TS19705

Single-Stage PFC
Primary-Side-Regulation LED Driver

SOT-26



Pin Definition:
1. Compensation
2. Ground
3. Current Sense
4. Output
5. V_{CC}
6. DMG

Description

TS19705 is a primary-side-regulation with Fly-back control IC with active power factor correction function 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 <±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 <±3%
- Low BOM Cost
- Primary-side feedback control
- Application Voltage Range: 90~ 264V_{AC}
- Transition-mode PFC operating
- Built-in Active Power Factor Correction
- Constant Output Current Control
- 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

Applications

- E27, T5, T8 LED lighting
- Bulb
- Down Light
- LED Lighting Applications

Ordering Information

Part No.	Package	Packing
TS19705CX6 RFG	SOT-26	3kpcs / 7” Reel

Note: “G” denote for Halogen Free Product

Absolute Maximum Ratings (T_A = 25°C unless otherwise noted)

Parameter	Symbol	Range	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	°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Power Dissipation @T_A=25 °C	P_D	0.3	W
Thermal Resistance Junction to Ambient (Note 2)	$R\theta_{JA}$	220	°C/W
Thermal Resistance Junction to Case	$R\theta_{JC}$	106.6	°C/W
ESD Rating (Human Body Model)	ESD	2	kV

Recommended Operating Conditions

Parameter	Symbol	Conditions	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	°C
Operating Ambient Temperature Range	T_{OPA}	-40 to +85	°C

Electrical Characteristics (V_{CC}=15 , T_A=25℃, unless otherwise specified)

Parameter	Symbol	Condition	Min	Typ	Max	Unit
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}=17V, @ V_{CC} off	--	30	50	μA
Quiescent current 2	I_{Q2}	Start-up @ 4.5kHz	--	600	800	μA
Operation supply current	I_{CC}		--	2.5	3..0	mA
Protection						
VCC 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
Oscillator						
Start-up timer	t_{STR}		--	220	--	μs
GM Amplifier						
Transconductance	g_m		--	60	--	μA/V
Source current	I_{COMP_SOU}		--	20	--	μA
Driver						
Dropout voltage	V_{OH}	V_{CC}=33V, I_O = 10mA	--	1.2	1.5	V
	V_{OL}	V_{CC}=33V, I_O = -10mA	--	0.12	--	V
Rising time	t_r	V_{CC}=20V, C_O =1nF	--	40	--	ns
Falling time	t_f	V_{CC}=20V, C_O =1nF	--	80	--	ns
Output clamp voltage	V_{O_CLAMP}		--	--	19	V
Leading edge blanking time	LEB_t		--	0.5	--	ns

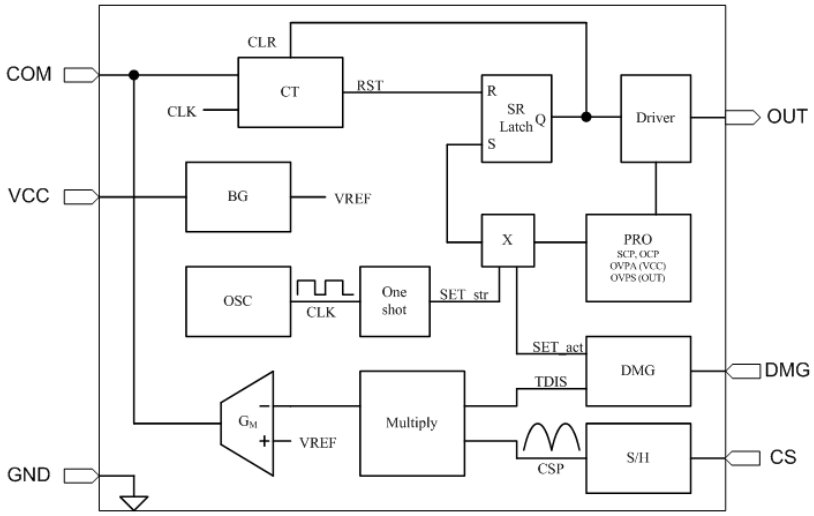
Note:

1. Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device.

2. Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at T_A=25°C.

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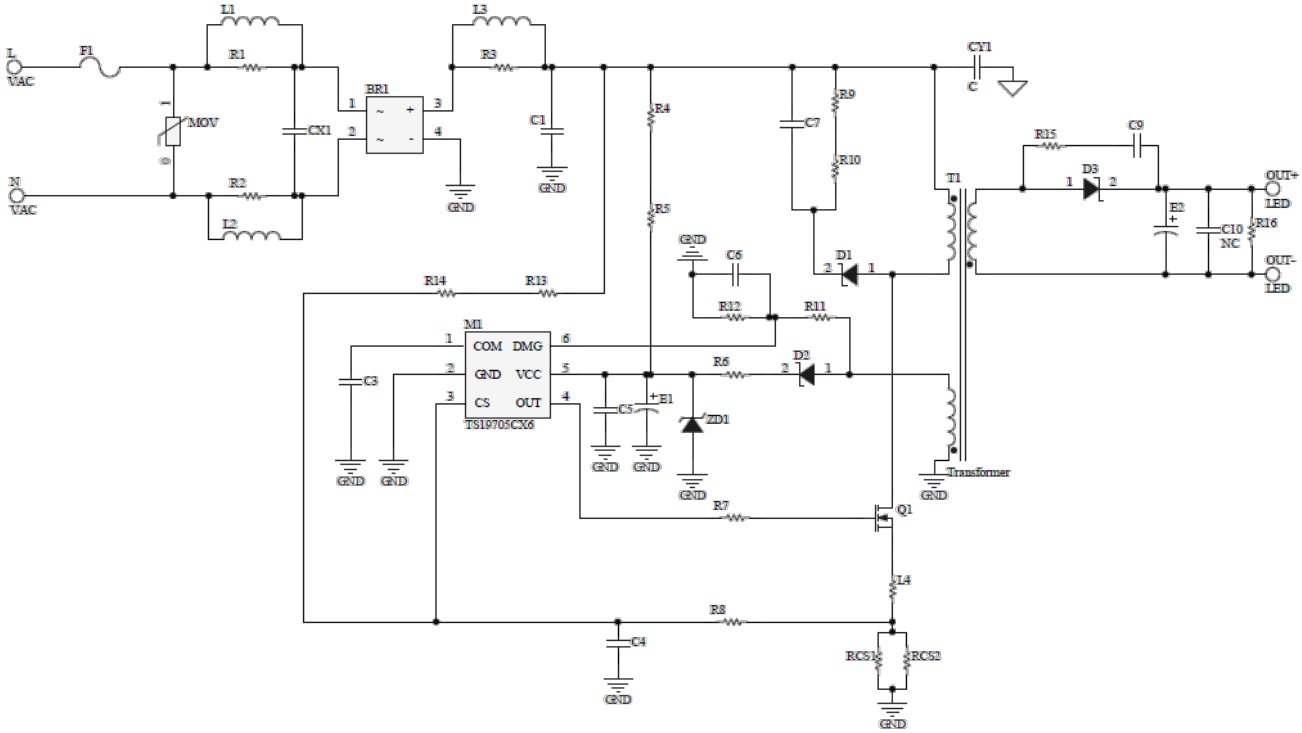
Function Block



