

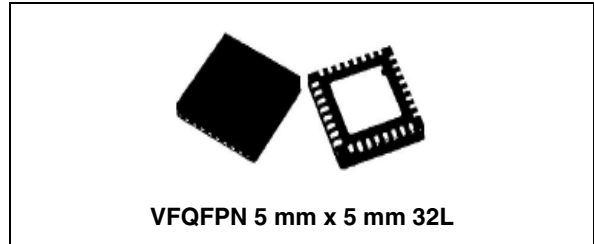
## Push-pull four channel driver with diodes

### Features

- 600 mA output current capability per channel
- 1.2 A peak output current (non repetitive) per channel
- Enable facility
- Overtemperature protection
- Logical "0" input voltage up to 1.5 V (high noise immunity)
- Internal clamp diodes

### Description

The device is a monolithic integrated high voltage, high current four channel driver designed to accept standard DTL or TTL logic levels and drive inductive loads (such as relays solenoids, DC and stepping motors) and switching power transistors.

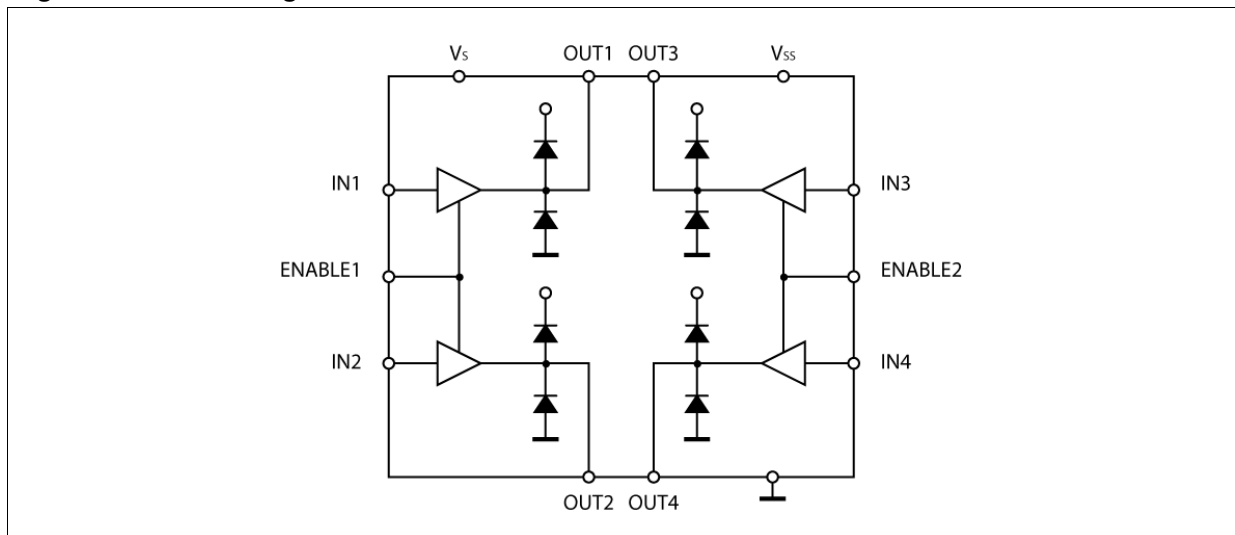


To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a lower voltage and internal clamp diodes are included.

This device is suitable for use in switching applications at frequencies up to 50 kHz.

The L2293Q is assembled in a VFQFPN-32L 5x5 package which has exposed pad available for heatsinking.

**Figure 1. Block diagram**



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# 1 Electrical data

## 1.1 Absolute maximum ratings

**Table 1. Absolute maximum ratings**

| Symbol    | Parameter                                                          | Value       | Unit               |
|-----------|--------------------------------------------------------------------|-------------|--------------------|
| $V_S$     | Supply voltage                                                     | 36          | V                  |
| $V_{SS}$  | Logic supply voltage                                               | 36          | V                  |
| $V_i$     | Input voltage                                                      | 7           | V                  |
| $V_{en}$  | Enable voltage                                                     | 7           | V                  |
| $I_o$     | Peak output current (100 $\mu$ s non repetitive)                   | 1.2         | A                  |
| $P_{tot}$ | Total power dissipation at $T_{pins} = 90\text{ }^{\circ}\text{C}$ | 4           | W                  |
| $T_J$     | Junction temperature                                               | 150         | $^{\circ}\text{C}$ |
| $T_{STG}$ | Storage temperature                                                | – 40 to 150 | $^{\circ}\text{C}$ |

