

**TS4270** 









TO-263-5L (D<sup>2</sup>PAK)



TO-252-5L (DPAK)



Pin Definition:

- 1. Input
- 2. Reset Output
- 3. Ground
- 4. Reset Delay
- 5. Output

## **General Description**

This device is a 5V low-drop fixed-voltage regulator. The maximum input voltage is 42V (65V, ≤400 ms). Up to an input voltage of 26V and for an output current up to 550mA it regulates the output voltage within a 2% accuracy. The short circuit protection limits the output current of more than 650mA. The device incorporates over voltage protection and temperature protection that disables the circuit at un-permissibly high temperatures.

#### **Features**

- Output Voltage tolerance ≤±2%
- Low-drop Voltage
- **Integrated Over Temperature Protection**
- Reverse Polarity Protection
- Input Voltage up to 42V
- Over Voltage Protection up to 65V (≤400mS)
- Short-Circuit Proof
- Suitable for use in Automotive Electronics
- Wide Temperature Range
- Adjustable Reset Time
- ESD Protection > 4KV

**Ordering Information** 

Part No.	Package	Packing
TS4270CZ550 C0	TO-220-5L	50pcs / Tube
TS4270CM550 RN	TO-263-5L	800pcs / 13" Reel
TS4270CP550 RO	TO-252-5L	2.5kpcs / 13" Reel

#### Absolute Maximum Rating (T<sub>J</sub> =-40~150°C)

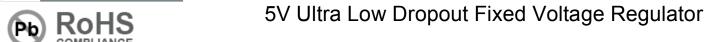
Parameter	Symbol	Limit	Unit
Input Voltage	$V_{l}$	42	V
Input Voltage (t ≤ 400mS)	$V_{l}$	65	COLV
Operating Input Voltage Range	$V_{l}$	6 to 42	V
Reset Output Voltage	$V_R$	-0.3 to 7	V
Reset Delay Voltage	$V_D$	-0.3 to 7	V
Output Voltage	Vo	-1.0 to 16	V
Ground Current	$I_{GND}$	-0.5	Α
Storage Temperature Range	$T_{ST}$	-50 to +150	°C
Junction Temperature Range	$T_J$	-40 to +150	°C

#### Thermal Information

Parameter		Symbol	Maximum	Unit
This make Denistance * ( Junction to Cose)	TO-263-5L	R⊖ <sub>JC</sub>	3	K/W
Thermal Resistance* (Junction to Case)	t <1mS	Zθ <sub>JC</sub>	2	<b>1</b>
Thermal Resistance* (Junction to Ambient)	TO-263-5L	$R\Theta_{JA}$	65	K/W



## **TS4270**



## **Electrical Specifications** (V<sub>IN</sub>=13.5V, -40°C≤ T<sub>J</sub> ≤150°C, unless otherwise noted)

Parameter	Symbol	Test Condition	Min	Тур	Max	Unit
Output Voltage	V <sub>OUT</sub>	5mA ≤I <sub>Q</sub> ≤550mA, 6V ≤V <sub>I</sub> ≤ 26V	4.90	5	5.10	V
Output Voltage	V <sub>OUT</sub>	I <sub>Q</sub> ≤300mA: 26V ≤V <sub>I</sub> ≤ 36V	4.90	5	5.10	V
Output Current Limit	I <sub>Qmax</sub>	V <sub>O</sub> =0V	650	850	1	mA
Current Consumption $(I_q = I_l - I_O)$	Iq	I <sub>O</sub> =5mA,		1	1.5	mA
Current Consumption $(I_q = I_l - I_O)$	Iq	I <sub>O</sub> =550mA,		55	75	mA
Current Consumption $(I_q = I_l - I_O)$	l <sub>q</sub>	I <sub>O</sub> =550mA, V <sub>I</sub> =5V		70	90	mA
Dropout Voltage (Note 1)	$V_{DR}$	I <sub>O</sub> =550mA		350	700	mV
Load Regulation	REG <sub>LOAD</sub>	I <sub>O</sub> = 5~550mA, V <sub>I</sub> = 6V		25	50	mV
Line Regulation	REG <sub>LINE</sub>	$I_0 = 5 \text{mA}, V_1 = 6 \sim 26 \text{V}$		12	25	mV
Power Supply Ripple Rejection	PSRR	f=100Hz, V <sub>r</sub> =0.5V <sub>SS</sub>		54	-	dB

