

# Genlocking Sync Generator with Digital Audio Clock for NTSC, PAL & VGA

## GENERAL DESCRIPTION

The ML6430/ML6431 are multi-standard single-chip BiCMOS video Genlock ICs for NTSC, PAL and VGA. They are designed to provide a stable clock from an analog video signal, and to provide timing pulses for clamping, decoding, blanking and processing video signals. The ML6430/ML6431 handle VCR glitches and variations created by head switching, tape dropouts, missing sync pulses, freeze frames, high speed playback and camcorder gyro errors. The ML6430/ML6431 are designed for high noise immunity, insensitivity to varying signal amplitudes, overmodulated color carriers, and sync glitches. Advanced analog and digital clock synthesis techniques provide multi-standard and non-standard operation from a single crystal or external asynchronous clock source. Pin selectable preset modes allow operation for most video standards in simple stand-alone mode without the necessity of using the serial bus. For more demanding applications, a two wire serial control bus is available for full control of all of the ML6430/ML6431 features.

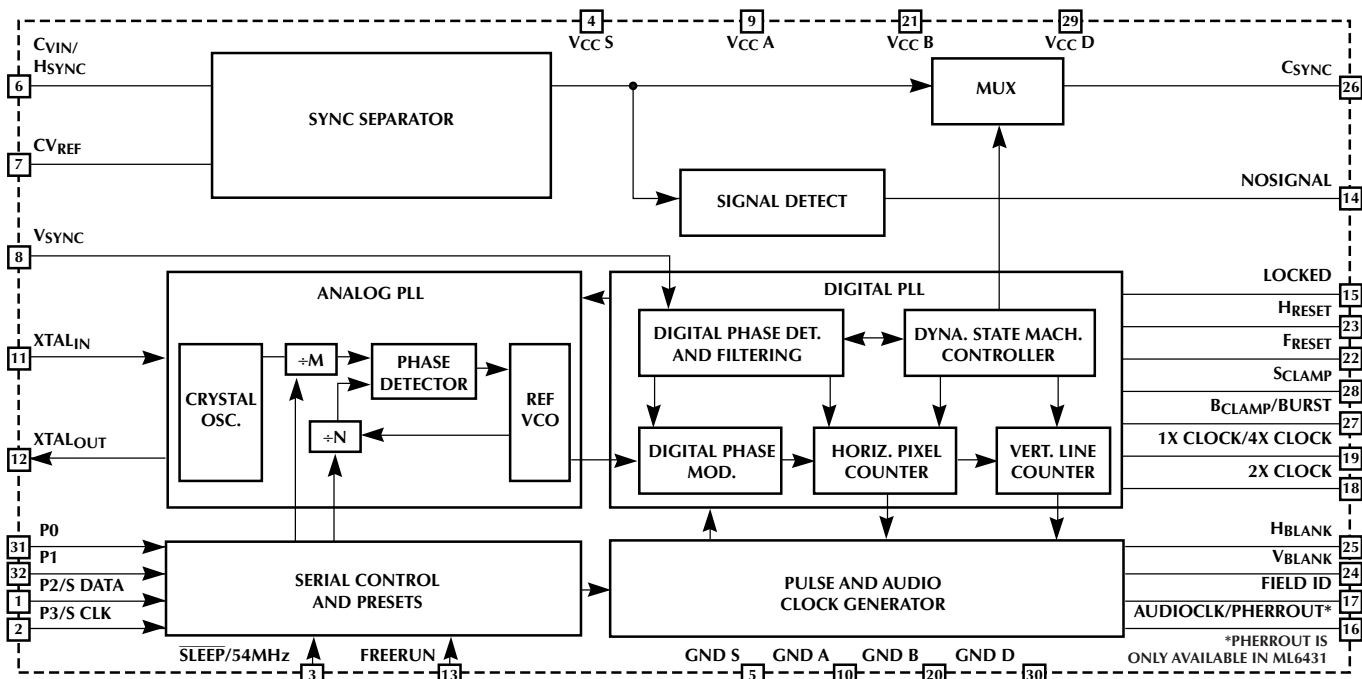
The ML6430/ML6431 are ideal for clock generation in MPEG encoders, high performance display timing, and video editing.

## FEATURES

- Line locked scalable horizontal pixel clock for an arbitrary number of pixels per line
- Standard frequencies of 12.27, 13.5, 14.75MHz, or 4Fsc
- 4x/2x or 2x/1x clock outputs (54 and 27MHz, or 27 and 13.5MHz) and VGA clocks
- Audio clocks: 32, 44.1, or 48kHz, locked to video
- On-chip sync separator, VCO and pulse generator
- Low clock jitter: Short Term: <200ps rms locked
- Line to line: <600ps rms (2.2ns peak-to-peak) locked
- Fast recovery from VCR head switch, stable for fast shuttle speeds and pause
- Single crystal or external frequency source
- PAL, NTSC or VGA operation
- 2 wire serial control bus, or selectable presets for stand alone operation
- RS170A compatible

**\* This Part Is End Of Life As Of August 1, 2000**

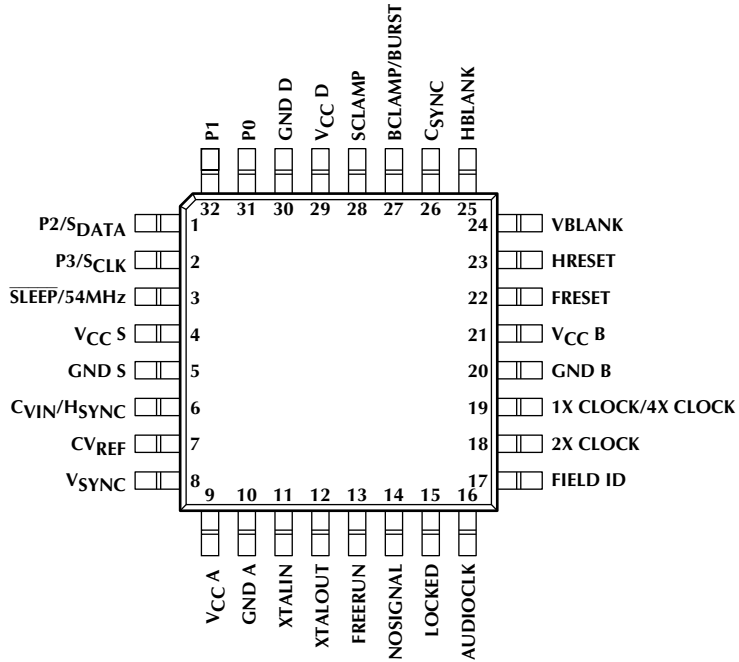
## BLOCK DIAGRAM



# ML6430/ML6431

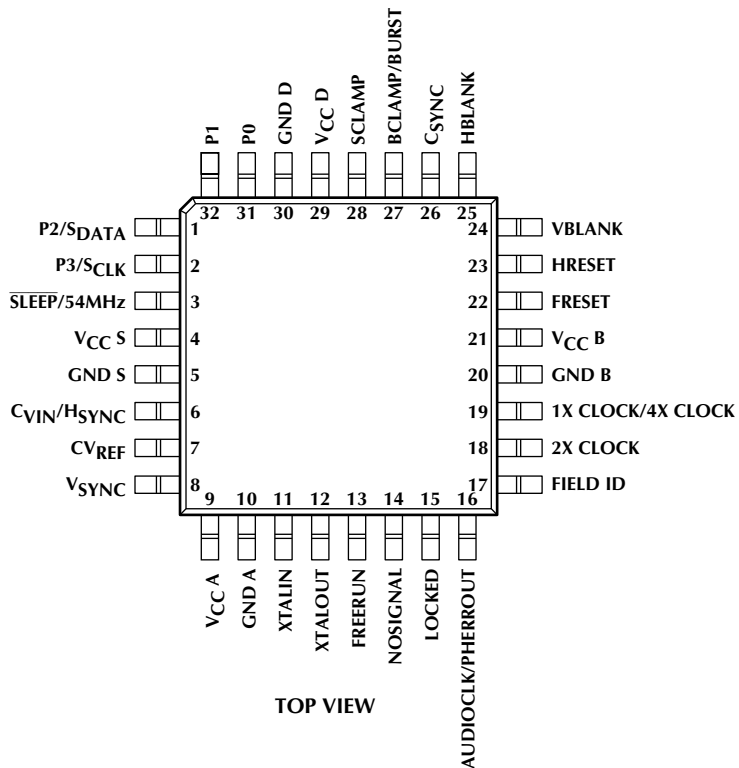
## PIN CONFIGURATION

**ML6430**  
32-Pin TQFP (H32-7)



TOP VIEW

**ML6431**  
32-Pin TQFP (H32-7)



TOP VIEW

**PIN DESCRIPTION** (NOTE: ML6430 and ML6431 pin functions are identical *except* for pin 16. See below)

| PIN | NAME                                | FUNCTION  | PIN | NAME                        | FUNCTION  |
|-----|-------------------------------------|---|-----|-----------------------------|---|
| 1   | P2/S <sub>DATA</sub>                | This is a dual function pin. If presets are enabled, refer to Table 7. If presets are disabled, serial bus data input.  | 13  | FREERUN                     | Forces the PLL to run at a selected standard without syncing to a video signal. Accuracy is $\pm 20$ ppm in FREERUN with ideal crystal, otherwise locked to video source  |
| 2   | P3/S <sub>CLK</sub>                 | This is a dual function pin. If presets are enabled, refer to Table 7. If presets are disabled, serial bus clock input.   | 14  | NOSIGNAL                    | Indicates video signal activity has not been detected at the composite input. If NOSIGNAL = low, this condition does not imply that lock has been established. The NOSIGNAL pin can be tied to FREERUN to create a local loop in which the genlock will not try to lock until a signal is detected at the input.                              |
| 3   | $\overline{\text{SLEEP}}$ /54MHz    | Hardware sleep mode: when low, disables entire chip for ultra-low power dissipation. Sleep mode can also be enabled/disabled via serial bus (Register 8). 54MHz is a clock input. This can be any 4X clock up to 70MHz used for pulse generation.   | 15  | LOCKED                      | Indicates when digital PLL is locked to incoming video signal.  |
| 4   | V <sub>CC S</sub>                   | Analog supply for sync separator.   | 16  | (ML6430) AUDIOCLK           | Digital audio clock output. Programmable for 32kHz, 44.1kHz or 48kHz output.  |
| 5   | GND S                               | Analog ground for sync separator.   | 16  | (ML6431) AUDIOCLK/PHERRROUT | This is a dual mode pin. Pin is selected via serial bus (Register 7). AUDIOCLK is an audio clock signal (see Table 9). PHERRROUT indicates whether incoming HSYNC is ahead or behind output HSYNC.  |
| 6   | CV <sub>IN</sub> /H <sub>SYNC</sub> | Composite video input; video input in typical composite video applications, or Y input for YUV applications, or G input for RGB applications with sync on green. For typical VGA or other high performance display applications, this input may be supplied with a TTL level H <sub>SYNC</sub> signal and the vertical sync input supplied with a TTL level V <sub>SYNC</sub> signal. | 17  | FIELD ID                    | Field Flag: Odd = 1, Even = 0   |
| 7   | CV <sub>REF</sub>                   | Reference voltage for internal sync slicer. The external capacitor is driven by a charge pump to follow the sync tip.   | 18  | 2X CLOCK                    | 2X oversampled PIXEL CLOCK & Output of Digital PLL. Nominal frequency of 27MHz  |
| 8   | V <sub>SYNC</sub>                   | Vertical input for non-composite sources. This input may be supplied with a TTL level V <sub>SYNC</sub> signal. For composite inputs this pin is tied high or low.  | 19  | 1X CLOCK/4X CLOCK           | 1X pixel clock. Nominal frequency of 13.5MHz or 54MHz $\pm 20$ ppm in FREERUN with ideal crystal, otherwise locked to video source. PAL 4X CLOCK not available (no 4x4.4336MHz clock).  |
| 9   | V <sub>CC A</sub>                   | Analog supply pin for analog PLL.   | 20  | GND B                       | Digital ground for output driver buffers.   |
| 10  | GND A                               | Analog ground for analog PLL.   | 21  | V <sub>CC B</sub>           | Digital supply for output driver buffers.   |
| 11  | XTAL <sub>IN</sub>                  | Crystal may be parallel tuned 3.58 MHz or 4.43MHz, or may be driven by an external oscillator at these frequencies, or at 4x these frequencies.   | 22  | F <sub>RESET</sub>          | Frame reset; active low for one half line at the high to low transition of field ID. In NTSC mode, FRESET goes low on the high-to-low transition on the Field ID pin and at the beginning of line 1 (see Figure 2). In PAL mode, FRESET goes low on the high-to-low transition on the Field ID pin and at the end of line 310 (see Figure 3). |
| 12  | XTAL <sub>OUT</sub>                 | Crystal drive pin. No connect if using external oscillator or clock.  |     |                             |   |

# ML6430/ML6431

## PIN DESCRIPTION (Continued)

| PIN | NAME                      | FUNCTION   | PIN | NAME               | FUNCTION  |
|-----|---------------------------|--|-----|--------------------|---|
| 23  | H <sub>RESET</sub>        | Horizontal reset; active low for one half pixel.   | 28  | S <sub>CLAMP</sub> | Sync clamp pulse occurs just after leading edge of sync. Duration is typically less than 50% of sync pulse to avoid problems with equalizers in the vertical interval, active high. |
| 24  | V <sub>BLANK</sub>        | Vertical blanking, active low  | 29  | V <sub>CC D</sub>  | Digital supply pin for digital PLL.   |
| 25  | H <sub>BLANK</sub>        | Horizontal blanking, active low  | 30  | GND D              | Digital ground pin for digital PLL.   |
| 26  | C <sub>SYNC</sub>         | Composite sync output. May be either the raw output of sync slicer, or regenerated signal from internal pulse generators. If raw slicer output is selected, then signals disappear when input signal disappears. If regenerated output is selected, then signal is always present regardless of input conditions. Preset modes produce regenerated sync. | 31  | P0                 | This is a three-state pin: low means serial bus is enabled, high or unconnected (high Z) means presets are active. Refer to Table 7.  |
| 27  | B <sub>CLAMP</sub> /BURST | This is a dual mode pin. User may select either a back porch clamp pulse or a burst gate pulse via the serial control bus. Preset is B <sub>CLAMP</sub> pulse.   | 32  | P1                 | This is a three state pin. Refer to Table 7. If presets are disabled pin is ignored.  |

**ABSOLUTE MAXIMUM RATINGS**

Absolute maximum ratings are those values beyond which the device could be permanently damaged. Absolute maximum ratings are stress ratings only and functional device operation is not implied.

