

8-Bit, 40 MSPS, 2-Channel D/A Converter

August 1997

Features

- Resolution 8-Bit
- Maximum Conversion Speed 40MHz
- YC 2-Channel Input/Output
- Differential Linearity Error ± 0.3 LSB
- Low Power Consumption 160mW
(200 Ω Load for 2V_{p-p} Output)
- Power Supply +5V Single
- Power-Down Mode
- Low Glitch Noise
- Direct Replacment for Sony CXD1177

Description

The HI1177 is a dual 8-bit CMOS digital-to-analog converter. It has input/output equivalent to 2 channels of Y and C for video use or I and Q for modulators.

The HI1177 is available in the industrial temperature range and is supplied in a 32 lead plastic metric quad flatpack (MQFP) package.

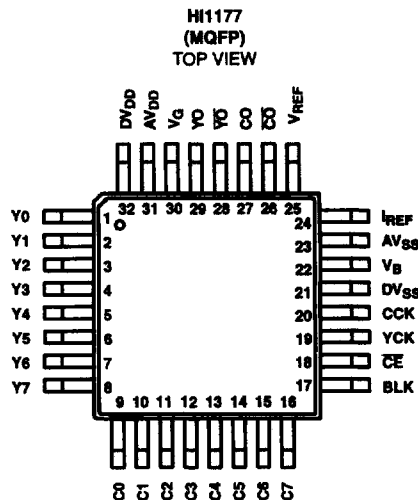
Ordering Information

| PART NUMBER | TEMP. RANGE (°C) | PACKAGE | PKG. NO. |
|-------------|------------------|------------|-----------|
| HI1177JCQ | -40 to 85 | 32 Ld MQFP | Q32.7x7-S |

