

SANYO

No. 5005

STK311-020**RDS Demodulator with Synchronization
and Error Correction****Overview**

The STK311-020 is an RDS demodulator hybrid IC for the Radio Data System (RDS), or multiplexed FM broadcasting of various kinds of data, specified by the European Broadcasting Union (EBU). It demodulates the multiplexed data modulating signal to recover the RDS signal and performs synchronization, error detection and error correction. Further, low-profile packaging is realized using Sanyo's insulated metal substrate technology (IMST) for the base, SC system and photoresist technologies and folded board construction.

Applications

- Car stereos
- Home stereos

Features

- 57kHz BPF built-in for adjustment-free operation
- 4MHz ceramic oscillator element built-in
- Few external components required for a complete RDS data demodulation system
- ARI-SK/DK decoder built-in

Specifications**Maximum Ratings** at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Ratings | Unit |
|------------------------|---------------------|-------------|------------------|
| Maximum supply voltage | $V_{CC\text{ max}}$ | 6.3 | V |
| Operating temperature | T_{opr} | -30 to +85 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | -40 to +100 | $^\circ\text{C}$ |

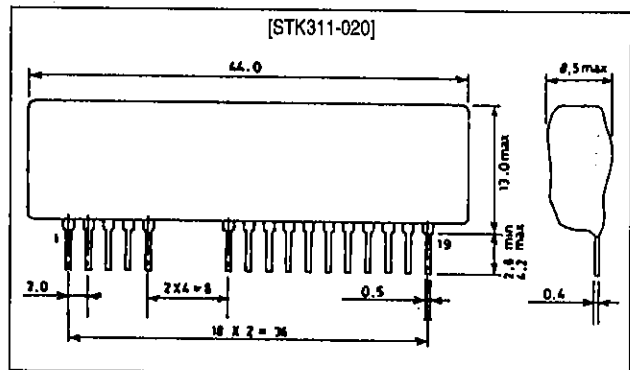
Recommended Operating Voltages at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Ratings | Unit |
|--------------------------------|------------|------------|------|
| Supply voltage | V_{CC} | 5 | V |
| Operating supply voltage range | V_{CCOP} | 4.7 to 5.5 | V |

Package Dimensions

unit: mm

4132A



Operating Characteristics at $T_a = 25^\circ\text{C}$, $V_{CC} = 5\text{V}$

| Parameter | Symbol | Conditions | min | typ | max | Unit |
|---------------------------------------|------------|---|----------------|--------------|-----|-------|
| Quiescent current | I_{CCO} | | - | 26 | 38 | mA |
| Band-pass filter gain | V_{GBPF} | $f = 57\text{kHz}$ | 9 | 12.5 | 17 | dB |
| Band-pass filter selectivity | | $f = 60\text{kHz}$ ($57\text{kHz} = 0\text{dB}$) | -6 | -2.5 | 0 | dB |
| | | $f = 54\text{kHz}$ ($57\text{kHz} = 0\text{dB}$) | -6 | -3.5 | 0 | dB |
| | | $f = 38\text{kHz}$ ($57\text{kHz} = 0\text{dB}$) | - | -39 | -33 | dB |
| PLL capture range | CR | 5mVrms, CW input | - | -0.5 +1.1 | - | % |
| RDS detector sensitivity | | Pin 12 low, input on pin 4 | - | 0.4 | 1.0 | mVrms |
| SK detector sensitivity | | Pin 11 low, input on pin 4 | - | 1.0 | 2.0 | mVrms |
| DK detector sensitivity | | Pin 10 low, input on pin 4 | - | 1.9 | 2.9 | mVrms |
| RDS input dynamic range | | Pin 12 low, (ARI + RDS) signal maximum input on pin 4 | 30 | 50 | - | mVrms |
| DK input dynamic range | | Pin 10 low, ARI signal maximum input on pin 4 | 75 | 100 | - | mVrms |
| VCO free-running frequency | f_{OSC} | | 453 | 456 | 459 | kHz |
| High level output voltage | V_{OH} | $I_{OH} = -50\mu\text{A}^1$ | $V_{CC} - 1.2$ | - | - | V |
| | | $I_{OH} = -10\mu\text{A}^1$ | $V_{CC} - 0.5$ | - | - | V |
| Low level output voltage | V_{OL} | $I_{OL} = 10\text{mA}^2$ | - | - | 1.5 | V |
| | | $I_{OL} = 1.8\text{mA}^2$ | - | - | 0.4 | V |
| Ceramic oscillator stabilization time | t_{CFS} | See Figure 1. | - | - | 10 | ms |
| Reset time | t_{RST} | | See Figure 2. | | | |