DC Supply Voltage ( $V_{CC A}$  &  $V_{CC D}$ ) ..... -0.3V to 7V  
 Analog & Digital Inputs/Outputs ... -0.3V to  $V_{CC A} + 0.3V$   
 Input current per pin .....  $\pm 25mA$   
 Storage Temperature ..... -65°C to 150°C  
 Junction Temperature ..... 125°C

**OPERATING CONDITIONS**

Supply Range ..... 4.5V to 5.5V  
 Temperature Range ..... 0°C to 70°C  
 Thermal Resistance ..... 80°C/W

**ELECTRICAL CHARACTERISTICS**

Unless otherwise specified,  $V_{CC} = 4.5$  to 5.5V and  $T_A = 0^\circ$  to 70°C,  $C_{IN} = 0.1\mu F$ ,  $C_{REF} = 0.1\mu F$  (Note 1).

| PARAMETER  | CONDITIONS                  | MIN            | TYP | MAX      | UNITS   |
|--|-----------------------------|----------------|-----|----------|---------|
| <b>SUPPLY</b>  |                             |                |     |          |         |
| Supply Current (Analog and Digital)                              |                             |                | 80  | 120      | mA      |
| Analog Supply Current  | $V_{CC A} = V_{CC D} = 4.5$ |                | 35  |          | mA      |
| Digital Supply Current   | Max programmed clock rates  |                | 45  |          | mA      |
| <b>DIGITAL INPUTS</b>  |                             |                |     |          |         |
| Low Level Input Voltage  |                             | 0              |     | 0.8      | V       |
| High Level Input Voltage   |                             | $V_{CC} - 0.8$ |     | $V_{CC}$ | V       |
| Low Level Input Current  | $V_{IN} = 0V + 0.1V$        |                |     | 1.0      | $\mu A$ |
| High Level Input Current   | $V_{IN} = V_{CC D} - 0.1V$  |                |     | 1.0      | $\mu A$ |
| Input Capacitance  |                             |                | 2   |          | pF      |
| <b>TTL INPUTS (<math>H_{SYNC}</math>, <math>V_{SYNC}</math>)</b> |                             |                |     |          |         |
| $V_{IL}$ Input Low Voltage                                       |                             |                |     | 0.8      | V       |
| $V_{IH}$ Input High Voltage                                      |                             | 2.0            |     |          | V       |
| <b>THREE STATE DIGITAL INPUTS</b>                                |                             |                |     |          |         |
| Low Level Input Voltage  |                             | 0              |     | 0.8      | V       |
| High Level Input Voltage   |                             | $V_{CC} - 0.8$ |     |          | V       |
| Low Level Input Current  | $V_{IN} = 0V$               |                | 50  | 150      | $\mu A$ |
| High Level Input Current   | $V_{IN} = V_{CC D}$         |                | 50  | 150      | $\mu A$ |
| Input Capacitance  |                             |                | 2   |          | pF      |
| Mid Level Input Voltage with 5V Supply                           |                             | 2              |     | 3        | V       |
| <b>DIGITAL OUTPUTS</b>   |                             |                |     |          |         |
| Low Level Output Voltage   |                             | 0              |     | 0.5      | V       |
| High Level Output Voltage  |                             | $V_{CC} - 0.5$ |     |          | V       |
| $C_{LOAD}$ : Output Capacitance                                  |                             |                | 50  |          | pF      |
| Output Disable Leakage   |                             |                |     | 10       | $\mu A$ |

# ML6430/ML6431

## GENLOCK PERFORMANCE SPECIFICATIONS

Unless otherwise noted,  $V_{IN} = 1 V_{PP}$  NTSC test signal for composite inputs, or 100% color bars for component (Note 1). See Figure 1 for parameter measurement definition

| PARAMETER              | CONDITIONS                     | MIN | TYP | MAX | UNITS   |
|------------------------|--------------------------------|-----|-----|-----|---------|
| <b>SYNC SEPARATION</b> |                                |     |     |     |         |
| Min Sync Amplitude     |                                | 135 |     |     | mV      |
| Max Video Amplitude    |                                |     |     | 3   | V       |
| Clamp timing error     | NTC7 AC bounce signal (Note 2) |     |     | 10  | ns      |
| Clamp Recovery Time    | NTC7 DC bounce signal (Note 3) |     |     | 16  | $\mu$ s |

### CLOCK RECOVERY

|   |  |    |     |     |       |
|---|--|----|-----|-----|-------|
| Short Term Output Jitter Rejection              | Input jitter = 50ns RMS                        |    | -15 |     | dB    |
| RMS Residual Output Clock Jitter                | Input jitter <1ns RMS                          |    | 600 |     | ps    |
| Peak to Peak ( $6\sigma$ ), Line to Line Jitter | Input Jitter < 1ns                             |    | 2.0 | 2.2 | ns    |
| Head Switch Recovery Time to 1ns Error          | 5 $\mu$ s step H change on or before line 1    |    | 4   |     | lines |
| Step Frequency Recovery Time to 1ns Error       | 1% step H frequency change on or before line 1 |    | 12  | 15  | ms    |
| Missing Sync Sensitivity                        | (Note 4)                                       |    | 1.0 |     | ns    |
| Sync Glitch Sensitivity                         | (Note 5)                                       |    | 1.0 |     | ns    |
| 4X Clock Duty Cycle                             | $C_{LOAD} = 50pF, f_{CLK4X} < 60MHz$           | 40 |     | 60  | %     |
| 2X Clock Duty Cycle                             | $C_{LOAD} = 50pF, f_{CLK2X} < 30MHz$           | 48 |     | 52  | %     |
| 1X Clock Duty Cycle                             | $C_{LOAD} = 50pF, f_{CLK1X} < 15MHz$           | 48 |     | 52  | %     |
| Clock Skew — 1X to 2X                           | $C_{LOAD} = 50pF, f_{CLK1X} < 15MHz$           |    |     | 6   | ns    |
| Pulse Output Rise Time                          | $C_{LOAD} = 50pF$                              | 2  |     | 10  | ns    |
| Pulse Output Fall Time                          | $C_{LOAD} = 50pF$                              | 2  |     | 10  | ns    |
| Pulse Output Setup Time                         | $C_{LOAD} = 50pF$                              | 20 |     |     | ns    |
| Pulse Output Hold Time                          | $C_{LOAD} = 50pF$                              | 20 |     |     | ns    |

### SERIAL BUS

| PARAMETER                          | CONDITIONS          | MIN            | TYP | MAX      | UNITS     |
|------------------------------------|---------------------|----------------|-----|----------|-----------|
| <b>INPUT</b>                       |                     |                |     |          |           |
| Low Level Input Voltage            |                     | 0              |     | 0.8      | V         |
| High Level Input Voltage           |                     | $V_{CC} - 0.8$ |     | $V_{CC}$ | V         |
| Low Level Input Current            | $V_{IN} = 0V$       |                |     | 1.0      | $\mu$ A   |
| High Level Input Current           | $V_{IN} = V_{CC} D$ |                |     | 1.0      | $\mu$ A   |
| Input Impedance $f_{CLK} = 100kHz$ |                     |                | 1   |          | $M\Omega$ |
| Input Capacitance ( $C_{IN}$ )     |                     |                | 2   |          | pF        |

### SYSTEM TIMING

|                                       |                              |     |    |     |     |
|---------------------------------------|------------------------------|-----|----|-----|-----|
| $S_{CLK}$ Frequency ( $f_{CLOCK}$ )   |                              |     |    | 100 | kHz |
| Input Hysteresis ( $V_{HYS}$ )        |                              | 0.2 |    |     | V   |
| Spike Suppression ( $t_{SPIKE}$ )     | Max length for zero response |     | 50 |     | ns  |
| Power Setup Time to Valid Data Inputs | VCC Settled to Within 1%     | 10  |    |     | ms  |

## SERIAL BUS LOGIC (Continued)

| PARAMETER  | CONDITIONS         | MIN | TYP | MAX | UNITS |
|--|--------------------|-----|-----|-----|-------|
| <b>SYSTEM TIMING (Continued)</b>                                       |                    |     |     |     |       |
| Wait Time From STOP to START On S <sub>DATA</sub> (t <sub>WAIT</sub> ) |                    |     | 1.3 |     | μs    |
| Hold Time for START On S <sub>DATA</sub> (t <sub>HD/START</sub> )      |                    |     | 0.6 |     | μs    |
| Setup Time for START On S <sub>DATA</sub> (t <sub>SU/START</sub> )     |                    |     | 0.6 |     | μs    |
| Min LOW Time On S <sub>CLK</sub> (t <sub>LOW</sub> )                   |                    | 1.3 |     |     | μs    |
| Min HIGH Time On S <sub>CLK</sub> (t <sub>HI</sub> )                   |                    | 0.6 |     |     | μs    |
| Hold Time On S <sub>DATA</sub> (t <sub>HD/DATA</sub> )                 |                    |     | 5.0 |     | μs    |
| Setup Time On (t <sub>SU/DATA</sub> )                                  | Fast mode (Note 2) | 100 |     |     | ns    |
|  | Slow mode (Note 2) | 250 |     |     | ns    |
| Rise Time for S <sub>CLK</sub> & S <sub>DATA</sub> (t <sub>LH</sub> )  |                    |     | 30  | 300 | ns    |
| Fall Time for S <sub>CLK</sub> & S <sub>DATA</sub> (t <sub>HL</sub> )  |                    |     | 30  | 300 | ns    |
| Setup Time for STOP On S <sub>DATA</sub> (t <sub>SU/STOP</sub> )       |                    |     | 0.6 |     | μs    |

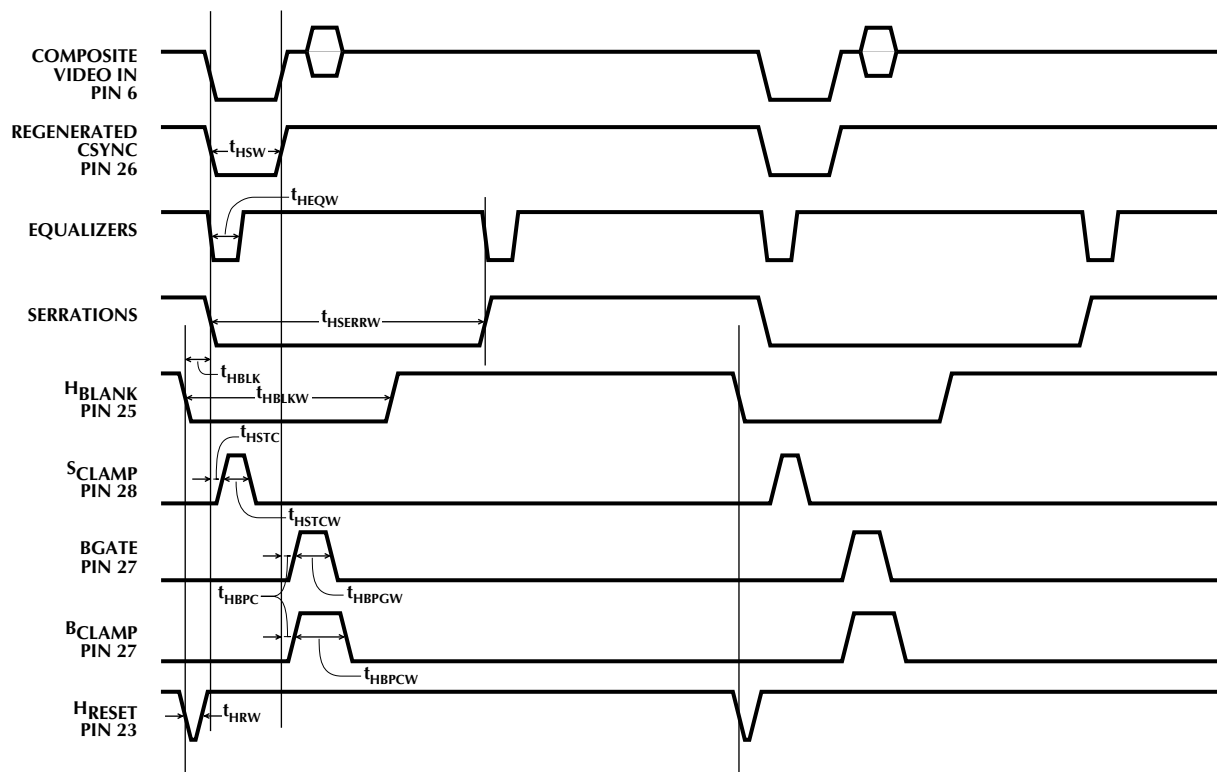
**Note 1:** Limits are guaranteed by 100% testing, sampling, or correlation with worst-case test conditions.

**Note 2:** Parameter is Luma dependent.

**Note 3:** Reclock time after bounce.

**Note 4:** Net phase error for single isolated missing H pulse.

**Note 5:** Net phase error for glitch at sync level <50ns.



NOTE: NOT TO SCALE

Figure 1. Line Rate Waveforms

# ML6430/ML6431

## DEVICE DIFFERENCES

Tables 1 and 2 summarize the differences between the ML6430 and ML6431. The pinouts of the ML6430 and the ML6431 are the same with the exception that the ML6431

has a few enhancements, (Center Frequency and Free Run Mode, see Table 1) and added functionality (see Table 2).

| DEVICE | FUNCTIONAL DESCRIPTION                      |      |             |              |       |               |          |  |                                      |          |
|--------|---|------|-------------|--------------|-------|---------------|----------|--|--------------------------------------|----------|
|        | Video Formats, Timing, and Pulse Generation |      | Clock Rates |              |       | Input Crystal |          | Free Run Mode  | VGA Clock                            | VCR Lock |
|        | NTSC  | PAL  | CCIR601     | Square Pixel | 4xFSC | 3.58 MHz      | 4.43 MHz |  |                                      |          |
| ML6430 | Yes   | Yes  | Yes         | Yes          | Yes   | Yes           | Yes      | Yes. Limited transition between free run modes 1 and 2. (Figure 4) | Yes. Limited to 640x480 pixel clock. | Yes      |
| ML6431 | Yes   | Yes* | Yes         | Yes*         | Yes   | Yes           | Yes      | Yes. Faster transition between freerun modes 1 and 2. (Figure 4a)  | Yes. Works up to 75MHz. (Table 6)    | Yes.     |

\* Readjusted the center frequency for PAL square pixel with NTSC crystal to achieve greater than +/-5% range. See Table 4

**Table 1. Summary of Functional Differences between the ML6430 and ML6431.**

| DEVICE | MODE                      | REGISTER DIFFERENCES                             |                   | PIN OUT DIFFERENCES |           |
|--------|---------------------------|--|-------------------|---------------------|-----------|
|        |                           | Register 7, Bit 2                                | Register 7, Bit 3 | Pin 3               | Pin 16    |
| ML6430 | Sleep Mode                | 0  | 0                 | SLEEP               | AUDIOCLK  |
|        | Pulse Generator Mode*     | 1  | 0                 | 54MHz**             | AUDIOCLK  |
|        | Time Base Correction Mode | <i>This function not available in the ML6430</i> |                   |                     |           |
| ML6431 | Sleep Mode                | 0  | 0                 | SLEEP               | AUDIOCLK  |
|        | Pulse Generator Mode*     | 1  | 0                 | 54MHz**             | AUDIOCLK  |
|        | PHERRROUT Mode*           | X  | 1                 | Must be set HIGH    | PHERRROUT |

\*For these modes the SLEEP mode can only be enable/disabled via serial bus (Register 8).

\*\*The 54MHz clock input (pin 3) can be any 4 x Clock up to 70MHz

**Table 2. Summary of Register Differences between the ML6430 and ML6431.**



## FUNCTIONAL DESCRIPTION

### DUAL PLLS

The Genlock has the following properties:

- A stable, asynchronous crystal controlled oscillator provides the basic timing signals.
- A precision analog circuit uses the above timing signals to generate an arbitrarily phased output whose phase can be altered at pixel rate.
- A digital PLL loop monitors the error signal from a digital phase detector, and generates a pixel by pixel phase adjustment of the output.
- An intelligent state machine further enhances performance by monitoring errors and error history and adjusting the gains of the loop accordingly.
- A circuit automatically detects a VCR signal and increases loop gain for proper tracking and minimum jitter.

The digital PLL has five operating modes. In normal operation with a stable input the controller will settle to state 1. If errors are large and consistent, controller will move to state 5. If error conditions are corrected, controller will sequentially decrease the state as the errors are reduced toward 0. If small but consistent errors persist while controller is in state 1, then controller may move to states 2 or 3 to help settle out errors more quickly. None of these changes will cause a reset of pixel count, or a discontinuity of output clocks. Operating modes are described in greater detail below.

