TEA1791T
GreenChip synchronous rectifier controller

1. General description

The TEA1791T 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 TEA1791T is a controller IC dedicated for synchronous rectification on the secondary side of discontinuous conduction mode and quasi resonant flyback converters.

The TEA1791T is fabricated in a Silicon On Insulator (SOI) process. This NXP SOI process makes possible a wide range of operation.

2. Features

2.1 Distinctive features

- Accurate synchronous rectification functionality.
- Wide supply voltage range (8.6 V to 38 V).
- High level of integration, resulting in a very low external component count.
- Wide opto coupler output voltage range (3.5 V to 38 V).
- Accurate internal voltage reference for voltage control (within 1 %).
- High driver output voltage of 10 V to drive all MOSFET brands to the lowest R_{DSon}.

2.2 Green features

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

2.3 Protection features

- Undervoltage protection.
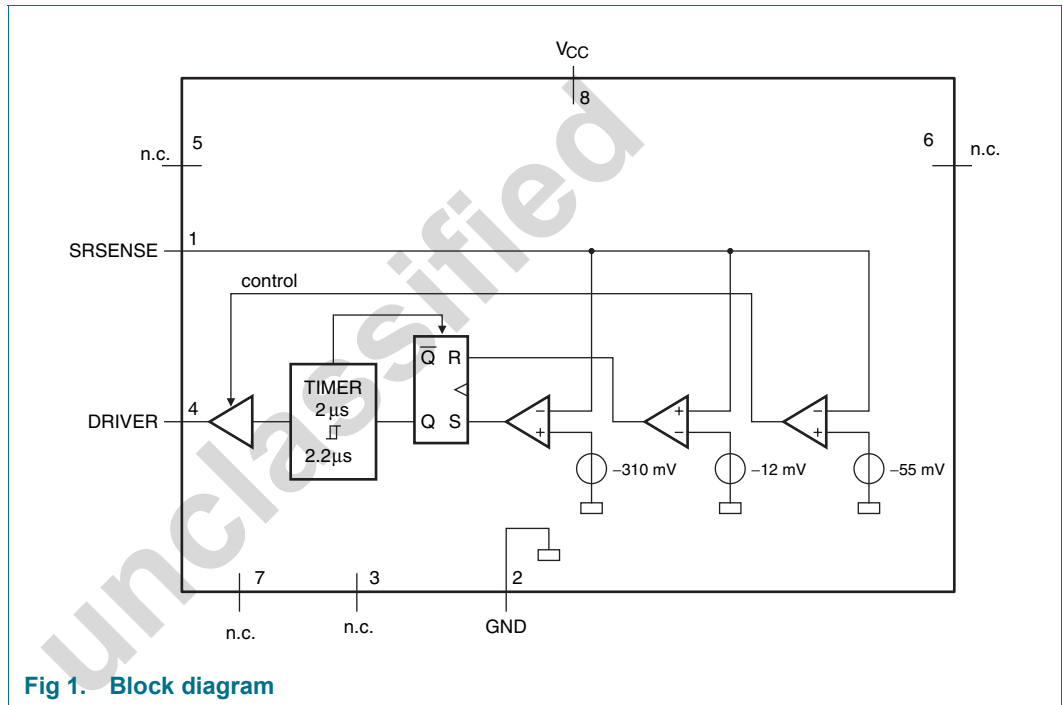
3. Applications

- The TEA1791T is intended for adapters. The device can also be used in all other discontinuous conduction mode and quasi resonant flyback systems that demand a highly efficient and cost-effective solution.

4. Ordering information
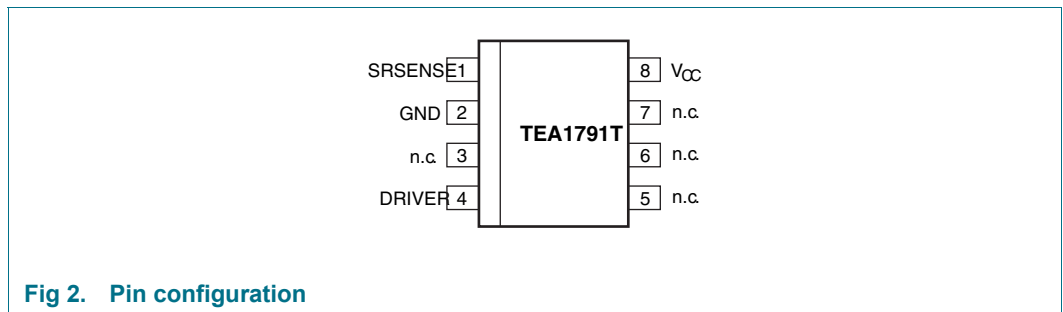
Table 1.   Ordering information

Type number	Package		Version
	Name	**Description**	
TEA1791T/N2	SO8	Plastic small outline package; 8 leads; body width 3.9 mm	SOT96-1

