# High-speed dual-differential comparator/sense amp NE/SE521

## FEATURES

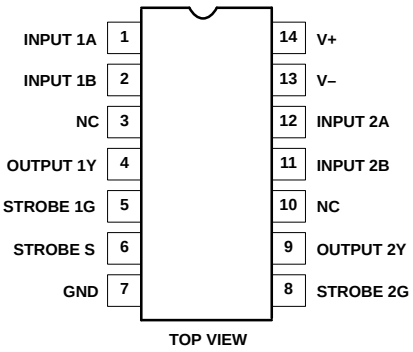
- 12ns maximum guaranteed propagation delay
- 20µA maximum input bias current
- TTL compatible strobes and outputs
- Large common-mode input voltage range
- Operates from standard supply voltages
- Military qualifications pending

## APPLICATIONS

- MOS memory sense amp
- A-to-D conversion
- High-speed line receiver

## PIN CONFIGURATION

D, F, N Packages

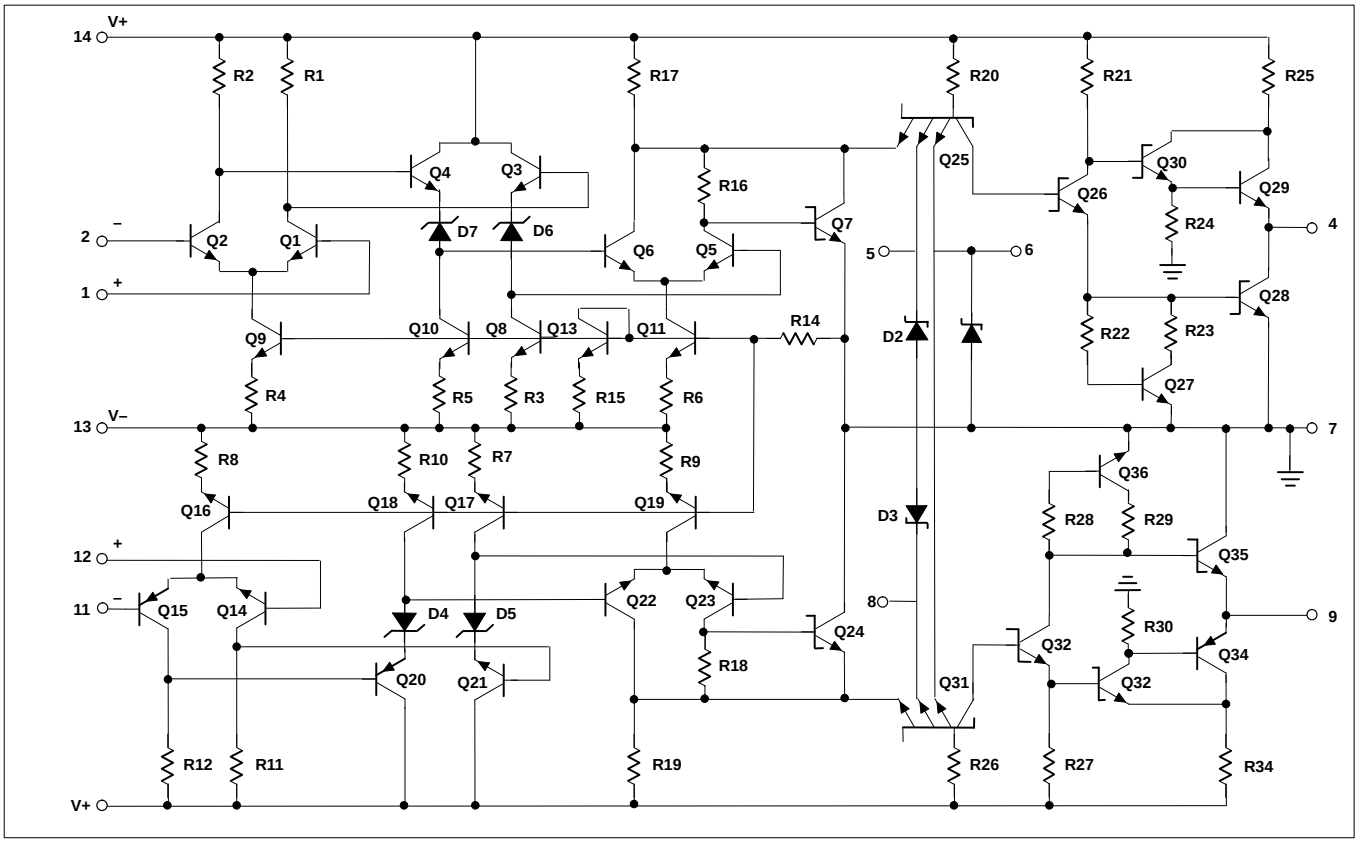



TOP VIEW

## ORDERING INFORMATION

| DESCRIPTION | TEMPERATURE RANGE | ORDER CODE | DWG # |
|---|---|---|---|
| 14-Pin Plastic Dual In-Line Package (DIP) | 0 to +70°C | NE521N | 0405B |
| 14-Pin SO Package | 0 to +70°C | NE521D | 0175D |
| 14-Pin Ceramic Dual In-Line Package (CERDIP) | 0 to +70°C | NE521F | 0581B |
| 14-Pin Ceramic Dual In-Line Package (CERDIP) | -55°C to +125°C | SE521F | 0581B |

