



Chipsmall Limited consists of a professional team with an average of over 10 year of expertise in the distribution of electronic components. Based in Hongkong, we have already established firm and mutual-benefit business relationships with customers from,Europe,America and south Asia,supplying obsolete and hard-to-find components to meet their specific needs.

With the principle of “Quality Parts,Customers Priority,Honest Operation,and Considerate Service”,our business mainly focus on the distribution of electronic components. Line cards we deal with include Microchip,ALPS,ROHM,Xilinx,Pulse,ON,Everlight and Freescale. Main products comprise IC,Modules,Potentiometer,IC Socket,Relay,Connector.Our parts cover such applications as commercial,industrial, and automotives areas.

We are looking forward to setting up business relationship with you and hope to provide you with the best service and solution. Let us make a better world for our industry!



## Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China



## Single Stage Flyback or Buck-Boost Current Control with Active PFC for LED lighting

### DESCRIPTION

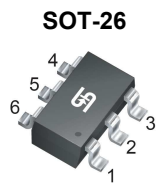
TS19705 is constant current control IC with active power factor correction isolated or non-isolated AC-DC LED lighting control. The TS19705 is configurable as an isolated, primary-side-regulated Flyback controller or non-isolated Buck-Boost converter for LED lighting applications. The IC achieves high power factor and low Total Harmonic Distortion (THD) operation by Boundary Conduction Mode (BCM). The line and load regulation of LED current is about  $<\pm 3\%$  because of particular control method. TS19705 also provides gate driving voltage clamping,  $V_{CC}$  overvoltage protection and system output open/short circuit protection to increase IC performance.

### FEATURES

- Accuracy Constant Current  $<\pm 3\%$
- Low BOM Cost
- Flyback or Buck-Boost w/o photocoupler
- Application Voltage Range: 90~264V<sub>AC</sub>
- Built-in Active Power Factor Correction
- Good Line and Load Regulation
- Open-LED Protection on DMG pin
- Over-Voltage Protection on  $V_{CC}$  pin
- Short-LED Protection
- Cycle by Cycle Over Current Protection on CS pin
- Over-Temperature Protection
- Gate Driving Voltage Clamping

### APPLICATION

- LED lighting
- Down lights, Tube lamps, PAR Lamps, Bulbs

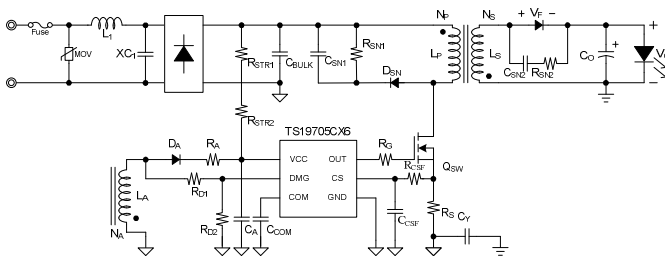


### Pin Definition:

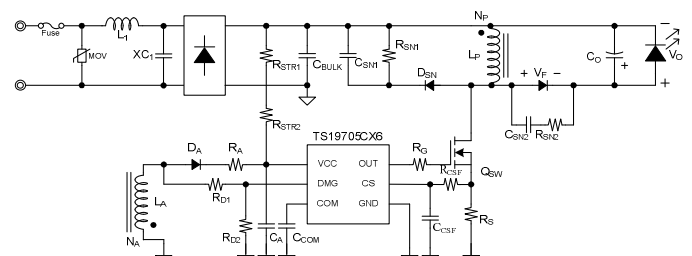
1. COM
2. GND
3. CS
4. Output
5.  $V_{CC}$
6. DMG

**Notes:** MSL 3 (Moisture Sensitivity Level) per J-STD-020

### TYPICAL APPLICATION CIRCUIT



**Flyback Converter**



**Buck-Boost Converter**

<b>ABSOLUTE MAXIMUM RATINGS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified) <sup>(Note 1)</sup>			
PARAMETER	SYMBOL	LIMIT	UNIT
Power supply pin	$V_{CC}$	40	V
DMG voltage to GND	$V_{DMG}$	-0.3 to 40	V
OUT voltage to GND	$V_{OUT}$	-0.3 to 40	V
CS voltage to GND	$V_{CS}$	-0.3 to 5.5	V
COM voltage to GND	$V_{COM}$	-0.3 to 5	V
Junction Temperature Range	$T_J$	-40 to +150	$^\circ\text{C}$
Storage Temperature Range	$T_{STG}$	-65 to +150	$^\circ\text{C}$
Power Dissipation @ $T_A=25^\circ\text{C}$	$P_D$	0.3	W
ESD Rating (Human Body Model)	ESD	2	kV

