



## DIGITAL AUDIO INTERFACE RECEIVER

### FEATURES

- Standard Digital Audio Interface Receiver (EIAJ1201)
- Sampling Rate: 32/44.1/48/88.2/96 kHz
- Recover 128 / 256 / 384 / 512  $f_s$  System Clock
- Very Low Jitter System Clock Output (80ps Typically)
- On-Chip Master Clock Oscillator, Only an External 12.000 MHz or 16.000 MHz Crystal Is Required
- Selectable Output PCM Audio Data Format
- Output User Bit Data, Flag Signals, and Channel Status Data With Block Start Signal
- Single + 3.3-V Power Supply
- Package: 28 SSOP

### APPLICATIONS

- AV Receiver
- MD Player
- DAC Unit

### DESCRIPTION

The DIR1701 is a digital audio interface receiver (DIR) which receives and decodes audio data up to 96 kHz according to the AES/EBU, IEC958, S/PDIF, and EIAJCP340/1201 consumer and professional format interface standards. The DIR1701 demultiplexes the channel status bit and user bit directly to serial output pins, and has dedicated output pins for the most important channel status bits.

The significant advantages of the DIR1701 are *96 kHz sampling rate capability* and *Low-jitter clock recovery by the Sampling Period Adaptive Controlled Tracking (SpAct™) system*. Input signal is relocked with the patented *Sampling period Adaptive controlled tracking system* for maximum quality. These two features are required for recent consumer and professional audio instruments, in which the DIR has an interface to any kind of delta-sigma type ADC/DAC with 96 kHz sampling rate.



This integrated circuit can be damaged by ESD. Burr-Brown recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

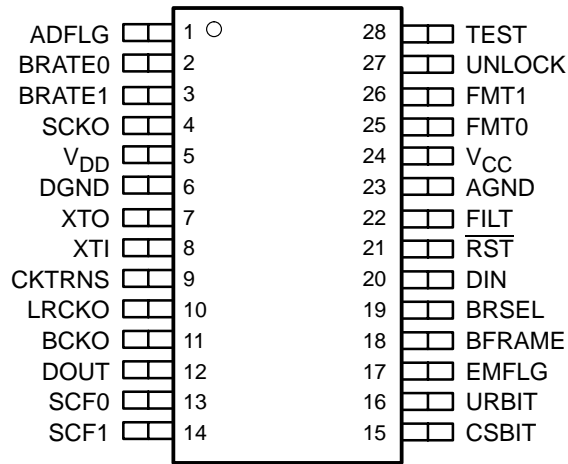
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.



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DIR1701  
(TOP VIEW)



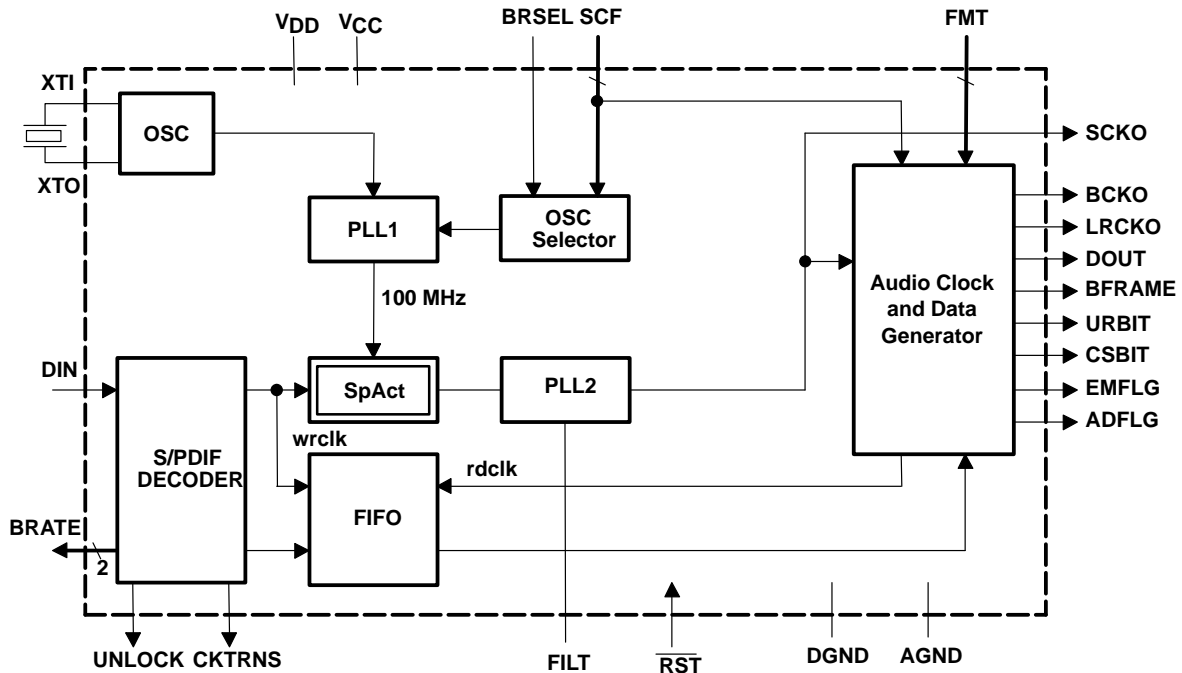
PACKAGE/ORDERING INFORMATION

| PRODUCT  | PACKAGE | PACKAGE DRAWING NUMBER | OPERATION TEMPERATURE RANGE | PACKAGE MARKING | ORDERING NUMBER† | TRANSPORT MEDIA |
|----------|---------|------------------------|-----------------------------|-----------------|------------------|-----------------|
| DIR1701E | SSOP-28 | 324†                   | -25°C to +85°C              | DIR1701E        | DIR1701E         | Rails           |
|          |         |                        |                             |                 | DIR1701E/2K      | Tape and Reel   |

† TI equivalent no. 4040065.

‡ Models with a slash (/) are available only in tape and reel in the quantities indicated (e.g., /2K indicates 2000 devices per reel). Ordering 2000 pieces of DIR1701E/2K will get a single 2000-piece tape and reel.

block diagram



## Terminal Functions

| TERMINAL<br>NAME | PIN | I/O | DESCRIPTIONS  |
|------------------|-----|-----|---|
| ADFLG            | 1   | O   | Audio data or digital data flag                                     |
| BRATE0           | 2   | O   | $f_s$ rate flag 0 (32k, 44.1k, 48k, and 88k / 96k)                  |
| BRATE1           | 3   | O   | $f_s$ rate flag 1 (32k, 44.1k, 48k, and 88k / 96k)                  |
| SCKO             | 4   | O   | System clock output   |
| V <sub>DD</sub>  | 5   | –   | Digital power supply, +3.3 V  |
| DGND             | 6   | –   | Digital ground  |
| XTO              | 7   | O   | Crystal oscillator output   |
| XTI              | 8   | I   | Crystal oscillator input, external clock input                      |
| CKTRNS           | 9   | O   | Clock transition status output                                      |
| LRCKO            | 10  | O   | Audio latch enable (LRCK, $f_s$ ) output                            |
| BCKO             | 11  | O   | Audio bit clock output  |
| DOUT             | 12  | O   | Audio serial data output  |
| SCF0             | 13  | I   | System clock frequency select (128/256/384/512 $f_s$ ) (see Note 1) |
| SCF1             | 14  | I   | System clock frequency select (128/256/384/512 $f_s$ ) (see Note 1) |
| CSBIT            | 15  | O   | Channel status bit output (see Note 2)                              |
| URBIT            | 16  | O   | User bit output (see Note 2)  |
| EMFLG            | 17  | O   | Emphasis flag   |
| BFRAME           | 18  | O   | Block start clock (B-frame)   |
| BRSEL            | 19  | I   | Default bit rate select (32 / 44.1 / 48 / 88.2 / 96k) (see Note 1)  |
| DIN              | 20  | I   | S/PDIF data digital input (see Note 4)                              |
| RST              | 21  | I   | Reset input, active LOW (see Note 3)                                |
| FILT             | 22  | –   | External filter   |
| AGND             | 23  | –   | Analog ground   |
| V <sub>CC</sub>  | 24  | –   | Analog power supply, +3.3V  |
| FMT0             | 25  | I   | Audio data format select (see Note 1)                               |
| FMT1             | 26  | I   | Audio data format select (see Note 1)                               |
| UNLOCK           | 27  | O   | PLL unlock or parity error flag                                     |
| TEST             | 28  | I   | Should be connected to DGND (see Note 1)                            |

