

**MSM7582/7582B** **$\pi/4$  Shift QPSK MODEM****GENERAL DESCRIPTION**

The MSM7582/7582B are CMOS ICs for the  $\pi/4$  shift QPSK modem developed for the digital cordless telephone systems.

The devices are designed for Personal and Cell station applications, the MSM7582B is the improved MSM7582 in modulator burst rise-up and fall-down characteristics.

**FEATURES**

- Single Power Supply ( $V_{DD}$ : 2.7 V to 3.6 V)

(Modulator Block)

- Built-in Root Nyquist Filter for Baseband Limiting (50% Roll-off)
- Ramp Bit for Burst Signal Rise-up:
  - MSM7582/1.75 symbols
  - MSM7582B/2.0 symbols
- Ramp Bit for Burst Signal Fall-down:
  - MSM7582/2.75 symbols
  - MSM7582B/2.0 symbols
- Built-in D/A converters for Analog Output of Quadrature Signal I/Q Components and Power Envelope Output  $\sqrt{I^2 + Q^2}$
- Differential I/Q Analog output format
- I/Q Output DC Offset / Gain Adjustable

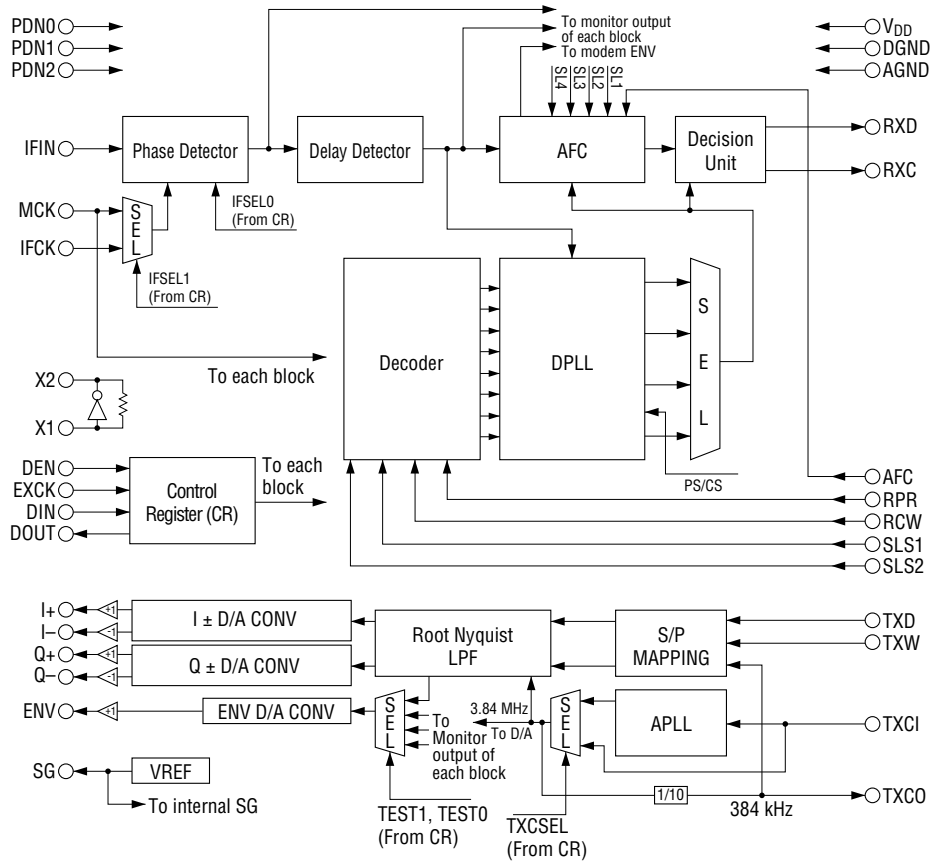
(Demodulator Block)

- Full Digital System,  $\pi/4$  shift QPSK Demodulation
- Input IF signal Frequency Selectable: 1.2/10.7/10.75/10.8 MHz
- Built-in Clock Recovery: 4 Circuits useful for Cell station

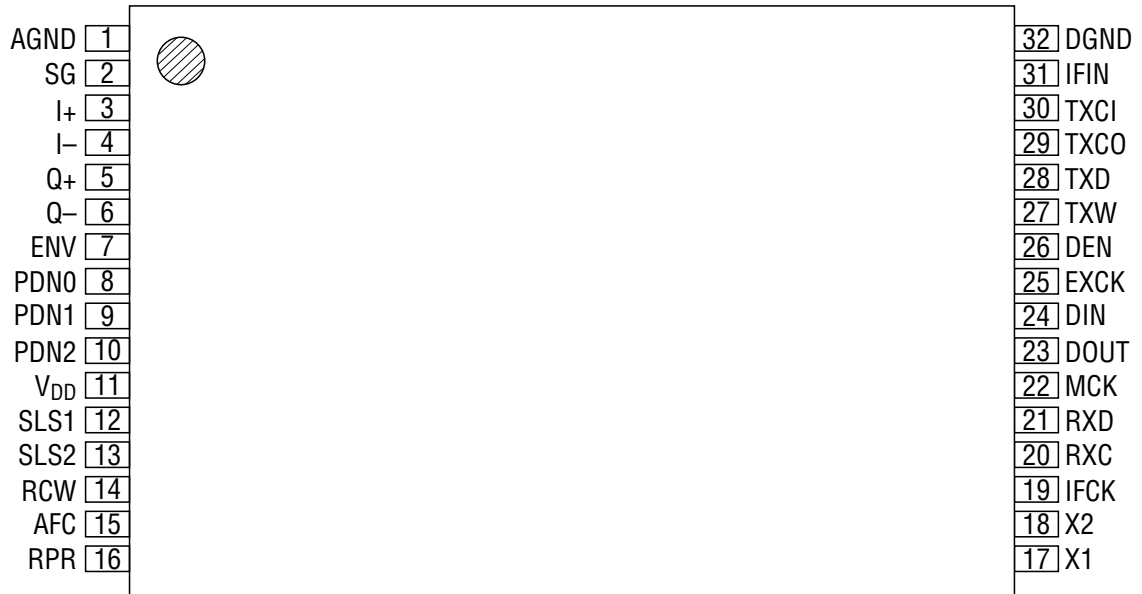
(Common)

- Various Power-down Modes: Transmit/Receive Independent
- Built-in Precise Analog Voltage Reference
- MCU Serial Interface for Mode setting and Built-in Test circuit
- Test Modes: Eye pattern / AFC Compensating Signal / Phase Detection Signal, possible to monitor
- Transmission Speed: 384 kbps
- Low Power consumption
  - Operating mode : 15 mA Typ. / Modulator ( $V_{DD} = 3.0$  V)
  - : 9 mA Typ. / Demodulator ( $V_{DD} = 3.0$  V)
  - Whole system Power-down mode: 0.01 mA Typ. ( $V_{DD} = 3.0$  V)
- Package:
  - 32-pin plastic TSOP (TSOPI32-P-814-0.50-1K)(Product name : MSM7582TS-K)
  - (Product name : MSM7582BTS-K)

**BLOCK DIAGRAM**



**PIN CONFIGURATION (TOP VIEW)**



**32-Pin Plastic TSOP**

## PIN AND FUNCTIONAL DESCRIPTIONS

### TXD

Transmit data input for 384 kbps.

### TXCI

Transmit clock input.

When the control register CR0 – B6 is “0”, a 384 kHz clock pulse synchronous with TXD should be input to this pin. This clock pulse should be continuous because these devices use APLL to generate the internal clock pulse.

When CR0 – B6 is “1”, a 3.84 MHz clock pulse should be input to this pin. When the 3.84 MHz clock pulse is applied, TXCO outputs a 384 kHz clock pulse, which is generated by dividing the 3.84 MHz to TXCI by 10. The transmit data, synchronous 384 kHz clock pulse, should be input to the TXD. In this case the devices do not use APLL, and the 3.84 MHz clock pulse need not be continuous. (Refer to Fig. 1.)

### TXCO

Transmit clock output.

When CR0 - B6 is “0”, TXCO outputs the 384 kHz clock pulse (APLL output) for monitoring purposes. When CR0 – B6 is “1”, this pin outputs a 384 kHz clock pulse generated by dividing the TXCI input by 10. (Refer to Fig. 1.)

When CR0 – B6 = “0” and CR5 – B7 = “1”, this pin outputs the burst timing position.

### TXW

Transmit data window input.

