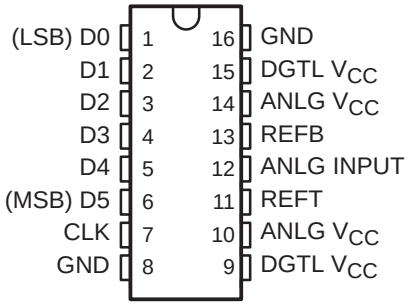
- **6-Bit Resolution**
- **Linearity Error . . . ±0.8%**
- **Maximum Conversion Rate . . . 30 MHz Typ**
- **Analog Input Voltage Range**
  V_{CC} to V_{CC} – 2 V
- **Analog Input Dynamic Range . . . 1 V**
- **TTL Digital I/O Level**
- **Low Power Consumption**
  200 mW Typ
- **5-V Single-Supply Operation**
- **Interchangeable With Fujitsu MB40576**

N PACKAGE
(TOP VIEW)

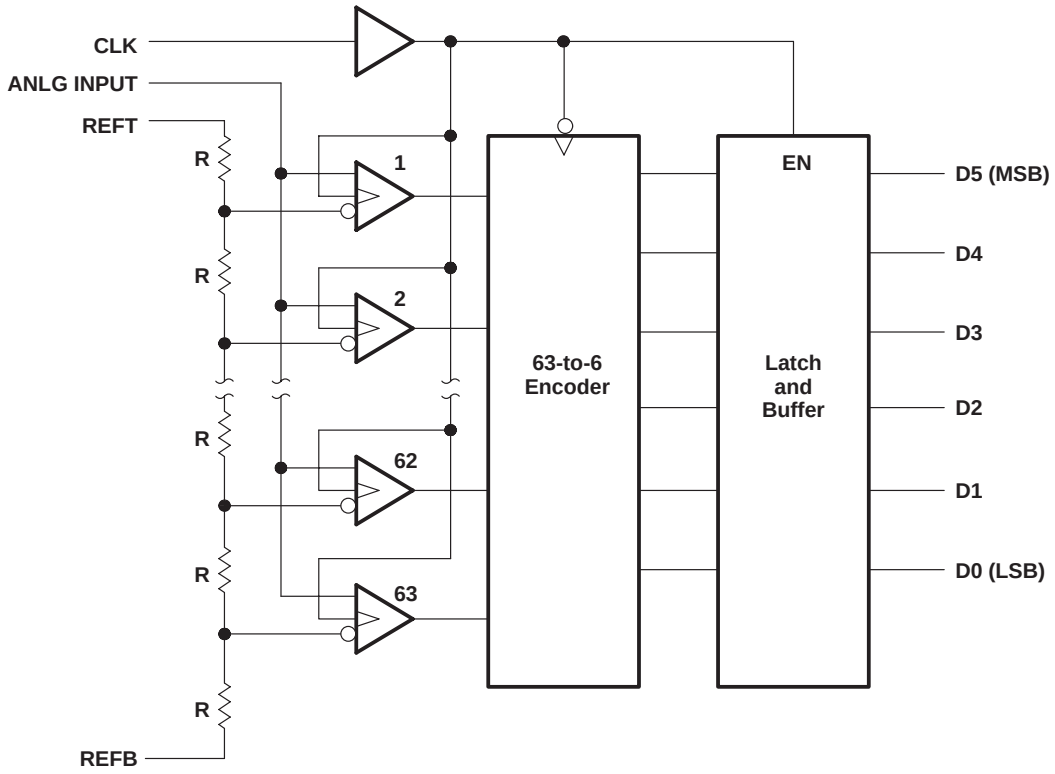


description

The TL5501 is a low-power ultra-high-speed video-band analog-to-digital converter that uses the Advanced Low-Power Schottky (ALS) process. It utilizes the full-parallel comparison (flash method) for high-speed conversion. It converts wide-band analog signals (such as a video signal) to a digital signal at a sampling rate of dc to 30 MHz. Because of this high-speed capability, the TL5501 is suitable for digital video applications such as digital TV, video processing with a computer, or radar signal processing.

