

NB7V586M

1.8V Differential 2:1 Mux Input to 1.2V/1.8V 1:6 CML Clock/Data Fanout Buffer / Translator

Multi-Level Inputs w/ Internal Termination

Description

The NB7V586M is a differential 1-to-6 CML Clock/Data Distribution chip featuring a 2:1 Clock/Data input multiplexer with an input select pin. The IN_x/\overline{IN}_x inputs incorporate internal 50 Ω termination resistors and will accept differential LVPECL, CML, or LVDS logic levels (see Figure 12). The IN_x/\overline{IN}_x inputs and core logic are powered with a 1.8 V supply. The NB7V586M produces six identical differential CML output copies of Clock or Data. The outputs are configured as three banks of two differential pair. Each bank (or all three banks) have the flexibility of being powered by any combination of either a 1.8 V or 1.2 V supply.

The 16 mA differential CML output structure provides matching internal 50 Ω source terminations and 400 mV output swings when externally terminated with a 50 Ω resistor to V_{CCOX} (see Figure 11).

The 1:6 fanout design was optimized for low output skew and minimal jitter and is ideal for SONET, GigE, Fiber Channel, Backplane and other Clock/Data distribution applications operating up to 6 GHz or 10 Gb/s typical. The V_{REFAC} reference outputs can be used to bias capacitor-coupled differential or single-ended input signals.

The NB7V586M is offered in a low profile 5x5 mm 32-pin Pb-Free QFN package. Application notes, models, and support documentation are available at www.onsemi.com.

The NB7V586M is a member of the GigaComm™ family of high performance clock products.

Features

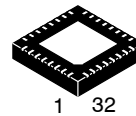
- Maximum Input Data Rate > 10 Gb/s Typical
- Data Dependent Jitter < 10 ps
- Maximum Input Clock Frequency > 6 GHz Typical
- Random Clock Jitter < 0.8 ps RMS, Max
- Low Skew 1:6 CML Outputs, 20 ps Max
- 2:1 Multi-Level Mux Inputs
- 175 ps Typical Propagation Delay
- 50 ps Typical Rise and Fall Times
- Differential CML Outputs, 330 mV Peak-to-Peak, Typical
- Operating Range: $V_{CC} = 1.71$ V to 1.89 V
- Operating Range: $V_{CCOX} = 1.14$ V to 1.89 V
- Internal 50 Ω Input Termination Resistors
- V_{REFAC} Reference Output
- QFN32 Package, 5 mm x 5 mm
- -40°C to +85°C Ambient Operating Temperature
- These are Pb-Free Devices



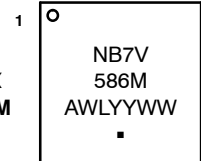
ON Semiconductor®

<http://onsemi.com>

MARKING DIAGRAM*



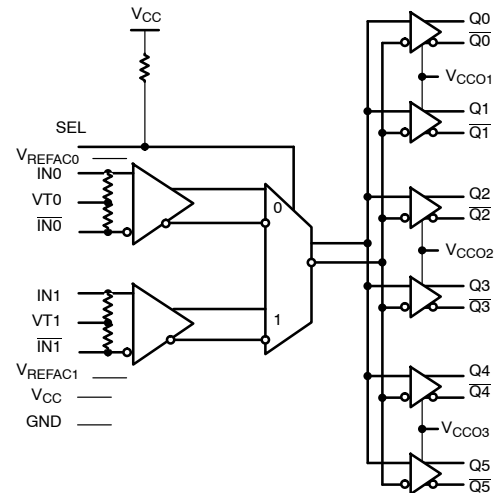
QFN32
MN SUFFIX
CASE 488AM



A = Assembly Location
WL = Wafer Lot
YY = Year
WW = Work Week
G or ■ = Pb-Free Package

*For additional marking information, refer to Application Note AND8002/D.