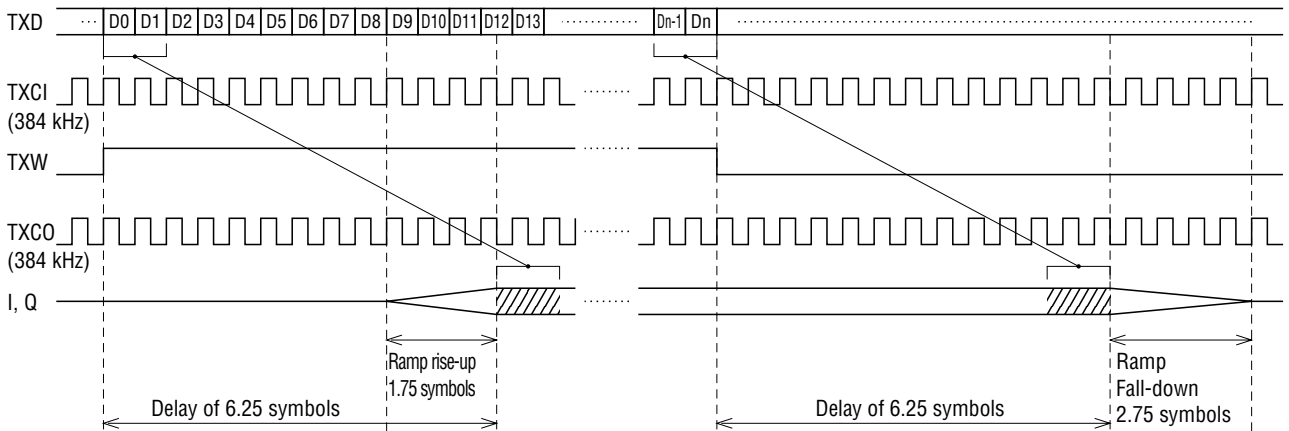
The transmit timing signal for the burst data is input to the device pin. If TXW is “1”, the modulation data is output. However, the MSM7582 is different from the MSM7582B in the ramp response time for burst rise-up and burst fall-down of I, Q modulated outputs, as shown in the table below. (Refer to Fig, 1-1 for the MSM7582 and Fig, 1-2 for the MSM7582B)

|                | <b>MSM7582</b> | <b>MSM7582B</b> |
|----------------|----------------|-----------------|
| Ramp Rise-up   | 1.75 symbols   | 2 symbols       |
| Ramp Fall-down | 2.75 symbols   | 2 symbols       |

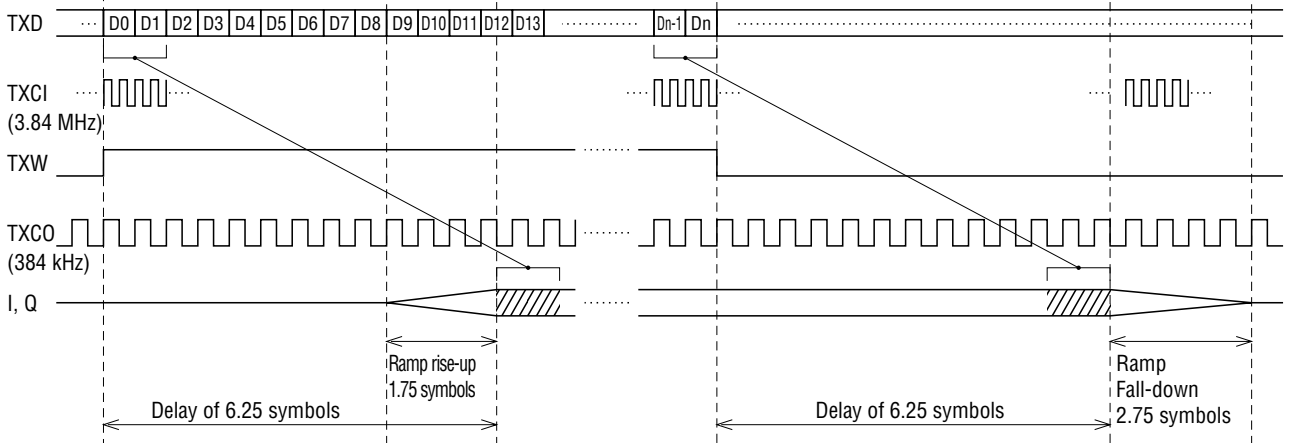
The TXCO burst position output timing discribed before, is different, according to this table.

**MSM7582**

(1) CR0 – B6 = "0"



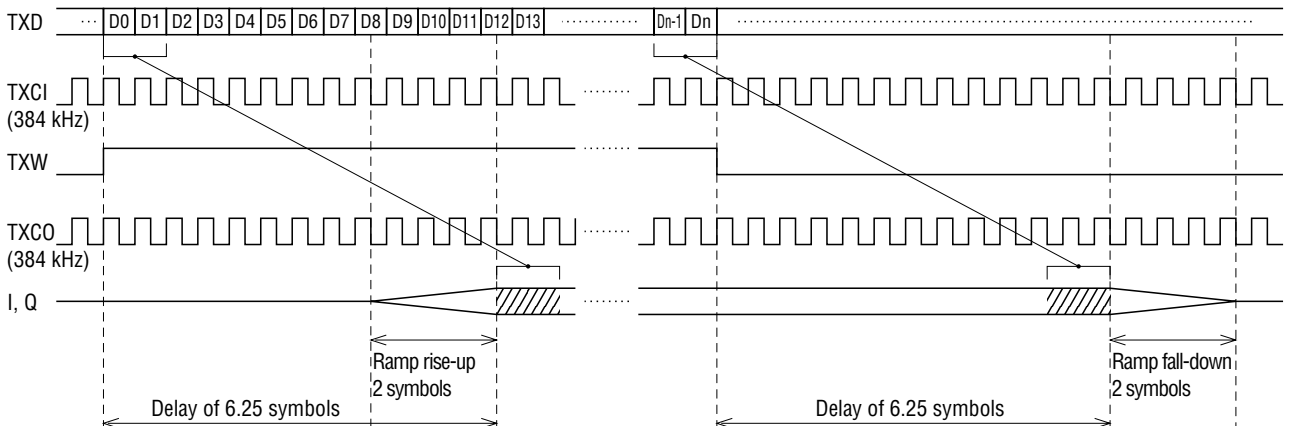
(2) CR0 – B6 = "1"



**Figure 1-1 Transmit Timing Diagram**

MSM7582B

(1) CR0 – B6 = "0"



(2) CR0 – B6 = "1"

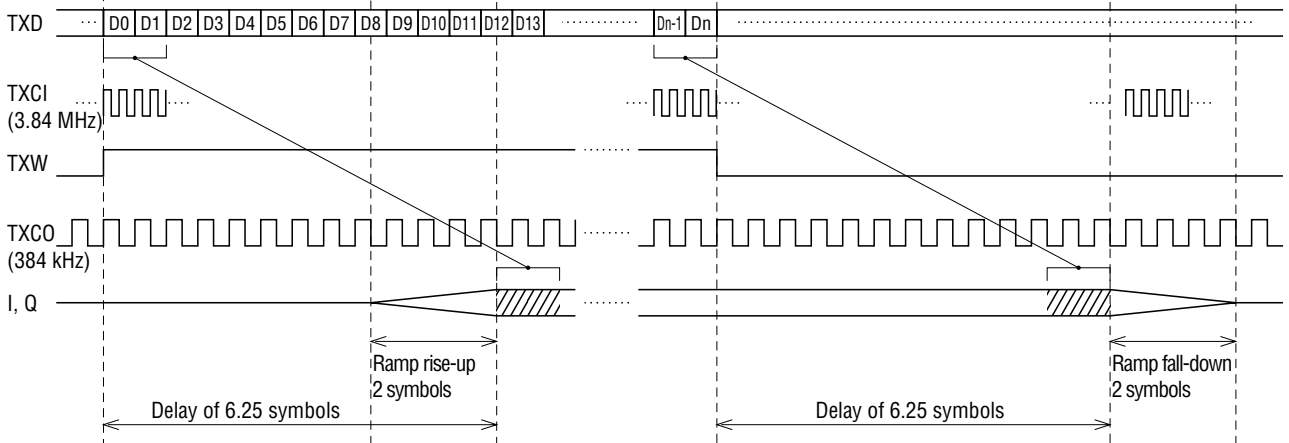


Figure 1-2 Transmit Timing Diagram

I+, I-

Quadrature modulation signal I component differential analog outputs.

Their output levels are 500 mV<sub>pp</sub> with 1.6 Vdc as the center value. The output pin load conditions are: R ≥ 10 kΩ, C ≤ 20 pF. The gain of these pins can be adjusted using the control register CR1 – B7 to B4, and the offset voltage at the I- pin can be adjusted using CR3 – B7 to B3.

Q+, Q-

Quadrature modulation signal Q component differential analog outputs.

Their output levels are 500 mV<sub>pp</sub> with 1.6 Vdc as the center value. The output pin load conditions are: R ≥ 10 kΩ, C ≤ 20 pF. The gain of these pins can be adjusted using the control register CR1 – B3 to B0, and the offset voltage at the Q- pin can be adjusted by using CR4 – B7 to B3.

**ENV**

Quadrature modulation signal envelope ( $\sqrt{I^2 + Q^2}$ ) output.

Its output level is 500 mV<sub>PP</sub> with 1.6 Vdc as a center value. The output pin load conditions are : R ≥ 10 kΩ, C ≤ 20 pF. The gain of this output can be adjusted using the control register CR2 – B7 to B4.

This pin is also used to monitor eye pattern, AFC Compensating signal, and phase defection of the demodulator block during the test mode. Refer to the description of the control register for details.

**SG**

Internal reference voltage output.

The output voltage is about 2.0 V. A bypass capacitor should be connected between this pin and the AGND pin.

**PDN0, PDN1, PDN2**

Inputs for power-down control.

PDN0 controls the standby / communication modes, PDN1 controls the modulator, and PDN2 controls the demodulator. Refer to Table 1 for details.

