

# High Bandwidth Triple Video Filters with Buffered Outputs for RGB or YUV

## GENERAL DESCRIPTION

The ML6426 are a family of triple video filters with buffered outputs. There are several versions of the ML6426, each with different passband cut-off frequencies of 6.7MHz, 12MHz, 15MHz, 24MHz, 30MHz, 36MHz, and 48MHz. Each channel contains a 4<sup>th</sup>-order Butterworth lowpass reconstruction video filter. The filter is optimized for minimum overshoot and flat group delay and guaranteed differential gain and phase at the outputs of the integrated cable drivers.

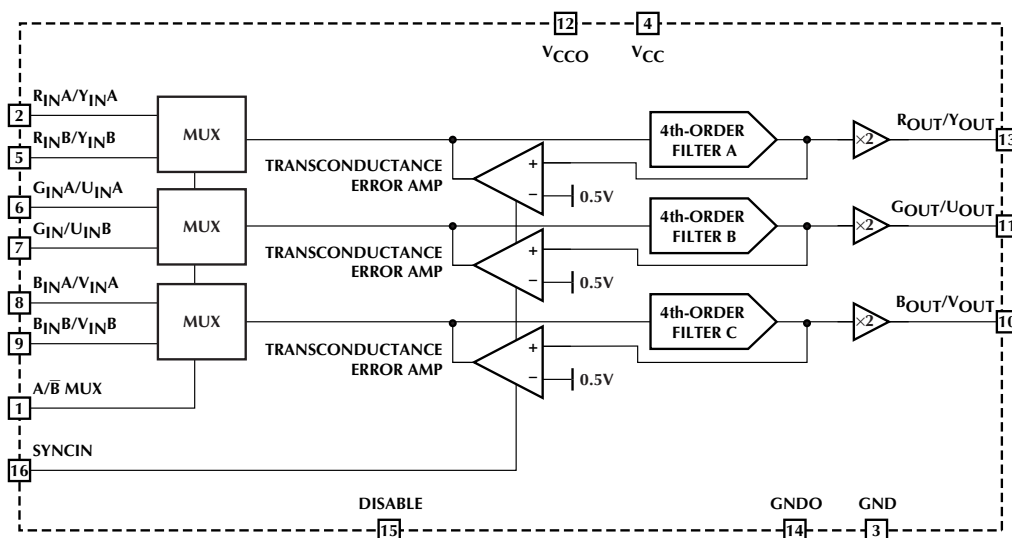
All input signals from DACs are AC coupled into the ML6426. All channels have DC restore circuitry to clamp the DC input levels during video H-sync, using an output feedback clamp. An external H-sync signal is required for this purpose.

All outputs must be AC coupled into their loads. Each output can drive 2V<sub>P-P</sub> into a 150Ω load. All channels have a gain of 2 (6dB) at 1V<sub>P-P</sub> input levels.

## FEATURES

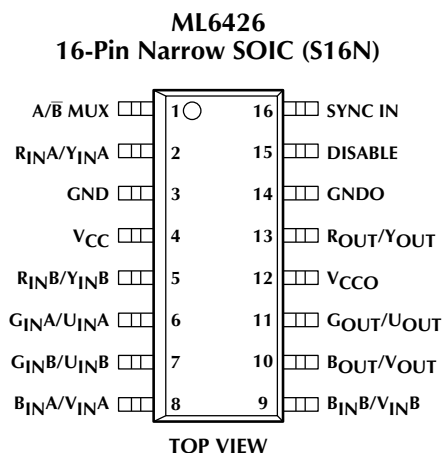
- 5V ±10% operation
- RGB/YUV filters for ATSC Digital Television VESA Standard
- 2:1 Mux Inputs for multiple RGB/YUV inputs
- Triple Reconstruction Filter options for 6.7, 12, 15, 24, 30, 36, and 48MHz to handle various line rates
- Multiple ML6426 outputs can be paralleled to drive RGB/YUV outputs at different frequencies for various line rates by means of Disable/Enable pin.
- 6dB drivers and sync tip clamps for DC restore
- DC restore with minimal tilt
- 0.4% differential gain on all channels  
0.4° differential phase on all channels  
0.8% total harmonic distortion on all channels
- 2kV ESD protection

## BLOCK DIAGRAM



|          | ML6426-1 | ML6426-2 | ML6426-3 | ML6426-4 | ML6426-5 | ML6426-6 | ML6426-15 |
|----------|----------|----------|----------|----------|----------|----------|-----------|
| Filter A | 6.7MHz   | 12MHz    | 24MHz    | 30MHz    | 36MHz    | 48MHz    | 15MHz     |
| Filter B | 6.7MHz   | 12MHz    | 24MHz    | 30MHz    | 36MHz    | 48MHz    | 15MHz     |
| Filter C | 6.7MHz   | 12MHz    | 24MHz    | 30MHz    | 36MHz    | 48MHz    | 15MHz     |

## PIN CONFIGURATION



## PIN DESCRIPTION

| PIN | NAME                                | FUNCTION                                                                                                  | PIN | NAME                                | FUNCTION                                                                                      |
|-----|-------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|-------------------------------------|-----------------------------------------------------------------------------------------------|
| 1   | A/ $\bar{B}$ MUX                    | Logic input pin to select between Bank <A> and Bank <B> video inputs. This pin is internally pulled high. | 8   | B <sub>IN</sub> A/V <sub>IN</sub> A | Unfiltered analog B- or V-channel input for Bank <A>. Sync must be provided at SYNC IN pin.   |
| 2   | R <sub>IN</sub> A/Y <sub>IN</sub> A | Unfiltered analog R- or Y-channel input for Bank <A>. Sync must be provided at SYNC IN pin.               | 9   | B <sub>IN</sub> B/V <sub>IN</sub> B | Unfiltered analog B- or V-channel input for Bank <B>. Sync must be provided at SYNC IN pin.   |
| 3   | GND                                 | Analog ground                                                                                             | 10  | B <sub>OUT</sub>                    | Analog B or V-channel output                                                                  |
| 4   | V <sub>CC</sub>                     | Analog 5V supply                                                                                          | 11  | G <sub>OUT</sub>                    | Analog G or U-channel output                                                                  |
| 5   | R <sub>IN</sub> B/Y <sub>IN</sub> B | Unfiltered analog R- or Y-channel input for Bank <B>. Sync must be provided at SYNC IN pin.               | 12  | V <sub>CCO</sub>                    | 5V power supply for output buffers                                                            |
| 6   | G <sub>IN</sub> A/U <sub>IN</sub> A | Unfiltered analog G- or U-channel input for Bank <A>. Sync must be provided at SYNC IN pin.               | 13  | R <sub>OUT</sub>                    | Analog R or Y-channel output                                                                  |
| 7   | G <sub>IN</sub> B/U <sub>IN</sub> B | Unfiltered analog G- or U-channel input for Bank <B>. Sync must be provided at SYNC IN pin.               | 14  | GNDO                                | Analog ground                                                                                 |
|     |                                     |                                                                                                           | 15  | DISABLE                             | Disable/Enable pin. Turns the chip off when logic high. Internally pulled low.                |
|     |                                     |                                                                                                           | 16  | SYNC IN                             | Input for an external H-sync logic signal for filter channels. CMOS level input. Active High. |

## 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.

$V_{CC}$  ..... -0.3V to 7V  
 Junction Temperature ..... 150°C  
 ESD ..... >2000V  
 Analog and Digital I/O ..... GND -0.3V to  $V_{CC} + 0.3V$

Storage Temperature Range ..... -65°C to 150°C  
 Lead Temperature (Soldering, 10 sec) ..... 260°C  
 Thermal Resistance ( $\theta_{JA}$ ) ..... 100°C/W

