
    lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Terima kasih ");
    Play_Record();
    RLY = 1;
delay_ms(15000);
    RLY = 0;
lcd_clear();
}
goto awal;
}
else {
lcd_clear();
lcd_gotoxy(0,0);
lcd_putsf(" Tidak ada ");
lcd_gotoxy(0,1);
lcd_putsf(" Pengguna ");
}
}```
FOTO ALAT

Berikut ini tampilan gambar foto dari alat otomasi:

Gambar 1. Alat Otomasi Klosét Setelah Dikemas
Gambar 2. Desain Dudukan Aktuator Solenoid
Gambar 3. Pemasangan Aktuator Solenoid Terhadap Klep Saluran Air Dalam Tangki Klosét
GP2D12/GP2D15

General Purpose Type Distance Measuring Sensors

Features
1. Less influence on the color of reflective objects, reflectivity
2. Line-up of distance output/distance judgement type
   - Distance output type (analog voltage): GP2D12
   - Detecting distance: 10 to 80cm
   - Distance judgement type: GP2D15
   - Judgement distance: 24cm
   (Adjustable within the range of 10 to 80cm)
3. External control circuit is unnecessary
4. Low cost

Applications
1. TVs
2. Personal computers
3. Cars
4. Copiers

Absolute Maximum Ratings
(Ta=25°C, Vcc=5V)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply voltage</td>
<td>Vcc</td>
<td>−0.3 to +7</td>
<td>V</td>
</tr>
<tr>
<td>Output terminal voltage</td>
<td>Vo</td>
<td>−0.3 to Vcc +0.3</td>
<td>V</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>T_{op}</td>
<td>−10 to +60</td>
<td>°C</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>T_{stg}</td>
<td>−40 to +70</td>
<td>°C</td>
</tr>
</tbody>
</table>

Outline Dimensions
(Unit: mm)

- The dimensions marked * are described the dimensions of lens center position.
- Unspecified tolerance: ±0.3mm
### Recommended Operating Conditions

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Rating</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating supply voltage</td>
<td>Vcc</td>
<td>4.5 to +5.5 V</td>
<td></td>
</tr>
</tbody>
</table>

### Electro-optical Characteristics

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Symbol</th>
<th>Conditions</th>
<th>MIN.</th>
<th>TYP.</th>
<th>MAX.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance measuring range</td>
<td>AL</td>
<td>±10</td>
<td>10</td>
<td></td>
<td>80</td>
<td>cm</td>
</tr>
<tr>
<td>Output terminal voltage</td>
<td>GP2D12</td>
<td>V0</td>
<td>0.25</td>
<td>0.4</td>
<td>0.55</td>
<td>V</td>
</tr>
<tr>
<td>Output terminal voltage</td>
<td>GP2D15</td>
<td>V0</td>
<td>-</td>
<td>-</td>
<td>0.6</td>
<td>V</td>
</tr>
<tr>
<td>Difference of output voltage</td>
<td>GP2D12</td>
<td>AV0</td>
<td>1.75</td>
<td>2.0</td>
<td>2.25</td>
<td>V</td>
</tr>
<tr>
<td>Difference of output voltage</td>
<td>GP2D15</td>
<td>V0</td>
<td>21</td>
<td>24</td>
<td>27</td>
<td>cm</td>
</tr>
<tr>
<td>Average Dissipation current</td>
<td>Z0C</td>
<td>L=50cm</td>
<td>33</td>
<td>50</td>
<td></td>
<td>mA</td>
</tr>
</tbody>
</table>

### Notes:

1. Using reflective object: White paper (Made by Kodak Co. Ltd; gray cards R=27; white face, reflective ratio; 90%)
2. We ship the device after the following adjustments: Output switching distance L=24mm±3cm must be measured by the sensor.
3. Distance measuring range of the optical sensor system.
4. Output switching has a hysteresis width. The distance specified by V0 should be the one with which the output L switches to the output H.

