TEA1705

GreenChip SMPS transient controller

Rev. 2 — 12 December 2013 Product data sheet

1. General description

The TEA1705 is a secondary side IC to be used in Switched Mode Power Supplies (SMPS) with high power density. The device offers excellent transient response in primary controlled systems of NXP Semiconductors, with ultra-low no-load power and minimum sized output capacitors. The TEA1705 is intended to be used in power supplies and battery chargers with 5 V output. The TEA1705 operates in combination with the NXP Semiconductors primary-side controller like the TEA1720xT. The output voltage is continuously monitored and when the output voltage is below the V_{det} level, a transient interrupt signal is generated. This signal is transmitted via the transformer to the primary side to wake up the primary controller. This system reduces the volume of the output capacitors, minimizing the BOM cost. It also enables the building of compact chargers.

2. Features and benefits

- Excellent transient performance with ultra-low no-load power and smallest output capacitors
- Fast detection of a decreasing output voltage during load steps
- Integrated output voltage clamp function
- Device available in small SOT23 package

3. Applications

- Battery chargers for smart phones and media tablets
- Standby supply for TV and desktop PC

4. Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
TEA1705/1	TO-236AB	plastic surface-mounted package; 3 leads	SOT23

5. Marking

Table 2. Marking codes

Type number	Marking code[1]
TEA1705	%4U

[1] % = placeholder for manufacturing site code

6. Block diagram

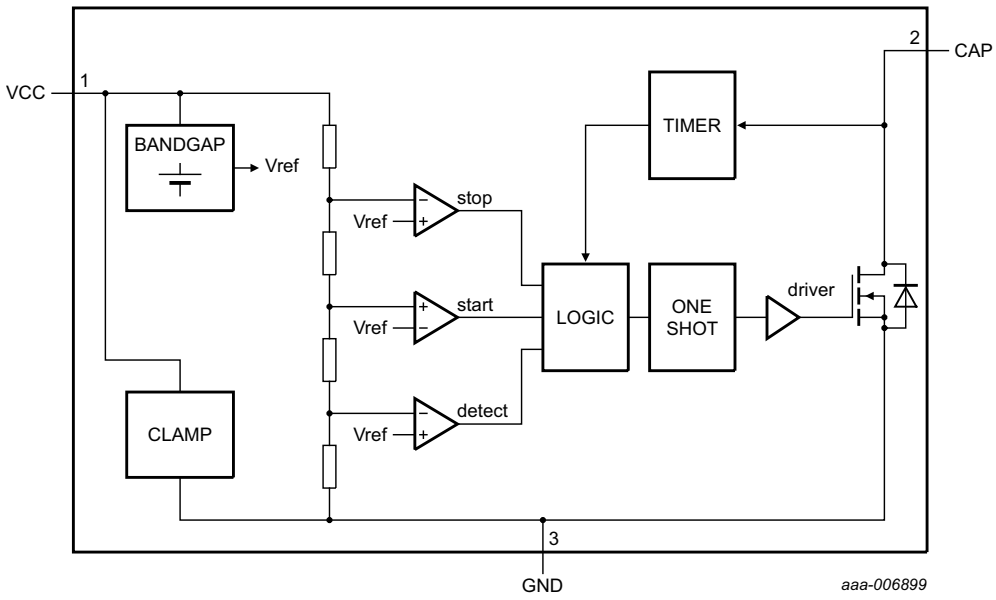


Fig 1. TEA1705 block diagram

7. Pinning information

7.1 Pinning

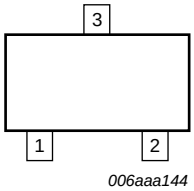


Fig 2. TEA1705 pin configuration

7.2 Pin description

Table 3. Pin description

Symbol	Pin	Description
VCC	1	supply voltage
CAP	2	connection for communication capacitor
GND	3	ground

8. Functional description

8.1 Start-up

The TEA1705 starts up when a supply voltage is applied to the VCC pin. When the VCC voltage exceeds the $V_{startup}$ level the IC is enabled. The IC stays in this mode until the VCC voltage drops below the $V_{CC(stop)}$ level. All detection voltages on the VCC pin are derived from an integrated temperature compensated band gap voltage.