## OPERATING CONDITIONS

Temperature Range ..... 0°C to 70°C  
 $V_{CC}$  Range ..... 4.5V to 5.5V

## ELECTRICAL CHARACTERISTICS

Unless otherwise specified,  $V_{CC} = 5V \pm 10\%$ ,  $T_A$  = Operating Temperature Range (Note 1)

| SYMBOL         | PARAMETER                                                  | CONDITIONS                                  | MIN  | TYP | MAX  | UNITS     |
|----------------|------------------------------------------------------------|---------------------------------------------|------|-----|------|-----------|
| <b>GENERAL</b> |                                                            |                                             |      |     |      |           |
| $I_{CC}$       | Supply Current                                             | No Load ( $V_{CC}=5.5V$ )                   |      | 52  | 80   | mA        |
| $A_V$          | Low Frequency Gain (R, G, B)                               | $V_{IN} = 100mV_{P-P}$ at 100KHz            | 5.34 | 6.0 | 6.65 | dB        |
| $V_{OUT}$      | Output Level during Sync (R, G, B <sub>i</sub> )           | DURING SYNC                                 | 0.7  | 0.9 | 1.1  | V         |
|                | Output Capability                                          | $R_L = 150\Omega$ , AC-coupled@1MHz         | 2    |     |      | VP-P      |
| $t_{CLAMP}$    | Clamp Response Time                                        | Settled to Within 10mV, $C_{IN} = 0.1\mu F$ |      | 10  |      | ms        |
| $V_I$          | Input Signal Dynamic Range (R, G, B <sub>i</sub> )         | AC Coupled                                  |      | 1.4 |      | $V_{P-P}$ |
| OS             | Peak Overshoot (R, G, B <sub>i</sub> )                     | $2V_{P-P}$ Output Pulse                     |      | 4.3 |      | %         |
| $C_L$          | Output Load Capacitance (R, G, B <sub>i</sub> )            | All Outputs                                 |      |     | 35   | pF        |
|                | Output Load Drive Capability, per Pin (YUV or RGB Outputs) | One Load is 150Ω                            |      | 2   |      | loads     |
| dG             | Differential Gain (R, G, B <sub>i</sub> )                  | All Outputs at $f_C/2$                      |      | 0.4 |      | %         |
| dφ             | Differential Phase (R, G, B <sub>i</sub> )                 | All Outputs at $f_C/2$                      |      | 0.4 |      | °         |
| $T_{HD}$       | Output Distortion (R, G, B <sub>i</sub> )                  | $V_{OUT} = 2V_{P-P}$ at 1 MHz               |      | 0.8 |      | %         |
| PSRR           | PSRR (R, G, B <sub>i</sub> )                               | $0.5V_{P-P}$ (100kHz) at $V_{CC}$           |      | 35  |      | dB        |
| $I_{SC}$       | Output Short Circuit Current (R, G, B <sub>i</sub> )       | Note 2                                      |      | 120 |      | mA        |
| $V_{IH}$       | Input Voltage Logic High                                   | DISABLE, SYNC IN                            | 2.5  |     |      | V         |
| $V_{IL}$       | Input Voltage Logic Low                                    | DISABLE, SYNC IN                            |      |     | 1.0  | V         |
| $T_{MUX}$      | Input Mux Data Valid Time                                  | A/B Mux Pin Valid High or Low               |      | 2   |      | μs        |

### 6.7MHz FILTER: ML6426-1

|             |                                                 |                                                         |     |     |     |                   |
|-------------|-------------------------------------------------|---------------------------------------------------------|-----|-----|-----|-------------------|
| $f_{1dB}$   | -1dB Bandwidth Flatness (R, G, B <sub>i</sub> ) | 25°C                                                    | 4.0 | 4.8 |     | MHz               |
| $f_c$       | -3dB Bandwidth Flatness (R, G, B <sub>i</sub> ) | 25°C                                                    | 6.0 | 6.7 | 7.3 | MHz               |
| $f_{0.8fc}$ | 0.8 x $f_C$ Attenuation                         |                                                         |     | 1.5 |     | dB                |
| $f_{SB}$    | StopBand Rejection (All Channels $\geq 4 f_C$ ) | $f_{IN} \geq 4 f_C$ , Note 3                            | -38 | -42 |     | dB                |
| NOISE       | Output Noise (R, G, B <sub>i</sub> )            | Fullband                                                |     | 1.0 |     | mV <sub>RMS</sub> |
| $X_{TALK}$  | Crosstalk                                       | Input of $0.5V_{P-P}$ at 1 MHz Between any two Channels |     | -55 |     | dB                |
| $X_{TALK}$  | A/B MUX Crosstalk                               | Input of $0.5V_{P-P}$ at 3.58/4.43MHz                   |     | -54 |     | dB                |

## ELECTRICAL CHARACTERISTICS (Continued)

| SYMBOL                              | PARAMETER                                                     | CONDITIONS                                                        | MIN  | TYP | MAX  | UNITS             |
|-------------------------------------|---------------------------------------------------------------|-------------------------------------------------------------------|------|-----|------|-------------------|
| 6.7MHZ FILTER: ML6426-1 (continued) |                                                               |                                                                   |      |     |      |                   |
| T <sub>PD</sub>                     | Group Delay (R, G, B, <sub>)</sub>                            | 100kHz                                                            |      | 70  |      | ns                |
| ΔT <sub>PD</sub>                    | Group Delay Deviation from Flatness<br>(R, G, B, <sub>)</sub> | to 3.58MHz                                                        |      | 4.0 |      | ns                |
|                                     |                                                               | to 4.43MHz                                                        |      | 8.0 |      | ns                |
|                                     |                                                               | to 10MHz                                                          |      | 9   |      | ns                |
| 2MHz FILTER: ML6426-2               |                                                               |                                                                   |      |     |      |                   |
| f <sub>1dB</sub>                    | −1dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 7.8  | 9.2 |      | MHz               |
| f <sub>C</sub>                      | −3dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 10.8 | 12  | 13.2 | MHz               |
| f <sub>0.8fc</sub>                  | 0.8 x f <sub>C</sub> Attenuation                              |                                                                   |      | 1.2 |      | dB                |
| f <sub>SB</sub>                     | StopBand Rejection (All Channels ≥ 4 f <sub>C</sub> )         | f <sub>IN</sub> ≥ 4 f <sub>C</sub> , Note 3                       |      | −40 |      | dB                |
| NOISE                               | Output Noise (R, G, B, <sub>)</sub>                           | Fullband                                                          |      | 1   |      | mV <sub>RMS</sub> |
| X <sub>TALK</sub>                   | Crosstalk                                                     | Input of 0.5V <sub>P-P</sub> at 1 MHz<br>Between any two Channels |      | −55 |      | dB                |
| X <sub>TALK</sub>                   | A/ $\overline{B}$ MUX Crosstalk                               | Input of 0.5V <sub>P-P</sub> at 3.58/4.43MHz                      |      | −54 |      | dB                |
| T <sub>PD</sub>                     | Group Delay (R, G, B, <sub>)</sub>                            | 100kHz                                                            |      | 40  |      | ns                |
| ΔT <sub>PD</sub>                    | Group Delay Deviation from Flatness<br>(R, G, B, <sub>)</sub> | to 3.58MHz                                                        |      | 1   |      | ns                |
|                                     |                                                               | to 4.43MHz                                                        |      | 1   |      | ns                |
|                                     |                                                               | to 10MHz                                                          |      | 7   |      | ns                |
| 24MHz FILTER: ML6426-3              |                                                               |                                                                   |      |     |      |                   |
| f <sub>1dB</sub>                    | −1dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 13.6 | 16  |      | MHz               |
| f <sub>C</sub>                      | −3dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 21.6 | 24  | 26.4 | MHz               |
| f <sub>0.8fc</sub>                  | 0.8 x f <sub>C</sub> Attenuation                              |                                                                   |      | 1.7 |      | dB                |
| f <sub>SB</sub>                     | StopBand Rejection (All Channels ≥ 4 f <sub>C</sub> )         | f <sub>IN</sub> ≥ 4 f <sub>C</sub> , Note 3                       |      | −40 |      | dB                |
| NOISE                               | Output Noise (R, G, B, <sub>)</sub>                           | Fullband                                                          |      | 1.0 |      | mV <sub>RMS</sub> |
| X <sub>TALK</sub>                   | Crosstalk                                                     | Input of 0.5V <sub>P-P</sub> at 1 MHz<br>Between any two Channels |      | −55 |      | dB                |
| X <sub>TALK</sub>                   | A/ $\overline{B}$ MUX Crosstalk                               | Input of 0.5V <sub>P-P</sub> at 3.58/4.43MHz                      |      | -54 |      | dB                |
| T <sub>PD</sub>                     | Group Delay (R, G, B, <sub>)</sub>                            | 100kHz                                                            |      | 22  |      | ns                |
| ΔT <sub>PD</sub>                    | Group Delay Deviation from Flatness<br>(R, G, B, <sub>)</sub> | to 3.58MHz                                                        |      | 1   |      | ns                |
|                                     |                                                               | to 4.43MHz                                                        |      | 1   |      | ns                |
|                                     |                                                               | to 10MHz                                                          |      | 2   |      | ns                |
| 30MHz FILTER: ML6426-4              |                                                               |                                                                   |      |     |      |                   |
| f <sub>1dB</sub>                    | −1dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 15.3 | 18  |      | MHz               |
| f <sub>C</sub>                      | −3dB Bandwidth Flatness (R, G, B, <sub>)</sub>                | 25°C                                                              | 27   | 30  | 33   | MHz               |
| f <sub>0.8fc</sub>                  | 0.8 x f <sub>C</sub> Attenuation                              |                                                                   |      | 1.7 |      | dB                |
| f <sub>SB</sub>                     | StopBand Rejection (All Channels ≥ 4 f <sub>C</sub> )         | f <sub>IN</sub> ≥ 4 f <sub>C</sub> , Note 3                       |      | −40 |      | dB                |
| NOISE                               | Output Noise (R, G, B, <sub>)</sub>                           | Fullband                                                          |      | 1.0 |      | mV <sub>RMS</sub> |