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#### Fig.1 Internal Block Diagram

GP2D12

- GND
- Vcc 5V
- LED
- PSD
- Signal processing circuit
- Voltage regulator
- Oscillation circuit
- Output circuit
- Distance measuring IC
- V0 Analog output

#### Fig.2 Internal Block Diagram

GP2D15

- GND
- Vcc 5V
- LED
- PSD
- Signal processing circuit
- Voltage regulator
- Oscillation circuit
- Output circuit
- Distance measuring IC
- V0 Digital output

#### Fig.3 Timing Chart

- Vcc (Power supply)
- Distance measuring operation
- V0 (Output)

- First measurement
- Second measurement
- nth measurement
- Unstable output
- First output
- Second output
- nth output
- 38.3ms/9.6ms
- 5.0ms (GP2D12)
- 7.6ms/1.9ms (GP2D15)
ISD2560/75/90/120

SINGLE-CHIP, MULTIPLE-MESSAGES,
VOICE RECORD/PLAYBACK DEVICE
60-, 75-, 90-, AND 120-SECOND DURATION
APPENDICES

1. GENERAL DESCRIPTION

Winbond’s ISD2500 ChipCorder® Series provide high-quality, single-chip, Record/Playback solutions for 60- to 120-second messaging applications. The CMOS devices include an on-chip oscillator, microphone preamplifier, automatic gain control, anti-aliasing filter, smoothing filter, speaker amplifier, and high density multi-level storage array. In addition, the ISD2500 is microcontroller compatible, allowing complex messaging and addressing to be achieved. Recordings are stored into on-chip nonvolatile memory cells, providing zero-power message storage. This unique, single-chip solution is made possible through Winbond’s patented multilevel storage technology. Voice and audio signals are stored directly into memory in their natural form, providing high-quality, solid-state voice reproduction.

2. FEATURES

• Easy-to-use single-chip, voice record/playback solution
• High-quality, natural voice/audio reproduction
• Single-chip with duration of 60, 75, 90, or 120 seconds.
• Manual switch or microcontroller compatible
• Playback can be edge- or level-activated
• Directly cascadable for longer durations
• Automatic power-down (push-button mode)
  - Standby current 1 μA (typical)
• Zero-power message storage
  - Eliminates battery backup circuits
• Fully addressable to handle multiple messages
• 100-year message retention (typical)
• 100,000 record cycles (typical)
• On-chip clock source
• Programmer support for play-only applications
• Single +5 volt power supply
• Available in die form, PDIP, SOIC and TSOP packaging
• Temperature: die (0°C to +50°C) and package (0°C to +70°C)
APPENDICES

ISD2560/75/90/120

5. PIN CONFIGURATION

* Same pinouts for ISD2575 / 2590 / 25120 products
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<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
</table>
| Ax/Mx    | 1-10/1-7 | 8-17/8-14 | Address/Mode Inputs: The Address/Mode Inputs have two functions depending on the level of the two Most Significant Bits (MSB) of the address pins (A8 and A9). If either or both of the two MSBs are LOW, the inputs are all interpreted as address bits and are used as the start address for the current record or playback cycle. The address pins are inputs only and do not output any internal address information during the operation. Address inputs are latched by the falling edge of CE.
|          |         |          | If both MSBs are HIGH, the Address/Mode inputs are interpreted as Mode bits according to the Operational Mode table on page 12. There are six operational modes (M0...M5) available as indicated in the table. It is possible to use multiple operational modes simultaneously. Operational Modes are sampled on each falling edge of CE, and thus Operational Modes and direct addressing are mutually exclusive. |
| AUX IN   | 11      | 18       | Auxiliary Input: The Auxiliary Input is multiplexed through to the output amplifier and speaker output pins when CE is HIGH, P/R is HIGH, and playback is currently not active or if the device is in playback overflow. When cascading multiple ISD2500 devices, the AUX IN pin is used to connect a playback signal from a following device to the previous output speaker drivers. For noise considerations, it is suggested that the auxiliary input is not driven when the storage array is active. |
| VSSA, VSSD | 13, 12  | 20, 19   | Ground: The ISD2500 series of devices utilizes separate analog and digital ground busses. These pins should be connected separately through a low-impedance path to power supply ground. |
| SP+/SP-  | 14/15   | 21/22    | Speaker Outputs: All devices in the ISD2500 series include an on-chip differential speaker driver, capable of driving 50 mW into 16 Ω from AUX IN (12.2 mW from memory). If the speaker outputs are held at VSSA levels during record and power down. It is therefore not possible to parallel speaker outputs of multiple ISD2500 devices or the outputs of other speaker drivers. A single-end output may be used (including a coupling capacitor between the SP pin and the speaker). These outputs may be used individually with the output signal taken from either pin. However, the use of single-end output results in a 1 to 4 reduction in its output power. |