## 1.2 Recommended conditions

**Table 2. Recommended conditions**

| Symbol   | Parameter            | Value              |     |     | Unit               |
|----------|----------------------|--------------------|-----|-----|--------------------|
|          |                      | Min                | Typ | Max |                    |
| $V_S$    | Supply voltage       | $V_{SS}$           |     | 36  | V                  |
| $V_{SS}$ | Logic supply voltage | 2.8 <sup>(1)</sup> |     | 36  | V                  |
| $T_J$    | Junction temperature | -20 <sup>(1)</sup> |     | 125 | $^{\circ}\text{C}$ |

1. See [Figure 2](#)

1.3 Thermal data

Figure 2. Typical minimum logic supply voltage vs junction temperature

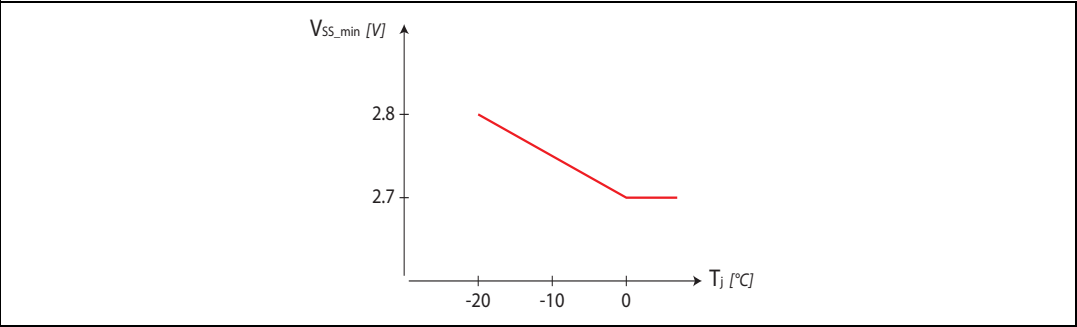


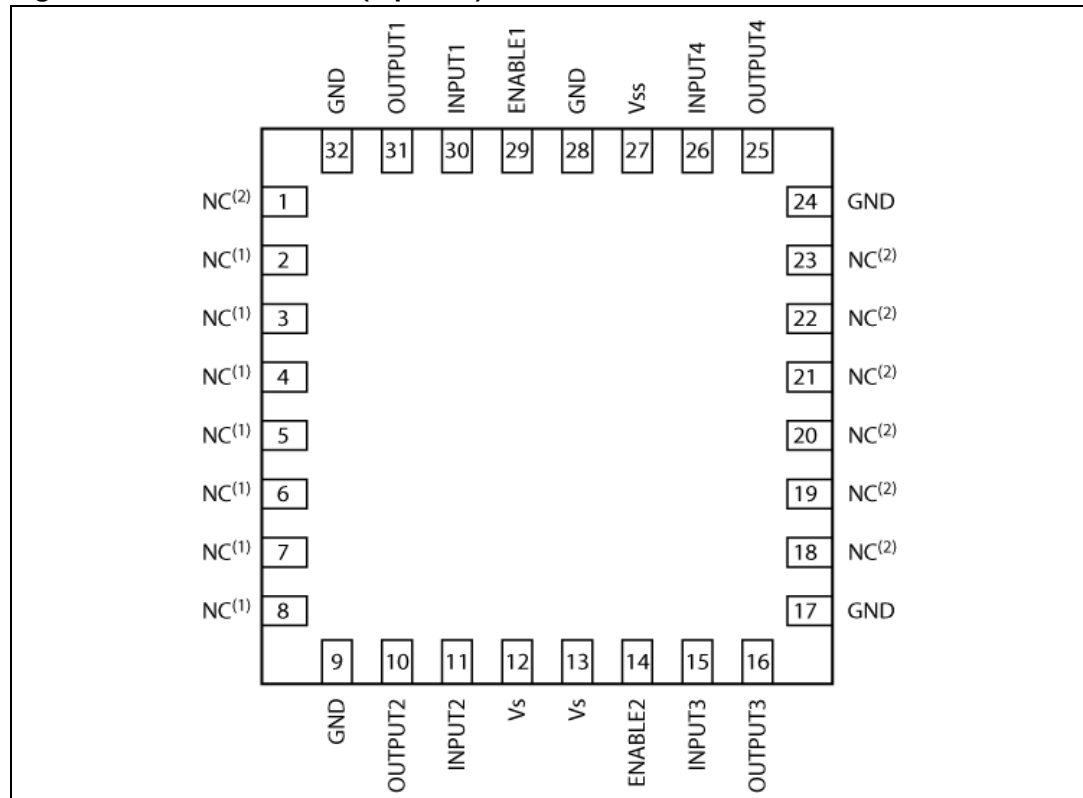