#### **Reset Generator**

Parameter	Symbol	Test Condition	Min	Тур	Max	Unit
Switching Threshold	$V_{RT}$		4.5	4.65	4.8	V
Reset High Voltage	$V_{ROH}$		4.5	_	-	V
Reset Low Voltage (Note 2)	$V_{ROL}$	R <sub>intern</sub> =30kΩ, 1V≤ V <sub>O</sub> ≤4.5V	_	60	_	mV
Reset Low Voltage	$V_{ROL}$	$I_R$ =3mA, $V_O$ =4.4V	_	200	400	mV
Reset Pull-up	R	Internally Connected to Output	18	30	46	kΩ
Lower Reset Timing Threshold	$V_{DRL}$	$V_{O} < V_{RT}$	0.2	0.45	0.8	V
Charge Current	I <sub>d</sub>	V <sub>D</sub> =1V	8	14	25	uA
Upper Timing Threshold	$V_{DU}$		1.4	1.8	2.3	V
Delay Time	td	C <sub>D</sub> =100nF	_	13	-	ms
Reset Reaction Time	t <sub>RR</sub>	C <sub>D</sub> =100nF	_	_	3	us

## **Over Voltage Protection**

Parameter	Symbol	Test Condition	Min	Тур	Max	Unit
Turn-off Voltage	$V_{L, OV}$		42	44	46	V

#### Note:

## **Pin Definitions and Functions**

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Pin	Symbol	Function				
1	Input	Block to ground directly on the IC with ceramic capacitor				
2	Reset Output	The open collector output is connected to the 5 V output via an integrated resistor of 30 kW				
3	GND	Internally connected to heatsink				
4	Reset Delay	Connect a capacitor to ground for delay time adjustment				
5	Output	5V, block to ground with 22 mF capacitor ESR, < 3W				

<sup>1.</sup> Drop voltage =  $V_{IN}$  -  $V_{OUT}$  (measured when the output voltage has dropped 100 mV from the nominal value obtained at 13.5 V input)

<sup>2.</sup> Reset peak is always lower than 1.0 V.

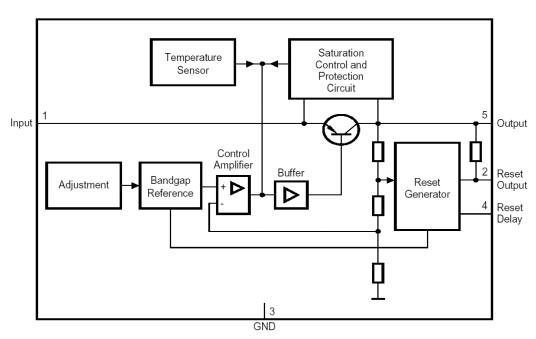


**TS4270** 

## 5V Ultra Low Dropout Fixed Voltage Regulator



#### **Block Diagram**



#### **Application Description**

The IC regulates an input voltage in the range of  $5.5 \text{V} < \text{V}_1 < 36 \text{V}$  to  $\text{V}_{\text{Onom}} = 5.0 \text{V}$  Up to 26V it produces a regulated output current of more than 550mA. Above 26V the save-operating-area protection allows operation up to 36V with a regulated output current of more than 300mA. Over voltage protection limits operation at 42V. The over voltage protection hysteresis restores operation if the input voltage has dropped below 36V. A reset signal is generated for an output voltage of  $\text{V}_0 < 4.5 \text{V}$ . The delay for power-on reset can be set externally with a capacitor.

#### **Design Notes for External Components**

An input capacitor  $C_1$  is necessary for compensation of line influences. The resonant circuit consisting of lead inductance and input capacitance can be damped by a resistor of approx.1 $\Omega$  Win series with  $C_1$ . An output capacitor  $C_0$  is necessary for the stability of the regulating circuit. Stability is guaranteed at values of  $C_0 \ge 22uF$  and ESR of  $< 3\Omega$ .