[1] Connection of speaker outputs in parallel may cause damage to the device.
[2] Never ground or drive an unused speaker output.
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### ISD2560/75/90/120

<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{\text{CCA}}, V_{\text{CCD}}$</td>
<td>18, 28</td>
<td>Supply Voltage: To minimize noise, the analog and digital circuits in the ISD2500 series devices use separate power busses. These voltage busses are brought out to separate pins and should be tied together as close to the supply as possible. In addition, these supplies should be decoupled as close to the package as possible.</td>
</tr>
<tr>
<td>MIC</td>
<td>17</td>
<td>Microphone: The microphone pin transfers input signal to the on-chip preamplifier. A built-in Automatic Gain Control (AGC) circuit controls the gain of this preamplifier from $-15$ to $24$ dB. An external microphone should be AC coupled to this pin via a series capacitor. The capacitor value, together with the internal $10 , \text{K}\Omega$ resistance on this pin, determines the low-frequency cutoff for the ISD2500 series passband. See Winbond's Application Information for additional information on low-frequency cutoff calculation.</td>
</tr>
<tr>
<td>MIC REF</td>
<td>18</td>
<td>Microphone Reference: The MIC REF input is the inverting input to the microphone preamplifier. This provides a noise-canceling or common-mode rejection input to the device when connected to a differential microphone.</td>
</tr>
<tr>
<td>AGC</td>
<td>19</td>
<td>Automatic Gain Control: The AGC dynamically adjusts the gain of the preamplifier to compensate for the wide range of microphone input levels. The AGC allows the full range of whispers to loud sounds to be recorded with minimal distortion. The “attack” time is determined by the time constant of a $5 , \text{K}\Omega$ internal resistance and an external capacitor ($C_2$ on the schematic of Figure 5 in section 11) connected from the AGC pin to $V_{\text{SSA}}$ analog ground. The “release” time is determined by the time constant of an external resistor ($R_2$) and an external capacitor ($C_2$) connected in parallel between the AGC pin and $V_{\text{SSA}}$ analog ground. Nominal values of $470 , \text{K}\Omega$ and $4.7 , \mu\text{F}$ give satisfactory results in most cases.</td>
</tr>
<tr>
<td>ANA IN</td>
<td>20</td>
<td>Analog Input: The analog input transfers analog signal to the chip for recording. For microphone inputs, the ANA OUT pin should be connected via an external capacitor to the ANA IN pin. This capacitor value, together with the $3.0 , \text{K}\Omega$ input impedance of ANA IN, is selected to give additional cutoff at the low-frequency end of the voice passband. If the desired input is derived from a source other than a microphone, the signal can be fed, capacitively coupled, into the ANA IN pin directly.</td>
</tr>
<tr>
<td>ANA OUT</td>
<td>21</td>
<td>Analog Output: This pin provides the preamplifier output to the user. The voltage gain of the preamplifier is determined by the voltage level at the AGC pin.</td>
</tr>
</tbody>
</table>
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**ISD2560/75/90/120**

<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>OVF</strong></td>
<td>22</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Overflow:</strong> This signal pulses LOW at the end of memory array, indicating the device has been filled and the message has overflowed. The <strong>OVF</strong> output then follows the <strong>CE</strong> input until a PD pulse has reset the device. This pin can be used to cascade several ISD2500 devices together to increase record/playback durations.</td>
</tr>
<tr>
<td><strong>CE</strong></td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Chip Enable:</strong> The <strong>CE</strong> input pin is taken LOW to enable all playback and record operations. The address pins and playback/record pin (<strong>P/R</strong>) are latched by the falling edge of <strong>CE</strong>. <strong>CE</strong> has additional functionality in the M6 (Push-Button) Operational Mode as described in the Operational Mode section.</td>
</tr>
<tr>
<td><strong>PD</strong></td>
<td>24</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Power Down:</strong> When neither record nor playback operations, the PD pin should be pulled HIGH to place the part in standby mode (see <strong>I_{BB}</strong> specification). When <strong>OVF</strong> pulses LOW for an overflow condition, PD should be brought HIGH to reset the address pointer back to the beginning of the memory array. The PD pin has additional functionality in the M6 (Push-Button) Operational Mode as described in the Operational Mode section.</td>
</tr>
<tr>
<td><strong>EOM</strong></td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>End-Of-Message:</strong> A nonvolatile marker is automatically inserted at the end of each recorded message. It remains there until the message is recorded over. The EOM output pulses LOW for a period of <strong>T_{EOM}</strong> at the end of each message. In addition, the ISD2500 series has an internal <strong>V_{CC}</strong> detect circuit to maintain message integrity should <strong>V_{CC}</strong> fall below 3.5V. In this case, EOM goes LOW and the device is fixed in Playback-only mode. When the device is configured in Operational Mode M6 (Push-Button Mode), this pin provides an active-HIGH signal, indicating the device is currently recording or playing. This signal can conveniently drive an LED for visual indicator of a record or playback operation in process.</td>
</tr>
</tbody>
</table>
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### ISD2560/75/90/120

