TEA1792ATS

GreenChip synchronous rectifier controller

Rev. 2 — 17 September 2013 **Product data sheet**

1. General description

The TEA1792ATS 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 TEA1792ATS is a controller IC dedicated to synchronous rectification on the secondary side of discontinuous conduction mode and quasi-resonant flyback converters.

The TEA1792ATS 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

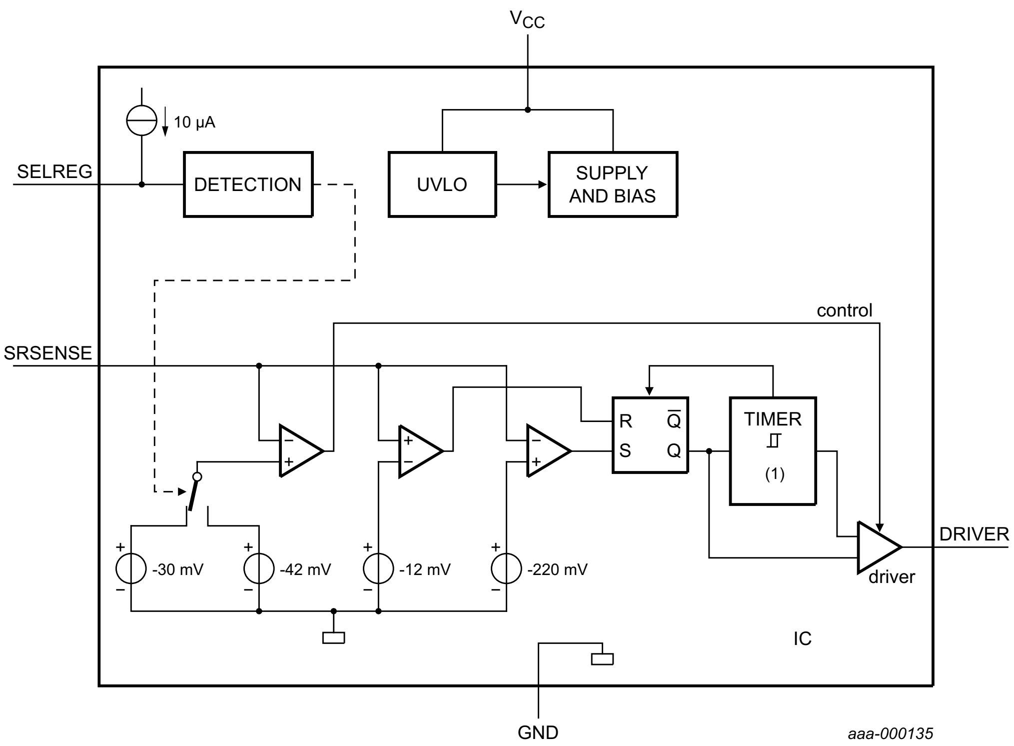
- The TEA1792ATS is intended for adapters. The device can also be used in all other discontinuous conduction mode systems and quasi-resonant flyback systems that demand a highly efficient and cost-effective solution.

4. Ordering information

Table 1. Ordering information

Type number	Package		
	Name	Description	Version
TEA1792ATS/1	TSOP6	plastic surface-mounted package; 6 leads	SOT457

5. Block diagram



See Table 2 for details on the pinning.

(1) 0.8 μs and 0.95 μs.

Fig 1. TEA1792ATS block diagram

6. Pinning information

6.1 Pinning

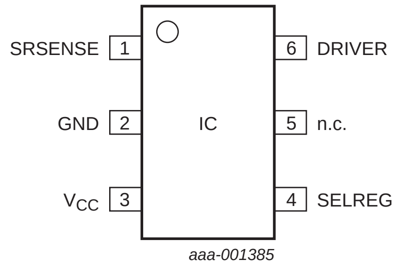


Fig 2. TEA1792ATS pin configuration (TSOP6)

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 TEA1792ATS 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. As soon as 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 $t_{act(sr)(min)}$ (0.8 μs 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).