- NOTES:
1. Schmitt trigger input with internal pulldown (TYP 51 k $\Omega$ ), 5 V tolerant.
  2. Serial outputs are utilized for both consumer and professional application.
  3. Schmitt trigger input with internal pullup (TYP 51 k $\Omega$ ), 5 V tolerant.
  4. CMOS level input with internal pulldown (TYP 51 k $\Omega$ ), 5 V tolerant.

## absolute maximum ratings†

|  |                               |
|--|-------------------------------|
| Supply voltage, $V_{CC}$ , $V_{DD}$                  | 4.0 V                         |
| Supply voltage differences, $V_{CC}$ , $V_{DD}$      | $\pm 0.1$ V                   |
| Ground voltage differences, AGND, DGND               | $\pm 0.1$ V                   |
| Digital input voltage: Digital input pins except XTI | -0.3 V to (6.5 V + 0.3 V)     |
| XTI  | -0.3 V to ( $V_{DD}$ + 0.3 V) |
| Input current (Any pins except supplies)             | $\pm 10$ mA                   |
| Ambient temperature under bias                       | -40°C to 125°C                |
| Storage temperature                                  | -55°C to 150°C                |
| Junction temperature                                 | 150°C                         |
| Lead temperature (soldering)                         | 260°C, 5 sec                  |
| Package temperature (IR reflow, peak)                | 235°C, 10 sec                 |

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

electrical characteristics, all specifications at  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = V_{DD} = 3.3\text{ V}$  (unless otherwise noted)

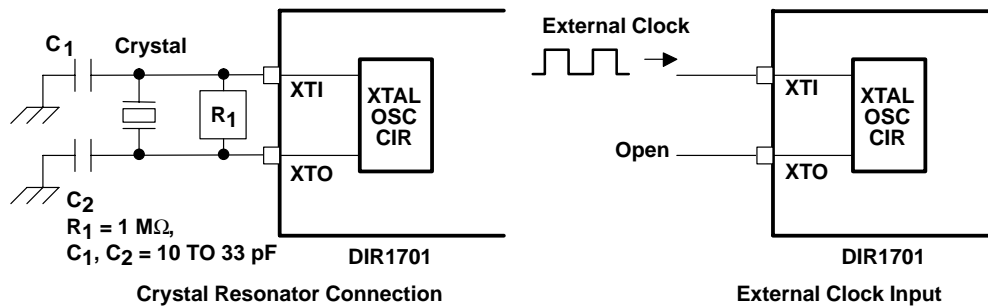
| PARAMETER                        |                              | TEST CONDITIONS                                 | MIN          | TYP                       | MAX          | UNIT               |     |
|----------------------------------|------------------------------|---|--------------|---------------------------|--------------|--------------------|-----|
| <b>DIGITAL INPUT/OUTPUT</b>      |                              |   |              |                           |              |                    |     |
| $V_{IH}^{(5)}$                   | Input logic level            |   | 2            |                           | 5.5          | VDC                |     |
| $V_{IL}^{(5)}$                   |                              |   |              |                           | 0.8          |                    |     |
| $V_{IH2}^{(6)}$                  |                              |   | $70\%V_{DD}$ |                           |              |                    |     |
| $V_{IL2}^{(6)}$                  |                              |   |              |                           | $30\%V_{DD}$ |                    |     |
| $V_{IH3}^{(7)}$                  |                              |   | $70\%V_{DD}$ |                           |              |                    | 5.5 |
| $V_{IL3}^{(7)}$                  |                              |   |              |                           | $30\%V_{DD}$ |                    |     |
| $V_{OH}^{(8)}$                   | Output logic level           | $I_O = 1\text{ mA}$                             | $V_{DD}-0.4$ |                           |              | VDC                |     |
| $V_{OL}^{(8)}$                   |                              | $I_O = -2\text{ mA}$                            |              |                           | 0.5          |                    |     |
| $V_{OH}^{(9)}$                   |                              | $I_O = 2\text{ mA}$                             | $V_{DD}-0.4$ |                           |              |                    |     |
| $V_{OL}^{(9)}$                   |                              | $I_O = -4\text{ mA}$                            |              |                           |              |                    | 0.5 |
| $I_{IH}^{(10)}$                  | Input leakage current        | $V_{IN} = V_{DD}$                               |              | 65                        | 100          | $\mu\text{A}$      |     |
| $I_{IL}^{(10)}$                  |                              | $V_{IN} = 0\text{ V}$                           | -10          |                           | 10           |                    |     |
| $I_{IH}^{(11)}$                  |                              | $V_{IN} = V_{DD}$                               | -10          |                           | 10           |                    |     |
| $I_{IL}^{(11)}$                  |                              | $V_{IN} = 0\text{ V}$                           | -100         | -65                       |              |                    |     |
| $I_{IH}^{(6)}$                   |                              | $V_{IN} = V_{DD}$                               | -10          |                           | 10           |                    |     |
| $I_{IL}^{(6)}$                   |                              | $V_{IN} = 0\text{ V}$                           | -10          |                           | 10           |                    |     |
| $f_s^{(12)}$                     | Input sampling frequency     |   | 32           |                           | 96           | kHz                |     |
| SCKO                             | System clock frequency       |   | 4.096        | 128/256/<br>384/512 $f_s$ | 49.152       | MHz                |     |
| $t_j$                            | SCKO clock jitter            |   |              | 80                        |              | ps RMS             |     |
|                                  | SCKO duty cycle              |   |              | 50%                       |              |                    |     |
|                                  | XTI clock accuracy           |   | -500         | See<br>Table 3            | 500          | ppm                |     |
| <b>S/PDIF INPUT</b>              |                              |   |              |                           |              |                    |     |
|                                  | Duty cycle                   | $V_{IN} = 1.5\text{ V}$ , $f_s = 96\text{ kHz}$ | 15%          |                           | 85%          |                    |     |
|                                  | Jitter                       | $V_{IN} = 1.5\text{ V}$                         |              |                           | 20           | ns p-p             |     |
| <b>POWER SUPPLY REQUIREMENTS</b> |                              |   |              |                           |              |                    |     |
| $V_{DD}$ , $V_{CC}$              | Voltage range                |   | 3            | 3.3                       | 3.6          | VDC                |     |
| $I_{CC}(V_{CC})$                 | Supply current (see Note 13) |   |              | 3.4                       | 4.7          | mA                 |     |
| $I_{DD}(V_{DD})$                 |                              |   |              | 26                        | 36           |                    |     |
| $P_D$                            | Power dissipation            |   |              | 100                       |              | mW                 |     |
| <b>POWER SUPPLY REQUIREMENTS</b> |                              |   |              |                           |              |                    |     |
|                                  | Operation temperature        |   | -25          |                           | 85           | $^\circ\text{C}$   |     |
| $\theta_{JA}$                    | Thermal resistance           | 28-pin SSOP                                     |              | 100                       |              | $^\circ\text{C/W}$ |     |

- NOTES: 5. TTL compatible, except pins 8, 20: XTI, DIN.  
6. Pin 8: XTI (CMOS logic level).  
7. Pin 20: DIN (CMOS logic level).  
8. Pins 1–3, 9, 17–18, 27: ADFLG, BRATE0, BRATE1, CKTRNS, EMFLG, BFRAME, UNLOCK.  
9. Pins 4, 10–12, 15–16: SCKO, LRCKO, BCKO, DOUT, CSBIT, URBIT.  
10. Pins 13–14, 19–20, 25–26, 28: SCF0, SCF1, BRSEL, DIN, FMT0, FMT1, CKSEL.  
11. Pin 21: RST  
12.  $f_s$  is defined as the incoming audio sampling frequency per channel.  
13. No load connected to SCKO, LRCKO, BCKO, DOUT, CSBIT, URBIT. Power supply current varies according to the system clock frequency.