<table>
<thead>
<tr>
<th>PIN NAME</th>
<th>PIN NO.</th>
<th>FUNCTION</th>
</tr>
</thead>
</table>
| XCLK     | 26      | **External Clock:** The external clock input has an internal pull-down device. The device is configured at the factory with an internal sampling clock frequency centered to ±1 percent of specification. The frequency is then maintained to a variation of ±2.25 percent over the entire commercial temperature and operating voltage ranges. If greater precision is required, the device can be clocked through the XCLK pin as follows:

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Sample Rate</th>
<th>Required Clock</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISD2560</td>
<td>8.0 kHz</td>
<td>1024 kHz</td>
</tr>
<tr>
<td>ISD2575</td>
<td>6.4 kHz</td>
<td>819.2 kHz</td>
</tr>
<tr>
<td>ISD2590</td>
<td>5.3 kHz</td>
<td>682.7 kHz</td>
</tr>
<tr>
<td>ISD25120</td>
<td>4.0 kHz</td>
<td>512 kHz</td>
</tr>
</tbody>
</table>

These recommended clock rates should not be varied because the antialiasing and smoothing filters are fixed, and aliasing problems can occur if the sample rate differs from the one recommended. The duty cycle on the input clock is not critical, as the clock is immediately divided by two. If the XCLK is not used, this input must be connected to ground.

| P/R       | 27      | **Playback/Record:** The P/R input pin is latched by the falling edge of the CE pin. A HIGH level selects a playback cycle while a LOW level selects a record cycle. For a record cycle, the address pins provide the starting address and recording continues until PD or CE is pulled HIGH or an overflow is detected (i.e. the chip is full). When a record cycle is terminated by pulling PD or CE HIGH, then End-Of-Message (EOM) marker is stored at the current address in memory. For a playback cycle, the address inputs provide the starting address and the device will play until an EOM marker is encountered. The device can continue to pass an EOM marker if CE is held LOW in address mode, or in an Operational Mode. (See Operational Modes section) |
M6 – Push-Button Mode
The ISD2500 series contain a Push-Button Operational Mode. The Push-Button Mode is used primarily in very low-cost applications and is designed to minimize external circuitry and components, thereby reducing system cost. In order to configure the device in Push-Button Operational Mode, the two most significant address bits must be HIGH, and the M6 mode pin must also be HIGH. A device in this mode always powers down at the end of each playback or record cycle after $CE$ goes HIGH.

When this operational mode is implemented, three of the pins on the device have alternate functionality as described in the table below.

<table>
<thead>
<tr>
<th>Pin Name</th>
<th>Alternate Functionality in Push-Button Mode</th>
</tr>
</thead>
<tbody>
<tr>
<td>$CE$</td>
<td>Start/Pause Push-Button (LOW pulse-activated)</td>
</tr>
<tr>
<td>PD</td>
<td>Stop/Reset Push-Button (HIGH pulse-activated)</td>
</tr>
<tr>
<td>EOM</td>
<td>Active-HIGH Run Indicator</td>
</tr>
</tbody>
</table>

$CE$ (START/PAUSE)
In Push-Button Operational Mode, $CE$ acts as a LOW-going pulse-activated START/PAUSE signal. If no operation is currently in progress, a LOW-going pulse on this signal will initiate a playback or record cycle according to the level on the P/R pin. A subsequent pulse on the $CE$ pin, before an EOM is reached in playback or an overflow condition occurs, will pause the current operation, and the address counter is not reset. Another $CE$ pulse will cause the device to continue the operation from the place where it is paused.