SIMPLIFIED LOGIC DIAGRAM



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

NB7V586M

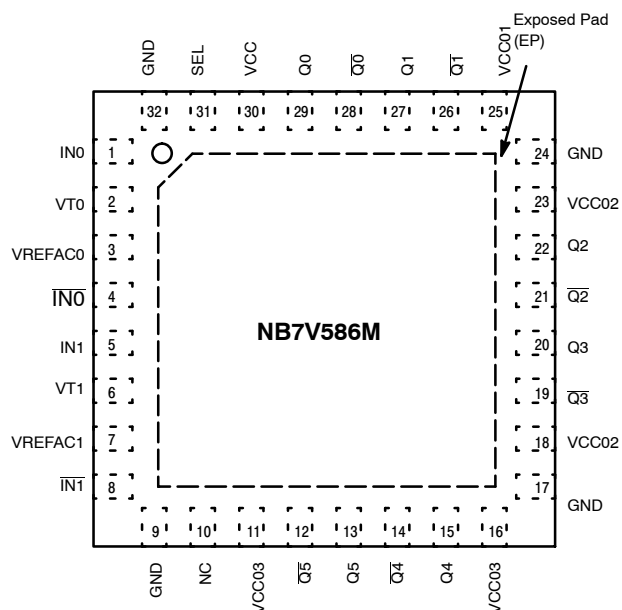


Figure 1. 32-Lead QFN Pinout (Top View)

Table 1. INPUT SELECT FUNCTION TABLE

| SEL* | CLK Input Selected |
|------|--------------------|
| 0 | IN0 |
| 1 | IN1 |

*Defaults HIGH when left open.

Table 2. PIN DESCRIPTION

| Pin | Name | I/O | Description |
|------------------|--|------------------------------|---|
| 1,4 5,8 | IN0, $\overline{\text{IN0}}$ IN1, $\overline{\text{IN1}}$ | LVPECL, CML, LVDS Input | Non-inverted, Inverted, Differential Inputs |
| 2,6 | VT0, VT1 | | Internal 100 Ω Center-tapped Termination Pin for IN0/ $\overline{\text{IN0}}$ and IN1/ $\overline{\text{IN1}}$ |
| 31 | SEL | LVTTTL/LVCMOS Input | Input Select pin; LOW for IN0 Inputs, HIGH for IN1 Inputs; defaults HIGH when left open |
| 10 | NC | – | No Connect |
| 30 | VCC | – | 1.8 V Positive Supply Voltage for the Inputs and Core Logic. |
| 25 | VCCO1 | – | 1.2 V or 1.8 V Positive Supply Voltage for the Q0, $\overline{\text{Q0}}$, Q1, $\overline{\text{Q1}}$ CML Outputs |
| 18, 23 | VCCO2 | – | 1.2 V or 1.8 V Positive Supply Voltage for the Q2, $\overline{\text{Q2}}$, Q3, $\overline{\text{Q3}}$ CML Outputs |
| 11, 16 | VCCO3 | – | 1.2 V or 1.8 V Positive Supply Voltage for the Q4, $\overline{\text{Q4}}$, Q5, $\overline{\text{Q5}}$ CML Outputs |
| 29, 28 27, 26 | Q0, $\overline{\text{Q0}}$ Q1, $\overline{\text{Q1}}$ | 1.2 V or 1.8 V CML Output | Non-inverted, Inverted Differential Outputs; powered by VCCO1 (Notes 1 and 2). |
| 22, 21 20, 19 | Q2, $\overline{\text{Q2}}$ Q3, $\overline{\text{Q3}}$ | 1.2 V or 1.8 V CML Output | Non-inverted, Inverted Differential Outputs; powered by VCCO2 (Notes 1 and 2). |
| 15, 14 13, 12 | Q4, $\overline{\text{Q4}}$ Q5, $\overline{\text{Q5}}$ | 1.2 V or 1.8 V CML Output | Non-inverted, Inverted Differential Outputs; powered by VCCO3 (Notes 1 and 2). |
| 9, 17, 24, 32 | GND | – | Negative Supply Voltage, connected to Ground |
| 3 7 | VREFAC0 VREFAC1 | – | Output Voltage Reference for Capacitor-Coupled Inputs, only |
| – | EP | – | The Exposed Pad (EP) on the QFN-32 package bottom is thermally connected to the die for improved heat transfer out of package. The exposed pad must be attached to a heat-sinking conduit. The pad is electrically connected to the die, and must be electrically and thermally connected to GND on the PC board. |

1. In the differential configuration when the input termination pins (VT0, VT1) are connected to a common termination voltage or left open, and if no signal is applied on INn/ $\overline{\text{INn}}$ input, then, the device will be susceptible to self-oscillation. Qn/ $\overline{\text{Qn}}$ outputs have internal 50 Ω source termination resistors.
2. All V_{CC}, VCC0x and GND pins must be externally connected to a power supply for proper operation.

