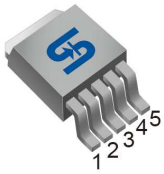
TS19601

700mA High Voltage Adjustable Current Regulator With Enable Control

TO-252-5L (PPAK)



Pin Definition:
1. VIN
2. ISET
3. GND
4. EN
5. OUT

General Description

The TS19601 is a high voltage, low dropout current regulator of maximum output current up to 700mA. The output current is decided by an external resistor, and the output sink current could be disabled via OE pin. TS19601 internally also build-in thermal protection to prevent the chip over heat damage.

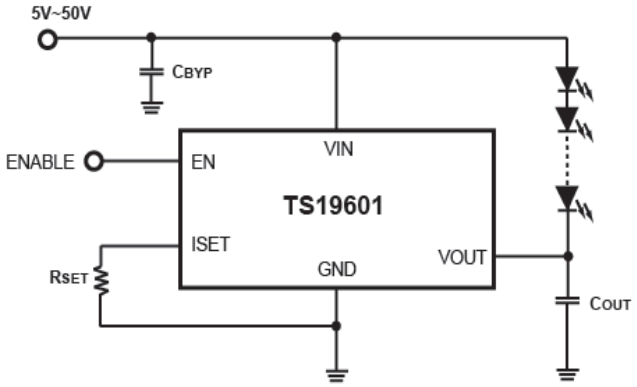
Features

- 0.5V V_{DROP} @ 700mA
- 700mA Maximum Output Current
- Output Current Controlled by External Resistor
- 3μs Fast Response Output Stage Enable Control
- Output Sustaining Voltage up to 75V
- Wide Supply Voltage Range: 5~50V

Applications

- High Power LED Driver
- RGB Full Color Power LED Driver
- LCD Monitor/TV LED Backlight Driver
- LED Table Lamp

Typical Application Circuit



Ordering Information

Part No.	Package	Packing
TS19601CP5 RO	TO-252-5L	2.5Kpcs / 13” Reel

Absolute Maximum Rating

Parameter	Symbol	Value	Unit
Input Voltage	V_{IN}	55	V
Output Sustaining Voltage	V_{DSN}	75	V
Output Sink Current	I_{OUT}	700	mA
Output Enable Voltage	V_{EN}	13.2	V
Operating Junction Temperature Range	T_{OPR}	+150	ºC
Storage Temperature Range	T_{STG}	-55 ~ +150	ºC
Thermal Resistance Junction to Air	θ_{JA}	80	ºC/W

Recommend Operating Conditions

Parameter	Symbol	Min	Typ	Max	Unit
Input Voltage	V_{IN}	5	--	50	V
Output Enable Voltage	V_{EN}	--	--	12	V
Output Sink Current	T_{OPR}	100	--	700	mA
Operating Free-Air Temperature Range	T_{STG}	-40	--	+85	ºC

Electrical Specification (V_{IN}=24V, T_A=25°C, unless otherwise specified.)

Parameter	Conditions	Min	Typ	Max	Unit
Output Current	V_{OUT} =0.5V, R_{SET}=3kΩ	--	200	--	mA
	V_{OUT} =0.5V, R_{SET}=1.71kΩ	--	350	--	
	V_{OUT} =0.5V, R_{SET}=1kΩ	--	600	--	
Output Current Deviation	V_{OUT} =0.5V, I_{OUT} =350mA~600mA	--	--	±5	%
SET Current Range		200	--	1400	μA
Minimum Output Current	I_{SET}=200μA	--	100	--	mA
Maximum Output Current	I_{SET}=1400μA	--	700	--	mA
Output Dropout Voltage	I_{SET}=1000μA (Note 1)	--	0.35	--	V
Load Regulation	V_{OUT} =0.5V to 3V, I_{OUT} =350mA	--	--	3	mA/V
Line Regulation	V_{OUT} =0.5V, I_{OUT} =350mA, V_{IN}=5~50V	--	0.08	0.15	%/V
Enable Low Input Voltage		0	--	0.8	V
Enable High Input Voltage	Should lower than VIN	2	--	12	V
Enable Low Input Current		-20	--	+20	μA
Enable High Input Current		-5	--	+5	μA
Output Enable Delay Time	EN from low to high. V_{OUT}=0.5V, I_{OUT}=350mA, Duty 50%	--	3	--	μS
Output Disable Delay Time	EN from high to low. V_{OUT}=0.5V, I_{OUT}=350mA, Duty 50%	--	3	--	μS
Supply Current Consumption		--	--	5	mA

