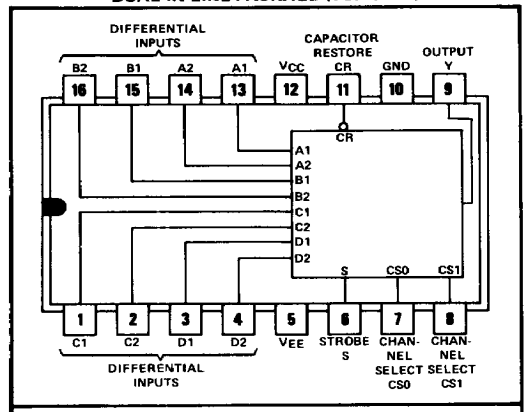
TYPES SN55244, SN75244
A-C-COUPLED FOUR-CHANNEL SENSE AMPLIFIERS

BULLETIN NO. DL-S 7312060, SEPTEMBER 1973

IDEAL FOR PLATED-WIRE, THIN-FILM, AND OTHER HIGH-SPEED LOW-LEVEL SENSING APPLICATIONS

- Input Threshold Level . . . 0.7 mV Typical
- t_{PHL} from Selected Channel . . . 18 ns Typical
- Decoded Input Channel Selection
- TTL Compatible Logic Inputs and Output
- Wired-AND Output Capability
- D-C Level-Restore Gate for Capacitors
- Output Strobe Capability

J,JA, OR N
DUAL-IN-LINE PACKAGE (TOP VIEW)



positive logic: see function tables

description

The SN55244 and SN75244 each comprise four input channels with decoded selection, two stages of gain employing capacitive coupling, and a TTL-compatible output gate. A-c coupling reduces access time by eliminating the problems usually associated with d-c offset voltages on the input lines. The output is normally high and pulses low only when the relationships shown in the function table take place.

The SN55244 is characterized for operation over the full military temperature of −55°C to 125°C; and the SN75244 is characterized for operation from 0°C to 70°C.

CHANNEL SELECTION TABLE

CS1	CS0	CHANNEL SELECTED
H	H	A
H	L	B
L	H	C
L	L	D

FUNCTION TABLE

INPUTS			OUTPUT
STROBE	CAPACITOR RESTORE	SELECTED CHANNEL	Y
L	X	X	H
X	H	X	H
X	X	L	H
H	L	↑	⊓
↑	L	H	⊓

H = high level (steady state, $V_I \geq V_{IH}$ min or $V_{ID} > V_T$
L = low level (steady state), $V_I \leq V_{IL}$ max or $V_{ID} < V_T$
X = irrelevant (any input, including transitions)
↑ = transition from low level to high level
⊓ = low-level output pulse

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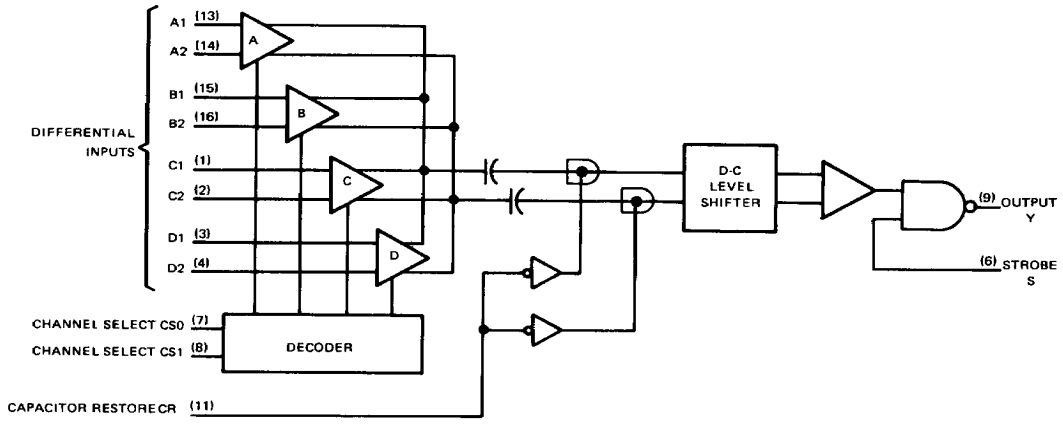
functional block diagram