**ELECTRICAL CHARACTERISTICS** (Continued)

| SYMBOL                             | PARAMETER                                                      | CONDITIONS                                                        | MIN  | TYP | MAX  | UNITS             |
|------------------------------------|----------------------------------------------------------------|-------------------------------------------------------------------|------|-----|------|-------------------|
| 30MHz FILTER: ML6426-4 (Continued) |                                                                |                                                                   |      |     |      |                   |
| X <sub>TALK</sub>                  | Crosstalk                                                      | Input of 0.5V <sub>P-P</sub> at 1 MHz<br>Between any two Channels |      | −55 |      | dB                |
| X <sub>TALK</sub>                  | A/ $\overline{B}$ MUX Crosstalk                                | Input of 0.5V <sub>P-P</sub> at 3.58/4.43MHz                      |      | -54 |      | dB                |
| T <sub>PD</sub>                    | Group Delay (R, G, B <sub>r</sub> )                            | 100kHz                                                            |      | 18  |      | ns                |
| ΔT <sub>PD</sub>                   | Group Delay Deviation from Flatness<br>(R, G, B <sub>r</sub> ) | to 10MHz                                                          |      | 0.5 |      | ns                |
|                                    |                                                                | to 27MHz                                                          |      | 2   |      | ns                |
| 36MHz FILTER: ML6426-5             |                                                                |                                                                   |      |     |      |                   |
| f <sub>1dB</sub>                   | −1dB Bandwidth Flatness (R, G, B <sub>r</sub> )                | 25°C                                                              | 17   | 20  |      | MHz               |
| f <sub>C</sub>                     | −3dB Bandwidth Flatness (R, G, B <sub>r</sub> )                | 25°C                                                              | 32.4 | 36  | 39.6 | MHz               |
| f <sub>0.8fc</sub>                 | 0.8 × f <sub>C</sub> Attenuation                               |                                                                   |      | 2   |      | dB                |
| f <sub>SB</sub>                    | StopBand Rejection (All Channels ≥ 4 f <sub>C</sub> )          | f <sub>IN</sub> ≥ 4 f <sub>C</sub> , Note 3                       |      | −40 |      | dB                |
| NOISE                              | Output Noise (R, G, B <sub>r</sub> )                           | Fullband                                                          |      | 1.0 |      | mV <sub>RMS</sub> |
| X <sub>TALK</sub>                  | Crosstalk                                                      | Input of 0.5V <sub>P-P</sub> at 1 MHz<br>Between any two Channels |      | −55 |      | dB                |
| X <sub>TALK</sub>                  | A/ $\overline{B}$ MUX Crosstalk                                | Input of 0.5V <sub>P-P</sub> at 3.58/4.43MHz                      |      | −54 |      | dB                |
| T <sub>PD</sub>                    | Group Delay (R, G, B <sub>r</sub> )                            | 100kHz                                                            |      | 17  |      | ns                |
| ΔT <sub>PD</sub>                   | Group Delay Deviation from Flatness<br>(R, G, B <sub>r</sub> ) | to 10MHz                                                          |      | 0.5 |      | ns                |
|                                    |                                                                | to 30MHz                                                          |      | 4   |      | ns                |
| 48MHz FILTER: ML6426-6             |                                                                |                                                                   |      |     |      |                   |
| f <sub>1dB</sub>                   | −1dB Bandwidth Flatness (R, G, B <sub>r</sub> )                | 25°C                                                              | 25.5 | 30  |      | MHz               |
| f <sub>C</sub>                     | −3dB Bandwidth Flatness (R, G, B <sub>r</sub> )                | 25°C                                                              | 43.2 | 48  | 52.8 | MHz               |
| f <sub>0.8fc</sub>                 | 0.8 × f <sub>C</sub> Attenuation                               |                                                                   |      | 1.2 |      | dB                |
| f <sub>SB</sub>                    | StopBand Rejection (All Channels ≥ 4 f <sub>C</sub> )          | f <sub>IN</sub> ≥ 4 f <sub>C</sub> , Note 3                       |      | −40 |      | dB                |
| NOISE                              | Output Noise (R, G, B <sub>r</sub> )                           | Fullband                                                          |      | 1.0 |      | mV <sub>RMS</sub> |
| X <sub>TALK</sub>                  | Crosstalk                                                      | Input of 0.5V <sub>P-P</sub> at 1 MHz<br>Between any two Channels |      | −55 |      | dB                |
| X <sub>TALK</sub>                  | A/ $\overline{B}$ MUX Crosstalk                                | Input of 0.5V <sub>P-P</sub> at 3.58/4.43MHz                      |      | −54 |      | dB                |
| T <sub>PD</sub>                    | Group Delay (R, G, B <sub>r</sub> )                            | 100kHz                                                            |      | 16  |      | ns                |
| ΔT <sub>PD</sub>                   | Group Delay Deviation from Flatness<br>(R, G, B <sub>r</sub> ) | to 10MHz                                                          |      | 0.5 |      | ns                |
|                                    |                                                                | to 40MHz                                                          |      | 2   |      | ns                |

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

**Note 2.** Sustained short circuit protection limited to 10 seconds.

**Note 3.** 38dB is based on tester noise limits.

## FUNCTIONAL DESCRIPTION

The ML6426 is a triple monolithic continuous time video filter designed for reconstructing video signals from an YUV/RGB video D/A source. The ML6426 is intended for use in AC coupled input and output applications.

The filters approximate a 4th-order Butterworth characteristic with an optimization toward low overshoot and flat group delay. All outputs are capable of driving  $2V_{P-P}$  into AC coupled  $150\Omega$  video loads, with up to  $35pF$  of load capacitance. All outputs are capable of driving a  $75\Omega$  load at  $1V_{P-P}$ .

All channels are clamped during sync to establish the appropriate output voltage swing range (DC restore). Thus the input coupling capacitors do not behave according to the conventional RC time constant. In most applications, the ML6426's input coupling capacitors are only  $0.1\mu F$ .

An external CMOS compatible  $H_{SYNC}$  pulse is required which is Active High on the SYNC IN Pin. See Figure 2.

During sync, the feedback clamp sources/sinks current to restore the DC level. The net result is that the average input current is zero. Any change in the input coupling capacitors' value will linearly affect the clamp response times.

Each channel is essentially tilt-free. Each input is clamped by a feedback amp which responds to the output during sync.

The ML6426 is robust and stable under all stated load and input conditions. Bypassing both  $V_{CC}$  pins directly to ground ensures this performance.

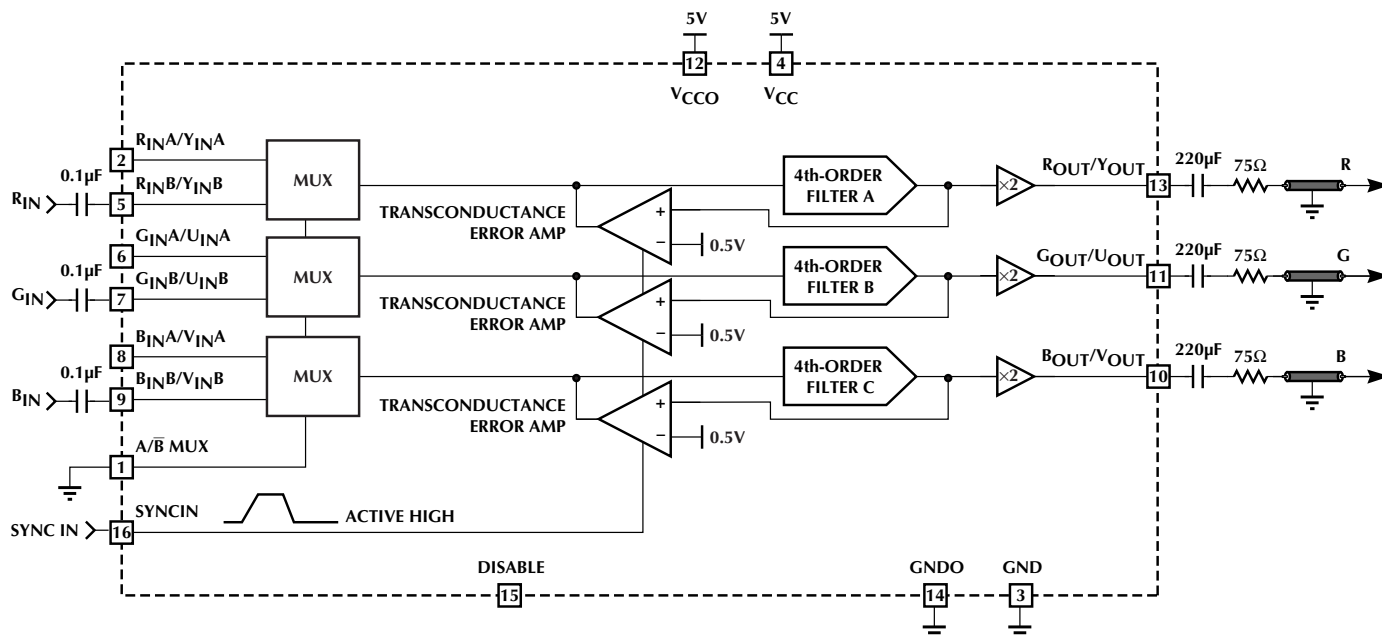


Figure 1. Typical Application Schematic

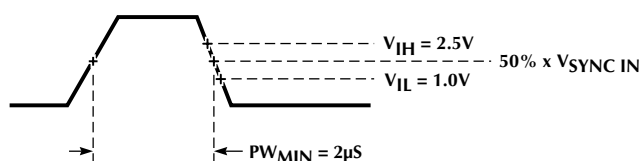


Figure 2. SYNC IN Pulse Width

## TYPICAL APPLICATIONS

### RECONSTRUCTION FILTER SELECTION FOR HDTV AND VGA SIGNAL FILTERING

The filtering requirements for HDTV and VGA standards vary depending on the resolution of the image to be displayed, and its refresh rate. The actual refresh rate of the display is not necessarily the same as the transmission rate of the frames of images. Some formats use a frame rate of 30Hz, but the display of those formats cannot be scanned onto the CRT at 30Hz. Excessive large area