5. Block diagram

Fig 1.   Block diagram

6. Pinning information

6.1 Pinning

Fig 2.   Pin configuration

6.2 Pin description

Table 2.   Pin description

Symbol	Pin	Description
SRSENSE	1	not connected
GND	2	ground
n.c.	3	not connected
DRIVER	4	driver output for SR MOSFET
n.c	5	not connected
n.c.	6	not connected
n.c.	7	not connected
V_{CC}	8	supply voltage

7. Functional description

7.1 Introduction

The TEA1791T is the controller for synchronous rectification to be used in discontinuous conduction mode and quasi resonant flyback converters.

7.2 Start-up and undervoltage lock out

The IC leaves the under-voltage lock-out state and activates the synchronous rectifier circuitry as soon as the voltage on the V_{CC} pin is above 8.6 V (typical). As soon as the voltage drops below 8.1 V (typical), the under-voltage lock-out state is re-entered and the SR driver output is actively kept low.

7.3 Synchronous rectification

After a negative voltage (−310 mV typical) is sensed on the SRSENSE pin, the driver output voltage is driven high and the external MOSFET is switched on. Immediately the SRSENSE voltage rises to −55 mV the driver output voltage is regulated to maintain the −55 mV on the SRSENSE pin. As soon as the SRSENSE voltage is above −12 mV, the driver output is pulled to ground.

After switch-on of the SR MOSFET, the input signal on the SRSENSE pin is blanked for 2 ms (typical). This eliminates false switch-off due to high frequency ringing at the start of the secondary stroke.

Because the driver output voltage is reduced as soon as the voltage on the SRSENSE pin is −55 mV, the external power switch can be switched off quickly when the current through the switch reaches zero. With this zero-current switch off, no separate standby mode is needed to maintain high efficiency during no-load operation. The zero current is detected by sensing a −12 mV level on the SRSENSE pin (see Figure 3).
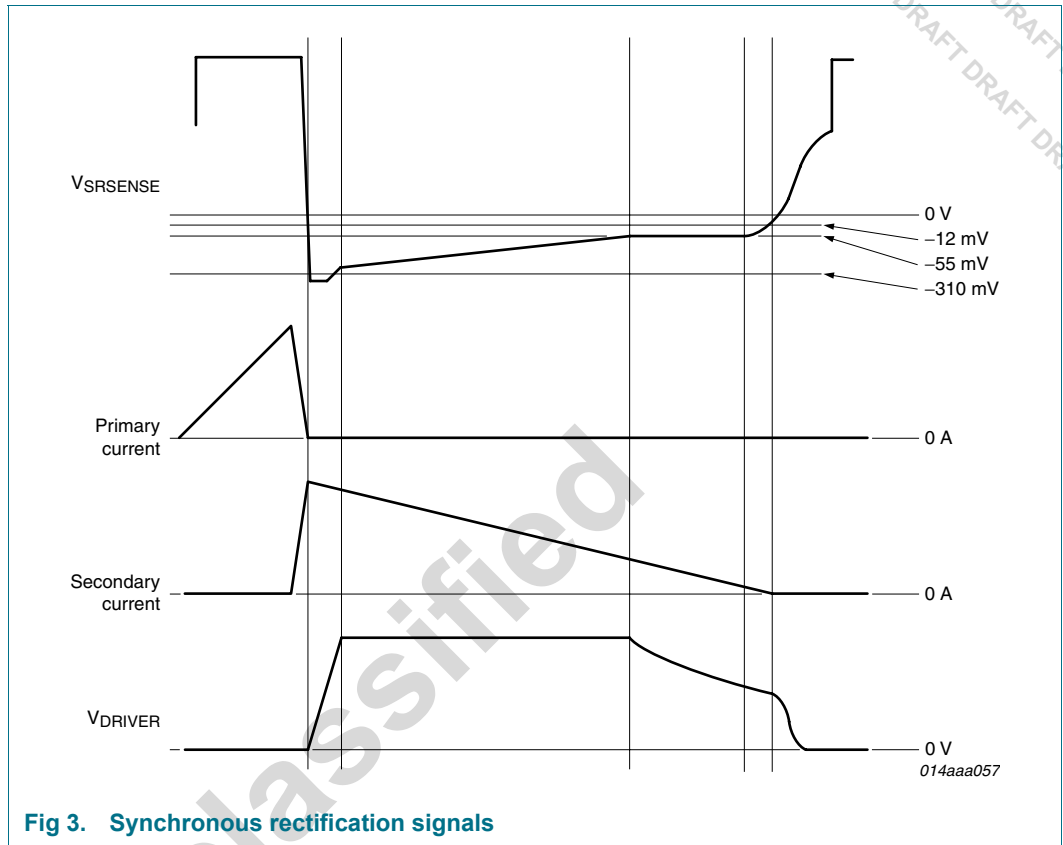
Fig 3. Synchronous rectification signals