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

Supply voltages (see Note 1)
- V_{CC} . . . . . 7 V
- V_{EE} . . . . . −8 V

Differential input voltage (see Note 2) . . . . . −6 V to 5 V
Common-mode input voltage . . . . . −6 V to 5 V
Capacitor restore, channel select, or strobe input voltage . . . . . 5.5 V
Continuous total dissipation at (or below) 25°C free-air temperature (see Note 3) . . . . . 1 W
Operating free-air temperature range: SN55244 . . . . . −55°C to 125°C
SN75244 . . . . . 0°C to 70°C
Storage temperature range . . . . . −65°C to 150°C
Lead temperature 1/16 inch from case for 60 seconds: J or JA package . . . . . 300°C
Lead temperature 1/16 inch from case for 10 seconds: N package . . . . . 260°C

NOTES: 1. All voltage values, except differential voltages, are with respect to the network ground terminal.
2. Differential input voltages are at A1 with respect to A2, and similarly B1 to B2, C1 to C2, and D1 to D2.
3. For operation above 25°C free-air temperature, refer to Dissipation Derating Curve, Figure 10.

recommended operating conditions

	SN55244			SN75244			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.75	5	5.25	4.75	5	5.25	V
Supply voltage, V_{EE}	−5.7	−6	−6.3	−5.7	−6	−6.3	V
Common-mode input current, I_{IC}			+200 −10			+200 −10	μA
Differential input current, I_{ID}			200			200	μA
Operating free-air temperature, T_A	−55		125	0		70	°C

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electrical characteristics at 25°C free-air temperature (unless otherwise noted)

PARAMETER			TEST FIGURE	TEST CONDITIONS†	MIN	TYP	MAX	UNIT
V_T	Differential input threshold voltage‡		1, 4	V_{CC} = 5 V, V_{EE} = −6 V, T_A = MIN to MAX		0.7		mV
I_{IB}	Differential input bias current of selected channel		2	V_{CC} = 5.25 V, V_{EE} = −6.3 V		20		μA
I_{IO}	Differential input offset current of selected channel		2	V_{CC} = 5.25, V_{EE} = −6.3 V		0.5		μA
V_{IH}	High-level input voltage	Channel Select CS0 or CS1	3	V_{CC} = 5 V, V_{EE} = −6 V	2.1			V
		Capacitor Restore or Strobe	1, 4		2			
V_{IL}	Low-level input voltage	Channel Select CS0 or CS1	3	V_{CC} = 5 V, V_{EE} = −6 V			0.7	V
		Capacitor Restore or Strobe	1, 4				0.8	
V_{ICR}	Common-mode input voltage range			V_{CC} = 5 V, V_{EE} = −6 V, I_{IC} = −10 μA to +200 μA		−6 to 4.7		V
V_{IDR}	Differential input voltage range			V_{CC} = 5 V, V_{EE} = −6 V, I_{ID} = 200 μA		0 to 3.7		V
V_{OH}	High-level output voltage			V_{CC} = 4.75 V, V_{EE} = −5.7 V, $V_{IL(S)}$ = 0.8 V, I_{OH} = −400 μA	2.4	3.6		V
V_{OL}	Low-level output voltage		1, 4	V_{CC} = 4.75 V, V_{EE} = −5.7 V, I_{OL} = 10 mA		0.4	0.5	V
I_{IH}	High-level input current	Channel select CS0 or CS1		V_{CC} = 5.25 V, V_{EE} = −6.3 V, V_I = 3.5 V		1.8	3	mA
		Capacitor restore					10	μA
		Strobe				40	200	μA
I_{IL}	Low-level input current	Channel select CS0 or CS1		V_{CC} = 5.25 V, V_{EE} = −6.3 V, V_I = 0		−0.6	−1	mA
		Capacitor restore				−2.5	−3.5	μA
I_{CC}	Supply current from V_{CC}			V_{CC} = 5.25 V, V_{EE} = −6.3 V, See Note 4	15	22	30	mA
I_{EE}	Supply current from V_{EE}				−15	−20	−30	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡This is the lowest value of differential voltage signal that will cause the output to drop to a level that sets the latch shown in Figure 1, the latch being in free air at 25°C.
NOTE 4: Supply currents are measured with the output open; CS0, CS1, and CR at 3.5 V; and A1, A2, and S at 0 V.