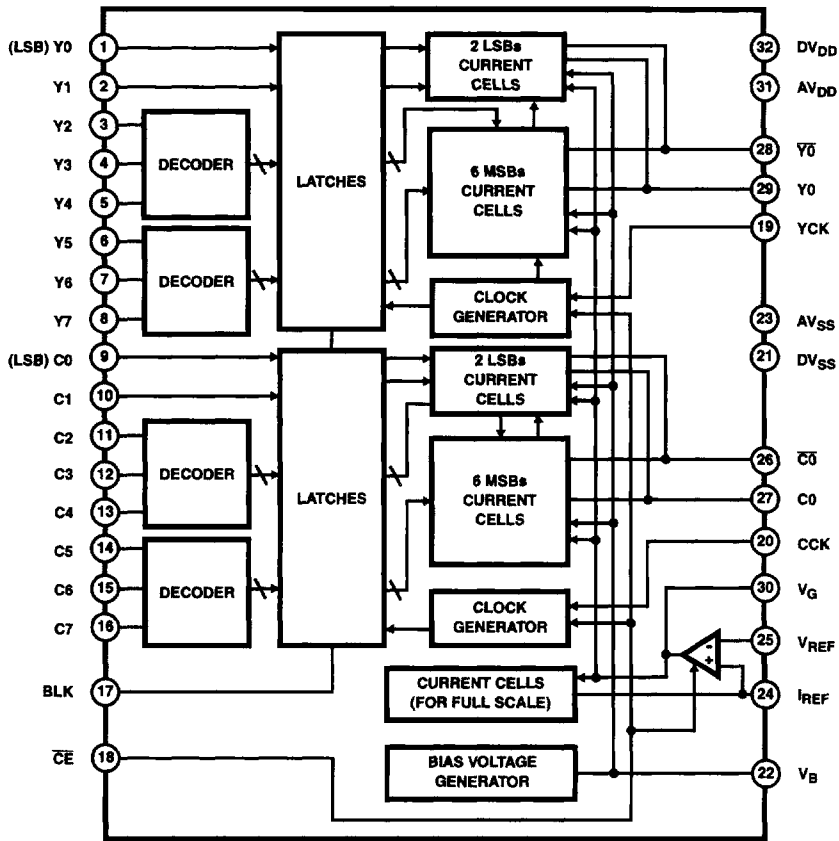
Applications

- I/Q Modulation
- YC Video
- Digital TV
- Wireless Transmitters

Pinout



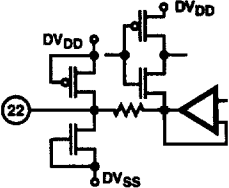
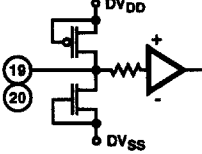
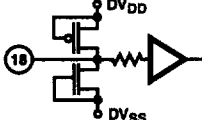
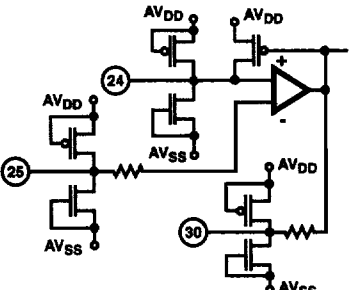
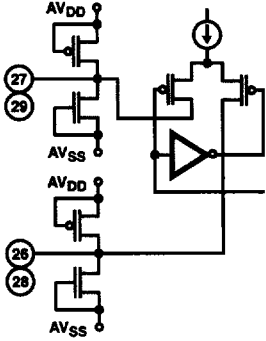
Functional Block Diagram



Pin Descriptions

| NUMBER | SYMBOL | EQUIVALENT CIRCUIT | DESCRIPTION |
|-------------------|----------------------|--------------------|----------------------------------------------------------------------|
| 1 to 8 9 to 16 | Y0 to Y7 C0 to C7 | | Digital Input. |
| 17 | BLK | | Blanking pin. No signal at "H" (Output 0V). Output condition at "L". |

Pin Descriptions (Continued)

| NUMBER | SYMBOL | EQUIVALENT CIRCUIT | DESCRIPTION |
|--------|------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------|
| 22 | V _B |  | Connect a capacitor of about 0.1μF. |
| 19 | YCK |  | Clock pin. Moreover all input pins are TTL-CMOS compatible. |
| 20 | CLK | | |
| 21 | DVSS | | Digital GND. |
| 23 | AVSS | | Analog GND. |
| 18 | CE |  | Chip enable pin. No signal (Output 0V) at "H" and minimizes power consumption. |
| 24 | I _{REF} |  | Connect a resistance 16 times "16R" that of output resistance value "R". |
| 25 | V _{REF} | | Set full scale output value. |
| 30 | V _G | | Connect a capacitor of about 0.1μF. |
| 31 | AVDD | | Analog V _{DD} . |
| 27 | CO |  | Current output pin. Voltage output can be obtained by connecting a resistance. |
| 29 | YO | | Inverted current output pin. Normally dropped to analog GND. |
| 26 | C _O | | |
| 28 | Y _O | | |
| 32 | DVDD | | Digital V _{DD} . |

Absolute Maximum Ratings $T_A = 25^{\circ}\text{C}$

Supply Voltage, V_{DD} 7V
 Input Voltage, V_{IN} V_{DD} to V_{SS}
 Output Current (For Each Channel), I_{OUT} 0mA to 15mA

Operating Conditions

Supply Voltage
 AV_{DD} , AV_{SS} 4.75V to 5.25V
 DV_{DD} , DV_{SS} 4.75V to 5.25V
 Reference Input Voltage, V_{REF} 2.0V
 Clock Pulse Width
 t_{PW1} 12.5ns (Min)
 t_{PW0} 12.5ns (Min)
 Temperature Range, T_{OPR} -40°C to 85°C

Thermal Information

Thermal Resistance (Typical, Note 7) θ_{JA} ($^{\circ}\text{C}/\text{W}$)
 MQFP Package 122
 Maximum Junction Temperature (Plastic Package) 150°C
 Maximum Storage Temperature Range -65°C to 150°C
 Maximum Lead Temperature (Soldering 10s) 300°C
 (MQFP - Lead Tips Only)

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

- θ_{JA} is measured with the component mounted on an evaluation PC board in free air.

