



TEA1892TS

GreenChip synchronous rectifier controller

Rev. 1 — 9 April 2014

Product data sheet

1. General description

The TEA1892TS is a member of the new generation of Synchronous Rectifier (SR) controller ICs for switched mode power supplies. Its high level of integration allows the design of a cost-effective power supply with a very low number of external components.

The TEA1892TS is a controller IC dedicated to synchronous rectification on the secondary side of discontinuous conduction mode and quasi-resonant flyback converters.

The TEA1892TS is fabricated in a Silicon-On-Insulator (SOI) process.

2. Features and benefits

2.1 Distinctive features

- Accurate synchronous rectification functionality
- Wide supply voltage range (8.5 V to 38 V)
- High level of integration, resulting in a very low external component count
- High driver output voltage of 10 V to drive all MOSFET brands to the lowest R_{DSon}
- Selectable regulation level for driver stage

2.2 Green features

- Low current consumption
- High system efficiency from no-load to full load

2.3 Protection features

- UnderVoltage Protection (UVP)

3. Applications

- The TEA1892TS is intended for adapters. The device can also be used in all other discontinuous conduction mode systems and quasi-resonant flyback systems that demand a highly efficient and cost-effective solution.

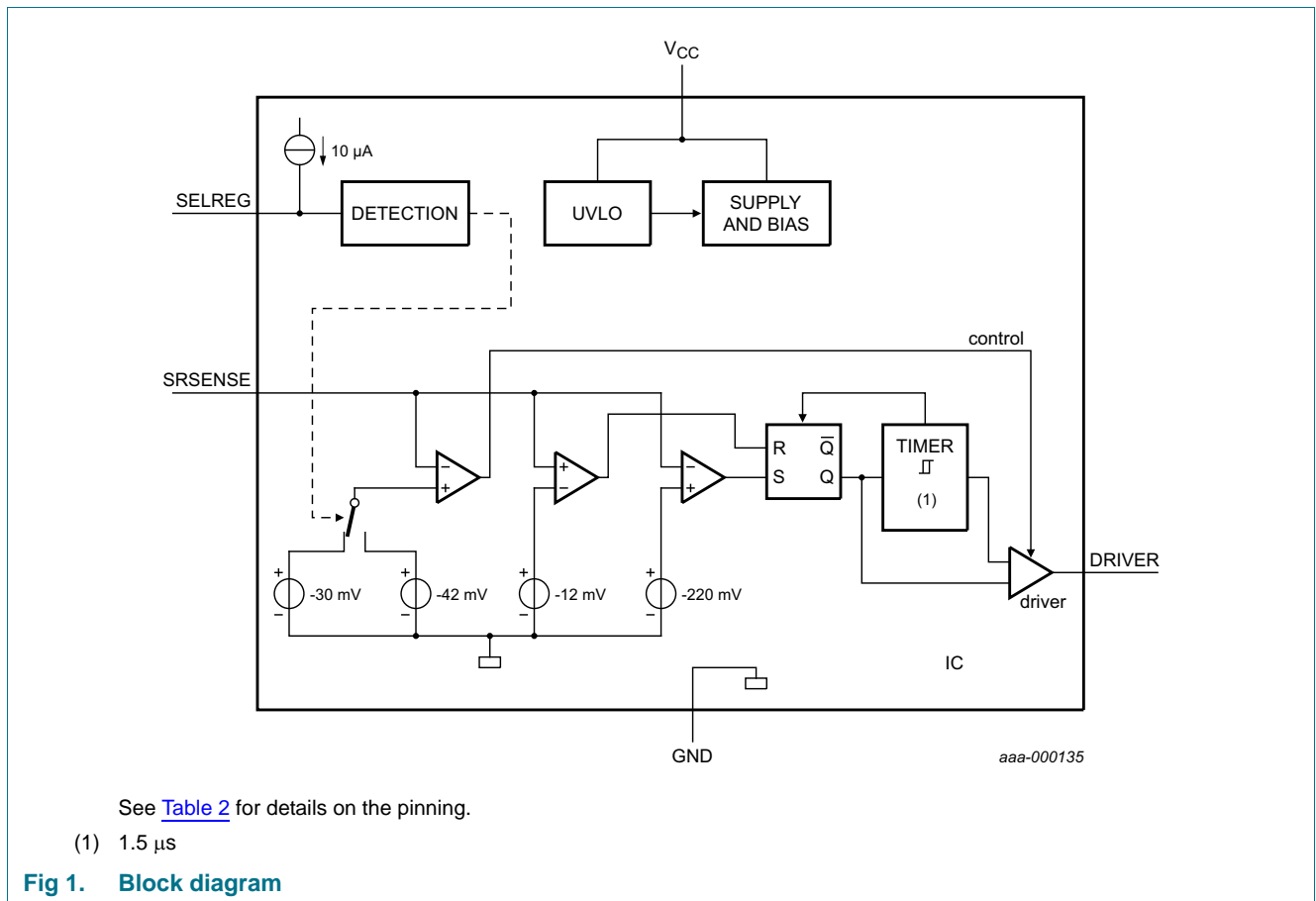


4. Ordering information

Table 1. Ordering information

| Type number | Package | | Version |
|-------------|---------|--|---------|
| | Name | Description | |
| TEA1892TS/1 | TSOP6 | plastic surface-mounted package; 6 leads | SOT457 |

5. Block diagram



6. Pinning information

6.1 Pinning

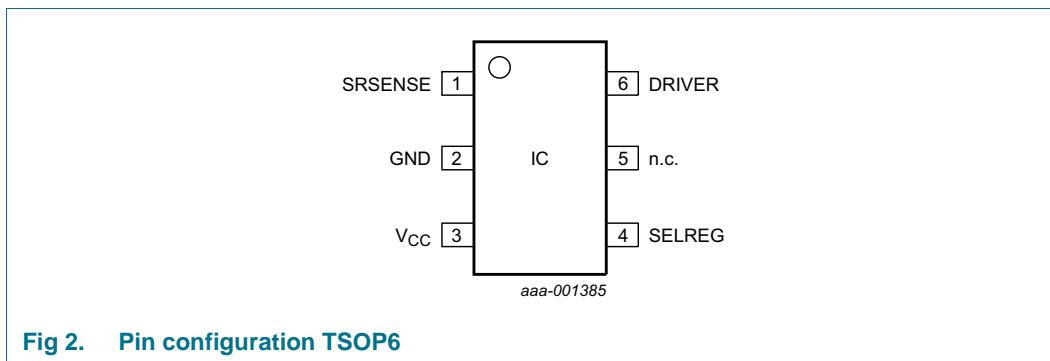


Fig 2. Pin configuration TSOP6

6.2 Pin description

Table 2. Pin description

| Symbol | Pin | Description |
|-----------------|-----|---|
| SRSENSE | 1 | synchronous timing input |