<b>THERMAL PERFORMANCE</b> <sup>(Note 3)</sup>			
PARAMETER	SYMBOL	LIMIT	UNIT
Thermal Resistance - Junction to Case	$R_{\theta JC}$	106	$^\circ\text{C/W}$
Thermal Resistance - Junction to Ambient	$R_{\theta JA}$	220	$^\circ\text{C/W}$

<b>RECOMMENDED OPERATING CONDITION</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified) <sup>(Note 4)</sup>			
PARAMETER	SYMBOL	LIMIT	UNIT
Power supply pin	$V_{CC}$	38	V
DMG voltage to GND	$V_{DMG}$	-0.3 to 38	V
OUT voltage to GND	$V_{OUT}$	-0.3 to 38	V
CS voltage to GND	$V_{CS}$	-0.3 to 5	V
COM voltage to GND	$V_{COM}$	-0.3 to $V_{CC}$	V
Operating Junction Temperature Range	$T_J$	-40 to +125	$^\circ\text{C}$
Operating Ambient Temperature Range	$T_{OPA}$	-40 to +85	$^\circ\text{C}$

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
<b>Supply Voltage</b>						
Turn-on voltage	$V_{CC\_ON}$		17	18	19	V
Turn-off voltage	$V_{CC\_OFF}$		8.5	9.5	10	V
Quiescent current 1	$I_{Q1}$	$V_{CC}=17\text{V}$ , @ $V_{CC}$ off	--	30	50	$\mu\text{A}$
Quiescent current 2	$I_{Q2}$	Start-up @ 4.5kHz	--	600	800	$\mu\text{A}$
Operation supply current	$I_{CC}$		--	2.5	3.0	mA
<b>Protection</b>						
$V_{CC}$ voltage protection	$V_{OVPA}$		31	32	34	V
Output voltage protection	$V_{OVPS}$		10	10.5	11	V
CS limit voltage	$V_{OCP}$		1.15	1.25	1.35	V
Short circuit protection	$V_{SCP}$	Guaranteed by design	--	3	--	V
<b>Oscillator</b>						
Start-up timer	$t_{STR}$		--	220	--	$\mu\text{s}$

<b>ELECTRICAL SPECIFICATIONS</b> ( $T_A = 25^\circ\text{C}$ unless otherwise specified)						
PARAMETER	SYMBOL	CONDITION	MIN	TYP	MAX	UNIT
<b>GM Amplifier</b>						
Transconductance	$g_m$		--	60	--	$\mu\text{A/V}$
Source current	$I_{\text{COMP\_SOU}}$		--	20	--	$\mu\text{A}$
<b>MOSFET Section</b>						
Dropout voltage	$V_{\text{OH}}$	$V_{\text{CC}}=33\text{V}, I_o = 10\text{mA}$	--	1.2	1.5	V
	$V_{\text{OL}}$	$V_{\text{CC}}=33\text{V}, I_o = -10\text{mA}$	--	0.12	--	V
Rising time	$t_r$	$V_{\text{CC}}=20\text{V}, C_o = 1\text{nF}$	--	40	--	ns
Falling time	$t_f$	$V_{\text{CC}}=20\text{V}, C_o = 1\text{nF}$	--	80	--	ns
Output clamp voltage	$V_{\text{O\_CLAMP}}$		--	--	19	V
Leading edge blanking time	$\text{LEB}_t$		--	0.5	--	$\mu\text{s}$