8.2 Detection

During the switching of the primary controller in the flyback application, the capacitor connected between the secondary winding of the transformer and the CAP pin is charged. The capacitor is charged using the body diode of the integrated switch. The switching of the primary side is monitored using a circuit on the CAP pin of the TEA1705.

When the switching has stopped for t_{blank} and the monitored VCC voltage is lower than the V_{det} level, the integrated switch is turned on for a duration of t_{on}. The external capacitor discharges through the secondary transformer winding. On the primary side of the transformer a wake-up pulse is detected by using a primary control IC like the TEA1720xT. The primary IC exits the energy save state and starts to deliver output power.

8.3 MOSFET-switch

Generating the transient interrupt signal is enabled by using an internal MOSFET-switch between the CAP and GND pins to discharge the external capacitor. The integrated body diode of this switch is used to charge the external capacitor when the primary switch in the flyback application is switching again.

8.4 Clamp

An integrated clamp function is present on the VCC pin. If the voltage on the VCC pin exceeds $V_{clamp(VCC)}$, the clamp circuit drains away the current. The clamp circuit has an impedance of R_{clamp}. It helps to prevent an overvoltage on the output capacitors.

9. Limiting values

Table 4. Limiting values

In accordance with the Absolute Maximum Rating System (IEC 60134).All voltages are measured with respect to GND; positive currents flow into the IC. 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		–0.3	+7	V
V_{CAP}	voltage on pin CAP		-	+50	V
Currents					
I_{CC}	supply current		0	50	mA
I_{CAP}	current on pin CAP	Repetitive; pulse width ≤ 1 μs; repetition time ≥ 50 μs	–2.5	+2.5	A
		Non-repetitive; pulse width ≤ 1 μs	–3.5	-	A
General					
T_{stg}	storage temperature		-55	+150	°C
T_j	junction temperature		–40	+150	°C
V_{ESD}	electrostatic discharge voltage	human body model[1]	–2000	+2000	V
		Charged device model	–500	+500	V

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

10. Thermal characteristics

Table 5. Thermal characteristics

Symbol	Parameter	Conditions		Typ	Unit
$R_{th(j-a)}$	thermal resistance from junction to ambient	in free air	[1]	300	K/W

[1] Device mounted on an FR-4 Printed-Circuit Board (PCB), single-sided copper, tin-plated and standard footprint.

11. Characteristics

Table 6. Characteristics

V_{CC} = 5 V; T_{amb} = 25 °C; all voltages referenced to GND; positive currents flow into the IC, unless otherwise specified.

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
High voltage (pin CAP)						
$I_{leak(CAP)}$	leakage current on pin CAP	V_{CAP} = 50 V	-	-	1	µA
Supply (pin VCC)						
$V_{startup}$	start-up voltage		4.3	4.4	4.5	V
$V_{CC(stop)}$	stop supply voltage		3.9	4.0	4.1	V
$V_{CC(hys)}$	hysteresis of supply voltage	$V_{CC(hys)} = V_{startup} - V_{CC(stop)}$	0.35	0.4	0.45	V
I_{CC}	supply current	V_{CC} = 5.5 V; current decreases slightly at lower supply voltages	85	97	110	µA
Detection (pin VCC)						
V_{det}	detection voltage		4.8	4.9	5.0	V
Switch (pin CAP)						
t_{on}	on-time		-	1.1	-	µs
R_{on}	on-state resistance	I_{CAP} = 100 mA	-	2	-	Ω
Timer (pin CAP)						
t_{blank}	blanking time	V_{CC} = 4.8 V; after last primary stroke	-	65	-	µs
Clamp (pin VCC)						
$V_{clamp(VCC)}$	clamp voltage on pin VCC	clamp start voltage; I_{VCC} = 1 mA	5.80	5.92	6.05	V
R_{clamp}	clamp resistance	differential measurement between V_{CC} = 7 V and $V_{CC} = V_{clamp(VCC)}$	-	26	-	Ω

12. Application information

A switched mode power supply application, using the TEA1705 transient controller is shown in Figure 3. On the secondary side the output voltage is monitored by the TEA1705. The TEA1705 works in combination with a primary-side controller.