| GND | 2 | ground |
| V _{CC} | 3 | supply voltage |
| SELREG | 4 | selection input for driver regulation level |
| n.c. | 5 | not connected |
| DRIVER | 6 | driver output for SR MOSFET |

7. Functional description

7.1 Introduction

The TEA1892TS is the controller for synchronous rectification used in discontinuous conduction mode and quasi-resonant flyback converters.

7.2 Start-up and UnderVoltage LockOut (UVLO)

The IC leaves the undervoltage lockout state and activates the synchronous rectifier circuitry when the voltage on the V_{CC} pin is above 8.5 V (typical). When the voltage drops below 8.0 V (typical), the undervoltage lockout state is entered again and the SR driver output is actively kept low.

7.3 Synchronous rectification

After a negative voltage lower than $V_{act(drv)}$ (–220 mV typical) is sensed on the SRSENSE pin, the driver output voltage is driven HIGH. Then the external MOSFET is switched on. When the SRSENSE voltage rises to $V_{reg(drv)}$ (–42 mV/–30 mV) the driver output voltage is regulated to maintain the $V_{reg(drv)}$ on the SRSENSE pin. When the SRSENSE voltage is above the $V_{deact(drv)}$ level (–12 mV typical), the driver output is pulled to ground.

After switch-on of the SR MOSFET, the input signal on the SRSENSE pin is blanked during the $t_{act(sr)(min)}$ (1.5 μ s typical). This action eliminates false switch-off due to high frequency ringing at the start of the secondary stroke.

When the voltage on the SRSENSE pin is $V_{reg(drv)}$, the driver output voltage is reduced. This reduction enables the external power switch to be switched off quickly when the current through the switch reaches zero. The zero current switch-off removes the need for a separate Standby mode to maintain high efficiency during the no-load operation. The zero current is detected by sensing a $V_{deact(drv)}$ (–12 mV typical) level on the SRSENSE pin (see [Figure 3](#)).