**basic operation theory**

The DIR1701 has two PLLs, PLL1 and PLL2. The SpAct (Sampling Period Adaptive Controlled Tracking) system is a newly developed clock recovery architecture, giving very low jitter clock from S/PDIF data input. The DIR1701 requires a system clock input for operation of SpAct; internal PLL1 provides a 100 MHz execution clock. The system clock can be obtained by either connecting a suitable crystal resonator at the XTI/XTO pins or applying an external clock input at the XTI pin as shown in Figure 1. Internal PLL2 generates the system clock SCKO by using the output signal of the SpAct frequency estimator.

When the S/PDIF input signal ceases, SCKO holds the latest tracked frequency. Also, the DIR1701 indicates the unlocked state by a HIGH level output at the UNLOCK pin. When the S/PDIF signal restarts, the PLL will lock in around 1ms with very low jitter, using the SpAct estimator. Then the DIR1701 indicates the locked status by a LOW level output at the UNLOCK pin. In this status, the BRATE pins indicate the actual bit rate of the incoming S/PDIF signal.



**Figure 1. System Clock Connections**

**system clock output**

The primary function of the DIR1701 is to recover audio data and a low jitter clock from a digital audio transmission line. The clocks that can be generated are SCKO (128/256/384/512 f<sub>S</sub>, shown in Table 1), BCKO (64 f<sub>S</sub>), and LRCKO (1 f<sub>S</sub>). SCKO is the output of the voltage controlled oscillator (VCO) in an analog PLL. The PLL function consists of a VCO, phase and frequency detector, and an external second-order loop filter. The closed-loop transfer function, which specifies the PLL jitter attenuation characteristics, is shown in Figure 2.

The crystal frequency should be defined for internal PLL by connecting the BRSEL pin to one of the output pins BFRAME or CSBIT as shown in Table 2. A 12 MHz crystal resonator can be used for 128f<sub>S</sub> (CSBIT), 256f<sub>S</sub> (OPEN) and 384f<sub>S</sub> (BFRAME). And a 16 MHz crystal resonator is used for 512f<sub>S</sub> (BFRAME). The system clock frequency can be set by control data at SCF0, SCF1 pin (shown in Table 3); this data must be stable before reset is applied.

Table 4 shows the state of the system and the condition of audio clocks and flags. Required accuracy of system clock by either crystal resonator or external clock input is ±500 ppm.

**Table 1. Generated System Clock (SCKO) Frequencies**

| SAMPLING RATE | 128 f <sub>S</sub> | 256 f <sub>S</sub> | 384 f <sub>S</sub> | 512 f <sub>S</sub> |
|---------------|--------------------|--------------------|--------------------|--------------------|
| 32 kHz        | 4.096 MHz          | 8.192 MHz          | 12.288 MHz         | 16.384 MHz         |
| 44.1 kHz      | 5.6448 MHz         | 11.2896 MHz        | 16.9344 MHz        | 22.5792 MHz        |
| 48 kHz        | 6.144 MHz          | 12.288 MHz         | 18.432 MHz         | 24.576 MHz         |
| 88.2kHz       | 11.2896 MHz        | 22.5792 MHz        | 33.8688 MHz        | 45.1584 MHz        |
| 96 kHz        | 12.288 MHz         | 24.576 MHz         | 36.864 MHz         | 49.152 MHz         |

## system clock output (continued)

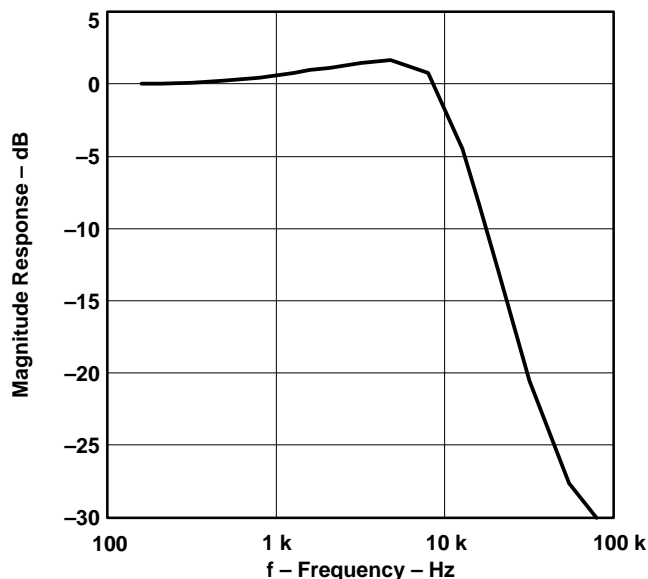


Figure 2. Jitter Attenuator Characteristics With Specified Loop Filter

Table 2. Selectable Crystal Oscillators

| SYSTEM CLOCK $f_S$ | CRYSTAL | BRSEL CONNECTED TO |
|--------------------|---------|--------------------|
| 128                | 12 MHz  | CSBIT              |
| 256                | 12 MHz  | OPEN or DGND       |
| 384                | 12 MHz  | BFRAME             |
| 512                | 16 MHz  | BFRAME             |

Table 3. System Clock Selection

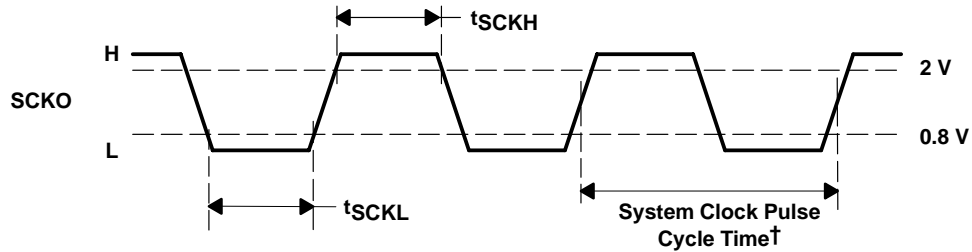
| SCF1 | SCF0 | SYSTEM CLOCK |
|------|------|--------------|
| LOW  | LOW  | 128 $f_S$    |
| LOW  | HIGH | 256 $f_S$    |
| HIGH | LOW  | 384 $f_S$    |
| HIGH | HIGH | 512 $f_S$    |

Table 4. System Clock and Data Output Operation

| CONDITIONS  | CLOCK AND DATA OUTPUTS |  |                                  |                                 |      |                   |        |                   |                   |
|-------------|------------------------|--|----------------------------------|---------------------------------|------|-------------------|--------|-------------------|-------------------|
|             | S/PDIF DATA            | SCKO   | BCKO                             | LRCKO                           | DOUT | BRATE             | UNLOCK | CS. UR BIT        | AD. EMFLG         |
| After RESET |                        | Unknown<br>(128, 256, 384, 512 $f_S$ )           | Unknown<br>(64 $f_S$ )           | Unknown<br>(1 $f_S$ )           | MUTE | LOW               | HIGH   | LOW               | LOW               |
| YES         |                        | PLL<br>(128, 256, 384, 512 $f_S$ )               | PLL<br>(64 $f_S$ )               | PLL<br>(1 $f_S$ )               | DATA | DETECT            | LOW    | DATA              | DATA              |
| NO          |                        | HOLD <sup>†</sup><br>(128, 256, 384, 512 $f_S$ ) | HOLD <sup>†</sup><br>(64 $f_S$ ) | HOLD <sup>†</sup><br>(1 $f_S$ ) | MUTE | HOLD <sup>†</sup> | HIGH   | HOLD <sup>†</sup> | HOLD <sup>†</sup> |

<sup>†</sup> Holds the latest tracked frequency.

