

Fixed Code Encoder

FEATURES

Operating

- 2 Programmable 32-bit serial numbers
- 10-bit serial number
- 66-bit transmission code length
- Non-volatile 16-bit counter
- 3.5V -13.3V operation
- 3 inputs, 7 functions available
- Selectable baud rate
- Automatic code word completion
- Battery low signal transmitted to receiver

Other

- Pin-out compatible with most KEELOQ® Encoders
- Simple programming interface
- On-chip EEPROM
- On-chip oscillator and timing components
- Button inputs have internal pull-down resistors
- Minimum External Components required

Typical Applications

The HCS101 is ideal for remote control applications. These applications include:

- Low-end automotive alarm systems
- Low-end automotive immobilizers
- Gate and garage door openers
- Identity tokens
- Low-end burglar alarm systems
- Fan and lighting controls
- Toys

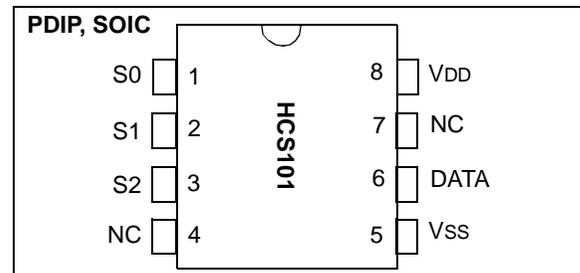
DESCRIPTION

The HCS101 from Microchip Technology Inc. is a fixed code encoder designed for remote control systems. It provides a small package outline and low cost to make this device a perfect solution for unidirectional remote control systems.

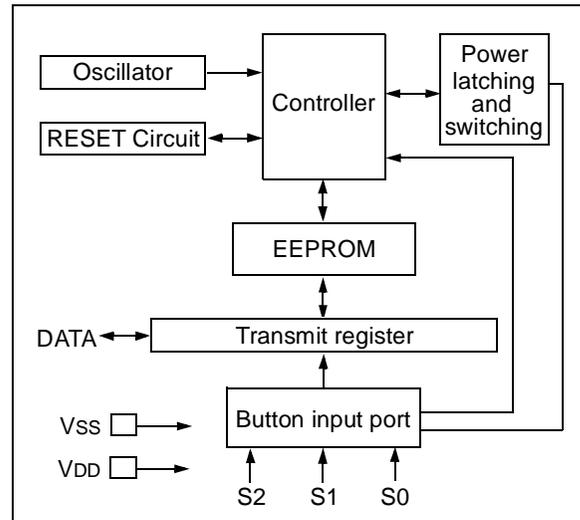
It is also pin compatible with Microchip's HCS201 Code Hopping Encoder allowing easy upgrading to a more secure remote keyless entry (RKE) system.

The 8-pin HCS101 operates over a wide voltage range of 3.5V to 13.3V and has three button inputs allowing the system designer the freedom to utilize up to 7 functions. The only components required for device operation are the buttons and RF circuitry, allowing a very low system cost.

PACKAGE TYPES



HCS101 BLOCK DIAGRAM



HCS101

1.0 SYSTEM OVERVIEW

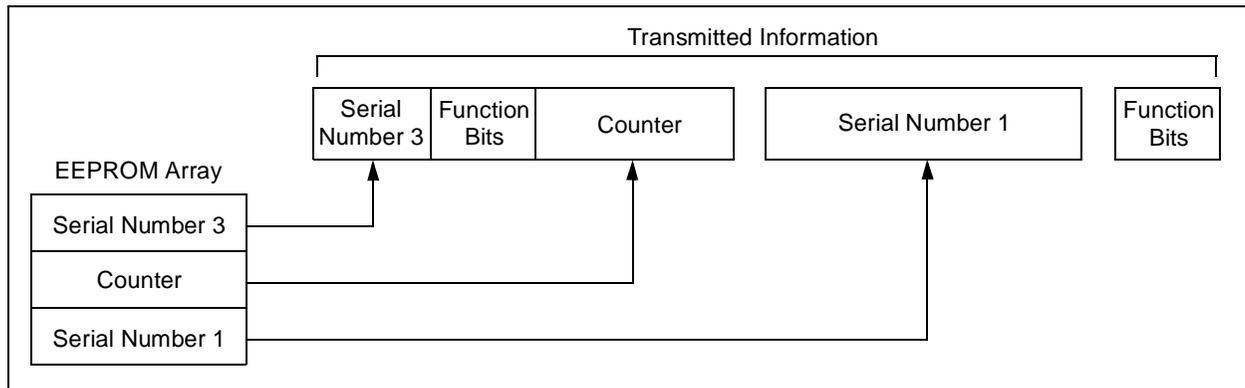
As indicated in the block diagram in Figure 1-1, the HCS101 has a small EEPROM array, which must be loaded with several parameters before use. These parameters include:

- Two 32-bit serial numbers
- 16-bit counter value
- Additional 10-bit serial number
- Configuration data

The EEPROM data for each transmitter is programmed by the manufacturer at the time of production.

Any type of controller may be used as a receiver, but it is typically a microcontroller with compatible firmware that allows the receiver to operate in conjunction with a transmitter, based on the HCS101.

FIGURE 1-1: BASIC OPERATION OF TRANSMITTER ENCODER



2.0 DEVICE OPERATION

As shown in the typical application circuits in Figure 2-1, the HCS101 is easy to use. It requires only the addition of buttons and RF circuitry for use as the transmitter in your application. A description of each pin is given in Table 2-1.

