

**CURRENT MODE SWITCHING  
POWER SUPPLY CONTROL CIRCUIT**

- DIRECT DRIVE OF THE EXTERNAL SWITCHING TRANSISTOR
- POSITIVE AND NEGATIVE OUTPUT CURRENTS UP TO 0.5 A
- CURRENT LIMITATION
- TRANSFORMER DEMAGNETIZATION SENSING
- FULL OVERLOAD AND SHORT-CIRCUIT PROTECTION
- PROPORTIONAL BASE CURRENT DRIVING
- LOW STANDBY CURRENT BEFORE STARTING (< 1.6 mA)
- THERMAL PROTECTION

**DESCRIPTION**

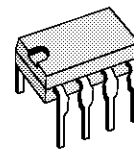
The TEA2018A is an 8-pin DIP low-cost integrated circuit designed for the control of switch mode power supplies.

Due to its current mode regulation, the TEA2018A facilitates design of power supplies with following features :

- High stability regulation loop
- Automatic input voltage feed-forward in discontinuous mode fly-back
- Automatic pulse-by-pulse current limitation

Typical applications : Video Display Units, TV sets, typewriters, microcomputers and industrial applications

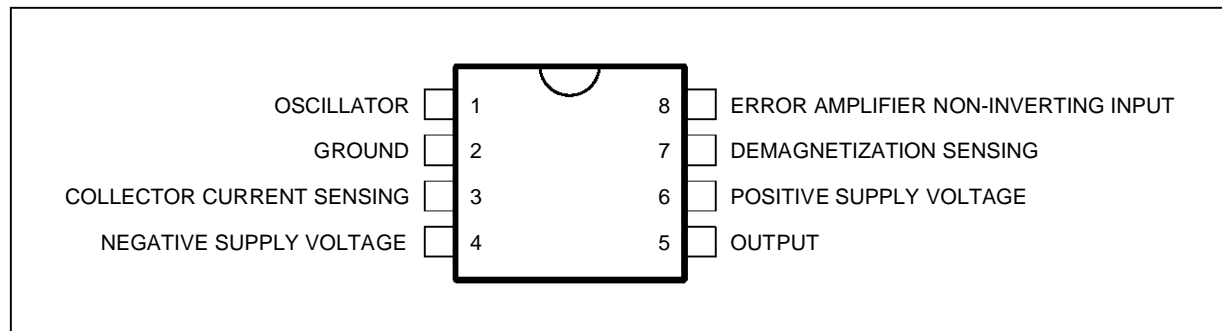
Where synchronization is required, use the TEA2019. For more details, see application note AN406/0591