## EQUIVALENT SCHEMATIC



## LOGIC FUNCTIONS

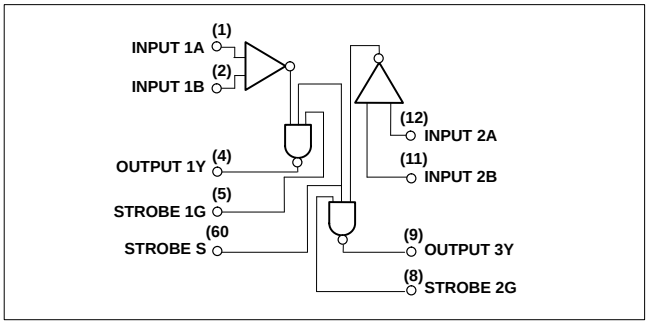
| $V_{ID}$ $A^+, B^-$ | STROBE S | STROBE G | OUTPUT (Y) |
|---|---|---|---|
| $V_{ID} \leq -V_{OS}$ | H | H | L |
| $-V_{OS} < V_{ID} < V_{OS}$ | H | H | Undefined |
| $V_{ID} \geq V_{OS}$ | H | H | H |
| X | L | X | H |
| X | X | L | H |

## ABSOLUTE MAXIMUM RATINGS

| SYMBOL | PARAMETER | RATING | UNIT |
|---|---|---|---|
| | Supply voltage | | |
| V+ | Positive | +7 | V |
| V- | Negative | -7 | V |
| $V_{IDR}$ | Differential input voltage | ±6 | V |
| $V_{IN}$ | Input voltage | | |
| | Common mode | ±5 | V |
| | Strobe/gate | +5.25 | V |
| $P_D$ | Maximum power dissipation[1] $T_A$= 25°C (still-air) | | |
| | F package | 1190 | mW |
| | N package | 1420 | mW |
| | D package | 1040 | mW |
| $T_A$ | Operating temperature range | | |
| | NE521 | 0 to 70 | °C |
| | SE521 | -55 to +125 | °C |
| $T_{STG}$ | Storage temperature range | -65 to +150 | °C |
| $T_{SOLD}$ | Lead soldering temperature (10 sec. max) | +300 | °C |

**NOTES:**
1. Derate above 25°C at the following rates:
   F package at 9.5mW/°C
   N package at 11.4mW/°C
   D package at 8.3mW/°C

## BLOCK DIAGRAM



## DC ELECTRICAL CHARACTERISTICS (SE521)

V+=+5V, V-=-5V, TA=-55°C to +125°C, unless otherwise specified.

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{OS}$ | Input offset voltage | V+=+4.5V, V-=-4.5V | | | | |
| | At 25°C | | | 6 | 7.5 | mV |
| | Over temperature range | | | | 15 | |
| $I_{BIAS}$ | Input bias current | V+=+5.5V, V-=-5.5V | | | | |
| | At 25°C | | | 7.5 | 20 | µA |
| | Over temperature range | | | | 40 | |
| $I_{OS}$ | Input offset current | V+=+5.5V, V-=-5.5V | | | | |
| | At 25°C | | | 1.0 | 5 | µA |
| | Over temperature range | | | | 12 | |
| $V_{CM}$ | Common-mode voltage range | V+=+4.5V, V-=-4.5V | –3 | | +3 | V |
| $V_{IL}$ | Low level input voltage | | | | | |
| | At 25°C | | | | 0.8 | V |
| | Over temperature | | | | 0.7 | |
| $V_{IH}$ | High level input voltage | | 2.0 | | | V |
| | Input current | V+=+5.5V, V-=-5.5V | | | | |
| $I_{IH}$ | High | $V_{IH}$=2.7V | | | | |
| | | 1G or 2G strobe | | | 50 | µA |
| | | Common strobe S | | | 100 | µA |
| | Input Current | | | | | |
| $I_{IL}$ | Low | $V_{IL}$=0.5V | | | | |
| | | 1G or 2G strobe | | | -2.0 | mA |
| | | Common strobe S | | | -4.0 | mA |
| | Output voltage | $V_{I(S)}$=2.0V | | | | |
| $V_{OH}$ | High | V+=+4.5V, V-=-4.5V, $I_{LOAD}$=-1mA | 2.5 | 3.4 | | V |
| $V_{OL}$ | Low | V+=+4.5V, V-=-4.5V, $I_{LOAD}$=10mA | | | 0.5 | |
| | | $T_A$=25°C, $I_{LOAD}$=20mA | | | 0.5 | |
| | Supply voltage | | | | | |
| V+ | Positive | | 4.5 | 5.0 | 5.5 | V |
| V- | Negative | | -4.5 | -5.0 | -5.5 | |
| | Supply current | V+=5.5V, V-=-5.5V, $T_A$=25°C | | | | |
| $I_{CC+}$ | Positive | | | 27 | 35 | mA |
| $I_{CC-}$ | Negative | | | -15 | -28 | |
| $I_{SC}$ | Short-circuit output current | | -35 | | -115 | mA |