If the secondary stroke of the flyback converter is shorter than 2 μs (typical), the driver output is disabled. This will guarantee stable operation for very low duty cycles. When the secondary stroke increases above 2.2 μs (typical) then the driver output is again enabled.

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 gate of the external power MOSFET has a source capability of typically 250 mA and a sink capability of typically 2.7 A. This permits fast turn-on and turn-off of the power MOSFET for efficient operation. The output voltage of the driver is limited to 10 V (typical). This high output voltage will drive all MOSFET brands to the minimum on-state resistance.

During start-up conditions ($V_{CC} < V_{startup}$) and undervoltage lock-out 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 are valid provided other ratings are not violated; 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
Currents					
I_{DRIVER}	current on pin DRIVER	duty cycle < 10 %	−0.8	+3	A
General					
P_{tot}	total power dissipation	T_{amb} < 80 °C	-	0.45	W
T_{stg}	storage temperature		−55	+150	°C
T_j	junction temperature		−20	+150	°C
V_{esd}	electrostatic discharge voltage	class 2			
		human body model	-	2000	V
		machine model	-	200	V
		charged device model	-	500	V

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

[2]   Equivalent to discharging a 200 pF capacitor through a 0.75 µH coil and 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	in free air	150	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		8.35	8.6	8.85	V
V_{hys}	hysteresis voltage		-	0.5	-	V
$I_{CC(oper)}$	operating supply current	V_{CC} = 8 V (V_{CC} < $V_{startup}$)	-	<tbd>	-	mA
Synchronous rectification sense input (pin SRSENSE)						
$V_{act(drv)}$	driver activation voltage		−340	−310	−280	mV

Table 5. **Characteristics** …*continued*

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
$V_{reg(drv)}$	driver regulation voltage		−65	−55	−45	mV
$V_{deact(drv)}$	driver deactivation voltage		-	−12	-	mV
$t_{d(act)(drv)}$	driver activation delay time		-	125	-	ns
$t_{act(sr)(min)}$	minimum synchronous rectification active time	Short time	1.5	2	2.5	µs
		Long time	1.7	2.2	2.7	µs
Driver (pin DRIVER)						
I_{source}	source current	V_{CC} = 15 V; voltage on pin DRIVER = 2 V	−0.3	−0.25	−0.2	A
I_{sink}	sink current	V_{CC} = 15 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 V	-	10	12	V

11. Application information

A switched mode power supply with the TEA1791T consists of a primary side discontinuous conduction mode flyback controller, a transformer, and an output stage with a feedback circuit. In the output stage a MOSFET (Qsec) is used for low conduction losses. The MOSFET is controlled by the TEA1791T.

The timing for the synchronous rectifier switch is derived from the voltage sensed on the SRSENSE pin. The resistor in the SRSENSE connection is needed to protect the TEA1791T from excessive voltages. The SRSENSE resistor should typically be 1 kΩ. Higher values might impair correct timing, lower values may not provide sufficient protection.

Fig 4. **Application diagram**

12. Test information

12.1 Quality information

The *General Quality Specification for Integrated Circuits, SNW-FQ-611* is applicable.