flicker would result. Such kinds of flicker can be seen on a PAL display with its brightness set high. To avoid this, the video will need to be stored in a frame buffer. This buffer already exists in the MPEG decoder of HDTV systems, so there is no cost penalty. The buffer is read out at twice the rate as the frame rate for 30Hz systems, thus getting us a refresh rate of 60Hz. Similar things are done for the 24Hz frame rate formats to boost them to a 60Hz refresh rate.

| PIXELS | VERTICAL LINES | ASPECT RATIO | PICTURE TRANSMISSION RATE |
|--------|----------------|--------------|---------------------------|
| 1920   | 1080           | 16:9         | 60I, 30P, 24P             |
| 1280   | 720            | 16:9         | 60P, 30P, 24P             |
| 704    | 480            | 16:9 and 4:3 | 60P, 60I, 30P, 24P        |
| 640    | 480            | 4:3          | 60P, 60I, 30P, 24P        |

P=progressive scan, I=interlaced scan

**Table 1: HDTV / Advanced TV Applications: (From Table 10.3 from ATSC document A54)**

| STANDARD   | PIXELS | VERTICAL LINES | PICTURE TRANSMISSION RATE (Note 2) | DISPLAY REFRESH RATE (Note 2) | APPROXIMATE HORIZONTAL RATE | APPROXIMATE SAMPLE CLOCK | APPROXIMATE RECONSTRUCTION FILTER CUTOFF | MICRO LINEAR FILTER TO USE (Note 3) |
|------------|--------|----------------|------------------------------------|-------------------------------|-----------------------------|--------------------------|------------------------------------------|-------------------------------------|
| SMPTE 274M | 1920   | 1080           | 60I                                | 60Hz                          | 35.3KHz                     | 81MHz                    | 40.5MHz                                  | ML6426-6                            |
|            | 1920   | 1080           | 30P, 24P                           | 60Hz                          | 70.6KHz                     | 162MHz                   | 81MHz                                    | N/A                                 |
| SMPTE      | 1280   | 720            | 60P, 30P, 24P                      | 60Hz                          | 47.1KHz                     | 60MHz                    | 30MHz                                    | ML6426-5<br>ML6426-4                |
|            | 704    | 480 (Note 1)   | 60I                                | 60Hz                          | 15.7KHz                     | 13.5MHz                  | 6.75MHz                                  | ML6426-1                            |
|            | 704    | 480            | 60P, 30P, 24P                      | 60Hz                          | 31KHz                       | 27MHz                    | 13.5MHz                                  | ML6426-2<br>ML6426-4                |
|            | 640    | 480 (Note 1)   | 60I                                | 60Hz                          | 15.7KHz                     | 24.5MHz                  | 12MHz                                    | ML6426-2                            |
|            | 640    | 480            | 60P, 30P, 24P                      | 60Hz                          | 31KHz                       | 12.27MHz                 | 6MHz                                     | ML6426-1                            |

P=progressive scan, I=interlaced scan, na = not available

**Note 1:** NTSC display rates, can be fed directly into NTSC encoder (set top box)

**Note 2:** 60 Hz also includes 59.94Hz

**Note 3:** custom frequencies ranging  $\pm 3$  to 6MHz can be special cut to order

**Table 2: Choosing the Correct Reconstruction Filter and Video Amplifier for TV Applications, ML6426 options**

## TYPICAL APPLICATIONS (Continued)

Pixel clock rates for the output D/A converters can be roughly determined from the Table 1. Don't forget that the deflection system of a CRT display needs retrace time for the vertical and horizontal.

This retrace time can vary from one design of an HDTV set to another, as it only involves tradeoffs between the frame buffer in the MPEG decoder and the CRT deflection system. Allowing for 10% retrace time for the vertical and 20% for the horizontal, the appropriate Reconstruction Filter is summarized in Table 2.

For VGA or RGB monitors, the following resolutions can use the corresponding Reconstruction Filter and Video Amplifier as shown in Table 3.

Figures 4, 5, and 6 show system diagrams when the ML6426 provides a good solution. Figure 7 provides a more detailed description for advanced TV applications using various resolutions for legacy video, SDTV, and HDTV.

## USING THE ML6426 IN MULTIPLE RESOLUTIONS

Several ML6426 devices can be used in parallel to construct a selectable filter selection block ranging from frequencies between 6.7 MHz to 50MHz. Each ML6426 can be individually controlled via the disable pin. In a parallel configuration, as shown in Figure 3 and 7, several ML6426 devices can be used and selected via general purpose I/O or other logic to perform the proper reconstruction filtering for the resolution of choice. This configuration allows for a minimum of bill of materials and reduces cost. Micro Linears ML6426 EVAL Kit demonstrates multi-resolution designs. Furthermore, since the ML6426 pin-out is identical for all the options, the filters can be interchanged. This allows for ease of product migration to integrate newer resolutions to filter and drive various DAC outputs at different sampling frequencies.

| PIXELS | VERTICAL LINES | NAME | REFRESH RATE<br>(prog except noted) | HORIZONTAL RATE | SAMPLE CLOCK | RECONSTRUCTION<br>FILTER CUTOFF | MICRO LINEAR<br>FILTER TO USE |
|--------|----------------|------|-------------------------------------|-----------------|--------------|---------------------------------|-------------------------------|
| 640    | 480            | VGA  | 60Hz                                | 31.5kHz         | 25.175MHz    | 12.5MHz                         | ML6426-2                      |
|        |                | VGA  | 72Hz                                | 37.9kHz         | 31.5MHz      | 15.5MHz                         | ML6426-3                      |
|        |                | VGA  | 75Hz                                | 37.5kHz         | 31.5MHz      | 15.5MHz                         | ML6426-3                      |
| 800    | 600            | SVGA | 56Hz                                | 35.1kHz         | 36MHz        | 18MHz                           | ML6426-3                      |
|        |                | SVGA | 60Hz                                | 37.9kHz         | 40MHz        | 20MHz                           | ML6426-3                      |
|        |                | SVGA | 72Hz                                | 48.1kHz         | 50MHz        | 25MHz                           | ML6426-3                      |
|        |                | SVGA | 75Hz                                | 46.9kHz         | 49.5MHz      | 25MHz                           | ML6426-3                      |
| 1024   | 768            | XGA  | 43Hz<br>Interlaced                  | 35.5kHz         | 44.9MHz      | 23MHz                           | ML6426-3                      |
|        |                | XGA  | 60Hz                                | 37.9kHz         | 65MHz        | 33MHz                           | ML6426-5                      |
|        |                | XGA  | 70Hz                                | 56.5kHz         | 75MHz        | 37.5MHz                         | ML6426-5                      |
|        |                | XGA  | 75Hz                                | 60kHz           | 78.75MHz     | 39.4MHz                         | ML6426-6                      |
| 1280   | 1024           | SXGA | 75Hz                                | 80kHz           | 135MHz       | 68MHz                           | na                            |
|        |                | SXGA | 60Hz                                |                 | 113MHz       | 57MHz                           | na                            |
| 1600   | 1200           | UXGA | 60Hz                                |                 | 166MHz       | 83MHz                           | na                            |