**SCKO timing**



SCKO Clock Pulse Width High  $t_{SCKH}$  7 ns (min)  
 SCKO Clock Pulse Width Low  $t_{SCKL}$  7 ns (min)

†  $1/128 f_S$ ,  $1/256 f_S$ ,  $1/384 f_S$  or  $1/512 f_S$ .

**bit rate detection**

By using the SpAct frequency estimator (not the S/PDIF channel status bit), the DIR1701 detects automatically the sample rate of an incoming S/PDIF signal and indicates the frequency at the BRATE pins.

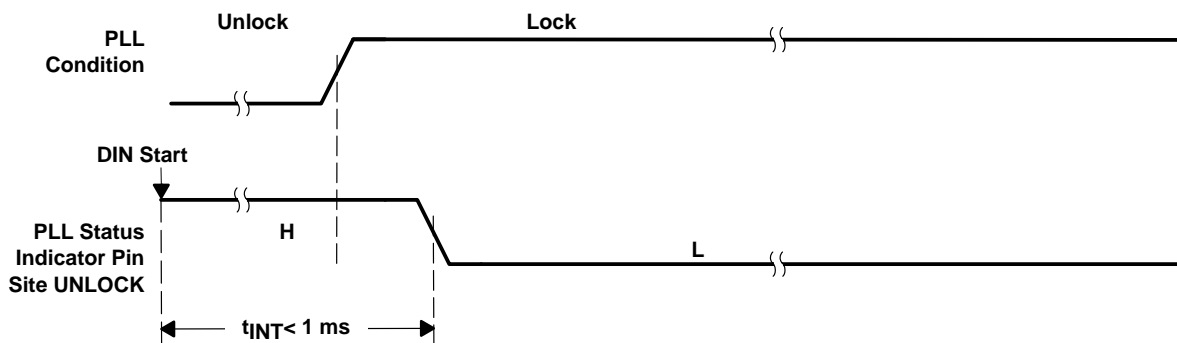
Table 5 lists the frequency ranges reported. Except for 88.2 and 96 kHz, these sample rates are the same as the channel status bit defined in the S/PDIF specifications. When the bit-rate is 88.2 or 96 kHz the indicator shows the same HL value. This state is not defined in the S/PDIF specifications.

**Table 5. Incoming Sample Frequency Bits**

| SAMPLING RATE | BRATE1 | BRATE0 |
|---------------|--------|--------|
| 32 kHz        | HIGH   | HIGH   |
| 44.1 kHz      | LOW    | LOW    |
| 48 kHz        | LOW    | HIGH   |
| 88.2 kHz      | HIGH   | LOW    |
| 96 kHz        | HIGH   | LOW    |

**timing specification for PLL operation**

**lock-up time**



**Figure 3. PLL Lock Up Timing**



### relation between audio-data-output timing and PLL condition indicator timing

When the analog PLL is still unlocked and the S/PDIF signal starts, after at least ten rising edges, the S/PDIF decoder can detect the incoming S/PDIF signal. The DOUT pin becomes LOW (MUTE) until the analog PLL locks. This MUTE period  $t_{INT}$  is less than 1 ms (the analog PLL lockup time is less than 0.5 ms). When the decoder detects that incoming S/PDIF signal has stopped, UNLOCK goes HIGH at the next LRCKO transition. SCKO keeps its frequency at the latest tracked bit rate.

When S/PDIF signal is not present after removal of reset, the frequency of the DIR1701 audio clocks (SCKO, BCKO, LRCKO) is not known.