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switching characteristics, V_{CC} = 5 V, V_{EE} = −6 V, T_A = 25°C

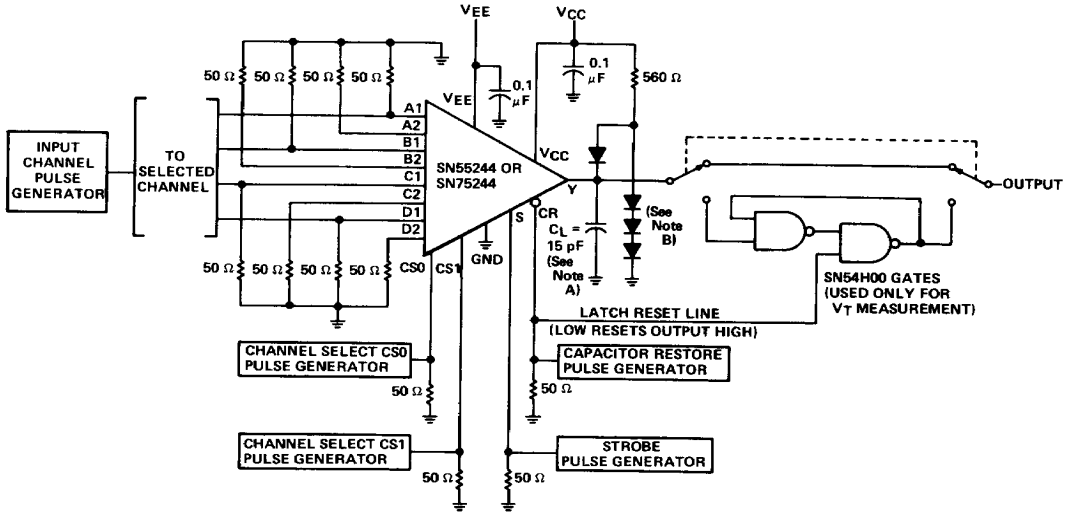
PARAMETER†	FROM (INPUT)	TEST FIGURE	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Differential input channel A, B, C, or D	1, 5, 8	C_L = 15 pF		40		ns
t_{PHL}					18	25	ns
t_{PLH}	Strobe	1, 6			30		ns
t_{PHL}					18	25	ns
t_{PLH}	Channel select CS0 or CS1	1, 7			40		ns
t_{PHL}					25		ns

†t_{PLH} ≡ propagation delay time, low-to-high-level output.
t_{PHL} ≡ propagation delay time, high-to-low-level output.

operating characteristics, V_{CC} = 5 V, V_{EE} = −6 V, T_A = 25°C

PARAMETER		TEST FIGURE	TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{su}min Minimum setup time	Channel select CS0 or CS1	5			15		ns
	Capacitor restore				10		
	strobe				10		
$t_h$min Minimum hold time for capacitor restore high		8			130		ns
t_{orC} Common-mode-input overload recovery time		9	V_{IC} = ±2 V		50		ns
t_{orD} Differential-input overload recovery time		9	V_{ID} = ±1 V		65		ns

PARAMETER MEASUREMENT INFORMATION



NOTES: A. C_L includes probe and jig capacitance.
B. All diodes are 1N916 or 1N3064.
C. Each channel is tested separately. Inputs not under test are left open.
D. The pulse generators shown above have the following characteristics: Z_O = 50 Ω, t_r = 10 ns, t_f = 10 ns.