The TL5501 is characterized for operation from 0°C to 70°C.

functional block diagram



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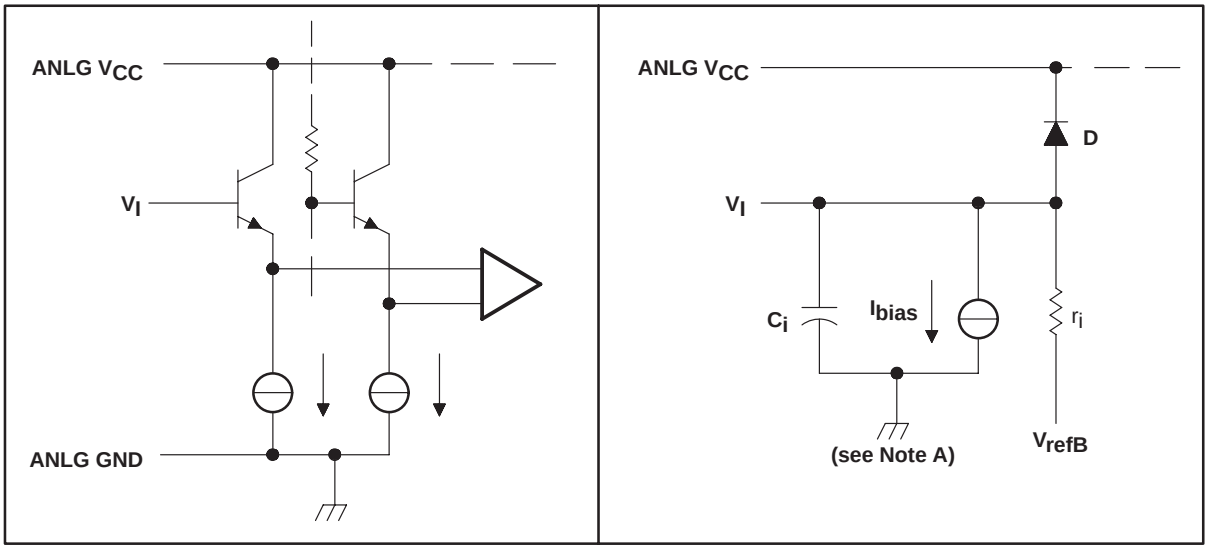
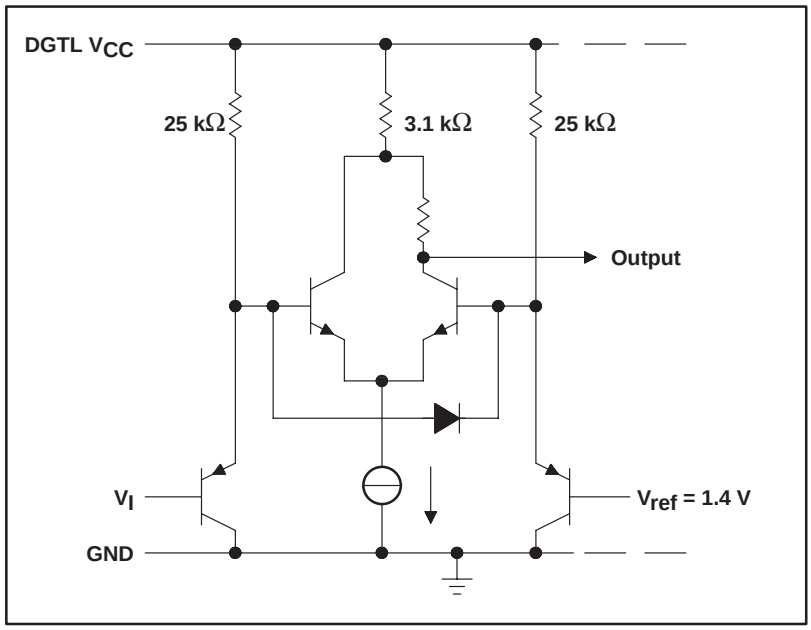
equivalents of analog input circuit



NOTE A: C_i – nonlinear emitter-follower junction capacitance
r_i – linear resistance model for input current transition caused by comparator switching.
$V_I < V_{refB}$: Infinite; CLK high: infinite.
V_{refB} – voltage at REFB terminal
I_{bias} – constant input bias current
D – base-collector junction diode of emitter-follower transistor

equivalent of digital input circuit



FUNCTION TABLE

STEP	ANALOG INPUT VOLTAGE	DIGITAL OUTPUT CODE					
0	3.992 V	L	L	L	L	L	L
1	4.008 V	L	L	L	L	L	H
⋮	⋮			⋮			
31	4.488 V	L	H	H	H	H	H
32	4.508 V	H	L	L	L	L	L
33	4.520 V	H	L	L	L	L	H
⋮	⋮			⋮			
62	4.984 V	H	H	H	H	H	L
63	5.000 V	H	H	H	H	H	H

† These values are based on the assumption that V_{refB} and V_{refT} have been adjusted so that the voltage at the transition from digital 0 to 1 (V_{ZT}) is 4.000 V and the transition to full scale (V_{FT}) is 4.992 V. 1 LSB = 16 mV.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage range, ANLG V_{CC} (see Note 1) . . . . . –0.5 V to 7 V
Supply voltage range, DGTL V_{CC} . . . . . –0.5 V to 7 V
Input voltage range at digital input, V_I . . . . . –0.5 V to 7 V
Input voltage range at analog input, V_I . . . . . –0.5 V to ANLG V_{CC} +0.5 V
Analog reference voltage range, V_{ref} . . . . . –0.5 V to ANLG V_{CC} +0.5 V
Storage temperature range . . . . . –55°C to 150°C
Operating free-air temperature range . . . . . 0°C to 70°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds . . . . . 260°C