N/A = not available

**Table 3: Choosing the Correct Reconstruction Filter and Video Amplifier for TV Applications, ML6426 options**



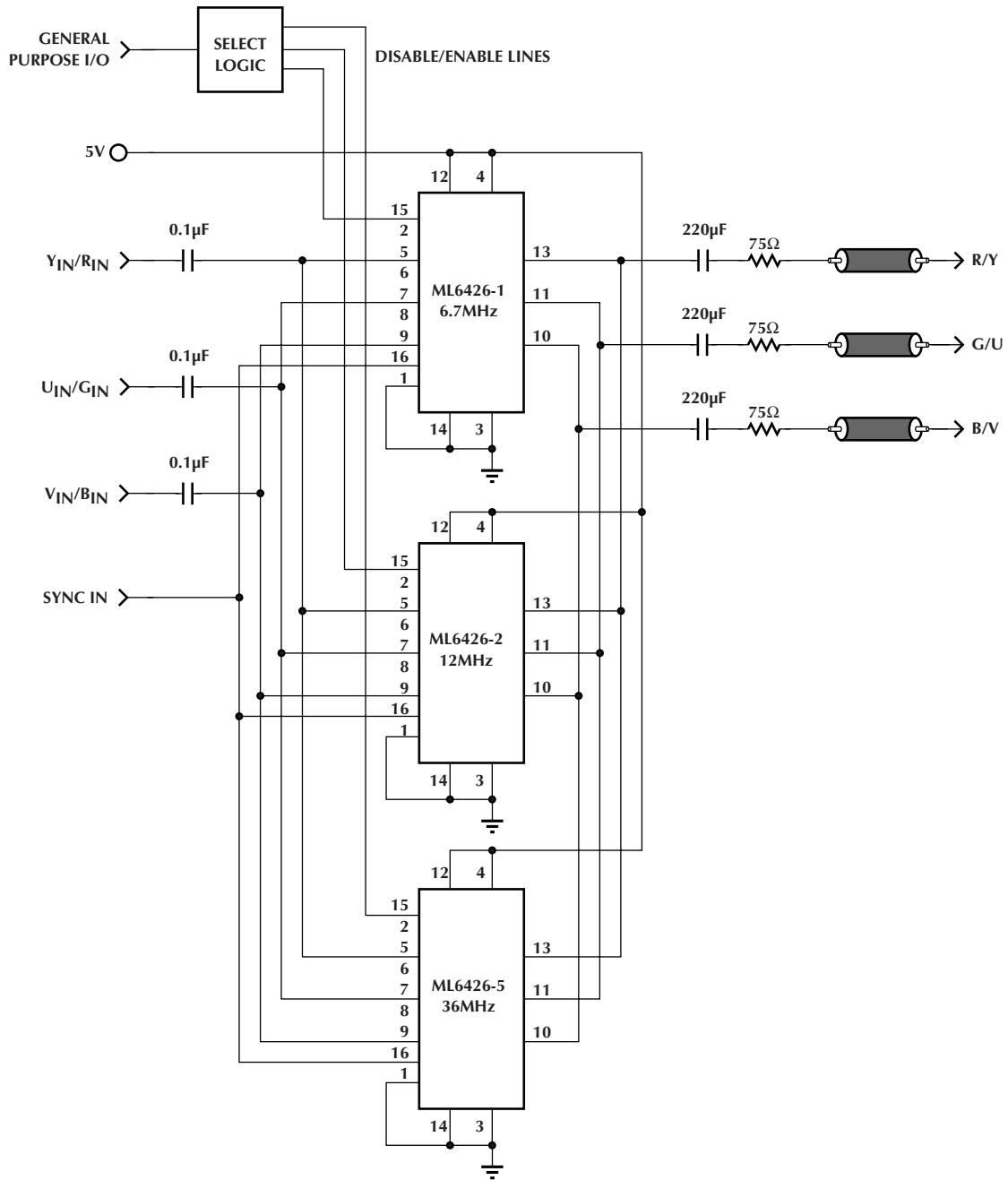


Figure 3. ATSC Digital Television Application

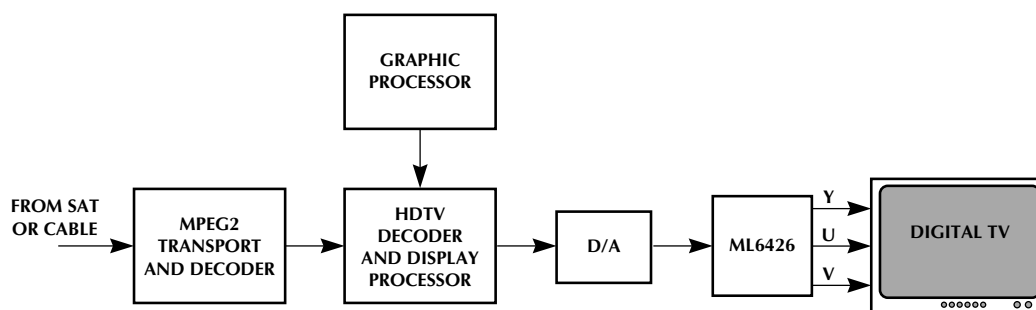


Figure 4. Digital TV Receiver or HDTV Decoder Box

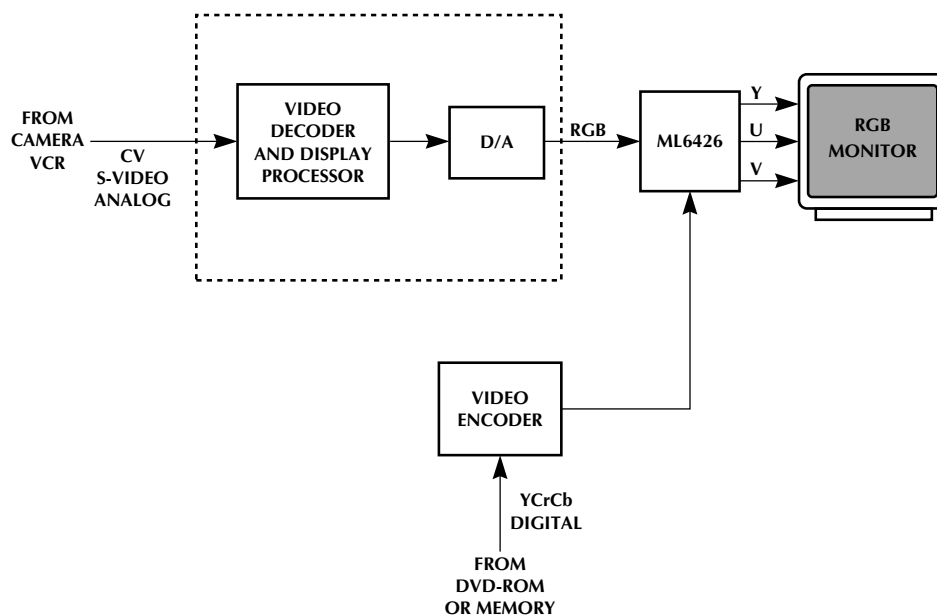


Figure 5. PC Graphics/Frame Grabber Editing Card

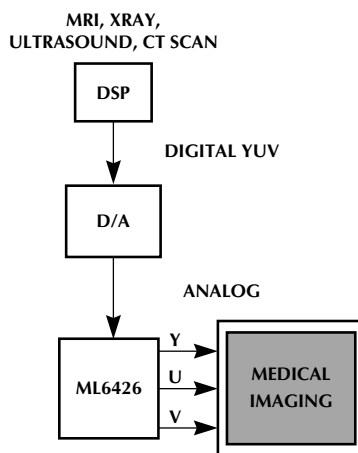


Figure 6. PC MRI, XRAY, Ultrasound, CT Scan

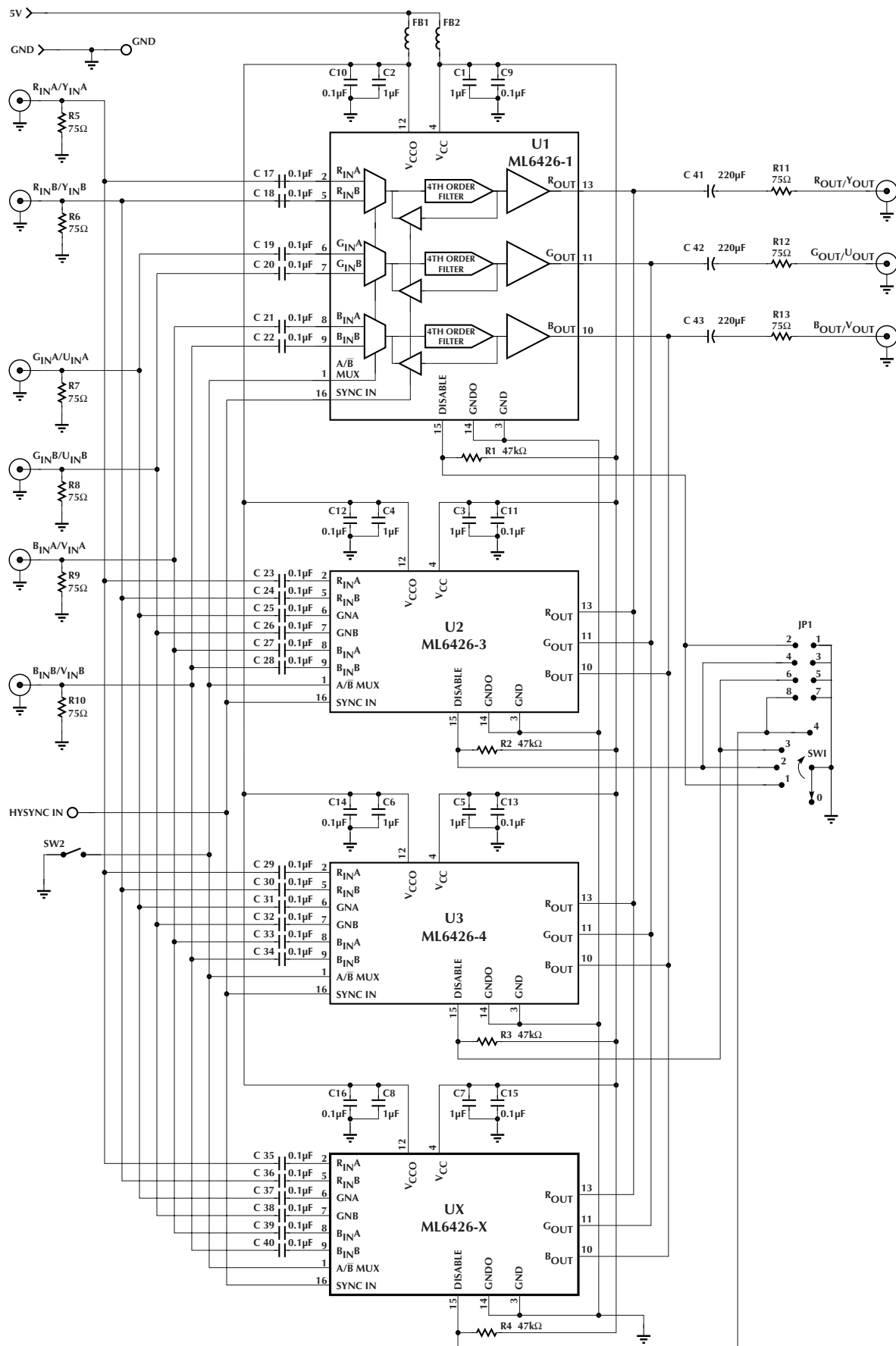


Figure 7. Typical Applications Schematic

## PERFORMANCE DATA

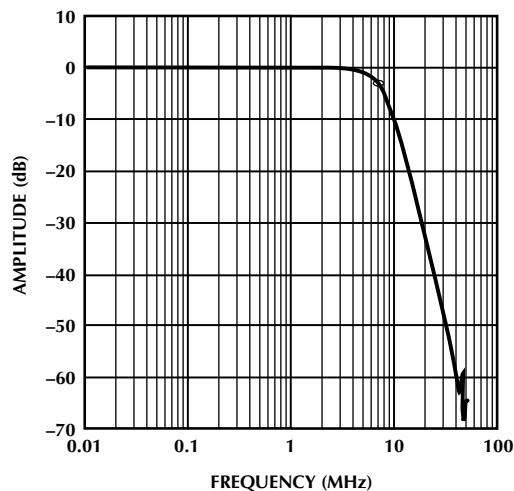