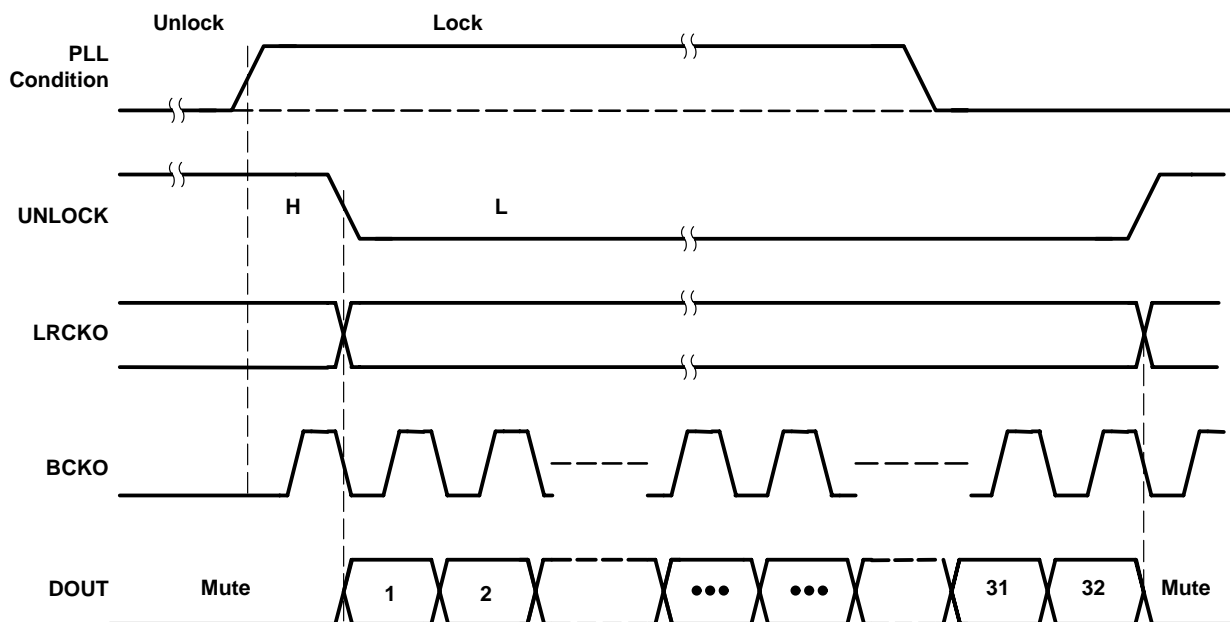


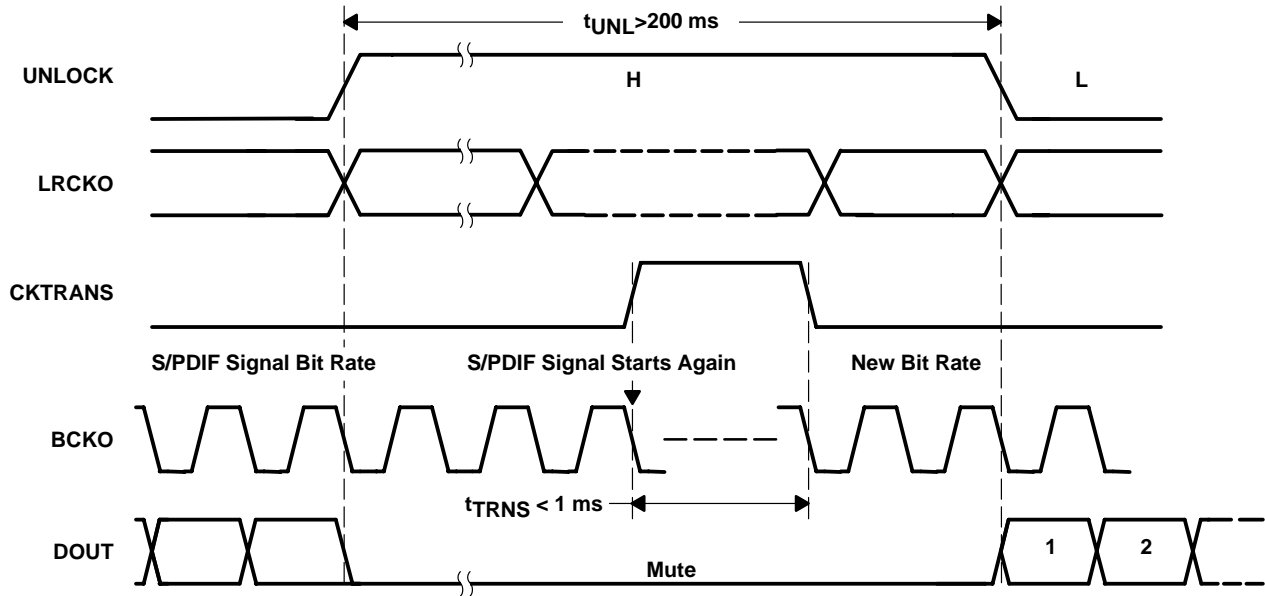
Figure 4. Relation Between Audio Data Output Timing and UNLOCK Flag Timing

**unlock flag minimum pulse width time**

**CASE-A when PLL is unlocked**

When the PLL is unlocked, the UNLOCK flag pin is HIGH and the audio data output DOUT becomes LOW (MUTE). The MUTE period,  $t_{UNL}$ , is at least 200 ms. In this period, SCKO, BCKO, and LRCKO frequency hold the latest tracked frequency.

If an S/PDIF signal is connected again in this unlock period, the bit rate is changed to the incoming signal frequency, after at least 1 ms (before the UNLOCK flag goes LOW). The CKTRNS pin indicates validity of SCKO. When CKTRNS is HIGH, the frequency of SCKO, BCKO, and LRCKO is in transition between states.



**Figure 5. UNLOCK Flag Minimum Pulse Width Time for PLL Unlocked**

## unlock flag minimum pulse width time (continued)

### CASE-B when parity error occurs

When a parity error occurs in one subframe interval, UNLOCK becomes HIGH during this sub-frame then returns LOW at the next arriving subframe.

During this subframe with parity error, the data output will hold the previous data of each channel.

#### CASE-B When Parity Error Occurs

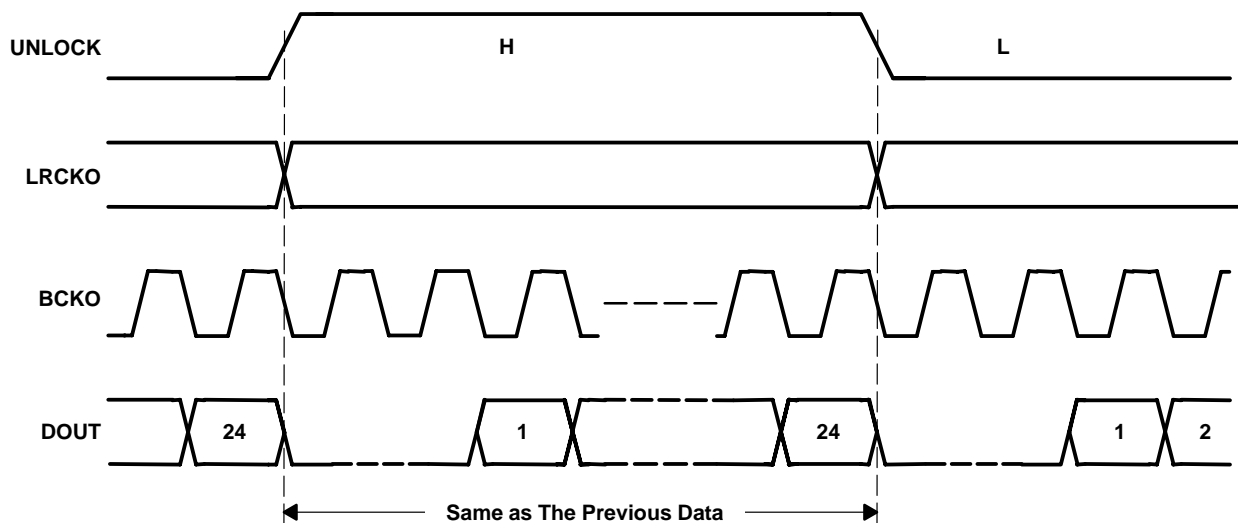


Figure 6. UNLOCK Timing for Parity Error

### PCM audio interface

The DIR1701 can produce 16-bit or 24-bit output data in standard format and 24-bit output data in IIS format.

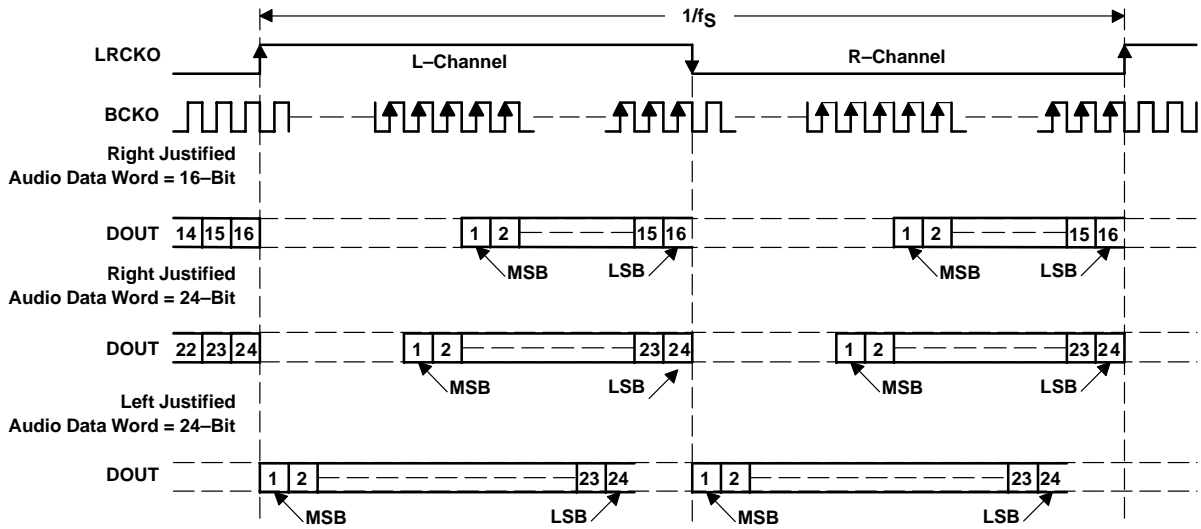
The PCM audio interface format of the DIR1701 is selected using the format pins FMT1, FMT0. Table 6 shows the FMT pin configuration.