Electrical Specifications $f_{CLK} = 40\text{MHz}$, $V_{DD} = 5\text{V}$, $R_{OUT} = 200\Omega$, $V_{REF} = 2.0\text{V}$, $T_A = 25^{\circ}\text{C}$

| PARAMETER | SYMBOL | TEST CONDITIONS | TEST LEVEL OR NOTES | PART NUMBER OR GRADE | | | UNITS |
|------------------------------|------------|----------------------------------|---------------------|----------------------|-----|-----|---------------|
| | | | | MIN | TYP | MAX | |
| Resolution | n | | | - | 8 | - | bit |
| Maximum Conversion Speed | f_{MAX} | | | 40 | - | - | MHz |
| Linearity Error | E_L | | | -2.5 | - | 2.5 | LSB |
| Differential Linearity Error | E_D | | | -0.3 | - | 0.3 | LSB |
| Full Scale Output Voltage | V_{FS} | | | 1.9 | 2.0 | 2.2 | V |
| Full Scale Output Ratio | F_{SR} | | Note 1 | 0 | 1.5 | 3 | % |
| Full Scale Output Current | I_{FS} | | | - | 10 | 15 | mA |
| Offset Output Voltage | V_{OS} | | | - | - | 1 | mV |
| Power Supply Current | I_{DD} | 14.3MHz, at Color Bar Data Input | | - | - | 32 | mA |
| Digital Input Current | High Level | I_{IH} | | - | - | 5 | μA |
| | Low Level | I_{IL} | | -5 | - | - | μA |
| Setup Time | t_S | | | 5 | - | - | ns |
| Hold Time | t_H | | | 10 | - | - | ns |
| Propagation Delay Time | t_{PD} | | | - | 10 | - | ns |
| Glitch Energy | GE | $R_{OUT} = 75\Omega$ | | - | 30 | - | pV-s |
| Cross Talk | CT | 1MHz Sin Wave Output | | - | 57 | - | dB |

NOTE:

- Full scale output ratio = $\left| \frac{\text{Full-scale voltage of channel}}{\text{Average of the full-scale voltage of the channels}} - 1 \right| \times 100(\%)$.

I/O Correspondence Table (Output Full Scale Voltage: 2V)

| INPUT CODE | | OUTPUT VOLTAGE |
|------------|-----------------|----------------|
| MSB | LSB | |
| 1 | 1 1 1 1 1 1 1 1 | 2.0V |
| | ⋮ | |
| 1 | 0 0 0 0 0 0 0 0 | 1.0V |
| | ⋮ | |
| 0 | 0 0 0 0 0 0 0 0 | 0V |

Timing Diagram

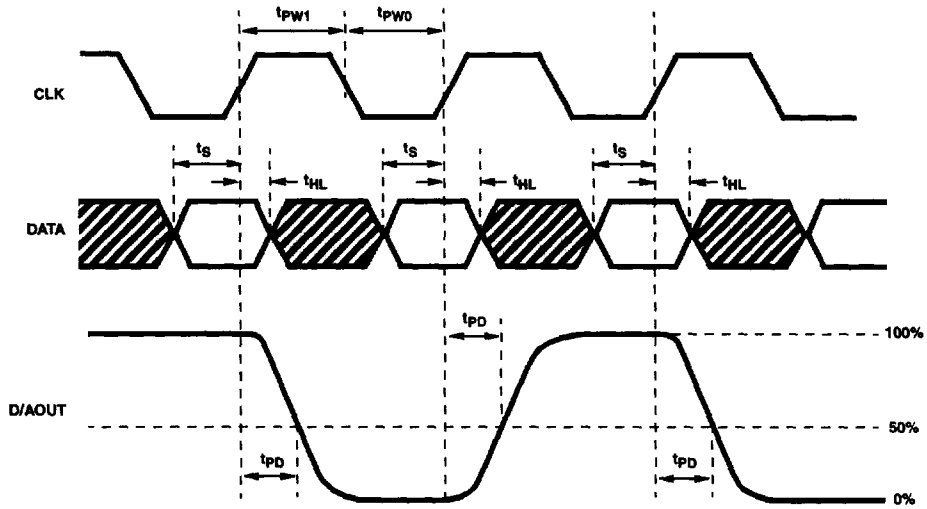


FIGURE 1.