FIGURE 2-1: TYPICAL CIRCUITS

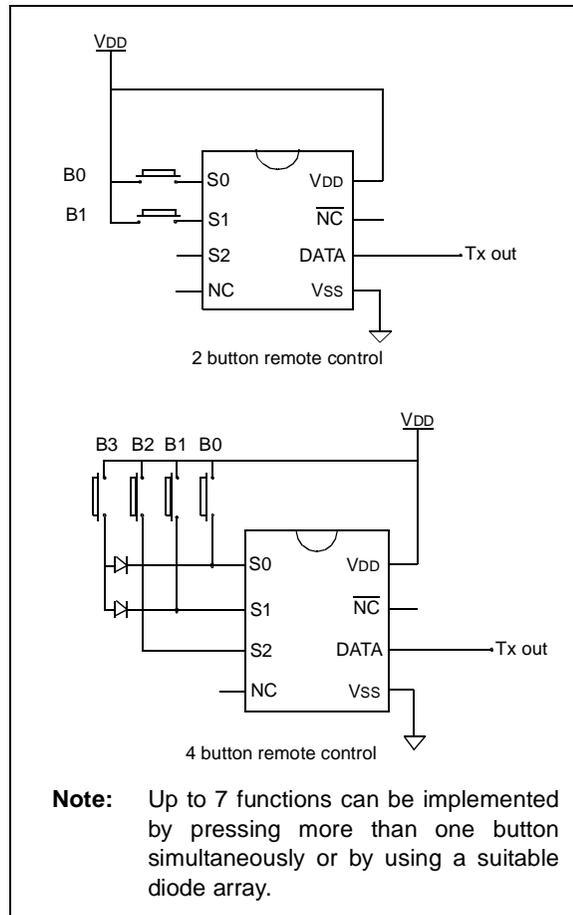


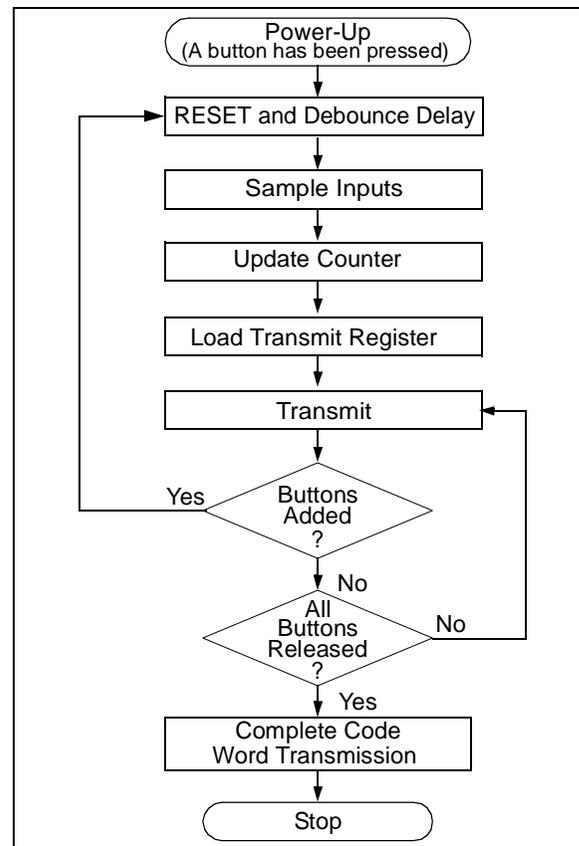
TABLE 2-1: PIN DESCRIPTIONS

| Name | Pin Number | Description |
|------|------------|---|
| S0 | 1 | Switch input 0 |
| S1 | 2 | Switch input 1 |
| S2 | 3 | Switch input 2/Clock pin for Programming mode |
| NC | 4 | No connection |
| VSS | 5 | Ground reference connection |
| DATA | 6 | Pulse Width Modulation (PWM) output pin/Data pin for Programming mode |
| NC | 7 | No connection |
| VDD | 8 | Positive supply voltage connection |

The HCS101 will wake-up upon detecting a switch closure and then delay for a debounce delay (T_{DB}) as shown in Figure 2-2. The device will then update the 16-bit counter before it loads the transmit register. The data is then transmitted serially on the DATA pin in Pulse Width Modulation (PWM) format.

If additional buttons are pressed during a transmission, the current transmission is terminated. The HCS101 restarts and the new transmission will contain the latest button information. When all buttons are released, the device completes the current code word and then powers down. Released buttons do not terminate and/or restart transmissions.

FIGURE 2-2: ENCODER OPERATION



HCS101

3.0 TRANSMITTED WORD

3.1 Transmission Format (PWM Mode)

The HCS101 transmission is made up of several code words as shown in Figure 3-1. Each code word starts with a preamble and a header, followed by the data. The code word is followed by a guard period before the next code word begins. The same code word is transmitted as long as the button is pressed. Refer to Table 7-3 for transmission timing requirements.

3.2 Code Word Organization

The HCS101 transmits a 66-bit code word. The 66-bit word is constructed from the serial numbers, counter and function information. The code word format is shown in Figure 3-2.

Under normal conditions, serial number 1 is transmitted with the counter and serial number 3. If all the buttons are pressed, serial number 2 is transmitted in place of the counter and serial number 3.