*1. DATA START, DATA OUT, CLOCK OUT

*2. RECEIVE, CORRECTION, ERROR, DATA START, DATA OUT, CLOCK OUT

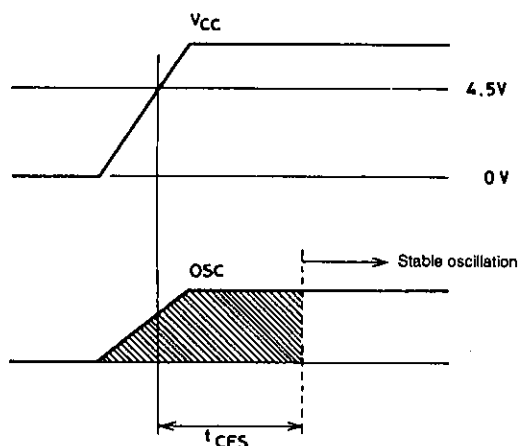
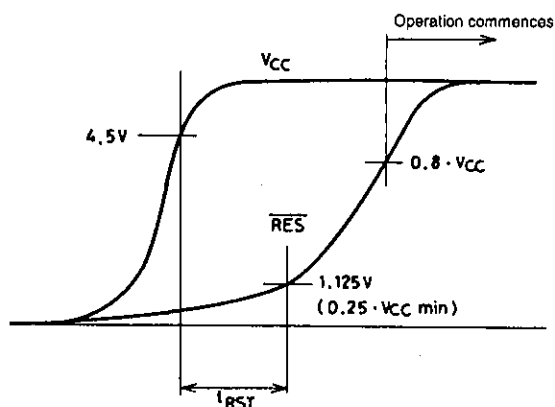


Figure 1. Oscillator stabilization time



Allow $\geq 10\text{ms}$ for the oscillator stabilization time.