PD (STOP/RESET)
In Push-Button Operational Mode, PD acts as a HIGH-going pulse-activated STOP/RESET signal. When a playback or record cycle is in progress and a HIGH-going pulse is observed on PD, the current cycle is terminated and the address pointer is reset to address 0, the beginning of the message space.

EOM (RUN)
In Push-Button Operational Mode, EOM becomes an active-HIGH RUN signal which can be used to drive an LED or other external device. It is HIGH whenever a record or playback operation is in progress.

Recording in Push-Button Mode
1. The PD pin should be LOW, usually using a pull-down resistor.
2. The P/R pin is taken LOW.

3. The CE pin is pulsed LOW. Recording starts, EOM goes HIGH to indicate an operation in progress.

4. When the CE pin is pulsed LOW. Recording pauses, EOM goes back LOW. The internal address pointers are not cleared, but the EOM marker is stored in memory to indicate as the message end. The P/R pin may be taken HIGH at this time. Any subsequent CE would start a playback at address 0.

5. The CE pin is pulsed LOW. Recording starts at the next address after the previous set EOM marker. EOM goes back HIGH.[3]

6. When the recording sequences are finished, the final CE pulse LOW will end the last record cycle, leaving a set EOM marker at the message end. Recording may also be terminated by a HIGH level on PD, which will leave a set EOM marker.

Playback in Push-Button Mode

1. The PD pin should be LOW.

2. The P/R pin is taken HIGH.

3. The CE pin is pulsed LOW. Playback starts, EOM goes HIGH to indicate an operation in progress.

4. If the CE pin is pulsed LOW or an EOM marker is encountered during an operation, the part will pause. The internal address pointers are not cleared, and EOM goes back LOW. The P/R pin may be changed at this time. A subsequent record operation would not reset the address pointers and the recording would begin where playback ended.

5. CE is again pulsed LOW. Playback starts where it left off, with EOM going HIGH to indicate an operation in progress.

6. Playback continues as in steps 4 and 5 until PD is pulsed HIGH or overflow occurs.

7. If in overflow, pulling CE LOW will reset the address pointer and start playback from the beginning. After a PD pulse, the part is reset to address 0.
8. TIMING DIAGRAMS

