

12-Bit, 80 MSPS, High Speed Video D/A Converter

January 1998

Features

- Throughput Rate **80 MSPS**
- Low Power **650mW**
- Integral Linearity Error **0.75 LSB**
- Low Glitch Energy **3.0pV-s**
- TTL/CMOS Compatible Inputs
- Improved Hold Time **0.25ns**
- Excellent Spurious Free Dynamic Range

Applications

- Professional Video
- Cable TV Headend Equipment

Description

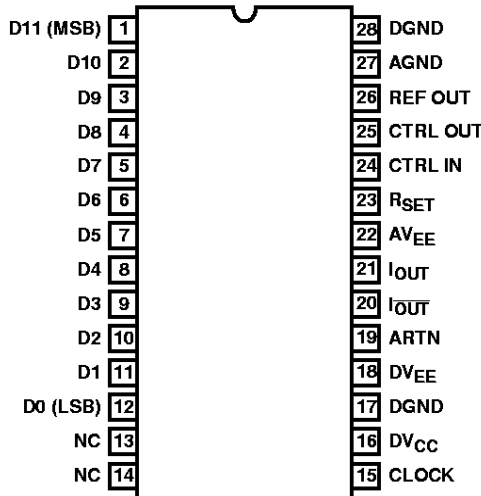
The HI5735 is a 12-bit, 80 MSPS, D/A converter which is implemented in the Harris BiCMOS 10V (HBC-10) process. Operating from +5V and -5.2V, the converter provides -20.48mA of full scale output current and includes an input data register and bandgap voltage reference. Low glitch energy and excellent frequency domain performance are achieved using a segmented architecture. The digital inputs are TTL/CMOS compatible and translated internally to ECL. All internal logic is implemented in ECL to achieve high switching speed with low noise. The addition of laser trimming assures 12-bit linearity is maintained along the entire transfer curve.

Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
HI5735KCP	0 to 70	28 Lead PDIP	E28.6
HI5735KCB	0 to 70	28 Lead SOIC	M28.3

