

# UBA2080; UBA2080A; UBA2081

## Half-bridge driver IC

Rev. 3 — 18 June 2012

Product data sheet

## 1. General description

The UBA2080(A) and UBA2081 are high voltage monolithic integrated circuits made using the latch-up free Silicon-On-Insulator (SOI) process. The circuit is designed for driving MOSFETs in a half-bridge configuration.

## 2. Features and benefits

- Latch-up free and robust half bridge driver
- Output driver capability:  $I_{O(sink)} = 400\text{ mA}$  and  $I_{O(source)} = 200\text{ mA}$
- Maximum frequency 800 kHz
- UBA2080:
  - ◆ Outputs in phase with HIN and LIN inputs
  - ◆ Overlap protection
- UBA2081:
  - ◆ Outputs in phase with CLK input
  - ◆ Adjustable dead-time
  - ◆ Low active shutdown input

## 3. Applications

- Driver (via external MOSFETs) for any kind of load in a half-bridge configuration
- UBA2080A:
  - ◆ Selectable between UBA2080 and UBA2081 functionality
  - ◆ Thermally enhanced package for high frequency operation.

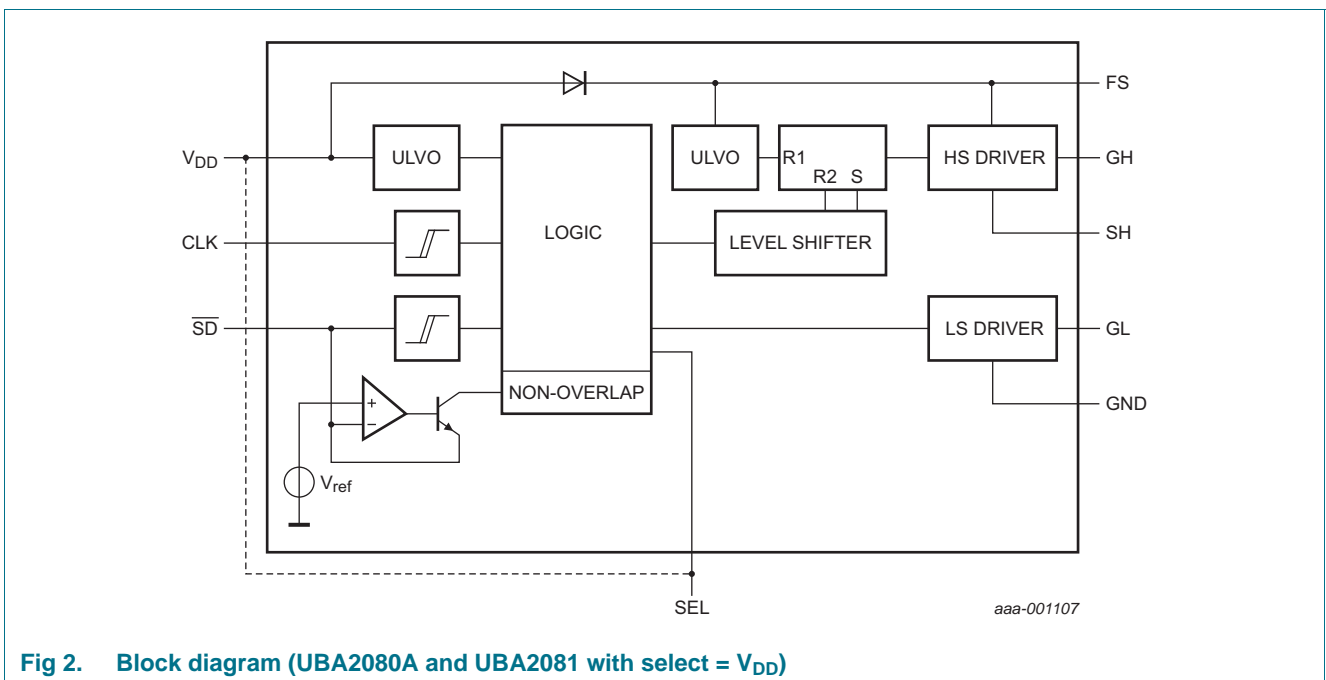
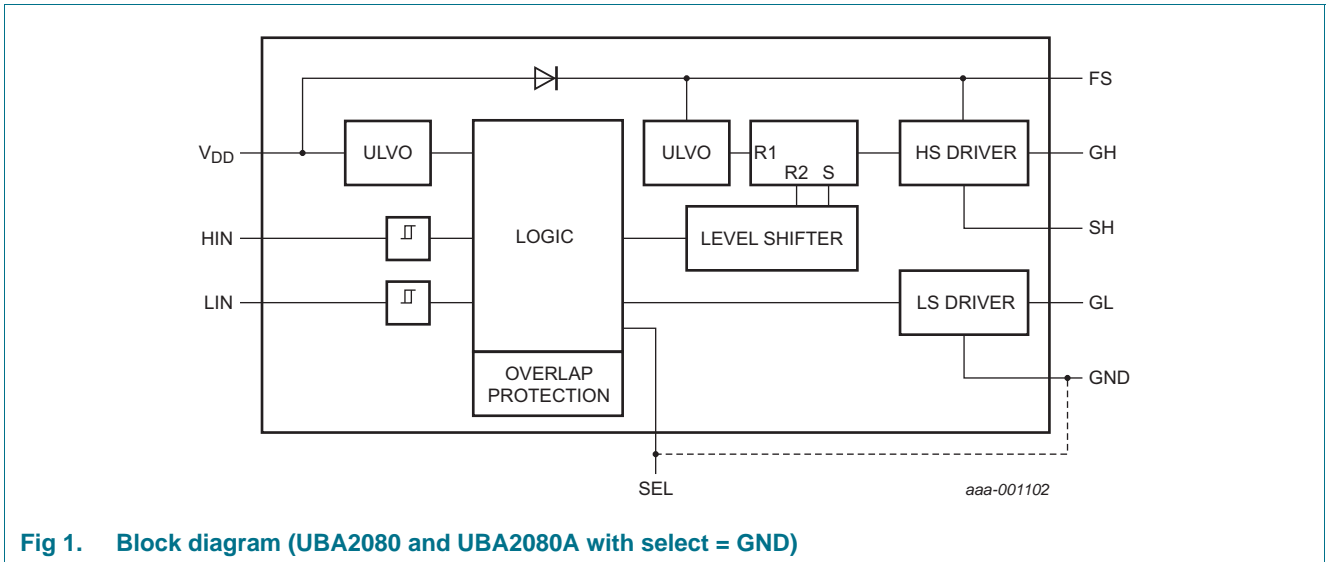
## 4. Ordering information