FIGURE 3-1: CODE WORD TRANSMISSION FORMAT

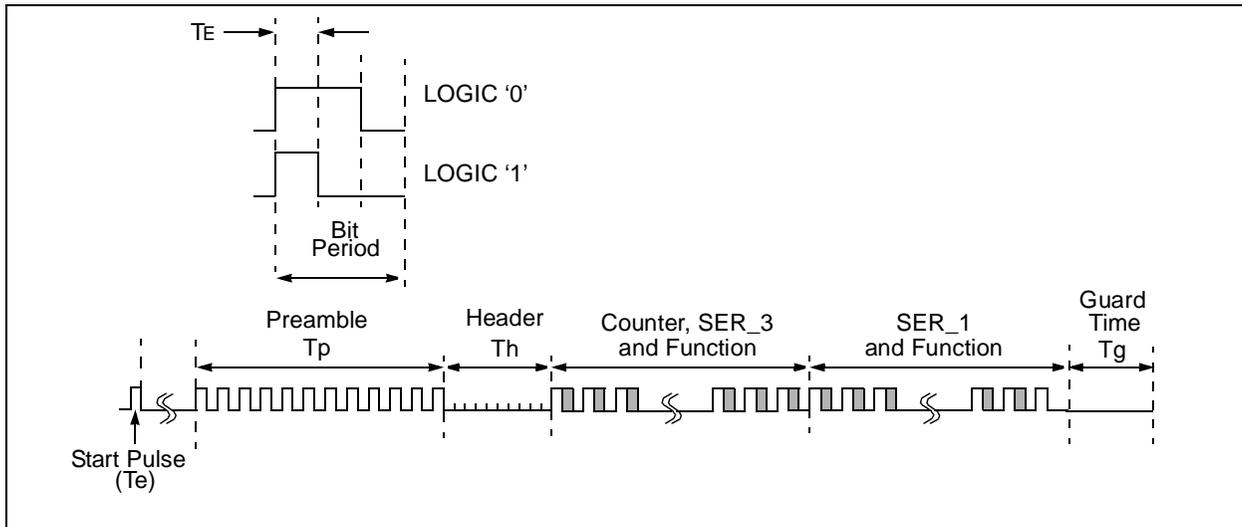
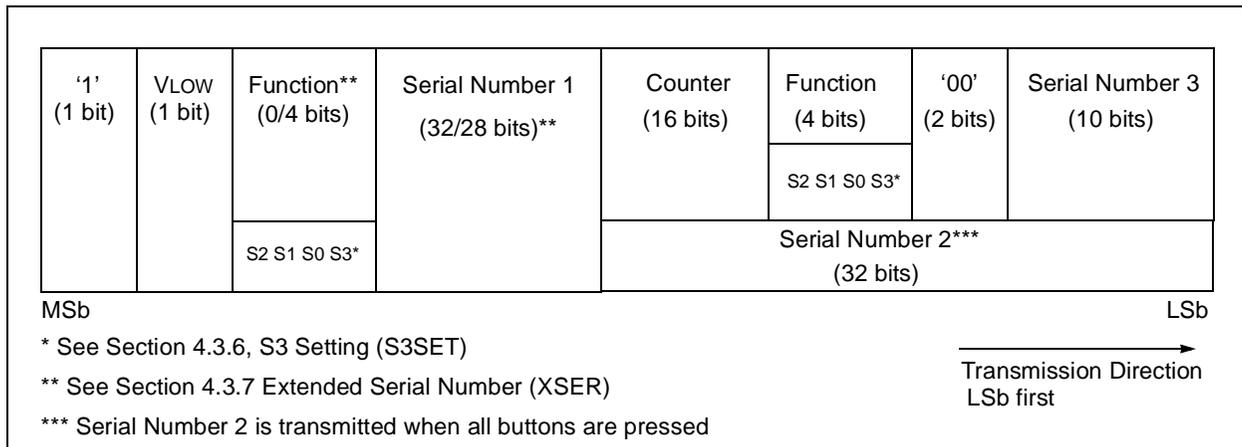


FIGURE 3-2: CODE WORD ORGANIZATION



4.0 EEPROM MEMORY ORGANIZATION

The HCS101 contains 192 bits (12 x 16-bit words) of EEPROM memory as shown in Table 4-1. Further descriptions of the memory array are given in the following sections.

TABLE 4-1: EEPROM MEMORY MAP

| WORD ADDRESS | MNEMONIC | DESCRIPTION |
|--------------|----------|--|
| 0 | RESERVED | Set to 0000H |
| 1 | RESERVED | Set to 0000H |
| 2 | RESERVED | Set to 0000H |
| 3 | RESERVED | Set to 0000H |
| 4 | CNTR | Counter |
| 5 | RESERVED | Set to 0000H |
| 6 | SER_1 | Device Serial Number 1 (word 0) 16 LSb's |
| 7 | SER_1 | Device Serial Number 1 (word 1) 16 MSb's |
| 8 | SER_2 | Device Serial Number 2 (word 0) 16 LSb's |
| 9 | SER_2 | Device Serial Number 2 (word 1) 16 MSb's |
| 10 | SER_3 | Device Serial Number 3 |
| 11 | CONFIG | Config Word |

4.1 CNTR (Counter)

This is the 16-bit gray code counter value that can be used to track the number of times a transmitter has been activated.

4.2 SER_1, SER_2, SER_3 (Encoder Serial Number)

SER_1, and SER_2 are the 32-bit device serial numbers. SER_3 is an additional 10-bit serial number transmitted with every transmission. The most significant 6 bits of the 16-bit SER_3 word are reserved and should be set to zero.

4.3 Configuration Word

The configuration word is a 16-bit word stored in the EEPROM array that is used by the device to store the status configuration options. Further explanations of each of the bits are described in the following sections.

TABLE 4-2: CONFIGURATION WORD

| Bit Number | Bit Name |
|------------|----------|
| 0 | OSC0 |
| 1 | OSC1 |
| 2 | OSC2 |
| 3 | OSC3 |
| 4 | VLOWS |
| 5 | BRS |
| 6 | MTX4 |
| 7 | TXEN |
| 8 | S3SET |
| 9 | XSER |
| 10 | RESERVED |
| 11 | RESERVED |
| 12 | RESERVED |
| 13 | RESERVED |
| 14 | RESERVED |
| 15 | RESERVED |

4.3.1 OSCILLATOR TUNING BITS (OSC0 TO OSC3)

These bits are used to tune the nominal frequency of the HCS101 to within $\pm 10\%$ of its nominal value over temperature and voltage.

4.3.2 LOW VOLTAGE TRIP POINT SELECT (VLOWS)

The low voltage trip point select bit (VLOWS) and the S3 setting bit (S3SET) are used to determine the voltage level for the low voltage detector.

| VLOWS | S3SET* | Trip Point |
|-------|--------|------------|
| 0 | 0 | 4.4 |
| 0 | 1 | 4.4 |
| 1 | 0 | 9 |
| 1 | 1 | 6.75 |

* See also Section 4.3.6

4.3.3 BAUDRATE SELECT BITS (BRS)

BRS selects the speed of transmission and the code word blanking. Table 4-3 shows how the bit is used to select the different baud rates and Section 5.2 provides a detailed explanation of code word blanking.

TABLE 4-3: BAUDRATE SELECT

| BRS | Basic Pulse Element | Code Words Transmitted |
|-----|---------------------|------------------------|
| 0 | 400 μ s | All |
| 1 | 200 μ s | 1 out of 2 |

4.3.4 MINIMUM FOUR TRANSMISSIONS (MTX4)

If this bit is cleared, at least one code word is completed when the HCS101 is activated. If this bit is set, at least four complete code words are transmitted.

4.3.5 TRANSMIT PULSE ENABLE (TXEN)

If this bit is cleared, no start pulse occurs before a transmission. If the bit is set, a start pulse (1 TE long) is transmitted before the first code word's preamble.

