

Am686

Voltage Comparators

Distinctive Characteristics

- 12ns MAXIMUM PROPAGATION DELAY AT 5mV OVERDRIVE
- Complementary Schottky TTL outputs
- Fanout of 5

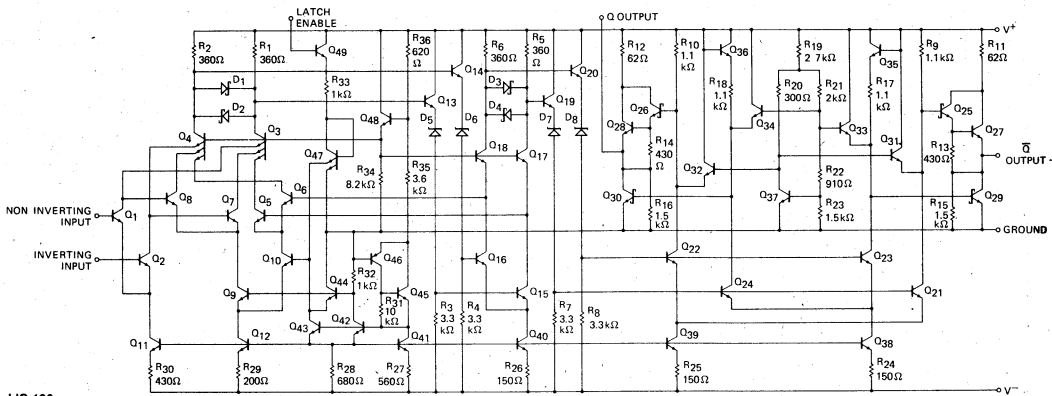
FUNCTIONAL DESCRIPTION

The Am686 is a fast voltage comparator manufactured with an advanced bipolar NPN, Schottky diode high-frequency process that makes possible very short propagation delays without sacrificing the excellent matching characteristics hitherto associated only with slow, high-performance linear IC's. The circuit has differential analog inputs and complementary logic outputs compatible with Schottky TTL. The output current capability is adequate for driving 5 standard Schottky inputs. The low input offset and high resolution

make this comparator especially suitable for high-speed precision analog-to-digital processing.

A latch function is provided to allow the comparator to be used in a sample-and-hold mode. If the Latch Enable input is LOW, the comparator functions normally. When the Latch Enable is driven HIGH, the comparator outputs are locked in their existing logical states. If the latch function is not used, the Latch Enable may be left open or connected to ground.

CIRCUIT DIAGRAM



LIC-130

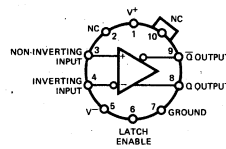
ORDERING INFORMATION*

Part Number	Package Type	Temperature Range	Order Number
Am686	Metal Can	0 to +70°C	AM686HC
	DIP	0 to +70°C	AM686DC
	8-Pin Mini	0 to +70°C	AM686CN
	8-Pin Mini	0 to +70°C	AM686CN-1
Am686	Metal Can	-55 to +125°C	AM686HM
	DIP	-55 to +125°C	AM686DM
Am686	Dice	0 to +70°C	AM686XC
	Dice	-55 to +125°C	AM686XM
Am686	Leadless	0 to +70°C	AM686LC
	Leadless	-55 to +125°C	AM686LM

*Also available with burn-in processing. To order add suffix B to part number.

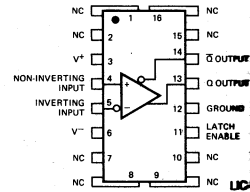
CONNECTION DIAGRAMS — Top Views

Metal Can H-10-1

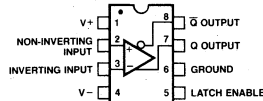


LIC-131

Dual In-Line D-16-1

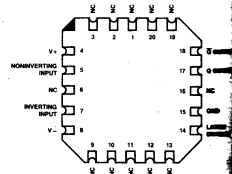


Dual In-Line P-8-1



LIC-884

Leadless Chip-Pak L-20-1



Note: On metal package, pin 5 is connected to case. On DIP, pin 6 is connected to case.