**Table-1 Power Down Control**

|                    | PDN0 | PDN2 | PDN1 | Function                                                                                                                                             | Mode   |
|--------------------|------|------|------|------------------------------------------------------------------------------------------------------------------------------------------------------|--------|
| Standby Mode       | 0    | 0/1  | 1    | All power-down. The control register is reset.                                                                                                       | Mode A |
|                    | 0    | 0    | 0    | All power-down. The control register is not reset.                                                                                                   | Mode B |
|                    | 0    | 1    | 0    | Modulator power is off (VREF and PLL power are also off). Demodulator power is on.                                                                   | Mode C |
| Communication Mode | 1    | 0    | 0    | Modulator power is off (VREF and PLL power is on). I and Q outputs are in a high-impedance state. Only demodulator clock recovery block power is on. | Mode D |
|                    | 1    | 0    | 1    | Modulator power is on. Only demodulator clock recovery block power is on.                                                                            | Mode E |
|                    | 1    | 1    | 0    | Modulator power is off (VREF and PLL power is on). I and Q outputs are in a high-impedance state. Demodulator power is on.                           | Mode F |
|                    | 1    | 1    | 1    | Modulator power is on. Demodulator power is on.                                                                                                      | Mode G |

**V<sub>DD</sub>**

+3 V power supply voltage.

**AGND**

Analog signal ground.

**DGND**

Digital signal ground.

AGND and DGND are not connected in the device. This pin should be tied to the AGND pin on the PCB as close as possible from the device.

**MCK**

Master clock input.  
The clock frequency is 19.2 MHz.

**IFIN**

Modulated signal input for the demodulator block.  
Select the IF frequency from 1.2 MHz, 10.7 MHz, 10.75 MHz, and 10.8 MHz, based on CR0 – B4 and B3.

**IFCK**

Clock signal input for demodulator block IF frequencies (10.7 MHz or 10.75 MHz).  
If the IF frequency is 10.7 MHz, 19.0222 MHz should be supplied. When it is 10.75 MHz, 19.1111 MHz should be supplied. When the IF frequency is 1.2 MHz or 10.8 MHz, set this pin to “0” or “1”. (Refer to Fig. 2.)

**X1, X2**

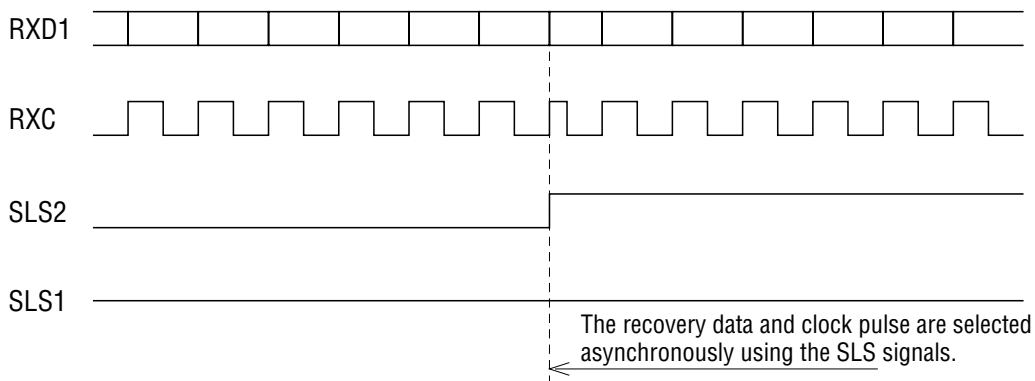
Crystal oscillator connection pins.  
When supplying a 19.0222 MHz or 19.1111 MHz clock to IFCK, use these pins (Refer to Fig. 2.)



**Figure 2 How to Use IFCK, X1, and X2**

**RXD, RXC**

Receive data and clock output. When power is turned on, the outputs of circuits selected by SLS1 and SLS2 appear at these pins. (Refer to Fig. 3)



**Figure 3 RXD and RXC Timing Diagram**



**SLS2, SLS1**

Receiver slot select signal inputs.

The devices have four sets of clock recovery circuit to each channel and four AFC information storage registers. One these circuits is selected from a combination of the signals at these pins.

(SLS2, SLS1) = (0, 0): Slot 1, (0, 1): Slot 2  
 (1, 0): Slot 3, (1, 1): Slot 4

**RPR**

High-speed phase clock control signal input for the clock recovery circuit.

If this pin is "1", the clock recovery circuit starts in the high-speed phase clock mode. When the phase difference is less than a defined value, the circuit shifts to the low-speed phase clock mode automatically. When this pin is "0", the circuit is always in the low-speed phase clock mode.

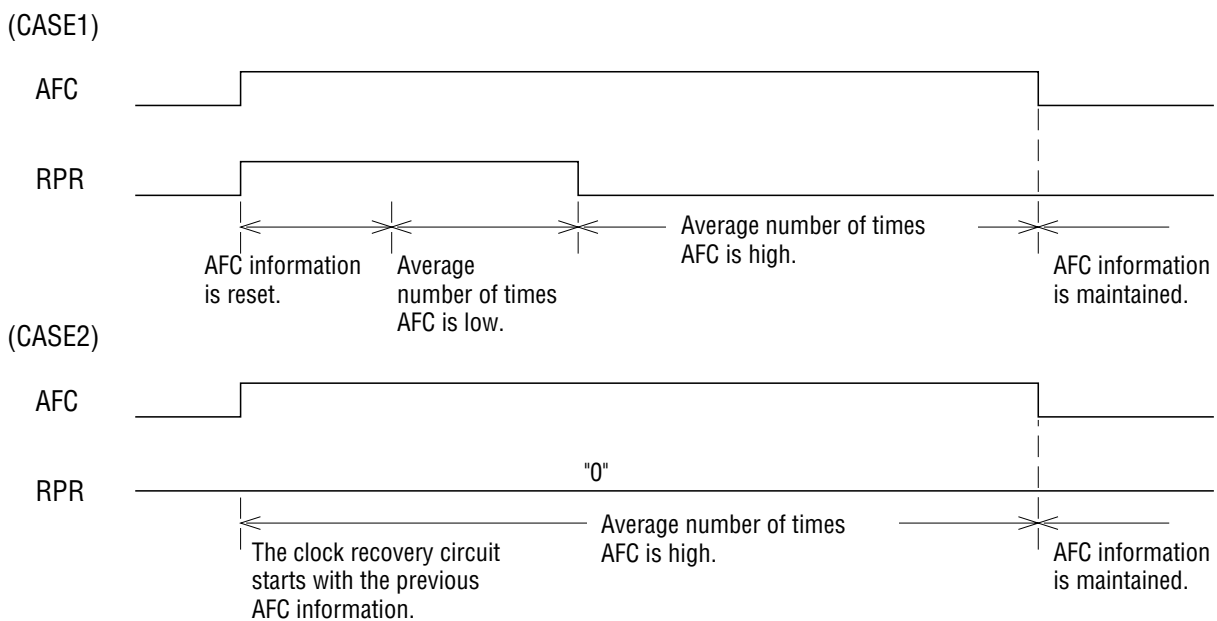
**AFC**

AFC operation range specification signal input.

As shown in Fig. 4, the AFC information is reset when both AFC and RPR are set to "1". AFC operation starts after a fixed number of clock cycles and after the AFC information is reset. If RPR is set to "1", an average number of times that AFC turns on is low. If RPR is "0", AFC is high. If AFC is "0", frequency error is not calculated, but the frequency is corrected using an error that is held.

**RCW**

Clock recovery circuit operation ON/OFF control signal input. If RCW pin is "0", DPLL does not make any phase corrections.

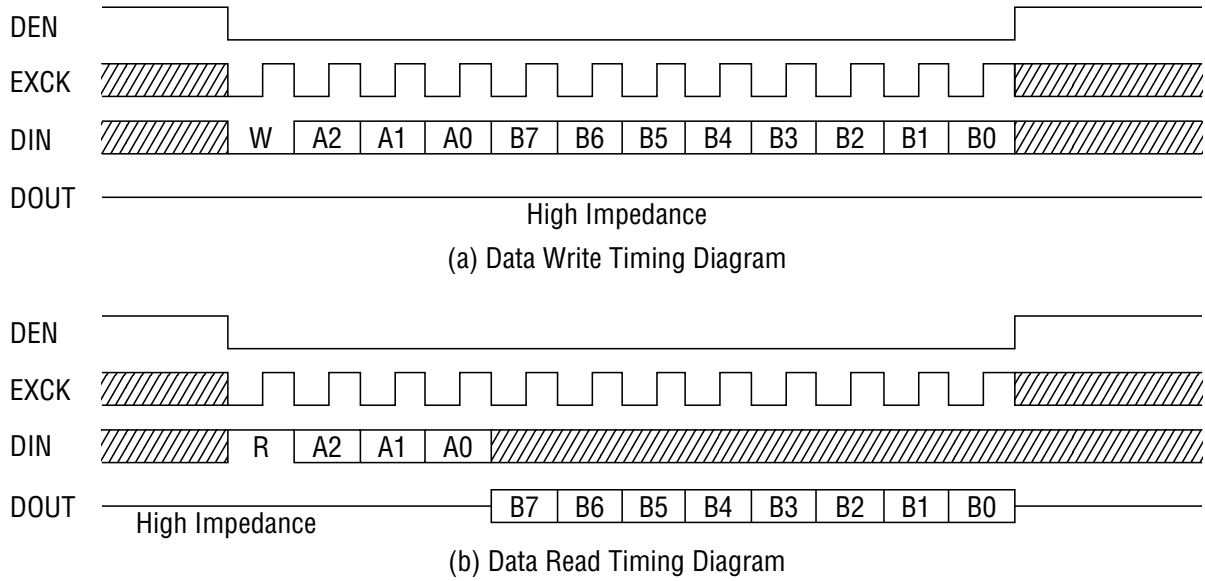


**Figure 4 AFC Control Timing Diagram**

**DEN , EXCK, DIN, DOUT**

Serial control ports for the microprocessor interface.