#### **Circuit Description**

The control amplifier compares a reference voltage, which is kept highly accurate by resistance adjustment, to a voltage that is proportional to the output voltage and drives the base of a series transistor via a buffer. Saturation control as a function of the load current prevents any over-saturation of the power element. If the output voltage decreases below 4.5V, an external capacitor  $C_D$  on pin 4 (Reset Delay) will be discharged by the reset generator. If the voltage on this capacitor drops below  $V_{DLR}$ , a reset signal is generated on pin 2 (Reset Output), i.e. reset output is set low. If the output voltage rises above 4.5V,  $C_D$  will be charged with constant current. After the power-on-reset time the voltage on the capacitor reaches  $V_{DU}$  and the reset output will be set high again. The value of the power-on-reset time can be set within a wide range depending of the capacitance of  $C_D$ .

The IC also incorporate a number of internal circuits for protection against:

- Overload
- · Over Voltage
- Over temperature
- · Reverse Polarity



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#### **Reset Timing**

The power-on reset delay time is defined by the charging time of an external capacitor  $C_D$  which can be calculated as follows:

 $C_D = (\Delta t \times I_{D,C}) / \Delta V$ 

C<sub>D</sub> = Delay capacitors

Definitions:  $\Delta t$  = Reset delay Time  $t_{rd}$ 

 $I_{D,C}$  = Charge current, typical 14uA

 $\Delta V = V_{DU}$ , typical 1.8V

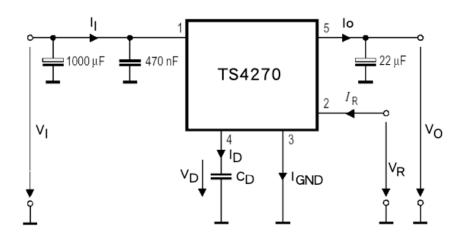
V<sub>DU</sub> = Upper reset timing threshold at C<sub>D</sub> for reset delay time

 $t_{rd} = \Delta V \times C_D/I_{D,C}$ 

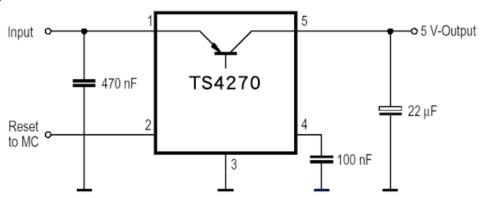
The reset reaction time  $t_{rr}$  is the time it takes the voltage regulator to set the reset out LOW after the output voltage has dropped below the reset threshold. It is typical 1uS for delay capacitor of 47nF. For other values for  $C_D$  the reaction time can be estimated using the following equation:

$$t_{rr} \approx 20s/F \times C_D$$

#### **Test Circuit**



## **Application Circuit**



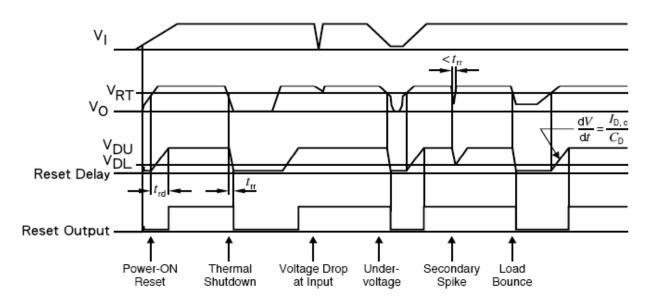


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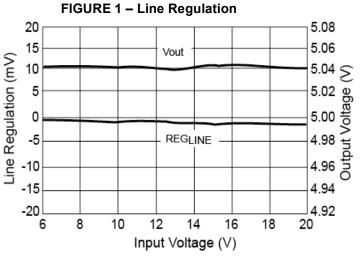