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Table 3. ATTRIBUTES

| Characteristics | | Value |
|--|-----------------------------------|----------------------|
| ESD Protection | Human Body Model Machine Model | > 2 kV > 200 V |
| Input Pullup Resistor (R _{PU}) | | 75 kΩ |
| Moisture Sensitivity (Note 3) | | Level 1 |
| Flammability Rating | Oxygen Index: 28 to 34 | UL 94 V-0 @ 0.125 in |
| Transistor Count | | 308 |
| Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test | | |

3. For additional information, see Application Note AND8003/D.

Table 4. MAXIMUM RATINGS

| Symbol | Parameter | Condition 1 | Condition 2 | Rating | Unit |
|----------------------|---|---------------------|--------------------------------------|-------------------------------|--------------|
| V _{CC} | Positive Power Supply | GND = 0 V | | 3.0 | V |
| V _{CCOx} | Positive Power Supply | GND = 0 V | | 3.0 | V |
| V _{IO} | Input/Output Voltage | GND = 0 V | $-0.5 \leq V_{IO} \leq V_{CC} + 0.5$ | -0.5 to V _{CC} + 0.5 | V |
| V _{INPP} | Differential Input Voltage $ I_{N_x} - \overline{I_{N_x}} $ | | | 1.89 | V |
| I _{IN} | Input Current Through R _T (50 Ω Resistor) | | | ± 40 | mA |
| I _{OUT} | Output Current | Continuous Surge | | 34 40 | mA |
| I _{VFREFAC} | V _{REFAC} Sink/Source Current | | | ± 1.5 | mA |
| T _A | Operating Temperature Range | | | -40 to +85 | °C |
| T _{stg} | Storage Temperature Range | | | -65 to +150 | °C |
| θ _{JA} | Thermal Resistance (Junction-to-Ambient) (Note 4) | 0 lfpm 500 lfpm | QFN-32 QFN-32 | 31 27 | °C/W °C/W |
| θ _{JC} | Thermal Resistance (Junction-to-Case) (Note 4) | Standard Board | QFN-32 | 12 | °C/W |
| T _{sol} | Wave Solder Pb-Free | | | 265 | °C |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

4. JEDEC standard multilayer board – 2S2P (2 signal, 2 power) with 8 filled thermal vias under exposed pad.

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Table 5. DC CHARACTERISTICS – CML OUTPUT $V_{CC} = 1.8\text{ V} \pm 5\%$, $V_{CCO1} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $V_{CCO2} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $V_{CCO3} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $GND = 0\text{ V}$, $T_A = -40^\circ\text{C}$ to 85°C (Note 5)

| Symbol | Characteristic | Min | Typ | Max | Unit |
|--------|----------------|-----|-----|-----|------|
|--------|----------------|-----|-----|-----|------|

POWER SUPPLY CURRENT (Inputs and Outputs open)

| | | | | | |
|-----------|---|--|----|-----|----|
| I_{CC} | Power Supply Current for V_{CC} (Inputs and Outputs Open) | | 75 | 125 | mA |
| I_{CCO} | Power Supply Current for V_{CCOx} (Inputs and Outputs Open) | | 95 | 105 | |

CML OUTPUTS (Note 6)

| | | | | | |
|----------|---|---------------------------------|---------------------------------|---------------------------------|----|
| V_{OH} | Output HIGH Voltage $V_{CC} = 1.8\text{ V}$, $V_{CCOx} = 1.8\text{ V}$ $V_{CC} = 1.8\text{ V}$, $V_{CCOx} = 1.2\text{ V}$ | $V_{CCOx} - 40$ 1760 1160 | $V_{CCOx} - 20$ 1780 1180 | V_{CCOx} 1800 1200 | mV |
| V_{OL} | Output LOW Voltage $V_{CC} = 1.8\text{ V}$, $V_{CCOx} = 1.8\text{ V}$ $V_{CC} = 1.8\text{ V}$, $V_{CCOx} = 1.2\text{ V}$ | $V_{CCOx} - 500$ 1300 700 | $V_{CCOx} - 400$ 1400 800 | $V_{CCOx} - 275$ 1525 925 | mV |