Note 1: Output Dropout Voltage: Duty 90% x I_{OUT} @ V_{OUT}=0.5V

Pin Function Description

Pin Number	Pin Name	Pin Function
1	VIN	Power Supply Pin
2	ISET	Output Current Setting pin. Connect a resistor from ISET to GND to set the LED bias current. I_{SET}=1.2V/R_{SET}
3	GND	Ground Pin
4	EN	Output Stage Enable Control pin. High enable the output pin. It can be left floating for normally on.
5	OUT	Output pin. Sink current is decided by the current on R_{SET} connected to I_{SET} pin. I_{OUT}=500 x I_{SET}=500 x 1.2V/R_{SET}

Electrical Characteristics Curve

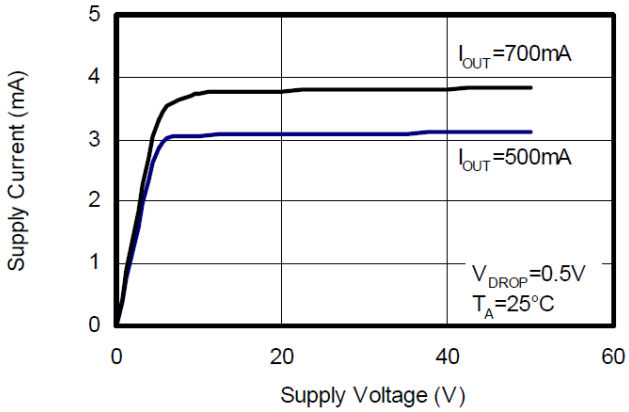


Figure 1. Supply Current vs. Supply Voltage

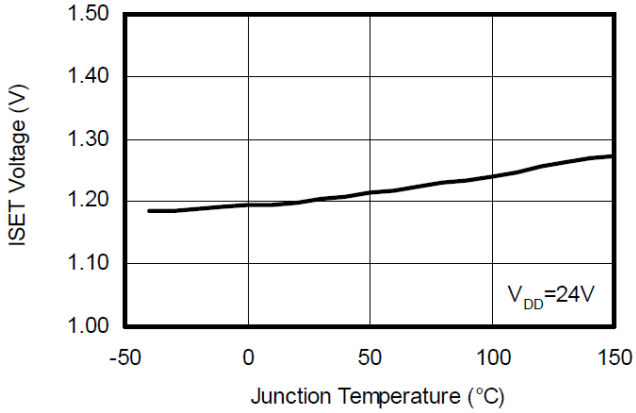


Figure 2. ISET Voltage vs. Junction Temperature

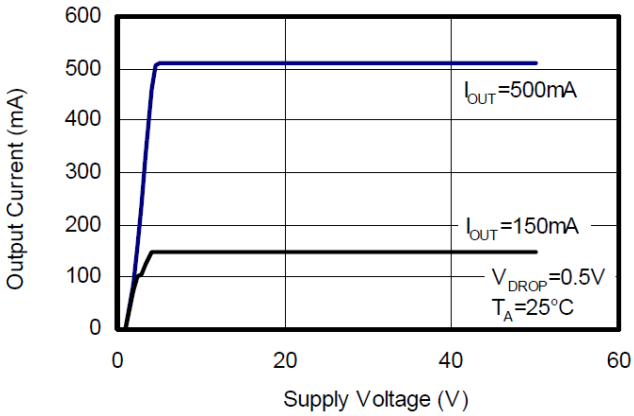


Figure 3. Output Current vs. Supply Voltage

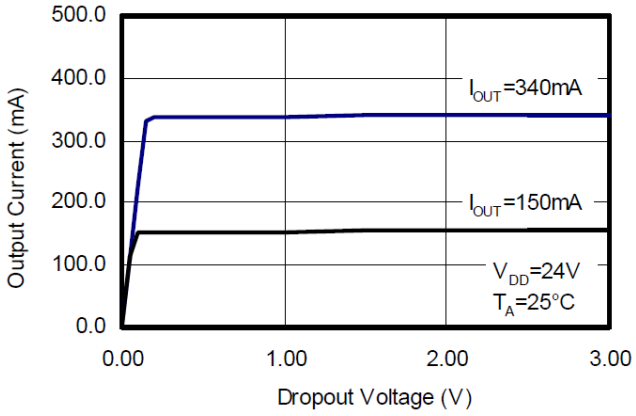


Figure 4. Output Current vs. Dropout Voltage

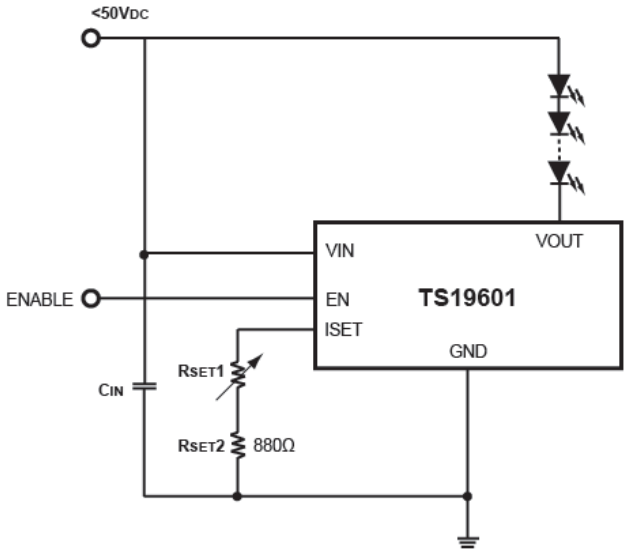