Table 3. Thermal data

| Symbol       | Parameter                                               | Value | Unit          |
|--------------|---------------------------------------------------------|-------|---------------|
| $R_{th(JA)}$ | Thermal resistance junction-ambient max. <sup>(1)</sup> | 42    | $^{\circ}C/W$ |

1. Mounted on a double-layer FR4 PCB with a dissipating copper surface of 0.5 cm<sup>2</sup> on the top side plus 6 cm<sup>2</sup> ground layer connected through 18 via holes (9 below the IC).

## 2 Pin connection

Figure 2. Pin connection (top view)



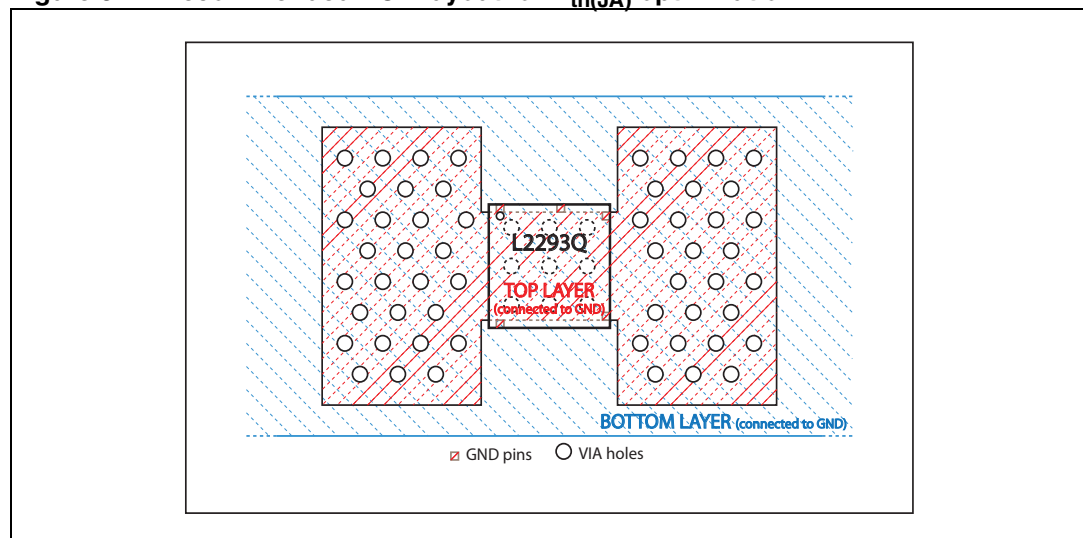
Note:

NC<sup>(1)</sup> These NC pins are connected to the exposed PAD.

The exposed PAD must be connected to GND pins.

NC<sup>(2)</sup> These NC pins can be connected to GND pins and exposed PAD.