DIFFERENTIAL INPUTS DRIVEN SINGLE-ENDED (Note 7) (Figure 6)

| | | | | | |
|-----------|--|----------------|--|----------------|----|
| V_{th} | Input Threshold Reference Voltage Range (Note 8) | 1050 | | $V_{CC} - 100$ | mV |
| V_{IH} | Single-Ended Input HIGH Voltage | $V_{th} + 100$ | | V_{CC} | mV |
| V_{IL} | Single-Ended Input LOW Voltage | GND | | $V_{th} - 100$ | mV |
| V_{ISE} | Single-Ended Input Voltage ($V_{IH} - V_{IL}$) | 200 | | 1200 | mV |

V_{REFAC}

| | | | | | |
|-------------|---|----------------|----------------|----------------|----|
| V_{REFAC} | Output Reference Voltage @ 100 μA for Capacitor – Coupled Inputs, Only | $V_{CC} - 550$ | $V_{CC} - 450$ | $V_{CC} - 300$ | mV |
|-------------|---|----------------|----------------|----------------|----|

DIFFERENTIAL INPUTS DRIVEN DIFFERENTIALLY (Note 9) (Figures 4 and 7)

| | | | | | |
|-----------|--|------|--|----------------|---------------|
| V_{IHD} | Differential Input HIGH Voltage (I_N, \bar{I}_N) | 1100 | | V_{CC} | mV |
| V_{ILD} | Differential Input LOW Voltage (I_N, \bar{I}_N) | GND | | $V_{CC} - 100$ | mV |
| V_{ID} | Differential Input Voltage (I_N, \bar{I}_N) ($V_{IHD} - V_{ILD}$) | 100 | | 1200 | mV |
| V_{CMR} | Input Common Mode Range (Differential Configuration, Note 10) (Figure 9) | 1050 | | $V_{CC} - 50$ | mV |
| I_{IH} | Input HIGH Current I_N/\bar{I}_N (V_{TO} / V_{T1} Open) | -150 | | 150 | μA |
| I_{IL} | Input LOW Current I_N/\bar{I}_N (V_{TO} / V_{T1} Open) | -150 | | 150 | μA |

CONTROL INPUT (SEL Pin)

| | | | | | |
|----------|------------------------------------|----------------------|----|----------------------|---------------|
| V_{IH} | Input HIGH Voltage for Control Pin | $V_{CC} \times 0.65$ | | V_{CC} | mV |
| V_{IL} | Input LOW Voltage for Control Pin | GND | | $V_{CC} \times 0.35$ | mV |
| I_{IH} | Input HIGH Current | -150 | 20 | +150 | μA |
| I_{IL} | Input LOW Current | -150 | 5 | +150 | μA |

TERMINATION RESISTORS

| | | | | | |
|------------|--|----|----|----|----------|
| R_{TIN} | Internal Input Termination Resistor (Measured from I_N to V_{Tx}) | 45 | 50 | 55 | Ω |
| R_{TOUT} | Internal Output Termination Resistor | 45 | 50 | 55 | Ω |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

- Input parameters vary 1:1 with V_{CC} . and output parameters vary 1:1 with V_{CCOx} .
- CML outputs (Q_n/\bar{Q}_n) have internal 50 Ω source termination resistors and must be externally terminated with 50 Ω to V_{CCOx} for proper operation.
- V_{th} , V_{IH} , V_{IL} and V_{ISE} parameters must be complied with simultaneously.
- V_{th} is applied to the complementary input when operating in single-ended mode.
- V_{IHD} , V_{ILD} , V_{ID} and V_{CMR} parameters must be complied with simultaneously.
- V_{CMR} min varies 1:1 with GND, V_{CMR} max varies 1:1 with V_{CC} . The V_{CMR} range is referenced to the most positive side of the differential input signal.