MAXIMUM RATINGS (Above which the useful life may be impaired)

Positive Supply Voltage	+7V
Negative Supply Voltage	-7V
Input Voltage	±4V
Differential Input Voltage	±6V
Power Dissipation (Note 2)	600mW
Lead Temperature (Soldering, 60 sec)	300°C
Storage Temperature Range	-65 to +150°C

Operating Temperature Range	Am686C and Am686C-1	0 to +70°C
	Am686M	-55 to +125°C
Operating Supply Voltage Range	Am686C and Am686C-1	V ⁺ = +5.0V ±5%, V ⁻ = -6.0V ±5%
	Am686M	V ⁺ = +5.0V ±10%, V ⁻ = -6.0V ±10%
Minimum Operating Voltage (V ⁺ to V ⁻)		9.7V

ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE RANGES

(Unless Otherwise Specified)

DC Characteristics

Symbol	Parameter	Conditions (Note 3)	Am686C	Am686C-1	Am686M	Units
V _{OS}	Input Offset Voltage	R _S ≤ 100Ω, T _A = 25°C R _S ≤ 100Ω	3.0 3.5	6.0 10.0	2.0 3.0	mV max mV max
ΔV _{OS} /ΔT	Average Temperature Coefficient of Input Offset Voltage	R _S ≤ 100Ω	10	-	10	μV/°C max
I _{OS}	Input Offset Current	25°C ≤ T _A ≤ T _A (max) T _A = T _A (min)	1.0 1.3	1.0 1.3	1.0 1.6	μA max μA max
I _B	Input Bias Current	25°C ≤ T _A ≤ T _A (max) T _A = T _A (min)	10 13	12 20	10 16	μA max μA max
V _{CM}	Input Voltage Range		+2.7, -3.3	+2.7, -3.3	+2.7, -3.3	V min
CMRR	Common Mode Rejection Ratio	R _S ≤ 100Ω, -3.3V ≤ V _{CM} ≤ +2.7V	80	-	80	dB min
SVRR	Supply Voltage Rejection Ratio	R _S ≤ 100Ω	70	-	70	dB min
V _{OH}	Output HIGH Voltage	I _L = -1.0mA, V _S = V _S (min)	2.7	2.7	2.5	V min
V _{OL}	Output LOW Voltage	I _L = 10mA, V _S = V _S (max)	0.5	0.5	0.5	V max
I ⁺	Positive Supply Current		42	50	40	mA max
I ⁻	Negative Supply Current		34	40	32	mA max
P _{DISS}	Power Dissipation		415	500	400	mW max

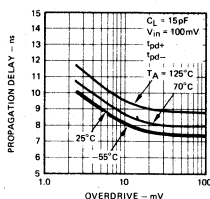
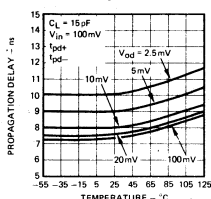
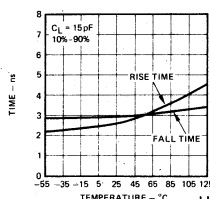
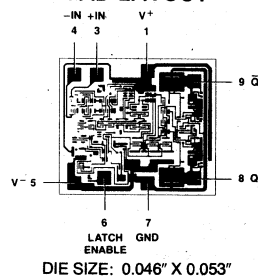
Switching Characteristics (V⁺ = +5.0V, V⁻ = -6.0V, V_{in} = 100mV, V_{od} = 5.0mV, C_L = 15pF) (Note 4)

Symbol	Parameter	Conditions	Am686C	Am686C-1	Am686M	Units
t _{pd+}	Propagation Delay, Input to Output HIGH	T _A (min) ≤ T _A ≤ 25°C T _A = T _A (max)	12 15	12 -	12 15	ns max ns max
t _{pd-}	Propagation Delay, Input to Output LOW	T _A (min) ≤ T _A ≤ 25°C T _A = T _A (max)	12 15	12 -	12 15	ns max ns max
Δt _{pd}	Difference in Propagation Delay between Outputs	T _A = 25°C	2.0	2.0	2.0	ns max

Notes: 2. For the metal can package, derate at 6.8mW/°C for operation at ambient temperatures above +95°C; for the dual-in-line package, derate at 9mW/°C for operation at ambient temperatures above 115°C.

3. Unless otherwise specified, V⁺ = +5.0V, V⁻ = -6.0V and the Latch Enable input is at V_{OL}. The switching characteristics are for a 100mV input step with 5.0mV overdrive.

4. The outputs of the Am686 are unstable when biased into their linear range. In order to prevent oscillation, the rate-of-change of the input signal as it passes through the threshold of the comparator must be at least 1V/μs. For slower input signals, a small amount of external positive feedback may be applied around the comparator to give a few millivolts of hysteresis.