The MSM7582 and MSM7582B contain a 6-byte control register. An external CPU uses these pins to read data from and write data to the control register. DEN is an enable signal input pin. EXCK is a data shift clock pulse input pin. DIN is an address and data input pin. DOUT is a data output pin. Figure 5 shows an input/output timing diagram.



**Figure 5 MCU Interface Input/Output Timing Diagram**

The register map is shown below

**Table-2 Control Register Map**

| Register | Address |    |    | Data           |                |                |                |                |               |              |              | R/W |
|----------|---------|----|----|----------------|----------------|----------------|----------------|----------------|---------------|--------------|--------------|-----|
|          | A2      | A1 | A0 | B7             | B6             | B5             | B4             | B3             | B2            | B1           | B0           |     |
| CR0      | 0       | 0  | 0  | PS/CS          | TXCSEL         | MODOFF         | IFSEL1         | IFSEL0         | ENVSEL        | TEST1        | TEST0        | R/W |
| CR1      | 0       | 0  | 1  | Ich<br>GAIN3   | Ich<br>GAIN2   | Ich<br>GAIN1   | Ich<br>GAIN0   | Qch<br>GAIN3   | Qch<br>GAIN2  | Qch<br>GAIN1 | Qch<br>GAIN0 | R/W |
| CR2      | 0       | 1  | 0  | ENV<br>GAIN3   | ENV<br>GAIN2   | ENV<br>GAIN1   | ENV<br>GAIN0   | —              | —             | —            | —            | R/W |
| CR3      | 0       | 1  | 1  | Ich<br>Offset4 | Ich<br>Offset3 | Ich<br>Offset2 | Ich<br>Offset1 | Ich<br>Offset0 | —             | —            | —            | R/W |
| CR4      | 1       | 0  | 0  | Qch<br>Offset4 | Qch<br>Offset3 | Qch<br>Offset2 | Qch<br>Offset1 | Qch<br>Offset0 | —             | —            | —            | R/W |
| CR5      | 1       | 0  | 1  | BSTO<br>ENBL   | ICT6           | ICT5           | ICT4           | LOCAL<br>INV1  | LOCAL<br>INV0 | CLK<br>SEL1  | CLK<br>SEL0  | R/W |

R/W : Read/Write enable R : Read-only register

**ABSOLUTE MAXIMUM RATINGS**

| Parameter             | Symbol           | Condition | Rating                       | Unit |
|-----------------------|------------------|-----------|------------------------------|------|
| Power Supply Voltage  | V <sub>DD</sub>  | —         | 0 to 5                       | V    |
| Digital Input Voltage | V <sub>DIN</sub> | —         | -0.3 to V <sub>DD</sub> +0.3 | V    |
| Operating Temperature | T <sub>op</sub>  | —         | -25 to +70                   | °C   |
| Storage Temperature   | T <sub>STG</sub> | —         | -55 to +150                  | °C   |

**RECOMMENDED OPERATING CONDITIONS**

(V<sub>DD</sub> = 2.7 V to 3.6 V, Ta = -25°C to +70°C)

| Parameter                   | Symbol             | Condition                    | Min.                   | Typ.    | Max.                   | Unit |
|-----------------------------|--------------------|------------------------------|------------------------|---------|------------------------|------|
| Power Supply Voltage        | V <sub>DD</sub>    | —                            | 2.7                    | —       | 3.6                    | V    |
| Operating Temperature Range | Ta                 | —                            | -25                    | —       | +70                    | °C   |
| Input High Voltage          | V <sub>IH</sub>    | All digital input pins       | 0.45 × V <sub>DD</sub> | —       | V <sub>DD</sub>        | V    |
| Input Low Voltage           | V <sub>IL</sub>    | All digital input pins       | 0                      | —       | 0.16 × V <sub>DD</sub> | V    |
| Master Clock Frequency      | f <sub>MCK</sub>   | MCK                          | —                      | 19.2    | —                      | MHz  |
| Modulator Input Frequency   | f <sub>TXC1</sub>  | TXCI (when CR0 – B6 = "0")   | —                      | 384     | —                      | kHz  |
|                             | f <sub>TXC2</sub>  | TXCI (when CR0 – B6 = "1")   | —                      | 3.84    | —                      | MHz  |
| Demodulator Input Frequency | f <sub>IFCK1</sub> | IFCK (when IFIN = 10.7 MHz)  | -50 ppm                | 19.0222 | +50 ppm                | MHz  |
|                             | f <sub>IFCK2</sub> | IFCK (when IFIN = 10.75 MHz) | -50 ppm                | 19.1111 | +50 ppm                | MHz  |
| Clock Duty Cycle            | D <sub>CCK</sub>   | MCK, IFCK, TXCI              | 40                     | 50      | 60                     | %    |
| IF Input Duty Cycle         | D <sub>CIF</sub>   | IFCK                         | 45                     | 50      | 55                     | %    |

**ELECTRICAL CHARACTERISTICS**

**DC Characteristics**

(V<sub>DD</sub> = 2.7 V to 3.6 V, Ta = -25°C to +70°C)

| Parameter             | Symbol           | Condition                                     | Min.                  | Typ. | Max.            | Unit |
|-----------------------|------------------|-----------------------------------------------|-----------------------|------|-----------------|------|
| Power Supply Current  | I <sub>DD1</sub> | Mode A, Mode B (when V <sub>DD</sub> = 3.0 V) | —                     | 0.02 | 0.05            | mA   |
|                       | I <sub>DD2</sub> | Mode C (when V <sub>DD</sub> = 3.0 V)         | —                     | 5.5  | 11.0            | mA   |
|                       | I <sub>DD3</sub> | Mode D (when V <sub>DD</sub> = 3.0 V)         | —                     | 5.5  | 11.0            | mA   |
|                       | I <sub>DD4</sub> | Mode E (when V <sub>DD</sub> = 3.0 V)         | —                     | 11.5 | 23.0            | mA   |
|                       | I <sub>DD5</sub> | Mode F (when V <sub>DD</sub> = 3.0 V)         | —                     | 9.5  | 19.0            | mA   |
|                       | I <sub>DD6</sub> | Mode G (when V <sub>DD</sub> = 3.0 V)         | —                     | 14.0 | 28.0            | mA   |
| Output High Voltage   | V <sub>OH</sub>  | I <sub>OH</sub> = 0.4 mA                      | 0.5 × V <sub>DD</sub> | —    | V <sub>DD</sub> | V    |
| Output Low Voltage    | V <sub>OL</sub>  | I <sub>OL</sub> = -1.2 mA                     | 0.0                   | —    | 0.4             | V    |
| Input Leakage Current | I <sub>IH</sub>  | —                                             | —                     | —    | 10              | μA   |
|                       | I <sub>IL</sub>  | —                                             | —                     | —    | 10              | μA   |

## Analog Interface Characteristics

(V<sub>DD</sub> = 2.7 V to 3.6 V, T<sub>a</sub> = -25°C to +70°C)

| Parameter                                | Symbol           | Condition                               | Min. | Typ. | Max.            | Unit             |
|------------------------------------------|------------------|-----------------------------------------|------|------|-----------------|------------------|
| Output Resistance Load                   | R <sub>LIQ</sub> | I+, I-, Q+, Q-, ENV                     | 1.0  | —    | —               | kΩ               |
| Output Capacitance Load                  | C <sub>LIQ</sub> | I+, I-, Q+, Q-, ENV                     | —    | —    | 20              | pF               |
| Output DC Voltage Level                  | V <sub>DC1</sub> | I+, I-, Q+, Q- (TXW = 0)                | 1.55 | 1.6  | 1.65            | V                |
|                                          | V <sub>DC2</sub> | I+ (CR0 - B5 = 1)<br>when not modulated | —    | 1.77 | —               | V                |
|                                          | V <sub>DC3</sub> | Q+ (CR0 - B5 = 1)<br>when not modulated | —    | 1.67 | —               | V                |
|                                          | V <sub>DC4</sub> | ENV (TXW = 0)                           | —    | 1.35 | —               | V                |
|                                          | V <sub>DC5</sub> | ENV (TXW = 1, CR0 - B2 = 0, TXD = 0)    | —    | 1.72 | —               | V                |
|                                          | V <sub>DC6</sub> | ENV (TXW = 1, CR0 - B2 = 1, TXD = 0)    | —    | 1.63 | —               | V                |
| Output AC Voltage Level                  | V <sub>AC</sub>  | I+, I-, Q+, Q-<br>(TXD = 0)             | —    | 360  | —               | mV <sub>PP</sub> |
| Output DC Voltage Adjustment Level Range | DCVL             | —                                       | —    | ±45  | —               | mV               |
| Output AC Voltage Adjustment Level Range | ACVL             | —                                       | —    | ±4   | —               | %                |
| Out-of-band Spectrum                     | P600             | 600 kHz detuning (*)                    | 60   | —    | —               | dB               |
|                                          | P900             | 900 kHz detuning (*)                    | 65   | —    | —               | dB               |
| Modulation Accuracy                      | EVM              | —                                       | —    | 1.0  | 3.0             | % rms            |
| Demodulator IF Input Level               | IFV              | IFIN input level                        | 0.5  | —    | V <sub>DD</sub> | V <sub>PP</sub>  |
| IFIN Input Impedance                     | RIF              | —                                       | —    | 20   | —               | kΩ               |
|                                          | CIF              | —                                       | —    | 5    | —               | pF               |
| SG Output Voltage                        | VSG              | —                                       | —    | 2.0  | —               | V                |
| SG Output Impedance                      | RSG              | —                                       | —    | 1.5  | —               | kΩ               |