Test Circuits

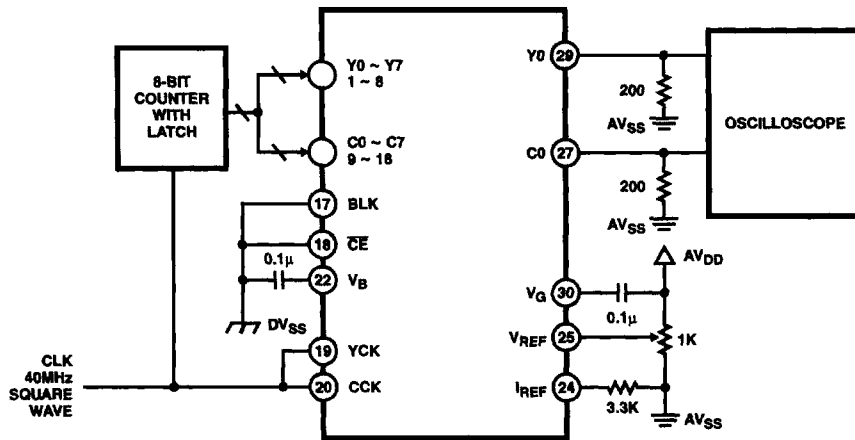


FIGURE 2. MAXIMUM CONVERSION

Test Circuits (Continued)