FIGURE 1–V_T, V_{IH}, V_{IL}, V_{OL}, t_{PLH}, t_{PHL}

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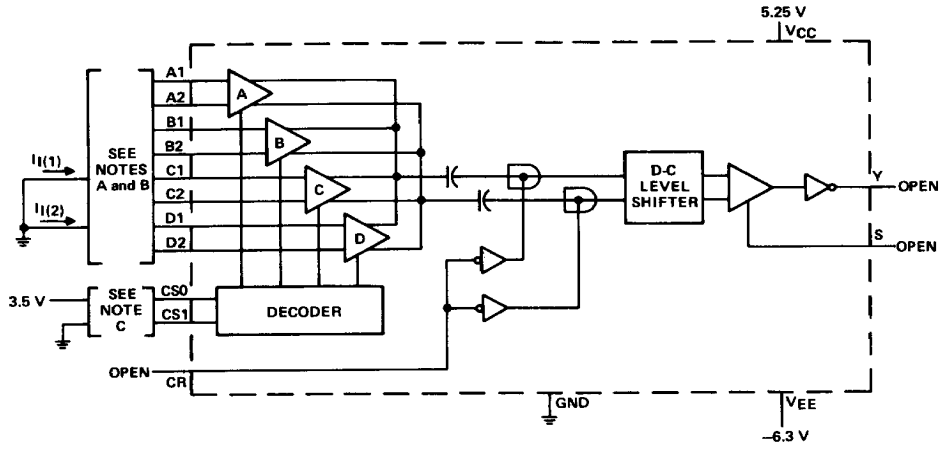
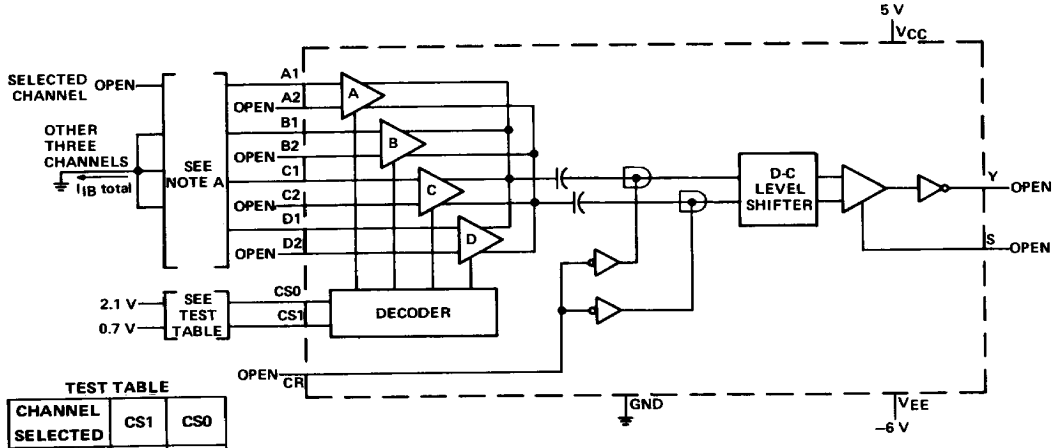
PARAMETER MEASUREMENT INFORMATION

d-c test circuits



NOTES: A. Each channel is tested separately. Channel inputs not under test are open.
B. $I_{IB} = I_{I(1)}$ or $I_{I(2)}$ (typical value applies to each). $I_{IO} = I_{I(1)} - I_{I(2)}$. $I_{I(1)}$ and $I_{I(2)}$ are the currents into the differential inputs of the channel under test.
C. Each channel is selected in turn as shown in the channel selection table.

FIGURE 2–I_{IB}, I_{IO}



TEST TABLE

CHANNEL SELECTED	CS1	CS0
A	2.1 V	2.1 V
B	2.1 V	0.7 V
C	0.7 V	2.1 V
D	0.7 V	0.7 V

NOTE A: The total bias current I_{IB}, coming from the unselected channels, must be less than 1 μA.

FIGURE 3–V_{IH}, V_{IL}

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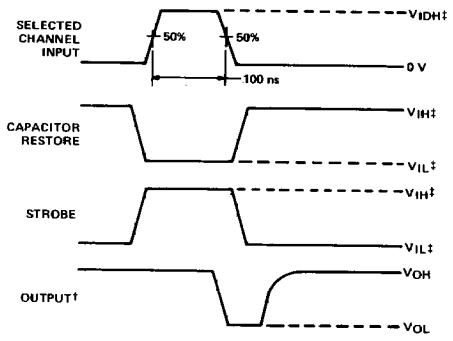
PARAMETER MEASUREMENT INFORMATION

switching waveforms



‡ TABLE OF INPUT LEVELS

INPUT	TESTING V_T			TESTING V_{OH}, V_{OL}		
	V_{IDH}	V_{IH}	V_{IL}	V_{IDH}	V_{IH}	V_{IL}
Selected Channel	V_T			10 mV		
Capacitor Restore		3 V	0 V		2 V	0.8 V
Strobe		3 V	0 V		2 V	0.8 V

†Output waveform is for latch output (see Figure 1) when testing V_T, otherwise for Y output.