13. Package outline

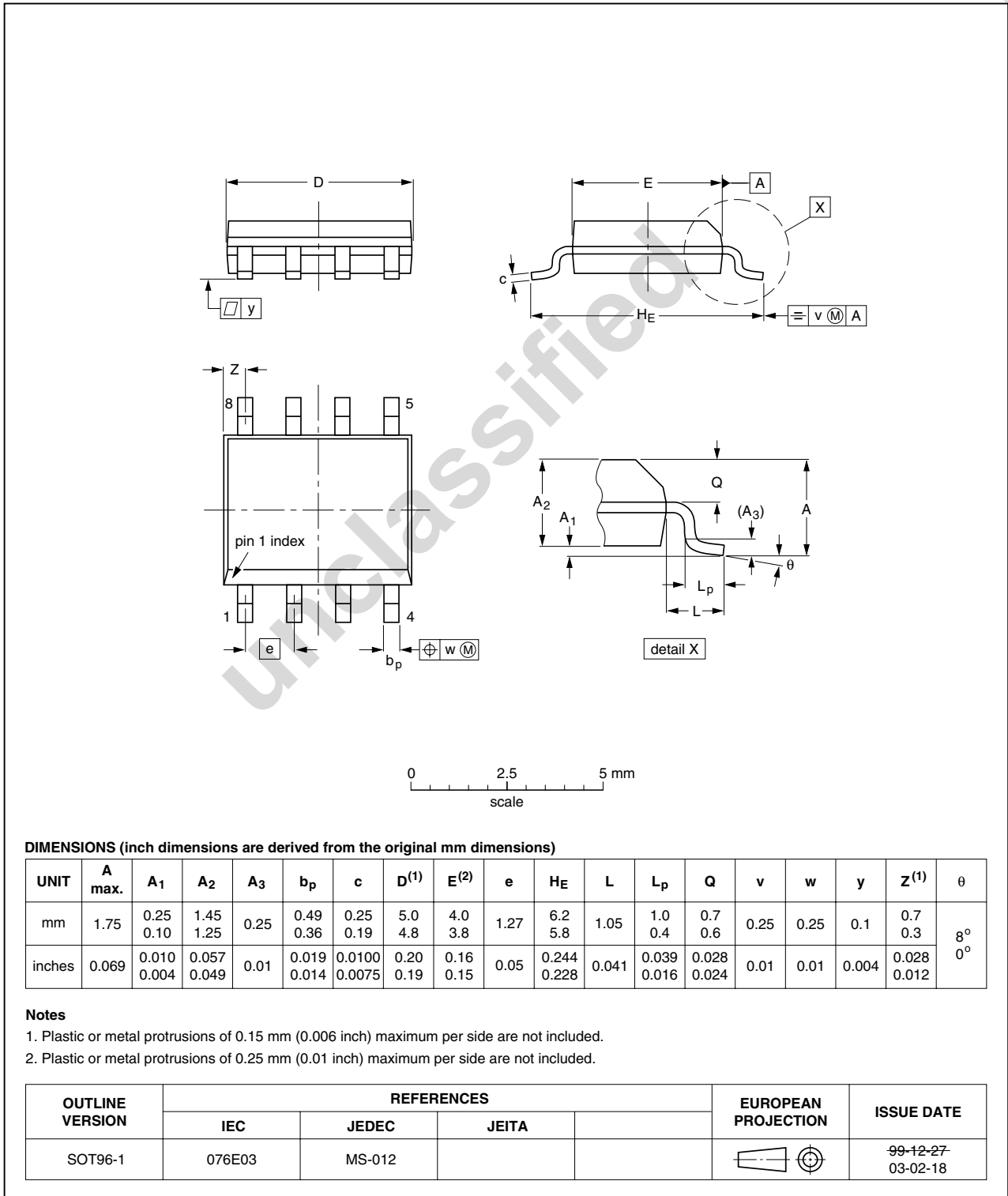**SO8: plastic small outline package; 8 leads; body width 3.9 mm**

SOT96-1

DIMENSIONS (inch dimensions are derived from the original mm dimensions)