Figure 3. Recommended PCB layout for  $R_{th(JA)}$  optimization



**Table 4. Pin description**

| Pin n°                       | Name            | Type | Function                                                                                                                      |
|------------------------------|-----------------|------|-------------------------------------------------------------------------------------------------------------------------------|
| 1, 18, 19, 20,<br>21, 22, 23 | NC              |      | Not connected                                                                                                                 |
| 2, 3, 4, 5, 6, 7,            | NC              |      | Pins connected to the exposed PAD                                                                                             |
| 8, 9, 17, 24, 28,<br>32      | GND             |      | Ground                                                                                                                        |
| 10                           | OUTPUT2         | O    | Output 2                                                                                                                      |
| 11                           | INPUT2          | I    | Input 2                                                                                                                       |
| 12, 13                       | V <sub>S</sub>  |      | Supply voltage for the power output stages. A non-inductive 100 nF capacitor must be connected between these pins and ground. |
| 14                           | ENABLE2         | I    | Enable 2 input, the LOW state disables the Output 3 and Output 4.                                                             |
| 15                           | INPUT3          | I    | Input 3                                                                                                                       |
| 16                           | OUTPUT3         | O    | Output 3                                                                                                                      |
| 25                           | OUTPUT4         | O    | Output 4                                                                                                                      |
| 26                           | INPUT4          | I    | Input 4                                                                                                                       |
| 27                           | V <sub>SS</sub> |      | Supply voltage for the logic blocks. A 100 nF capacitor must be connected between this pin and ground.                        |
| 29                           | ENABLE1         | I    | Enable 1 input, the LOW state disables the output 1 and Output 2.                                                             |
| 30                           | INPUT1          | I    | Input 1                                                                                                                       |
| 31                           | OUTPUT1         | O    | Output 1                                                                                                                      |

### 3 Electrical characteristics

For each channel,  $V_S = 24\text{ V}$ ,  $V_{SS} = 5\text{ V}$ ,  $T_A = 25\text{ }^{\circ}\text{C}$ , unless otherwise specified.

**Table 5. Electrical characteristics**

| Symbol         | Pin            | Parameter                            | Test condition                                          | Min   | Typ  | Max      | Unit          |
|----------------|----------------|--------------------------------------|---------------------------------------------------------|-------|------|----------|---------------|
| $I_S$          | 12, 13         | Total quiescent supply current       | $V_i = L; I_O = 0; V_{en} = H$                          |       | 2    | 6        | mA            |
|                |                |                                      | $V_i = H; I_O = 0; V_{en} = H$                          |       | 16   | 24       | mA            |
|                |                |                                      | $V_{en} = L$                                            |       |      | 4        | mA            |
| $I_{SS}$       | 27             | Total quiescent logic supply current | $V_i = L; I_O = 0; V_{en} = H$                          |       | 44   | 60       | mA            |
|                |                |                                      | $V_i = H; I_O = 0; V_{en} = H$                          |       | 16   | 22       | mA            |
|                |                |                                      | $V_{en} = L$                                            |       | 16   | 24       | mA            |
| $V_{IL}$       | 11, 15, 26, 30 | Input low voltage                    |                                                         | - 0.3 |      | 1.5      | V             |
| $V_{IH}$       | 11, 15, 26, 30 | Input high voltage                   | $V_{SS} \leq 7\text{ V}$                                | 2.3   |      | $V_{SS}$ | V             |
|                |                |                                      | $V_{SS} > 7\text{ V}$                                   | 2.3   |      | 7        | V             |
| $I_{IL}$       | 11, 15, 26, 30 | Low voltage input current            | $V_{IL} = 1.5\text{ V}$                                 |       |      | - 10     | $\mu\text{A}$ |
| $I_{IH}$       | 11, 15, 26, 30 | High voltage input current           | $2.3\text{ V} \leq V_{IH} \leq V_{SS} - 0.6\text{ V}$   |       | 30   | 100      | $\mu\text{A}$ |
| $V_{en L}$     | 14, 29         | Enable low voltage                   |                                                         | - 0.3 |      | 1.5      | V             |
| $V_{en H}$     | 14, 29         | Enable high voltage                  | $V_{SS} \leq 7\text{ V}$                                | 2.3   |      | $V_{SS}$ | V             |
|                |                |                                      | $V_{SS} > 7\text{ V}$                                   | 2.3   |      | 7        | V             |
| $I_{en L}$     | 14, 29         | Low voltage enable current           | $V_{en L} = 1.5\text{ V}$                               |       | - 30 | - 100    | $\mu\text{A}$ |
| $I_{en H}$     | 14, 29         | High voltage enable current          | $2.3\text{ V} \leq V_{en H} \leq V_{SS} - 0.6\text{ V}$ |       |      | $\pm 10$ | $\mu\text{A}$ |
| $V_{CE(sat)H}$ | 10, 16, 25, 31 | Source output saturation voltage     | $I_O = - 0.6\text{ A}$                                  |       | 1.4  | 1.8      | V             |
| $V_{CE(sat)L}$ | 10, 16, 25, 31 | Sink output saturation voltage       | $I_O = + 0.6\text{ A}$                                  |       | 1.2  | 1.8      | V             |
| $V_F$          |                | Clamp diode forward voltage          | $I_O = 600\text{ nA}$                                   |       | 1.3  |          | V             |

$V_S = 24\text{ V}$ ,  $V_{SS} = 5\text{ V}$ ,  $T_A = 25\text{ }^\circ\text{C}$ , unless otherwise specified.