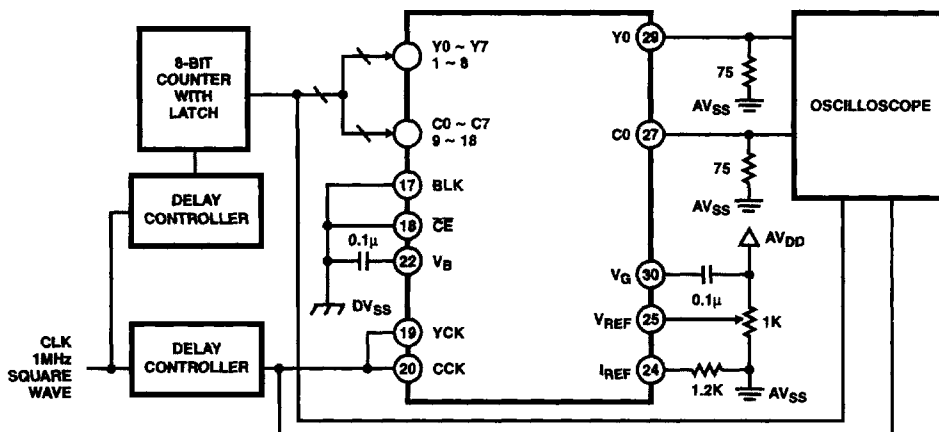


FIGURE 3. SETUP HOLD TIME AND GLITCH ENERGY

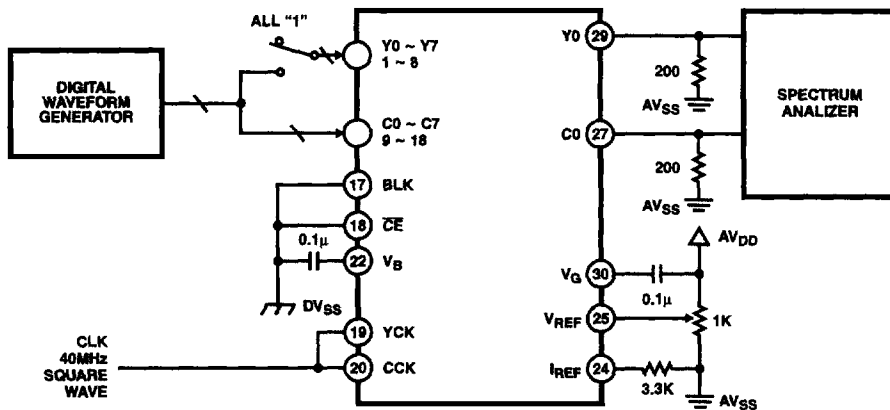


FIGURE 4. CROSSTALK

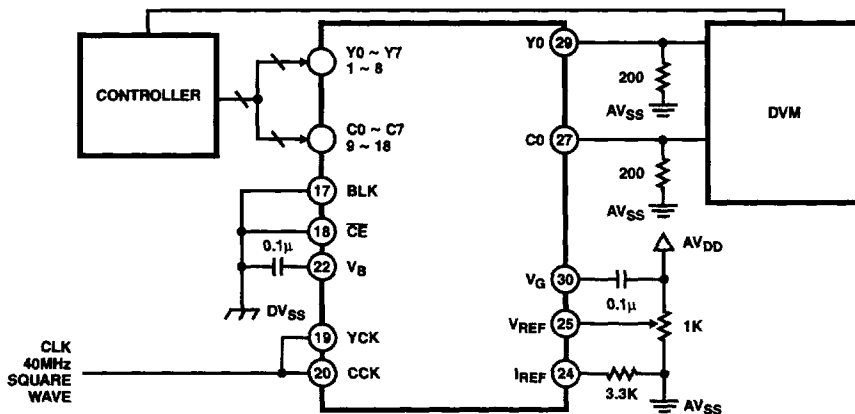


FIGURE 5. DC CHARACTERISTICS

Test Circuits (Continued)