See for more information the *TEA1720xT data sheets*.

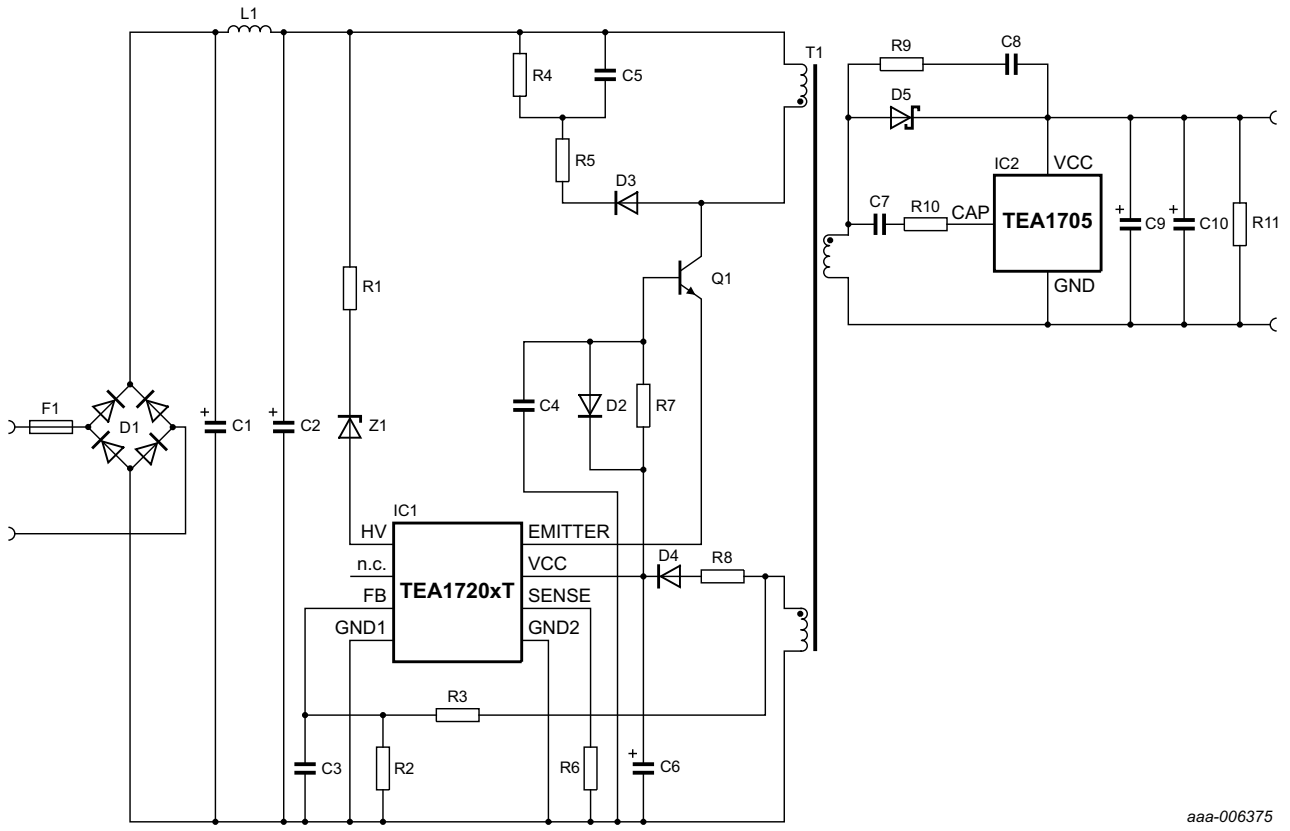
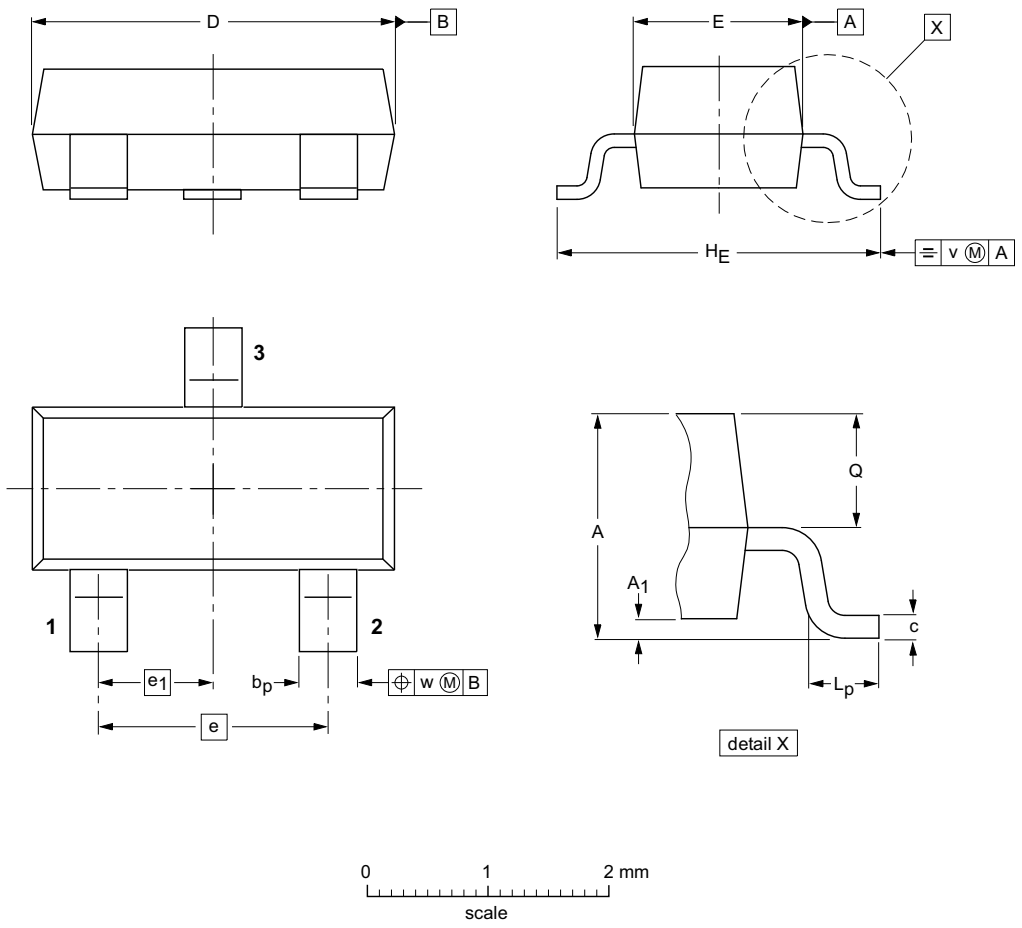