**DIP8**  
(Plastic Package)

**ORDER CODE : TEA2018A**

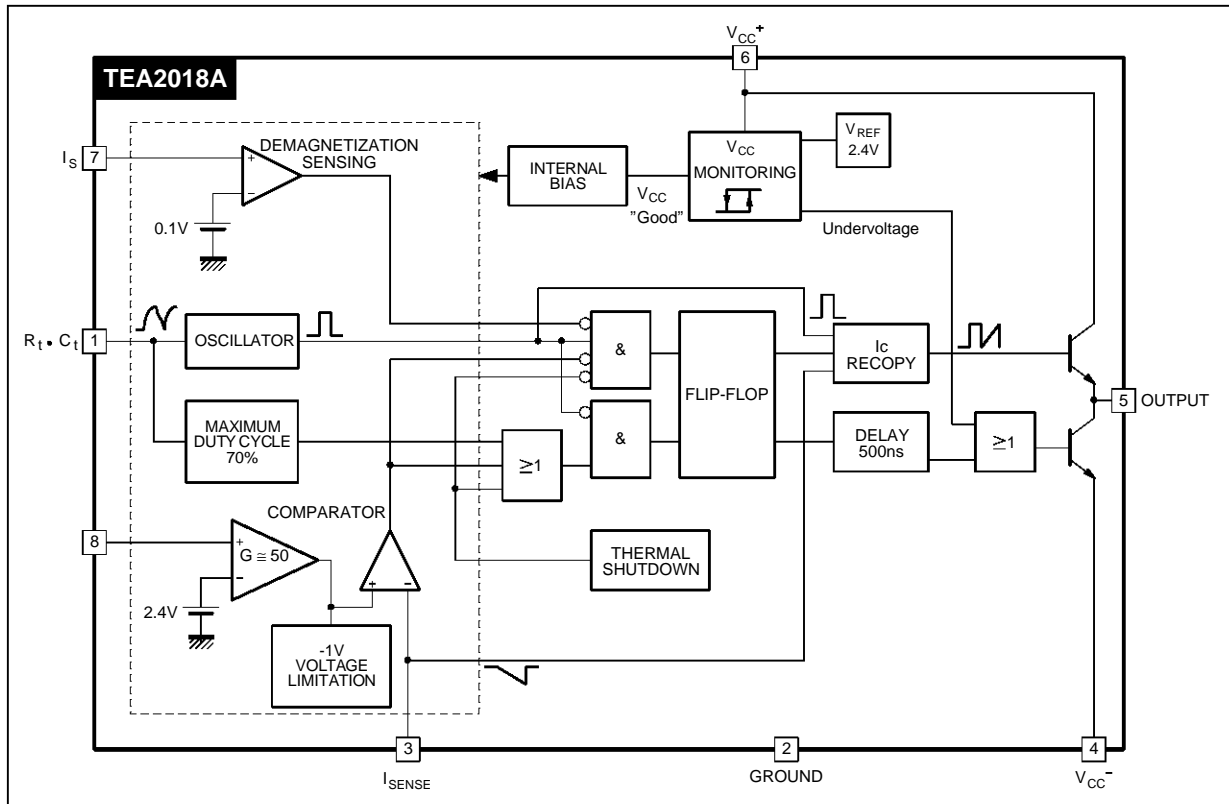
**PIN CONNECTIONS**



2018A-01.EPS

# TEA2018A

## BLOCK DIAGRAM



## ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
$V_{CC+}$	Positive Supply Voltage	15	V
$V_{CC-}$	Negative Supply Voltage	-5	V
$I_o(\text{peak})$	Peak Output Current (duty cycle < 5%)	$\pm 1$	A
$I_i$	Input Current (Pin 3)	$\pm 5$	mA
$T_j$	Junction Temperature	+150	$^{\circ}\text{C}$
$T_{\text{oper}}$	Operating Ambient Temperature Range	-20, +70	$^{\circ}\text{C}$
$T_{\text{stg}}$	Storage Temperature Range	-40, +150	$^{\circ}\text{C}$

## THERMAL DATA

Symbol	Parameter	Value	Unit
$R_{th(j-a)}$	Junction-ambient Thermal Resistance	80	$^{\circ}\text{C}/\text{W}$

## ELECTRICAL OPERATING CHARACTERISTICS

$T_{\text{amb}} = 25^{\circ}\text{C}$ , potentials referenced to ground (unless otherwise specified) (see test circuit)

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{CC+}$	Positive Supply Voltage	6.6	8	15	V
$V_{CC-}$	Negative Supply Voltage	-1	-3	-5	V
$V_{CC(\text{start})}$	Minimum Positive Supply Voltage required for starting ( $V_{CC+}$ rising)		6	6.6	V
$V_{CC(\text{stop})}$	Minimum Positive Voltage below which device stops operating ( $V_{CC+}$ falling)	4.2	4.9	5.6	V

**ELECTRICAL OPERATING CHARACTERISTICS**

$T_{amb} = 25^{\circ}\text{C}$ , potentials referenced to ground (unless otherwise specified) (see test circuit)