Figure 2. Reset time

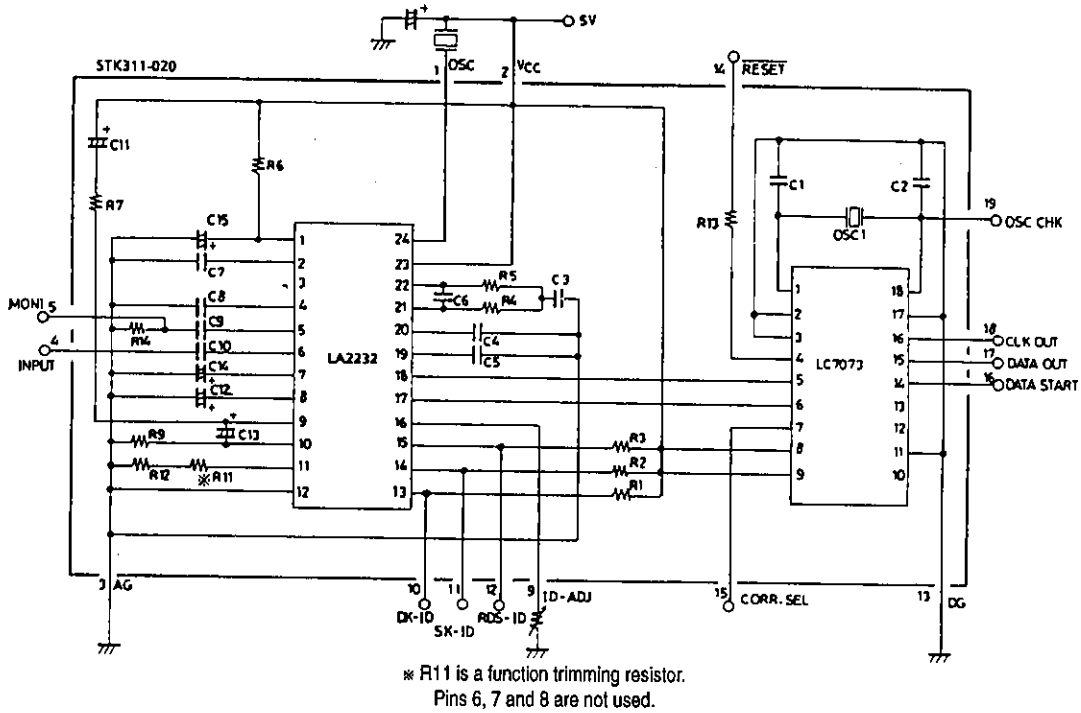
Output Signal Settings

CLK OUT and DATA START output signals can be set as shown in the following table.

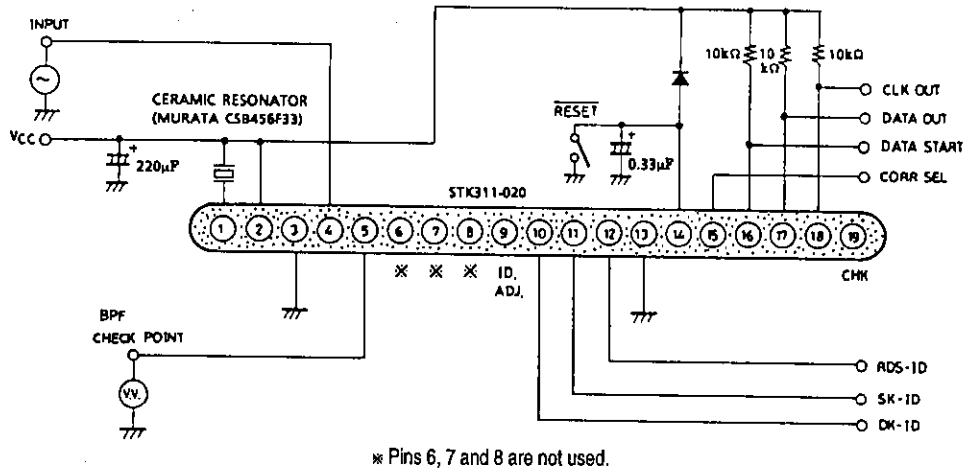
| Setting ^{*1} | CLK OUT polarity | DATA START output |
|-----------------------|------------------|-------------------|
| 1 | Falling edge | Each block |
| 2 | Falling edge | Second block only |
| 3 | Rising edge | Each block |
| 4 | Rising edge | Second block only |

*1. Setting 1 is the default setting.