Table 6. Audio Output Data Format Select

| FMT1 | FMT0 | AUDIO DATA FORMAT                 |
|------|------|-----------------------------------|
| LOW  | LOW  | 16 bit MSB first, Right justified |
| LOW  | HIGH | 24 bit MSB first, Right justified |
| HIGH | LOW  | 24 bit MSB first, Left justified  |
| HIGH | HIGH | 24 bit IIS                        |

PCM audio interface (continued)

Standard Data Format; L-Channel = HIGH, R-Channel = LOW



IIS Data Format; L-Channel = LOW, R-Channel = HIGH

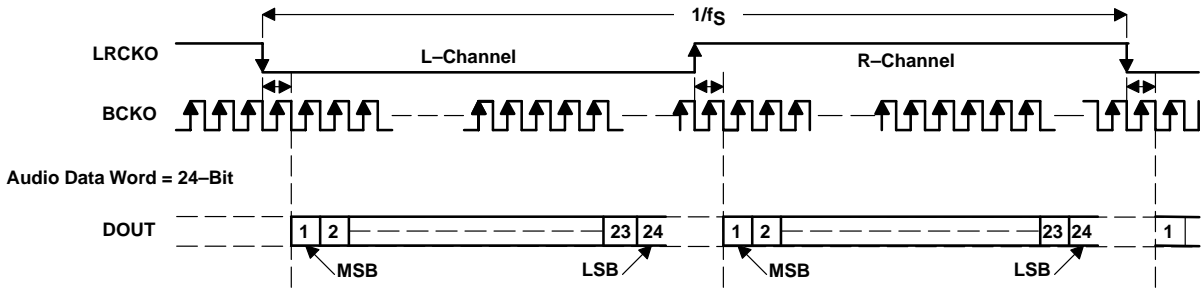
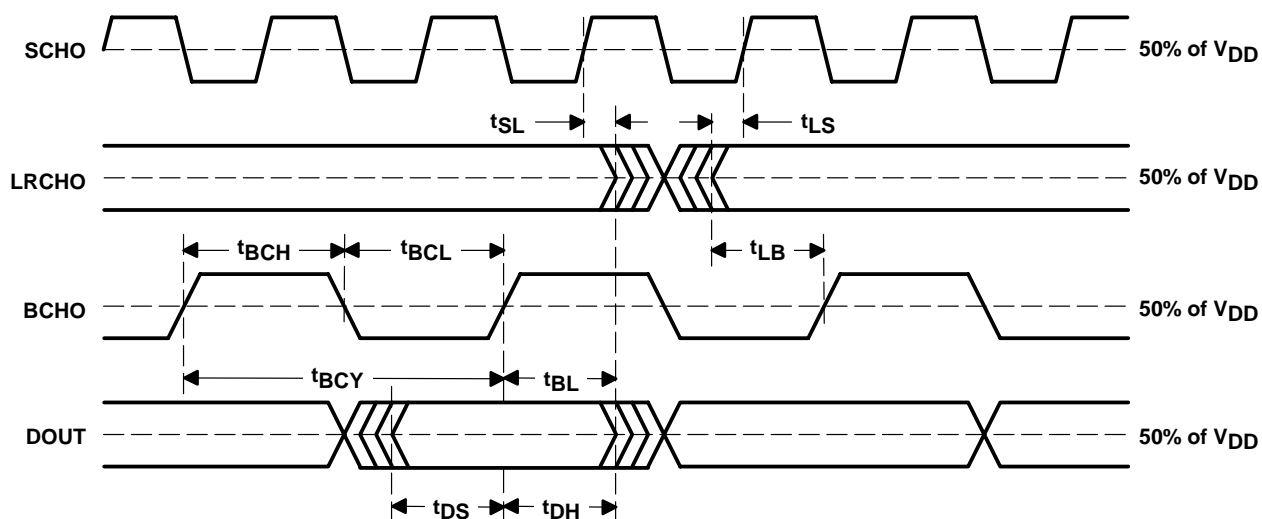


Figure 7. Audio Data Output Format

## PCM audio interface (continued)



| PARAMETERS |                                | MIN | MAX      | UNITS |
|------------|--------------------------------|-----|----------|-------|
| $t_{SL}$   | SCKO rising edge to LRCKO edge | 11  |          | ns    |
| $t_{LS}$   | LRCKO edge to SCKO rising edge | 5   |          | ns    |
| $t_{BCY}$  | BCKO pulse cycle time          |     | 64 $f_S$ |       |
| $t_{BCL}$  | BCKO pulse width low           | 78  |          | ns    |
| $t_{BCH}$  | BCKO pulse width high          | 78  |          | ns    |
| $t_{BL}$   | BCKO rising edge to LRCKO edge | 78  |          | ns    |
| $t_{LB}$   | LRCKO edge to BCKO rising edge | 78  |          | ns    |
| $t_{DS}$   | DOUT setup time                | 78  |          | ns    |
| $t_{DH}$   | DOUT hold time                 | 78  |          | ns    |

Figure 8. Audio Data Output Timing

## dedicated output pins for both professional and consumer applications

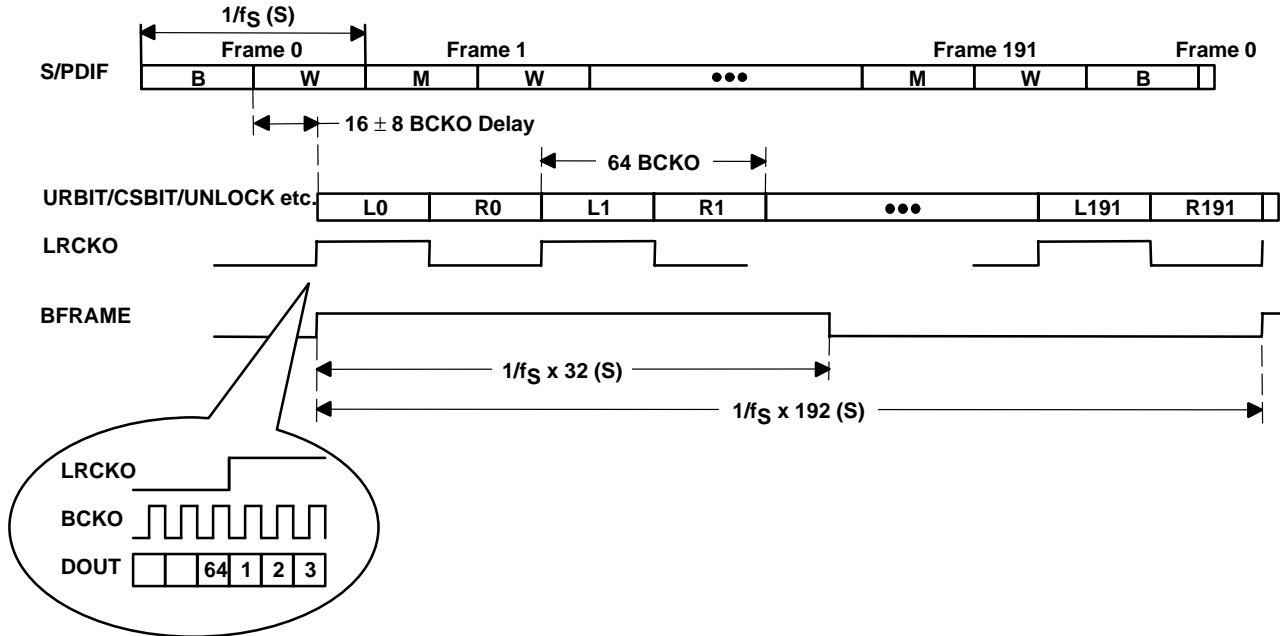
The DIR1701 has parallel output pins for both professional and consumer applications. In professional mode de-emphasis flag EMFLG indicates a 50/15- $\mu$ s time constant pre-emphasis. Professional mode is set when Bit 0 of CSBIT Byte 0 is HIGH. When Bits 2 to 4 of CSBIT Byte 0 is 110, the EMFLG becomes HIGH. In other cases, EMFLG is LOW. Audio/non-audio flag ADFLG indicates S/PDIF data mode, i.e., Bit 1 of CSBIT Byte 0. When ADFLG is LOW, S/PDIF data includes PCM audio signal. In other cases, ADFLG is HIGH.