Fig 3. Application diagram

13. Package outline

Plastic surface-mounted package; 3 leads **SOT23**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1 max.	b_p	c	D	E	e	e_1	H_E	L_p	Q	v	w
mm	1.1 0.9	0.1	0.48 0.38	0.15 0.09	3.0 2.8	1.4 1.2	1.9	0.95	2.5 2.1	0.45 0.15	0.55 0.45	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT23		TO-236AB				~~04-11-04~~ 06-03-16

Fig 4. Package outline SOT23

14. Revision history

Table 7. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
TEA1705 v.2	20131212	Product data sheet	-	TEA1705 v.1
Modifications:	• The data sheet status has changed from preliminary to product.			
TEA1705 v.1	20131203	Preliminary 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.

Product specification — The information and data provided in a Product data sheet shall define the specification of the product as agreed between NXP Semiconductors and its customer, unless NXP Semiconductors and customer have explicitly agreed otherwise in writing. In no event however, shall an agreement be valid in which the NXP Semiconductors product is deemed to offer functions and qualities beyond those described in the Product data sheet.

15.3 Disclaimers

Limited warranty and liability — 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. NXP Semiconductors takes no responsibility for the content in this document if provided by an information source outside of NXP Semiconductors.

In no event shall NXP Semiconductors be liable for any indirect, incidental, punitive, special or consequential damages (including - without limitation - lost profits, lost savings, business interruption, costs related to the removal or replacement of any products or rework charges) whether or not such damages are based on tort (including negligence), warranty, breach of contract or any other legal theory.

Notwithstanding any damages that customer might incur for any reason whatsoever, NXP Semiconductors' aggregate and cumulative liability towards customer for the products described herein shall be limited in accordance with the *Terms and conditions of commercial sale* of NXP Semiconductors.

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 life support, life-critical or safety-critical systems or equipment, nor in applications where failure or malfunction of an NXP Semiconductors product can reasonably be expected to result in personal injury, death or severe property or environmental damage. NXP Semiconductors and its suppliers accept 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.

Customers are responsible for the design and operation of their applications and products using NXP Semiconductors products, and NXP Semiconductors accepts no liability for any assistance with applications or customer product design. It is customer's sole responsibility to determine whether the NXP Semiconductors product is suitable and fit for the customer's applications and products planned, as well as for the planned application and use of customer's third party customer(s). Customers should provide appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP Semiconductors does not accept any liability related to any default, damage, costs or problem which is based on any weakness or default in the customer's applications or products, or the application or use by customer's third party customer(s). Customer is responsible for doing all necessary testing for the customer's applications and products using NXP Semiconductors products in order to avoid a default of the applications and the products or of the application or use by customer's third party customer(s). NXP does not accept any liability in this respect.

Limiting values — Stress above one or more limiting values (as defined in the Absolute Maximum Ratings System of IEC 60134) will cause permanent damage to the device. Limiting values are stress ratings only and (proper) operation of the device at these or any other conditions above those given in the Recommended operating conditions section (if present) or the Characteristics sections of this document is not warranted. Constant or repeated exposure to limiting values will permanently and irreversibly affect the quality and reliability of the device.

Terms and conditions of commercial 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, unless otherwise agreed in a valid written individual agreement. In case an individual agreement is concluded only the terms and conditions of the respective agreement shall apply. NXP Semiconductors hereby expressly objects to applying the customer's general terms and conditions with regard to the purchase of NXP Semiconductors products by customer.

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.

Export control — This document as well as the item(s) described herein may be subject to export control regulations. Export might require a prior authorization from competent authorities.

Non-automotive qualified products — Unless this data sheet expressly states that this specific NXP Semiconductors product is automotive qualified, the product is not suitable for automotive use. It is neither qualified nor tested in accordance with automotive testing or application requirements. NXP Semiconductors accepts no liability for inclusion and/or use of non-automotive qualified products in automotive equipment or applications.

In the event that customer uses the product for design-in and use in automotive applications to automotive specifications and standards, customer (a) shall use the product without NXP Semiconductors' warranty of the product for such automotive applications, use and specifications, and (b) whenever customer uses the product for automotive applications beyond NXP Semiconductors' specifications such use shall be solely at customer's own risk, and (c) customer fully indemnifies NXP Semiconductors for any liability, damages or failed product claims resulting from customer design and use of the product for automotive applications beyond NXP Semiconductors' standard warranty and NXP Semiconductors' product specifications.

Translations — A non-English (translated) version of a document is for reference only. The English version shall prevail in case of any discrepancy between the translated and English versions.

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

For more information, please visit: http://www.nxp.com
For sales office addresses, please send an email to: salesaddresses@nxp.com

Date of release: 12 December 2013
Document identifier: TEA1705