Table 1. Ordering information

| Type number | Package |   |          |
|-------------|---------|---|----------|
|             | Name    | Description                             | Version  |
| UBA2080P    | DIP8    | plastic dual in-line package; 8 leads   | SOT97-1  |
| UBA2081P    |         |   |          |
| UBA2080T    | SO8     | plastic small outline package; 8 leads  | SOT96-1  |
| UBA2081T    |         |   |          |
| UBA2080AT   | SO14    | plastic small outline package; 14 leads | SOT108-1 |



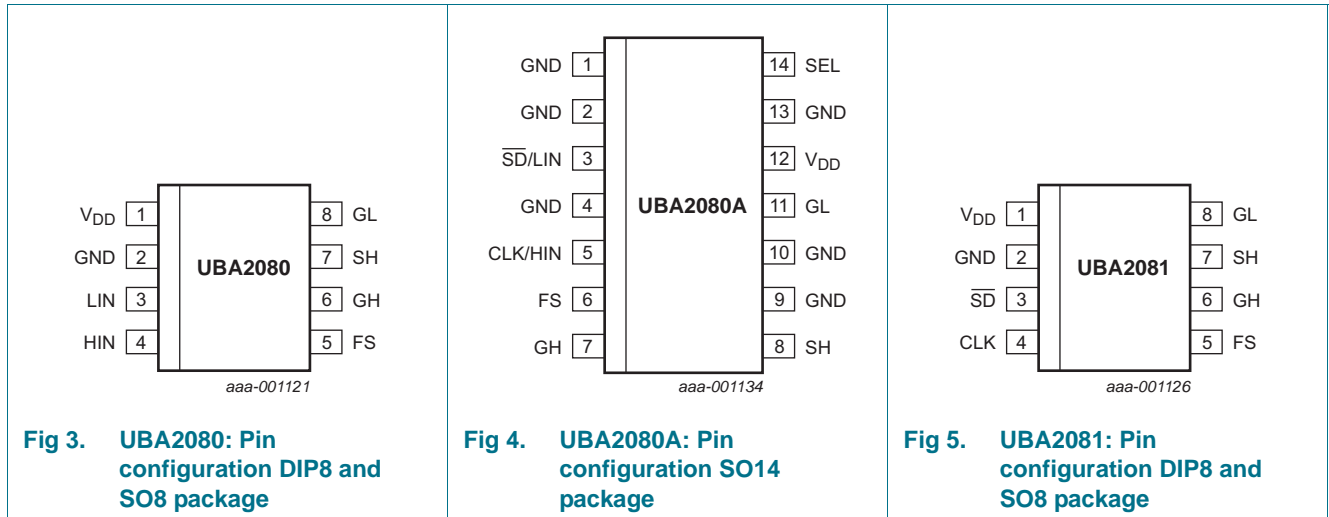
## 5. Block diagram



Refer to [Figure 7](#) and [Figure 8](#) for detailed information on the required application components.

## 6. Pinning information

### 6.1 Pinning



### 6.2 Pin description

**Table 2. Pin description UBA2080/UBA2081 DIP8 and SO8**

| Symbol                 | Pin                |                    | Description   |
|------------------------|--------------------|--------------------|---|
|                        | UBA2080 (DIP8/SO8) | UBA2081 (DIP8/SO8) |   |
| V <sub>DD</sub>        | 1                  |                    | IC supply   |
| GND                    | 2                  |                    | IC ground and low-side driver return                          |
| LIN                    | 3                  | -                  | low-side driver logic input                                   |
| $\overline{\text{SD}}$ | -                  | 3                  | low active analog shutdown input and non-overlap time setting |
| HIN                    | 4                  | -                  | high-side driver logic input                                  |
| CLK                    | -                  | 4                  | clock logic input   |
| FS                     | 5                  |                    | floating supply voltage                                       |
| GH                     | 6                  |                    | high-side MOSFET gate   |
| SH                     | 7                  |                    | high-side MOSFET source                                       |
| GL                     | 8                  |                    | low-side MOSFET gate  |