## DC ELECTRICAL CHARACTERISTICS(NE521)

V+=+5V, V-=-5V, TA=0 to 70°C, unless otherwise specified.

| SYMBOL | PARAMETER | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | Min | Typ | Max | |
| $V_{OS}$ | Input offset voltage | V+=+4.75V, V-=-4.75V | | | | |
| | At 25°C | | | 6 | 7.5 | mV |
| | Over temperature range | | | | 10 | |
| $I_{BIAS}$ | Input bias current | V+=+5.25V, V-=-5.25V | | | | |
| | At 25°C | | | 7.5 | 20 | µA |
| | Over temperature range | | | | 40 | |
| $I_{OS}$ | Input offset current | V+=+5.25V, V-=-5.25V | | | | |
| | At 25°C | | | 1.0 | 5 | µA |
| | Over temperature range | | | | 12 | |
| $V_{CM}$ | Common-mode voltage range | V+=+4.75V, V-=-4.75V | –3 | | +3 | V |
| | Input current | V+=+5.25V, V-=-5.25V | | | | |
| $I_{IH}$ | High | $V_{IH}$=2.7V | | | | |
| | | 1G or 2G strobe | | | 50 | µA |
| | | Common strobe S | | | 100 | µA |
| | Input Current | | | | | |
| $I_{IL}$ | Low | $V_{IL}$=0.5V | | | | |
| | | 1G or 2G strobe | | | -2.0 | mA |
| | | Common strobe S | | | -4.0 | mA |
| | Output voltage | $V_{I(S)}$=2.0V | | | | |
| $V_{OH}$ | High | V+=+4.75V, V-=-4.75V, $I_{LOAD}$=-1mA | 2.7 | 3.4 | | V |
| $V_{OL}$ | Low | V+=+5.25V, V-=-5.25V, $I_{LOAD}$=20mA | | | 0.5 | |
| | Supply voltage | | | | | |
| V+ | Positive | | 4.75 | 5.0 | 5.25 | V |
| V- | Negative | | -4.75 | -5.0 | -5.25 | |
| | Supply current | V+=5.25V, V-=-5.25V, $T_A$=25°C | | | | |
| $I_{CC+}$ | Positive | | | 27 | 35 | mA |
| $I_{CC-}$ | Negative | | | -15 | -28 | |
| $I_{SC}$ | Short-circuit output current | | -40 | | -100 | mA |

## AC ELECTRICAL CHARACTERISTICS

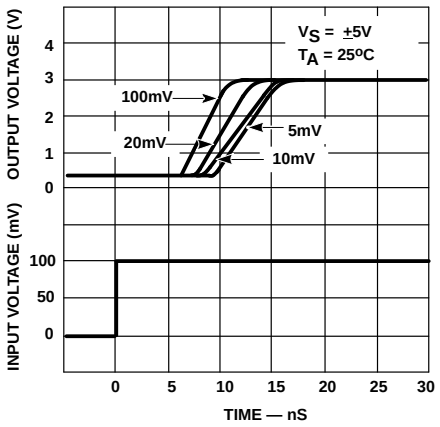
$T_A$=25°C, $R_L$=280W $C_L$=15pF V+=5V V-=5V**.**

| SYMBOL | PARAMETER | FROM INPUT | TO OUTPUT | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | |
| **Large-signal switching speed** | | | | | | | |
| | Propagation delay | | | | | | |
| $t_{PLH(D)}$ | Low to high[1] | Amp | Output | | 8 | 12 | |
| $t_{PHL(D)}$ | High to low[1] | Amp | Output | | 6 | 9 | ns |
| $t_{PLH(S)}$ | Low to high[2] | Strobe | Output | | 4.5 | 10 | |
| $t_{PHL(S)}$ | High to low[2] | Strobe | Output | | 3.0 | 6 | |
| $f_{MAX}$ | Max. operating frequency | | | 40 | 55 | | MHz |