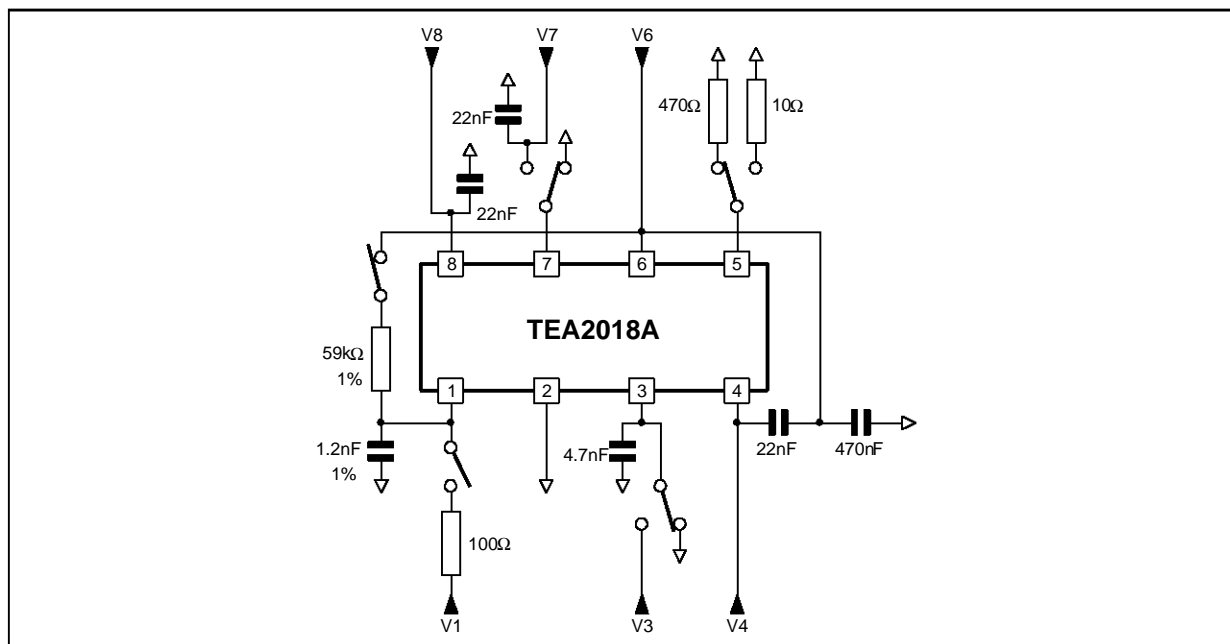
Symbol	Parameter	Min.	Typ.	Max.	Unit
$\Delta V_{CC+}$	Hysteresis on $V_{CC+}$ Threshold	0.7	1.1	1.6	V
$I_{CC(sb)}$	Stand-by Supply Current before starting ( $V_{CC+} < V_{CC(start)}$ )		1	1.6	mA
$V_{th(IC)}$	Current Limitation Threshold Voltage (Pin 3)	-1100	-1000	-880	mV
$R_{(IC)}$	Collector Current Sensing Input Resistance		1000		$\Omega$
$V_{7(th)}$	Demagnetization Sensing Threshold	75	100	125	mV
$I_S$	Demagnetization Sensing Input Current (Pin 7 = 0V)		1		$\mu\text{A}$
$\tau_{max}$	Maximum Duty Cycle	60	70		%
$A_V$	Error Amplifier Gain		50		
$I_{I+}$	Error Amplifier Input Current (non-inverting input)		2		$\mu\text{A}$
$V_{REF}$	Internal Reference Voltage	2.3	2.4	2.5	V
$\frac{\Delta V_{REF}}{\Delta T}$	Reference Voltage Temperature Drift		$10^{-4}$		$\text{V}/^{\circ}\text{C}$
$t_{OSC}$	Oscillator Free-running Period ( $R = 59\text{k}\Omega$ , $C = 1.2\text{nF}$ )	44	48	52	$\mu\text{s}$
$\frac{\Delta f_{OSC}}{\Delta T}$	Oscillator Frequency Drift with Temperature ( $V_{CC+} = +8\text{V}$ )		0.05		$\%/^{\circ}\text{C}$
$\frac{\Delta f_{OSC}}{\Delta V_{CC}}$	Oscillator Frequency Drift with $V_{CC+}$ ( $+8\text{V} < V_{CC+} < +14\text{V}$ )		0.5		$\%/V$
$t_{on(min)}$	Minimum Conducting Time ( $C_t = 1\text{nF}$ )		2		$\mu\text{s}$