1. Normal: Gain is low, instantaneous phase gain is 1/32, giving a net short term jitter gain (output/input jitter) of about -30db. Full peak to peak jitter (including lower frequency jitter) from a white source is about -15db.
2. Slow: Gain is increased by 4x, and settling time reduced by about the same. This mode is used as a transition mode during normal lock sequence, or as a modest speed up mode if errors are high.
3. Medium: Gain is increased by 8x, and settling time reduced by about the same. This mode is used as a transition mode during normal lock sequence, or as a speed up mode if errors are consistently high.
4. Fast: Gain is increased by 16x. Adds frequency adjustments to mode 5 for fast settling during hot switches or pathological gyro errors in hand held camcorders.
5. Phase: Only Gain is 16x for phase changes, 0 for frequency changes. Primarily used to quickly settle head switch phase errors without affecting loop frequency.

### LOW POWER SLEEP MODES

Sleep mode may be initiated either from the serial control bus, or from an external pin. In both cases the entire chip except the serial bus is shut down. For applications where PHERROUT is used, the sleep mode can only be enabled/disabled via serial control.

### PHERROUT SIGNAL

The PHERROUT pin indicates, on a line by line basis, whether the H SYNC pulse of the analog input signal is leading or trailing the genlock's output H SYNC pulse. This information is used by the genlock to decide whether to speed up or slow down the internal clock to achieve locking of the H SYNC pulses. If PHERROUT = 0, then the analog sync is ahead; therefore, the internal clock will speed up in an effort to lock the H SYNC pulses. By contrast, if PHERROUT = 1, then the analog sync is behind; therefore, the internal clock will slow down in an effort to lock the H SYNC pulses. Ultimately, when the genlock is locked to the incoming analog signal, PHERROUT will alternate approximately every line between 0 and 1.

| PHERROUT (PIN 16) | DESCRIPTION             |
|-------------------|-------------------------|
| 0                 | Speed up output timing  |
| 1                 | Slow down output timing |

Table 3. PHERROUT Signal Description

### SYNC SEPARATION

Sync separation is accomplished using peak tracking analog amplifiers with a precision sync slicer. The closed tracking loop is equipped with timers to discriminate true sync pulses from noise glitches or chroma overshoots. The use of analog sync separation techniques removes a serious source of jitter present in most digital PLLs.

### CRYSTAL SELECTION

The precision crystal source for the ML6430/ML6431 can be supplied in one of four ways. An industry standard 3.58MHz parallel tuned NTSC color subcarrier crystal or a 4.43MHz parallel tuned PAL color subcarrier crystal may be used. Alternately, a 14.318MHz NTSC or 17.7MHz PAL, 4xFs, or a 3.58MHz or 4.43MHz oscillator source may be used. Regardless of the crystal used, the ML6430/ML6431 can lock to PAL, NTSC, Beta or MII or YUV in either 625 or 525 standards. Table 4 provides the clock rate accuracy for both the NTSC and PAL clock rates for each crystal selected. Note that the range may vary between the ML6430 and the ML6431.

## FUNCTIONAL DESCRIPTION (Continued)

| CENTER FREQUENCY AND ± RANGE FOR EACH FREQUENCY<br>STANDARD OF THE ML6430 |                 |                     |
|---|-----------------|---------------------|
| VIDEO STANDARD  | CLOCK RATE      | CLOCK RATE ACCURACY |
| <b>3.58MHz Crystal</b>  |                 |                     |
| NTSC Square Pixel   | 4xClk= 49.09MHz | +8.35%/ -5.19%      |
| NTSC 601  | 4xClk= 54.00MHz | +6.07%/ -7.18%      |
| NTSC 4fsc   | 4xClk= 57.27MHz | +7.15%/ -6.23%      |
| PAL Square Pixel  | 4xClk= 59.00MHz | +4.01%/ -9.10%      |
| PAL 601   | 4xClk= 54.00MHz | +6.07%/ -7.18%      |
| PAL 4fsc  | 4xClk= 35.47MHz | +9.58%/ -4.14%      |
| <b>4.43MHz Crystal</b>  |                 |                     |
| NTSC Square Pixel   | 4xClk= 49.09MHz | +8.28%/ -5.23%      |
| NTSC 601  | 4xClk= 54.00MHz | +7.81%/ -5.64%      |
| NTSC 4fsc   | 4xClk= 57.27MHz | +6.00%/ -7.18%      |
| PAL Square Pixel  | 4xClk= 59.00MHz | +7.27%/ -6.13%      |
| PAL 601   | 4xClk= 54.00MHz | +7.81%/ -5.64%      |
| PAL 4fsc  | 4xClk= 35.47MHz | +7.05%/ -6.31%      |

| CENTER FREQUENCY AND ± RANGE FOR EACH FREQUENCY<br>STANDARD OF THE ML6431 |                 |                     |
|---|-----------------|---------------------|
| VIDEO STANDARD  | CLOCK RATE      | CLOCK RATE ACCURACY |
| <b>3.58MHz Crystal</b>  |                 |                     |
| NTSC Square Pixel   | 4xClk= 49.09MHz | +8.35%/ -5.19%      |
| NTSC 601  | 4xClk= 54.00MHz | +6.07%/ -7.18%      |
| NTSC 4fsc   | 4xClk= 57.27MHz | +7.15%/ -6.23%      |
| PAL Square Pixel  | 4xClk= 59.00MHz | +7.47%/ -5.93%      |
| PAL 601   | 4xClk= 54.00MHz | +6.07%/ -7.18%      |
| PAL 4fsc  | 4xClk= 35.47MHz | +7.64%/ -5.77%      |
| <b>4.43MHz Crystal</b>  |                 |                     |
| NTSC Square Pixel   | 4xClk= 49.09MHz | +8.28%/ -5.23%      |
| NTSC 601  | 4xClk= 54.00MHz | +7.81%/ -5.64%      |
| NTSC 4fsc   | 4xClk= 57.27MHz | +6.00%/ -7.18%      |
| PAL Square Pixel  | 4xClk= 59.00MHz | +7.27%/ -6.13%      |
| PAL 601   | 4xClk= 54.00MHz | +7.81%/ -5.64%      |
| PAL 4fsc  | 4xClk= 35.47MHz | +7.05%/ -6.31%      |

Table 4. NTSC/ PAL Clock Rate Range vs. Crystal Input

### DISABLING AUTOMATIC VCR SIGNAL DETECTION

| DEVICE | DISABLE VCR SIGNAL DETECTION?   |
|--------|---|
| ML6430 | No. Detection function is always on.  |
| ML6431 | Yes. Detection function can be disabled or enabled via serial bus only. This feature is enabled by default. |

Table 5.

In the ML6430, the VCR detection circuit is always enabled. This circuit detects the presence of a VCR input signal at  $C_{VIN}$  /  $H_{SYNC}$  (pin 6) and automatically adjusts the gain settings for the digital PLL to optimize locking performance. This circuit scans for head switching greater than the thresholds selected by the user threshold bits (via serial bus) and then increases the phase gain of the digital PLL to compensate.

In the ML6431, the VCR detection circuit operates the same as the ML6430 with the additional ability to disable or enable the VCR detection circuit to optimize for low jitter performance. This feature is enabled by default. This feature can be disabled in the ML6431 only by setting the appropriate values in Register 7, Bit 0 via the serial bus interface (see Table 11). When the VCR detect circuit is disabled, the ML6431 is optimized for low jitter performance.

### PULSE GENERATOR MODE

#### 54MHz Input or Any 4X Clock

The 54MHz pin (pin 3) is an input that clocks the horizontal and vertical counters. In this mode, the ML6430 or ML6431 is used as a pulse generator. The input signal at can be any 4X clock; for example, 54MHz (4 x CCIR clock rate of 13.5MHz), 49.09MHz (4 x Square Pixel clock rate of 12.27MHz), or 57.27 MHz (4 x Fsc clock rate of 14.31MHz for NTSC color subcarrier). This input is limited to 70MHz.

As a pulse generator, the sync, clamp, blanking, and clock signals are derived from the clock input at the 54MHz pin. This mode is activated by setting the appropriate values in Register 7 via the serial bus. See Tables 10 or 11.

#### USING $F_{RESET}$ FOR NTSC vs. PAL MODES

In NTSC mode,  $F_{RESET}$  (pin 22) goes low on the high-to-low transition of the FIELD ID pin (pin 17) and the beginning of line 1 (see Figure 2).

In the PAL mode,  $F_{RESET}$  (pin 22) goes low on the low-to-high transition of the FIELD ID pin and the end of line 310 (see Figure 3).

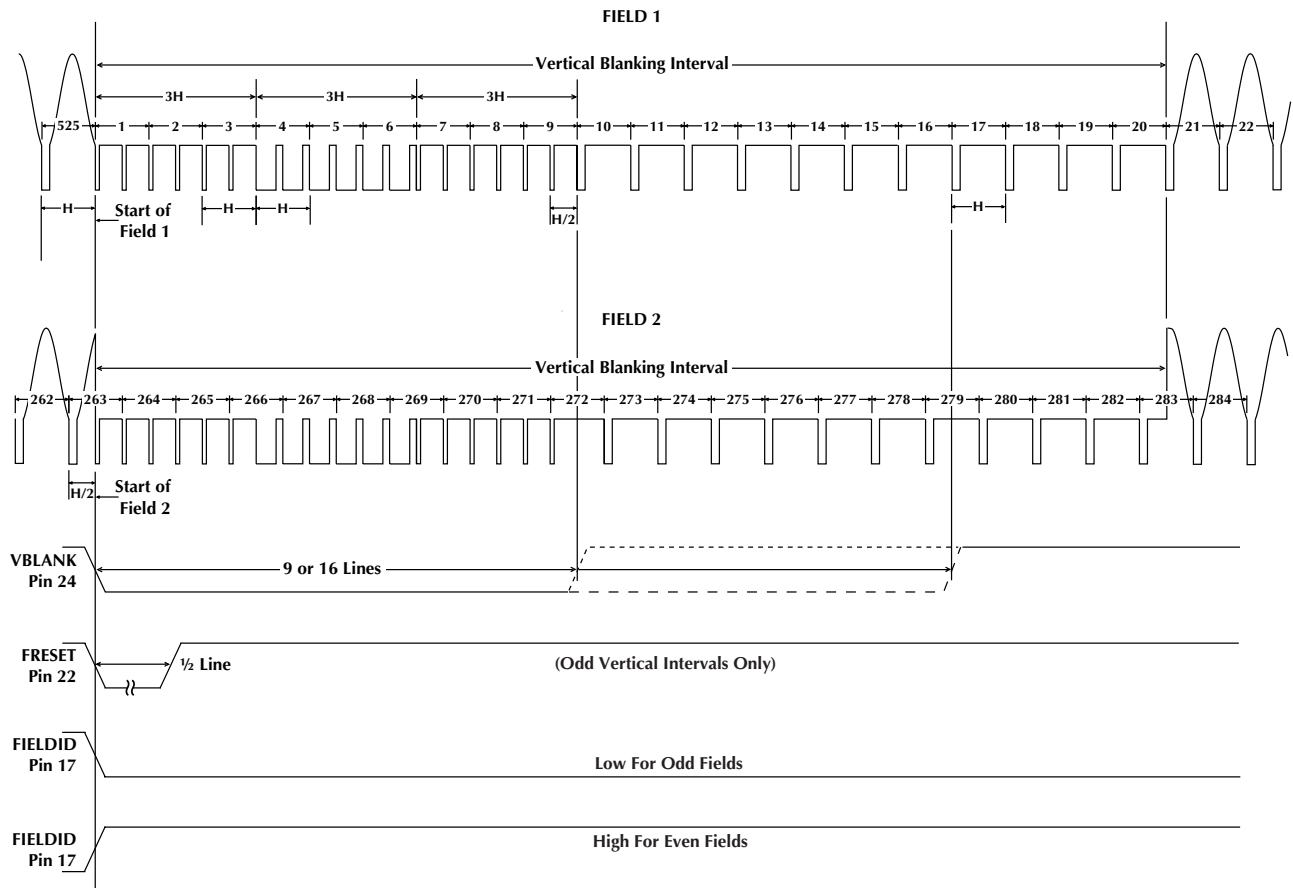


Figure 2. NTSC Field Rate Waveforms

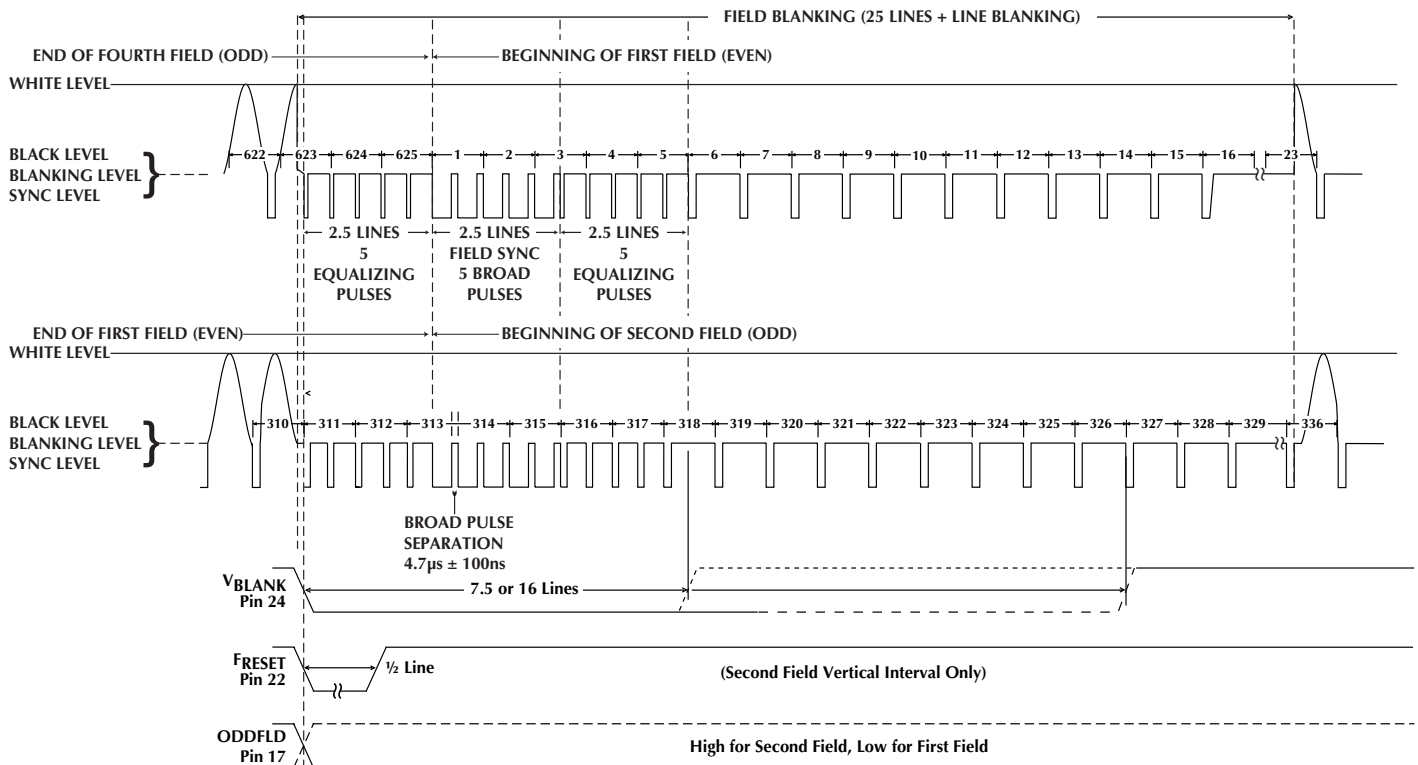


Figure 3. PAL 625 Field Rate Waveforms

## FUNCTIONAL DESCRIPTION (Continued)

### FREERUN MODE

Both the ML6430 and ML6431 can be used in Freerun mode. The ML6431 is recommended for applications requiring a more robust Freerun mode of operations. Figure 4 and Figure 4a describe the state diagrams for both the ML6430 and ML6431. Note that the ML6431 includes a faster path to go from FREERUN MODE #1 to FREERUN MODE #2.