\* Power attenuation at 600 kHz or 900 kHz ±96 kHz as referred to two times of the power in frequency band of 0 to 96 kHz

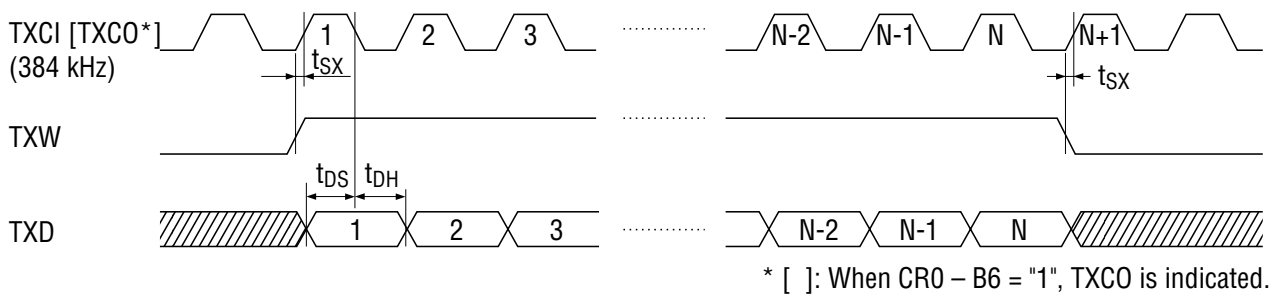
Digital Interface Characteristics

(V<sub>DD</sub> = 2.7 V to 3.6 V, T<sub>a</sub> = -25°C to +70°C)

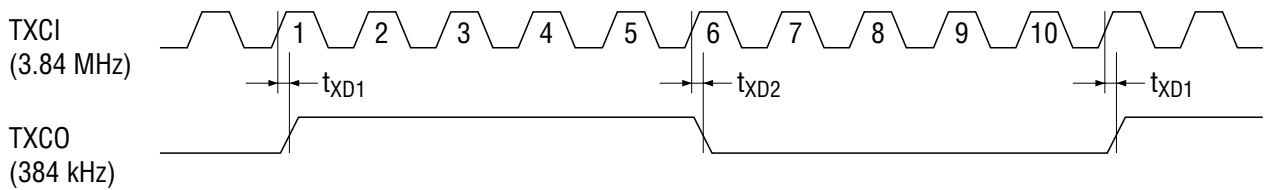
| Parameter                                     | Symbol                               | Condition      |        | Min. | Typ. | Max. | Unit |
|-----------------------------------------------|--------------------------------------|----------------|--------|------|------|------|------|
|                                               |                                      |                | Other  |      |      |      |      |
| Transmitter Digital Input/Output Setting Time | t <sub>SX</sub>                      | C load = 50 pF | Fig. 6 | -200 | —    | 200  | ns   |
|                                               | t <sub>DS</sub>                      |                |        | 0    | —    | 200  | ns   |
|                                               | t <sub>XD1</sub>                     |                |        | 0    | —    | 200  | ns   |
|                                               | t <sub>XD2</sub>                     |                |        | 0    | —    | 200  | ns   |
|                                               | t <sub>XD3</sub>                     |                |        |      |      |      |      |
| t <sub>XD4</sub>                              |                                      |                |        |      |      |      |      |
| Receiver Digital Input/Output Setting Time    | t <sub>RD1</sub>                     | C load = 50 pF | Fig. 7 | 0    | —    | 200  | ns   |
|                                               | t <sub>RD2</sub>                     |                |        | 0    | —    | 200  | ns   |
|                                               | t <sub>RS1</sub> to t <sub>RS4</sub> |                |        | 10   | —    | —    | μs   |
|                                               | t <sub>RW</sub>                      |                |        | 10   | —    | —    | μs   |
| Serial Port Digital Input/Output Setting Time | t <sub>M1</sub>                      | C load = 50 pF | Fig. 8 | 50   | —    | —    | ns   |
|                                               | t <sub>M2</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M3</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M4</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M5</sub>                      |                |        | 100  | —    | —    | ns   |
|                                               | t <sub>M6</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M7</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M8</sub>                      |                |        | 0    | —    | 100  | ns   |
|                                               | t <sub>M9</sub>                      |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M10</sub>                     |                |        | 50   | —    | —    | ns   |
|                                               | t <sub>M11</sub>                     |                |        | 0    | —    | 50   | ns   |
| EXCK Clock Frequency                          | f <sub>EXCK</sub>                    | —              | EXCK   | —    | —    | 10   | MHz  |