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Table 6. AC CHARACTERISTICS $V_{CC} = 1.8\text{ V} \pm 5\%$, $V_{CCO1} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $V_{CCO2} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $V_{CCO3} = 1.2\text{ V} \pm 5\%$ or $1.8\text{ V} \pm 5\%$, $GND = 0\text{ V}$, $T_A = -40^\circ\text{C}$ to 85°C (Note 11)

| Symbol | Characteristic | Min | Typ | Max | Unit |
|--------------------|---|------------|-----|------------|--------------------|
| f_{MAX} | Maximum Input Clock Frequency, $V_{OUTPP} \geq 200\text{ mV}$ | 4.0 | 6.0 | | GHz |
| $f_{DATAMAX}$ | Maximum Operating Input Data Rate (PRBS23) | 10 | | | Gbps |
| V_{OUTPP} | Output Voltage Amplitude (See Figures 4, Note 15) $f_{in} \leq 4.0\text{ GHz}$ | 200 | 330 | | mV |
| t_{PLH}, t_{PHL} | Propagation Delay to Output Differential @ 1 GHz, IN_x/\overline{IN}_x to Q_n/\overline{Q}_n Measured at Differential Crosspoint SEL to Q_n | 125 125 | 175 | 250 300 | ps |
| $t_{PLH\ TC}$ | Propagation Delay Temperature Coefficient | | 100 | | fs/°C |
| t_{SKEW} | Output – Output Skew (Within Device) (Note 12) Device – Device Skew ($t_{pd\ Max} - t_{pd\ min}$) | | | 30 50 | ps |
| t_{DC} | Output Clock Duty Cycle (Reference Duty Cycle = 50%) $f_{in} \leq 4.0\text{ GHz}$ | 45 | 50 | 55 | % |
| t_{JITTER} | Output Random Jitter (RJ) (Note 13) $f_{in} \leq 4.0\text{ GHz}$ Deterministic Jitter (DJ) (Note 14) 10 Gbps | | 0.2 | 0.8 10 | ps rms ps pk-pk |
| V_{INPP} | Input Voltage Swing (Differential Configuration) (Note 15) | 100 | | 1200 | mV |
| t_r, t_f | Output Rise/Fall Times @ 1 GHz (20% – 80%) Q_n, \overline{Q}_n | | 50 | 65 | ps |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

11. Measured using a 400 mV source, 50% duty cycle clock source. All outputs must be loaded with external $50\ \Omega$ to V_{CCOx} . Input edge rates 40 ps (20% – 80%).
12. Skew is measured between outputs under identical transitions and conditions. Duty cycle skew is defined only for differential operation when the delays are measured from cross-point of the inputs to the crosspoint of the outputs.
13. Additive RMS jitter with 50% duty cycle clock signal.
14. Additive Peak-to-Peak data dependent jitter with input NRZ data at PRBS23.
15. Input and output voltage swing is a single-ended measurement operating in differential mode.

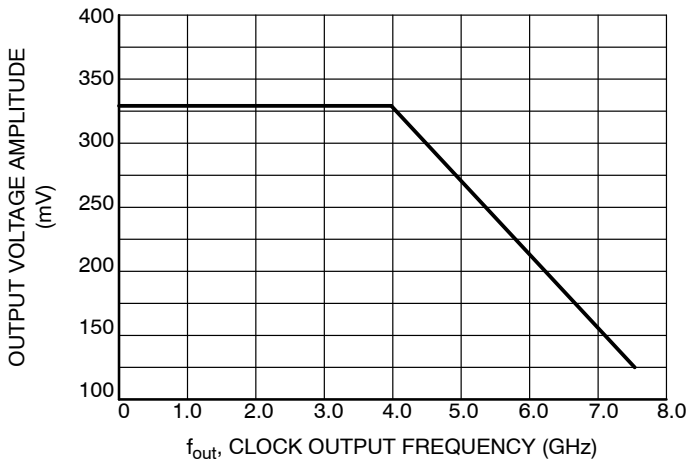


Figure 2. Output Voltage Amplitude (V_{OUTPP}) vs. Input Frequency (f_{in}) at Ambient Temperature (Typical)