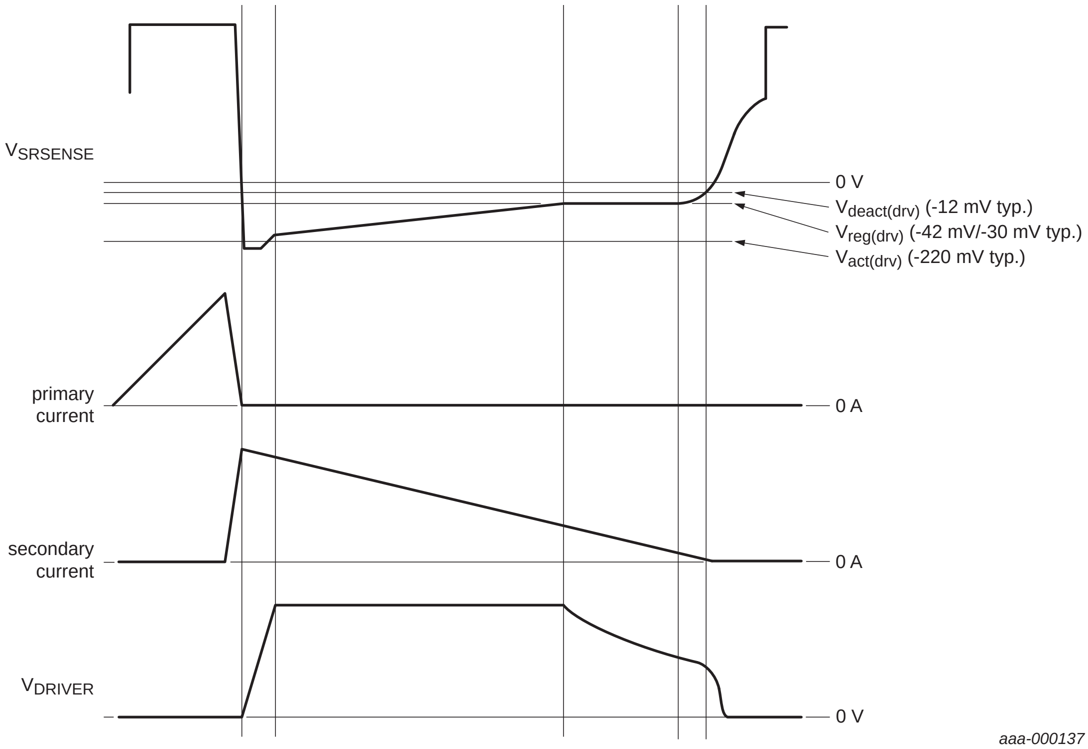


Fig 3. Synchronous rectification signals

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 μA. 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.

If the secondary stroke of the flyback converter is shorter than $t_{act(sr)(min)}$ short time (0.8 μs typical), the driver output is disabled. This action guarantees stable operation for very low duty cycles. When the secondary stroke increases above $t_{act(sr)(min)}$, long time (0.95 μs typical), 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 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
$I_{CC(oper)}$	operating supply current	V_{CC} = 8 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 kΩ		–55	–42	–30	mV
		resistance between pins SELREG and GND > 700 kΩ		–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	short time		0.6	0.8	1	μs
		long time		0.7	0.95	1.2	μs
$I_{o(SELREG)}$	output current on pin SELREG	V_{SELREG} = 2.5 V		–12	–10	–8	μA
Driver (pin DRIVER)							
I_{source}	source current	V_{CC} = 15 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 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		9	10	12	V

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

11. Application information

A switched mode power supply with the TEA1792ATS 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 TEA1792ATS 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 TEA1792ATS from excessive voltages. The $R_{SRSENSE}$ resistor is typically 1 kΩ. Higher values can impair correct timing, lower values do not provide sufficient protection.