**TIMING DIAGRAM**

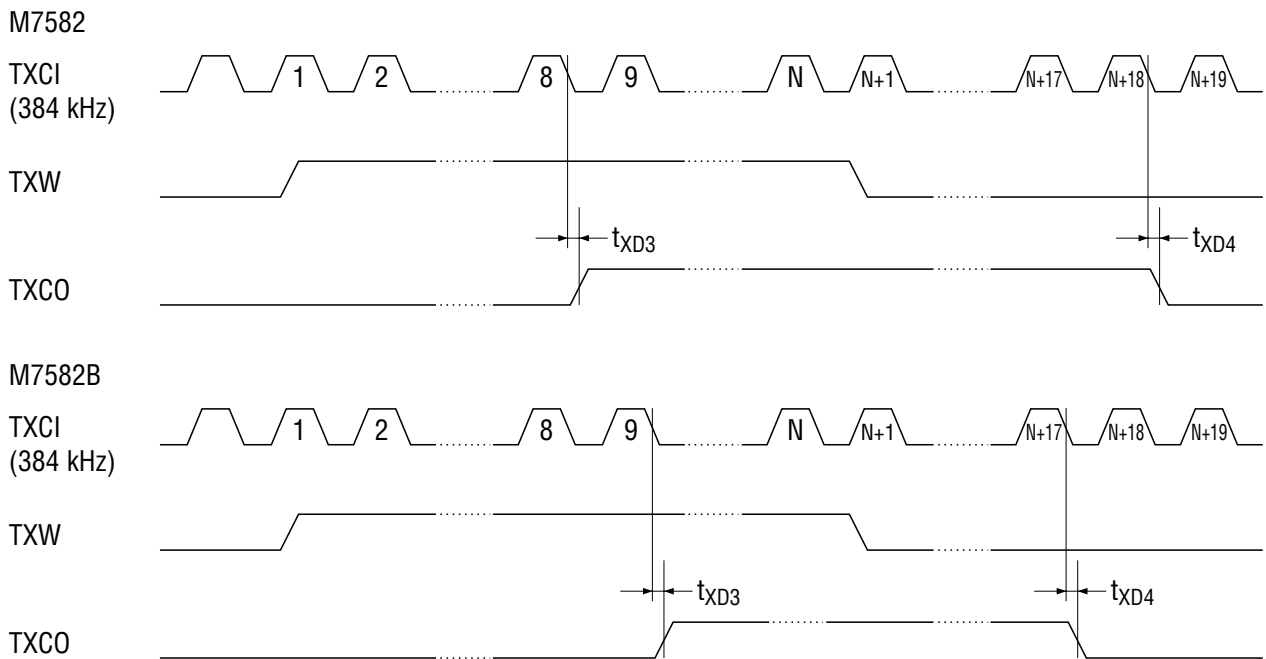
**Transmit Data Input Timing**



**Transmit Clock (TXCO) Output Timing (when CR0 – B6 = 1)**



**Transmit Burst Position Output (TXCO) Timing (when CR0 – B6 = 0 and CR5 – B7 = 1)**



**Figure 6 Transmit (Modulator) Digital Input/Output Timing**

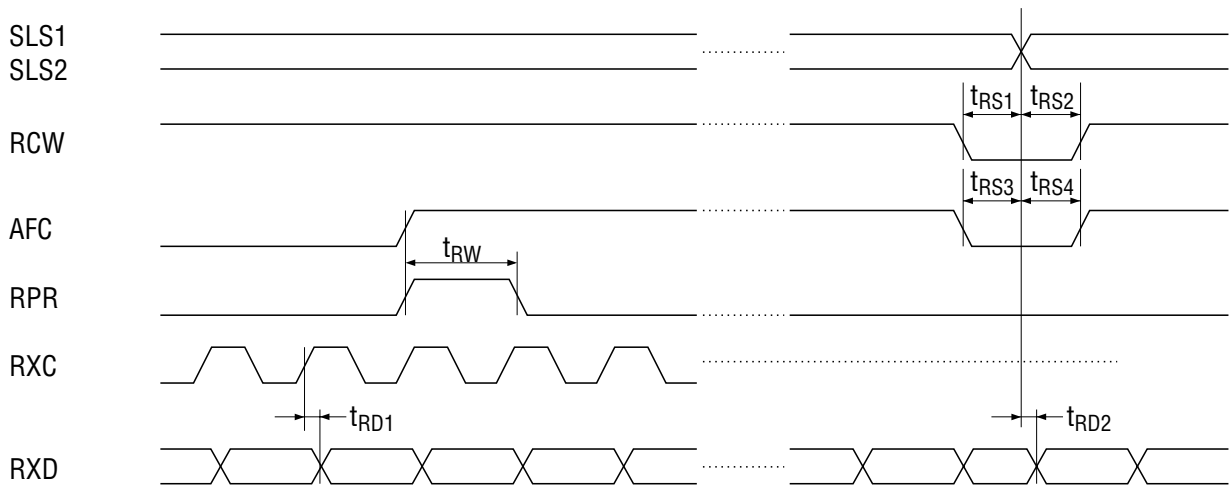


Figure 7 Receiver (Demodulator) Digital Input/Output Timing

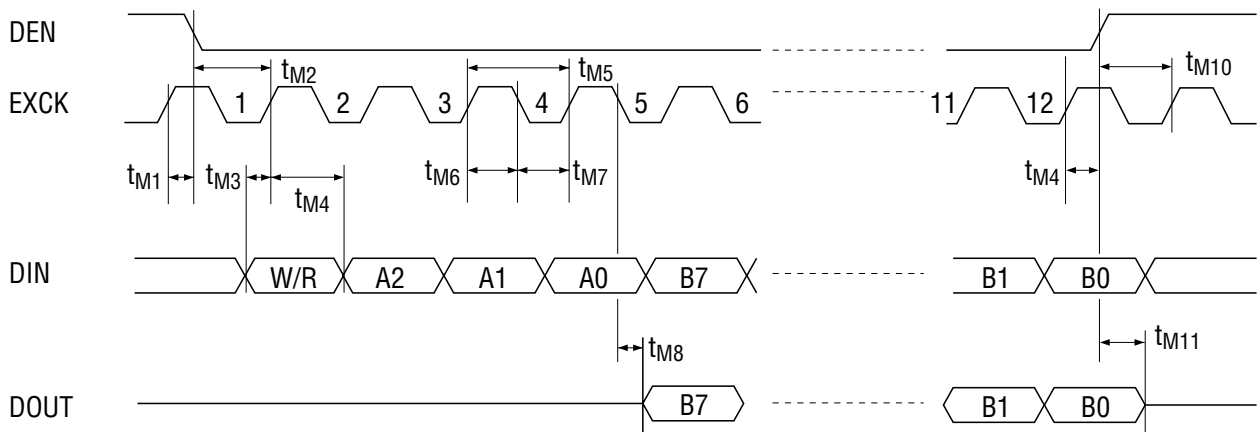


Figure 8 Serial Control Port Interface



## FUNCTIONAL DESCRIPTION

### Control Registers

(1) CR0 (basic operation mode setting)

|                   | <b>B7</b> | <b>B6</b> | <b>B5</b> | <b>B4</b> | <b>B3</b> | <b>B2</b> | <b>B1</b> | <b>B0</b> |
|-------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| CR0               | PS/CS     | TXC SEL   | MOD OFF   | IFSEL 1   | IFSEL 0   | ENV SEL   | TEST 1    | TEST 0    |
| Initial value (*) | 0         | 0         | 0         | 0         | 0         | 0         | 0         | 0         |

\* the initial value is set when a reset signal is supplied by a PDN.

**B7:** PS/CS selection

- 1/CS (4 Clock recovery DPLLs are on.)
- 0/PS (2 Clock recovery DPLLs are on.)

**B6:** Transmit timing clock selection

- 0/TXCI input: 384 kHz.  
TXCO output: 384 kHz output from APLL. Transmit data TXD is input in synchronization with the rising edge of TXCI (APLL is on.)
- 1/TXCI input: 3.84 MHz.  
TXCO output: 384 kHz (one-tenth of the TXCI frequency). Transmit data TXD is input in synchronization with the rising edge of TXCO (APLL is off.)

**B5:** Modulation on/off control

- 1/modulation OFF (with phase fixed)
- 0/modulation ON.

**B4, B3:** Receiver input IF frequency selection

- (0, 0), (0, 1): 1.2 MHz
- (1, 0): 10.8 MHz
- (1, 1): 10.7 MHz/10.75 MHz

**B2:** Transmit envelope ( $I^2 + Q^2$  or  $\sqrt{I^2 + Q^2}$ ) output selection

- 1/ $I^2 + Q^2$  output
- 0/ $\sqrt{I^2 + Q^2}$  output

**B1, B0:** Test mode selection bits. Each monitor output is output to the transmit ENV pin.

- (0, 0): Transmit envelope ( $I^2 + Q^2$  or  $\sqrt{I^2 + Q^2}$ ) output
- (0, 1): receiver phase detection signal output
- (1, 0): receiver delay detection signal output
- (1, 1): receiver AFC information output

(2) CR1 (I, Q gain adjustment)

|               | <b>B7</b>    | <b>B6</b>    | <b>B5</b>    | <b>B4</b>    | <b>B3</b>    | <b>B2</b>    | <b>B1</b>    | <b>B0</b>    |
|---------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| CR1           | Ich<br>GAIN3 | Ich<br>GAIN2 | Ich<br>GAIN1 | Ich<br>GAIN0 | Qch<br>GAIN3 | Qch<br>GAIN2 | Qch<br>GAIN1 | Qch<br>GAIN0 |
| Initial value | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |

B7 to B4: I+ / I- output gain setting, in 3 mV steps (Refer to Table-3.)

B3 to B0: Q+ / Q- output gain setting, in 3 mV steps (Refer to Table-3.)

(3) CR2 (ENV gain adjustment)

|               | <b>B7</b>    | <b>B6</b>    | <b>B5</b>    | <b>B4</b>    | <b>B3</b> | <b>B2</b> | <b>B1</b> | <b>B0</b> |
|---------------|--------------|--------------|--------------|--------------|-----------|-----------|-----------|-----------|
| CR2           | ENV<br>GAIN3 | ENV<br>GAIN2 | ENV<br>GAIN1 | ENV<br>GAIN0 | —         | —         | —         | —         |
| Initial value | 0            | 0            | 0            | 0            | 0         | 0         | 0         | 0         |

B7 to B4: ENV output gain adjustment (Refer to Table-3.)

B3 to B0: Not used

**Table-3 I, Q, and ENV Output Gain Values**

| <b>CR1-B7</b> | <b>-B6</b> | <b>-B5</b> | <b>-B4</b> | <b>Description</b>                |
|---------------|------------|------------|------------|-----------------------------------|
| <b>CR1-B3</b> | <b>-B2</b> | <b>-B1</b> | <b>-B0</b> |                                   |
| <b>CR2-B7</b> | <b>-B6</b> | <b>-B5</b> | <b>-B4</b> |                                   |
| 0             | 1          | 1          | 1          | Amplitude 1.042 × Reference value |
| 0             | 1          | 1          | 0          | 1.036                             |
| 0             | 1          | 0          | 1          | 1.030                             |
| 0             | 1          | 0          | 0          | 1.024                             |
| 0             | 0          | 1          | 1          | 1.018                             |
| 0             | 0          | 1          | 0          | 1.012                             |
| 0             | 0          | 0          | 1          | 1.006                             |
| 0             | 0          | 0          | 0          | 1.000 (Reference value)           |
| 1             | 1          | 1          | 1          | 0.994                             |
| 1             | 1          | 1          | 0          | 0.988                             |
| 1             | 1          | 0          | 1          | 0.982                             |
| 1             | 1          | 0          | 0          | 0.976                             |
| 1             | 0          | 1          | 1          | 0.970                             |
| 1             | 0          | 1          | 0          | 0.964                             |
| 1             | 0          | 0          | 1          | 0.958                             |
| 1             | 0          | 0          | 0          | 0.952                             |

(4) CR3 (I- output offset voltage adjustment)

|               | B7          | B6          | B5          | B4          | B3          | B2 | B1 | B0 |
|---------------|-------------|-------------|-------------|-------------|-------------|----|----|----|
| CR3           | Ich Offset4 | Ich Offset3 | Ich Offset2 | Ich Offset1 | Ich Offset0 | —  | —  | —  |
| Initial value | 0           | 0           | 0           | 0           | 0           | 0  | 0  | 0  |

B7 to B3: I- output pin offset voltage adjustment (Refer to Table-4.)

B2 to B0: Not used

(5) CR4 (Q- output offset voltage adjustment)

|               | B7          | B6          | B5          | B4          | B3          | B2 | B1 | B0 |
|---------------|-------------|-------------|-------------|-------------|-------------|----|----|----|
| CR4           | Qch Offset4 | Qch Offset3 | Qch Offset2 | Qch Offset1 | Qch Offset0 | —  | —  | —  |
| Initial value | 0           | 0           | 0           | 0           | 0           | 0  | 0  | 0  |

B7 to B4: Q- output pin offset voltage adjustment (Refer to Table-4.)

B3 to B0: Not used

**Table-4 I and Q Channel Offset Adjustment Values**

| CR3-B7 | B6 | B5 | B4 | B3 | Description   | CR3-B7 | B6 | B5 | B4 | B3 | Description  |
|--------|----|----|----|----|---------------|--------|----|----|----|----|--------------|
| CR4-B7 | B6 | B5 | B4 | B3 |               | CR4-B7 | B6 | B5 | B4 | B3 |              |
| 0      | 1  | 1  | 1  | 1  | Offset +45 mV | 1      | 1  | 1  | 1  | 1  | Offset -3 mV |
| 0      | 1  | 1  | 1  | 0  | +42 mV        | 1      | 1  | 1  | 1  | 0  | -6 mV        |
| 0      | 1  | 1  | 0  | 1  | +39 mV        | 1      | 1  | 1  | 0  | 1  | -9 mV        |
| 0      | 1  | 1  | 0  | 0  | +36 mV        | 1      | 1  | 1  | 0  | 0  | -12 mV       |
| 0      | 1  | 0  | 1  | 1  | +33 mV        | 1      | 1  | 0  | 1  | 1  | -15 mV       |
| 0      | 1  | 0  | 1  | 0  | +30 mV        | 1      | 1  | 0  | 1  | 0  | -18 mV       |
| 0      | 1  | 0  | 0  | 1  | +27 mV        | 1      | 1  | 0  | 0  | 1  | -21 mV       |
| 0      | 1  | 0  | 0  | 0  | +24 mV        | 1      | 1  | 0  | 0  | 0  | -24 mV       |
| 0      | 0  | 1  | 1  | 1  | +21 mV        | 1      | 0  | 1  | 1  | 1  | -27 mV       |
| 0      | 0  | 1  | 1  | 0  | +18 mV        | 1      | 0  | 1  | 1  | 0  | -30 mV       |
| 0      | 0  | 1  | 0  | 1  | +15 mV        | 1      | 0  | 1  | 0  | 1  | -33 mV       |
| 0      | 0  | 1  | 0  | 0  | +12 mV        | 1      | 0  | 1  | 0  | 0  | -36 mV       |
| 0      | 0  | 0  | 1  | 1  | +9 mV         | 1      | 0  | 0  | 1  | 1  | -39 mV       |
| 0      | 0  | 0  | 1  | 0  | +6 mV         | 1      | 0  | 0  | 1  | 0  | -42 mV       |
| 0      | 0  | 0  | 0  | 1  | +3 mV         | 1      | 0  | 0  | 0  | 1  | -45 mV       |
| 0      | 0  | 0  | 0  | 0  | 0 mV          | 1      | 0  | 0  | 0  | 0  | -48 mV       |