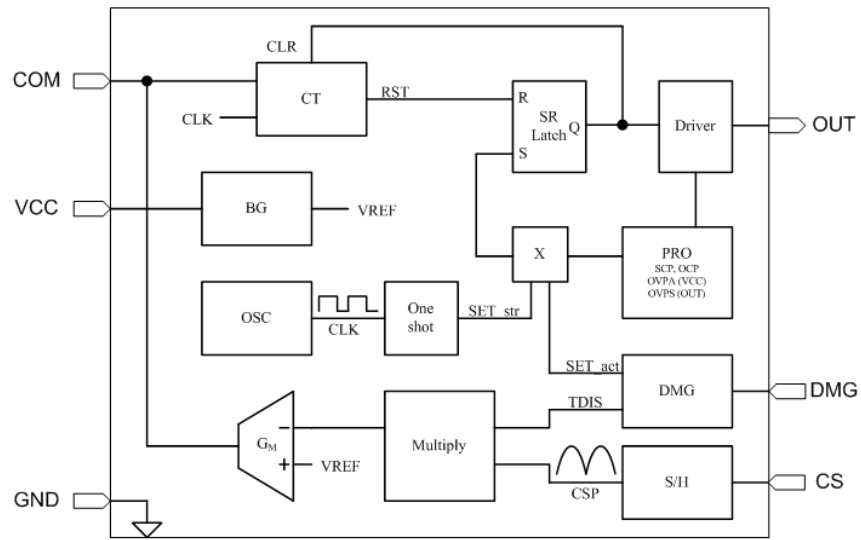
**Note:**

1. Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.
2. Devices are ESD sensitive. Handling precaution recommended.
3. Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at  $T_A=25^\circ\text{C}$ .
4. The device is not guaranteed to function outside its operating conditions.
5. Guaranteed by design.
6. Auto Recovery Type.

**ORDERING INFORMATION**

PART NO.	PACKAGE	PACKING
TS19705CX6 RFG	SOT-26	3,000pcs / 7"Reel

**FUNCTION BLOCK**



**PIN DESCRIPTION**

PIN NO.	NAME	FUNCTION
1	COM	Output pin of error amplifier.
2	GND	Ground return for all internal circuitry.
3	CS	Input current sense pin.
4	OUT	Power MOS output pin.
5	V <sub>CC</sub>	Power supply pin for all internal circuitry.
6	DMG	Zero current demagnetization sensing.

## APPLICATION INFORMATION

### Function Description

TS19705 is constant current control IC with active power factor correction isolated or non-isolated AC-DC LED lighting control. The TS19705 is configurable as an isolated, primary-side-regulated Flyback controller or non-isolated Buck-Boost converter for LED lighting applications. The controller is Boundary Conduction Mode (BCM) operation with constant on time based regulator design to achieve high power factor performance.

The TS19705 has built-in  $V_{CC}$  over voltage protection, open LED protection, short LED protection, over temperature protection, primary side current limit and gate clamp functions.

The average output current can be expressed as below.

$$I_{O\_avg} = \frac{N_P}{N_S} \times \frac{0.333 * \eta}{2 * R_S}$$

Where :

- $I_{O\_avg}$  is the average output current
- $N_P$  is the primary-side turn ratio
- $N_S$  is the secondary-side turn ratio
- $R_S$  is the sensing resistor connected between the MOSFET source and the GND

### Pin Detail

#### **Compensation**

This is the output of the  $g_m$  amplifier. Connect with a suitable RC network to ground.

#### **Ground**

GND is the reference node of internal circuit.

#### **Current Sense**

MOSFET current signal sensing for multiplication and current limit setting function.

$$I_{CS(LIMIT)} = \frac{1.25}{R_S}$$

Where :

- $I_{CS}$  is the input current sense
- $R_S$  is the sensing resistor connected between the MOSFET source and GND

#### **Output**

Gate drive for external MOSFET switch and is built-in gate clamp function.

#### **$V_{CC}$**

Power supply for the controller during normal operation. The controller will start up when  $V_{CC}$  reaches 18V (typical) and will shut-down when  $V_{CC}$  voltage is below 9.5V (typical). A decoupling capacitor should be connected between the  $V_{CC}$  and GND pin as close as possible.

The TS19705 performs  $V_{CC}$  over voltage protection though  $V_{CC}$  pin. Once  $V_{CC}$  pin exceeds in 32V, TS19705 turns off and latches out the MOSFET switcher until  $V_{CC}$  goes below  $V_{CC\_OFF}$ .