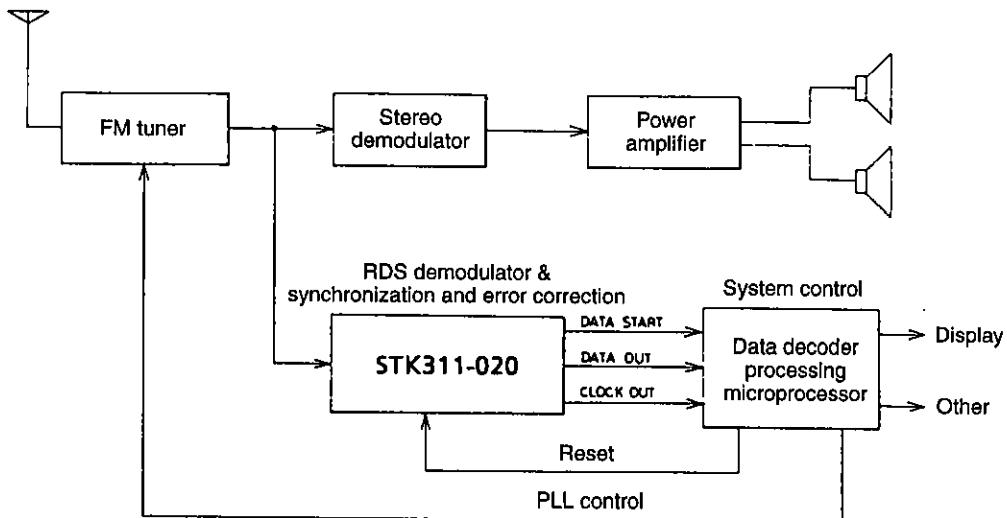
Equivalent Circuit



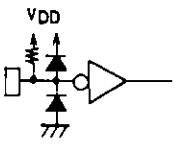
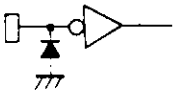
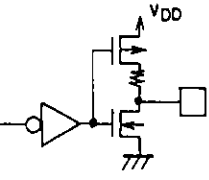
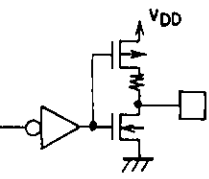
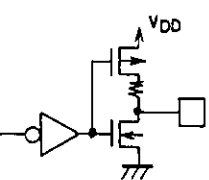
Sample Application Circuit



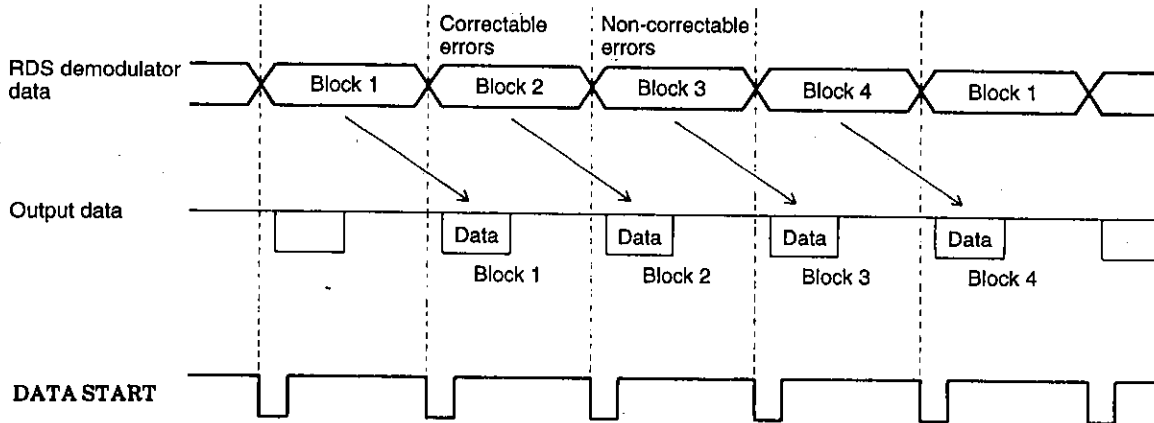
Sample System Configuration



Pin Functions

| Pin No. | Pin name | Function | |
|---------|-----------------|---|--|
| 1 | OSC | VCO ceramic oscillator pin (456kHz) | |
| 2 | V _{CC} | Supply pin: LA2232 and LC7073 positive supply | |
| 3 | AG | Ground pin: LA2232 analog ground | |
| 4 | INPUT | Input pin | |
| 5 | MONI | BPF (for adjustment) monitor output | |
| 9 | ID-ADJ | SK detector sensitivity adjustment pin | |
| 10 | DK-ID | DK signal detector indicator output. Low-level output when an DK signal is detected, and high-level when not detected. | |
| 11 | SK-ID | SK signal detector indicator output. Low-level output when an SK signal is detected, and high-level when not detected. | |
| 12 | RDS-ID | RDS signal detector indicator output. Low-level output when an RDS signal is detected, and high-level when not detected. | |
| 13 | DG | Ground pin: LC7073 digital ground | |
| 14 | RESET |  | Reset input. Reset restart occurs when held low for ≥ 4 cycles. Schmitt-trigger input. Pull-up resistor built-in. |
| 15 | CORR. SEL |  | Error correction selection input. This pin selects whether the IC corrects errors in the RDS demodulated data. Input = 0: No correction performed. Input = 1: Error correction performed. In modes where error correction is enabled, up to five error bits are corrected for distances of 5 bits or less. |
| 16 | DATA START |  | Serial data output block data start signal (D.S. CONTROL) input to control the output waveform. Pull-up MOS transistor (CMOS) output. |
| 17 | DATA OUT |  | Serial data output. Pull-up MOS transistor (CMOS) output. |
| 18 | CLK OUT |  | Clock output. Pull-up MOS transistor (CMOS) output. |
| 19 | OSC CHK | OSC1 oscillation frequency check pin | |

RDS Demodulator Data (LA2232 Output) and LC7073 Output Data Relationship



The LC7073 serial data output is delayed by 1 block from the data received from the LA2232.