(6) CR5

|               | <b>B7</b> | <b>B6</b> | <b>B5</b> | <b>B4</b> | <b>B3</b>  | <b>B2</b>  | <b>B1</b> | <b>B0</b> |
|---------------|-----------|-----------|-----------|-----------|------------|------------|-----------|-----------|
| CR5           | BSTO ENBL | ICT6      | ICT5      | ICT4      | LOCAL INV1 | LOCAL INV0 | CLK SEL1  | CLK SEL0  |
| Initial value | 0         | 0         | 0         | 0         | 0          | 0          | 0         | 0         |

B7: Modulator burst window output enable bit.

- 1/ The timing of the I and Q baseband modulation output burst is output at the TXCO pin.
- 0/ The 384 kHz transmit timing clock pulse is output at the TXCO pin.

B6 to B4: ICT6 to ICT4. Device test control bits.

B3, B2: Local inverting mode setting bits.

- (1, 1) = local inverting mode
- (0, 0) = normal mode

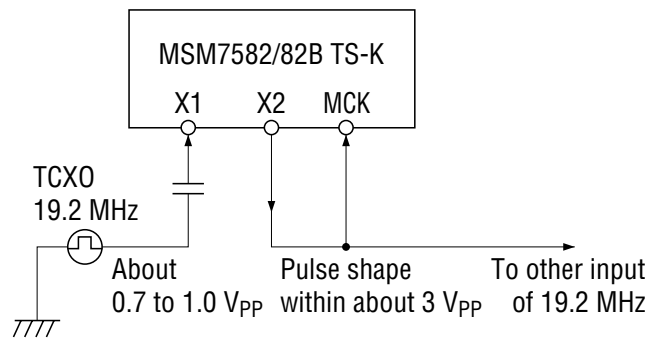
B1: Clock pulse shaping mode selection bit.

- 1/ Clock pulse shaping mode (Refer to Fig 9.)
- 0/ Oscillator circuit mode

B0: Power-on control bit for X1, X2 pins, when the clock pulse shaping mode.

- 1/ Always power-on
- 0/ Power-down in the whole device power-down state when Power on otherwise.

Note: CR5 – B6 to B4 are used to test the device. They should be set to “0” during normal operation.