**Table 3. Pin description UBA2080AT (SO14)**

| Symbol                      | Pin                | Description   |
|-----------------------------|--------------------|---|
| GND                         | 1, 2, 4, 9, 10, 13 | IC ground and low side driver return  |
| $\overline{\text{SD}}$ /LIN | 3                  | low-side driver logic input or low active shutdown and non-overlap time setting |
| CLK/HIN                     | 5                  | high-side driver logic input or clock logic input                               |
| FS                          | 6                  | floating supply voltage   |
| SH                          | 8                  | high-side MOSFET source   |

Table 3. Pin description UBA2080AT (SO14) ...continued

| Symbol          | Pin | Description   |
|-----------------|-----|---|
| GH              | 7   | high-side MOSFET gate   |
| GL              | 11  | low-side MOSFET gate  |
| V <sub>DD</sub> | 12  | IC supply   |
| SEL             | 14  | select UBA2080 or UBA2081 functionality; only connect to GND or V <sub>DD</sub> |

## 7. Functional description

### 7.1 Start-up state

The IC enters the start-up state when the supply voltage on pin V<sub>DD</sub> increases. In the start-up state, the high-side power transistor is non-conducting and the low-side power transistor is switched on. The internal circuit is reset and the capacitor on the bootstrap pin FS is charged. The start-up state is defined until the value of V<sub>DD</sub> = the V<sub>DD(start)</sub> value. After which the IC switches to the oscillation state.

The circuit enters the start-up state again when the voltage on pin V<sub>DD</sub> < V<sub>DD(stop)</sub>.

### 7.2 UBA2080 oscillation state

In the oscillation state, the output voltage of the GL and GH drivers depend on the logical signals HIN and LIN (see [Table 4](#)).

To prevent cross conduction in the half-bridge MOSFETs, the combination HIN = LIN = 1 is not allowed. Both GL and GH are LOW under this condition.

Table 4. UBA2080 Logic table

| State       | HIN | LIN | GH   | GL   |
|-------------|-----|-----|------|------|
| Start-up    | -   | -   | LOW  | HIGH |
| Oscillation | 0   | 0   | LOW  | LOW  |
| Oscillation | 0   | 1   | LOW  | HIGH |
| Oscillation | 1   | 0   | HIGH | LOW  |
| Oscillation | 1   | 1   | LOW  | LOW  |

### 7.3 UBA2081 oscillation state

In the oscillation state, the output voltage of the GL and GH drivers depend on the logical signals CLK and SD (see [Table 5](#)).

Table 5. UBA2081 Logic table

| State       | CLK | SD | GH   | GL   |
|-------------|-----|----|------|------|
| Start-up    | -   | -  | LOW  | HIGH |
| Oscillation | 0   | 0  | LOW  | HIGH |
| Oscillation | 1   | 0  | HIGH | LOW  |
| Oscillation | 0   | 1  | LOW  | LOW  |
| Oscillation | 1   | 1  | LOW  | LOW  |

#### 7.4 UBA2081 non-overlap time

The external resistor ( $R_{SD}$ ) on pin SD sets the non-overlap time of the UBA2081. The relationship between this resistor value and actual dead-time is listed in [Figure 6](#).

It is essential to add a 10 nF to 100 nF decoupling capacitor across  $R_{SD}$  to ensure a noise immune dead-time system.

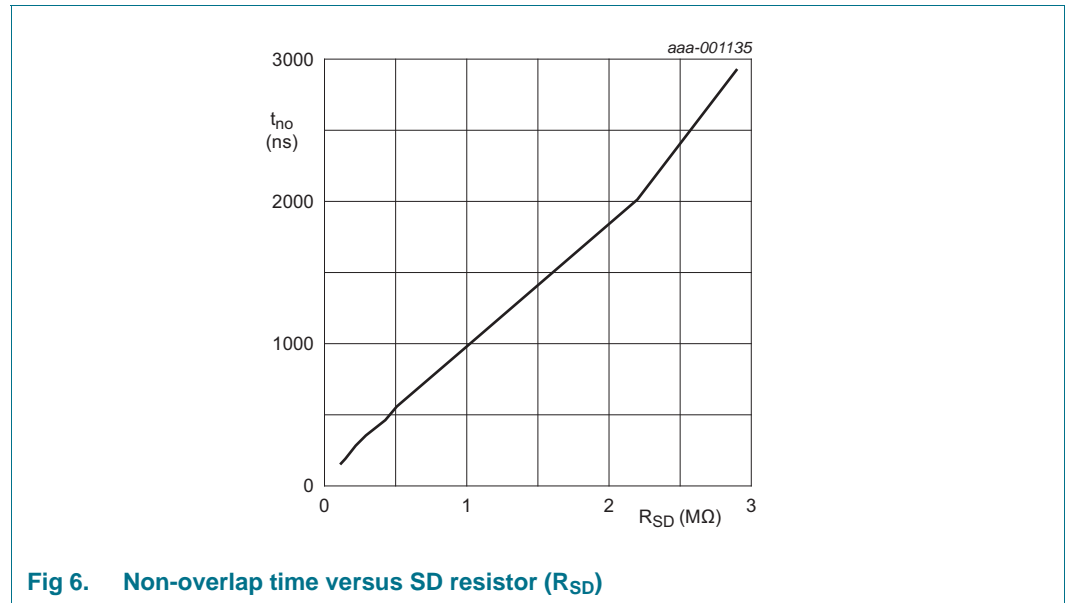


Fig 6. Non-overlap time versus SD resistor ( $R_{SD}$ )

#### 7.5 UBA2081 shutdown protection

When the voltage at pin  $\overline{SD}$  is pulled below  $V_{IH}$ , the internal sink drivers of the pins GL and GH are immediately enabled to switch off the external power MOSFETs.