Figure 8. Passband Flatness all Outputs (Normalized) 6.7 MHz, ML6426CS-1

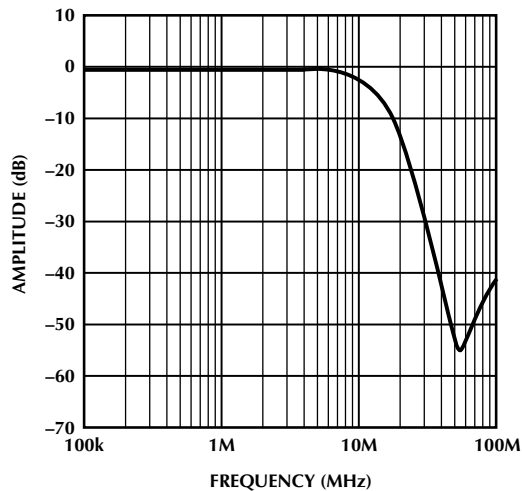


Figure 9. Passband Flatness all Outputs (Normalized) 12MHz, ML6426CS-2

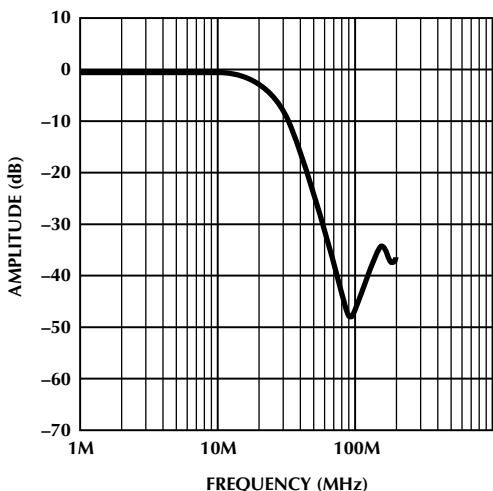


Figure 10. Passband Flatness all Outputs (Normalized) 24 MHz, ML6426CS-3

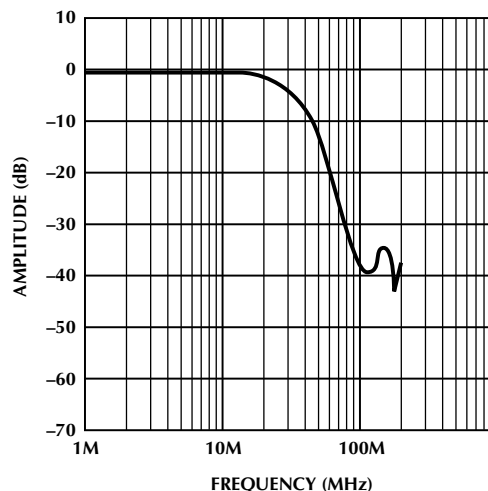


Figure 11. Passband Flatness all Outputs (Normalized) 30 MHz, ML6426CS-4

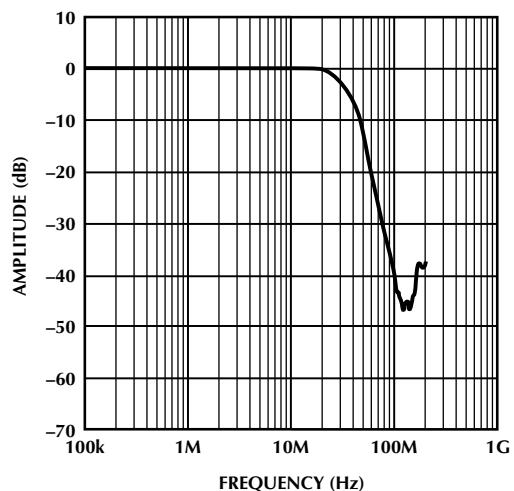


Figure 12. Passband Flatness all Outputs (Normalized) 36MHz, ML6426CS-5

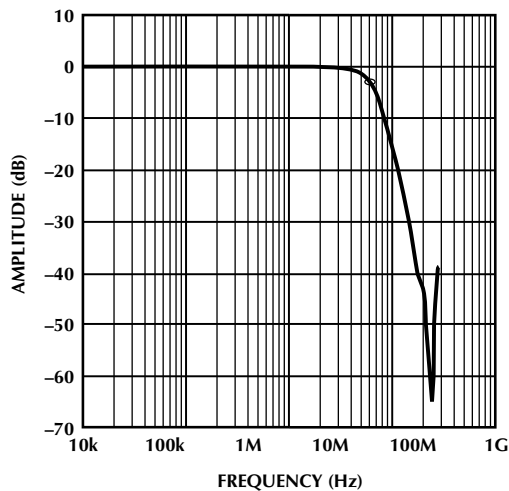


Figure 13. Passband Flatness all Outputs (Normalized) 48MHz, ML6426CS-6

PERFORMANCE DATA (Continued)