**Freerun mode:** FREERUN MODE #1 is entered when the freerun pin is toggled high while the ML6430/ML6431 is horizontally locked (i.e. internal horizontal locked signal is present). In this mode, the digital frequency value stored in the line-locked PLL is held and the ML6430/ML6431 will freerun at a frequency very close to that of the last locked video source. Freerun mode #1 is best used by physically tying the NoSignal pin to the freerun pin as shown in Figures 9 or 10. FREERUN MODE #2 is entered when the freerun pin is toggled high while the ML6430/ML6431

is not horizontally locked to a video source. In this mode, a ROM lookup table is used to set the freerun frequency of the ML6430/ML6431. In this mode the output frequency is as accurate as the Crystal plus the accuracy of the look up table. See Figures 4 and 4a for the NoSignal-Locked-Freerun state machine diagram.

**NoSignal:** NoSignal will go low if video is present for one entire field. NoSignal will be high if video is not present for one entire field.

**Locked (ML6430):** The ML6430 must be line (horizontal) locked to an input video source and also be vertically locked before the locked detect signal goes high. When a video source is removed, the locked signal may be high or low. Please note that the locked pin is the logical AND of the internal horizontal locked and vertical locked signals. For example, the internal horizontal locked signal may be high even though the locked pin is asserted low.

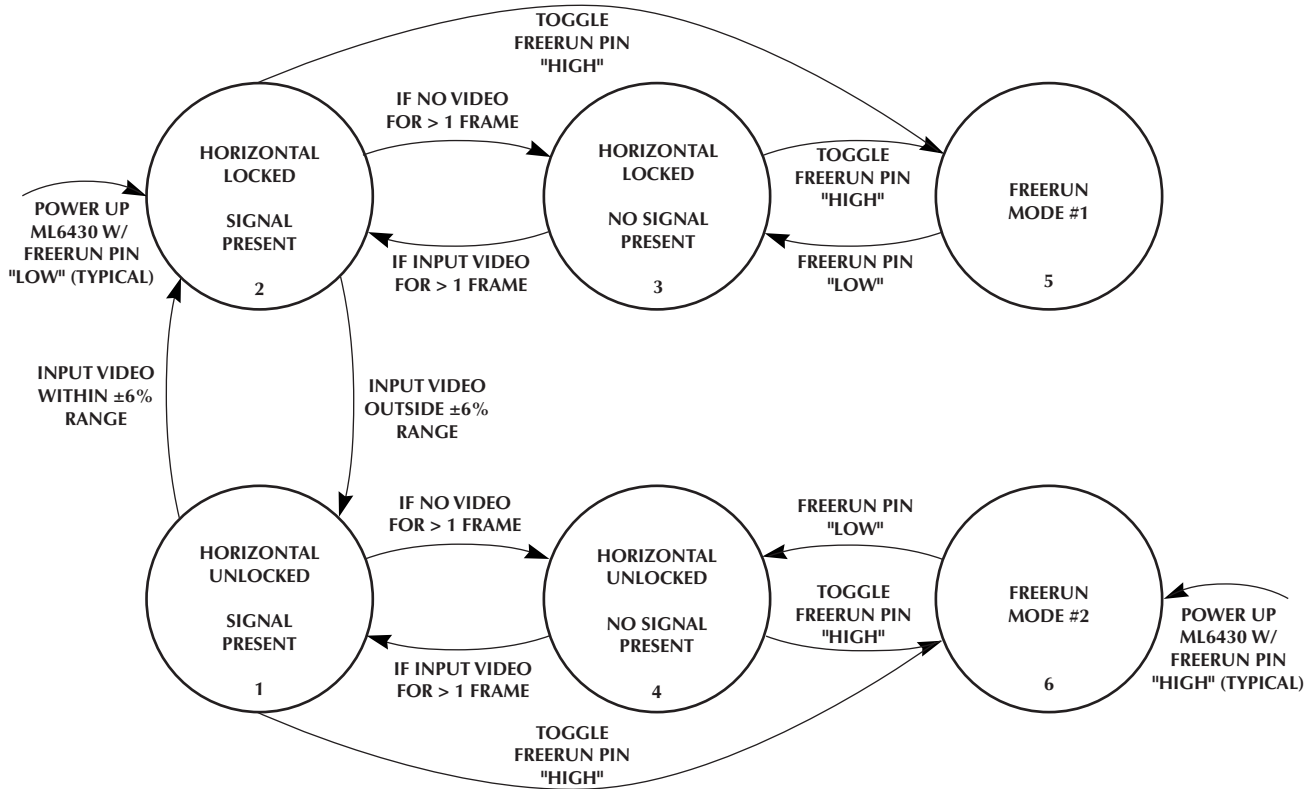


Figure 4. ML6430 Freerun Mode State Diagram

## FUNCTIONAL DESCRIPTION (Continued)

**Locked (ML6431):** The ML6431 must be line (horizontal) locked to an input video source for at least two fields and also be vertically locked before the locked detect signal goes high. When a video source is removed, the ML6431 will lose horizontal lock after two entire fields with no video present. However, vertical lock may be lost before horizontal lock. Because the locked pin is the logical AND of the internal horizontal locked and vertical locked signals the locked pin may go low before the internal horizontal locked signal.

### VGA CLOCKS

For VGA applications the ML6431 is recommended. Table 6 provides a list of the VGA clocks that can be generated using the ML6431. To use the information in

Table 6 first find the resolution and refresh rate required. Determine which crystal, PAL or NTSC is needed. Change the crystal to the proper frequency if necessary. Over the serial-bus, program the registers as indicated in Table 6. Supply to pin 6 an horizontal sync signal at TTL or CMOS levels and at the specified frequency. Trigger an oscilloscope on the falling edge of the horizontal input to view the outputs. The VGA pixel clock will be found on pin 18. Other useful signals are noted in table 6. External logic may be needed to produce usable vertical sync pulses.

### AUDIO CLOCKS

The audio modes can be activated via serial bus (Register 7). When this mode is activated an audio clock frequency can be selected via serial bus (Register 8). See Table 9.

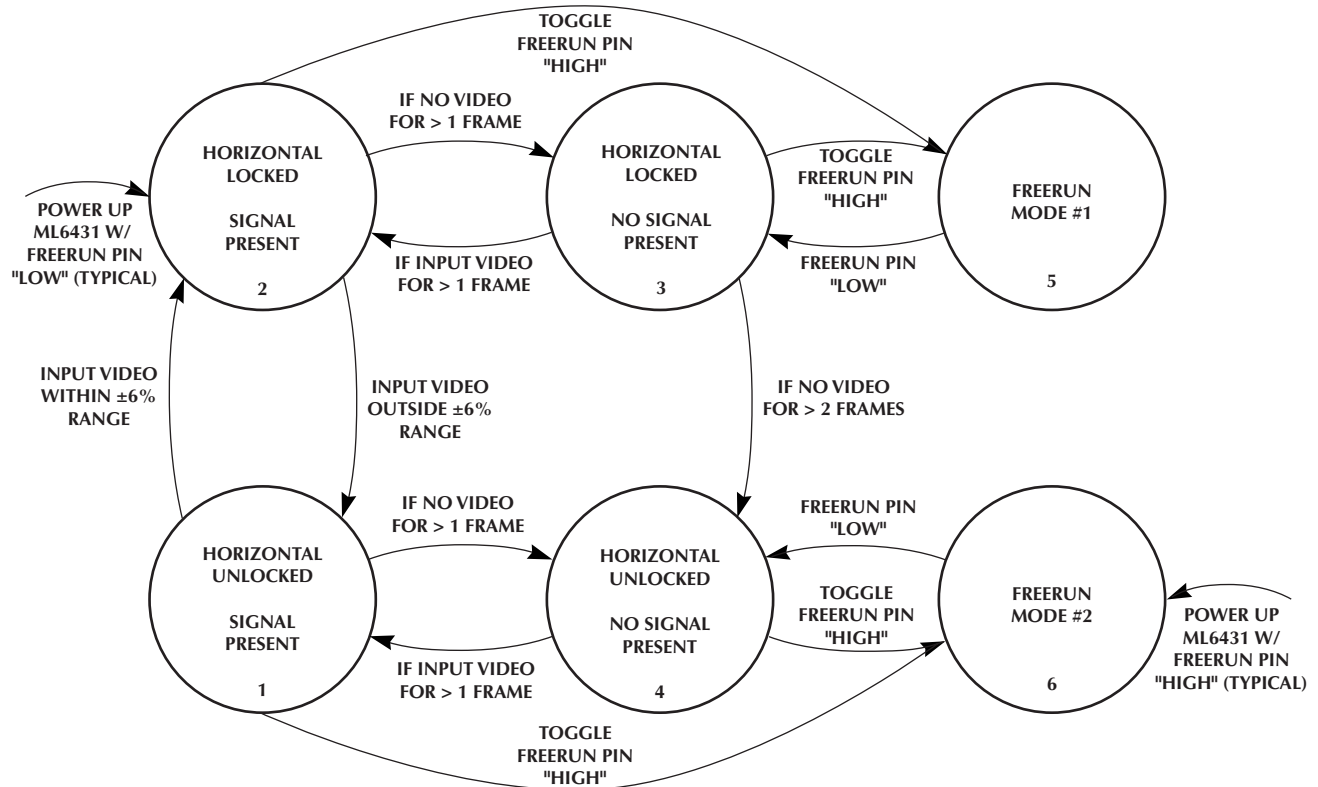


Figure 4a. ML6431 Freerun Mode State Diagram

| ML6431 Data Register Settings* |                   |              |                      |                 |               |                     |                  |         |           |          |     |                    |                  |                   |                 |
|--------------------------------|-------------------|--------------|----------------------|-----------------|---------------|---------------------|------------------|---------|-----------|----------|-----|--------------------|------------------|-------------------|-----------------|
| Resolution                     | # Pixels per Line | Refresh Rate | Horizontal Frequency | Pixel Frequency | Standard Type | Original Standard # | Freq. Std.       | PALXtal | Pixel Reg | PherrOut | VGA | External Xtal Used | Pixel Clk Output | Horizontal Pulses | Vertical Pulses |
| 640 x 480                      | 800               | 60 Hz        | 31.5 KHz             | 25.175 MHz      | Industry      |                     | NTSC Sq Pix =000 | 1       | 572       | 0        | 1   | 4.43               | 2X               | "Hsync,Hreset"    | Vreset          |
|                                | 832               | 72 Hz        | 37.9 KHz             | 31.500 MHz      | VESA          | VS901101            | NTSC Sq Pix =000 | 0       | 640       | 0        | 1   | 4.43               | 2X               | "Hsync,Hreset"    | Vreset          |
|                                | 840               | 75 Hz        | 37.5 KHz             | 31.500 MHz      | VESA          | VDMT75HZ            | NTSC Sq Pix =000 | 0       | 656       | 0        | 1   | 4.43               | 2X               | "Hsync,Hreset"    | Vreset**        |
| 800 x 600                      | 1024              | 56 Hz        | 35.1 KHz             | 36.000 MHz      | VESA          | VG900601            | PAL 4FSC =101    | 1       | 512       | 1        | 1   | 4.43               | 4X               | "Hsync,Hreset"    | Vreset          |
|                                | 1056              | 60 Hz        | 37.9 KHz             | 40.000 MHz      | VESA          | VG900602            | NTSC Sq Pix =000 | 1       | 544       | 1        | 1   | 3.58               | 4X               | "Hsync,Hreset"    | Vreset**        |
|                                | 1040              | 72 Hz        | 48.1 KHz             | 50.000 MHz      | VESA          | VS900603A           | NTSC Sq Pix =000 | 1       | 528       | 1        | 1   | 4.43               | 4X               | "Hsync,Hreset"    | Vreset**        |
|                                | 1056              | 75 Hz        | 46.9 KHz             | 49.500 MHz      | VESA          | VDMT75HZ            | NTSC Sq Pix =000 | 1       | 544       | 1        | 1   | 4.43               | 4X               | "Hsync,Hreset"    | Vreset**        |
| 1024 x 768                     | 1264              | 43 Hz/Int    | 35.5 KHz             | 44.900 MHz      | Industry      |                     | PAL 4FSC =101    | 0       | 752       | 1        | 1   | 4.43               | 4X               | "Hsync,Hreset"    | Vreset**        |
|                                | 1344              | 60 Hz        | 48.4 KHz             | 65.000 MHz      | VESA          | VG901101A           | PAL 601 = 011    | 0       | 832       | 1        | 1   | 4.43               | 4X               | "Hsync,Hreset"    | Vreset**        |
|                                | 1328              | 70 Hz        | 56.5 KHz             | 75.000 MHz      | VESA          | VS910801-2          | PAL 4FSC =101    | 0       | 816       | 1        | 1   | 3.58               | 4X & clk doubler | No                | No              |

\*For Data Register Settings: TTL = High, VGA = On, VCR = Off, Noise Gating = On, Dis Auto Ver Det = 1

\*\* w/ external glue logic

**Table 6. VGA Rates Supported**

**FUNCTIONAL DESCRIPTION** (Continued)**PRESET PIN CONTROL**

The ML6430/ML6431 may be controlled via a set of four preset mode pins. These pins do not allow access to all the programmable features of the ML6430/ML6431, but are intended to provide a simpler interface for most applications.