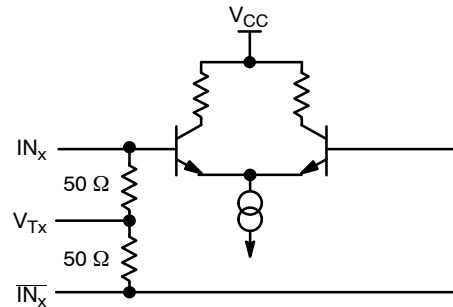


Figure 3. Input Structure

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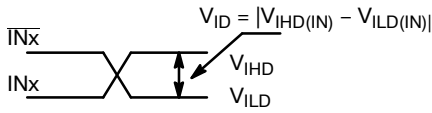


Figure 4. Differential Inputs Driven Differentially

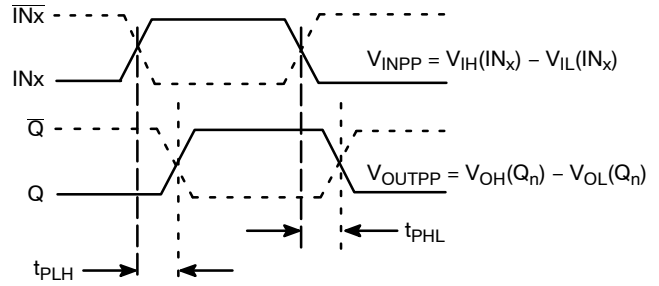


Figure 5. AC Reference Measurement

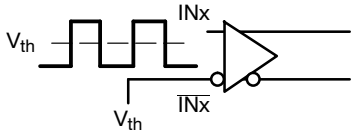


Figure 6. Differential Input Driven Single-Ended

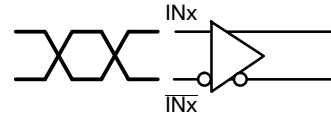


Figure 7. Differential Inputs Driven Differentially

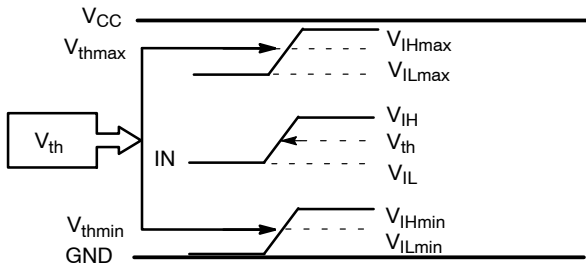


Figure 8. V_{th} Diagram

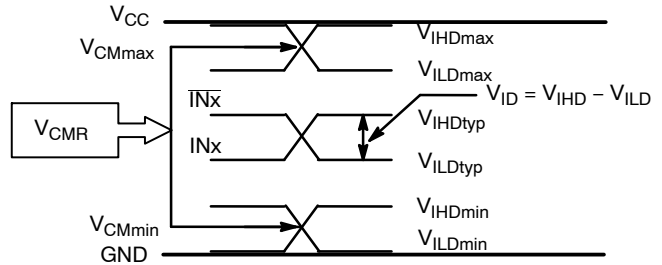


Figure 9. V_{CM} Diagram

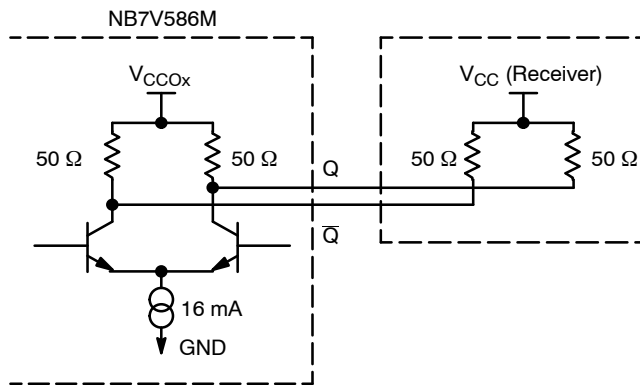


Figure 10. Typical CML Output Structure and Termination

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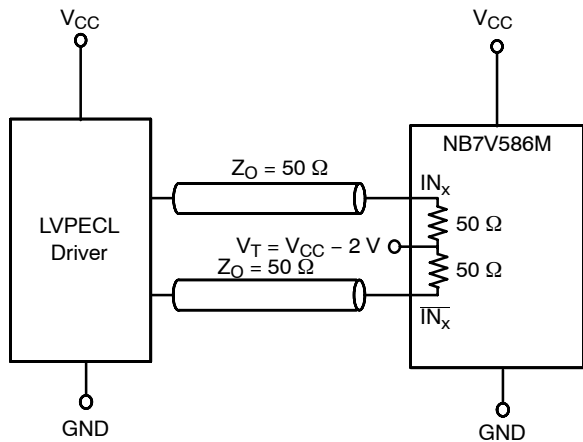