**APPLICATION INFORMATION (Continue)**

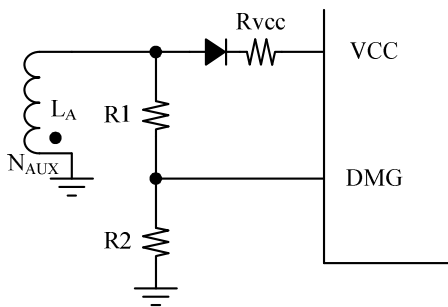
**Pin Detail**

**DMG**

The Output voltage is reflected by the auxiliary winding ( $N_{AUX}$ ) voltage of Flyback transformer, the DMG pin can sense output information to depart from start up voltage ( $V_{O\_STR}$ ) and protection voltage ( $V_{O\_OVP}$ ).

When DMG sense voltage under  $V_{O\_STR}$ , the circuit will work on short circuit protection,  $f_{STR}=1/t_{STR}$ .

When DMG sense voltage over  $V_{O\_OVP}$ , the circuit will work on over voltage protection, it will latches out until  $V_{CC}$  goes below  $V_{CC\_OFF}$ .



$$V_{O\_OVP} = \frac{N_{SEC}}{N_{AUX}} \times V_{OVPS} \times \frac{R1+R2}{R2}$$

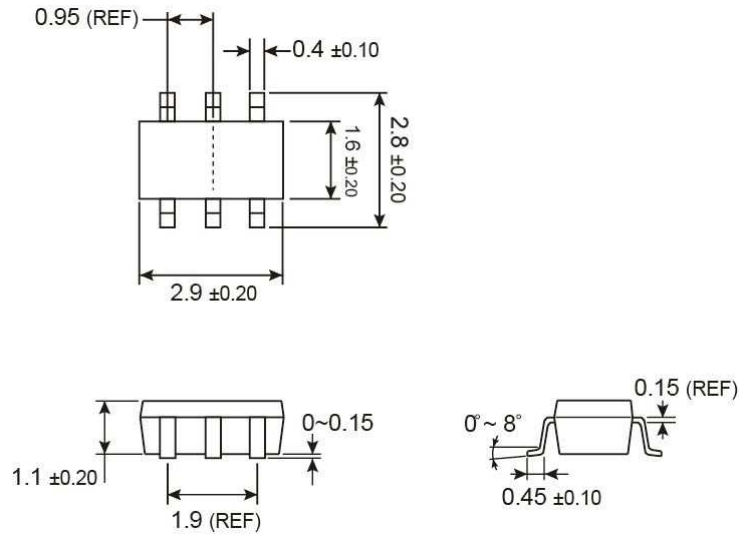
$$V_{O\_STR} = \frac{N_{SEC}}{N_{AUX}} \times 3 \times \frac{R1+R2}{R2}$$

Where :

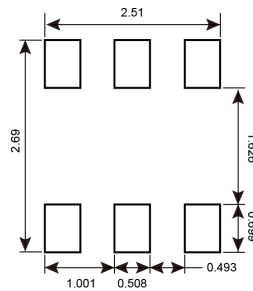
- $V_{OUT\_OVP}$  is the output-over-voltage protection point
- $V_{OVPS}$  is the over voltage protection signal
- $V_{O\_STR}$  is the start-up timer
- $N_{AUX}$  is the number of auxiliary-winding turns
- $N_{SEC}$  is the number of secondary-winding turns

**PACKAGE OUTLINE DIMENSIONS** (Unit: Millimeters)

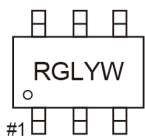
**SOT-26**



**SUGGESTED PAD LAYOUT** (Unit: Millimeters)



**MARKING DIAGRAM**



- RG** = Device code
- L** = Lot Code A~Z
- Y** = Year Code  
(F=2016, G=2017, H=2018, J=2019, K=2020)
- W** = Week Code  
A~Z = wk1~wk26  
A~Z = wk27~wk52



## Notice

Specifications of the products displayed herein are subject to change without notice. TSC or anyone on its behalf, assumes no responsibility or liability for any errors or inaccuracies.

Information contained herein is intended to provide a product description only. No license, express or implied, to any intellectual property rights is granted by this document. Except as provided in TSC's terms and conditions of sale for such products, TSC assumes no liability whatsoever, and disclaims any express or implied warranty, relating to sale and/or use of TSC products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright, or other intellectual property right.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications. Customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify TSC for any damages resulting from such improper use or sale.