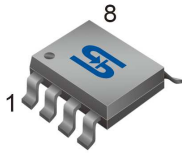


SOP-8



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 $\pm 3\%$ 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
- Universal Input Voltage from 90VAC ~ 264VAC
- 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

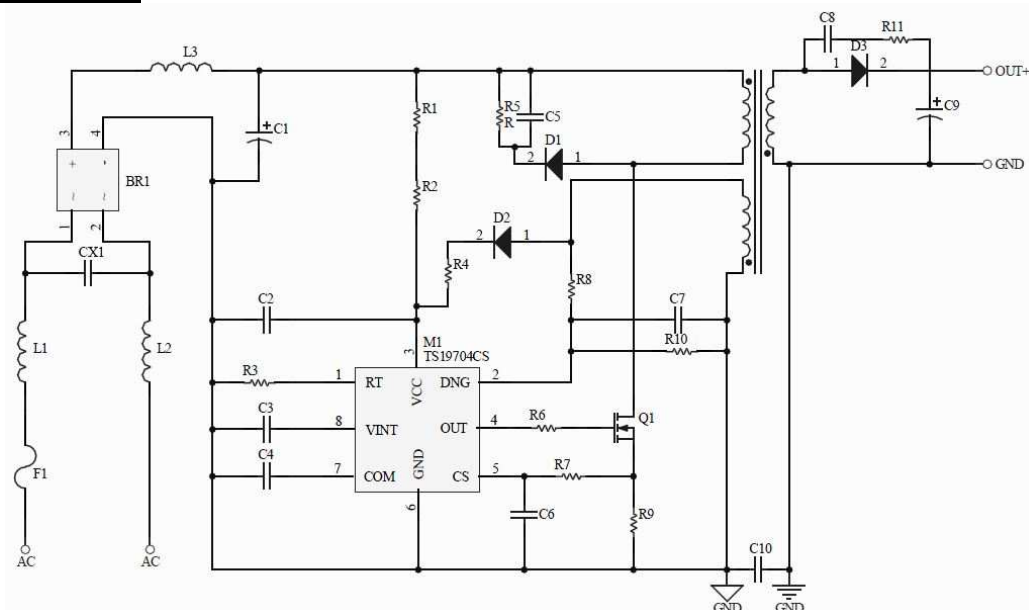
- LED Down Light
- LED Tube
- LED PAR Lamp
- LED Bulb

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 (T_a = 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 _{OUT}	-0.3 to 40	V
RT voltage to GND	V _{RT}	-0.3 to 5	V
CS voltage to GND	V _{CS}	-0.3 to 5	V
COM voltage to GND	V _{COM}	-0.3 to 5	V
VINT voltage to GND	V _{VINT}	-0.3 to 5	V
Operating junction temperature rang	T _J	-40 to + 125	°C
Operating ambient temperature rang	T _{OPA}	-40 to +85	°C
Storage temperature rang	T _{STG}	-65 to +150	°C
Lead temperature (Soldering 5 sec)	T _{LEAD}	260	°C
Power dissipation @T _A =25 °C	P _D	0.4	W
Thermal resistance junction to ambient	θ _{JA}	160	°C/W
ESD rating (Human body mode)	V _{ESD}	2	kV

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
Turn-on voltage	V _{CC_ON}		17.2	18.2	19.2	V
Turn-off voltage	V _{CC_OFF}		9.5	10	10.5	V
Quiescent current	I _Q		--	25	35	uA
Normal current consumption	I _{CC}		--	1	2	mA
PROTECTION						
VCC voltage protection	V _{OVPV}		31	32	33	V
Output voltage protection	V _{OVP}		10	10.5	11	V
CS limit voltage	V _{OCPH}		1.2	1.25	1.3	V
CS limit voltage(Short Circuit)	V _{OCP}		0.3	0.33	0.36	V
OSCILLATOR						
Start up timer	T _{STR}	R _{RT} =50Kohm	--	240	--	us
Switch timer(with jitter)	T _S	R _{RT} =50Kohm	--	24	--	us
MULTIPLY						
Multiply gain	K _P		--	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 _{COM_SINK}		--	55	--	uA
Maximum source current	I _{COM_SOUR}		--	55	--	uA

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

Parameter	Symbol	Condition	Min	Typ	Max	Unit
DRIVER						
Rising time	T_{RISE}	$V_{CC}=20V, C_O = 0.1nF$	--	100	--	ns
Falling time	T_{FAIL}	$V_{CC}=20V, C_O = 0.1nF$	--	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.