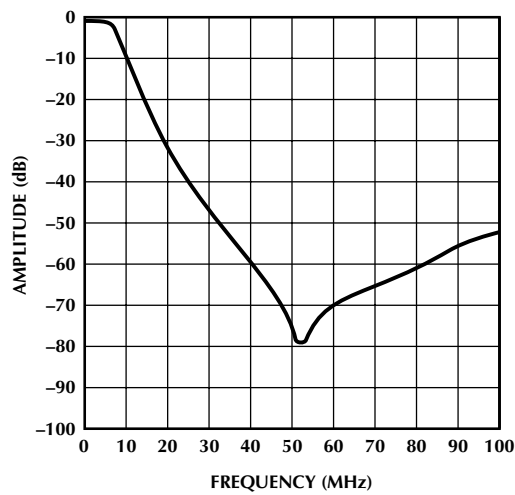


Figure 14. Frequency Response All Outputs ML6426-CS-1

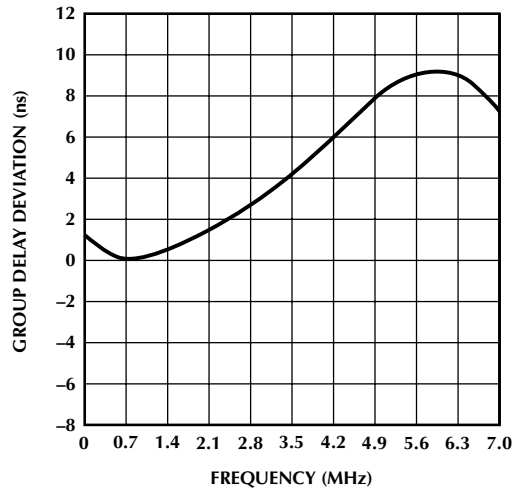


Figure 15. Group Delay Deviation of Passband, All Outputs ML6426CS-1

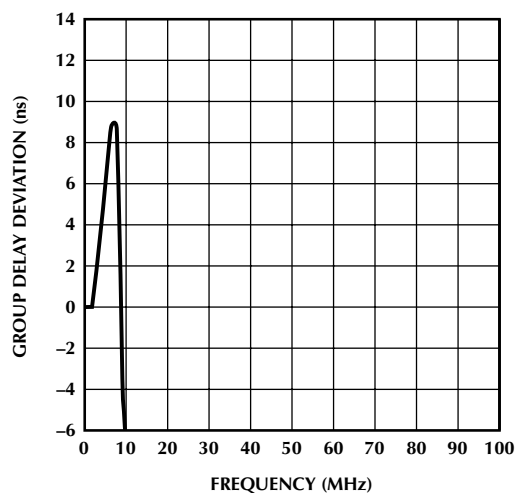


Figure 16. Group Delay Deviation All band, All Outputs ML6426CS-1

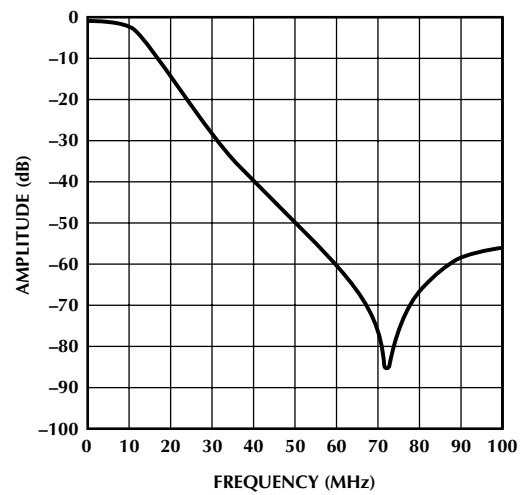


Figure 17. Frequency Response All Outputs ML6426CS-2

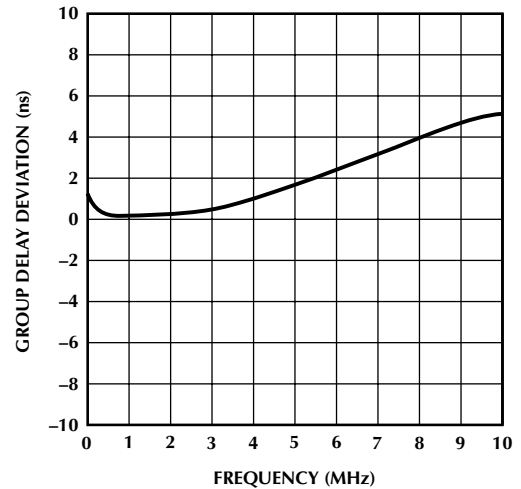


Figure 18. Group Delay Deviation of Passband, All Outputs ML6426CS-2

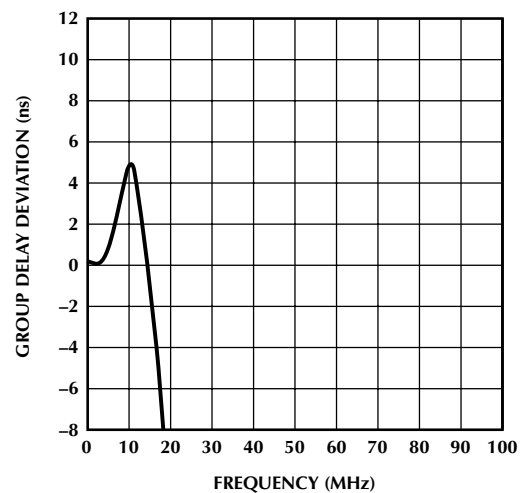


Figure 19. Group Delay Deviation All Band, All Outputs ML6426CS-2

## PERFORMANCE DATA (Continued)

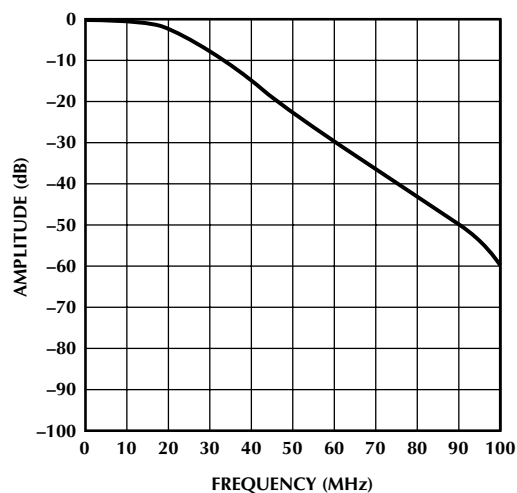


Figure 20. Frequency Response All Outputs ML6426CS-3

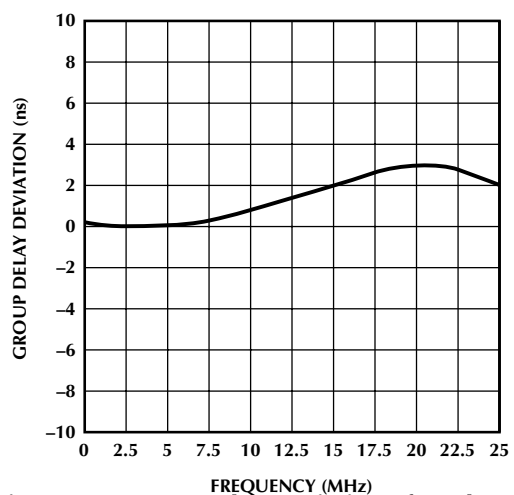


Figure 21. Group Delay Deviation of Passband, All Outputs ML6426CS-3

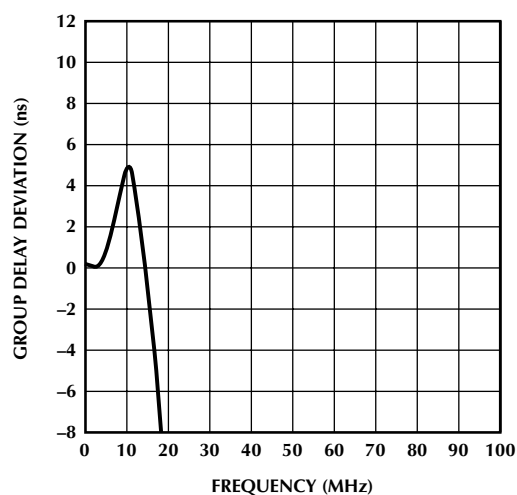


Figure 22. Group Delay Deviation All Band, All Outputs ML6426CS-3

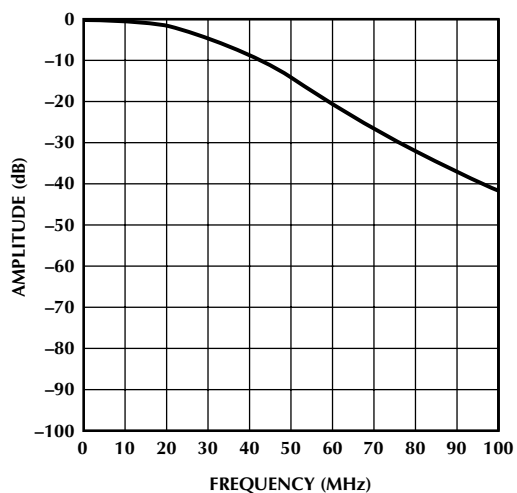


Figure 23. Frequency Response All Outputs ML6426CS-4

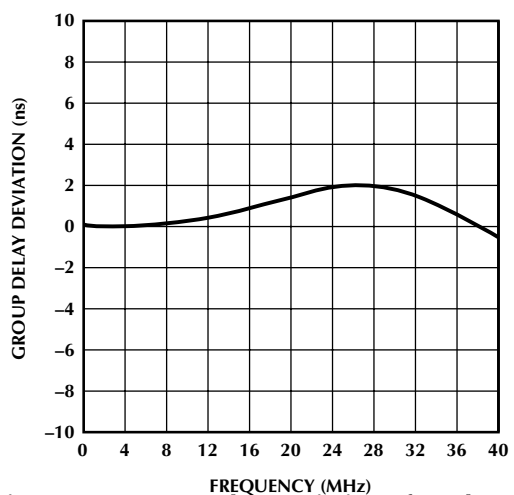


Figure 24. Group Delay Deviation of Passband, All Outputs ML6426CS-4

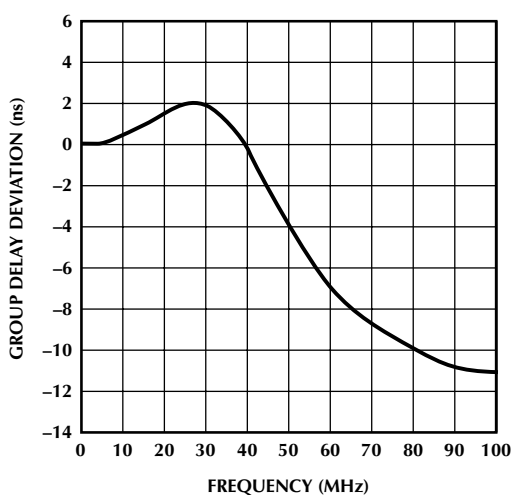


Figure 25. Group Delay Deviation All Band, All Outputs ML6426CS-4

## PERFORMANCE DATA (Continued)

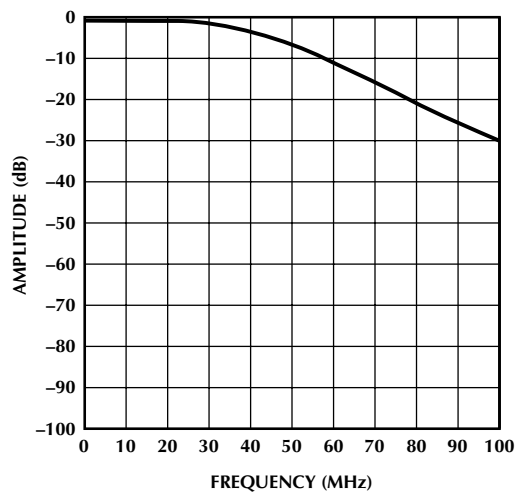


Figure 26. Frequency Response All Outputs  