NOTE 1: All voltage values are with respect to the network ground terminal.

recommended operating conditions

	MIN	NOM	MAX	UNIT
Supply voltage, ANLG V_{CC}	4.75	5	5.25	V
Supply voltage, DGTL V_{CC}	4.75	5	5.25	V
High-level input voltage, V_{IH}	2			V
Low-level input voltage, V_{IL}			0.8	V
Input voltage at analog input, V_I (see Note 2)	4		5	V
Analog reference voltage (top side), V_{refT} (see Note 2)	4	5	5.1	V
Analog reference voltage (bottom side), V_{refB} (see Note 2)	3	4	4.1	V
High-level output current, I_{OH}	–400			μA
Low-level output current, I_{OL}			4	mA
Clock pulse duration, high-level or low-level, t_w	25			ns
Operating free-air temperature, T_A	0		70	°C

NOTE 2: $V_{refB} < V_I < V_{refT}$, $V_{refT} - V_{refB} = 1$ V ±0.1 V.

electrical characteristics over operating supply voltage range, T_A = 25°C (unless otherwise noted)

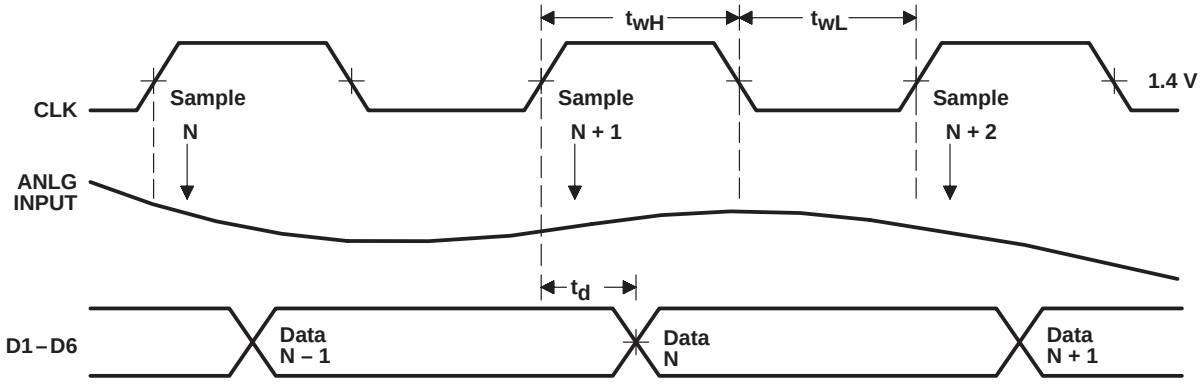
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
I_I	Analog input current	V_I = 5 V			75	µA
		V_I = 4 V			73	
I_{IH}	Digital high-level input current	V_I = 2.7 V		0	20	µA
I_{IL}	Digital low-level input current	V_I = 0.4 V	– 400	–40		µA
I_I	Digital input current	V_I = 7 V			100	µA
I_{refB}	Reference current	V_{IrefB} = 4 V		–4	–7.2	mA
$I_{ref\,T}$	Reference current	V_{IrefB} = 5 V		4	7.2	mA
V_{OH}	High-level output voltage	I_{OH} = –400 µA	2.7			V
V_{OL}	Low-level output voltage	I_{OL} = 1.6 mA			0.4	V
r_i	Analog input resistance		100			kΩ
$1C_i$	Analog input capacitance			35	65	pF
I_{CC}	Supply current			40	60	mA

operating characteristics over operating supply voltage range, T_A = 25°C (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP†	MAX	UNIT
E_L	Linearity error				±0.8	%FSR
f_{max}	Maximum converstion rate		20	30		MHz
t_d	Digital output delay time	See Figure 3		15	30	ns