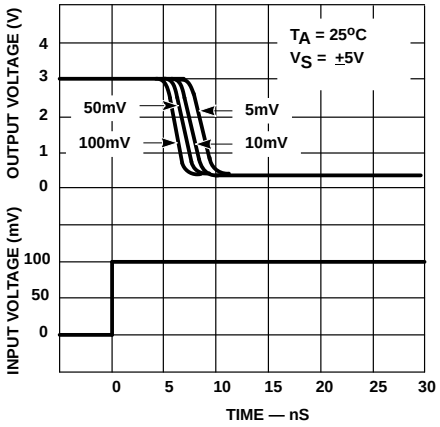
**NOTES:**
1. Response time measured from 0V point of ±100m$V_{P-P}$ 10MHz square wave to the 1.5V point of the output.
2. Response time measured from 1.5V point of input to 1.5V point of the output.

## TYPICAL PERFORMANCE CHARACTERISTICS

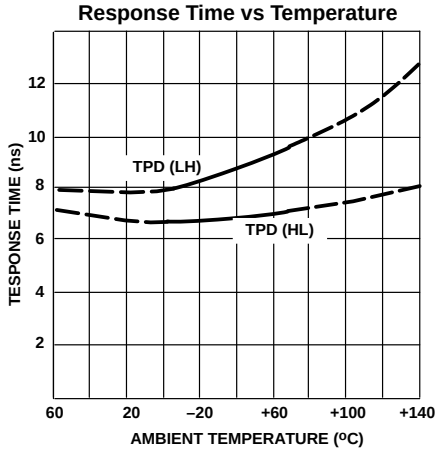
Response Time for Various Input Overdrives



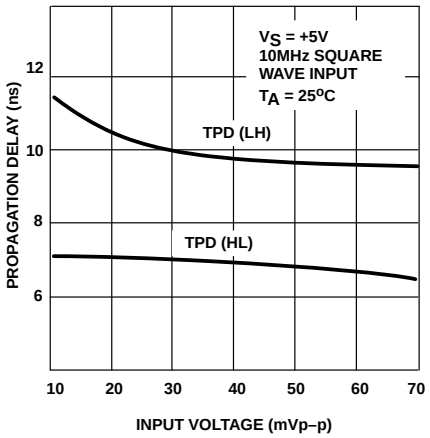

Response Time for Various Input Overdrives



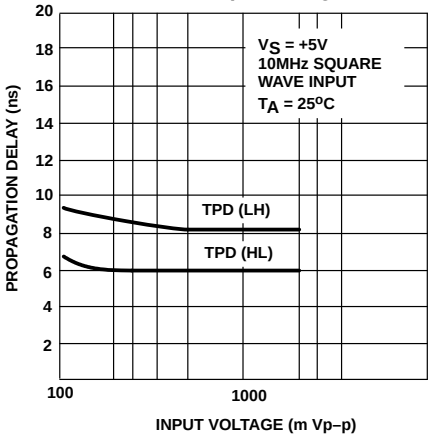

Response Time vs Temperature



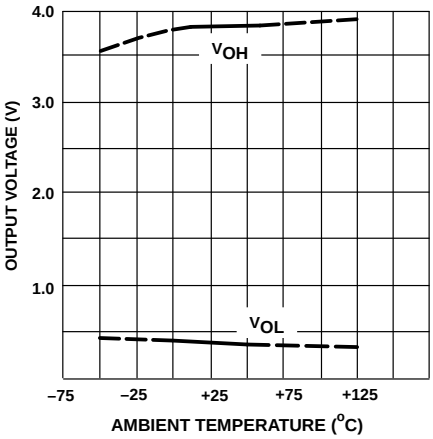

Propagation Delay for Various Input Voltages



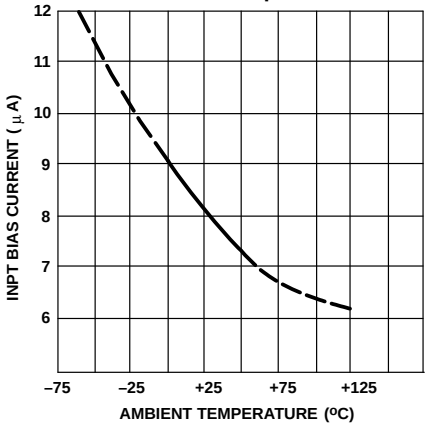

Propagation Delay for Various Input Voltages




Output Voltage vs Ambient Temperature




Input Bias Current vs Ambient Temperature




Input Offset Current vs Ambient Temperature