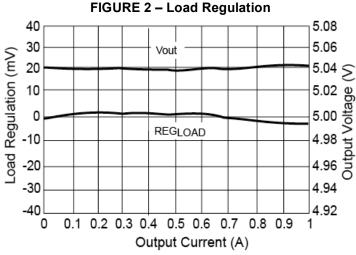


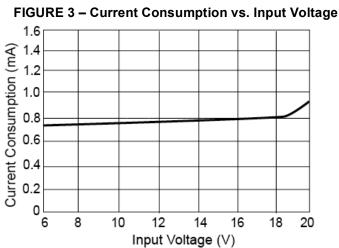
#### **Reset Time Response**

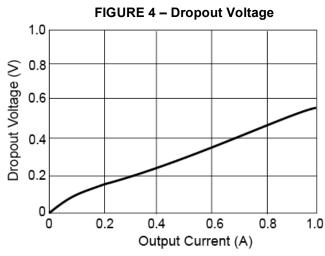


#### **Electrical Characteristics Curve**







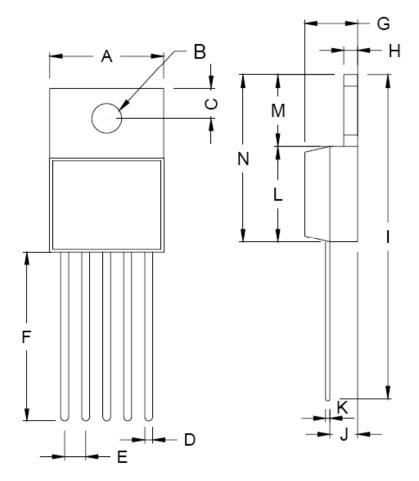




## **TS4270**

5V Ultra Low Dropout Fixed Voltage Regulator

## **TO-220-5L Mechanical Drawing**



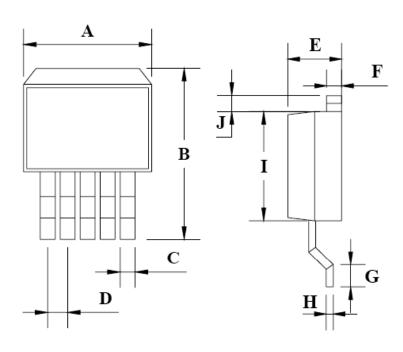
TO-220-5L DIMENSION							
DIM	MILLIM	ETERS	INCHES				
DIIVI	MIN	MAX	MIN	MAX			
Α	10.00	10.50	0.394	0.413			
В	3.240	4.440	0.128	0.175			
С	2.440	2.940	0.096	0.116			
D	0.260	1.020	0.010	0.040			
Е	1.570	1.830	0.062	0.072			
F	13.31	14.13	0.524	0.556			
G	4.475	5.225	0.176	0.206			
Н	1.170	1.370	0.046	0.054			
I	27.60	29.44	1.087	1.159			
J	2.175	2.925	0.086	0.115			
K	0.297	0.477	0.012	0.019			
L	8.280	8.800	0.326	0.346			
М	6.010	6.510	0.237	0.256			
N	14.29	15.31	0.563	0.603			



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## **TO-263-5L Mechanical Drawing**



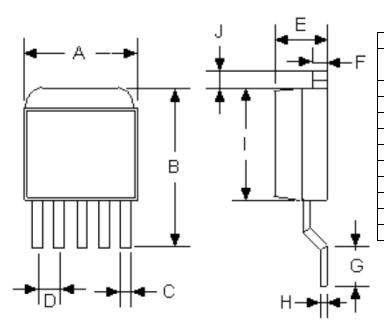
TO-263-5L DIMENSION							
DIM	MILLIM	ETERS	INC	HES			
DIIVI	MIN	MAX	MIN	MAX			
Α	10.220	10.260	0.402	0.404			
В	14.600	15.870	0.575	0.625			
С	0.750	0.770	0.030	0.030			
D	1.573	1.827	0.062	0.072			
Е	4.560	4.570	0.179	0.180			
F	1.240	1.270	0.049	0.050			
G	2.280	2.790	0.090	0.110			
Н	0.280	0.320	0.011	0.013			
I	8.240	8.280	0.324	0.326			
J	1.540	1.800	0.060	0.071			



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## **TO-252-5L Mechanical Drawing**



TO-252-5L DIMENSION							
DIM	MILLIM	ETERS	INCHES				
DIIVI	MIN	MAX	MIN	MAX.			
Α	6.350	6.730	0.250	0.265			
В	9.080	10.440	0.357	0.411			
С	0.460	0.640	0.018	0.025			
D	1.27	BSC	0.05BSC				
Е	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			
Н	0.460	0.570	0.018	0.022			
	5.34	5.550	0.210	0.219			
J	1.520	2.030	0.060	0.080			



# Preliminary TS4270 5V Ultra Low Dropout Fixed Voltage Regulator

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