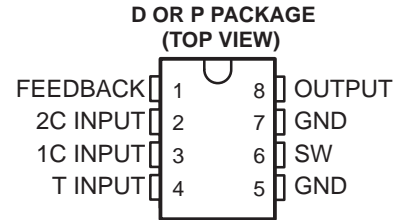


- Internal Step-Up Switching Regulator
- Fixed 9-V Output
- Charges Battery Source During Transformer-Coupled-Input Operation
- Minimum External Components Required (1 Inductor, 1 Capacitor, 1 Diode)
- 1- or 2-Cell-Input Operation



Terminals 5 and 7 are connected together internally.

## description

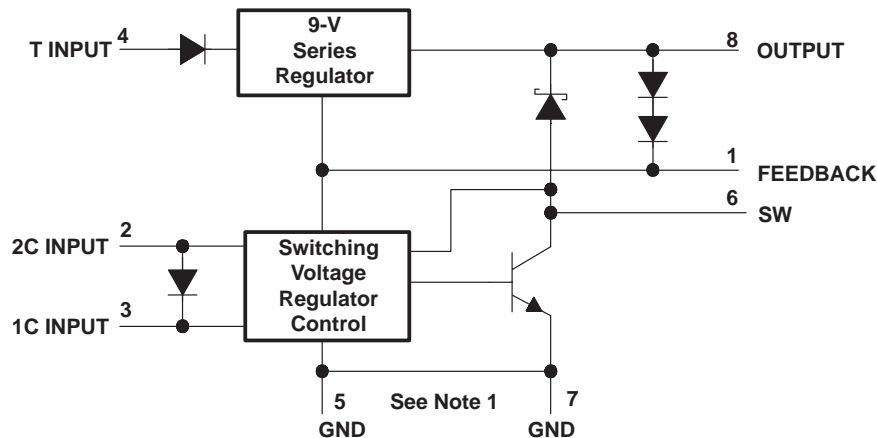
The TL496C power-supply control circuit is designed to provide a 9-V regulated supply from a variety of input sources. Operable from a 1- or 2-cell battery input, the TL496C performs as a switching regulator with the addition of a single inductor and filter capacitor. When ac coupled with a step-down transformer, the TL496C operates as a series regulator to maintain the regulated output voltage and, with the addition of a single catch diode, time shares to recharge the input batteries.

The design of the TL496C allows minimal supply current drain during standby operation (125  $\mu$ A typical). With most battery sources, this allows a constant bias to be maintained on the power supply. This makes power instantly available to the system, thus eliminating power-up sequencing problems.