Figure 3. Demodulator data and output data relationship

Serial Data Output Format and Timing

| Bit | Function | | | |
|-----------|---|--|---|---|
| S | Start bit (normally "0") | | | |
| E | Error flag | Parameter | E | F |
| | | No errors | 0 | 0 |
| F | Correction flag | Errors corrected | 0 | 1 |
| | | Non-correctable errors | 1 | 1 |
| OE | Offset E (normally "0", for future expansion) | | | |
| OF | Offset F (normally "0", for future expansion) | | | |
| A/B | Group type version | 0: Version A 1: Version B | | |
| B1, B0 | Block number | 00: Block 1 01: Block 2 10: Block 3 11: Block 4 | | |
| D15 to D0 | RDS data | | | |

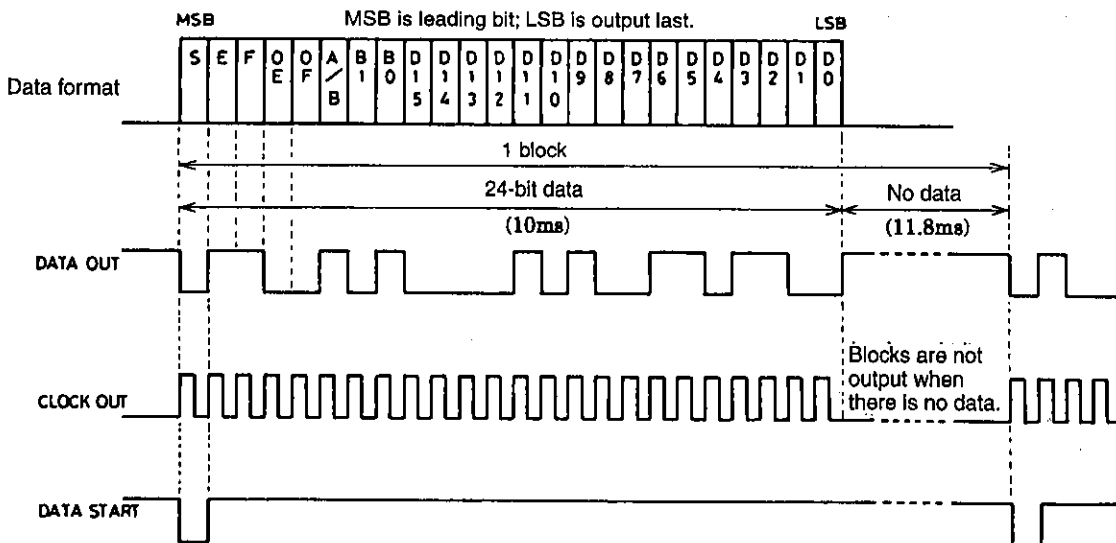


Figure 4. Serial data output format and timing

Control Input CORR. SEL Read Timing

Normally, this pin is checked for its state. However, error correction can be enabled/disabled at any time.

During Sync Detection

CORR. SEL is read for every bit of demodulator data from the RDS demodulator IC (indicated by ↓), and is read into the LSI when 4 consecutive, matching states occur.