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**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{CC+}$	Positive Supply Voltage		8		V
$V_{CC-}$	Negative Supply Voltage		-3		V
$I_O$	Output Current			0.5	A
$f_{oper}$	Operating Frequency		30		kHz

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**TEST CIRCUIT**

2018A-03.EPS

**GENERAL DESCRIPTION**

(see application note AN-086)

**Operating Principles** (Figure 1)

On every period, the beginning of the conduction time of the transistor is triggered by the fall of the oscillator sawtooth which acts as clock signal. The period  $T_{osc}$  is given by :  $T_{osc} \cong 0.66 C_t (R_t + 200)$  ( $T_{osc}$  in seconds,  $C_t$  in Farad,  $R_t$  in  $\Omega$ )

The end of the conduction time is determined by a signal issued from comparing the following signals :

- a) the sawtooth waveform representing the collector current of the switching transistor, sampled across the emitter shunt resistor,
- b) the output of the error amplifier.

**Base Drive**

- Fast turn-on : On each period, a current pulse ensures fast transistor switch-on. This pulse performs also the  $t_{on(min)}$  function at the beginning of the conduction.
- Proportional base drive : In order to save power, the positive base current after the starting pulse becomes an image of the collector current.

The ratio  $\frac{I_C}{I_B}$  is programmed as follows Figure 2) :

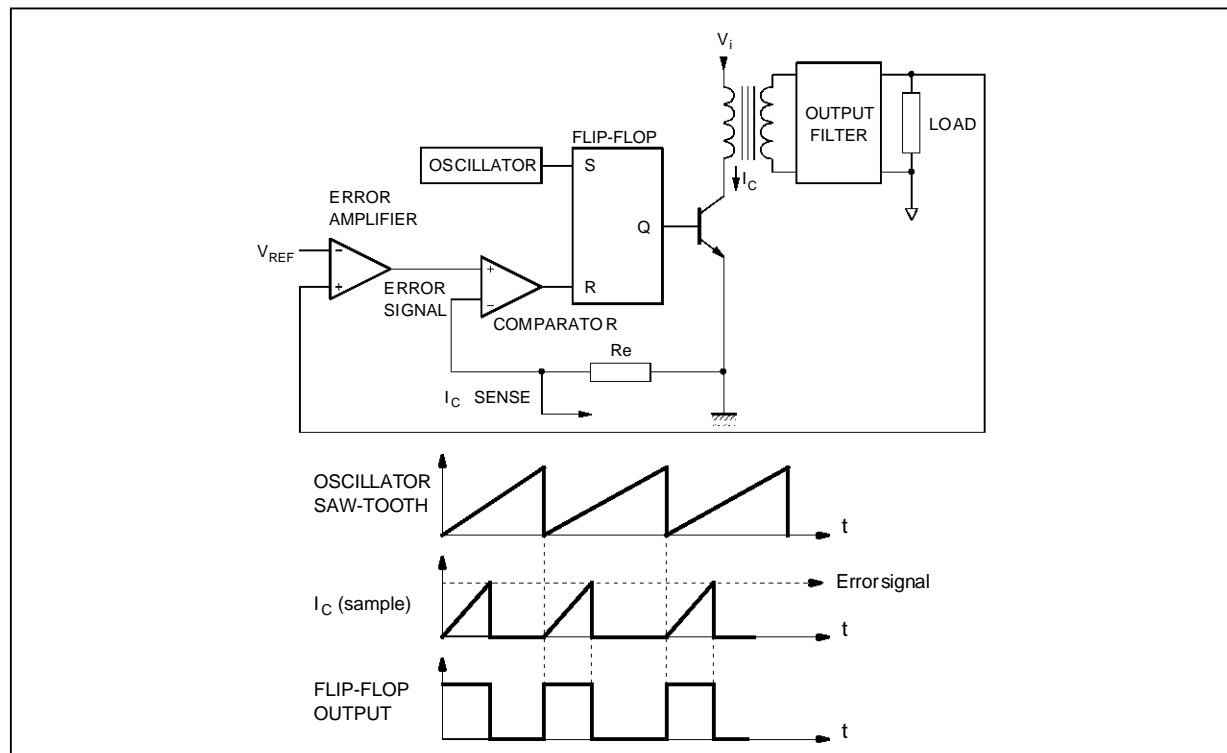
$$\frac{I_C}{I_B} = \frac{R_B}{R_e}$$

- Efficient and fast switch-off : When the positive base drive is removed, 1ms (typically) will elapse before the application of negative current therefore allowing a safe and rapid collector current fall.