4.3.6 S3 SETTING (S3SET)

This bit determines the value of S3 in the function code during a transmission and the high trip point selected by V_{LOWS} in Section 4.3.2. If this bit is cleared, S3 mirrors S2 during a transmission. If the S3SET bit is set, S3 in the function code is always set, independent of the value of S2.

4.3.7 EXTENDED SERIAL NUMBER (XSER)

If this bit is cleared, the most significant four bits of the 32-bit Serial Number 1 are replaced with the function code. If this bit is set, the full 32-bit Serial Number 1 is transmitted.

5.0 SPECIAL FEATURES

5.1 Code Word Completion

Code word completion is an automatic feature that ensures the entire code word is transmitted, even if the button is released before the transmission is complete. If the button is held down beyond the time for one code word, multiple code words will result. If another button is activated during a transmission, the active transmission will be aborted and a new transmission will begin using the new button information.

5.2 Blank Alternate Code Word

Federal Communications Commission (FCC) Rules, Part 15 specify the limits on fundamental power and harmonics that can be transmitted. Power is calculated on the worst case average power transmitted in a 100 ms window. It is therefore advantageous to minimize the duty cycle of the transmission by minimizing the duty cycle of the individual bits and by blanking out consecutive words. The transmission duty cycle can be lowered by setting BRS. This reduces the average power transmitted and hence, assists in FCC approval of a transmitter device. Shortening the code word length and transmitting only every other code word (Figure 5-1) also may allow a higher amplitude transmission for greater range.

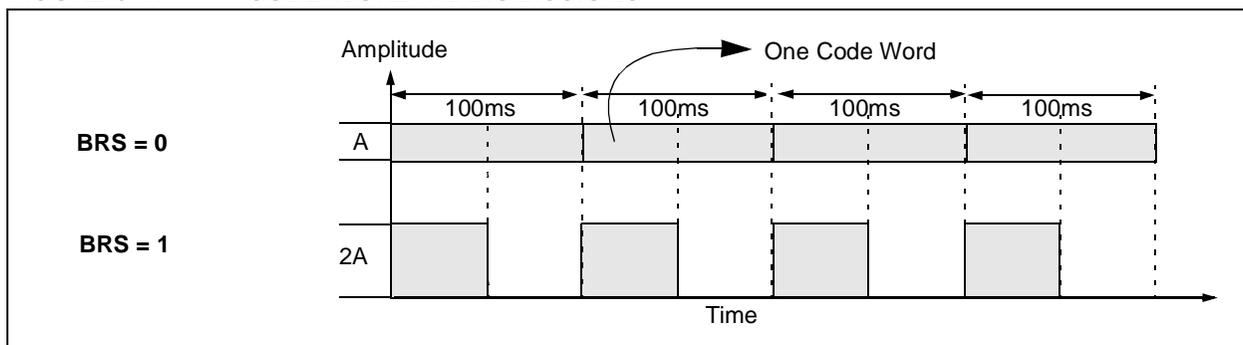
5.3 Auto-Shutoff

The auto-shutoff function automatically stops the device from transmitting if a button inadvertently gets pressed for longer than the time-out period, T_{TO}. This will prevent the device from draining the battery if a button gets pressed while the transmitter is in a pocket or purse.

5.4 V_{LOW}: Voltage LOW Indicator

The V_{LOW} bit is included in every transmission and will be transmitted as a one if the operating voltage has dropped below the low voltage trip point. Refer to Figure 3-2. The trip point is selectable based on the battery voltage being used. See Section 4.3.2 for a description of how the low voltage select option is set.

FIGURE 5-1: CODE WORD TRANSMISSIONS



6.0 PROGRAMMING THE HCS101

When using the HCS101 in a system, the user will have to program some parameters into the device, including the serial number and the counter, before it can be used. The programming cycle allows the user to input a 192-bit serial data stream which is then stored internally in EEPROM. Programming will be initiated by forcing the DATA line high after the S2 line has been held high for the appropriate length of time. Refer to Table 6-1 and Figure 6-1.

After the Program mode is entered, a delay must be provided to the device for the automatic bulk write cycle to complete. This will write all locations in the EEPROM to all zeros. The device can then be programmed by clocking in 16 bits at a time, using S2 as the clock line and DATA as the data in line. After each 16-bit word is loaded, a programming delay is required for the internal program cycle to complete. This delay can take up to T_{wc} .

The HCS101 will signal that the write is complete by sending out a train of ACK pulses, TACKH high, TACKL low on DATA. The ACK pulses will continue until S2 is dropped. These times can be used to calculate the oscillator calibration value. The first pulse's width should NOT be used for calibration.

At the end of the programming cycle, the device can be verified as shown in Figure 6-2 by reading back the EEPROM. Reading is done by clocking the S2 line and reading the data bits on the DATA pin. **A verify operation can only be done once, immediately following the program cycle.**

Note: To ensure that the device does not accidentally enter Programming mode, DATA should never be pulled high by the circuit connected to it. Special care should be taken when driving PNP RF transistors.