Application Information

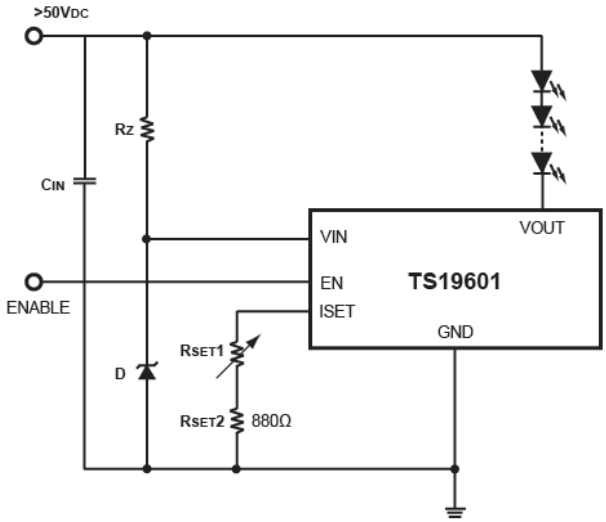
TS19601 is a high voltage, low dropout current regulator for maximum output current up to 700mA with OE pin control. The current could be linearly adjusted through variable resister connected to ISET pin, or by PWM control via OE pin. Although the absolute maximum rating of OUT pin 75V, the dropout voltage between OUT pin and GND pin should not be too large when current is sinking because of the thermal dissipation capability of the package.

Here are some of the typical application examples:

DC Voltage Input

Any DC voltage level between 5V to 50V could be adopted as power source VDD for typical application of TS19601 as long as VDD is larger than the total forward voltage drop of the LED string (at expecting current) by 0.35V. If 50V ~ 60V voltage level is adopted as power source to positive end of the LED string, one Zener shunt regulator could be used to provide appropriate voltage to VDD pin.