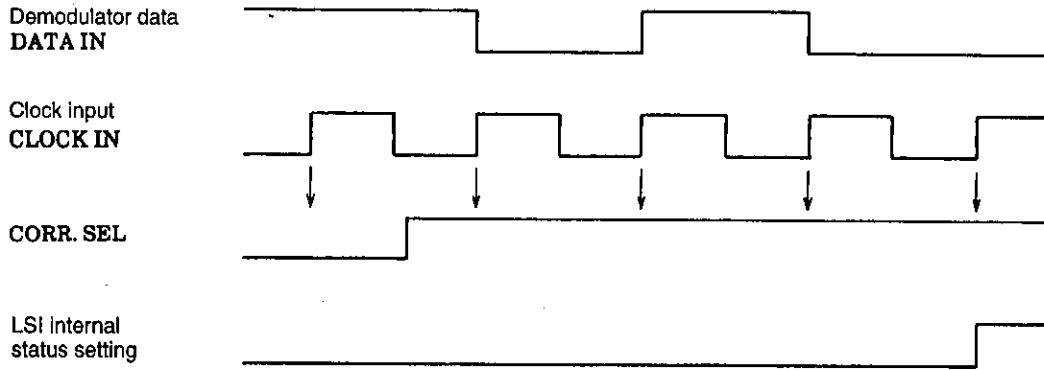


Figure 5. CORR.SEL read timing during sync detection

After Sync Detection

CORR. SEL is read for the head of each block of demodulator data from the RDS demodulator IC (indicated by ↓), and is read into the LSI when 4 consecutive, matching states occur.

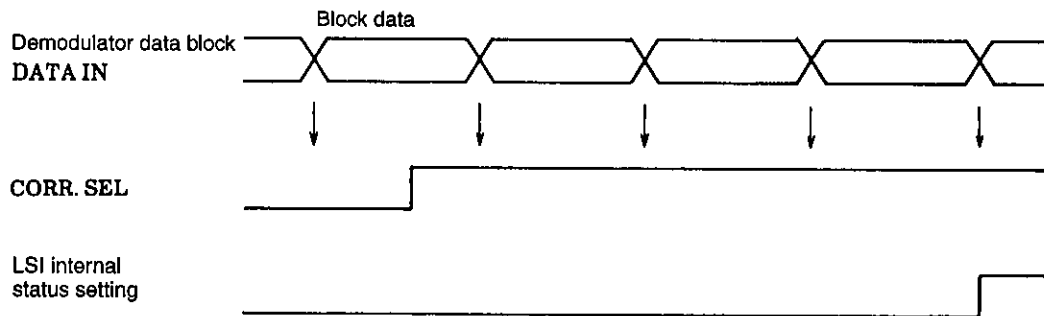
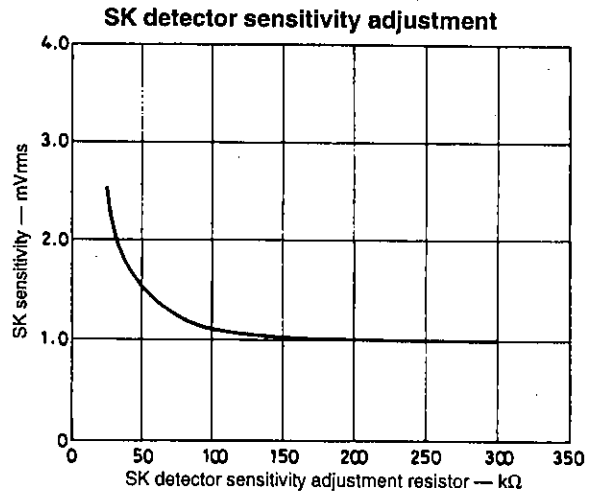
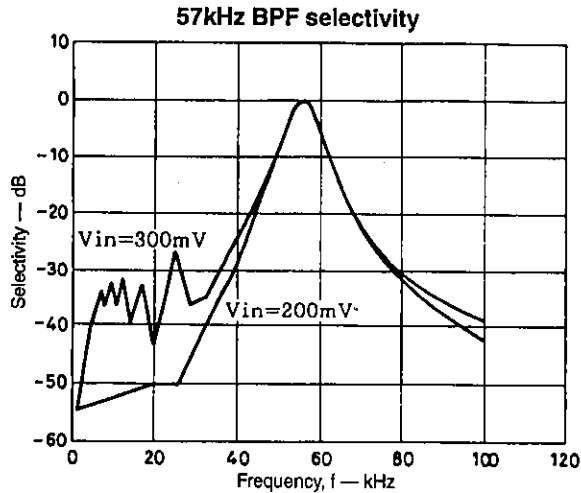


Figure 6. CORR.SEL read timing after sync detection

Characteristics Data



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