Table 6. AC operation

| Symbol    | Parameter                     | Test condition         | Min | Typ | Max | Unit |
|-----------|-------------------------------|------------------------|-----|-----|-----|------|
| $t_r$     | Rise time <sup>(1)</sup>      | 0.1 to 0.9 $V_O$       |     | 250 |     | ns   |
| $t_f$     | Fall time <sup>(1)</sup>      | 0.9 to 0.1 $V_O$       |     | 250 |     | ns   |
| $t_{on}$  | Turn-on delay <sup>(1)</sup>  | 0.5 $V_i$ to 0.5 $V_O$ |     | 750 |     | ns   |
| $t_{off}$ | Turn-off delay <sup>(1)</sup> | 0.5 $V_i$ to 0.5 $V_O$ |     | 200 |     | ns   |

1. See [Figure 4](#)

Figure 4. Switching times

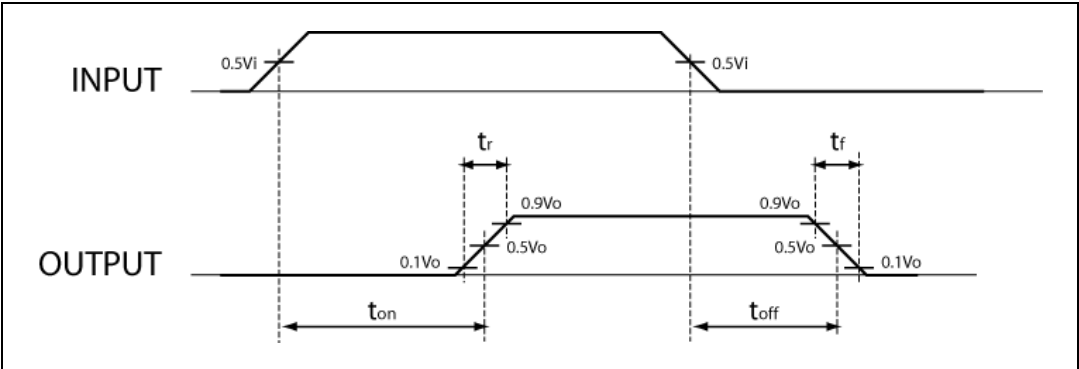


Table 7. Truth table (one channel)

| Input | Enable <sup>(1)</sup> | Output           |
|-------|-----------------------|------------------|
| H     | H                     | H                |
| L     | H                     | L                |
| H     | L                     | Z <sup>(2)</sup> |
| L     | L                     | Z <sup>(2)</sup> |