### AVAILABLE OPTIONS

T <sub>A</sub>	PACKAGED DEVICES		CHIP FORM (Y)
	SURFACE MOUNT (D)	PLASTIC DIP (P)	
0°C to 70°C	TL496CD	TL496CP	TL496Y

## functional block diagram



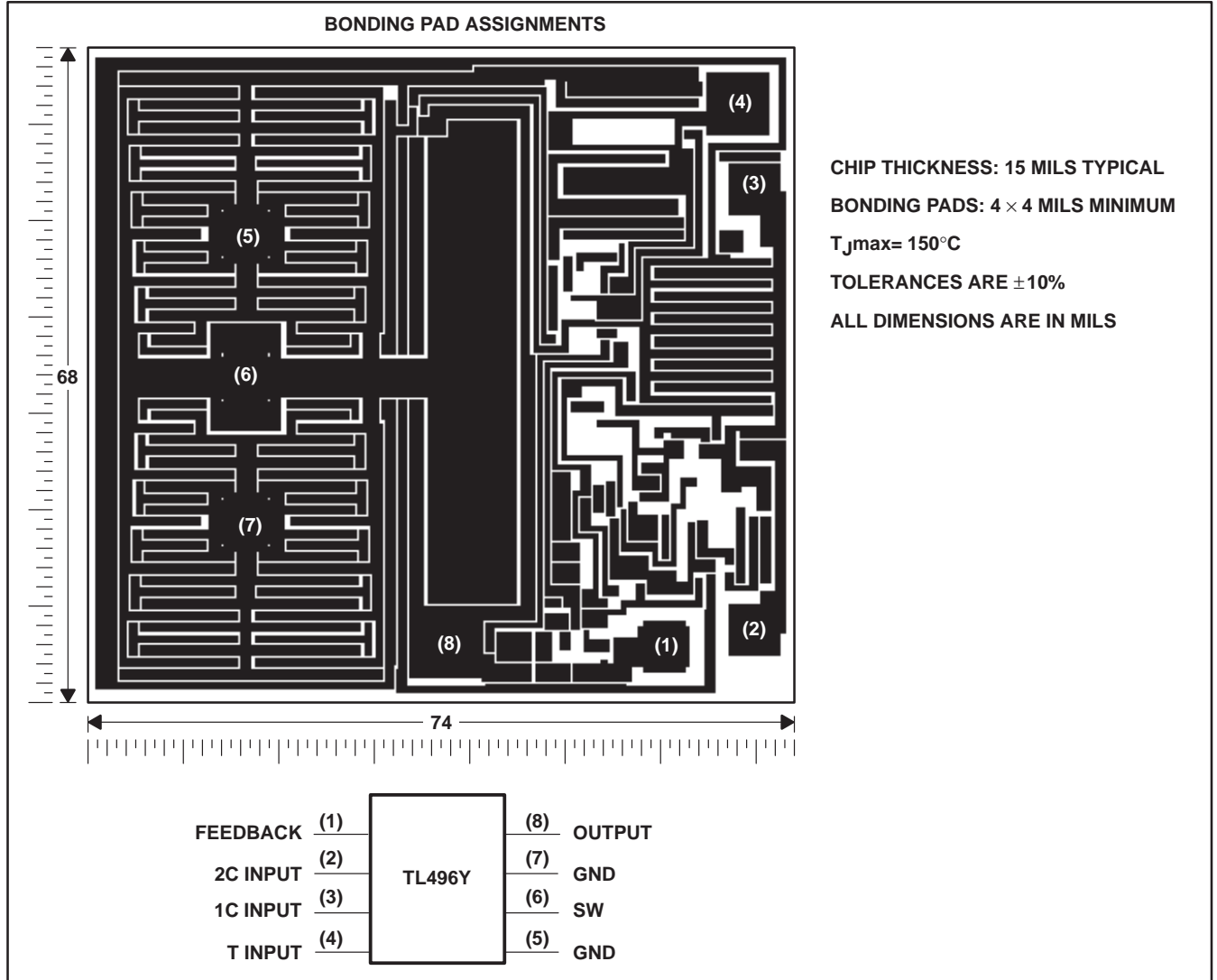
NOTE 1: Terminals 5 and 7, though connected together internally, must both be terminated to ground to ensure proper circuit operation.

# TL496C, TL496Y 9-VOLT POWER-SUPPLY CONTROLLERS

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## TL496Y chip information

This chip, when properly assembled, displays characteristics similar to the TL496C. Thermal compression or ultrasonic bonding may be used on the doped aluminum bonding pads. The chips may be mounted with conductive epoxy or a gold-silicon preform.



# TL496C, TL496Y 9-VOLT POWER-SUPPLY CONTOLLERS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)†

Input voltage, $V_I$ : 2C INPUT .....	3.5 V
1C INPUT .....	2.5 V
T INPUT .....	20 V
Output voltage, $V_O$ (SW) .....	12 V
Diode reverse voltage (OUTPUT) .....	12 V
Switch current (SW) .....	1.2 A
Diode current (OUTPUT) .....	1.2 A
Continuous total power dissipation .....	See Dissipation Rating Table
Operating free-air temperature range, $T_A$ .....	0°C to 70°C
Storage temperature range, $T_{stg}$ .....	–65°C to 150°C
Lead temperature 1,6 mm (1/16 inch) from case for 10 seconds .....	260°C

† Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR	$T_A = 70^\circ\text{C}$ POWER RATING
D	725 mW	5.8 mW/°C	464 mW
P	1000 mW	8.0 mW/°C	640 mW

## recommended operating conditions

	MIN	MAX	UNIT
Input voltage, one-cell operation (2C and 1C INPUTS to ground)	1.1	1.5	V
Input voltage, two-cell operation (2C INPUT to ground)	2.3	3	V
Input voltage, one-cell or two-cell operation (T INPUT to ground)	$V_O + 2$	20	V