FIGURE 4–V_T, V_{IH}, V_{IL}, V_{OH}, V_{OL}

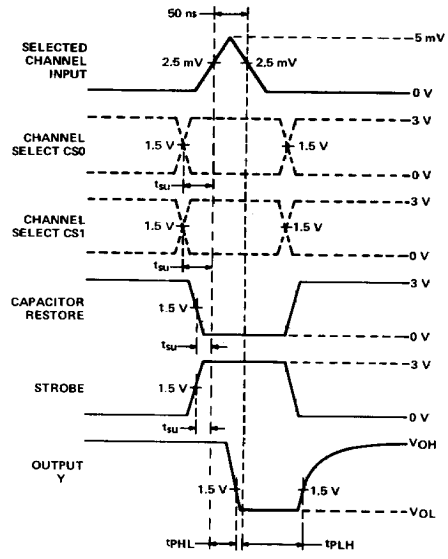


FIGURE 5–SETUP TIMES OF CHANNEL SELECT CS0, CHANNEL SELECT CS1, CAPACITOR RESTORE, AND STROBE; AND PROPAGATION DELAY TIMES FROM SELECTED CHANNEL

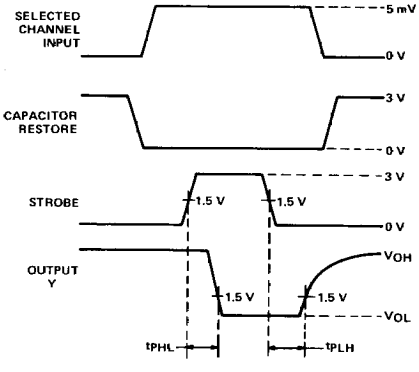


FIGURE 6–PROPAGATION DELAY TIMES FROM STROBE

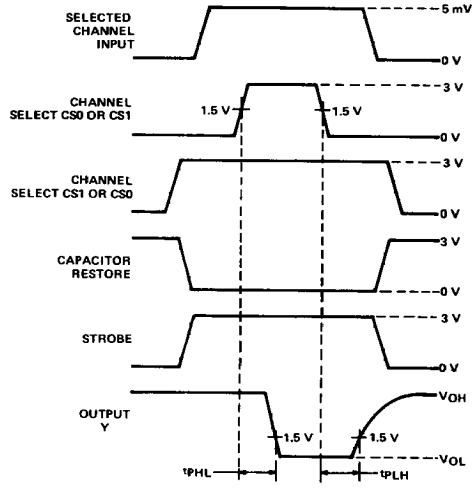


FIGURE 7–PROPAGATION DELAY TIME FROM CHANNEL SELECT CS0 OR CHANNEL SELECT CS1

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PARAMETER MEASUREMENT INFORMATION

switching waveforms (continued)

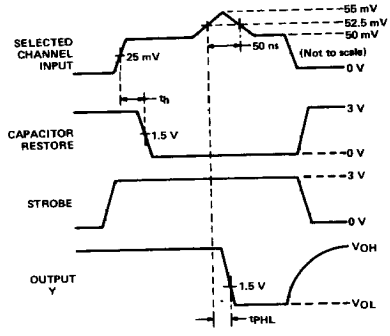
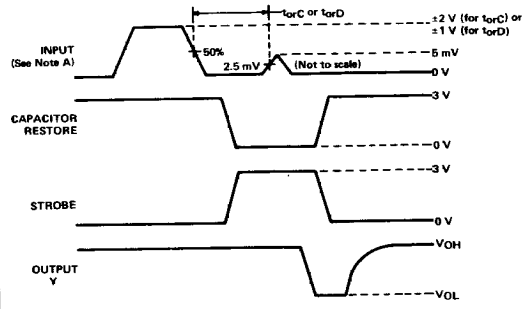


FIGURE 8—HOLD TIME FOR CAPACITOR RESTORE HIGH, PROPAGATION DELAY TIME FROM SELECTED CHANNEL



NOTE A: Although the large initial pulse is shown as a positive pulse, it may be either a positive or a negative common-mode or differential-mode input pulse. The triangular 5-mV input pulse is a differential-mode pulse.