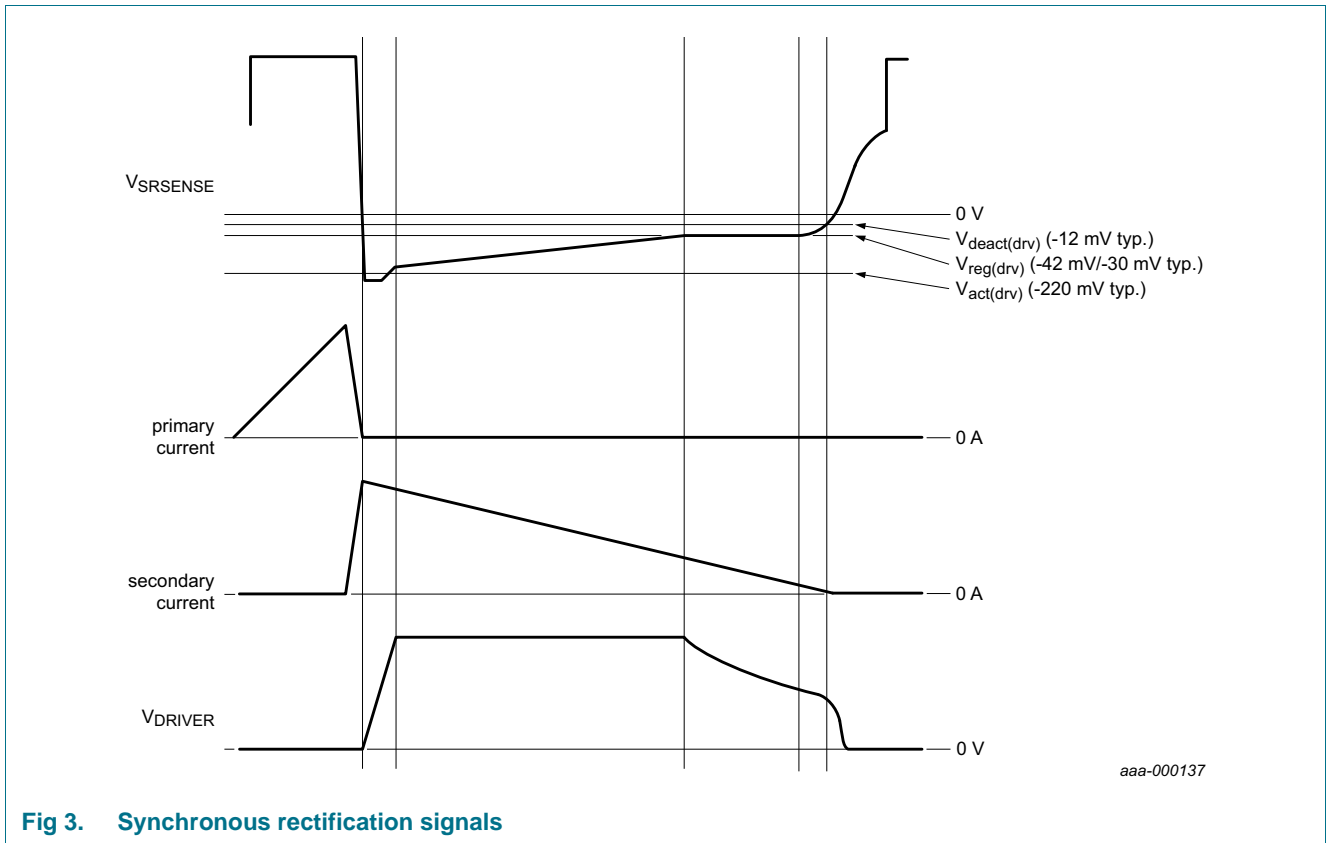


Fig 3. Synchronous rectification signals

The level of the driver regulation voltage $V_{reg(drv)}$ can be selected using the SELREG pin. When this SELREG pin is grounded, the typical $V_{reg(drv)}$ equals -42 mV. When the SELREG pin is left open, the $V_{reg(drv)}$ level equals -30 mV.

Internally, the SELREG pin has a pull-up current source of 10 μ A. When this pin is short circuited to ground, the pin selects the lowest $V_{reg(drv)}$. If the pin is left open, the highest $V_{reg(drv)}$ value is selected.

7.4 Supply management

All internal reference voltages are derived from a temperature compensated, on-chip band gap circuit.