PERFORMANCE CURVES**Propagation Delay as a Function of Input Overdrive****Propagation Delay as a Function of Temperature****Output Rise and Fall Times as a Function of Temperature****METALLIZATION AND PAD LAYOUT**

Am687 • Am687A

Dual Voltage Comparators

Distinctive Characteristics

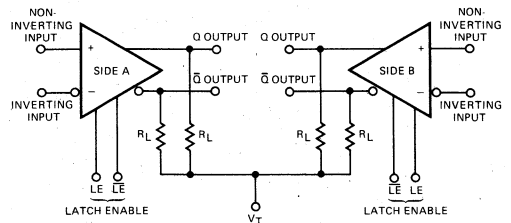
- 8.0ns MAXIMUM PROPAGATION DELAY AT 5mV OVERDRIVE
- Complementary ECL outputs
- 50Ω line driving capability

FUNCTIONAL DESCRIPTION

The Am687 and Am687A are fast dual voltage comparators constructed on a single silicon chip with an advanced high-frequency process. The circuits feature very short propagation delays as well as excellent matching characteristics. Each comparator has differential analog inputs and complementary logic outputs compatible with most forms of ECL. The output current capability is adequate for driving terminated 50Ω transmission lines. The low input offsets and short delays make these comparators especially suitable for high-speed precision analog-to-digital processing.

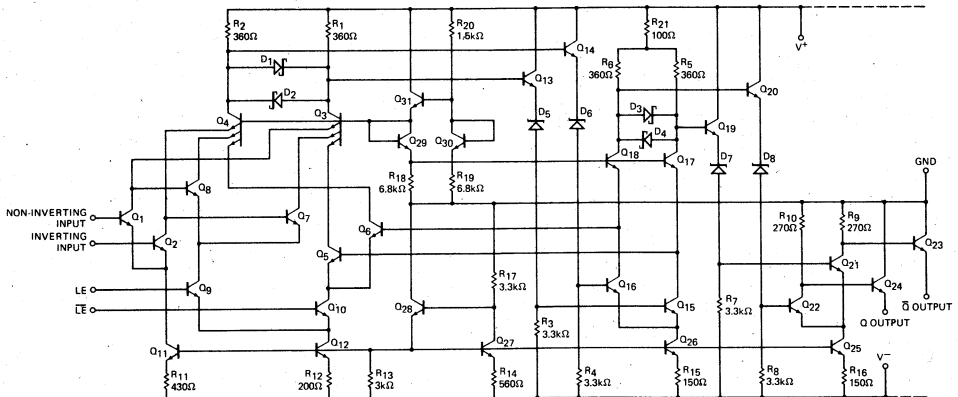
The comparators are similar to the Am685 high-speed comparator but have been designed to operate from a 5V positive supply (instead of 6V), dissipating less power than two Am685's. Separate latch functions are provided to allow each comparator to be independently used in a sample-hold mode. The Latch Enable inputs are intended to be driven from the complementary outputs of a standard ECL gate. If LE is HIGH and LE is LOW, the comparator functions normally. When LE is driven LOW and LE is driven HIGH, the comparator outputs are locked in their existing logical states. If the latch function is not used, LE must be connected to ground.

FUNCTIONAL DIAGRAM



The outputs are open emitters; therefore external pull-down resistors are required. These resistors may be in the range of 50–200Ω connected to –2.0V, or 200–2000Ω connected to –5.2V.

CIRCUIT DIAGRAM (Each Comparator)



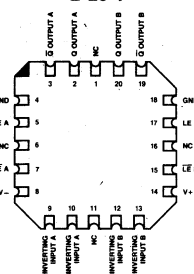
ORDERING INFORMATION*

Part Number	Package Type	Temperature Range	Order Number
Am687A	DIP	–30 to +85°C	AM687ADL
Am687A	DIP	–55 to +125°C	AM687ADM
Am687	DIP	–30 to +85°C	AM687DL
Am687	DIP	–55 to +125°C	AM687DM
Am687	Dice	–30 to +85°C	AM687XL
Am687	Dice	–55 to +125°C	AM687XM
Am687A	Leadless	–30 to +85°C	AM687ALL
Am687A	Leadless	–55 to +125°C	AM687ALM
Am687	Leadless	–30 to +85°C	AM687LL
Am687	Leadless	–55 to +125°C	AM687LM

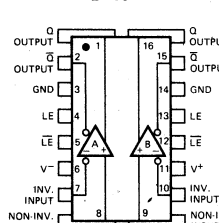
*Also available with burn-in processing. To order add suffix B to part number.

CONNECTION DIAGRAMS – Top Views

L-20-1



D-16-1



Note: Pin 1 is marked for orientation.