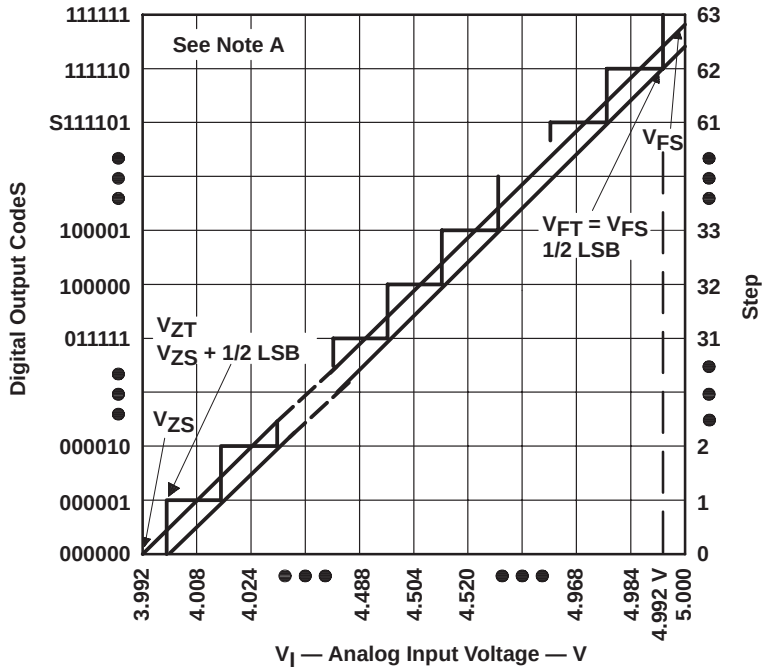
† All typical values are at V_{CC} = 5 V, V_{ref} = 4 V, T_A = 25°C.

timing diagram



TYPICAL CHARACTERISTICS

IDEAL CONVERSION CHARACTERISTICS



NOTE A: This curve is based on the assumption that V_{refB} and V_{refT} have been adjusted so that the voltage at the transition from digital 0 to 1 (V_{ZT}) is 4.000 V and the transition to full scale (V_{FT}) is 4.992 V. 1 LSB = 16 mV.

Figure 1

END-POINT LINEARITY ERROR

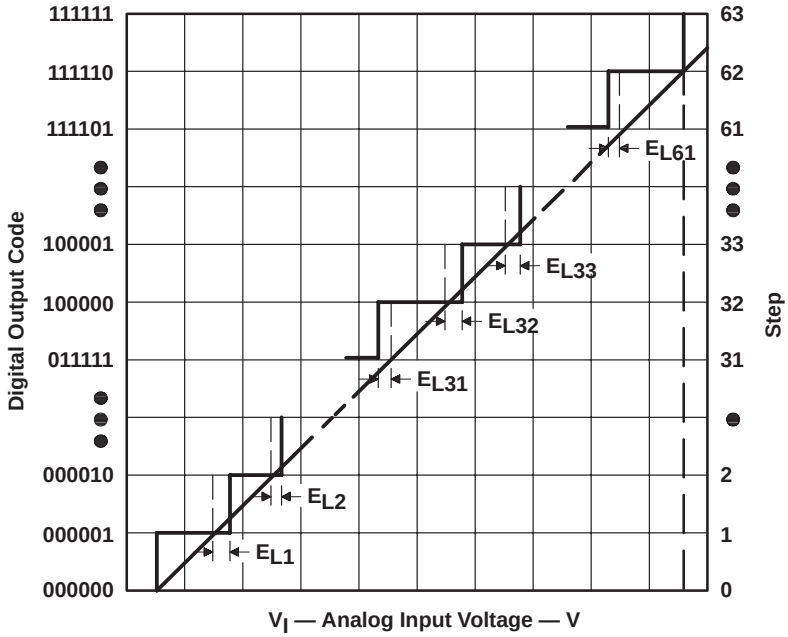


Figure 2

PARAMETER MEASUREMENT INFORMATION

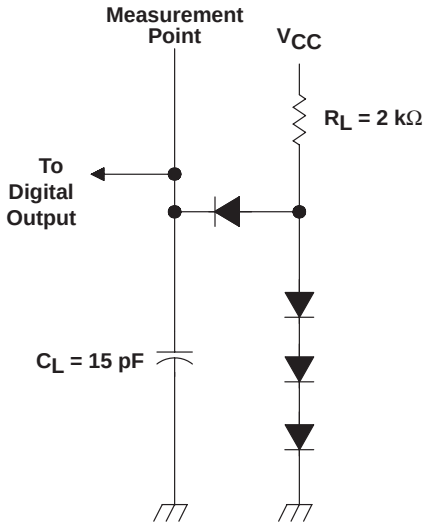


Figure 3. Load Circuit

PACKAGING INFORMATION

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead/Ball Finish	MSL Peak Temp (3)
TL5501CDWA	OBSOLETE	SOP	DWA	16		TBD	Call TI	Call TI
TL5501CDWAR	OBSOLETE	SOP	DWA	16		TBD	Call TI	Call TI
TL5501CDWAR	OBSOLETE	SOP	DWA	16		TBD	Call TI	Call TI

(1) The marketing status values are defined as follows:
ACTIVE: Product device recommended for new designs.
LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.
NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.
PREVIEW: Device has been announced but is not in production. Samples may or may not be available.
OBSOLETE: TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.
TBD: The Pb-Free/Green conversion plan has not been defined.
Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.
Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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