Figure 11. LVPECL Interface

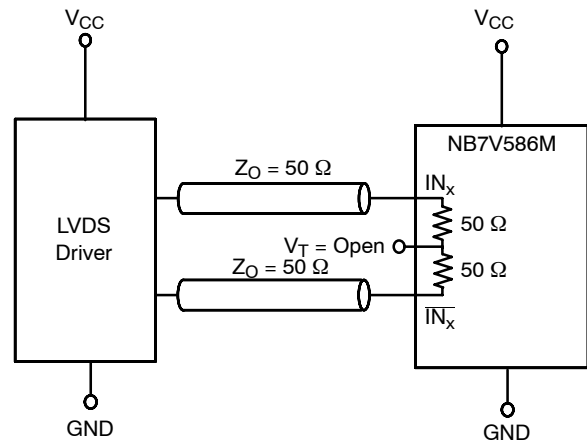


Figure 12. LVDS Interface

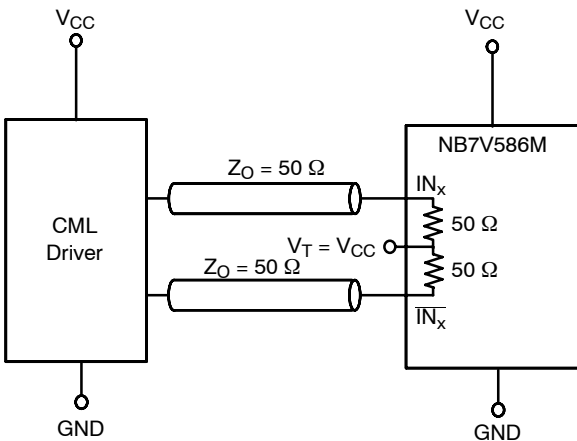
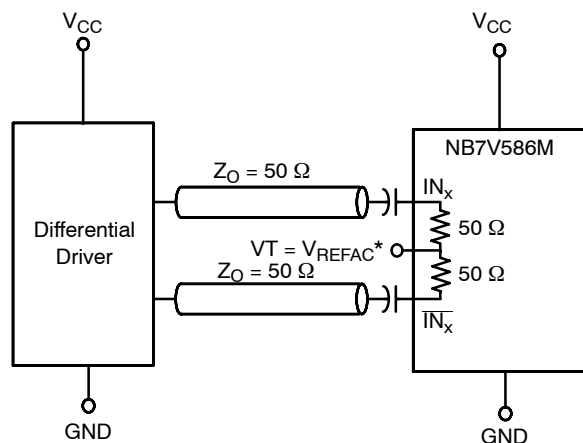