The shutdown comparator has a hysteresis of  $V_{hys}(\overline{SD})$  to avoid multiple switching.

Preferably, pin  $\overline{SD}$  is pulled low via a collector of a transistor (see application schematic) to avoid loading of this pin (Influences the non-overlap time settings) at normal operation.

#### 7.6 UBA2080 overlap protection

The internal logic takes care that the GL driver and GH driver are both set to LOW in this situation to avoid that  $HIN = LIN = 1$  causes a cross current in the external half-bridge.

#### 7.7 UBA2080A select function

Pin SEL enables the selection of either the UBA2080 or the UBA2081 functionality.  $SEL = 0$  gives the UBA2080 functionality.  $SEL = V_{DD}$  gives the UBA2081 functionality.

## 8. Limiting values

**Table 6. Limiting values**

In accordance with the Absolute Maximum Rating System (IEC 60134).

| Symbol              | Parameter                       | Conditions  | Min                 | Max                    | Unit |
|---------------------|---------------------------------|---|---------------------|------------------------|------|
| V <sub>DD</sub>     | supply voltage                  | nominal   | 0                   | 15.5                   | V    |
| V <sub>FS</sub>     | voltage on pin FS               |   | V <sub>SH</sub>     | V <sub>SH</sub> + 15.5 | V    |
| V <sub>SH</sub>     | voltage on pin SH               | source high-side MOSFET   | -3                  | +600                   | V    |
|                     |                                 | t < 1 μs  | -14                 | +600                   | V    |
| V <sub>i(HIN)</sub> | input voltage on pin HIN        | logic input for high-side driver  | 0                   | 15.5                   | V    |
| V <sub>i(LIN)</sub> | input voltage on pin LIN        | logic input for low-side driver   | 0                   | 15.5                   | V    |
| V <sub>i(SEL)</sub> | input voltage on pin SEL        |   | 0                   | 15.5                   | V    |
| V <sub>CLK</sub>    | voltage on pin CLK              | logic input for output drivers  | 0                   | 15.5                   | V    |
| V <sub>i(SD)</sub>  | input voltage on pin SD         | logic input for output drivers and analog input for non-overlap setting | 0                   | 15.5                   | V    |
| SR                  | slew rate                       | on pin SH; repetitive   | -6                  | +6                     | V/ns |
| T <sub>j</sub>      | junction temperature            |   | -40                 | +150                   | °C   |
| T <sub>amb</sub>    | ambient temperature             |   | -40                 | +150                   | °C   |
| T <sub>stg</sub>    | storage temperature             |   | -55                 | +150                   | °C   |
| V <sub>ESD</sub>    | electrostatic discharge voltage | human body model:   | <a href="#">[1]</a> |                        |      |
|                     |                                 | pins FS, GH and SH  | -                   | 1                      | kV   |
|                     |                                 | pins V <sub>DD</sub> , HIN, LIN, SD, CLK, SEL                           | -                   | 2                      | kV   |
|                     |                                 | machine model:  | <a href="#">[2]</a> |                        |      |
|                     |                                 | all pins  | -                   | 250                    | V    |

[1] In accordance with the Human Body Model (HBM): equivalent to discharging a 100 pF capacitor through a 1.5 kΩ series resistor.

[2] In accordance with the Machine Model (MM): equivalent to discharging a 200 pF capacitor through a 1.5 kΩ series resistor and a 0.75 μH inductor.

## 9. Thermal characteristics

**Table 7. Thermal characteristics**

| Symbol               | Parameter                                   | Conditions  | Typ                     | Unit |
|----------------------|---|-------------|-------------------------|------|
| <b>SO8</b>           |   |             |                         |      |
| R <sub>th(j-a)</sub> | thermal resistance from junction to ambient | in free air | <a href="#">[1]</a> 160 | K/W  |
| <b>SO14 and DIP8</b> |   |             |                         |      |
| R <sub>th(j-a)</sub> | thermal resistance from junction to ambient | in free air | <a href="#">[1]</a> 100 | K/W  |

[1] In accordance with IEC 60747-1.

## 10. Characteristics

**Table 8. Characteristics**

$T_j = 25\text{ °C}$ ; all voltages are measured with respect to SGND;  $V_{DD} = 12.8\text{ V}$ ; positive currents flow into the IC.