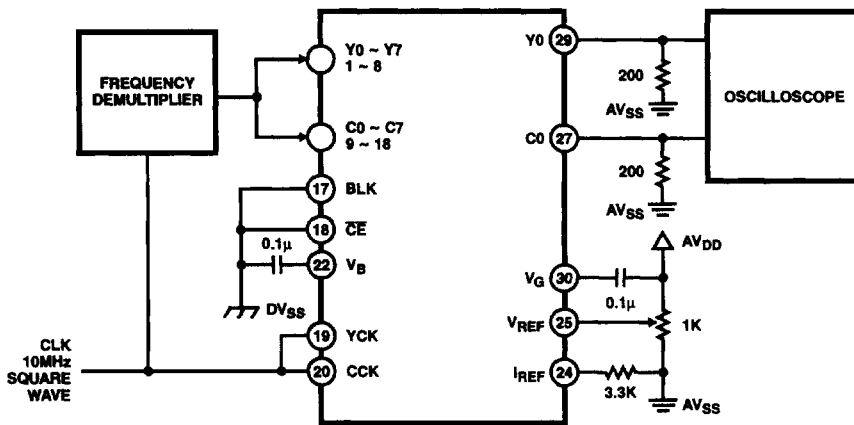


FIGURE 6. PROPAGATION DELAY TIME

Typical Performance Curves

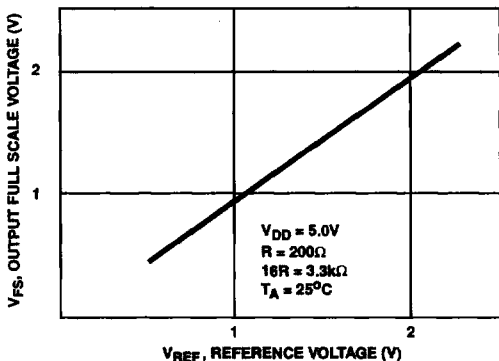


FIGURE 7. OUTPUT FULL SCALE VOLTAGE vs REFERENCE VOLTAGE

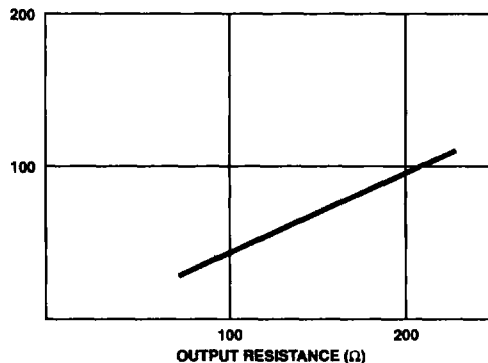


FIGURE 8. GLITCH ENERGY vs OUTPUT RESISTANCE

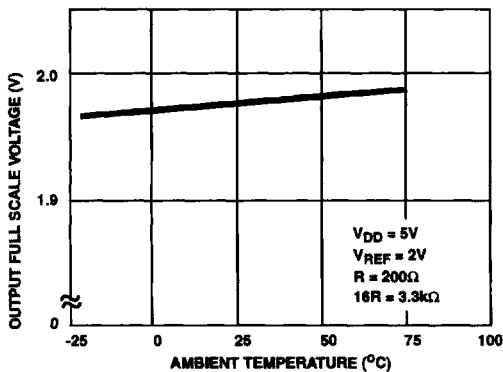


FIGURE 9. OUTPUT FULL SCALE VOLTAGE vs AMBIENT TEMPERATURE

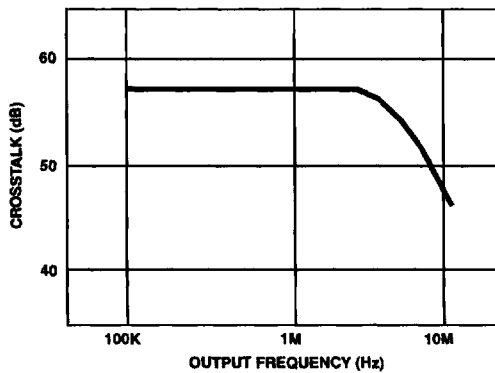
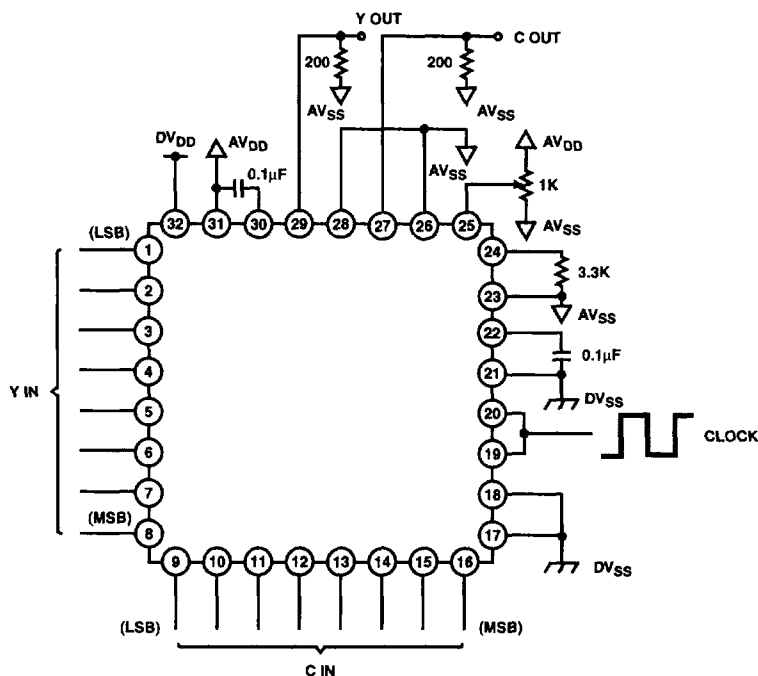


FIGURE 10. CROSSTALK vs OUTPUT FREQUENCY

Application Circuit



NOTE: Application circuits shown are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits or for any infringement of third party patent and other right due to same.

FIGURE 11.

Operation

- How to select the output resistance:
 - The HI1177 is a D/A converter of the current output type. To obtain the output voltage connect the resistance to IO pin (Y0, C0). For specifications we have:

| | |
|---------------------------|-----------------------------------|
| Output full scale voltage | $V_{FS} = \text{less than } 2V$ |
| Output full scale current | $I_{FS} = \text{less than } 15mA$ |
 - Calculate the output resistance value from the relation of $V_{FS} = I_{FS} \times R$. Also, 16 times resistance of the output resistance is connected to reference current pin I_{REF} . In some cases, however, this turns out to be a value that does not actually exist. In such a case a value close to it can be used as a substitute. Here please note that V_{FS} becomes $V_{FS} = V_{REF} \times 16R/R'$. R is the resistance connected to IO while R' is connected to I_{REF} . Increasing the resistance value can curb power consumption. On the other hand glitch energy and data settling time will inversely increase. Set the most suitable value according to the desired application.
- Phase relation between data and clock:
 - To obtain the expected performance as a D/A converter, it is necessary to set properly the phase relation between data and clock applied from the exterior. Be sure to satisfy the provisions of the set up time (t_S) and hold time (t_H) as stipulated in the Electrical Characteristics.
- V_{DD} , V_{SS} :
 - To reduce noise effects separate analog and digital systems in the device periphery. For V_{DD} pins, both digital and analog, bypass respective GNDs by using a ceramic capacitor of about $0.1\mu F$, as close as possible to the pin.