**PULSE OUTPUTS**

Pulse outputs are defined in Table 12. Note that the pulse widths and start times are chosen to the nearest clock edge, and indicated errors assume nominal clock operating frequency.

| P3 | P2 | P1 | P0 | STD  | CLOCK RATE   | CRYSTAL  |
|----|----|----|----|------|--------------|----------|
| 0  | 1  | 0  | 1  | NTSC | Square pixel | 3.58MHz  |
| 1  | 0  | 0  | 1  | NTSC | CCIR601      | 3.58MHz  |
| 1  | 1  | 0  | 1  | NTSC | 4Fsc         | 3.58MHz  |
| 0  | 1  | 1  | 1  | PAL  | Square pixel | 3.58MHz  |
| 1  | 0  | 1  | 1  | PAL  | CCIR601      | 3.58MHz  |
| 1  | 1  | 1  | 1  | PAL  | 4Fsc         | 3.58MHz  |
| 0  | 1  | 0  | Z  | NTSC | Square pixel | 4.43MHz  |
| 1  | 0  | 0  | Z  | NTSC | CCIR601      | 4.43MHz  |
| 1  | 1  | 0  | Z  | NTSC | 4Fsc         | 4.43MHz  |
| 0  | 1  | 1  | Z  | PAL  | Square pixel | 4.43MHz  |
| 1  | 0  | 1  | Z  | PAL  | CCIR601      | 4.43MHz  |
| 1  | 1  | 1  | Z  | PAL  | 4Fsc         | 4.43MHz  |
| 0  | Z  | 0  | 1  | NTSC | Square pixel | 14.32MHz |
| Z  | 0  | 0  | 1  | NTSC | CCIR601      | 14.32MHz |
| Z  | Z  | 0  | 1  | NTSC | 4Fsc         | 14.32MHz |
| 0  | Z  | 1  | 1  | PAL  | Square pixel | 14.32MHz |
| Z  | 0  | 1  | 1  | PAL  | CCIR601      | 14.32MHz |
| Z  | Z  | 1  | 1  | PAL  | 4Fsc         | 14.32MHz |

| P3 | P2 | P1 | P0 | STD  | CLOCK RATE          | CRYSTAL  |
|----|----|----|----|------|---------------------|----------|
| 0  | Z  | 0  | Z  | NTSC | Square pixel        | 17.72MHz |
| Z  | 0  | 0  | Z  | NTSC | CCIR601             | 17.72MHz |
| Z  | Z  | 0  | Z  | NTSC | 4Fsc                | 17.72MHz |
| 0  | Z  | 1  | Z  | PAL  | Square pixel        | 17.72MHz |
| Z  | 0  | 1  | Z  | PAL  | CCIR601             | 17.72MHz |
| Z  | Z  | 1  | Z  | PAL  | 4Fsc                | 17.72MHz |
| Z  | 1  | 0  | 1  | NTSC | Square pixel, VGA   | 3.58MHz  |
| 1  | Z  | 0  | 1  | NTSC | CCIR601, VGA        | 3.58MHz  |
| 0  | 0  | 0  | 1  | NTSC | 4Fsc, VGA           | 3.58MHz  |
| Z  | 1  | 1  | 1  | PAL  | Square pixel, VGA   | 3.58MHz  |
| 1  | Z  | 1  | 1  | PAL  | CCIR601, VGA        | 3.58MHz  |
| 0  | 0  | 1  | 1  | PAL  | 4Fsc, VGA           | 3.58MHz  |
| Z  | 1  | 0  | Z  | NTSC | Square pixel, VGA   | 4.43MHz  |
| 1  | Z  | 0  | Z  | NTSC | CCIR601, VGA        | 4.43MHz  |
| 0  | 0  | 0  | Z  | NTSC | 4Fsc, VGA           | 4.43MHz  |
| Z  | 1  | 1  | Z  | PAL  | Square pixel, VGA   | 4.43MHz  |
| 1  | Z  | 1  | Z  | PAL  | CCIR601, VGA        | 4.43MHz  |
| 0  | 0  | 1  | Z  | PAL  | 4Fsc, VGA           | 4.43MHz  |
| X  | X  | X  | 0  |      | Serial control mode |          |

Z = Floating input, 0 = Low input, 1 = High input, X = Don't care

**Table 7. Preset Pin Modes**

## FUNCTIONAL DESCRIPTION (Continued)

### CONTROL REGISTER INFORMATION

| REGISTER                | SETTING                  |
|-------------------------|--------------------------|
| PulsePol[2:0]           | 000                      |
| Clk4X                   | 0                        |
| Pixel[10:0]             | Determined by PRESET pin |
| Burst                   | 0                        |
| CSyncRaw                | 0                        |
| RawClamp                | 0                        |
| TTL Sync                | 0                        |
| WideBlank               | 0                        |
| HDelay[6:0]             | 1000000                  |
| Noise Gating            | 0                        |
| Test 3,1,4              | 0, 0, 0                  |
| External 54<br>Clock IN | 0                        |
| FAud[1:0]               | 01                       |
| VCR                     | 0                        |
| SLEEP                   | 0                        |
| Thresh[1:0]             | 11                       |
| VGA                     | Determined by PRESET pin |
| Div4                    | Determined by PRESET pin |
| Fstd[2:0]               | Determined by PRESET pin |
| PALX <sub>TAL</sub>     | Determined by PRESET pin |

**Table 8. Default Control Register Settings for Preset Mode**

### REGISTER DESCRIPTION

**SLEEP:** Enables or disables sleep mode. When using serial bus control, ALL registers must be programmed to their intended state after power up to ensure correct operation of the ML6430/ML6431.

**CSR:** Composite sync register bit controls whether composite sync output is from the sync separator, (raw CSYNC) or from the internal pulse generator (regenerated CSYNC).

**Pulse Polarity Control:** The active state of output sync pulses, blanking pulses, or clamp pulses may be programmed to either 0 or 1 state by use of these bits.

**P0:** CSYNC pulse output is high active when 1, low active when 0.

**P1:** H<sub>BLANK</sub> and V<sub>BLANK</sub> pulse outputs are high active when 1, low active when 0.

**P2:** S<sub>CLAMP</sub> and B<sub>CLAMP</sub> pulse outputs are high active when 1, low active when 0.

**Burst:** Controls the length of Burst Gate so pulse can be used for either burst gating in encoder applications or back porch clamping.

**RawClamp:** Controls the source of the S<sub>CLAMP</sub> (sync clamp) pulse. Pulse is timed relative to incoming sync edge, or regenerated sync edge.

**PALXTAL:** Controls the expected crystal frequency at the oscillator inputs. 0 = NTSC 3.58MHz, or 1 = PAL 4.43MHz.

**Thresh1, Thresh0:** Selects the pixel error threshold at which relock is initiated. Values are:

0,0: 2.5 pixels  
0,1: 2.5 pixels  
1,0: 1.0 pixels  
1,1: 4.0 pixels

**Noise Gating:** Enables a 3/4 line window to lockout any unwanted horizontal sync pulses.

**VGA:** Produces non-interlaced progressive scan outputs.

**Div4:** Controls the prescaler in the M/N loop. High means that 4Fs external oscillator signals are expected, low assumes a PAL or NTSC Fs crystal will be used.

**VCR:** Controls the gain range and locking maneuvers of the digital loop. Provides better locking to the unpredictability of VCR headswitches and jitter.

**Blanking Width Control:** The number of blanked lines in the vertical interval is programmable to either 9 or 16.

**XTAL:** external Crystal Control: 0=NTSC 3.58MHz, or 1=PAL 4.43MHz, for both local crystal and external oscillator mode.

**External 54MHz Clock:** This mode permits injecting a 54MHz clock (or other 4X clock) directly into the horizontal pixel counter via the SLEEP pin. All timing pulses are synchronous to the 54MHz clock (or other 4X clock).

**Serial Bus Control:** To place the ML6430/ML6431 in serial mode, take P0 (Preset) to logical '0' or ground. The serial control system is written to by the external processor in 8-bit bytes. Each of these bytes is partitioned into an address (upper 4 bits of serial byte) and a data register (lower 4 bits of serial byte). In Table 10, the Register heading refers to the 4-bit address, and Data Bit refers to a particular bit in the 4-bit register (Bit0 is LSB).

**Pixel:** Program all bits to zero to enable default values for each standard. Otherwise use the following equation:

$$P[10:0] = 2 \times (\text{number of pixels per line}) - 1024 \quad (1)$$

**Test:** All test bits must be programmed to zero.



**FUNCTIONAL DESCRIPTION** (Continued)

**Audio Clock:** The ML6430/ML6431 outputs a clock at 32kHz, 44.1kHz, or 48kHz. This clock is locked in frequency to the basic video clock regardless of the standard being used. With VCR head switches, the phase correction required to track the timing is removed from the audio clock by a patented circuit. This prevents the audio clock from being modulated by step changes in video timing. See the Table 9 for the audio clock rates supported and how they are derived internally.

**ADDITIONAL CONTROL REGISTERS (ML6431 ONLY)**

**DisAutoVCR:** Disables the auto VCR detect circuit.

Register 7, Bit 0: DisAutoVCR

**PHERROUT:** MUX phase error signal onto AUDIOCLK/PHERROUT pin.

Register 7, Bit 3: PHERROUT enable

This bit controls the source of AUDIOCLK/PHERROUT. When this bit is low, AUDIOCLK/PHERROUT provides the audio clock output. When this bit is high, AUDIOCLK/PHERROUT provides the 1-bit digital phase error of each Hsync edge.

Additionally, when both PHERROUT enable and VGA bits are logic high, the reset point of the pixel counter is changed from 512 to 256. This changes the equation for calculating the number of pixels per line verses the Pixel Counter bits to the following:

$$P[10:0] = 2 \times (\text{number of pixels per line}) - 512 \quad (2)$$

| VIDEO STANDARD    | AUDIO RATE | AUDIO/PIXEL CLOCK RATIO                               | AUDIO/FRAME RATE RATIO                    |
|-------------------|------------|---|---|
| CCIR601 NTSC      | 48kHz      | $(96000 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(8008 \div 5) \times 29.97\text{Hz}$     |
| CCIR601 NTSC      | 44.1kHz    | $(88200 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(147147 \div 100) \times 29.97\text{Hz}$ |
| CCIR601 NTSC      | 32kHz      | $(64000 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(16016 \div 15) \times 29.97\text{Hz}$   |
| CCIR601 PAL       | 48kHz      | $(96000 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(1920) \times 25\text{Hz}$               |
| CCIR601 PAL       | 44.1kHz    | $(88200 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(1764) \times 25\text{Hz}$               |
| CCIR601 PAL       | 32kHz      | $(64000 \div 27\text{MHz}) \times 13.5\text{MHz}$     | $(1280) \times 25\text{Hz}$               |
| NTSC Square Pixel | 48kHz      | $(105600 \div 27\text{MHz}) \times 12.27\text{MHz}$   | $(8008 \div 5) \times 29.97\text{Hz}$     |
| NTSC Square Pixel | 44.1kHz    | $(97020 \div 27\text{MHz}) \times 12.27\text{MHz}$    | $(147147 \div 100) \times 29.97\text{Hz}$ |
| NTSC Square Pixel | 32kHz      | $(70400 \div 27\text{MHz}) \times 12.27\text{MHz}$    | $(16016 \div 15) \times 29.97\text{Hz}$   |
| PAL Square Pixel  | 48kHz      | $(96000 \div 29.5\text{MHz}) \times 14.75\text{MHz}$  | $(1920) \times 25\text{Hz}$               |
| PAL Square Pixel  | 44.1kHz    | $(88200 \div 29.5\text{MHz}) \times 14.75\text{MHz}$  | $(1764) \times 25\text{Hz}$               |
| PAL Square Pixel  | 32kHz      | $(64000 \div 29.5\text{MHz}) \times 14.75\text{MHz}$  | $(1280) \times 25\text{Hz}$               |
| NTSC 4xFSC        | 48kHz      | $(105600 \div 31.5\text{MHz}) \times 14.32\text{MHz}$ | $(8008 \div 5) \times 29.97\text{Hz}$     |
| NTSC 4xFSC        | 44.1kHz    | $(92400 \div 30\text{MHz}) \times 14.32\text{MHz}$    | $(147147 \div 100) \times 29.97\text{Hz}$ |
| NTSC 4xFSC        | 32kHz      | $(70400 \div 31.5\text{MHz}) \times 14.32\text{MHz}$  | $(16016 \div 15) \times 29.97\text{Hz}$   |
| PAL 4xFSC         | 48kHz      | $(76800 \div 28.37\text{MHz}) \times 17.72\text{MHz}$ | $(1920) \times 25\text{Hz}$               |
| PAL 4xFSC         | 44.1kHz    | $(70560 \div 28.37\text{MHz}) \times 17.72\text{MHz}$ | $(1764) \times 25\text{Hz}$               |
| PAL 4xFSC         | 32kHz      | $(51200 \div 28.37\text{MHz}) \times 17.72\text{MHz}$ | $(1280) \times 25\text{Hz}$               |

**Table 9. Audio Clock Generation (ML6430/ML6431)**

| REGISTER | DATA BIT | DESCRIPTION  |  | VALUERANGE   | BIT CODE RANGE  |
|----------|----------|--------------|--|--|---|
| 0        | 0        | PulsePol 0   | C <sub>SYNC</sub> Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 1        | PulsePol 1   | H/V Blank Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 2        | PulsePol 2   | S/B Clamp Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 3        | Clk 4X       | Select 4X Clock  | Low 1X Clock = 13.5MHz<br>High 4X Clock = 54MHz  | 0 or 1  |
| 1        | 0        | Pixel0       | Pix Counter Load Bit 0   | Numerical value taken as unsigned binary. Actual no. of pixels is:<br>$512 + \frac{P[10:0]}{2}$ Do not vary pixel [10:0] by more than ±6% from nominal.<br>$1024 > \text{no. of pixels} > 512$ and<br>$f_{\text{NOM}} \times 1.06 > f_{\text{NEW}} > f_{\text{NOM}} \times 0.94$ | nom = ~011 0000 0000<br>max = 011 0011 0000<br>min = 010 1101 0000                  |
| 1        | 1        | Pixel1       | Pix Counter Load Bit 1   |  |   |
| 1        | 2        | Pixel2       | Pix Counter Load Bit 2   |  |   |
| 1        | 3        | Pixel3       | Pix Counter Load Bit 3   |  |   |
| 2        | 0        | Pixel4       | Pix Counter Load Bit 4   |  |   |
| 2        | 1        | Pixel5       | Pix Counter Load Bit 5   |  |   |
| 2        | 2        | Pixel6       | Pix Counter Load Bit 6   |  |   |
| 2        | 3        | Pixel7       | Pix Counter Load Bit 7   |  |   |
| 3        | 0        | Pixel8       | Pix Counter Load Bit 8   |  |   |
| 3        | 1        | Pixel9       | Pix Counter Load Bit 9   |  |   |
| 3        | 2        | Pixel10      | Pix Counter Load Bit 10  |  |   |
| 3        | 3        | Burst        | Burst Gate Enable  | Low = Back Porch Clamp<br>High = Burst Gate  | 0 or 1  |
| 4        | 0        | CSyncRaw     | (or C <sub>SYNC</sub> Regen)   | Low = regenerated C <sub>SYNC</sub><br>High = raw C <sub>SYNC</sub>  | 0 or 1  |
| 4        | 1        | RawClamp     | (or Clamp Regen)   | Low = regenerated Clamp<br>High = raw Clamp  | 0 or 1  |
| 4        | 2        | TTL Sync     | TTL horizontal + vertical Sync Input   | Low = sync separator active<br>High = TTL horiz + vert sync input  | 0 or 1  |
| 4        | 3        | WideBlank    | (or Narrow)  | Low = narrow blanking<br>High = wide blanking  | 0 or 1  |
| 5        | 0        | HDelay0      | H Delay parameter allows moving the entire constellation of output pulses relative to the incoming H <sub>SYNC</sub> . Exception: Sync Tip clamp may be selected for delay or triggered from incoming sync depending on application. | 7-bit Horizontal Delay parameter. Values:<br>$-64p < \text{Hdly} < 63p$ , $p = 1/F_{4XCLK}$  | 0000000 to 1111111:<br>0000000 means -64p<br>1111111 means +63p<br>1000000 means 0p |
| 5        | 1        | HDelay1      |  |  |   |
| 5        | 2        | HDelay2      |  |  |   |
| 5        | 3        | HDelay3      |  |  |   |
| 6        | 0        | HDelay4      |  |  |   |
| 6        | 1        | HDelay5      |  |  |   |
| 6        | 2        | HDelay6      |  |  |   |
| 6        | 3        | Noise Gating | 3/4 line lockout   | Low = noise gating on<br>High = noise gating off   | 0 or 1  |

Table 10. ML6430 Register Map

| REGISTER | DATA BIT | DESCRIPTION         |  | VALUERANGE  | BIT CODE RANGE |
|----------|----------|---------------------|--|---|----------------|
| 7        | 0        | Test 3              | For test mode only:<br>No user programmable features | Set to 0  | 0              |
| 7        | 1        | Test 1              | For test mode only:<br>No user programmable features | Set to 0  | 0              |
| 7        | 2        | Ext 54<br>Clock IN  |  | Low = Pin 3 is SLEEP<br>High = Pin 3 is 54MHz Clock   | 0 or 1         |
| 7        | 3        | Test 4              | For test mode only:<br>No user programmable features | Set to 0  | 0              |
| 8        | 0        | FAud0               | AudioClk Freq Bit 0                                  | 00 = 48kHz, 01 = 44.1kHz, 10 = 32kHz  | 00 to 10       |
| 8        | 1        | FAud1               | AudioClk Freq Bit 1                                  |   |                |
| 8        | 2        | VCR                 | Enable VCR Mode                                      | High = Enabled, Low = Disabled  |                |
| 8        | 3        | SLEEP               | Power Down Mode                                      | High = Power Down, Low = Normal   | 0 or 1         |
| 9        | 0        | Thresh0             | Select 'Out of Lock' Threshold                       | 00 = 2.5 Pixels      10 = 1.0 Pixels  | 00 to 11       |
| 9        | 1        | Thresh1             |  | 01 = 2.5 Pixels      11 = 4.0 Pixels  |                |
| 9        | 2        | VGA                 | Enable VGA Mode                                      | High = Enabled, Low = Disabled  | 0 or 1         |
| 9        | 3        | Div4                | Enable /4 on M/N Loop                                | High = Enabled, Low = Disabled  | 0 or 1         |
| 10       | 0        | FStd0               | Freq Std Sel Bit 0                                   | 000 = NTSC Sq Pix    011 = PAL 601<br>001 = PAL Sq Pix    100 = NTSC 4Fsc<br>010 = NTSC 601      101 = PAL 4Fsc | 000 to 101     |
| 10       | 1        | FStd1               | Freq Std Sel Bit 1                                   |   |                |
| 10       | 2        | FStd2               | Freq Std Sel Bit 2                                   |   |                |
| 10       | 3        | PALX <sub>TAL</sub> | Enable PAL Ref Freq                                  | High = Enabled, Low = Disabled  | 0 or 1         |