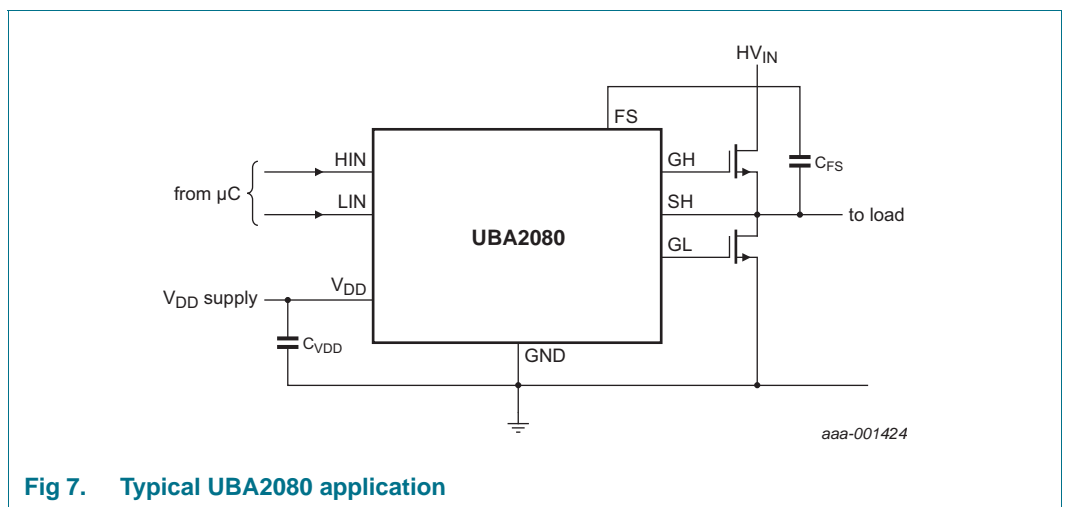
| Symbol                     | Parameter                     | Conditions  | Min | Typ | Max | Unit          |
|----------------------------|-------------------------------|---|-----|-----|-----|---------------|
| <b>High-voltage supply</b> |                               |   |     |     |     |               |
| $I_{leak}$                 | leakage current               | FS = GH = SH = 600 V  | -   | -   | 10  | $\mu\text{A}$ |
| <b>Start-up state</b>      |                               |   |     |     |     |               |
| $I_{VDD}$                  | current on pin $V_{DD}$       |   | 420 | 520 | 620 | $\mu\text{A}$ |
| $V_{DD(start)}$            | start supply voltage          |   | 11  | 12  | 13  | V             |
| $V_{DD(stop)}$             | stop supply voltage           |   | 8   | 8.5 | 9   | V             |
| $V_{DD(hys)}$              | hysteresis of supply voltage  | start-to-stop   | 3   | 3.5 | 4   | V             |
| <b>Pin LIN input</b>       |                               |   |     |     |     |               |
| $V_{IH}$                   | HIGH-level input voltage      |   | 1.6 | 2.2 | 2.8 | V             |
| $V_{hys(LIN)}$             | hysteresis voltage on pin LIN |   | -   | 400 | -   | mV            |
| $I_{I(LIN)}$               | input current on pin LIN      |   | -   | 0   | 1   | $\mu\text{A}$ |
| <b>Pin HIN input</b>       |                               |   |     |     |     |               |
| $V_{IH}$                   | HIGH-level input voltage      |   | 1.6 | 2.2 | 2.8 | V             |
| $V_{hys(HIN)}$             | hysteresis voltage on pin HIN |   | -   | 400 | -   | mV            |
| $I_{I(HIN)}$               | input current on pin HIN      |   | -   | 0   | 1   | $\mu\text{A}$ |
| <b>Pin CLK input</b>       |                               |   |     |     |     |               |
| $V_{IH}$                   | HIGH-level input voltage      |   | 2.7 | -   | -   | V             |
| $V_{IL}$                   | LOW-level input voltage       |   | -   | -   | 0.8 | V             |
| $I_{I(CLK)}$               | input current on pin CLK      |   | -   | 0   | 1   | $\mu\text{A}$ |
| <b>Pin SD input</b>        |                               |   |     |     |     |               |
| $V_{IH}$                   | HIGH-level input voltage      | to activate shutdown  | 1.6 | 2.2 | 2.8 | V             |
| $V_{hys(SD)}$              | hysteresis voltage on pin SD  |   | -   | 400 | -   | mV            |
| $t_{no}$                   | non-overlap time              | $R_{SD} = 100\text{ k}\Omega$ ; typical minimum   | -   | 140 | -   | ns            |
|                            |                               | $R_{SD} = 3\text{ M}\Omega$ ; typical maximum   | -   | 2.4 | -   | $\mu\text{s}$ |
| <b>Pin SEL input</b>       |                               |   |     |     |     |               |
| $I_{I(SEL)}$               | input current on pin SEL      |   | -   | 0   | 1   | $\mu\text{A}$ |
| <b>gate drivers</b>        |                               |   |     |     |     |               |
| $I_{O(source)}$            | output source current         | $V_{FS} = V_{VDD} = 12\text{ V}$ ; $V_{SH} = 0\text{ V}$ ;<br>$V_{GH} = V_{GL} = 8\text{ V}$        | -   | 200 | -   | mA            |
| $I_{O(sink)}$              | output sink current           | $V_{FS} = V_{VDD} = 12\text{ V}$ ; $V_{SH} = 0\text{ V}$ ;<br>$V_{GH} = V_{GL} = 4\text{ V}$        | -   | 400 | -   | mA            |
| $V_{d(bs)}$                | bootstrap diode voltage       | $I_{d(bs)} = 20\text{ mA}$  | -   | 2.3 | -   | V             |
| $V_{UVLO}$                 | undervoltage lockout voltage  | reset   | 3.6 | 4.2 | 4.8 | V             |
| $I_{FS}$                   | current on pin FS             | $V_{FS} = V_{VDD} = 12\text{ V}$ ; $V_{SH} = 0\text{ V}$  | 27  | 32  | 37  | $\mu\text{A}$ |
| <b>Timing</b>              |                               |   |     |     |     |               |
| $t_{PD}$                   | propagation delay             | UBA2080; matching;<br>$C_{(GL)} = C_{(GH)} = 0$ , propagation time<br>difference between GL and GH. | -   | 50  | -   | ns            |