In consumer mode EMFLG indicates 2-channel audio with a 50/15- $\mu$ s time constant pre-emphasis. Consumer mode is set when Bit 0 of CSBIT Byte 0 is LOW. When Bits 3 to 5 of CSBIT Byte 0 is 100, EMFLG becomes HIGH. In other cases, EMFLG is LOW. The ADFLG signal indicates whether S/PDIF includes digital data, such as AC-3 or not. When Bit 1 of CSBIT Byte 0 is HIGH, the incoming S/PDIF includes non-audio signal. In other cases, ADFLG is LOW.

These dedicated output pins are checked for only L-ch CS information. The DIR1701 does not support CRC check function in professional mode. As for other flags, CS bit and user-bit for professional and consumer applications, are directly supplied by serial mode at CSBIT (pin 15) and URBIT (pin 16). These pins indicate L-ch and R-ch information sequentially.

**dedicated output pins for both professional and consumer applications (continued)**

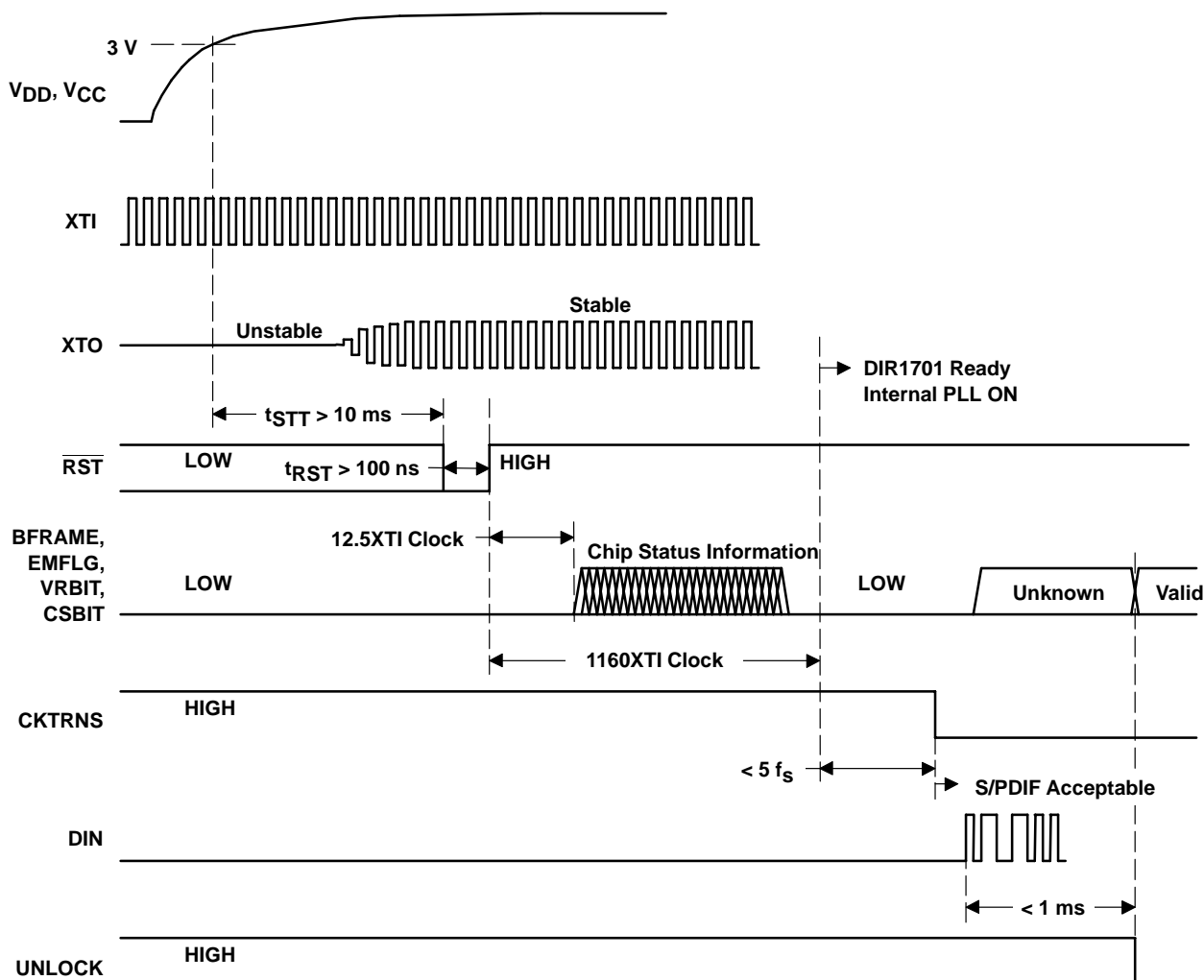
Audio data and clock timing are described below. The serial output data starts after  $16 \pm 8$  BCKO clocks from when the corresponding subframe arrives. When B subframe arrives, BFRAME pin becomes HIGH during  $1/f_S \times 32$  (s), then BFRAME returns to LOW after 32 frames.