Table 10. ML6430 Register Map (Continued)

| REGISTER | DATA BIT | DESCRIPTION  |  | VALUERANGE   | BIT CODE RANGE  |
|----------|----------|--------------|--|--|---|
| 0        | 0        | PulsePol 0   | C <sub>SYNC</sub> Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 1        | PulsePol 1   | H/V Blank Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 2        | PulsePol 2   | S/B Clamp Polarity   | High Active-Low Active   | 0 or 1  |
| 0        | 3        | Clk 4X       | Select 4X Clock  | Low 1X Clock = 13.5MHz<br>High 4X Clock = 54MHz  | 0 or 1  |
| 1        | 0        | Pixel0       | Pix Counter Load Bit 0   | Numerical value taken as unsigned binary. Actual no. of pixels is:<br><br>$512 + \frac{P[10:0]}{2}$ Do not vary pixel [10:0] by more than ±6% from nominal.<br><br>$1024 > \text{no. of pixels} > 512$ and<br>$f_{\text{NOM}} \times 1.06 > f_{\text{NEW}} > f_{\text{NOM}} \times 0.94$ | nom = ~011 0000 0000<br>max = 011 0011 0000<br>min = 010 1101 0000                  |
| 1        | 1        | Pixel1       | Pix Counter Load Bit 1   |  |   |
| 1        | 2        | Pixel2       | Pix Counter Load Bit 2   |  |   |
| 1        | 3        | Pixel3       | Pix Counter Load Bit 3   |  |   |
| 2        | 0        | Pixel4       | Pix Counter Load Bit 4   |  |   |
| 2        | 1        | Pixel5       | Pix Counter Load Bit 5   |  |   |
| 2        | 2        | Pixel6       | Pix Counter Load Bit 6   |  |   |
| 2        | 3        | Pixel7       | Pix Counter Load Bit 7   |  |   |
| 3        | 0        | Pixel8       | Pix Counter Load Bit 8   |  |   |
| 3        | 1        | Pixel9       | Pix Counter Load Bit 9   |  |   |
| 3        | 2        | Pixel10      | Pix Counter Load Bit 10  | If PHERR enable and VGA = 1, the actual no. of pixels is:<br>P[10:0]=2x(no. of pixels per line)-512  |   |
| 3        | 3        | Burst        | Burst Gate Enable  | Low = Back Porch Clamp<br>High = Burst Gate  | 0 or 1  |
| 4        | 0        | CSyncRaw     | (or C <sub>SYNC</sub> Regen)   | Low = regenerated C <sub>SYNC</sub><br>High = raw C <sub>SYNC</sub>  | 0 or 1  |
| 4        | 1        | RawClamp     | (or Clamp Regen)   | Low = regenerated Clamp<br>High = raw Clamp  | 0 or 1  |
| 4        | 2        | TTL Sync     | TTL horizontal + vertical Sync Input   | Low = sync separator active<br>High = TTL horiz + vert sync input  | 0 or 1  |
| 4        | 3        | WideBlank    | (or Narrow)  | Low = narrow blanking<br>High = wide blanking  | 0 or 1  |
| 5        | 0        | HDelay0      | H Delay parameter allows moving the entire constellation of output pulses relative to the incoming H <sub>SYNC</sub> . Exception: Sync Tip clamp may be selected for delay or triggered from incoming sync depending on application. | 7-bit Horizontal Delay parameter. Values:<br>$-64p < \text{Hdly} < 63p$ , $p = 1/F_{4\text{XCLK}}$   | 0000000 to 1111111:<br>0000000 means -64p<br>1111111 means +63p<br>1000000 means 0p |
| 5        | 1        | HDelay1      |  |  |   |
| 5        | 2        | HDelay2      |  |  |   |
| 5        | 3        | HDelay3      |  |  |   |
| 6        | 0        | HDelay4      |  |  |   |
| 6        | 1        | HDelay5      |  |  |   |
| 6        | 2        | HDelay6      |  |  |   |
| 6        | 3        | Noise Gating | 3/4 line lockout   | Low = noise gating on<br>High = noise gating off   | 0 or 1  |

Table 11. ML6431 Register Map

| REGISTER | DATA BIT | DESCRIPTION          |   | VALUERANGE   | BIT CODE RANGE |
|----------|----------|----------------------|---|--|----------------|
| 7        | 0        | DisAutoVCR           |   | 0=Auto VCR Detect ON<br>1=Disable Auto VCR Detect  | 0 or 1         |
| 7        | 1        | Test 1               | For test mode only:<br>No user programmable features. | Set to 0   | 0              |
| 7        | 2        | Ext 54 Clock IN      |   | Low = Pin 3 is SLEEP<br>High = Pin 3 is Ext 54MHz Clock                                    | 0 or 1         |
| 7        | 3        | PHERROUT or AUDIOCLK |   | Low=Pin 16 is Audio CLK, Pin 3 is SLEEP<br>High=Pin 16 is PHERROUT, Pin 3 is RESET         | 0 or 1         |
| 8        | 0        | FAud0                | AudioClk Freq Bit 0                                   | 00 = 48kHz, 01 = 44.1kHz, 10 = 32kHz   | 00 to 10       |
| 8        | 1        | FAud1                | AudioClk Freq Bit 1                                   |  |                |
| 8        | 2        | VCR                  | Enable VCR Mode                                       | High = Enabled, Low = Disabled   |                |
| 8        | 3        | SLEEP                | Power Down Mode                                       | High = Power Down, Low = Normal  |                |
| 9        | 0        | Thresh0              | Select 'Out of Lock' Threshold                        | 00 = 2.5 Pixels    10 = 1.0 Pixels   | 00 to 11       |
| 9        | 1        | Thresh1              |   | 01 = 2.5 Pixels    11 = 4.0 Pixels   |                |
| 9        | 2        | VGA                  | Enable VGA Mode                                       | High = Enabled, Low = Disabled   | 0 or 1         |
| 9        | 3        | Div4                 | Enable /4 on M/N Loop                                 | High = Enabled, Low = Disabled   | 0 or 1         |
| 10       | 0        | FStd0                | Freq Std Sel Bit 0                                    | 000 = NTSC SqPix    011 = PAL 601<br>001 = PAL Sq Pix    100 = NTSC 4Fsc<br>010 = NTSC 601 | 000 to 100     |
| 10       | 1        | FStd1                | Freq Std Sel Bit 1                                    |  |                |
| 10       | 2        | FStd2                | Freq Std Sel Bit 2                                    |  |                |
| 10       | 3        | PALX <sub>TAL</sub>  | Enable PAL Ref Freq                                   |  |                |

Table 11. ML6431 Register Map (Continued)

## FUNCTIONAL DESCRIPTION (Continued)

### SERIAL BUS OPERATION

The serial bus control in the ML6430/ML6431 has two levels of addressing: Device Addressing and Register Addressing.

**Device Addressing:** Figure 5 shows the physical waveforms generated in order to address the ML6430/ML6431. There are six basic parts of the waveform:

1. Start Indication: Clock Cycle 0
2. Device Address Shifted: Clock Cycle 1 through 8
3. Device Address Strobed and Decoded: Clock Cycle 9

4. Data Shifted : Clock Cycle 10 through 17
5. Data Strobed into Appropriate Register: Clock Cycle 18
6. Stop indication: Clock Cycle 19

**Register Addressing:** Figure 6 shows the register map of the ML6430/6431. There are two basic parts of each received data byte: Address Nibble and Data Nibble

1. Address Nibble: The upper 4 bits of the data byte gives the register number in which to place the data.
2. Data Nibble: The lower 4 bits of the data byte is the data to be placed in the currently addressed register nibble.

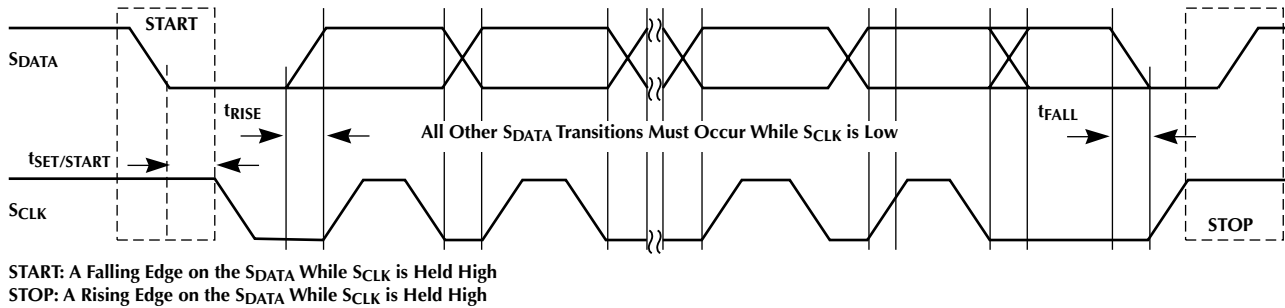


Figure 5. Definition of START & STOP on Serial Data Bus

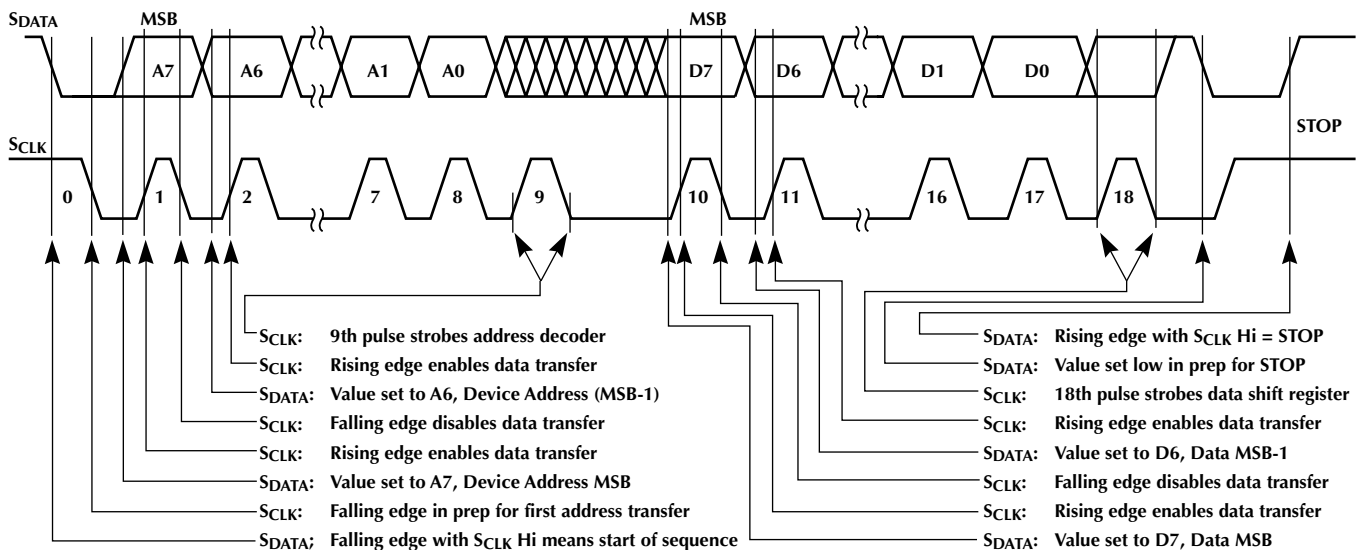


Figure 6. Definition of DATA FORMAT on Serial Data Bus

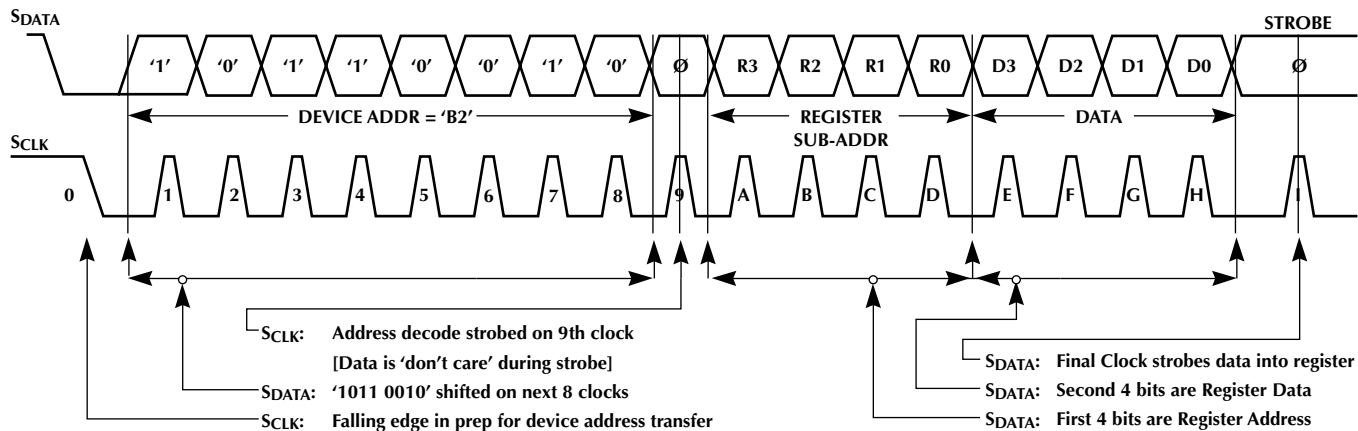


Figure 7. Typical Serial Bus Command

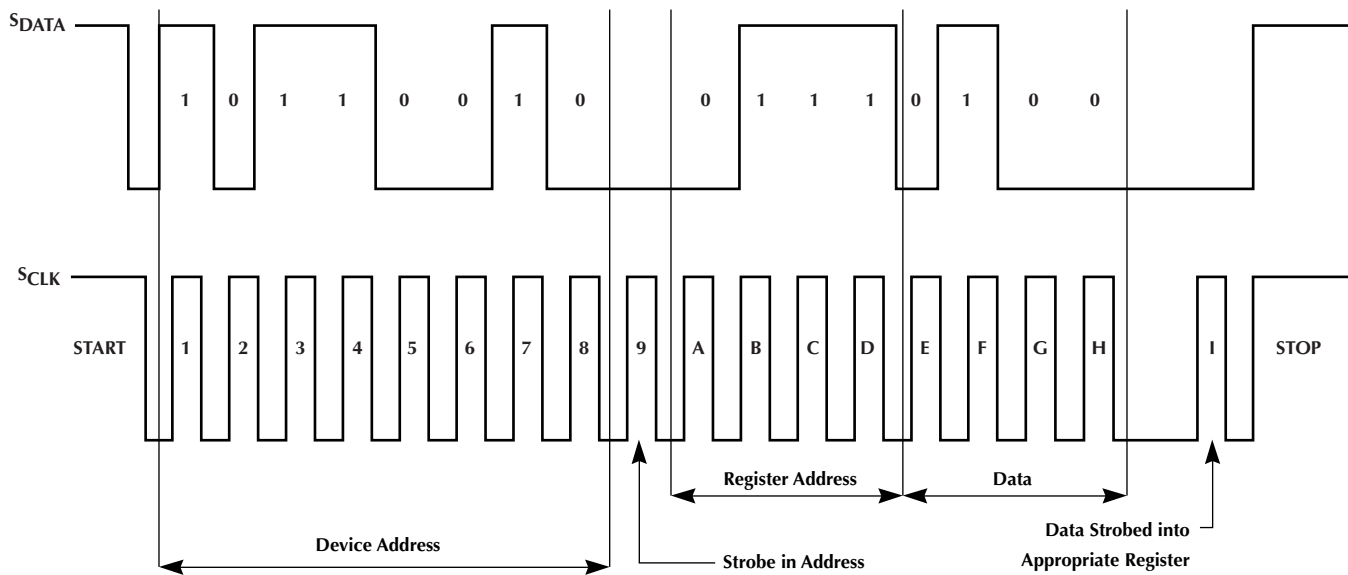


Figure 8. Serial Bus Command to Set Bit #2 in Register 7

## APPLICATIONS

The ML6430 and ML6431 can be used for a variety of applications. The following figures provide a basic setup for the various applications listed below:

Figure 9: ML6430 or ML6431 in NTSC CCIR Applications

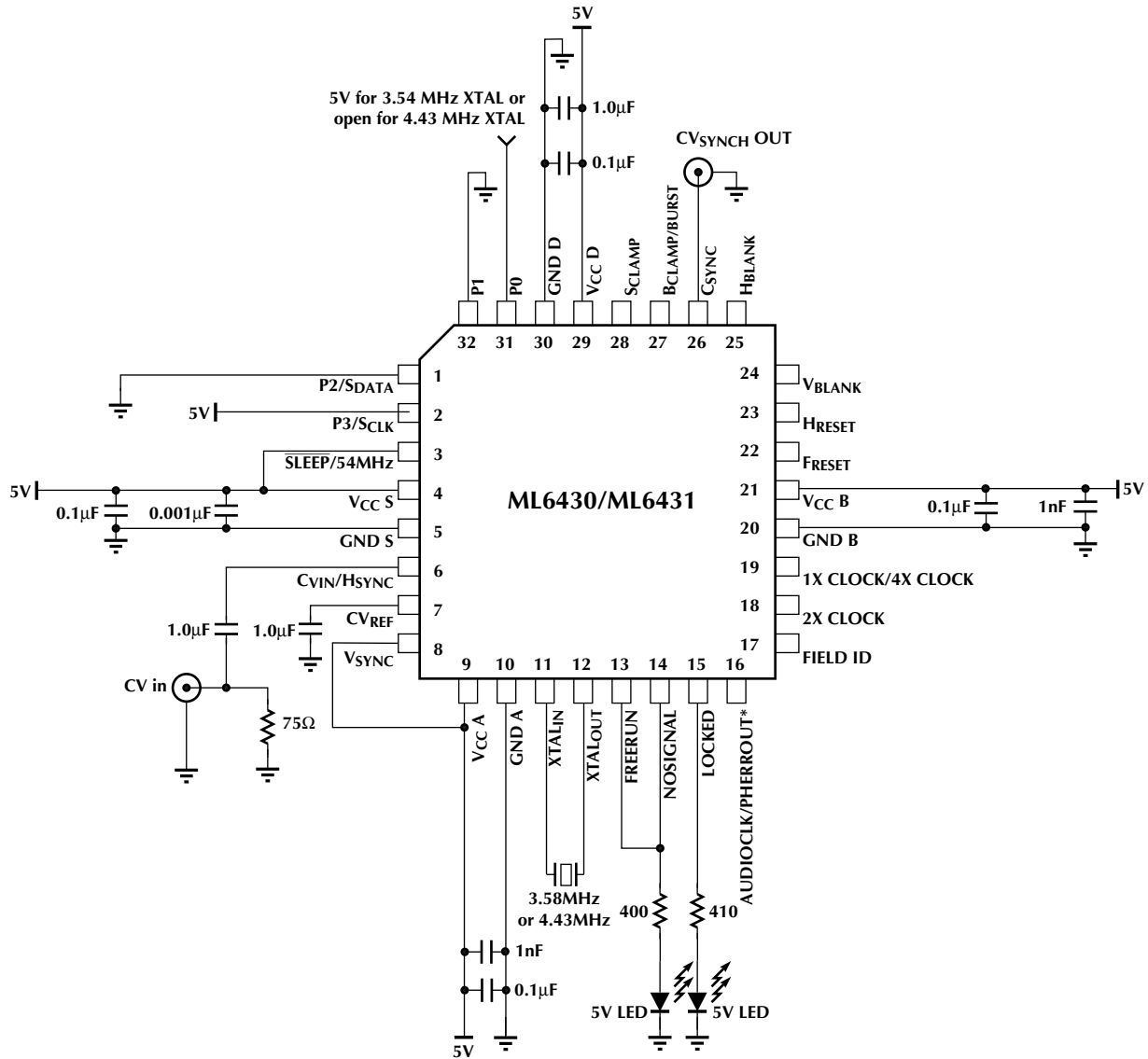
Figure 10: ML6430 or ML6431 in PAL CCIR Applications

Figure 11: ML6431 in VGA Application

Figure 12: ML6430 or ML6431 in Audio Applications

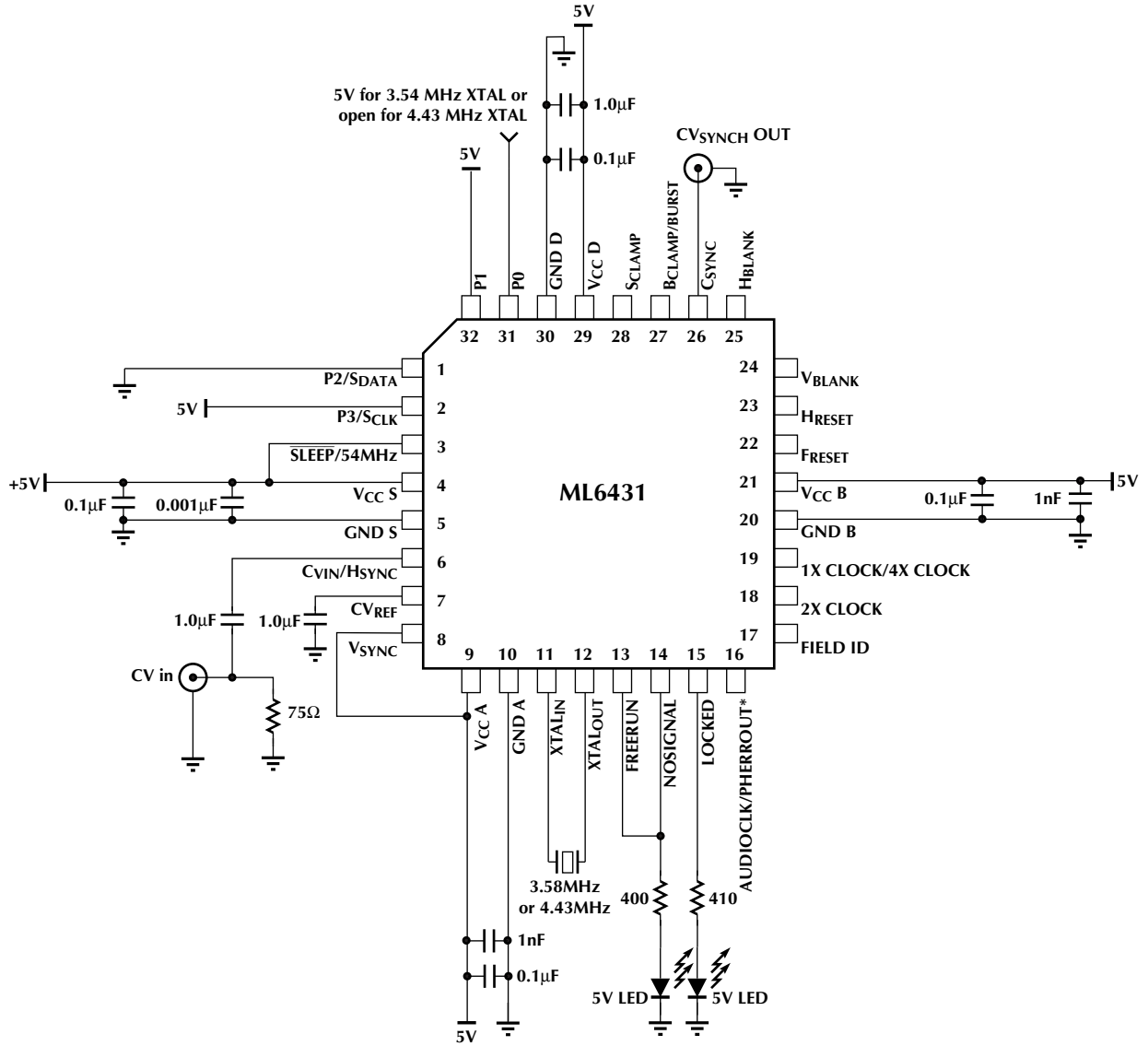
Figure 13: ML6430 or ML6431 in Pulse Generator Applications





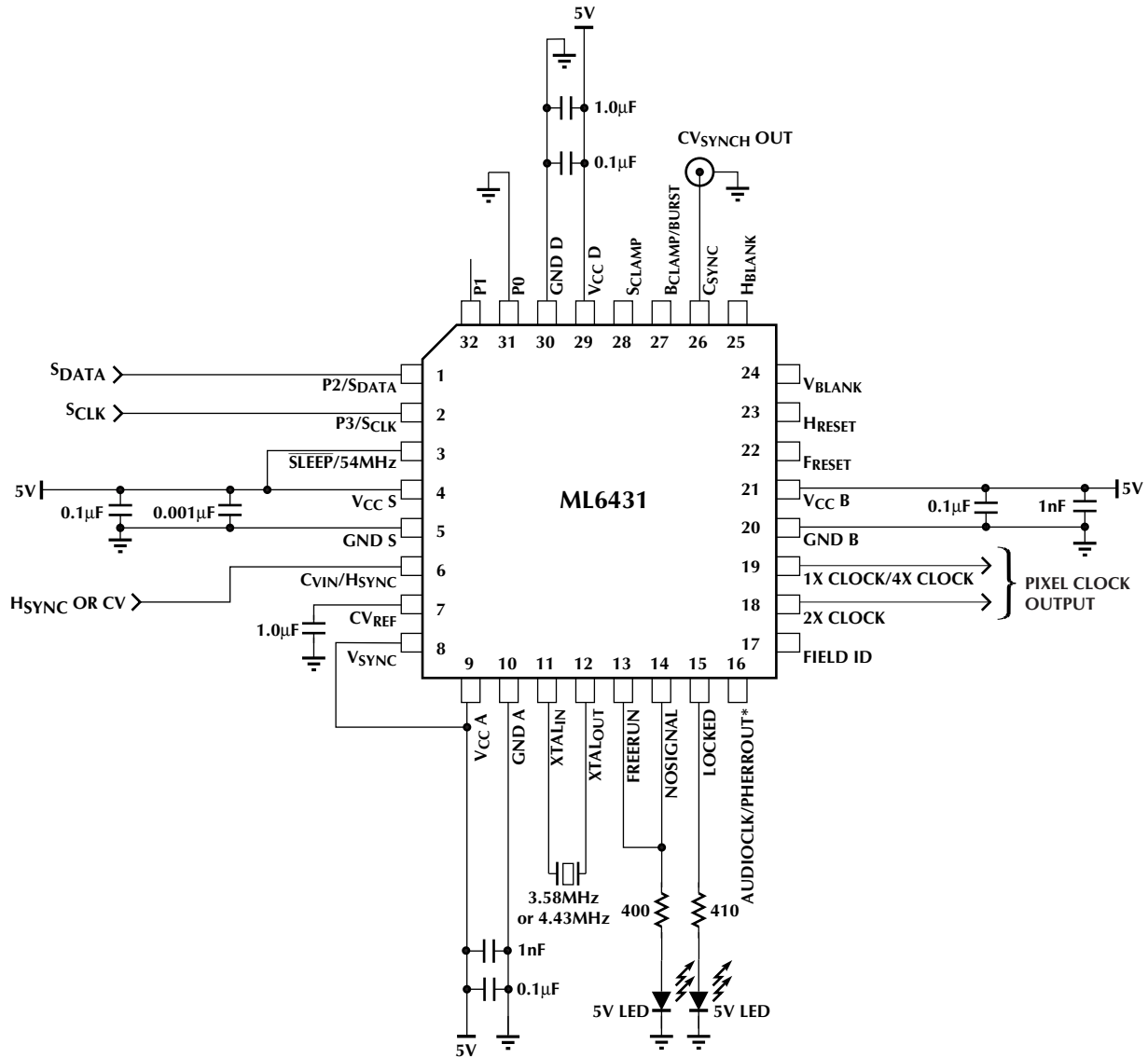
**Note 1.** For minimum VCC bypassing, connect capacitors VCC A only. (VCC A to GND A)  
 \*PHERROUT is only available with the ML6431

Figure 9. ML6430/ML6431 in NTSC CCIR Applications Programmed via Preset Pins



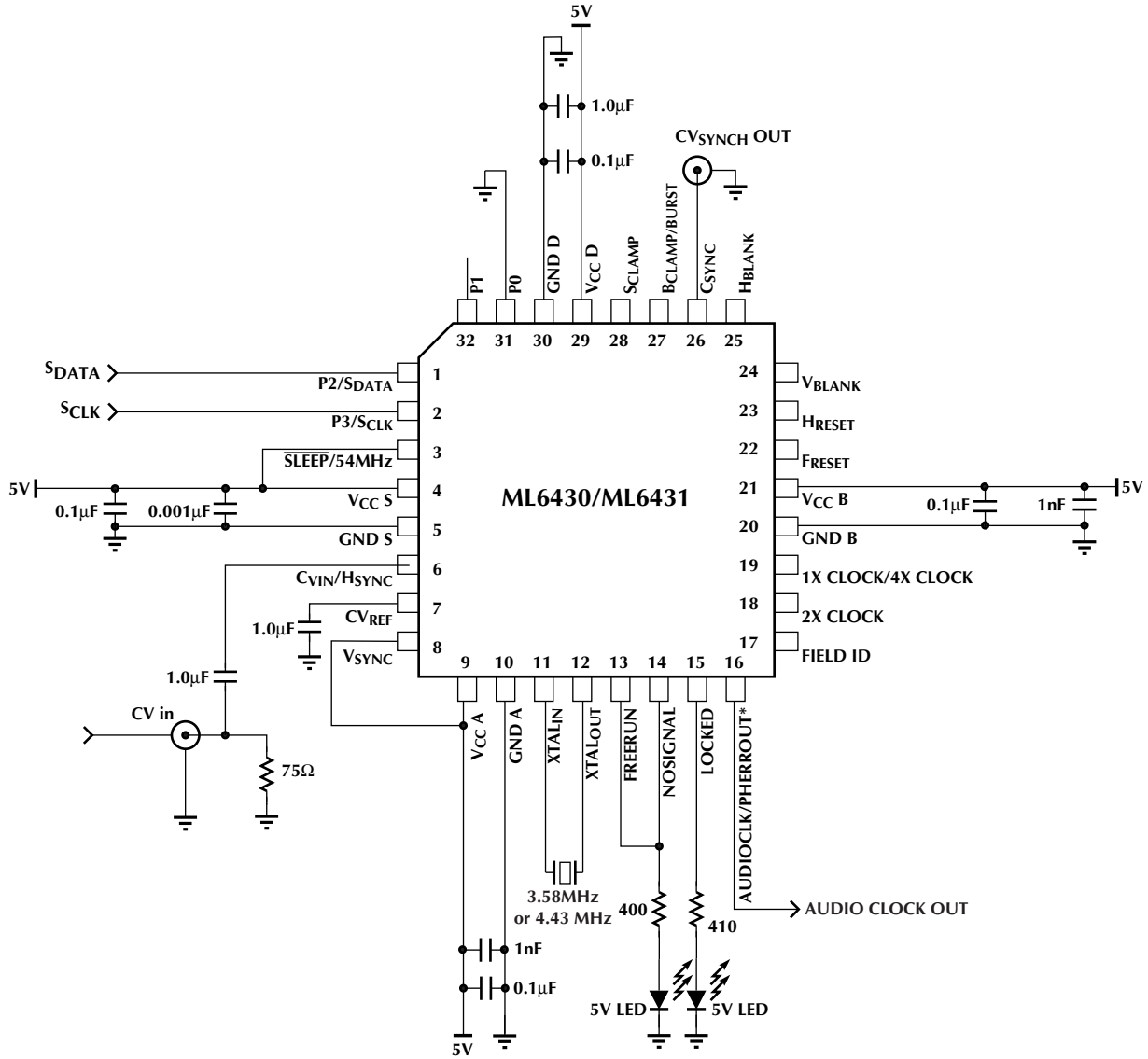
**Note 1.** For minimum  $V_{CC}$  bypassing, connect capacitors  $V_{CCA}$  only. ( $V_{CCA}$  to GND A)  
 \*PHERROUT is only available with the ML6431