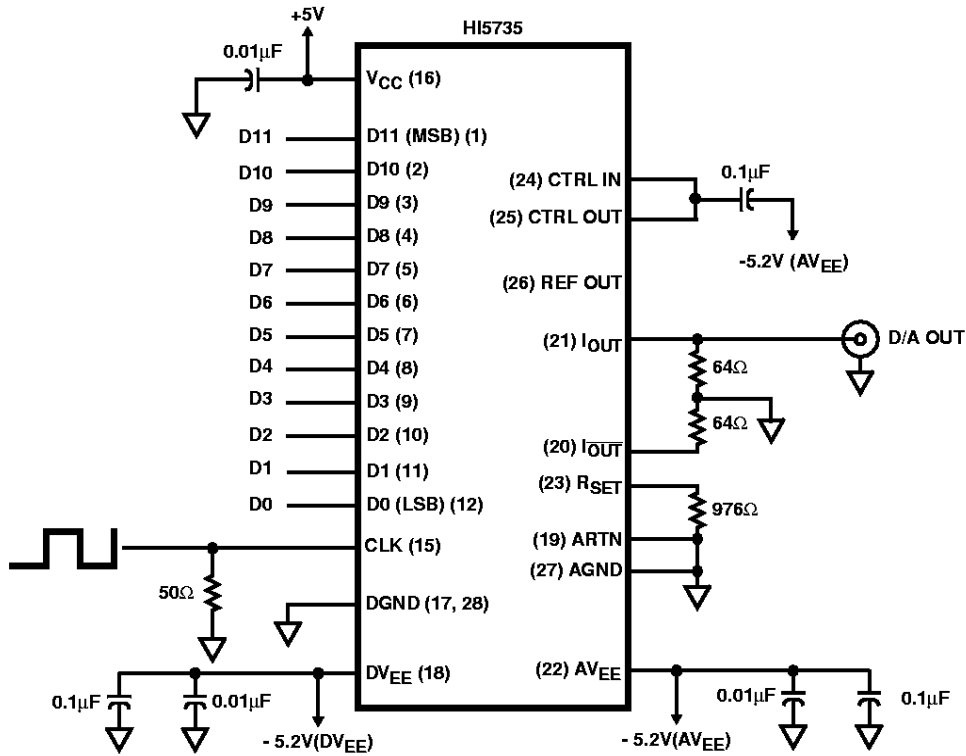
Pinout

HI5735
(PDIP, SOIC)
TOP VIEW

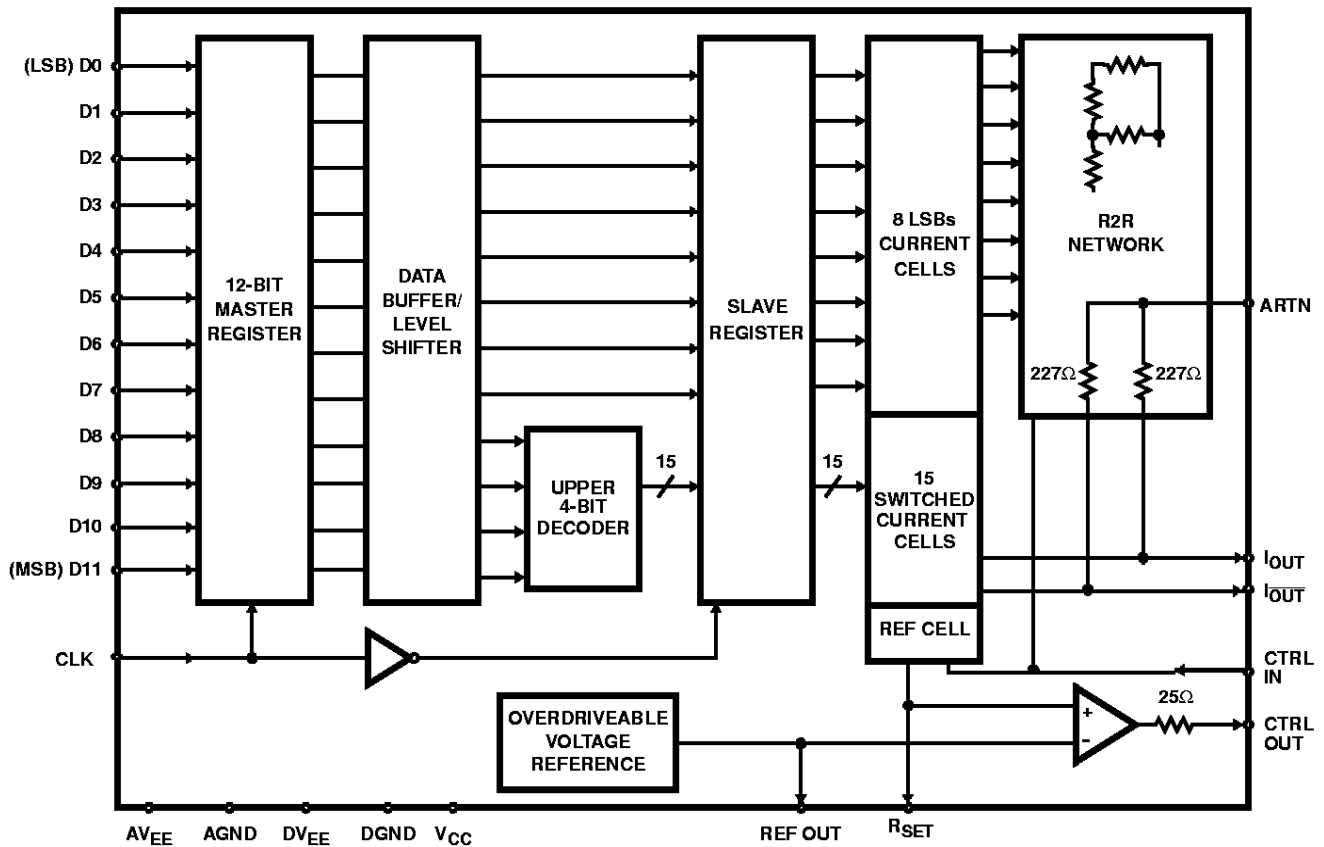


HI5735

Typical Application Circuit



Functional Block Diagram



HI5735

Absolute Maximum Ratings

Digital Supply Voltage V_{CC} to DGND	+5.5V
Negative Digital Supply Voltage DV_{EE} to DGND	-5.5V
Negative Analog Supply Voltage AV_{EE} to AGND, ARTN	-5.5V
Digital Input Voltages (D11-D0, CLK) to DGND	DV_{CC} to -0.5V
Internal Reference Output Current	± 2.5 mA
Voltage from CTRL IN to AV_{EE}	2.5V to 0V
Control Amplifier Output Current	± 2.5 mA
Reference Input Voltage Range	-3.7V to AV_{EE}
Analog Output Current (I_{OUT})	30mA

Thermal Information

Thermal Resistance (Typical, Note 1)	θ_{JA} ($^{\circ}$ C/W)
PDIP Package	55
SOIC Package	70
Maximum Junction Temperature	
Plastic Packages	150 $^{\circ}$ C
Maximum Storage Temperature Range	-65 $^{\circ}$ C to 150 $^{\circ}$ C
Maximum Lead Temperature (Soldering 10s)	300 $^{\circ}$ C (SOIC - Lead Tips Only)

Operating Conditions

Temperature Range

HI5735Blx -40 $^{\circ}$ C to 85 $^{\circ}$ C

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 AV_{EE} , DV_{EE} = -4.94 to -5.46V, V_{CC} = +4.75 to +5.25V, V_{REF} = Internal
 T_A = 25 $^{\circ}$ C for All Typical Values