# TL496C, TL496Y

## 9-VOLT POWER-SUPPLY CONTROLLERS

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electrical characteristics over recommended operating conditions,  $T_A = 25^\circ\text{C}$  (unless otherwise noted)

### series regulator section (T INPUT)

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT	
Dropout voltage	$V_I = 5\text{ V}$ , $I_O = -50\text{ mA}$		1.5	2	V	
Regulated output voltage	$V_I = 20\text{ V}$ , $I_O = -50\text{ }\mu\text{A}$	9.5	10.1	11.2	V	
		$I_O = -80\text{ mA}$	9	10		11
	$V_I = 20\text{ V}$ , FEEDBACK shorted to OUTPUT	$I_O = -50\text{ }\mu\text{A}$	8.5	9		9.7
		$I_O = -80\text{ mA}$	6.7	8.6		9.5
Standby current, T INPUT	$V_I = 20\text{ V}$ , OUTPUT = 12 V			400	$\mu\text{A}$	
Reverse current through T INPUT	$V_I = -1.5\text{ V}$ , 1 mA into OUTPUT			-25	$\mu\text{A}$	

### output switch

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_{CE(sat)}$ Collector-emitter saturation voltage	800 mA into SW, 2C INPUT = 2.25 V		0.35	0.6	V

### diode (SW to OUTPUT)

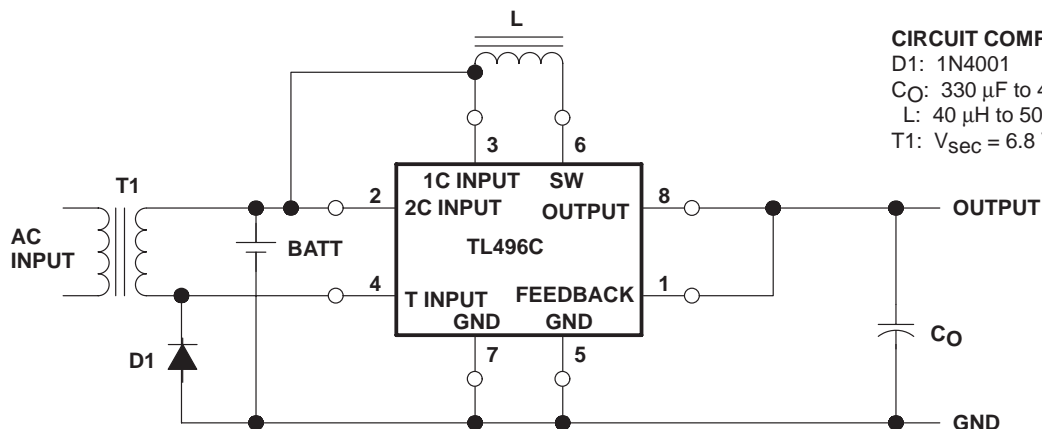
PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
$V_F$ Forward voltage	$I_F = 1.5\text{ A}$		1.6	2.5	V
$I_R$ Reverse current through SW	SW at 0 V, 1 mA into OUTPUT			-20	$\mu\text{A}$

### control section

PARAMETER	TEST CONDITIONS	MIN	TYP	MAX	UNIT
On-state current (2C INPUT)	FEEDBACK and OUTPUT = 0 V, 2C INPUT = 3 V		60	100	mA
Standby current (FEEDBACK)	FEEDBACK = 8.65 V, 2C INPUT and SW = 3 V			40	$\mu\text{A}$
Standby current (2C INPUT and SW)	FEEDBACK = 8.65 V, 2C INPUT and SW = 3 V			400	$\mu\text{A}$
Start-up current (current into SW to initiate cycle)	FEEDBACK, 2C INPUT, SW, and OUTPUT = 2.25 V	16			mA