7.5 Driver

The driver circuit to the external power MOSFET gate has a typical source capability of 400 mA and a typical sink capability of 2.7 A. These capabilities permit fast switch-on and switch-off of the power MOSFET for efficient operation. The source stage is coupled to the timer (see Figure 1). When the timer has finished, the source capability is reduced to a small current (5 mA typical) capable of keeping the driver output voltage at its level.

The output voltage of the driver is limited to 10 V (typical). This high output voltage drives all MOSFET brands to the minimum on-state resistance.

During start-up conditions ($V_{CC} < V_{startup}$) and undervoltage lockout the driver output voltage is actively pulled low.

8. Limiting values

Table 3. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134). All voltages are measured with respect to ground (pin 2); positive currents flow into the chip. The voltage ratings and current ratings are valid provided the other ratings are not violated.

| Symbol | Parameter | Conditions | Min | Max | Unit |
|----------------------|---------------------------------|---|------|------|------|
| Voltages | | | | | |
| V _{CC} | supply voltage | continuous | -0.4 | +38 | V |
| V _{SRSENSE} | voltage on pin SRSENSE | continuous | - | 120 | V |
| V _{SELREG} | voltage on pin SELREG | continuous | -0.4 | 5 | V |
| Currents | | | | | |
| I _{DRIVER} | current on pin DRIVER | duty cycle < 10 % | -0.8 | +3 | A |
| I _{SRSENSE} | current on pin SRSENSE | | -3 | - | mA |
| General | | | | | |
| P _{tot} | total power dissipation | T _{amb} < 80 °C | - | 0.27 | W |
| T _{stg} | storage temperature | | -55 | +150 | °C |
| T _j | junction temperature | | -40 | +150 | °C |
| V _{ESD} | electrostatic discharge voltage | human body model; JEDEC Class 2; all pins [1] | -2 | +2 | kV |
| | | charged device model; JEDEC Class 3; all pins | -500 | +500 | V |

[1] Equivalent to discharging a 100 pF capacitor through a 1.5 kΩ series resistor.

9. Thermal characteristics

Table 4. Thermal characteristics

| Symbol | Parameter | Conditions | Typ | Unit |
|----------------------|---|------------------|-----|------|
| R _{th(j-a)} | thermal resistance from junction to ambient | JEDEC test board | 259 | K/W |
| R _{th(j-c)} | thermal resistance from junction to case | JEDEC test board | 152 | K/W |

10. Characteristics

Table 5. Characteristics

T_{amb} = 25 °C; V_{CC} = 20 V; all voltages are measured with respect to ground (pin 2); currents are positive when flowing into the IC; unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|--------------------|---------------------|------|-----|------|------|
| Supply voltage management (pin V_{CC}) | | | | | | |
| V _{startup} | start-up voltage | | 8.2 | 8.5 | 8.8 | V |
| V _{hys} | hysteresis voltage | [1] | 0.35 | 0.5 | 0.65 | V |

Table 5. Characteristics ...continued

$T_{amb} = 25\text{ }^{\circ}\text{C}$; $V_{CC} = 20\text{ V}$; all voltages are measured with respect to ground (pin 2); currents are positive when flowing into the IC; unless otherwise specified.

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|--|---|---|-------|------|-------|---------------|
| $I_{CC(oper)}$ | operating supply current | $V_{CC} = 8\text{ V}$ ($V_{CC} < V_{startup}$) | 0.2 | 0.25 | 0.4 | mA |
| | | under normal operation; no-load on pin DRIVER | 0.8 | 1 | 1.2 | mA |
| Synchronous rectification sense input (pin SRSENSE) | | | | | | |
| $V_{act(drv)}$ | driver activation voltage | | -260 | -220 | -180 | mV |
| $V_{reg(drv)}$ | driver regulation voltage | resistance between pins SELREG and GND < 15 k Ω | -55 | -42 | -30 | mV |
| | | resistance between pins SELREG and GND > 700 k Ω | -38 | -30 | -22 | mV |
| $V_{deact(drv)}$ | driver deactivation voltage | | - | -12 | - | mV |
| $t_{d(act)(drv)}$ | driver activation delay time | | 50 | 75 | 100 | ns |
| $t_{act(sr)(min)}$ | minimum synchronous rectification active time | | 1.25 | 1.5 | 1.75 | μs |
| $I_{o(SELREG)}$ | output current on pin SELREG | $V_{SELREG} = 2.5\text{ V}$ | -12 | -10 | -8 | μA |
| Driver (pin DRIVER) | | | | | | |
| I_{source} | source current | $V_{CC} = 15\text{ V}$; voltage on pin DRIVER = 2 V | | | | |
| | | during minimum synchronous rectification time | -0.45 | -0.4 | -0.35 | A |
| | | minimum synchronous rectification time has ended | -6 | -5 | -4 | mA |
| I_{sink} | sink current | $V_{CC} = 15\text{ V}$ | | | | |
| | | voltage on pin DRIVER = 2 V | 1 | 1.4 | - | A |
| | | voltage on pin DRIVER = 9.5 V | 2.2 | 2.7 | - | A |
| $V_{o(max)}$ | maximum output voltage | $V_{CC} = 15\text{ V}$ | 9 | 10 | 12 | V |
| $f_{sw(max)}$ | maximum switching frequency | | 250 | - | - | kHz |