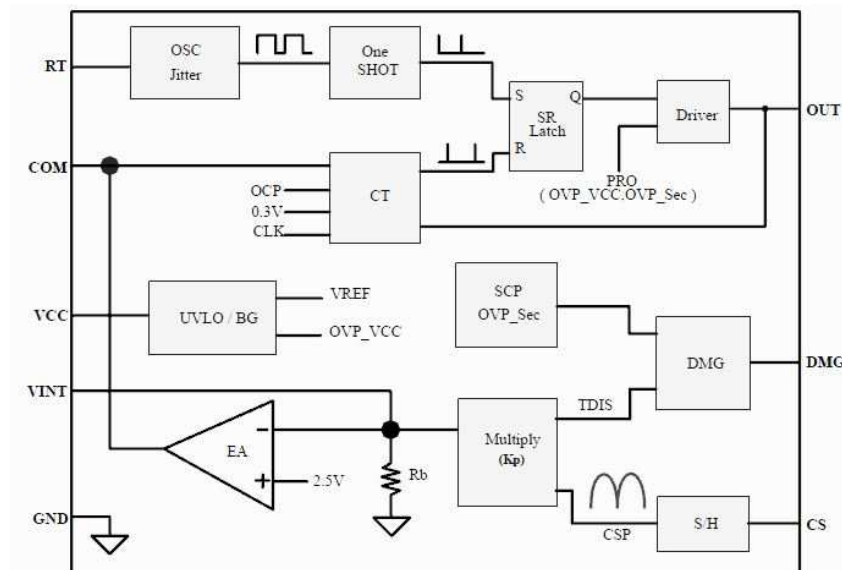
Note 2: Thermal Resistance is specified with the component mounted on a low effective thermal conductivity test board in free air at $T_A=25^\circ C$.

Note 3: T_{RISE} and T_{FAIL} are guarantee by design.

Note 4: Devices are ESD sensitive. Handling 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_{CS_PK} in wide range variation of Line voltage. We can design transformer critically by $I_{CS(Limit)}$ 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 provide the integral result(VINT). The average VINT is finally 2.5V(Vref) by the system close loop feedback. The average output current can express as below.

$$I_{O_avg} = \frac{N_P}{N_S} \times \frac{2.5}{2 \times K_P \times R_S}$$

Pin Detail Description

RT

Switch timer(T_s) and Start up timer(T_{str}) setup $T_{str} = 10T_s$:

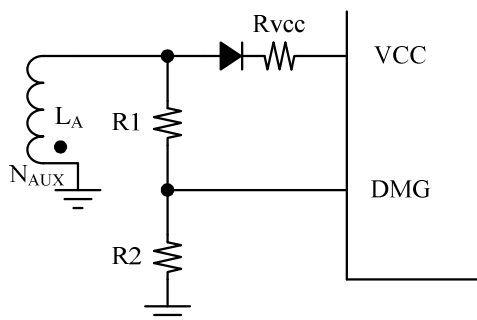
$$T_{S(\mu s)} = \frac{R_T}{2250}$$

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

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 V_{O_STR} , the circuit will work on short circuit protection, $FSTR=1/T_{str}$, $V_{CS_PK}=0.35V$, When DMG sense voltage over V_{O_OVP} , the circuit will work on over voltage protection, it will latch out off until V_{CC} under V_{CC_OFF} .



$$V_{O_STR} = \frac{N_S}{N_A} \times 3 \times \frac{R_1 + R_2}{R_2}$$

$$V_{O_OVP} = \frac{N_S}{N_A} \times V_{OVPS} \times \frac{R_1 + R_2}{R_2}$$

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_OFF} .

OUT

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

CS

MOSFET current signal sensing for Multiply(K_P)

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

GND

GND is the reference node of internal circuit.

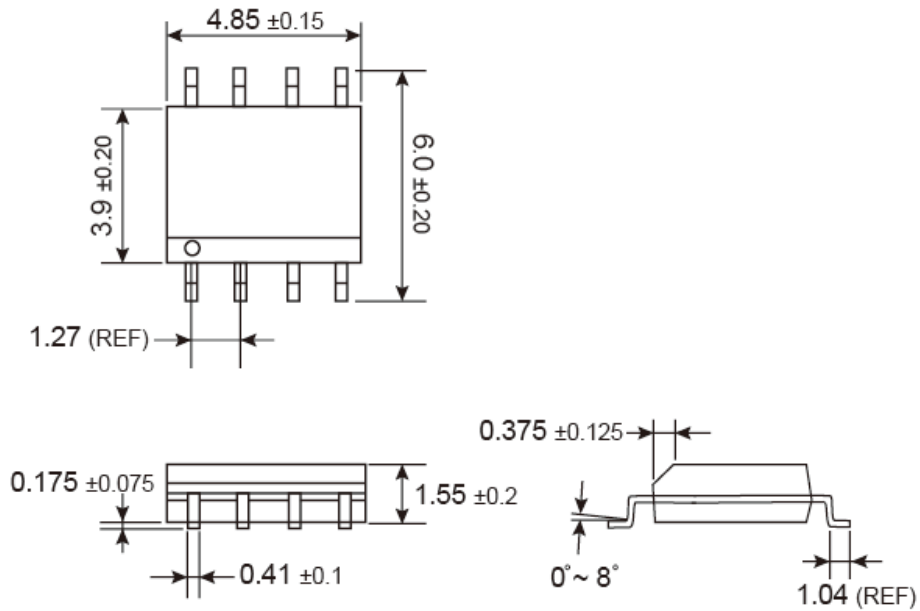
COM

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

VINT

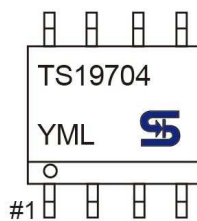
The VINT pin connect with a suitable Capacitor to ground. It saved the integral result of the VCS Multiplier by TDIS,

SOT-8 Mechanical Drawing



Unit: Millimeters

Marking Diagram



- Y** = Year Code
- M** = Month Code for Halogen Free Product
(O=Jan, P=Feb, Q=Mar, R=Apl, S=May, T=Jun, U=Jul, V=Aug, W=Sep, X=Oct, Y=Nov, Z=Dec)
- L** = Lot Code

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