PARAMETER	TEST CONDITIONS	HI5735BI $T_A = 0^{\circ}\text{C TO } 70^{\circ}\text{C}$			UNITS
		MIN	TYP	MAX	
SYSTEM PERFORMANCE					
Resolution		12	-	-	Bits
Integral Linearity Error, INL	(Note 4) ("Best Fit" Straight Line)	-	0.75	1.5	LSB
Differential Linearity Error, DNL	(Note 4)	-	0.5	1.0	LSB
Offset Error, I_{OS}	(Note 4)	-	20	75	μ A
Full Scale Gain Error, FSE	(Notes 2, 4)	-	1	10	%
Offset Drift Coefficient	(Note 3)	-	-	0.05	μ A/ $^{\circ}$ C
Full Scale Output Current, I_{FS}		-	20.48	-	mA
Output Voltage Compliance Range	(Note 3)	-1.25	-	0	V
DYNAMIC CHARACTERISTICS					
Throughput Rate	(Note 5)	80	-	-	MSPS
Output Voltage Full Scale Step Settling Time, t_{SETT} Full Scale	To ± 0.5 LSB Error Band $R_L = 50\Omega$ (Note 3)	-	20	-	ns
Single Glitch Area, GE (Peak)	$R_L = 50\Omega$ (Note 3)	-	5	-	μ V-s
Doublet Glitch Area, (Net)		-	3	-	μ V-s
Output Slew Rate	$R_L = 50\Omega$, DAC Operating in Latched Mode (Note 3)	-	1,000	-	V/ μ s
Output Rise Time	$R_L = 50\Omega$, DAC Operating in Latched Mode (Note 3)	-	675	-	ps
Output Fall Time	$R_L = 50\Omega$, DAC Operating in Latched Mode (Note 3)	-	470	-	ps
Differential Gain	$R_L = 50\Omega$ (Note 3)	-	0.15	-	%
Differential Phase	$R_L = 50\Omega$ (Note 3)	-	0.07	-	Deg