**Table 8. Characteristics ...continued**

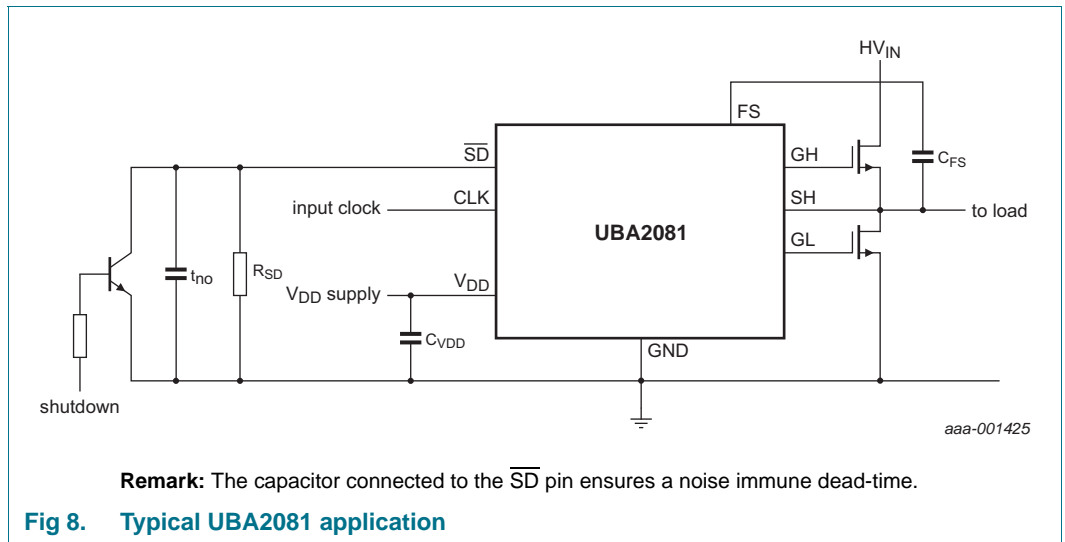
$T_j = 25\text{ }^\circ\text{C}$ ; all voltages are measured with respect to SGND;  $V_{DD} = 12.8\text{ V}$ ; positive currents flow into the IC.

| Symbol           | Parameter                        | Conditions                        | Min | Typ | Max | Unit |
|------------------|----------------------------------|-----------------------------------|-----|-----|-----|------|
| $t_{PD(LIN-GL)}$ | propagation delay from LIN to GL | UBA2080; $C_{(GL)} = 0\text{ pF}$ | -   | 240 | -   | ns   |
| $t_{PD(HIN-GH)}$ | propagation delay from HIN to GH | UBA2080; $C_{(GH)} = 0\text{ pF}$ | -   | 180 | -   | ns   |
| $f_{max}$        | maximum frequency                |                                   | 800 | -   | -   | kHz  |