Figure 10. ML6430/ML6431 in PAL CCIR Applications Programmed via Preset Pins



**Note 1.** For minimum VCC bypassing, connect capacitors VCC A only. (VCC A to GND A)  
 \*PHERROUT is only available with the ML6431

Figure 11. ML6431 in VGA Applications

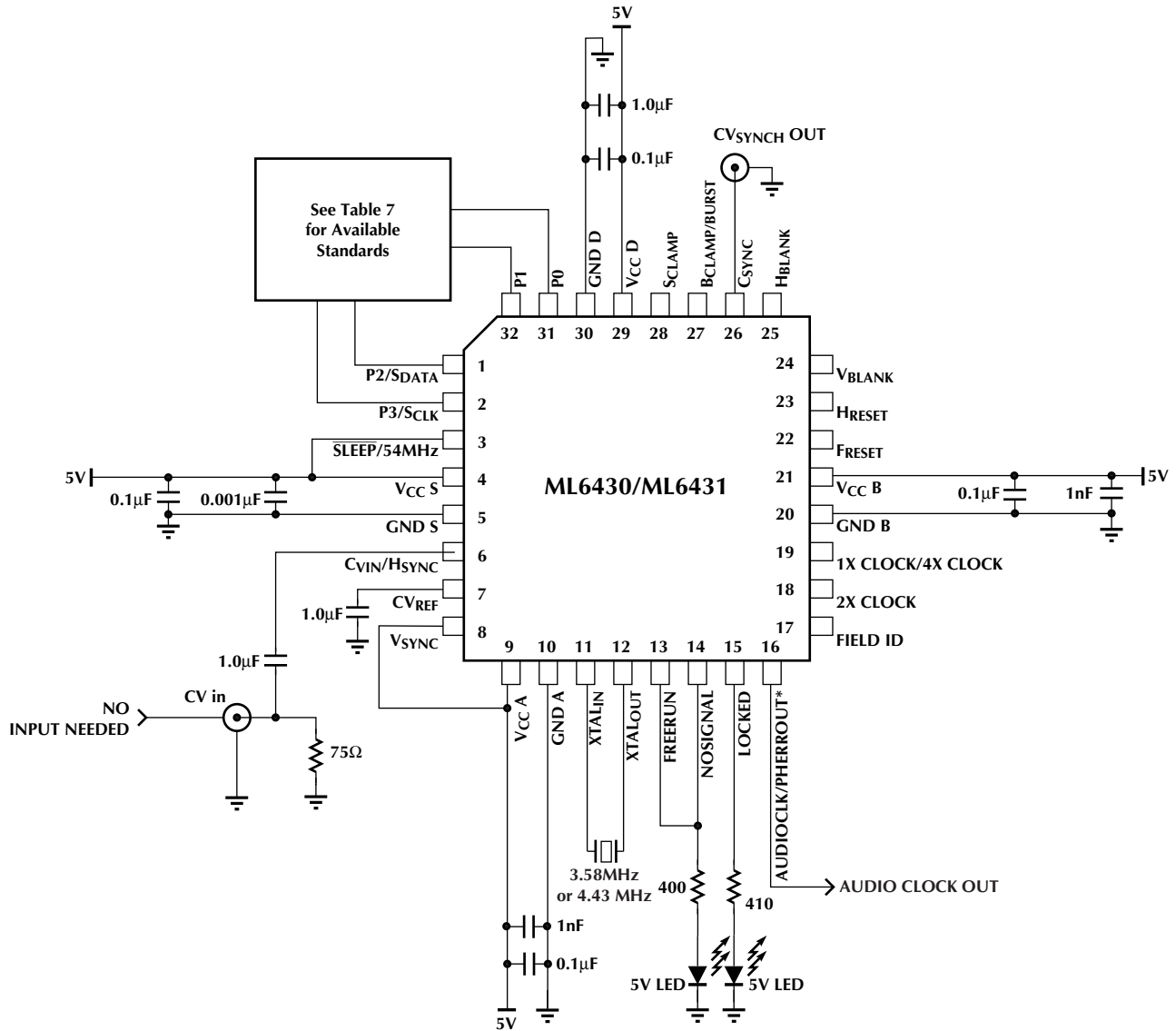


**Note 1.** For minimum V<sub>CC</sub> bypassing, connect capacitors V<sub>CC</sub>A only. (V<sub>CC</sub>A to GND A)

**Note 2.** See Table 4 for audio clock frequencies and registers

\*PHERROUT is only available with the ML6431

**Figure 12. ML6430/ML6431 in Audio Applications**



**Note 1.** For minimum VCC bypassing, connect capacitors VCC A only. (VCC A to GND A)

**Note 2.** See Table 4 for audio clock frequencies and registers

\*PHERROUT is only available with the ML6431

Figure 13. ML6430/ML6431 in Pulse Generator Applications

# ML6430/ML6431

## NTSC AT SQUARE PIXEL RATE

| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP     | UNITS  |
|---------------------|------------------------------|-------------|---------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 640         | 648     | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 780         | 780     | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       | 486         | 493,507 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 525         | 525     | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   | 16          | 15      | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow | 9           | 9       | lines  |
| t <sub>H</sub>      | H Line Time                  | 63.55       | 63.55   | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0     | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.73    | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 41      | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.28    | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      |             | 27.05   | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 122     | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.47    | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 326     | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.51        | 2.44    | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 3.91    | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.39   | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 10.9        | 10.76   | μs     |

## PAL AT SQUARE PIXEL RATE

| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP      | UNITS  |
|---------------------|------------------------------|-------------|----------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 768         | 767      | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 944         | 944      | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       |             | 609, 616 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 625         | 625      | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   |             | 15       | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow |             | 9        | lines  |
| t <sub>H</sub>      | H Line Time                  | 64.0        | 64.0     | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0      | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.68     | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 34       | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.31     | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      | 27.3        | 27.32    | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 102      | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.49     | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 339      | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.43        | 2.44     | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 4.0      | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.49    | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 12.0        | 12.0     | μs     |

Table 12. Pulse Output Timing

## NTSC AT 4 X FS RATE

| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP     | UNITS  |
|---------------------|------------------------------|-------------|---------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 768         | 752     | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 910         | 910     | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       | 486         | 493,507 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 525         | 525     | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   | 16          | 15      | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow | 9           | 9       | lines  |
| t <sub>H</sub>      | H Line Time                  | 63.55       | 63.55   | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0     | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.68    | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 35      | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.30    | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      | 27.05       | 27.02   | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 105     | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.47    | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 349     | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.51        | 2.51    | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 3.98    | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.54   | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 10.9        | 11.03   | μs     |

## PAL AT 4 X FS RATE

| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP      | UNITS  |
|---------------------|------------------------------|-------------|----------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 922         | 922      | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 1135.0064   | 1135     | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       |             | 609, 616 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 625         | 625      | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   |             | 15       | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow |             | 9        | lines  |
| t <sub>H</sub>      | H Line Time                  | 64.0        | 64.0     | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0      | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.74     | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 28       | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.25     | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      | 27.3        | 27.29    | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 169      | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.58     | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 225      | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.43        | 2.48     | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 4.06     | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.52    | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 12.0        | 12.12    | μs     |

Table 12. Pulse Output Timing (Continued)

# ML6430/ML6431

## NTSC AT CCIR601 RATE

| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP      | UNITS  |
|---------------------|------------------------------|-------------|----------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 720         | 709      | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 858         | 858      | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       | 486         | 493, 507 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 525         | 525      | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   | 16          | 15       | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow | 9           | 9        | lines  |
| t <sub>H</sub>      | H Line Time                  | 63.55       | 63.55    | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0      | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.67     | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 37       | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.37     | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      | 27.05       | 27.04    | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 111      | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.48     | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 370      | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.51        | 2.44     | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 4.10     | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.55    | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 10.9        | 11.03    | μs     |

## PAL AT CCIR601 RATE

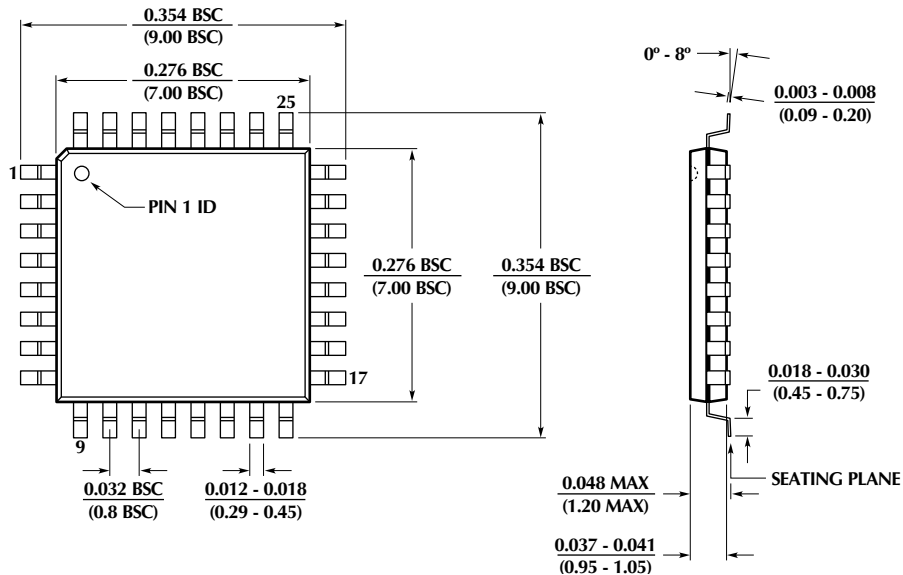
| SYMBOL              | NAME:<br>DESCRIPTION         | CCIR 601STD | TYP      | UNITS  |
|---------------------|------------------------------|-------------|----------|--------|
| N <sub>HA</sub>     | Clocks per H:<br>Active      | 720         | 702      | cycles |
| N <sub>H</sub>      | Clocks per H:<br>Whole Line  | 864         | 864      | cycles |
| N <sub>VA</sub>     | H per Frame:<br>Active       |             | 609, 616 | lines  |
| N <sub>V</sub>      | H per Frame:<br>Whole Line   | 625         | 625      | lines  |
| N <sub>VBLKW</sub>  | Lines of Blanking:<br>Wide   |             | 15       | lines  |
| N <sub>VBLKN</sub>  | Lines of Blanking:<br>Narrow |             | 9        | lines  |
| t <sub>H</sub>      | H Line Time                  | 64.0        | 64.0     | μs     |
| t <sub>HS</sub>     | H Sync Time                  | 0.0         | 0.0      | μs     |
| t <sub>HSW</sub>    | H Sync Width                 | 4.7         | 4.67     | μs     |
| t <sub>HRW</sub>    | H Reset Width                |             | 37       | μs     |
| t <sub>HEQW</sub>   | Equalizer Sync<br>Width      | 2.35        | 2.30     | μs     |
| t <sub>HSERRW</sub> | Serration Sync<br>Width      | 27.30       | 27.33    | μs     |
| t <sub>HSTC</sub>   | Sync Tip Clamp<br>Pulse      | 300         | 111      | ns     |
| t <sub>HSTCW</sub>  | Sync Tip Clamp<br>Width      | 1.5         | 1.48     | μs     |
| t <sub>HBPC</sub>   | BurstPulse                   | 300         | 370      | ns     |
| t <sub>HBPGW</sub>  | BurstWidth                   | 2.43        | 2.44     | μs     |
| t <sub>HBPCW</sub>  | B Clamp Width                | 4.0         | 4.0      | μs     |
| t <sub>HBLK</sub>   | H Blanking Pulse             | -1.5        | -1.48    | μs     |
| t <sub>HBLKW</sub>  | H Blanking Pulse<br>Width    | 12.0        | 12.0     | μs     |

Table 12. Pulse Output Timing (Continued)




## PHYSICAL DIMENSIONS inches (millimeters)

Package: H32-7  
32-Pin (7 x 7 x 1mm) TQFP



## ORDERING INFORMATION

| PART NUMBER           | TEMPERATURE RANGE  | PACKAGE                    |
|-----------------------|--------------------|----------------------------|
| ML6430CH              | 0°C to 70°C        | 32-Pin TQFP (H32-7)        |
| <b>ML6431CH (EOL)</b> | <b>0°C to 70°C</b> | <b>32-Pin TQFP (H32-7)</b> |

© Micro Linear 2000.  **Micro Linear** is a registered trademark of Micro Linear Corporation. All other trademarks are the property of their respective owners.

Products described herein may be covered by one or more of the following U.S. patents: 4,897,611; 4,964,026; 5,027,116; 5,281,862; 5,283,483; 5,418,502; 5,508,570; 5,510,727; 5,523,940; 5,546,017; 5,559,470; 5,565,761; 5,592,128; 5,594,376; 5,652,479; 5,661,427; 5,663,874; 5,672,959; 5,689,167; 5,714,897; 5,717,798; 5,742,151; 5,747,977; 5,754,012; 5,757,174; 5,767,653; 5,777,514; 5,793,168; 5,798,635; 5,804,950; 5,808,455; 5,811,999; 5,818,207; 5,818,669; 5,825,165; 5,825,223; 5,838,723; 5,844,378; 5,844,941. Japan: 2,598,946; 2,619,299; 2,704,176; 2,821,714. Other patents are pending.

Micro Linear makes no representations or warranties with respect to the accuracy, utility, or completeness of the contents of this publication and reserves the right to make changes to specifications and product descriptions at any time without notice. No license, express or implied, by estoppel or otherwise, to any patents or other intellectual property rights is granted by this document. The circuits contained in this document are offered as possible applications only. Particular uses or applications may invalidate some of the specifications and/or product descriptions contained herein. The customer is urged to perform its own engineering review before deciding on a particular application. Micro Linear assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of Micro Linear products including liability or warranties relating to merchantability, fitness for a particular purpose, or infringement of any intellectual property right. Micro Linear products are not designed for use in medical, life saving, or life sustaining applications.

2092 Concourse Drive  
San Jose, CA 95131  
Tel: 408/433-5200  
Fax: 408/432-0295  
www.microlinear.com