HI5735

Electrical Specifications $V_{EE}, DV_{EE} = -4.94$ to $-5.46V$, $V_{CC} = +4.75$ to $+5.25V$, $V_{REF} = \text{Internal}$
 $T_A = 25^\circ C$ for All Typical Values **(Continued)**

PARAMETER	TEST CONDITIONS	HI5735BI $T_A = 0^\circ C$ TO $70^\circ C$			UNITS
		MIN	TYP	MAX	
Spurious Free Dynamic Range to Nyquist (Note 3)	$f_{CLK} = 40MHz$, $f_{OUT} = 2.02MHz$, 20MHz Span	-	70	-	dBc
	$f_{CLK} = 80MHz$, $f_{OUT} = 2.02MHz$, 40MHz Span	-	70	-	dBc
REFERENCE/CONTROL AMPLIFIER					
Internal Reference Voltage, V_{REF}	(Note 4)	-1.27	-1.23	-1.17	V
Internal Reference Voltage Drift	(Note 3)	-	50	-	$\mu V/^\circ C$
Internal Reference Output Current Sink/Source Capability	(Note 3)	-125	-	+50	μA
Internal Reference Load Regulation	$I_{REF} = 0$ to $I_{REF} = -125\mu A$	-	50	-	μV
Input Impedance at REF OUT pin	(Note 3)	-	1.4	-	k Ω
Amplifier Large Signal Bandwidth (0.6V _{P-P})	Sine Wave Input, to Slew Rate Limited (Note 3)	-	3	-	MHz
Amplifier Small Signal Bandwidth (0.1V _{P-P})	Sine Wave Input, to -3dB Loss (Note 3)	-	10	-	MHz
Reference Input Impedance	(Note 3)	-	12	-	k Ω
Reference Input Multiplying Bandwidth (CTL IN)	$R_L = 50\Omega$, 100mV Sine Wave, to -3dB Loss at I_{OUT} (Note 3)	-	200	-	MHz
DIGITAL INPUTS (D9-D0, CLK, INVERT)					
Input Logic High Voltage, V_{IH}	(Note 4)	2.0	-	-	V
Input Logic Low Voltage, V_{IL}	(Note 4)	-	-	0.8	V
Input Logic Current, I_{IH}	(Note 4)	-	-	400	μA
Input Logic Current, I_{IL}	(Note 4)	-	-	700	μA
Digital Input Capacitance, C_{IN}	(Note 3)	-	3.0	-	pF
TIMING CHARACTERISTICS					
Data Setup Time, t_{SU}	See Figure 1 (Note 3)	3.0	2.0	-	ns
Data Hold Time, t_{HLD}	See Figure 1 (Note 3)	0.5	0.25	-	ns
Propagation Delay Time, t_{PD}	See Figure 1 (Note 3)	-	4.5	-	ns
CLK Pulse Width, t_{PW1} , t_{PW2}	See Figure 1 (Note 3)	3.0	-	-	ns
POWER SUPPLY CHARACTERISTICS					
I_{EEA}	(Note 4)	-	42	50	mA
I_{EED}	(Note 4)	-	70	85	mA
I_{CCD}	(Note 4)	-	13	20	mA
Power Dissipation	(Note 4)	-	650	-	mW
Power Supply Rejection Ratio	$V_{CC} \pm 5\%$, $V_{EE} \pm 5\%$	-	5	-	$\mu A/V$

NOTES:

- Gain Error measured as the error in the ratio between the full scale output current and the current through R_{SET} (typically 1.28mA). Ideally the ratio should be 16.
- Parameter guaranteed by design or characterization and not production tested.
- All devices are 100% tested at $25^\circ C$. 100% production tested at temperature extremes for military temperature devices, sample tested for industrial temperature devices.
- Dynamic Range must be limited to a 1V swing within the compliance range.