## 11. Application information



**Fig 7. Typical UBA2080 application**



**Fig 8. Typical UBA2081 application**



12. Package outline

SO8: plastic small outline package; 8 leads; body width 3.9 mm

SOT96-1

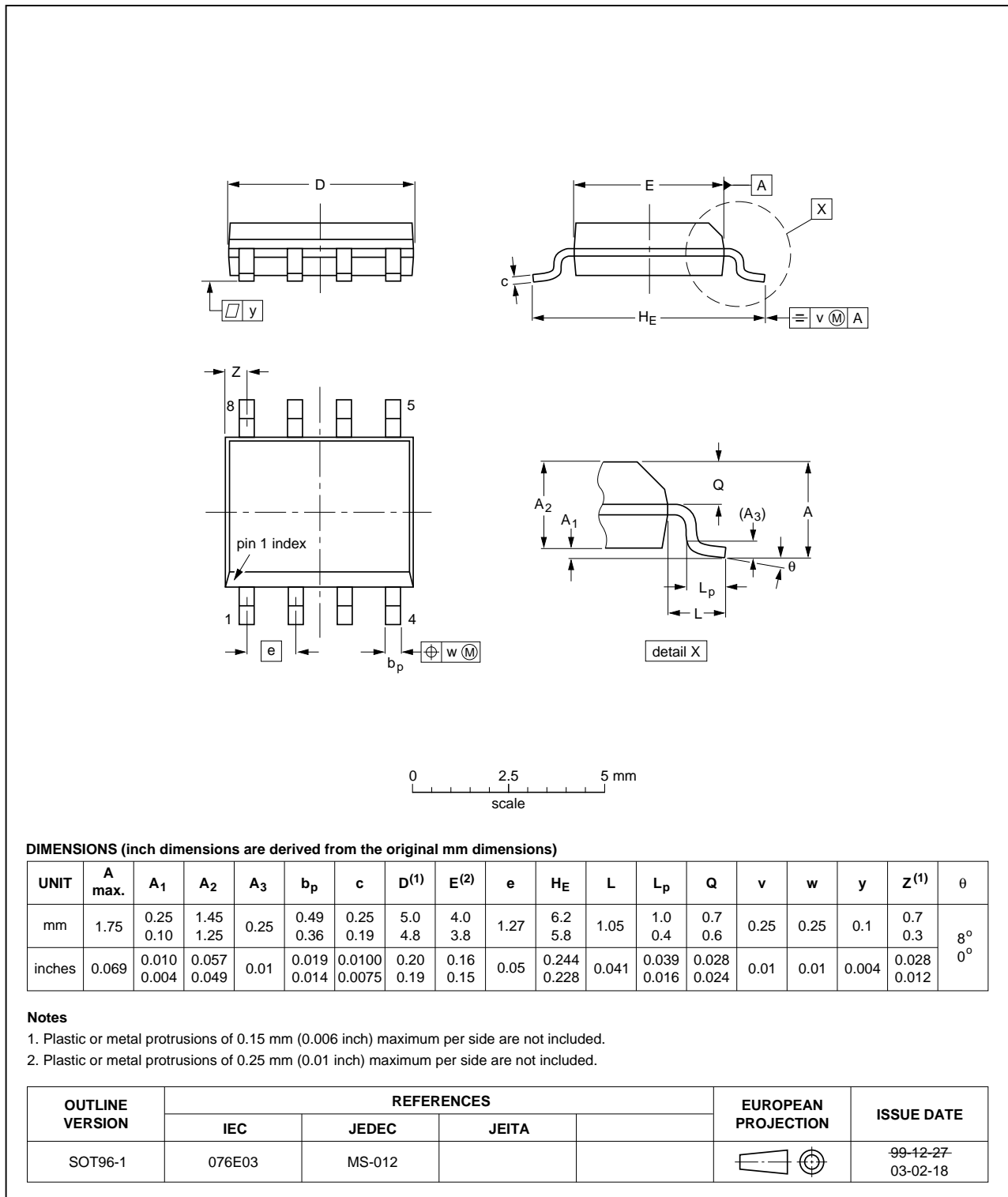


Fig 9. Package outline SOT96-1 (SO8)

DIP8: plastic dual in-line package; 8 leads (300 mil)

SOT97-1

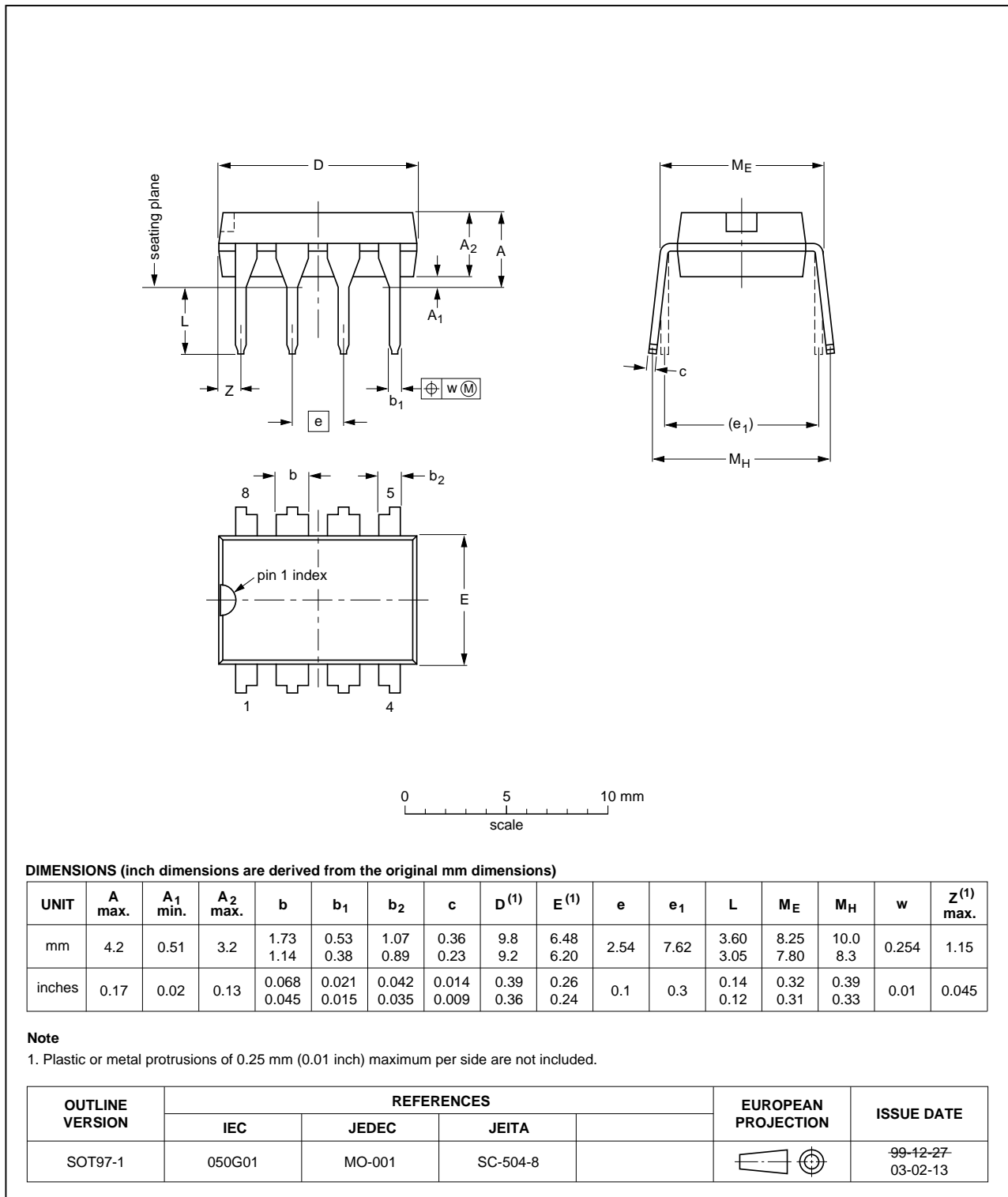


Fig 10. Package outline SOT97-1 (DIP8)