1. Relative to the considered channel

2. Z = High output impedance



## 4 Package mechanical data

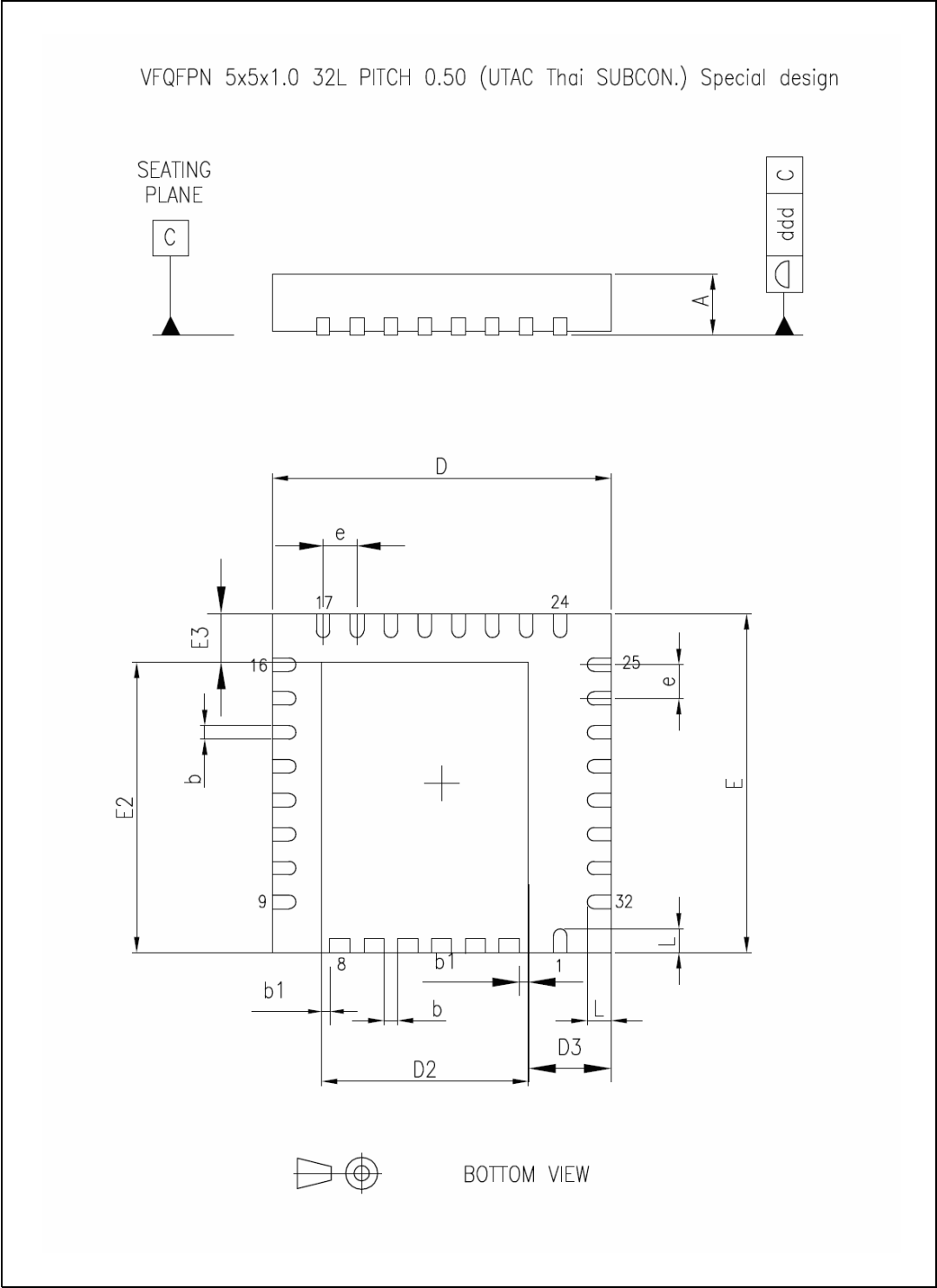
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**Table 8. VFQFPN 5x5x1.0 32L pitch 0.50**

| Dim. | Databook (mm) |       |       |
|------|---------------|-------|-------|
|      | Min           | Typ   | Max   |
| A    | 0.80          | 0.85  | 0.95  |
| b    | 0.18          | 0.25  | 0.30  |
| b1   | 0.165         | 0.175 | 0.185 |
| D    | 4.85          | 5.00  | 5.15  |
| D2   | 3.00          | 3.10  | 3.20  |
| D3   | 1.10          | 1.20  | 1.30  |
| E    | 4.85          | 5.00  | 5.15  |
| E2   | 4.20          | 4.30  | 4.40  |
| E3   | 0.60          | 0.70  | 0.80  |
| e    |               | 0.50  |       |
| L    | 0.30          | 0.40  | 0.50  |
| ddd  |               |       | 0.08  |

- Note:**
- 1 VFQFPN stands for thermally enhanced very thin profile fine pitch quad flat package no lead. Very thin profile:  $0.80 < A \leq 1.00$  mm.
  - 2 Details of terminal 1 are optional but must be located on the top surface of the package by using either a mold or marked features.

Figure 5. Package dimensions



## 5 Order codes

**Table 9. Order code**

| Order code | Package            | Packaging |
|------------|--------------------|-----------|
| L2293Q     | VFQFPN 5x5x1.0 32L | Tube      |

## 6 Revision history

**Table 10. Document revision history**

| Date        | Revision | Changes                                   |
|-------------|----------|-------------------------------------------|
| 10-Jul-2008 | 1        | First release                             |
| 26-Feb-2009 | 2        | Updated <a href="#">Table 3 on page 4</a> |
| 12-Aug-2009 | 3        | Updated description in coverpage          |

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