# TTS256 Text to Speech Processor Datasheet

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## Features

- Narrow 28pin DIP
- Companion chip to Magnevation SpeakJet and Savage Innovations SpeakGin
- Built in 600 Rule database
- 9600 N81 Baud Serial interface (non-inverted TTL level)
- Generates speech codes from ASCII text
- Compatible with Basic Stamp, OOPic, Pic

## Overview

The TTS256 is an 8-bit microprocessor programmed with 600 letter-to-sound rules for the automatic, real-time translation of English text to allophone addresses. Combined with the Magnevation SpeakJet or the Savage Innovations SpeakGin, the TTS256 makes a complete text-to-speech solution.

The TTS256 will read English words, numbers, currency, time, mathematical expressions and some punctuation characters.  As the rule set is constrained by the amount of memory in the device, the TTS256 will be able translate and pronounce correctly roughly 90% of text sent to it.  The translation quality is adequate for many embedded applications but is guaranteed to mispronounce some common words from time to time.

| Pin # | Name | Notes | Pin # | Name | Notes |
|---|---|---|---|---|---|
| 1 | _ | RESET (active high) | 15 | _ | Unused |
| 2 | _ | Unused | 16 | _ | Unused |
| 3 | _ | Unused | 17 | _ | Unused |
| 4 | _ | Unused | 18 | RX | Receives serial data from host processor to TTS256 |
| 5 | TX | Transmits data from TTS256 to host processor. On power up, the TTS256 sends a ready message along with firmware version to the host processor.  Debug data is sent when the TTS256 is in debug mode. | 19 | _ | Unused |

| 6 | _ | Unused | 20 | SJ_READY | This pin is used to monitor the status of the speech processor. Connection to Pin 15 (D2/BUFFER HALF FULL) of SpeakJet. |
|---|---|---|---|---|---|
| 7 | _ | Unused | 21 | _ | Unused |
| 8 | _ | Unused | 22 | _ | Unused |
| 9 | _ | Unused | 23 | _ | Unused |
| 10 | _ | Unused | 24 | SJ_TX | Transmits phoneme codes from the TTS256 to the SpeakJet. Connect to Pin 10 (RCX) of the SpeakJet. |
| 11 | _ | Unused | 25 | _ | Unused |
| 12 | _ | Unused | 26 | _ | Unused |
| 13 | _ | Unused | 27 | _ | Unused |
| 14 | Vss | Ground Connection | 28 | Vdd | Supply Voltage (+5V) |

# Operation

Communications parameters of the serial port are set to 9600 Baud N81. The host processors send up to 128 character the TTS256's serial port on pin 18 (RX). Text is spoken when the TTS256 receives a new line character (0x0A) or the maximum number of 128 characters has been received.

The TTS256 then converts the English text to SpeakJet allophone codes, which are then sent to the SpeakJet via the serial port.  The TTS256 then monitors the SpeakJet PIN 15 (BUFFER_HALF_FULL) line and waits to send more data.

Once the SpeakJet starts speaking, it lowers the SpeakJet ready line (pin 16 of the SpeakJet). After the SpeakJet has completed speaking and is ready to accept more data, the SpeakJet ready line is raised.   The host processor should monitor the SpeakJet ready line to determine when to send more text.   The host processor should wait at least 12mS after sending text before checking the status of the SpeakJet Speaking flag.

## Control Codes

Single SpeakJet control codes can be embedded in text data to alter volume, pitch and play built-in SpeakJet sounds effects.

| | |
|---|---|
| 0 = 0ms<br>1 = 100ms<br>2 = 200ms<br>3 = 700ms<br>4 = 30ms<br>5 = 60ms<br>6 = 90ms | Pauses of various durations, these will cause the volume to ramp down, wait a specified amount of time and the ramp back up. 1, 2 & 3, ramp the volume while the format frequencies are being changed. 4, 5 & 6 wait for silence before changing the format frequencies. |
| 7 = Fast | Plays the next phoneme at 1/2 the time it normally would play. |
| 8 = Slow | Plays the next phoneme at 1 and 1/2 the time it normally would play. |
| 14 = Stress | Plays the next phoneme with a small amount of stress in the voice. |
| 15 = Relax | Plays the next phoneme with a small amount of relaxation in the voice. |
| 128-254 | Phonemes and preprogrammed sound effects.  See SpeakJet datasheet. |

For example, the pistol shot sound is 253. Create a string with text and include the value 253 somewhere in it. The text will be read back and the gunshot sound will play. In a string constant in C, the value can be either octal or hexadecimal and is preceded by an escape character.

| | |
|---|---|
| Octal Value Encoded in String | "This is a gunshot\375" |
| Decimal Value Encoded in String | "This is a gunshot \xFD" |

The two byte commands (volume, pitch, etc.) will only pass through correctly if the second byte is a non-text character. Otherwise the TTS256 will process the second byte as text and incorrect data will be sent to the SpeakJet.  Two byte commands can be sent without this restriction by placing the TTS256 in pass through mode.

## Pass Through Mode

In cases where the host processor needs to communicate directly with the SpeakJet, the TTS256 offers a pass though mode that will send any received codes from the host directly to the SpeakJet without translation of any kind.

This is accomplished by sending the text "passthruon" and an end-of-line character. All characters sent to the TTS256 will be sent directly to the SpeakJet without translation.  An "X" ($58) will terminate the pass through mode. Note that this character cannot be used as the second byte of a two-byte command as it will terminate the pass through mode. An "X" is also used to terminate the SCP mode for communication directly with the SpeakJet internal registers. An alternate \A may be used to terminate SCP mode and not pass through.

## Debug Mode

The TTS256 has debugging mode that echo phoneme data and ruleset traversal information as English text is translated.    To enter debug mode, send "debugon" followed by a new line.  To exit debug mode, send "debugoff" followed by a new line.