MAXIMUM RATINGS (Above which the useful life may be impaired)

Positive Supply Voltage	+7 V
Negative Supply Voltage	-7 V
Input Voltage	±4 V
Differential Input Voltage	±6 V
Output Current	30 mA
Power Dissipation (Note 2)	600 mW

Operating Temperature Range

Am687-L, Am687A-L	-30°C to +85°C
Am687-M, Am687A-M	-55°C to +125°C
Storage Temperature Range	-65°C to +150°C
Lead Temperature (Soldering, 60 Sec.)	300°C
Minimum Operating Voltage (V ⁺ to V ⁻)	9.7V

ELECTRICAL CHARACTERISTICS OVER THE OPERATING TEMPERATURE RANGES (Unless otherwise specified)

DC Characteristics

Symbol	Parameter	Conditions (Note 3)	Am687A-L		Am687A-M		Units
			Am687-L	Am687-L	Am687-M	Am687-M	
			Min.	Max.	Min.	Max.	
V _{OS}	Input Offset Voltage	R _S < 100 Ω, T _A = 25°C	-3.0	+3.0	-2.0	+2.0	mV
		R _S < 100 Ω	-3.5	+3.5	-3.0	+3.0	mV
ΔV _{OS} /ΔT	Average Temperature Coefficient of Input Offset Voltage	R _S < 100 Ω	-10	+10	-10	+10	μV/°C
I _{OS}	Input Offset Current	25°C < T _A < T _A (max.) T _A = T _A (min.)	-1.0	+1.0	-1.0	+1.0	μA
			-1.3	+1.3	-1.6	+1.6	μA
I _B	Input Bias Current	25°C < T _A < T _A (max.) T _A = T _A (min.)		10		10	μA
				13		16	μA
V _{CM}	Input Voltage Range		-3.3	+2.7	-3.3	+2.7	V
CMRR	Common Mode Rejection Ratio	R _S < 100 Ω, -3.3 < V _{CM} < +2.7 V	80		80		dB
SVRR	Supply Voltage Rejection Ratio	R _S < 100 Ω, ΔV _S ± 5%	70		70		dB
V _{OH}	Output HIGH Voltage	T _A = 25°C	-0.960	-0.810	-0.960	-0.810	V
		T _A = T _A (min.)	-1.060	-0.890	-1.100	-0.920	V
		T _A = T _A (max.)	-0.890	-0.700	-0.850	-0.620	V
V _{OL}	Output LOW Voltage	T _A = 25°C	-1.850	-1.650	-1.850	-1.650	V
		T _A = T _A (min.)	-1.890	-1.675	-1.910	-1.690	V
		T _A = T _A (max.)	-1.825	-1.625	-1.810	-1.575	V
I ⁺	Positive Supply Current			35		32	mA
I ⁻	Negative Supply Current			48		44	mA
P _{DISS}	Power Dissipation			485		450	mW

Switching Characteristics (V_{in} = 100 mV, V_{od} = 5 mV)

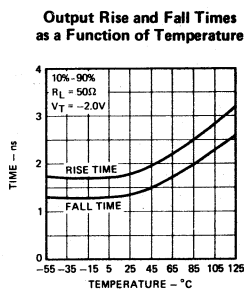
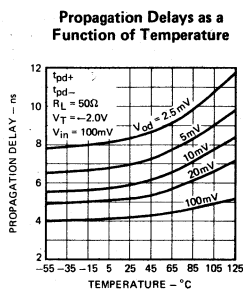
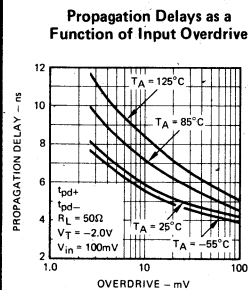
Symbol	Parameter	Conditions	Am687A-L	Am687A-M	Units
t _{pd+} , t _{pd-}	Propagation Delay, Am687A	T _A (min.) < T _A < 25°C T _A = T _A (max.)	8.0	8.0	ns
			10	12.5	ns
t _{pd+} , t _{pd-}	Propagation Delay, Am687	T _A (min.) < T _A < 25°C T _A = T _A (max.)	10	10	ns
			14	20	ns
t _s	Minimum Latch Set-up Time	T _A = 25°C	4.0	4.0	ns

Notes: 2. Derate at 9mW/°C for operation at ambient temperatures above +115°C.

3. Unless otherwise specified V⁺ = +5.0V, V⁻ = -5.2V, V_T = -2.0V, and R_L = 50Ω; all switching characteristics are for a 100mV input step with 5mV overdrive. The specifications given for V_{OS}, I_{OS}, I_B, CMRR, SVRR, t_{pd+} and t_{pd-} apply over the full V_{CM} range and for ±5% supply voltages. The Am687 and Am687A are designed to meet the specifications given in the table after thermal equilibrium has been established with a transverse air flow of 500 LFPM or greater.

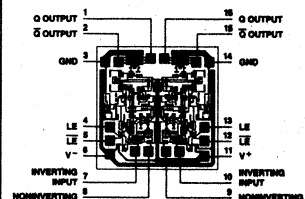
4. Because of the difficult and critical nature of switching measurements involving the latch, these parameters can not be tested in production. Engineering data indicates that at least 95% of the units will meet the specification given.

PERFORMANCE CURVES



LIC-137

METALLIZATION AND PAD LAYOUT



DIE SIZE 0.056" X 0.056"