**Figure 9 Example of Application Circuit when the Clock Pulse Shaping Mode is Generated by CR5-B1**

State Transition Time

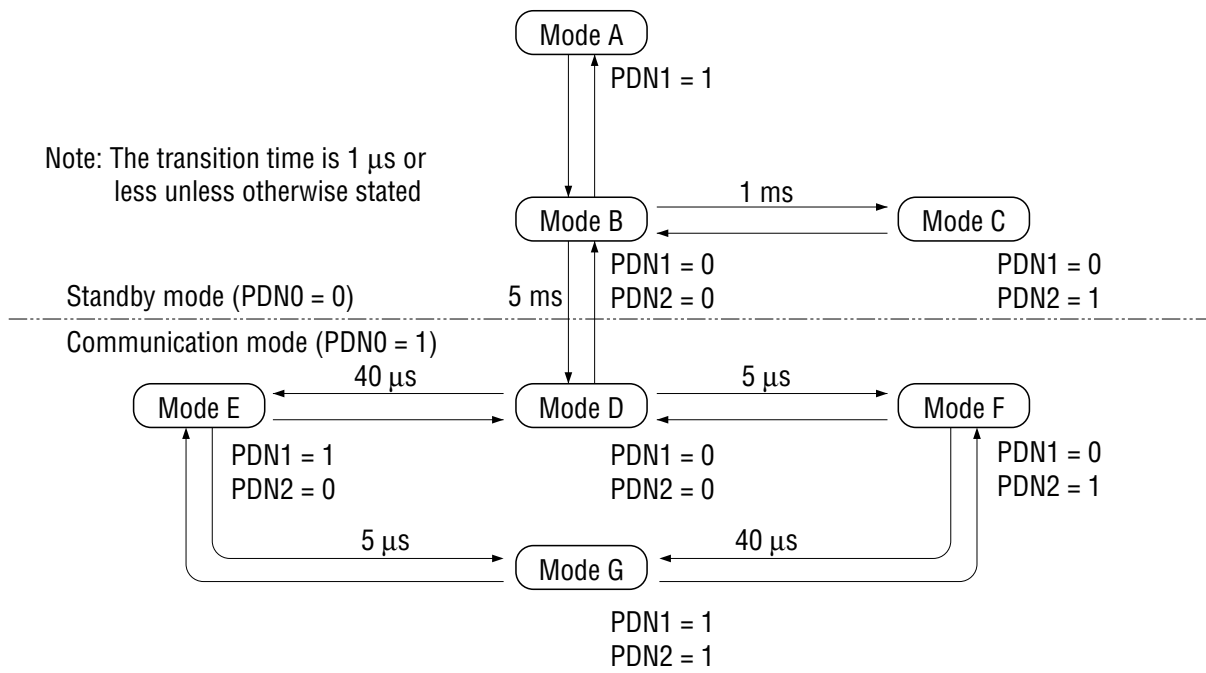


Figure 10 Power-Down State Transition Time

APPLICATION CIRCUIT

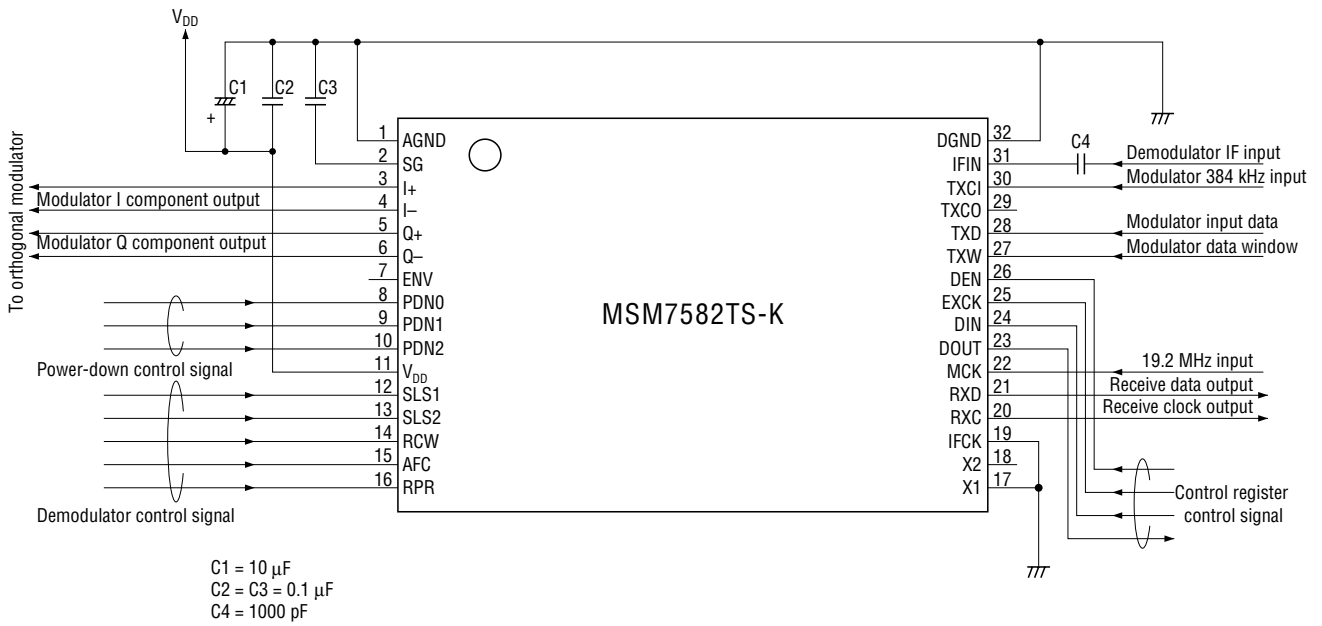
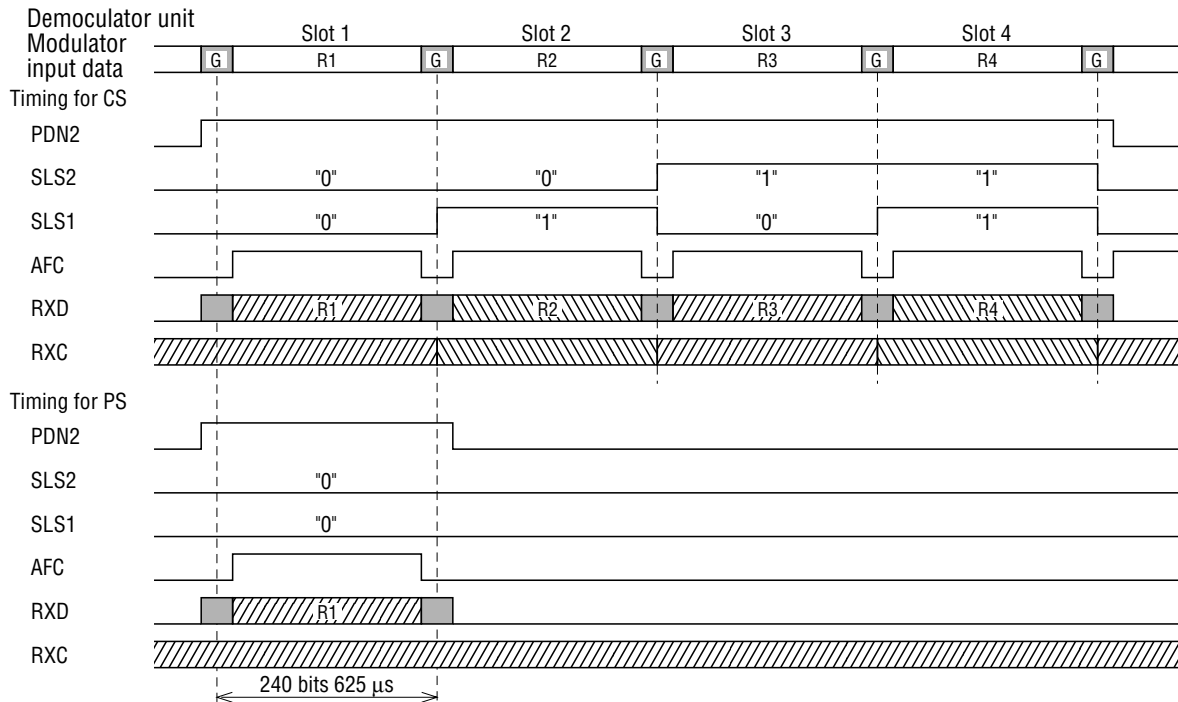
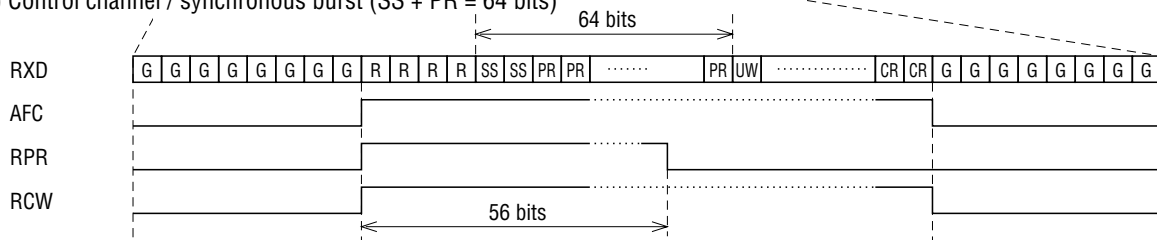


Figure 11 Example of Circuit Configuration

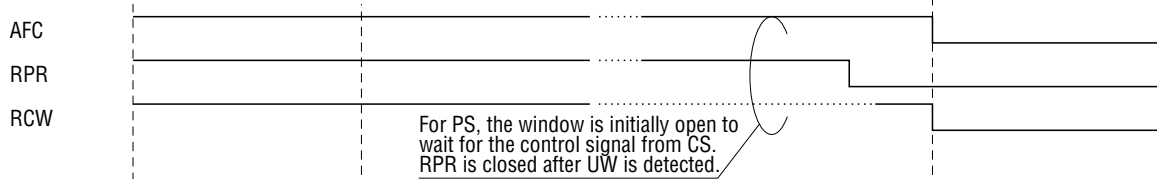
Demodulator Control Timing Diagram (Example)



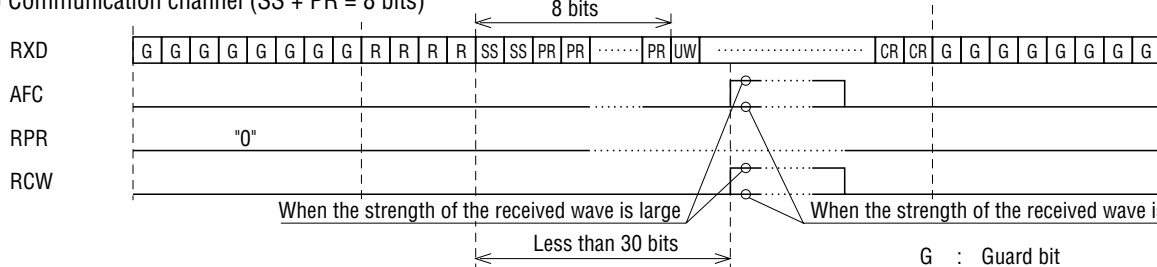
(1) Control channel / synchronous burst (SS + PR = 64 bits)



(2) When synchronization is not established (for PS only)



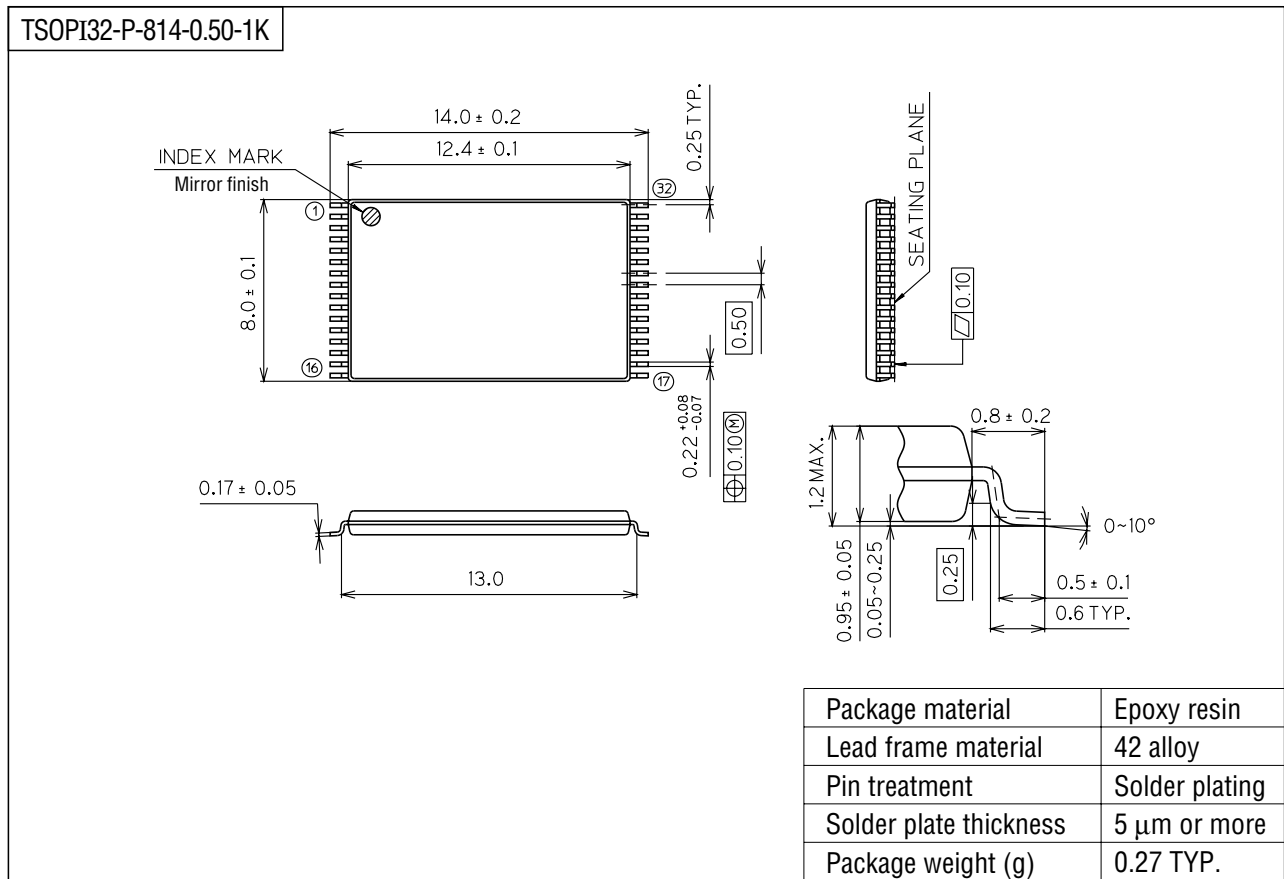
(3) Communication channel (SS + PR = 8 bits)



- G : Guard bit
- R : Ramp bit
- SS : Start symbol bit
- PR : Preamble bit
- UW : Unique word bit
- CR : CRC bit

PACKAGE DIMENSIONS

(Unit : mm)



Notes for Mounting the Surface Mount Type Package

The SOP, QFP, TSOP, SOJ, QFJ (PLCC), SHP and BGA are surface mount type packages, which are very susceptible to heat in reflow mounting and humidity absorbed in storage. Therefore, before you perform reflow mounting, contact Oki's responsible sales person for the product name, package name, pin number, package code and desired mounting conditions (reflow method, temperature and times).