FIGURE 6-1: PROGRAMMING WAVEFORMS

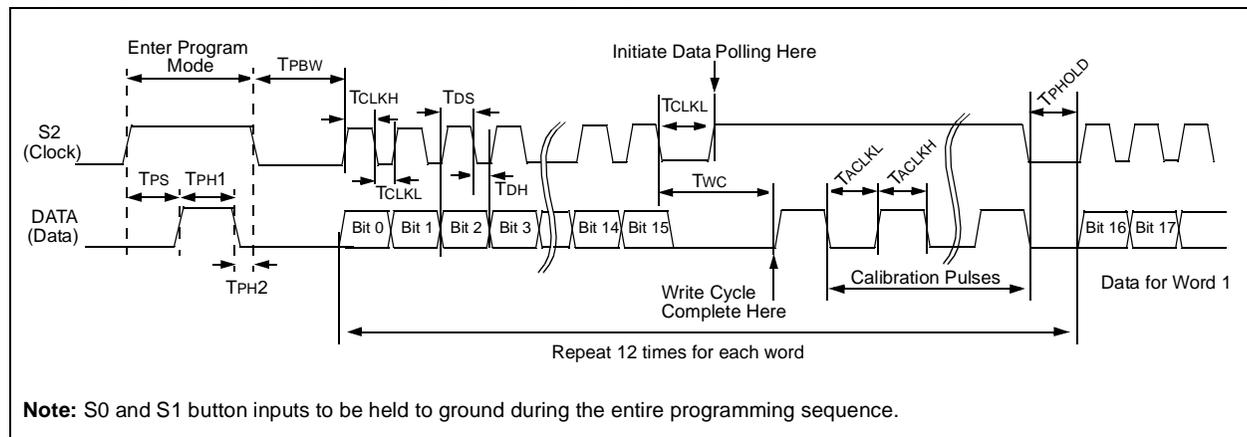
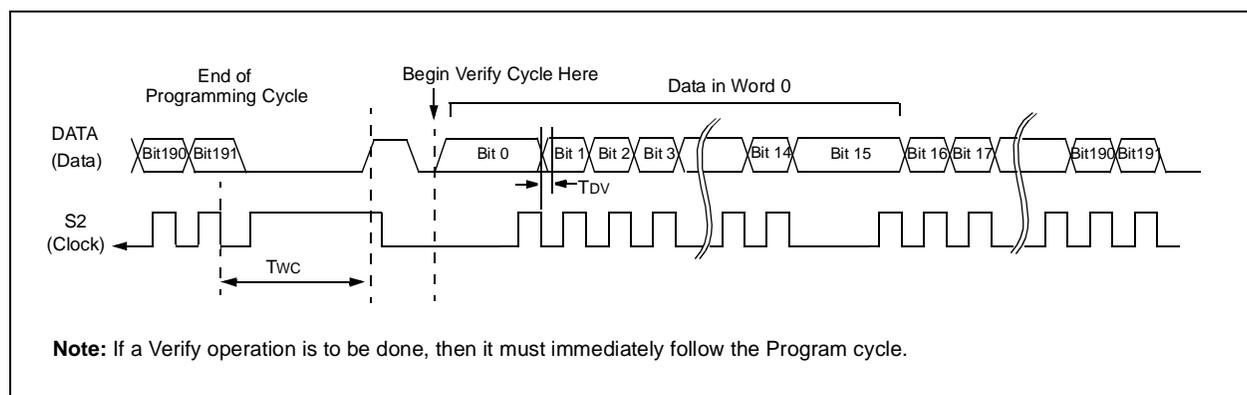


FIGURE 6-2: VERIFY WAVEFORMS



HCS101

TABLE 6-1: PROGRAMMING/VERIFY TIMING REQUIREMENTS

| VDD = 5.0V ± 10% 25° C ± 5°C | | | | |
|---------------------------------|--------|------|------|-------------------|
| Parameter | Symbol | Min. | Max. | Units |
| Program mode setup time | TPS | 2.0 | 5.0 | ms |
| Hold time 1 | TPH1 | 4.0 | — | ms |
| Hold time 2 | TPH2 | 50 | — | µs |
| Bulk Write time | TPBW | 4.0 | — | ms |
| Program delay time | TPROG | 4.0 | — | ms |
| Program cycle time | TWC | 50 | — | ms |
| Clock low time | TCLKL | 50 | — | µs |
| Clock high time | TCLKH | 50 | — | µs |
| Data setup time | TDS | 0 | — | µs |
| Data hold time | TDH | 30 | — | µs |
| Data out valid time | TDV | — | 30 | µs |
| Hold time | TPHOLD | 100 | — | µs ⁽¹⁾ |
| Acknowledge low time | TACKL | 800 | — | µs ⁽¹⁾ |
| Acknowledge high time | TACKH | 800 | — | µs ⁽¹⁾ |

Note 1: Typical values - not tested in production

7.0 ELECTRICAL CHARACTERISTICS FOR HCS101

Absolute Maximum Ratings[†]

| | |
|---------------------------------------|---------------------|
| VDD Supply voltage | -0.3 to 13.5 V |
| VIN Input voltage | -0.3 to VDD + 0.3 V |
| VOUT Output voltage | -0.3 to VDD + 0.3 V |
| IOUT Max output current..... | 50 mA |
| TSTG Storage temperature (Note) | -55 to +125°C |
| TL501 Lead soldering temp (Note)..... | 300°C |
| VESD ESD rating | 2000 V |

[†] **NOTICE:** Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

TABLE 7-1: DC CHARACTERISTICS

| Commercial (C):TAMB = 0°C to +70°C Industrial (I):TAMB = -40°C to +85°C | | | | | | | | | |
|---|-------|-------------------|------------------|---------|--------------------|------------------|---------|------|---|
| | | 3.5V < VDD < 5.0V | | | 5.0V < VDD < 13.3V | | | | |
| Parameter | Sym. | Min. | Typ ¹ | Max. | Min. | Typ ¹ | Max. | Unit | Conditions |
| Operating Current (avg) ⁽²⁾ | ICC | | — | 0.5 | | — | 2 | mA | |
| Standby Current | ICCS | | 0.1 | 1.0 | | 0.1 | 1.0 | µA | |
| Auto-shutoff Current ^(3,4) | ICCS | | 40 | 75 | | 160 | 300 | µA | |
| High Level Input Voltage | VIH | 0.55VDD | | VDD+0.3 | 2.75 | | VDD+0.3 | V | |
| Low Level Input Voltage | VIL | -0.3 | | 0.15VDD | -0.3 | | 0.75 | V | |
| High Level Output Voltage | VOH | 0.6VDD | | | 3.3 | | | V | IOH = -1.0 mA VDD = 3.5V IOH = -2.0 mA VDD = 10V |
| Low Level Output Voltage | VOL | | | 0.08VDD | | | 0.4 | V | IOL = 1.0 mA VDD = 3.5V IOL = 2.0 mA VDD = 10V |
| Pull-down Resistance; S0-S2 | RSO-2 | 40 | 60 | 80 | 40 | 60 | 80 | kΩ | VDD = 4.0V |
| Pull-down Resistance; DATA | RDATA | 80 | 120 | 160 | 80 | 120 | 160 | kΩ | VDD = 4.0V |

Note 1: Typical values are at 25°C.

2: No load.

3: Auto-shutoff current specification does not include the current through the input pulldown resistors.

