



SOP-8



#### Pin Definition:

1. RT 8. VINT 2. DMG 7. COMP 3. VCC 6. GND 4. OUT 5. CS

### **Description**

The TS19704 is a Primary-Side Control IC, high efficiency and simpler design with active power factor correction especially for LED lighting applications. The IC achieves high power factor and low THD operation by Discontinuous Conduction Mode (DCM) and constant on time. Precise constant current control regulates about ±3% accurate versus changes in input voltage and output voltage. TS19704 also provides gate driving voltage clamping, Vcc overvoltage protection and system output open/short circuit protection to increase device performance.

### **Features**

- Primary-side feedback control
- Application voltage range: 80V<sub>AC</sub> ~ 308V<sub>AC</sub>
- Built-in Active Power Factor Correction
- Constant Output Current Control
- DCM Constant On-Time topology
- Good Line and Load Regulation
- Open-LED Protection on DMG pin
- Over-Voltage Protection on VCC pin
- Short-LED Protection
- Cycle by Cycle Over current Protection on CS pin
- Over-Temperature Protection
- Programmable switching frequency by RT Pin
- Gate Driving Voltage Clamping

#### **Application**

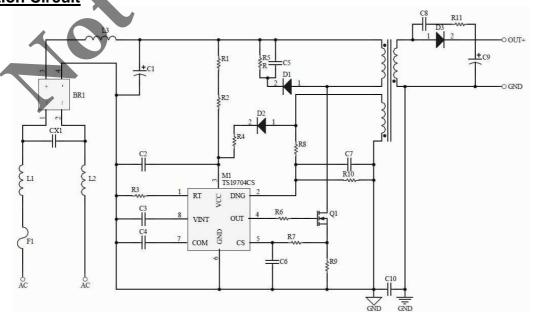
- LED Down Light
- LED Tube
- LED PAR Lamp
- LED Bulb

### **Ordering Information**

Part No.	Package	Packing		
TS19704CS RLG	SOP-8	2.5Kpcs / 13" Reel		

Note: "G" denote for Halogen Free Product

### **Application Circuit**







**Absolute Maximum Rating** (Ta = 25°C unless otherwise noted)

Parameter	Symbol	Range	Unit
Power supply pin	$V_{DD}$	40	V
DMG voltage to GND	$V_{DMG}$	-0.3 to 40	V
OUT voltage to GND	V <sub>OUT</sub>	-0.3 to 40	V
RT voltage to GND	V <sub>RT</sub>	-0.3 to 5	V
CS voltage to GND	V <sub>CS</sub>	-0.3 to 5	V
COM voltage to GND	V <sub>COM</sub>	-0.3 to 5	V
VINT voltage to GND	$V_{VINT}$	-0.3 to 5	V
Operating junction temperature rang	TJ	-40 to + 125	°C
Operating ambient temperature rang	T <sub>OPA</sub>	-40 to +85	°C
Storage temperature rang	T <sub>STG</sub>	-65 to +150	°C
Lead temperature (Soldering 5 sec)	T <sub>LEAD</sub>	260	°C
Power dissipation @TA=25 °C	Pp	0.4	W
Thermal resistance junction to ambient	$\theta_{JA}$	160	°C/W
ESD rating (Human body mode)	V <sub>ESD</sub>	2	kV