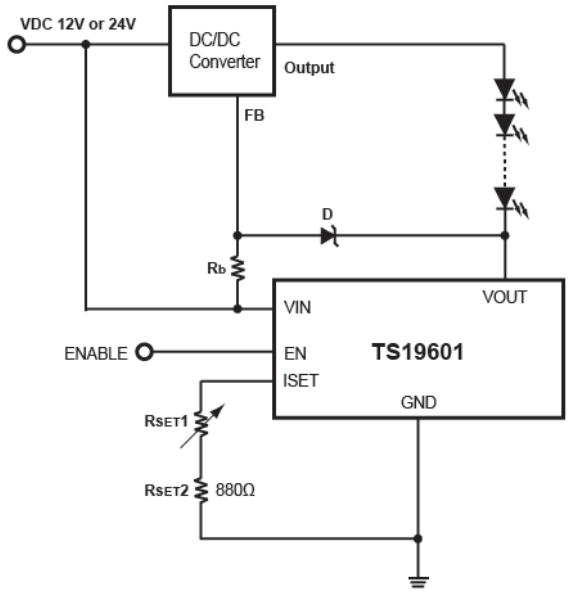




Application Information (Continue)

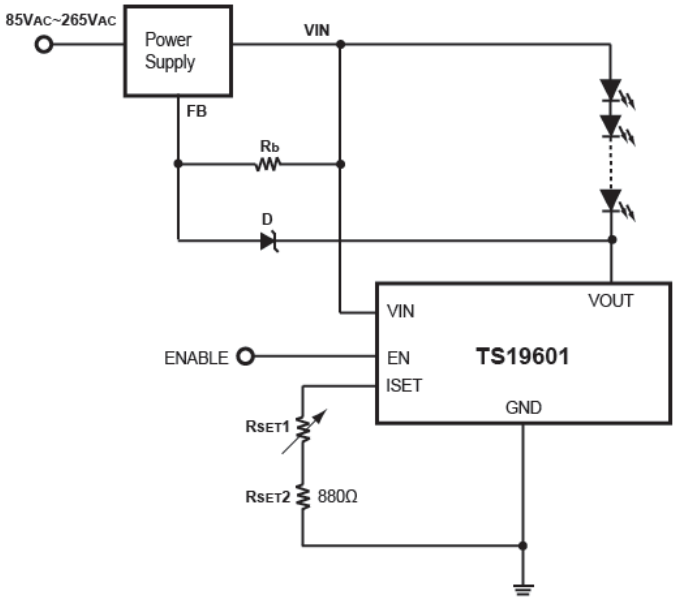
LED Backlight Solution

TS19601 could coordinate with any type of DC-to-DC converter through feedback path to realized LED backlight module. The number of LEDs in the string is variable even with certain fixed power source since the output voltage of the DC-to-DC converter could be modulated according to feedback signal.



AC Voltage Input

TS19601 could work with any kind of well-known or well-developed switch-mode power supply system. Simply cut off the internal feedback path of the power supply system and then feed the signal from TS19601 back to the power supply system instead.



Thermal Consideration Information

The Maximum Power Dissipation on Current Regulator

$P_{D(MAX)} = V_{OUT(MAX)} \times I_{OUT(NOM)} + V_{IN(MAX)} \times I_{DD}$

- $V_{OUT(MAX)}$ = the maximum voltage on output pin;
- $I_{OUT(NOM)}$ = the nominal output current;
- I_{DD} = the quiescent current the regulator consumes at $I_{OUT(NOM)}$;
- $V_{IN(MAX)}$ = the maximum input voltage.

Thermal Consideration

The TS19601 has internal power and thermal limiting circuitry designed to protect the device under overload conditions. However, maximum junction temperature ratings should not be exceeded under continuous normal load conditions. The thermal protection circuit of TS19601 prevents the device from damage due to excessive power dissipation. When the device junction temperature rises to approximately 150℃, the regulator will be turned off. When power consumption is over about 1000mW (TO-252 package, at T_A=70℃), additional heat sink is required to control the junction temperature below 125℃.