4: Auto-shutoff current is periodically sampled and not 100% tested.

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FIGURE 7-1: POWER-UP AND TRANSMIT TIMING

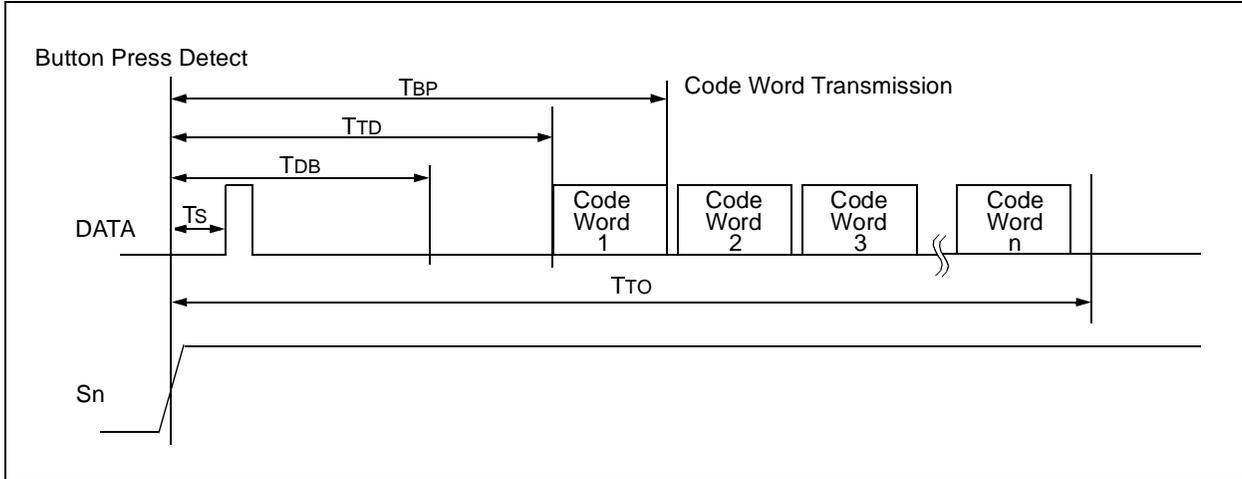


TABLE 7-2: POWER-UP AND TRANSMIT TIMING⁽²⁾

| | | Standard Operating Conditions (unless otherwise specified): Commercial (C): 0°C ≤ TA ≤ +70°C Industrial (I): -40°C ≤ TA ≤ +85°C | | | | |
|---------------|-----------------------------------|--|-------------|---------------------|--------------|-------------------|
| Symbol | Parameters | Min. | Typ. | Max. | Units | Conditions |
| TBP | Time to second button press | 10 + Code Word Time | — | 26 + Code Word Time | ms | (Note 1) |
| TTD | Transmit delay from button detect | 12 | — | 26 | ms | |
| TDB | Debounce delay | 6 | — | 20 | ms | |
| TTO | Auto-shutoff time-out period | — | 27 | — | s | |
| Ts | Start pulse delay | — | 4.5 | — | ms | |

Note 1: TBP is the time in which a second button can be pressed without completion of the first code word and the intention was to press the combination of buttons.

2: Typical values - not tested in production.

FIGURE 7-2: PREAMBLE/HEADER FORMAT

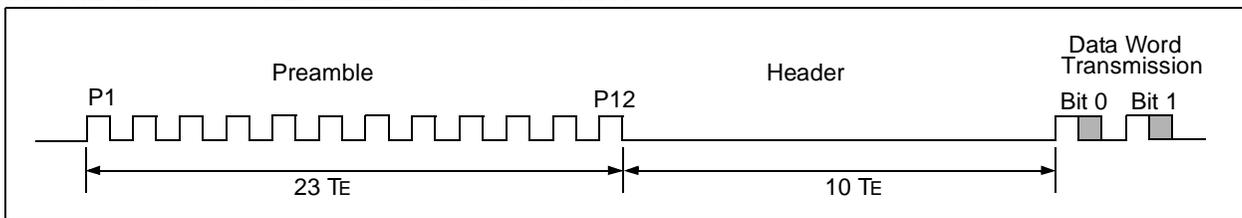


FIGURE 7-3: DATA WORD FORMAT (XSER = 0)