ML6426-CS-5

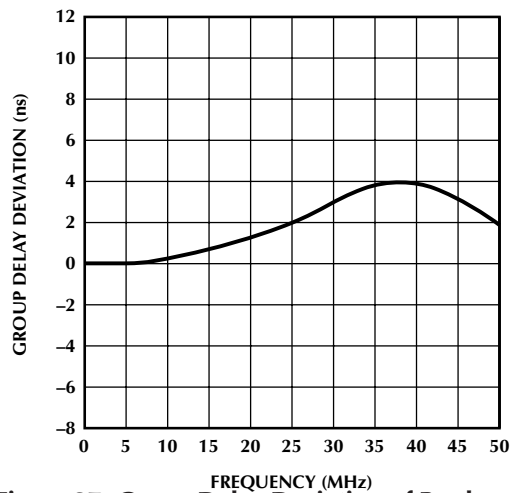


Figure 27. Group Delay Deviation of Passband,  
All Outputs ML6426CS-5

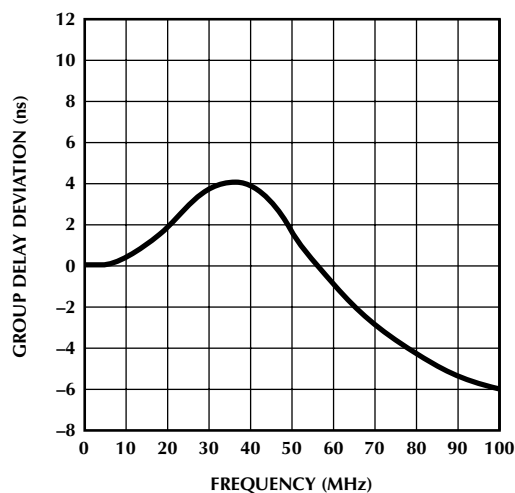


Figure 28. Group Delay Deviation All band,  
All Outputs ML6426CS-5

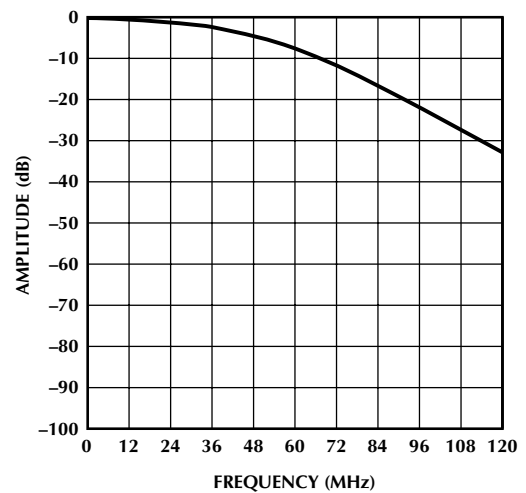


Figure 29. Frequency Response All Outputs  
ML6426CS-6

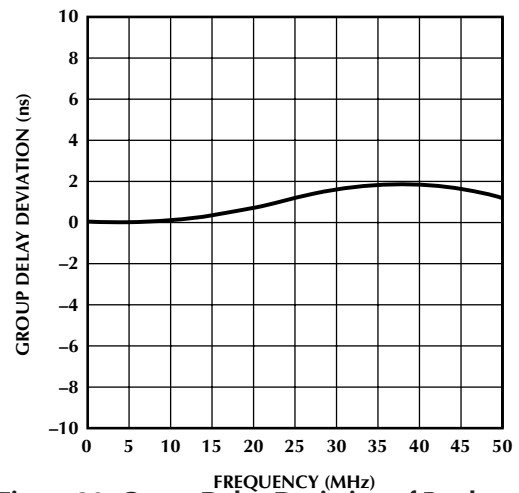


Figure 30. Group Delay Deviation of Passband,  
All Outputs ML6426CS-6

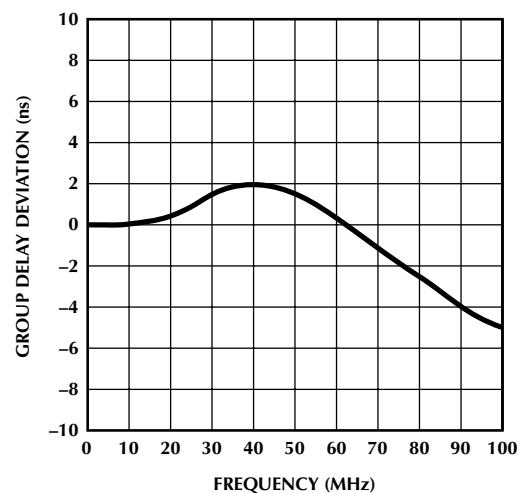
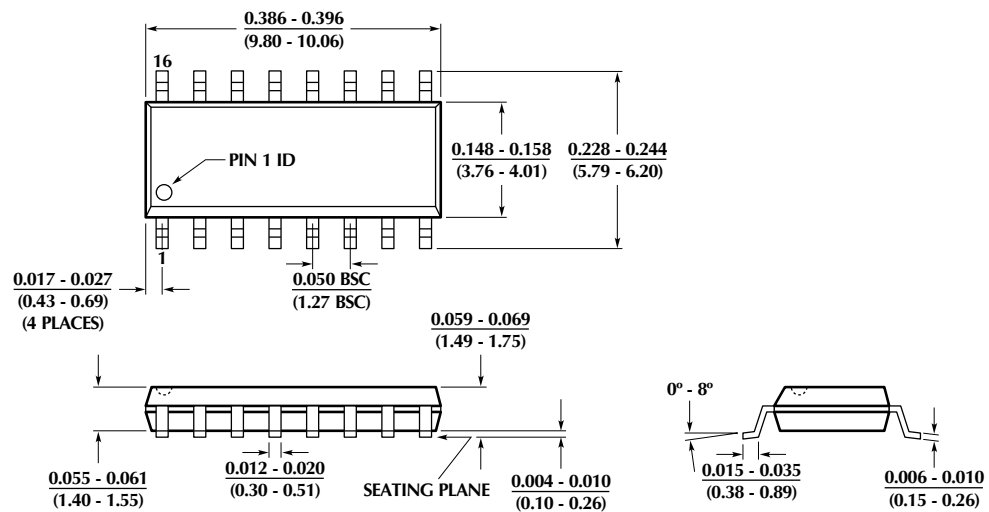


Figure 31. Group Delay Deviation All Band,  
All Outputs ML6426CS-6

## PHYSICAL DIMENSIONS

Package: S16N  
16-Pin Narrow SOIC





## ORDERING INFORMATION

| PART NUMBER | CUT-OFF FREQUENCY | TEMPERATURE RANGE | PACKAGE                   |
|-------------|-------------------|-------------------|---------------------------|
| ML6426CS-1  | 6.7MHz            | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-2  | 12MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-3  | 24MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-4  | 30MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-5  | 36MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-6  | 48MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |
| ML6426CS-15 | 15MHz             | 0°C to 70°C       | 16-Pin Narrow SOIC (S16N) |

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