**FIGURE 1: RECORD**

**FIGURE 2: PLAYBACK**
### TABLE 9: AC PARAMETERS – Packaged Parts

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sampling Frequency</td>
<td>$F_s$</td>
<td>8.0</td>
<td></td>
<td></td>
<td>kHz</td>
<td></td>
</tr>
<tr>
<td>ISD2560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>ISD2575</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td>ISD2590</td>
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</tr>
<tr>
<td>ISD25120</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filter Pass Band</td>
<td>$F_{CF}$</td>
<td>3.4</td>
<td></td>
<td></td>
<td>kHz</td>
<td>3 dB Roll-Off Point[3][4]</td>
</tr>
<tr>
<td>ISD2560</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ISD2575</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISD2590</td>
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</tr>
<tr>
<td>ISD25120</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record Duration</td>
<td>$T_{REC}$</td>
<td>58.1</td>
<td>60.0</td>
<td>62.0</td>
<td>sec</td>
<td>Commercial Operation[7]</td>
</tr>
<tr>
<td>ISD2560</td>
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<td></td>
<td></td>
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<td>ISD25120</td>
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<td></td>
</tr>
<tr>
<td>Playback Duration</td>
<td>$T_{PLAY}$</td>
<td>58.1</td>
<td>60.0</td>
<td>62.0</td>
<td>sec</td>
<td>Commercial Operation</td>
</tr>
<tr>
<td>ISD2560</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>ISD25120</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>CE Pulse Width</td>
<td>$T_{CE}$</td>
<td>100</td>
<td></td>
<td></td>
<td>nsec</td>
<td></td>
</tr>
<tr>
<td>Control/Address Setup Time</td>
<td>$T_{SET}$</td>
<td>300</td>
<td></td>
<td></td>
<td>nsec</td>
<td></td>
</tr>
<tr>
<td>Control/Address Hold Time</td>
<td>$T_{HOLD}$</td>
<td>0</td>
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<td></td>
<td>nsec</td>
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<tr>
<td>Power-Up Delay</td>
<td>$T_{PUD}$</td>
<td>24.1</td>
<td>25.0</td>
<td>27.8</td>
<td>msec</td>
<td>Commercial Operation</td>
</tr>
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<td></td>
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</tr>
<tr>
<td>ISD2575</td>
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<tr>
<td>ISD2590</td>
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</tr>
<tr>
<td>ISD25120</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PD Pulse Width (record)</td>
<td>$T_{PDR}$</td>
<td>25.0</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
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</tr>
<tr>
<td>ISD25120</td>
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</table>
### Table 9: AC Parameters – Packaged Parts (Cont’d)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Symbol</th>
<th>MIN[^I]</th>
<th>TYP[^J]</th>
<th>MAX[^I]</th>
<th>Units</th>
<th>Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PD Pulse Width (Play)</td>
<td>T&lt;sub&gt;PD&lt;/sub&gt;</td>
<td>12.5</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD2560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISD2575</td>
<td></td>
<td>15.625</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD2590</td>
<td></td>
<td>18.75</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD25120</td>
<td></td>
<td>25.0</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>PD Pulse Width (Static)</td>
<td>T&lt;sub&gt;PD&lt;/sub&gt;S</td>
<td>100</td>
<td></td>
<td></td>
<td>nsec</td>
<td></td>
</tr>
<tr>
<td>Power Down Hold</td>
<td>T&lt;sub&gt;PDH&lt;/sub&gt;</td>
<td>0</td>
<td></td>
<td></td>
<td>nsec</td>
<td></td>
</tr>
<tr>
<td>EOM Pulse Width</td>
<td>T&lt;sub&gt;EOM&lt;/sub&gt;</td>
<td>12.5</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD2560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISD2575</td>
<td></td>
<td>15.625</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD2590</td>
<td></td>
<td>18.75</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>ISD25120</td>
<td></td>
<td>25.0</td>
<td></td>
<td></td>
<td>msec</td>
<td></td>
</tr>
<tr>
<td>Overflow Pulse Width</td>
<td>T&lt;sub&gt;OVF&lt;/sub&gt;</td>
<td>0.5</td>
<td></td>
<td></td>
<td>μsec</td>
<td></td>
</tr>
<tr>
<td>Total Harmonic Distortion</td>
<td>THD</td>
<td>1</td>
<td>2</td>
<td></td>
<td>%</td>
<td>@ 1 kHz</td>
</tr>
<tr>
<td>Speaker Output Power</td>
<td>P&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>12.2</td>
<td></td>
<td>50</td>
<td>mW</td>
<td>R&lt;sub&gt;EXT&lt;/sub&gt; = 16 Ω[^M]</td>
</tr>
<tr>
<td>Voltage Across Speaker Pins</td>
<td>V&lt;sub&gt;OUT&lt;/sub&gt;</td>
<td>2.5</td>
<td></td>
<td></td>
<td>V p-p</td>
<td>R&lt;sub&gt;EXT&lt;/sub&gt; = 600 Ω</td>
</tr>
<tr>
<td>MIC Input Voltage</td>
<td>V&lt;sub&gt;IN&lt;/sub&gt;</td>
<td>20</td>
<td></td>
<td></td>
<td>mV</td>
<td>Peak-to-Peak[^K]</td>
</tr>
<tr>
<td>ANA IN Input Voltage</td>
<td>V&lt;sub&gt;ANI&lt;/sub&gt;</td>
<td>50</td>
<td></td>
<td></td>
<td>mV</td>
<td>Peak-to-Peak</td>
</tr>
<tr>
<td>AUX Input Voltage</td>
<td>V&lt;sub&gt;ANI&lt;/sub&gt;</td>
<td>1.25</td>
<td></td>
<td></td>
<td>V</td>
<td>Peak-to-Peak; R&lt;sub&gt;EXT&lt;/sub&gt; = 16 Ω</td>
</tr>
</tbody>
</table>

Notes:

[^I]: Typical values @ T<sub>A</sub> = 25°C and V<sub>DD</sub> = 5.0V.
[^J]: All Min/Max limits are guaranteed by Winbond via electrical testing or characterization. Not all specifications are 100% tested.
[^K]: Low-frequency cutoff depends upon the value of external capacitors (see Pin Descriptions)
[^M]: From AUX IN: if ANA IN is driven at 50 mV p-p, the P<sub>OUT</sub> = 12.2 mW, typical.
[^N]: With 5.1 KΩ series resistor at ANA IN.
[^O]: T<sub>OVF</sub> is required during a static condition, typically overflow.
[^P]: Sampling Frequency and playback duration can vary as much as ±2.25% over the commercial temperature range. For greater stability, an external clock can be utilized (see Pin Descriptions)
[^Q]: Filter specification applies to the antialiasing filter and the smoothing filter. Therefore, from input to output, expect a 6 dB drop by nature of passing through both filters.
FIGURE 5: DESIGN SCHEMATIC

Note: If desired, pin 18 (PDIP package) may be left unconnected (microphone preamplifier noise will be higher). In this case, pin 18 must not be tied to any other signal or voltage. Additional design example schematics are provided below.
### TABLE 13: APPLICATION EXAMPLE – BASIC DEVICE CONTROL

<table>
<thead>
<tr>
<th>Control Step</th>
<th>Function</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Power up chip and select Record/Playback Mode</td>
<td>1. PD = LOW, 2. P/R = As desired</td>
</tr>
<tr>
<td>2</td>
<td>Set message address for record/playback</td>
<td>Set addresses A0-A9</td>
</tr>
<tr>
<td>3A</td>
<td>Begin playback</td>
<td>P/R = HIGH, CE = Pulse LOW</td>
</tr>
<tr>
<td>3B</td>
<td>Begin record</td>
<td>P/R = LOW, CE = LOW</td>
</tr>
<tr>
<td>4A</td>
<td>End playback</td>
<td>Automatic</td>
</tr>
<tr>
<td>4B</td>
<td>End record</td>
<td>PD or CE = HIGH</td>
</tr>
</tbody>
</table>

### TABLE 14: APPLICATION EXAMPLE – PASSIVE COMPONENT FUNCTIONS

<table>
<thead>
<tr>
<th>Part</th>
<th>Function</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>Microphone power supply decoupling</td>
<td>Reduces power supply noise</td>
</tr>
<tr>
<td>R2</td>
<td>Release time constant</td>
<td>Sets release time for AGC</td>
</tr>
<tr>
<td>R3, R5</td>
<td>Microphone biasing resistors</td>
<td>Provides biasing for microphone operation</td>
</tr>
<tr>
<td>R4</td>
<td>Series limiting resistor</td>
<td>Reduces level to prevent distortion at higher supply voltages</td>
</tr>
<tr>
<td>R6</td>
<td>Series limiting resistor</td>
<td>Reduces level to high supply voltages</td>
</tr>
<tr>
<td>C1, C5</td>
<td>Microphone DC-blocking capacitor</td>
<td>Decouples microphone bias from chip. Provides single-pole low-frequency cutoff and command mode noise rejection.</td>
</tr>
<tr>
<td>C2</td>
<td>Attack/Release time constant</td>
<td>Sets attack/release time for AGC</td>
</tr>
<tr>
<td>C3</td>
<td>Low-frequency cutoff capacitor</td>
<td>Provides additional pole for low-frequency cutoff</td>
</tr>
<tr>
<td>C4</td>
<td>Microphone power supply decoupling</td>
<td>Reduces power supply noise</td>
</tr>
<tr>
<td>C6, C7, C8</td>
<td>Power supply capacitors</td>
<td>Filter and bypass of power supply</td>
</tr>
</tbody>
</table>
12. PACKAGE DRAWING AND DIMENSIONS

12.1. 28-LEAD 300-MIL PLASTIC SMALL OUTLINE IC (SOIC)

---

**INCHES**

<table>
<thead>
<tr>
<th></th>
<th>Min</th>
<th>Nom</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.701</td>
<td>0.708</td>
<td>0.711</td>
</tr>
<tr>
<td>B</td>
<td>0.097</td>
<td>0.101</td>
<td>0.104</td>
</tr>
<tr>
<td>C</td>
<td>0.292</td>
<td>0.296</td>
<td>0.299</td>
</tr>
<tr>
<td>D</td>
<td>0.005</td>
<td>0.009</td>
<td>0.0115</td>
</tr>
<tr>
<td>E</td>
<td>0.014</td>
<td>0.016</td>
<td>0.019</td>
</tr>
<tr>
<td>F</td>
<td>0.050</td>
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</tr>
<tr>
<td>G</td>
<td>0.400</td>
<td>0.408</td>
<td>0.410</td>
</tr>
<tr>
<td>H</td>
<td>0.024</td>
<td>0.032</td>
<td>0.040</td>
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</table>