**Figure 9. Timing Chart for Audio Data and Channel Status**

## reset sequence

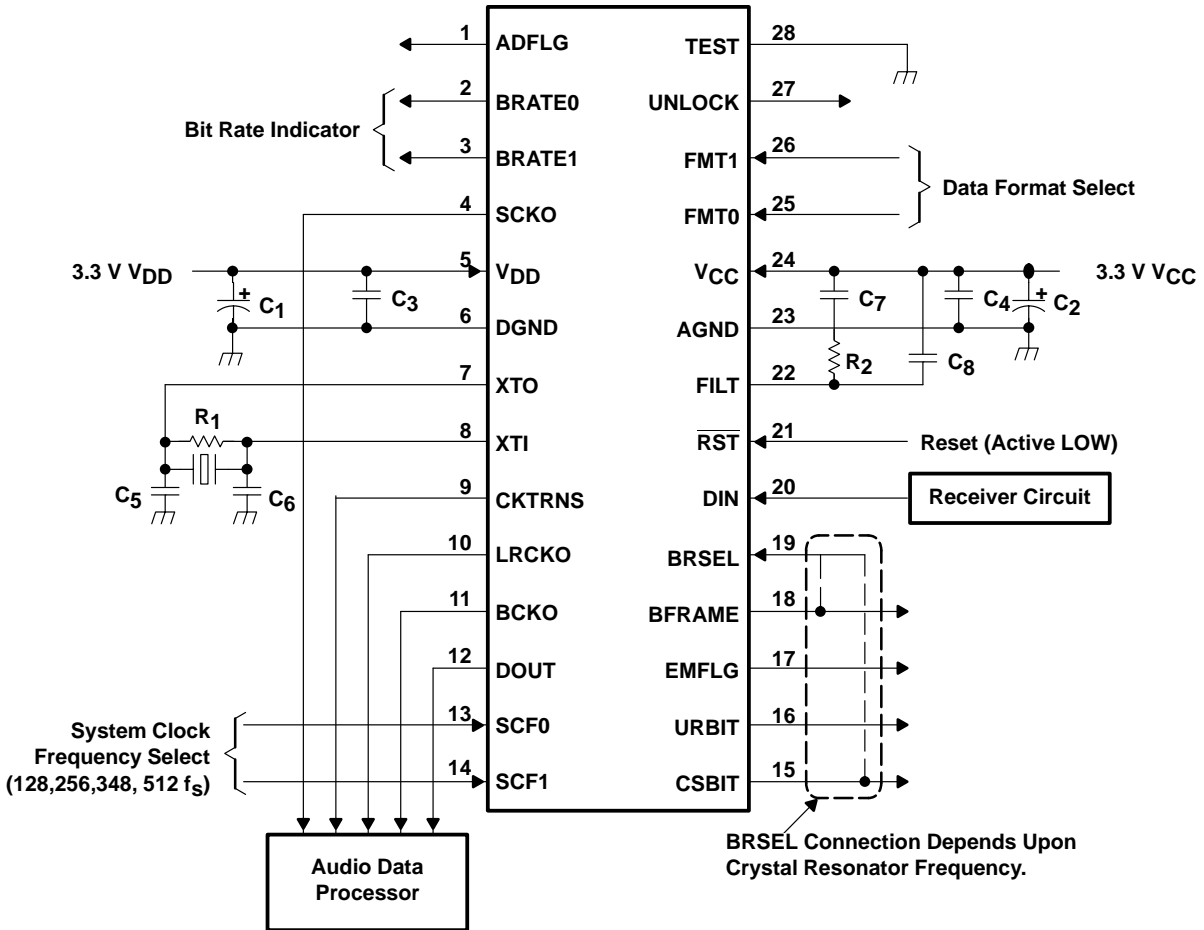
The DIR1701 requires external reset operation after power on. Figure 10 shows the reset sequence after power on. The DIR1701 is ready for receiving S/PDIF signal when the internal reset sequence has finished and CKTRNS goes to LOW. BFRAME, EMFLG, URBIT and CSBIT pins are used for configuration during the period from the rising edge of  $\overline{\text{RST}}$  to the falling edge of CKTRNS. S/PDIF signal is accepted after CKTRNS goes to LOW. The minimum pulse width of  $\overline{\text{RST}}$ ,  $t_{\text{RST}}$  is 100 ns. The  $\overline{\text{RST}}$  delay after the power supply reaches 3 V should be at least 10 ms. All of the output pins except CKTRNS and UNLOCK are LOW during  $\overline{\text{RST}}$  LOW.



NOTE: SCF0 and SCF1 should be settled during  $\overline{\text{RST}}$  assertion. The change of SCF0 and SCF1 is not permitted during normal operation. When the change is needed, the reset sequence must be started by asserting  $\overline{\text{RST}}$  again.

Figure 10. After Power ON

typical circuit connection

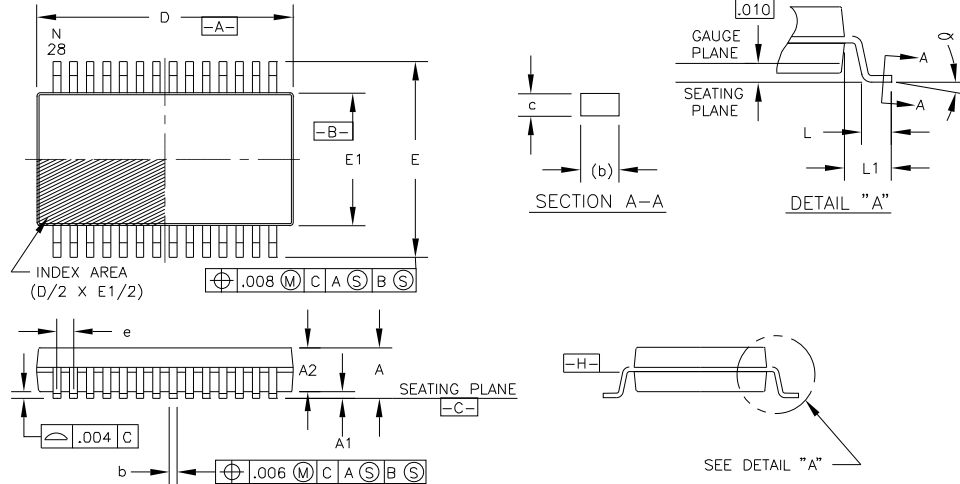


- C<sub>1</sub> , C<sub>2</sub>: Bypass Capacitor, 1 μF to 10 μF
- C<sub>3</sub> , C<sub>4</sub>: Bypass Capacitor, 0.01 μF to 0.1 μF
- C<sub>5</sub> , C<sub>6</sub>: OSC Capacitor, 10 to 33 pF
- C<sub>7</sub>: Loop Filter Capacitor, 0.022 μF
- C<sub>8</sub>: Ripple Capacitor, 0.0022 μF
- R<sub>1</sub>: OSC Resistor, 1 MΩ
- R<sub>2</sub>: Loop Filter Resistor, 6.8 kΩ

- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-150



Package Number 324 - 28-Lead Plastic SSOP



| DIM | INCHES |       | MILLIMETERS |       | N   | E | DIM | INCHES |      | MILLIMETERS |      | N | E |
|-----|--------|-------|-------------|-------|-----|---|-----|--------|------|-------------|------|---|---|
|     | MIN.   | MAX.  | MIN.        | MAX.  |     |   |     | MIN.   | MAX. | MIN.        | MAX. |   |   |
| A   | --     | .079  | --          | 2.00  |     |   |     |        |      |             |      |   |   |
| A1  | .002   | --    | 0.05        | --    |     |   |     |        |      |             |      |   |   |
| A2  | .065   | .073  | 1.65        | 1.85  |     |   |     |        |      |             |      |   |   |
| b   | .009   | .015  | 0.22        | 0.38  | 3,7 |   |     |        |      |             |      |   |   |
| c   | .004   | .010  | 0.09        | 0.25  | 7   |   |     |        |      |             |      |   |   |
| D   | .390   | .413  | 9.90        | 10.50 | 2   |   |     |        |      |             |      |   |   |
| E   | .291   | .323  | 7.40        | 8.20  |     |   |     |        |      |             |      |   |   |
| E1  | .196   | .220  | 5.00        | 5.60  | 2   |   |     |        |      |             |      |   |   |
| e   | .0256  | BASIC | 0.65        | BASIC |     |   |     |        |      |             |      |   |   |
| L   | .022   | .037  | 0.55        | 0.95  | 4   |   |     |        |      |             |      |   |   |
| L1  | .049   | REF   | 1.25        | REF   |     |   |     |        |      |             |      |   |   |
| N   | 28     |       | 28          |       | 5   |   |     |        |      |             |      |   |   |
| θ   | 0°     | 8°    | 0°          | 8°    |     |   |     |        |      |             |      |   |   |

NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5-1982.
2. D AND E1 DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS, BUT DO INCLUDE MOLD MISMATCH AND ARE MEASURED AT DATUM PLANE  $\square$ -H $\square$  MOLD PARTING LINE. MOLD FLASH OR PROTRUSION SHALL NOT EXCEED .008 INCH PER SIDE.
3. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE .005 INCH TOTAL IN EXCESS OF b DIMENSION AT MAXIMUM MATERIAL CONDITION.

DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION b BY MORE THAN .003 INCH AT LEAST MATERIAL CONDITION.

4. DIMENSION L TO BE DETERMINED AT SEATING PLANE-DATUM C.
5. N IS THE NUMBER OF TERMINAL POSITIONS.
6. A VISUAL INDEX FEATURE MUST BE LOCATED WITHIN THE CROSS-HATCHED AREA.
7. SECTION A-A DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN .004 AND .010 INCH FROM THE LEAD TIP.

PACKAGE NUMBER: ZZ324      REV.: C  
JEDEC NUMBER: MO-150



PACKAGE DRAWING

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