Figure 13. Standard 50 Ω Load CML Interface



**Figure 14. Capacitor-Coupled
Differential Interface
(V_T Connected to V_{REFAC})**

* V_{REFAC} bypassed to ground with a 0.01 μ F capacitor

ORDERING INFORMATION

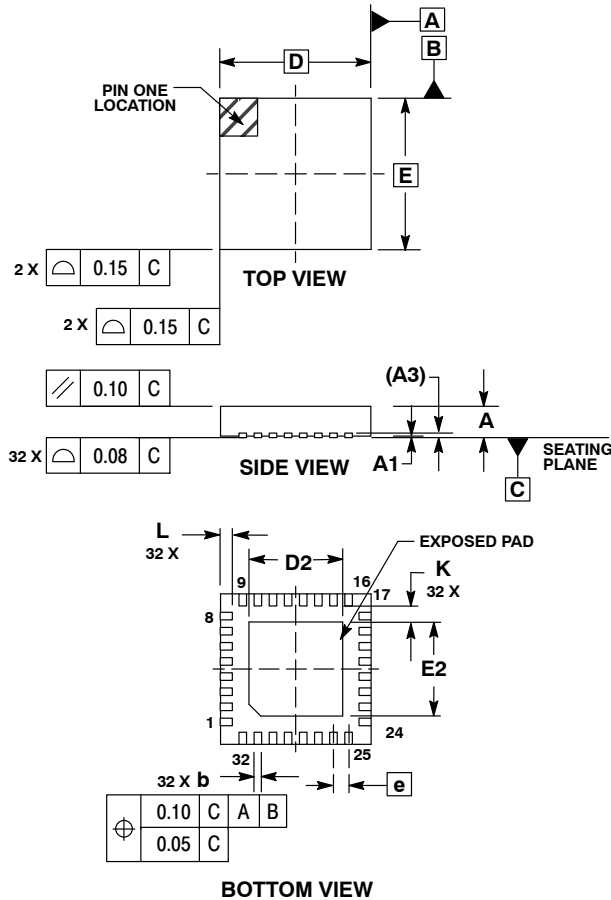
| Device | Package | Shipping [†] |
|---------------|--------------------|-----------------------|
| NB7V586MMNG | QFN32 (Pb-Free) | 74 Units / Rail |
| NB7V586MMNR4G | QFN32 (Pb-Free) | 1000 / Tape & Reel |

[†]For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

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PACKAGE DIMENSIONS

QFN32 5*5*1 0.5 P
CASE 488AM-01
ISSUE 0

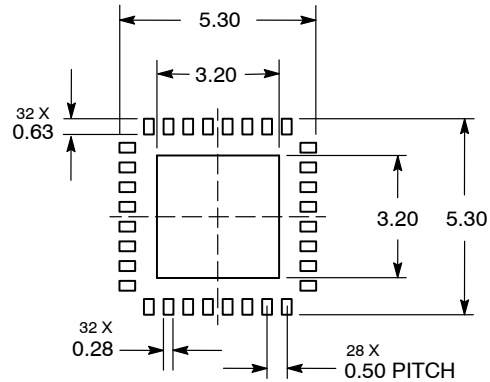


NOTES:

1. DIMENSIONS AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM TERMINAL
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS | | | |
|-------------|-----------|-------|-------|
| DIM | MIN | NOM | MAX |
| A | 0.800 | 0.900 | 1.000 |
| A1 | 0.000 | 0.025 | 0.050 |
| A3 | 0.200 REF | | |
| b | 0.180 | 0.250 | 0.300 |
| D | 5.00 BSC | | |
| D2 | 2.950 | 3.100 | 3.250 |
| E | 5.00 BSC | | |
| E2 | 2.950 | 3.100 | 3.250 |
| e | 0.500 BSC | | |
| K | 0.200 | --- | --- |
| L | 0.300 | 0.400 | 0.500 |

SOLDERING FOOTPRINT*



*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

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Компания «Life Electronics» занимается поставками электронных компонентов импортного и отечественного производства от производителей и со складов крупных дистрибьюторов Европы, Америки и Азии.

С конца 2013 года компания активно расширяет линейку поставок компонентов по направлению коаксиальный кабель, кварцевые генераторы и конденсаторы (керамические, пленочные, электролитические), за счёт заключения дистрибьюторских договоров

Мы предлагаем:

- Конкурентоспособные цены и скидки постоянным клиентам.
- Специальные условия для постоянных клиентов.
- Подбор аналогов.
- Поставку компонентов в любых объемах, удовлетворяющих вашим потребностям.
- Приемлемые сроки поставки, возможна ускоренная поставка.
- Доставку товара в любую точку России и стран СНГ.
- Комплексную поставку.
- Работу по проектам и поставку образцов.
- Формирование склада под заказчика.
- Сертификаты соответствия на поставляемую продукцию (по желанию клиента).
- Тестирование поставляемой продукции.
- Поставку компонентов, требующих военную и космическую приемку.
- Входной контроль качества.
- Наличие сертификата ISO.

В составе нашей компании организован Конструкторский отдел, призванный помогать разработчикам, и инженерам.

Конструкторский отдел помогает осуществить:

- Регистрацию проекта у производителя компонентов.
- Техническую поддержку проекта.
- Защиту от снятия компонента с производства.
- Оценку стоимости проекта по компонентам.
- Изготовление тестовой платы монтаж и пусконаладочные работы.



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