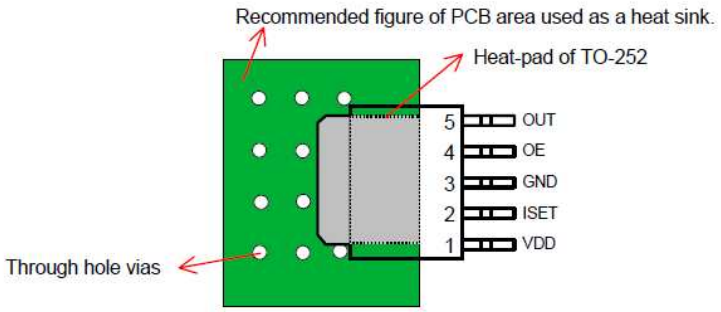
The junction temperature is:

$T_J = P_D (\theta_{JT} + \theta_{CS} + \theta_{SA}) + T_A$

- P_D : Dissipated power.
- θ_{JT}: Thermal resistance from the junction to the mounting tab of the package.
  For TO-252 package, θ_{JT} = 7.0℃/W.
- θ_{CS}: Thermal resistance through the interface between the IC and the surface on which it is mounted.
  (typically, θ_{CS} < 1.0℃ /W)
- θ_{SA}: Thermal resistance from the mounting surface to ambient (thermal resistance of the heat sink).

If PC Board copper is going to be used as a heat sink, below table can be used to determine the appropriate size of copper foil required. For multi-layered PCB, these layers can also be used as a heat sink. They can be connected with
several through-hole vias.

PCB θ_{JA} ºC/W	59	45	38	33	27	24	21
PCB heat sink size	500	1000	1500	2000	3000	4000	5000



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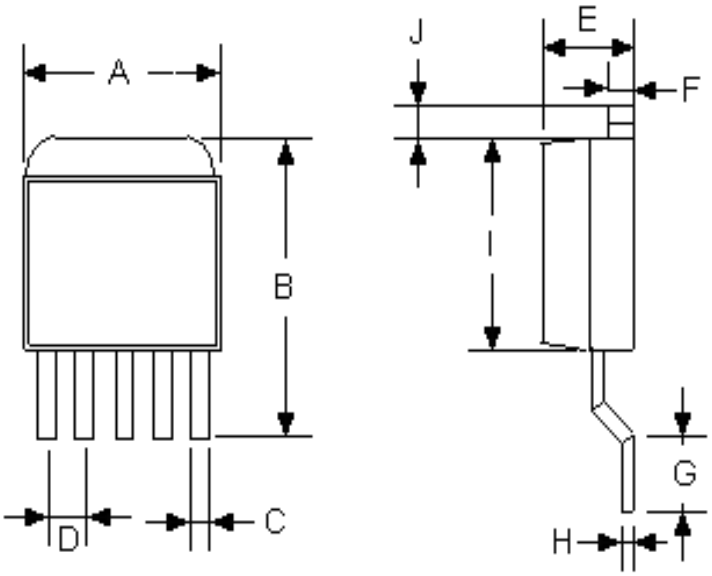
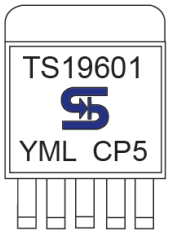
With Enable Control

TO-252-5L Mechanical Drawing



TO-252-5L DIMENSION				
DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX.
A	6.350	6.730	0.250	0.265
B	9.080	10.440	0.357	0.411
C	0.460	0.640	0.018	0.025
D	1.27BSC		0.05BSC	
E	2.19	2.380	0.086	0.094
F	0.460	0.570	0.018	0.022
G	1.400	1.780	0.055	0.070
H	0.460	0.570	0.018	0.022
I	5.34	5.550	0.210	0.219
J	1.520	2.030	0.060	0.080

Marking Diagram



Y = Year Code
M = Month Code
(**A**=Jan, **B**=Feb, **C**=Mar, **D**=Apl, **E**=May, **F**=Jun, **G**=Jul, **H**=Aug, **I**=Sep, **J**=Oct, **K**=Nov, **L**=Dec)
L = Lot Code

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