## **Electrical Characteristics** ( $V_{CC}$ =15 , $T_A$ =25 $^{\circ}$ C , unless otherwise specified.)

Parameter	Symbol	Condition	Min	Тур	Max	Unit
Turn-on voltage	V <sub>CC_ON</sub>		17.2	18.2	19.2	V
Turn-off voltage	V <sub>CC_OFF</sub>		9.5	10	10.5	V
Quiescent current	la			25	35	uA
Normal current consumption	lcc			1	2	mA
PROTECTION	PROTECTION					
VCC voltage protection	V <sub>OVPA</sub>		31	32	33	V
Output voltage protection	V <sub>OVPS</sub>		10	10.5	11	V
CS limit voltage	V <sub>OCPH</sub>		1.2	1.25	1.3	V
CS limit voltage(Short Circuit)	V <sub>OCPL</sub>		0.3	0.33	0.36	V
OSCILLATOR						
Start up timer	T <sub>STR</sub>	R <sub>RT</sub> =50Kohm		240		us
Switch timer(with jitter)	Ts	R <sub>RT</sub> =50Kohm		24		us
MULTIPLY						
Multiply gain	K <sub>P</sub>			12.5		V
ERROR AMPLIFIER						
Transconductance	$G_{M}$		84	120	156	umho
Reference voltage	$V_{REF}$		2.475	2.5	2.525	V
Maximum sink current	I <sub>COM_SINK</sub>			55		uA
Maximum source current	I <sub>COM_SOUR</sub>			55		uA

2/7 Version: E13



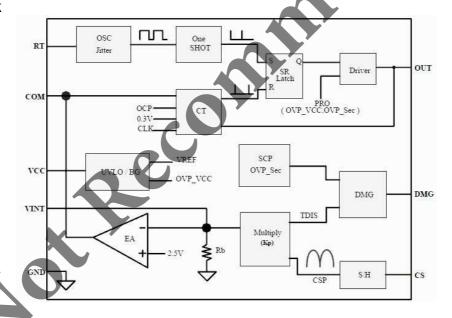


**Electrical Characteristics** (V<sub>CC</sub>=15 , T<sub>A</sub>=25°C , unless otherwise specified.)

Parameter	Symbol	Condition	Min	Тур	Max	Unit
DRIVER						
Rising time	T <sub>RISE</sub>	V <sub>CC</sub> =20V, C <sub>O</sub> =0.1nF		100		ns
Falling time	T <sub>FAIL</sub>	V <sub>CC</sub> =20V, C <sub>O</sub> =0.1nF		40		ns
Output clamp voltage	$V_{O\_CLAMP}$				16.5	V

- **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.
- **Note 2:** Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at TA=25°C.
- Note 3: TRISE and TFAIL are guarantee by design.
- Note 4: Devices are ESD sensitive. Handing precaution recommended.
- Note 5: The device is not guaranteed to function outside its operating conditions

#### **Function Block**



#### Pin Description

Pin No.	Name	Function		
1	RT	Frequency setting.		
2	DMG	Zero current demagnetization sensing.		
3	VCC	Power supply pin for all internal circuit.		
4	OUT	Power MOS output pin.		
5	CS	Input current sense pin.		
6	GND	Ground return for all internal circuitry.		
7	COM	Output pin of error amplifier.		
8	VINT	Integration output current signal pin.		





#### **Application Information**

#### **Function Description**

The TS19704 is a constant current Flyback controller with primary side control and PFC function for LED lighting applications. Which controller is DCM operation with constant on time based regulator design. In other to achieve high power factor and good EMI performance. This control algorithm fix I<sub>CS PK</sub> in wide range variation of Line voltage. We can design transformer critically by I<sub>CS(Limit)</sub> function. The TS19704 are built-in functions of VCC over voltage protection, open LED protection, short LED protection, over temperature protection, and primary side current limit, and gate clamp within. The TS19704 sense switch current from CS voltage Multiplier by TDIS to close provide the integral result(VINT). The avarge VINT is finally 2.5V(Vref) by the system close loop feedback. The avarge output current can express as below.

$$Io_{avg} = \frac{N_P}{N_S} \times \frac{2.5}{2 \times K_P \times R_S}$$

### **Pin Detail Description**

#### RT

Switch timer(Ts) and Start up timer(Tstr) setup Tstr = 10Ts:

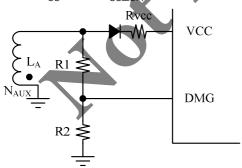
$$T_{S(\mu S)} = \frac{R_T}{2250}$$

$$T_{STR(\mu S)} = \frac{R_T}{225}$$

#### **DMG**

The Output voltage is reflected by the auxiliary winding(NAUX) 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 VO STR, the circuit will work on short circuit protection, FSTR=1/Tstr, V<sub>CS</sub>\_PK=0.35V, When DMG sense voltage over V<sub>O\_OVP</sub>, the circuit will work on over voltage protection, it will latch out off until  $V_{CC}$  under  $V_{CC\_OFF}$ 



$$V_{O\_STR} = \frac{N_S}{N_A} \times 3 \times \frac{R_I + R_2}{R_2}$$

$$V_{O\_OVP} = \frac{N_S}{N_A} \times V_{OVPS} \times \frac{R_I + R_2}{R_2}$$





### **Pin Detail Description (Continue)**

#### **VCC**

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 TS19704 perform  $V_{CC}$  over voltage protection though  $V_{CC}$  pin. Once  $V_{CC}$  pin exceed in 32V, TS19704 turns off and latch out the MOSFET switcher until  $V_{CC}$  under  $V_{CC}$  or under  $V_{CC}$  pin.

#### OUT

Gate drive for external MOSFET switch. Gate clamp function within.

#### <u>CS</u>

MOSFET current signal sensing for Multiply(K<sub>P</sub>)

$$I_{CS(Limit)} = \frac{1.25}{Rs}$$

#### **GND**

GND is the reference node of internal circuit.

#### COM

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

### **VINT**

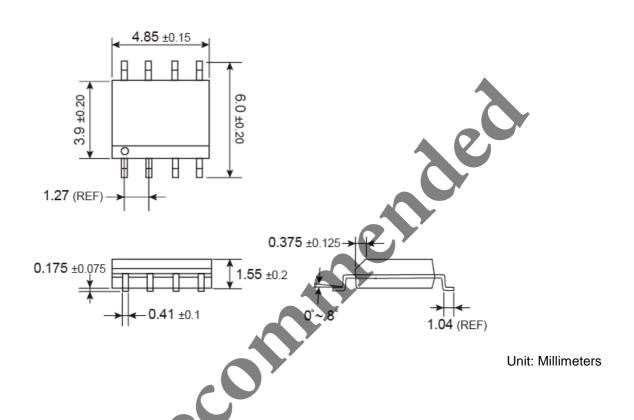
The VINT pin connect with a suitable Capacitor to ground. It saved the integral result of the VCS Multiplier by TDIS,



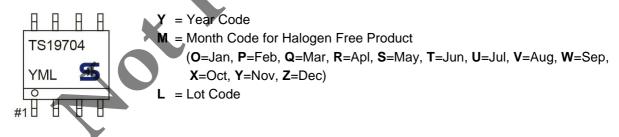




## **SOP-8 Mechanical Drawing**

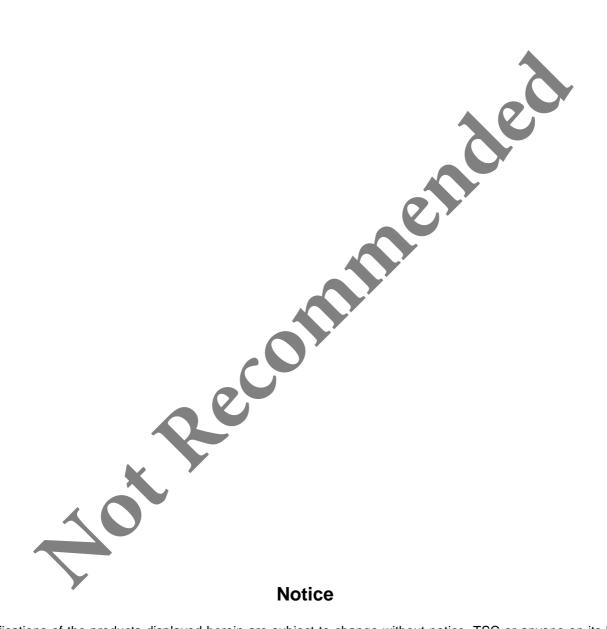


## **Marking Diagram**









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