**MILLIMETERS**

<table>
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<tr>
<th></th>
<th>Min</th>
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<th>Max</th>
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<tbody>
<tr>
<td>A</td>
<td>17.81</td>
<td>17.93</td>
<td>18.06</td>
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<tr>
<td>B</td>
<td>2.46</td>
<td>2.56</td>
<td>2.64</td>
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<tr>
<td>C</td>
<td>7.42</td>
<td>7.52</td>
<td>7.59</td>
</tr>
<tr>
<td>D</td>
<td>0.127</td>
<td>0.22</td>
<td>0.29</td>
</tr>
<tr>
<td>E</td>
<td>0.35</td>
<td>0.41</td>
<td>0.48</td>
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<tr>
<td>F</td>
<td>1.27</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>10.18</td>
<td>10.31</td>
<td>10.41</td>
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<tr>
<td>H</td>
<td>0.61</td>
<td>0.81</td>
<td>1.02</td>
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Note: Lead coplanarity to be within 0.004 inches.
13. ORDERING INFORMATION

Product Number Descriptor Key

**ISD25**

**ISD2500 Series**

- **Duration:**
  - 60 = 60 seconds
  - 75 = 75 seconds
  - 90 = 90 seconds
  - 120 = 120 seconds

**Special Temperature Field:**
- Blank = Commercial Packaged (0°C to +70°C)
- or Commercial Die (0°C to +50°C)

**Package Type:**
- **P** = 28-Lead 600mil Plastic Dual Inline Package (PDIP)
- **S** = 28-Lead 300mil Small Outline Integrated Circuit (SOIC)
- **E** = 28-Lead 8x13.4 mm Thin Small Outline Package (TSOP) Type 1
- **X** = Die

When ordering ISD2560/75/90/120 products refer to the following part numbers which are supported in volume for this product series. Consult the local Winbond Sales Representative or Distributor for availability information.

<table>
<thead>
<tr>
<th>Part Number</th>
<th>Part Number</th>
<th>Part Number</th>
<th>Part Number</th>
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<tbody>
<tr>
<td>ISD2560P</td>
<td>ISD2575P</td>
<td>ISD2590P</td>
<td>ISD25120P</td>
</tr>
<tr>
<td>ISD2560S</td>
<td>ISD2575S</td>
<td>ISD2560S</td>
<td>ISD25120S</td>
</tr>
<tr>
<td>ISD2560E</td>
<td>ISD2575E</td>
<td>ISD2560E</td>
<td>ISD25120E</td>
</tr>
<tr>
<td>ISD2560X</td>
<td>ISD2575X</td>
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<td>ISD25120X</td>
</tr>
</tbody>
</table>

For the latest product information, access Winbond’s worldwide website at [http://www.winbond-usa.com](http://www.winbond-usa.com)
## AC SOLENOIDS

### Specification

<table>
<thead>
<tr>
<th>MODEL NO</th>
<th>PUSH OR PULL</th>
<th>RATED STROKE (mm)</th>
<th>RATED PULL (kg)</th>
<th>RATED SERVICE</th>
<th>RATED VOLTAGE (AC)</th>
<th>RATED CYCLES</th>
<th>L<em>W</em>H Approx.</th>
<th>WEIGHT (kg)</th>
<th>TOTAL WEIGHT (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAS-05</td>
<td>10</td>
<td>0.5</td>
<td>Continuous</td>
<td>110 or 220</td>
<td>50/60Hz</td>
<td>84x33x38</td>
<td>0.086</td>
<td>0.066</td>
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<td>50/60Hz</td>
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<td>50/60Hz</td>
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<td>110 or 220</td>
<td>50/60Hz</td>
<td>93x49x50</td>
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<td>Continuous</td>
<td>110 or 220</td>
<td>50/60Hz</td>
<td>93x53x50</td>
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<td>110 or 220</td>
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<td>93x57x50</td>
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<td>110 or 220</td>
<td>50/60Hz</td>
<td>130x70x63</td>
<td>0.302</td>
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<td>50/60Hz</td>
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<td>110 or 220</td>
<td>50/60Hz</td>
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<td>110 or 220</td>
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