[1] The V_{CC} stop voltage is $V_{startup} - V_{hys}$.

11. Application information

A switched mode power supply with the TEA1892TS consists of a primary side discontinuous conduction mode flyback controller, a transformer and an output stage with a feedback circuit. A MOSFET (Q_{sec}) is used for low conduction losses in the output state. The TEA1892TS controls this MOSFET.

The timing for the synchronous rectifier switch is derived from the voltage sensed on the SRSENSE pin. The resistor in the SRSENSE connection protects the TEA1892TS from excessive voltages. The $R_{SRSENSE}$ resistor is typically 1 k Ω . Higher values can impair correct timing, lower values do not provide sufficient protection.

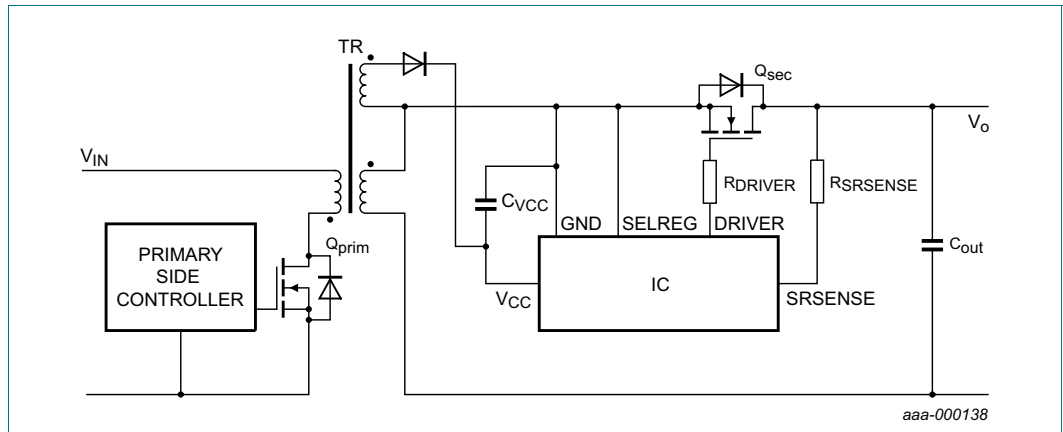


Fig 4. Application diagram high side rectification

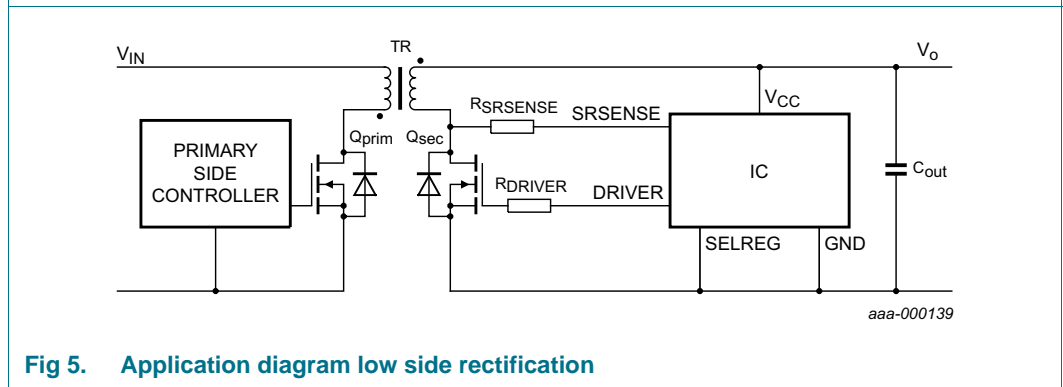


Fig 5. Application diagram low side rectification

12. Package outline

Plastic surface-mounted package (TSOP6); 6 leads

SOT457

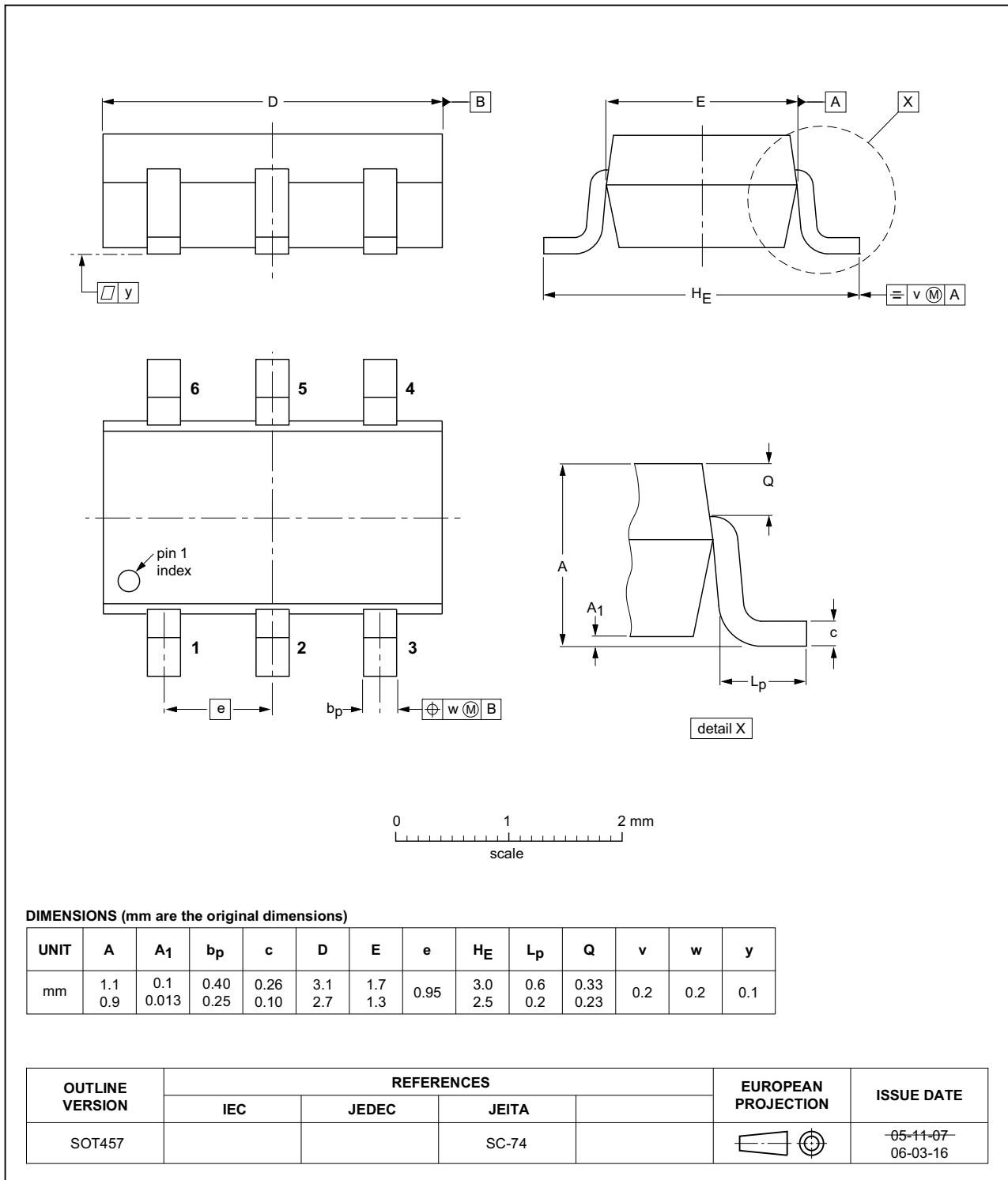


Fig 6. Package outline SOT457 (TSOP6)

13. Revision history

Table 6. Revision history

| Document ID | Release date | Data sheet status | Change notice | Supersedes |
|---------------|--------------|--------------------|---------------|------------|
| TEA1892TS v.1 | 20140409 | Product data sheet | - | - |

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