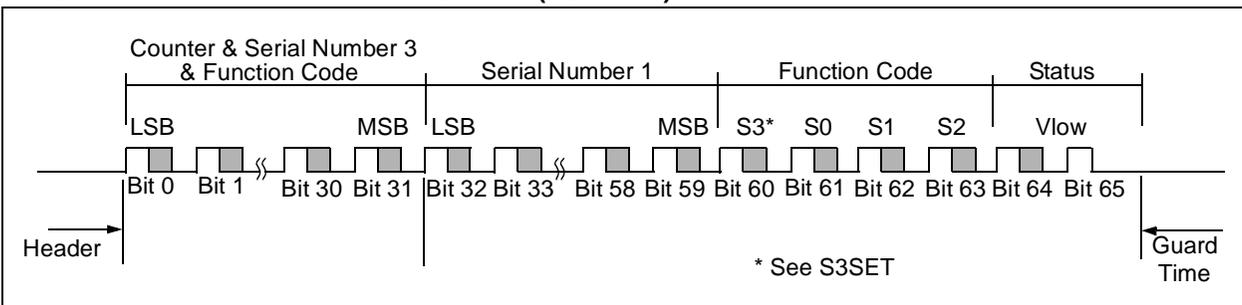


TABLE 7-3: CODE WORD TRANSMISSION TIMING REQUIREMENTS

| VDD = +3.5 to 13.3V Commercial (C):TAMB = 0°C to +70°C Industrial (I):TAMB = -40°C to +85°C | | | Code Words Transmitted | | | | | | Units |
|---|-----------------------|--------------|------------------------|-------|--------|------------|------|-------|-------|
| | | | All | | | 1 out of 2 | | | |
| Symbol | Characteristic | Number of TE | Min. | Typ. | Max. | Min. | Typ. | Max. | Units |
| TE | Basic pulse element | 1 | 360 | 400 | 440 | 180 | 200 | 220 | µs |
| TBP | PWM bit pulse width | 3 | — | 3 | — | — | 3 | — | ms |
| TP | Preamble duration | 24 | 8.64 | 9.6 | 10.56 | 4.32 | 4.8 | 5.28 | ms |
| TH | Header duration | 10 | 3.6 | 4.0 | 4.4 | 1.8 | 2.0 | 2.2 | ms |
| THOP | Hopping code duration | 96 | 34.56 | 38.4 | 42.24 | 17.28 | 19.2 | 21.12 | ms |
| TFIX | Fixed code duration | 102 | 36.72 | 40.8 | 44.88 | 18.36 | 20.4 | 22.44 | ms |
| TG | Guard Time | 39 | 14.04 | 15.6 | 17.16 | 7.02 | 7.8 | 8.58 | ms |
| — | Total Transmit Time | 271 | 97.56 | 108.4 | 119.24 | 48.78 | 54.2 | 59.62 | ms |
| — | PWM data rate | — | 925 | 833 | 757 | 1851 | 1667 | 1515 | bps |

Note: The timing parameters are not tested but derived from the oscillator clock.

HCS101

8.0 PACKAGING INFORMATION

8.1 Package Marking Information

8-Lead PDIP (300 mil)



8-Lead SOIC (150 mil)

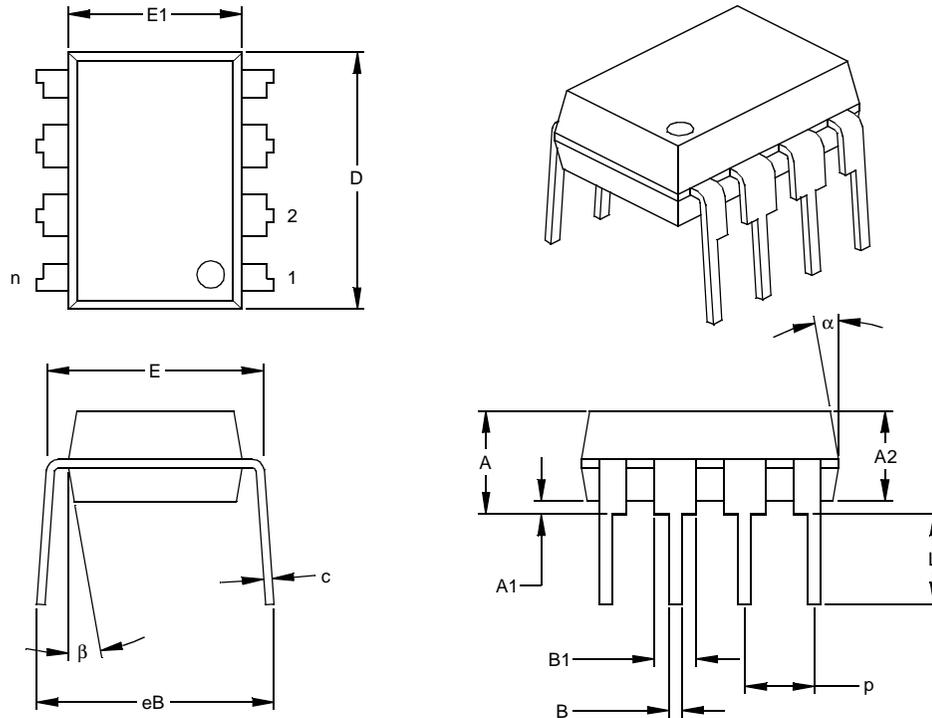


| |
|---|
| <p>Legend: XX...X Customer specific information* Y Year code (last digit of calendar year) YY Year code (last 2 digits of calendar year) WW Week code (week of January 1 is week '01') NNN Alphanumeric traceability code</p> <p>Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line thus limiting the number of available characters for customer specific information.</p> |
|---|

* Standard PICmicro device marking consists of Microchip part number, year code, week code, and traceability code. For PICmicro device marking beyond this, certain price adders apply. Please check with your Microchip Sales Office. For QTP devices, any special marking adders are included in QTP price.

8.2 Package Details

8-Lead Plastic Dual In-line (P) - 300 mil (PDIP)



| Units | | INCHES* | | | MILLIMETERS | | |
|----------------------------|------|---------|------|------|-------------|------|-------|
| Dimension Limits | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | | .100 | | | 2.54 | |
| Top to Seating Plane | A | .140 | .155 | .170 | 3.56 | 3.94 | 4.32 |
| Molded Package Thickness | A2 | .115 | .130 | .145 | 2.92 | 3.30 | 3.68 |
| Base to Seating Plane | A1 | .015 | | | 0.38 | | |
| Shoulder to Shoulder Width | E | .300 | .313 | .325 | 7.62 | 7.94 | 8.26 |
| Molded Package Width | E1 | .240 | .250 | .260 | 6.10 | 6.35 | 6.60 |
| Overall Length | D | .360 | .373 | .385 | 9.14 | 9.46 | 9.78 |
| Tip to Seating Plane | L | .125 | .130 | .135 | 3.18 | 3.30 | 3.43 |
| Lead Thickness | c | .008 | .012 | .015 | 0.20 | 0.29 | 0.38 |
| Upper Lead Width | B1 | .045 | .058 | .070 | 1.14 | 1.46 | 1.78 |
| Lower Lead Width | B | .014 | .018 | .022 | 0.36 | 0.46 | 0.56 |
| Overall Row Spacing | § eB | .310 | .370 | .430 | 7.87 | 9.40 | 10.92 |
| Mold Draft Angle Top | α | 5 | 10 | 15 | 5 | 10 | 15 |
| Mold Draft Angle Bottom | β | 5 | 10 | 15 | 5 | 10 | 15 |

* Controlling Parameter

§ Significant Characteristic

Notes:

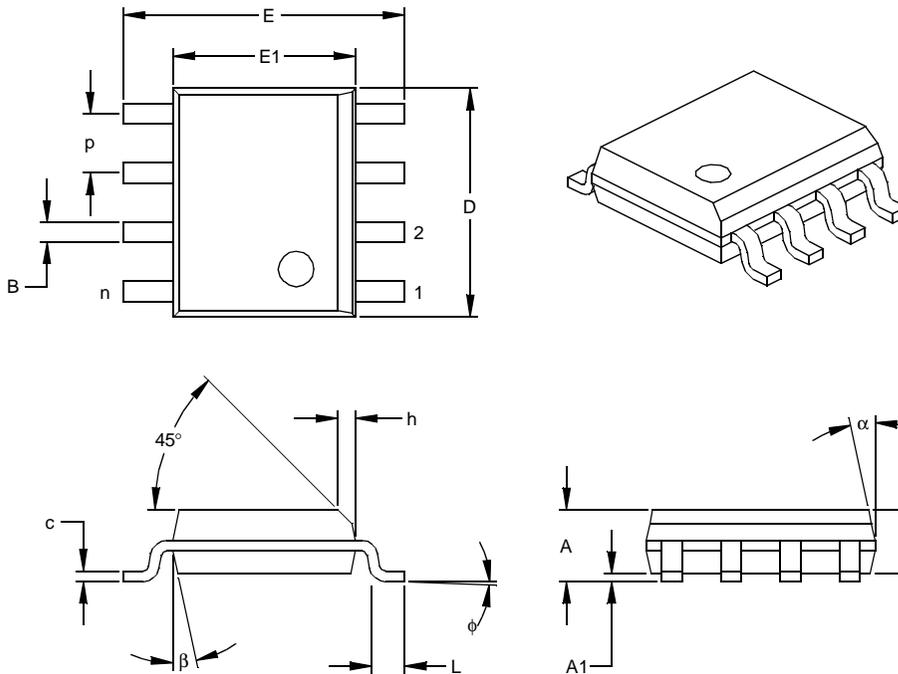
Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-001

Drawing No. C04-018

HCS101

8-Lead Plastic Small Outline (SN) - Narrow, 150 mil (SOIC)



| Dimension Limits | Units | INCHES* | | | MILLIMETERS | | |
|--------------------------|-------|---------|------|------|-------------|------|------|
| | | MIN | NOM | MAX | MIN | NOM | MAX |
| Number of Pins | n | | 8 | | | 8 | |
| Pitch | p | | .050 | | | 1.27 | |
| Overall Height | A | .053 | .061 | .069 | 1.35 | 1.55 | 1.75 |
| Molded Package Thickness | A2 | .052 | .056 | .061 | 1.32 | 1.42 | 1.55 |
| Standoff § | A1 | .004 | .007 | .010 | 0.10 | 0.18 | 0.25 |
| Overall Width | E | .228 | .237 | .244 | 5.79 | 6.02 | 6.20 |
| Molded Package Width | E1 | .146 | .154 | .157 | 3.71 | 3.91 | 3.99 |
| Overall Length | D | .189 | .193 | .197 | 4.80 | 4.90 | 5.00 |
| Chamfer Distance | h | .010 | .015 | .020 | 0.25 | 0.38 | 0.51 |
| Foot Length | L | .019 | .025 | .030 | 0.48 | 0.62 | 0.76 |
| Foot Angle | φ | 0 | 4 | 8 | 0 | 4 | 8 |
| Lead Thickness | c | .008 | .009 | .010 | 0.20 | 0.23 | 0.25 |
| Lead Width | B | .013 | .017 | .020 | 0.33 | 0.42 | 0.51 |
| Mold Draft Angle Top | α | 0 | 12 | 15 | 0 | 12 | 15 |
| Mold Draft Angle Bottom | β | 0 | 12 | 15 | 0 | 12 | 15 |

* Controlling Parameter

§ Significant Characteristic

Notes:

Dimensions D and E1 do not include mold flash or protrusions. Mold flash or protrusions shall not exceed .010" (0.254mm) per side.

JEDEC Equivalent: MS-012

Drawing No. C04-057

ON-LINE SUPPORT

Microchip provides on-line support on the Microchip World Wide Web (WWW) site.

The web site is used by Microchip as a means to make files and information easily available to customers. To view the site, the user must have access to the Internet and a web browser, such as Netscape or Microsoft Explorer. Files are also available for FTP download from our FTP site.

Connecting to the Microchip Internet Web Site

The Microchip web site is available by using your favorite Internet browser to attach to:

www.microchip.com

The file transfer site is available by using an FTP service to connect to:

<ftp://ftp.microchip.com>

The web site and file transfer site provide a variety of services. Users may download files for the latest Development Tools, Data Sheets, Application Notes, User's Guides, Articles and Sample Programs. A variety of Microchip specific business information is also available, including listings of Microchip sales offices, distributors and factory representatives. Other data available for consideration is:

- Latest Microchip Press Releases
- Technical Support Section with Frequently Asked Questions
- Design Tips
- Device Errata
- Job Postings
- Microchip Consultant Program Member Listing
- Links to other useful web sites related to Microchip Products
- Conferences for products, Development Systems, technical information and more
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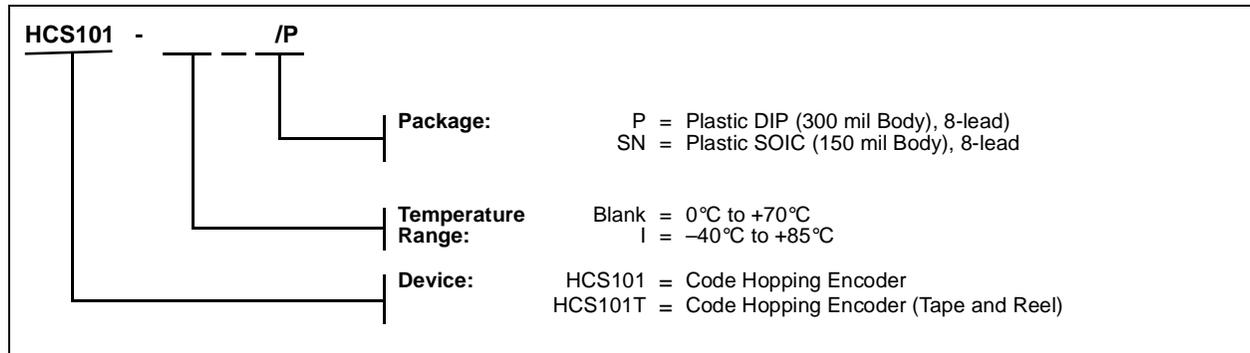
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