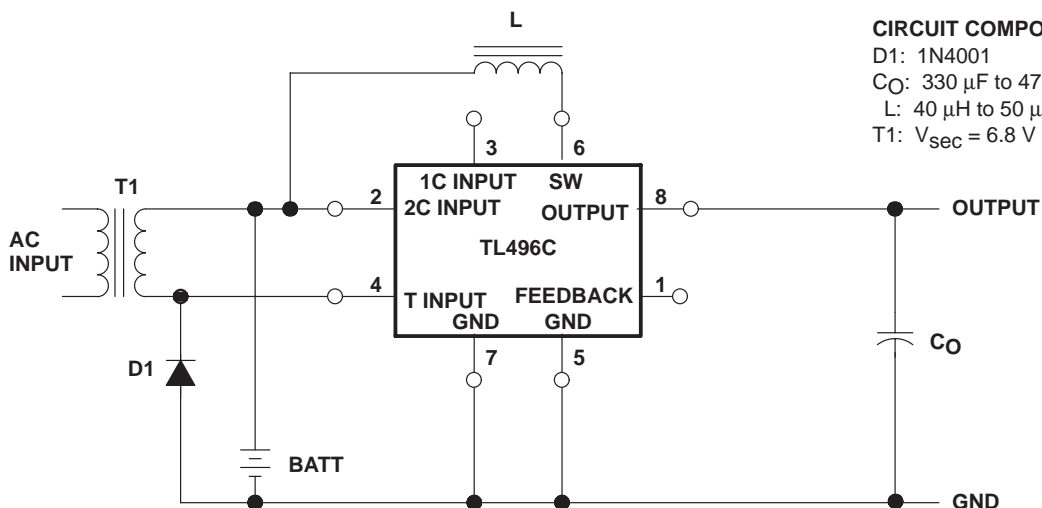
APPLICATION INFORMATION



CIRCUIT COMPONENT INFORMATION

D1: 1N4001  
C<sub>O</sub>: 330 μF to 470 μF, 10 V, electrolytic  
L: 40 μH to 50 μH, Q ≈ 3, R < 0.15 Ω  
T1: V<sub>sec</sub> = 6.8 V RMS typ, R<sub>sec</sub> = 11 Ω typ

Figure 1. One-Cell Operation



CIRCUIT COMPONENT INFORMATION

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Figure 2. Two-Cell Operation

electrical characteristics for one- and two-cell input operations

PARAMETER		ONE-CELL OPERATION (see Figure 1)	TWO-CELL OPERATION (see Figure 2)
Input current	No load	125 μA	125 μA
	R <sub>L</sub> = 120 Ω	525 mA	405 mA
Output voltage	No ac input	7.2 V	8.6 V
	With ac input	8.6 V	10 V
Output current capability		40 mA	80 mA
Efficiency		66%	66%
Battery life (AA NiCad) no load		60 days	166 days

# TL496C, TL496Y

## 9-VOLT POWER-SUPPLY CONTROLLERS

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### functional description

The TL496C is designed to operate from either a single-cell or two-cell battery source. To operate the device from a single cell (1.1 V to 1.5 V), the source must be connected to both inputs 1C INPUT and 2C INPUT as shown in Figure 1. For a two-cell operation (2.3 V to 3 V), the input is applied to 2C INPUT only and 1C INPUT is left open (see Figure 2).

### battery operation

The TL496C operates as a switching regulator from a battery input. The cycle is initiated when a low-voltage condition is sensed by the internal feedback (the thresholds at terminals 1 and 8 are approximately 7.2 and 8.6 V respectively). An internal latch is set and the output transistor is turned on. This causes the current in the external inductor (L) to increase linearly until it reaches a peak value of approximately 1 A. When the peak current is sensed, the internal latch is reset and the output transistor is turned off. The energy developed in the inductor is then delivered to the output storage capacitor through the blocking diode. The latch remains in the off state until the feedback signal indicates the output voltage is again deficient.

### transformer-coupled operation

The TL496C operates on alternate half cycles of the ac input during transformer-coupled operation to first sustain the output voltage and second to recharge the batteries. The TL496C performs like a series regulator to supply charge to the output filter/storage capacitor during the first half cycle. The output voltage of the series regulator is slightly higher than that created by the switching circuit. This maintains the feedback voltage above the switching regulator control circuit threshold, effectively inhibiting the switching control circuitry. During the second half cycle, an external diode (1N4001) is used to clamp the negative-going end of the transformer secondary to ground, thus allowing the positive-going end (end connected to V+ side of battery) to pump a charge into the standby batteries.

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