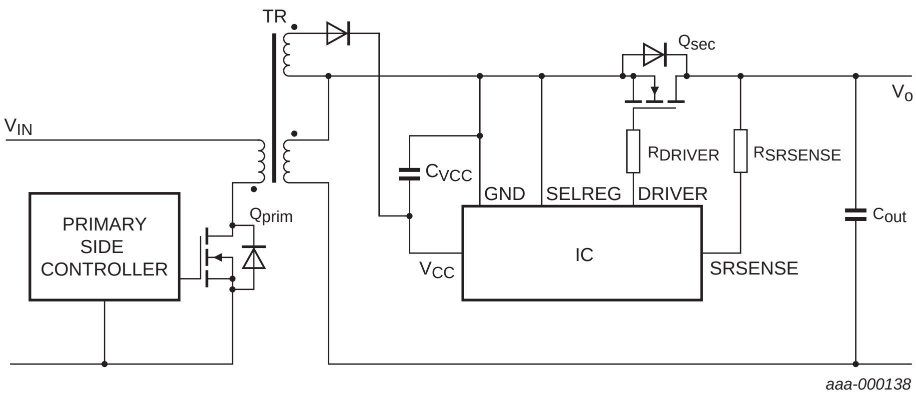


Fig 4. Application diagram high side rectification

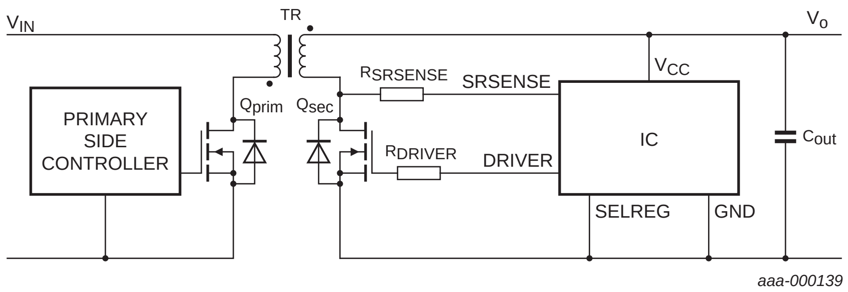
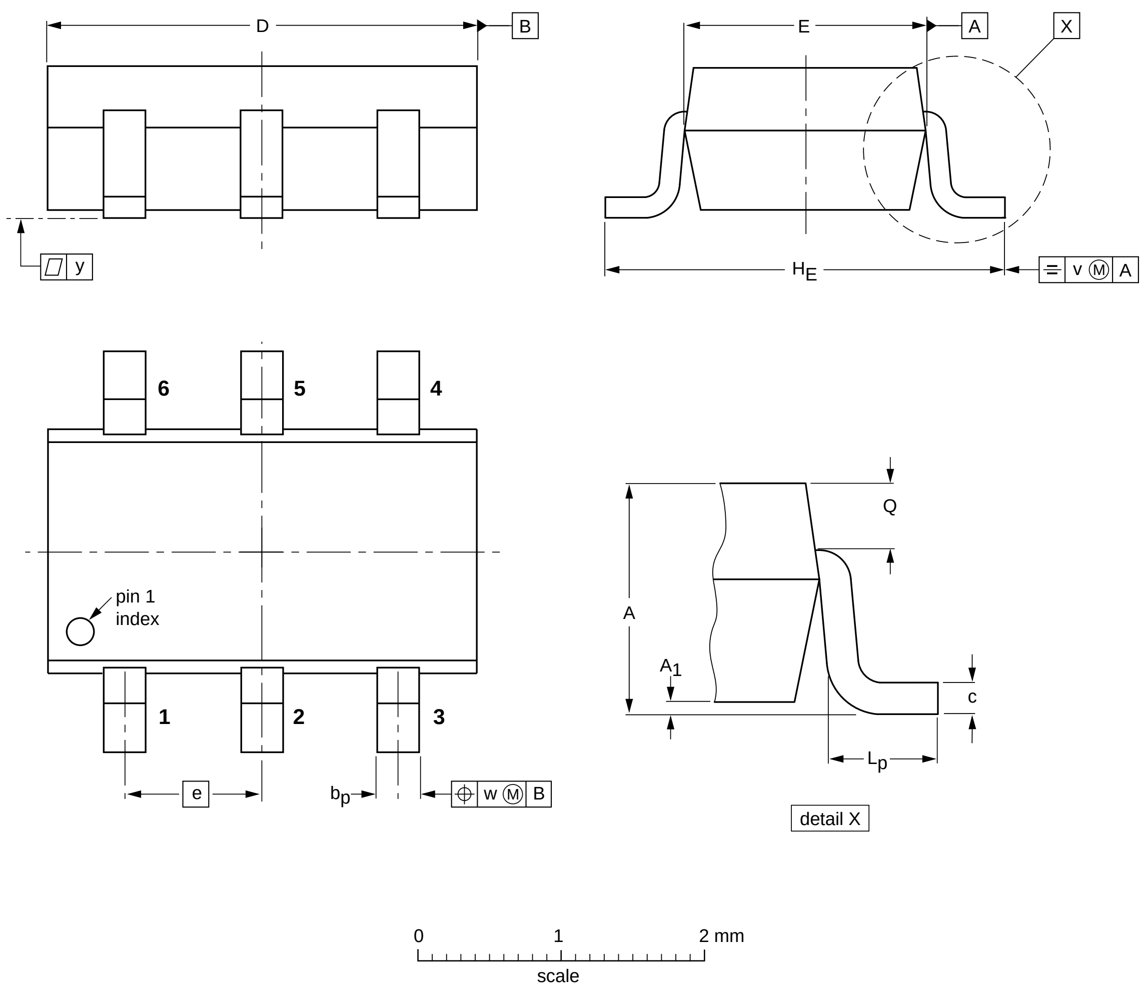


Fig 5. Application diagram low side rectification

12. Package outline

Plastic surface-mounted package (TSOP6); 6 leads **SOT457**



DIMENSIONS (mm are the original dimensions)

UNIT	A	A_1	b_p	c	D	E	e	H_E	L_p	Q	v	w	y
mm	1.1 0.9	0.1 0.013	0.40 0.25	0.26 0.10	3.1 2.7	1.7 1.3	0.95	3.0 2.5	0.6 0.2	0.33 0.23	0.2	0.2	0.1

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	JEITA			
SOT457			SC-74			~~05-11-07~~ 06-03-16

Fig 6. Package outline SOT457 (TSOP6)

13. Revision history

Table 6. Revision history

Document ID	Release date	Data sheet status	Change notice	Supersedes
TEA1792ATS v.2	20130917	Product data sheet	-	TEA1792ATS v.1
Modifications:	• Data sheet status changed from Objective data sheet to Product data sheet. • Table 1 "Ordering information" has been updated.			
TEA1792ATS v.1	20120810	Objective data sheet	-	-

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14.1 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.

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16. Contents

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