FIGURE 9—COMMON-MODE AND DIFFERENTIAL-MODE RECOVERY TIMES

THERMAL INFORMATION

DISSIPATION DERATING CURVE

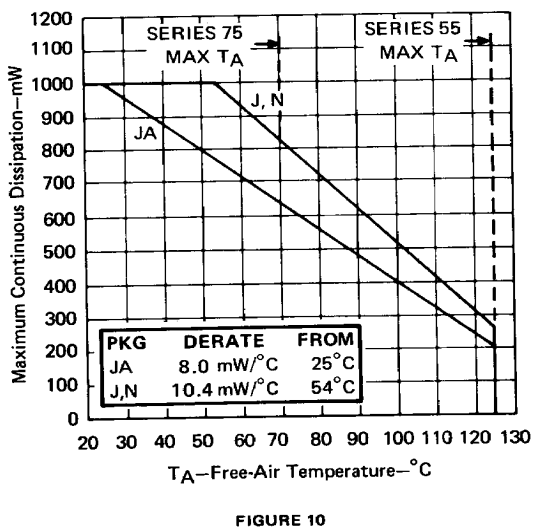


FIGURE 10

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TYPICAL CHARACTERISTICS†

VOLTAGE TRANSFER CHARACTERISTICS from STROBE

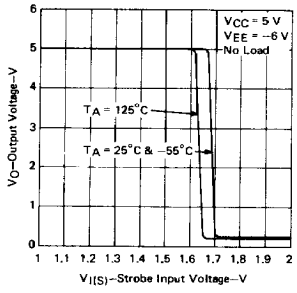

FIGURE 11

VOLTAGE TRANSFER CHARACTERISTICS from CHANNEL SELECT CS0

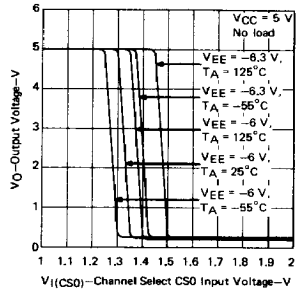

FIGURE 12

VOLTAGE TRANSFER CHARACTERISTICS from CHANNEL SELECT CS1

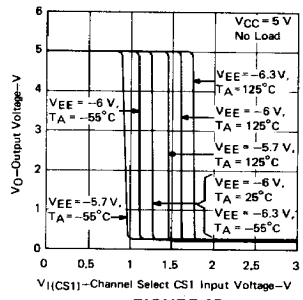

FIGURE 13

THRESHOLD VOLTAGE vs FREE-AIR TEMPERATURE

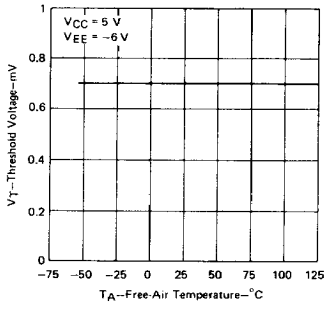

FIGURE 14

THRESHOLD VOLTAGE vs SUPPLY VOLTAGE VCC

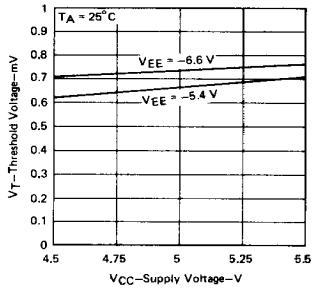

FIGURE 15

THRESHOLD VOLTAGE vs DIFFERENTIAL-INPUT PULSE WIDTH

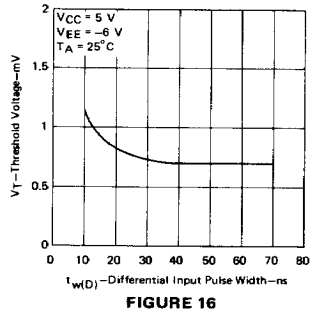

FIGURE 16

LOW-LEVEL OUTPUT VOLTAGE vs OUTPUT CURRENT

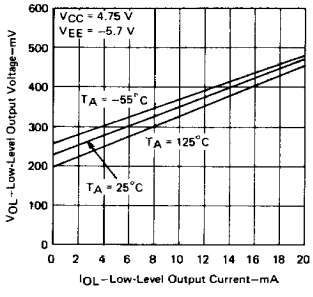

FIGURE 17

SMALL-SIGNAL DIFFERENTIAL INPUT IMPEDANCE vs FREQUENCY

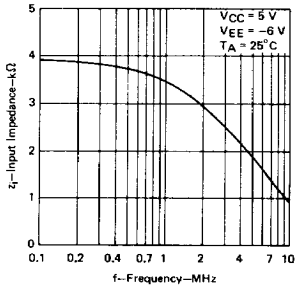

FIGURE 18

SENSE AMPLIFIER vs SMALL-SIGNAL PULSE RESPONSE

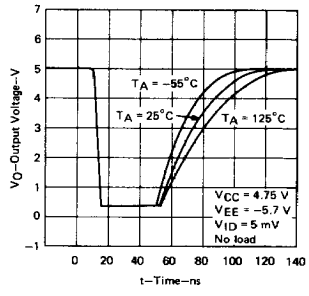

FIGURE 19

†Data for temperatures below 0°C and above 70°C are applicable for SN55244 only.

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