**Safety Functions**

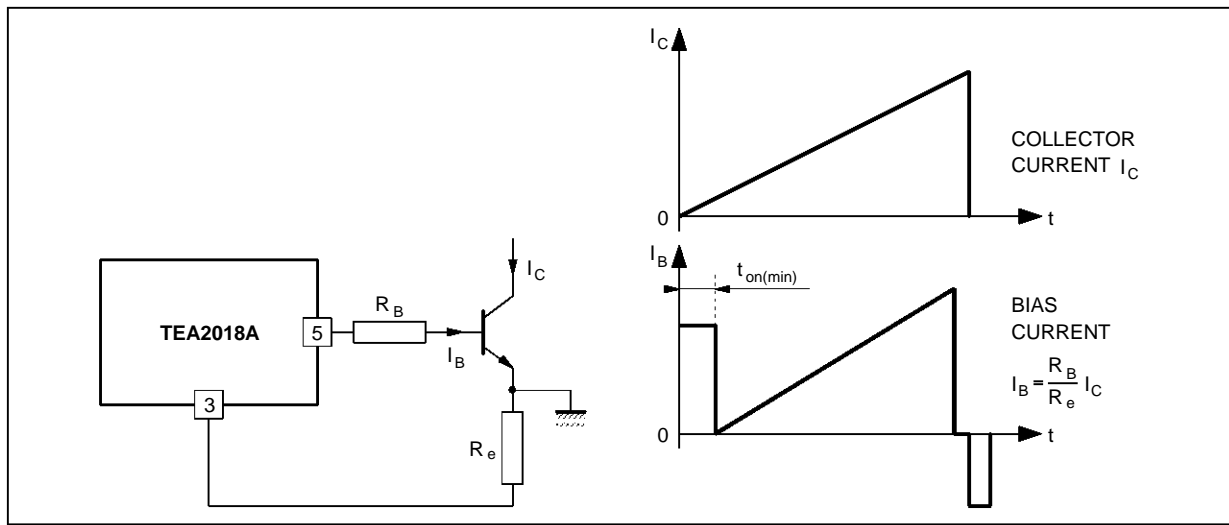
- Overload & short-circuit protection : When the voltage applied to pin 3 exceeds the current limitation threshold voltage  $[V_{th}(I_c)]$ , the output flip-flop is reset and the transistor is turned off. The shunt resistor  $R_e$  must be calculated so as to obtain the current limitation threshold on pin 3 at the maximum allowable collector current.
- Demagnetization sensing : This function disables any new conduction cycle of the transistor as long as the core is not completely demagnetized. When not used, pin 7 must be grounded.
- $t_{on(max)}$  : Outside the regulation area and in the absence of current limitation, the maximum conduction time is set at about 70 % of the period.
- $t_{on(min)}$  : A minimum conducting time is ensured during each period (see Figure 2)
- Supply voltage monitoring : The TEA2018A will stop operating if  $V_{CC}^+$  on pin 6 falls below the threshold level  $V_{CC(stop)}$