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_{CC}	Power supply pin for all internal circuitry.
6	DMG	Zero current demagnetization sensing.

Typical Application Circuit



Application Information

Function Description

The TS19705 is a constant current Fly-back controller with primary side control and PFC function 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.

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

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 sence
- 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 latchs out the MOSFET switcher until V_{CC} goes below V_{CC_OFF}.

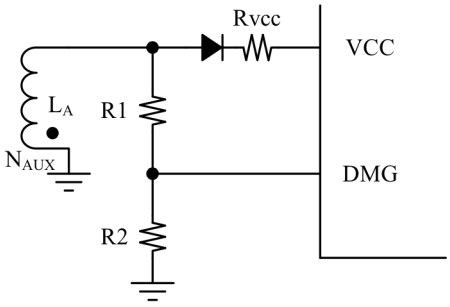
Application Information (Continue)

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 latchs out until V_{CC} goes below V_{CC_OFF}.



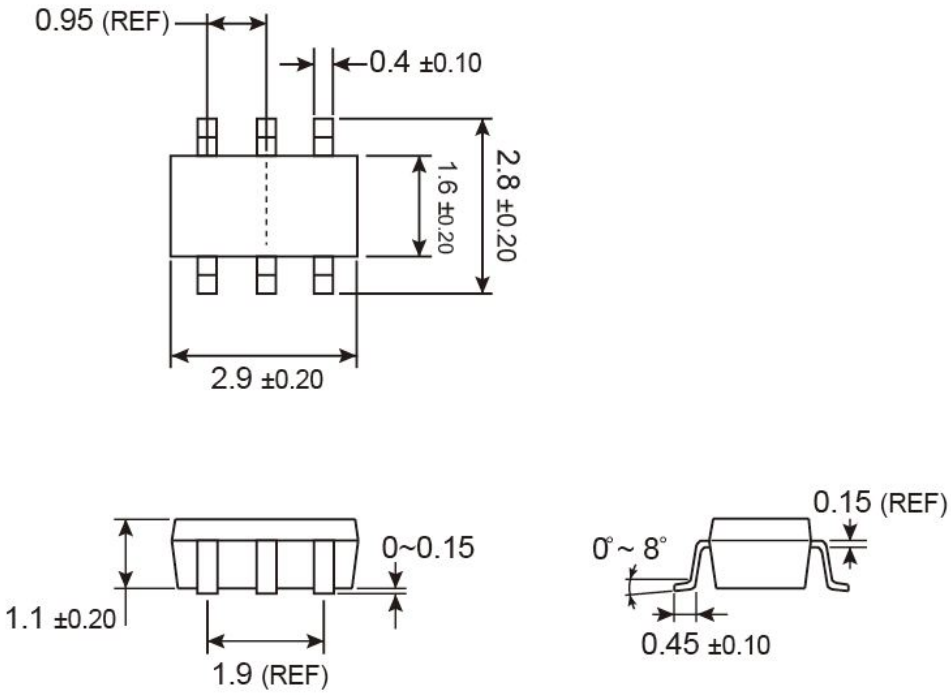
$$V_{O_OVP} = \frac{N_{SEC}}{N_{AUX}} \times V_{OVPS} \times \frac{R_1+R_2}{R_2}$$

$$V_{O_STR} = \frac{N_{SEC}}{N_{AUX}} \times 3 \times \frac{R_1+R_2}{R_2}$$

Where :

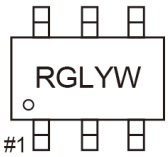
- V_{OUT_OVP} is the output-over-voltage protection point
- V_{OVPS} is the over voltage protection signal
- V_{O_STR} is the start-up timer
- N_{AUX} is the number of auxiliary-winding turns
- N_{SEC} is the number of secondary-winding turns

SOT-26 Mechanical Drawing



Unit: Millimeters

Marking Diagram



RG = Device Code
L = Lot Code A~Z
Y = Year Code
(**D**=2014, **E**=2015, **F**=2016, **G**=2017, **H**=2018, **J**=2019, **K**=2020)
W = Week Code
A~Z = wk1~wk26
A~Z = wk27~wk52

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