UNIT	A max.	A₁	A₂	A₃	bₚ	c	D[1]	E[2]	e	Hₑ	L	Lₚ	Q	v	w	y	Z[1]	θ
mm	1.75	0.25 0.10	1.45 1.25	0.25	0.49 0.36	0.25 0.19	5.0 4.8	4.0 3.8	1.27	6.2 5.8	1.05	1.0 0.4	0.7 0.6	0.25	0.25	0.1	0.7 0.3	8° 0°
inches	0.069	0.010 0.004	0.057 0.049	0.01	0.019 0.014	0.0100 0.0075	0.20 0.19	0.16 0.15	0.05	0.244 0.228	0.041	0.039 0.016	0.028 0.024	0.01	0.01	0.004	0.028 0.012	

Notes

1. Plastic or metal protrusions of 0.15 mm (0.006 inch) maximum per side are not included.
2. Plastic or metal protrusions of 0.25 mm (0.01 inch) maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT96-1	076E03	MS-012				~~99-12-27~~ 03-02-18

Fig 5. Package outline SOT96-1 (SO8)

14. Revision history

Table 6.   Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
TEA1791T_00.03	<tbd>	Objective data sheet	-	-
TEA1791T_00.02	<tbd>	Objective data sheet	-	-
TEA1791T_00.01	<tbd>	Objective data sheet	-	-

15. Legal information

15.1 Data sheet status

Document status[1][2]	Product status[3]	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.

[1] Please consult the most recently issued document before initiating or completing a design.

[2] The term 'short data sheet' is explained in section "Definitions".

[3] The product status of device(s) described in this document may have changed since this document was published and may differ in case of multiple devices. The latest product status information is available on the Internet at URL http://www.nxp.com.

15.2 Definitions

Draft — The document is a draft version only. The content is still under internal review and subject to formal approval, which may result in modifications or additions. NXP Semiconductors does not give any representations or warranties as to the accuracy or completeness of information included herein and shall have no liability for the consequences of use of such information.

Short data sheet — A short data sheet is an extract from a full data sheet with the same product type number(s) and title. A short data sheet is intended for quick reference only and should not be relied upon to contain detailed and full information. For detailed and full information see the relevant full data sheet, which is available on request via the local NXP Semiconductors sales office. In case of any inconsistency or conflict with the short data sheet, the full data sheet shall prevail.

15.3 Disclaimers

General — Information in this document is believed to be accurate and reliable. However, NXP Semiconductors does not give any representations or warranties, expressed or implied, as to the accuracy or completeness of such information and shall have no liability for the consequences of use of such information.

Right to make changes — NXP Semiconductors reserves the right to make changes to information published in this document, including without limitation specifications and product descriptions, at any time and without notice. This document supersedes and replaces all information supplied prior to the publication hereof.

Suitability for use — NXP Semiconductors products are not designed, authorized or warranted to be suitable for use in medical, military, aircraft, space or life support equipment, nor in applications where failure or malfunction of a NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors accepts no liability for inclusion and/or use of NXP Semiconductors products in such equipment or applications and therefore such inclusion and/or use is at the customer's own risk.

Applications — Applications that are described herein for any of these products are for illustrative purposes only. NXP Semiconductors makes no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) may cause permanent damage to the device. Limiting values are stress ratings only and operation of the device at these or any other conditions above those given in the Characteristics sections of this document is not implied. Exposure to limiting values for extended periods may affect device reliability.

Terms and conditions of sale — NXP Semiconductors products are sold subject to the general terms and conditions of commercial sale, as published at http://www.nxp.com/profile/terms, including those pertaining to warranty, intellectual property rights infringement and limitation of liability, unless explicitly otherwise agreed to in writing by NXP Semiconductors. In case of any inconsistency or conflict between information in this document and such terms and conditions, the latter will prevail.

No offer to sell or license — Nothing in this document may be interpreted or construed as an offer to sell products that is open for acceptance or the grant, conveyance or implication of any license under any copyrights, patents or other industrial or intellectual property rights.

15.4 Trademarks

Notice: All referenced brands, product names, service names and trademarks are the property of their respective owners.

GreenChip — is a trademark of NXP B.V.

16. Contact information

For more information, please visit: **http://www.nxp.com**

For sales office addresses, please send an email to: **salesaddresses@nxp.com**

17. Contents

founded by

PHILIPS

Date of release: 10 April 2008
Document identifier: TEA1791T_00.03