SO14: plastic small outline package; 14 leads; body width 3.9 mm

SOT108-1

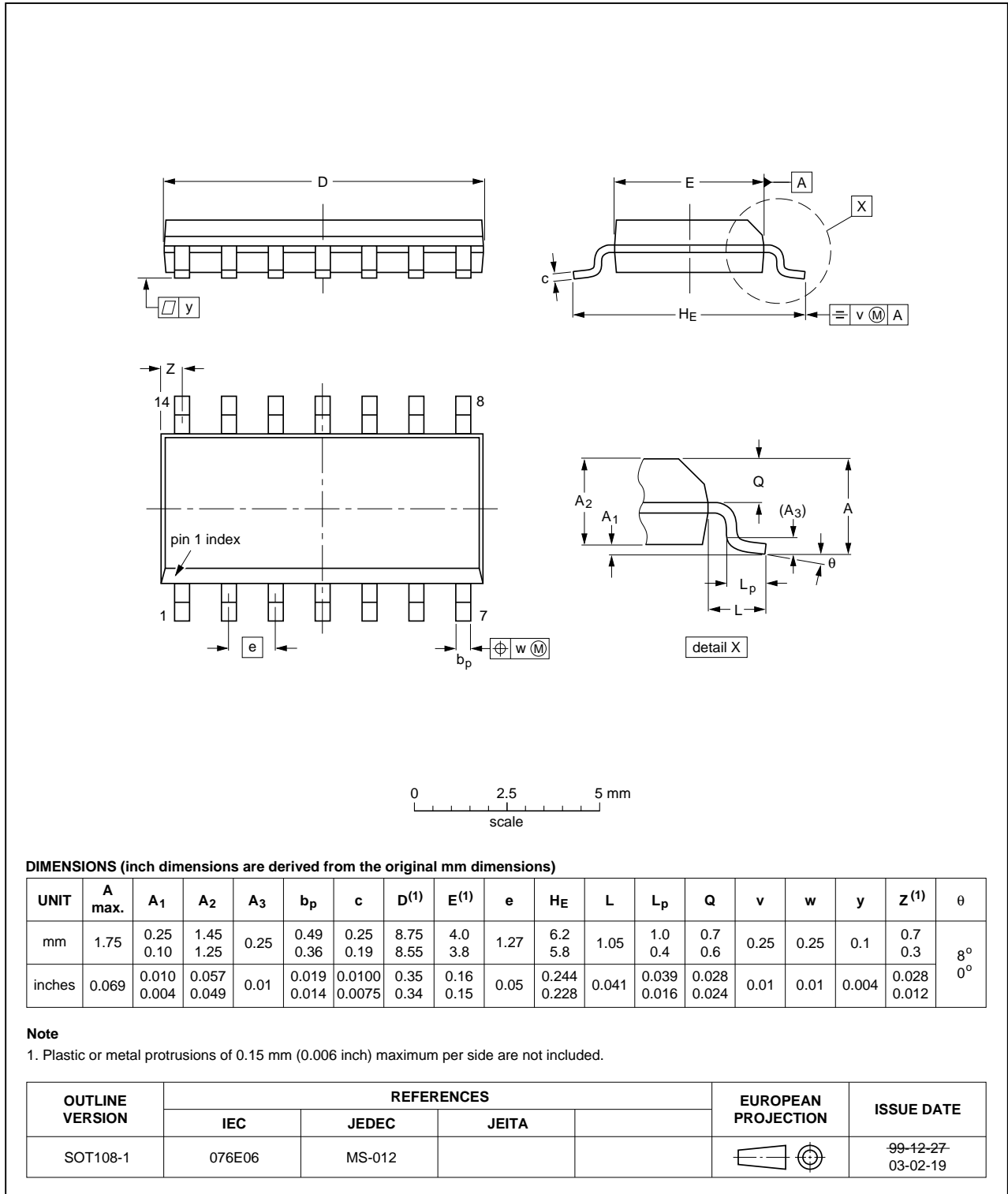


Fig 11. Package outline SOT108-1 (SO14)

## 13. Revision history

Table 9. Revision history

| Document ID           | Release date | Data sheet status  | Change notice | Supersedes            |
|-----------------------|--------------|--|---------------|-----------------------|
| UBA2080_UBA2081 v.3   | 20120618     | Product data sheet   | -             | UBA2080_UBA2081 v.2   |
| Modifications:        |              | <ul style="list-style-type: none"><li>Data sheet status changed from Preliminary to Product.</li><li><a href="#">Table 6 "Limiting values"</a> has been updated.</li></ul> |               |                       |
| UBA2080_UBA2081 v.2   | 20120426     | Preliminary data sheet   | -             | UBA2080_UBA2081 v 1.1 |
| UBA2080_UBA2081 v.1.1 | 20111206     | Objective data sheet   | -             | UBA2080_UBA2081 v.1   |
| UBA2080_UBA2081 v.1   | 20111116     | Objective data sheet   | -             |                       |

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### 14.1 Data sheet status

| Document status <sup>[1][2]</sup> | Product status <sup>[3]</sup> | Definition  |
|-----------------------------------|-------------------------------|---|
| Objective [short] data sheet      | Development                   | This document contains data from the objective specification for product development. |
| Preliminary [short] data sheet    | Qualification                 | This document contains data from the preliminary specification.                       |
| Product [short] data sheet        | Production                    | This document contains the product specification.                                     |

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