**TEST CIRCUIT**



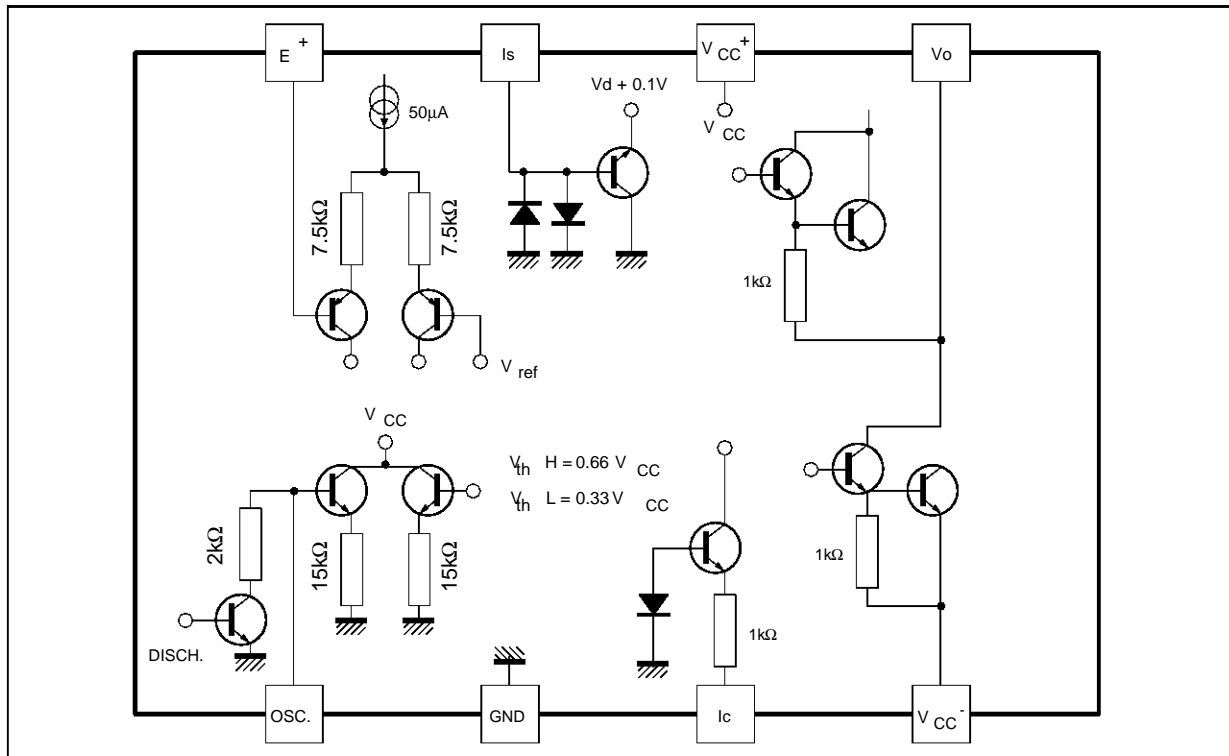
2018A-04.EPS - 2018A-06.EPS

Figure 2



2018A-06.EPS

SCHEMATICS OF INPUTS AND OUTPUTS



2018A-07.EPS

# TEA2018A

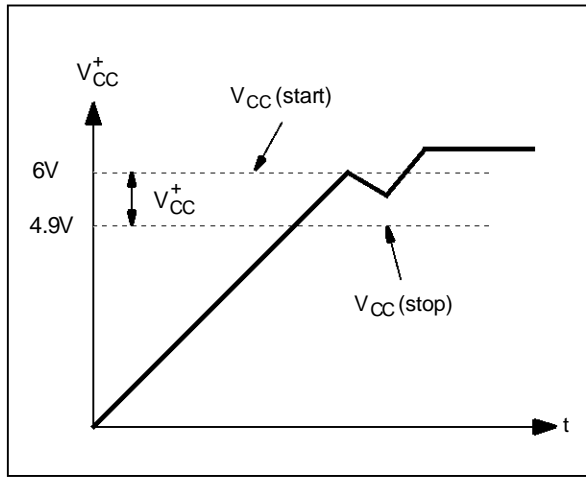
## Starting Process (Figure 3)

Prior to starting, a low current is drawn from the high voltage source through a high value resistor.

This current charges the power supply voltage capacitor of the device.

No output pulses are available before the voltage on pin 6 has reached the threshold level [ $V_{CC(start)}$ ,

**Figure 3** : Normal Start-up Sequence

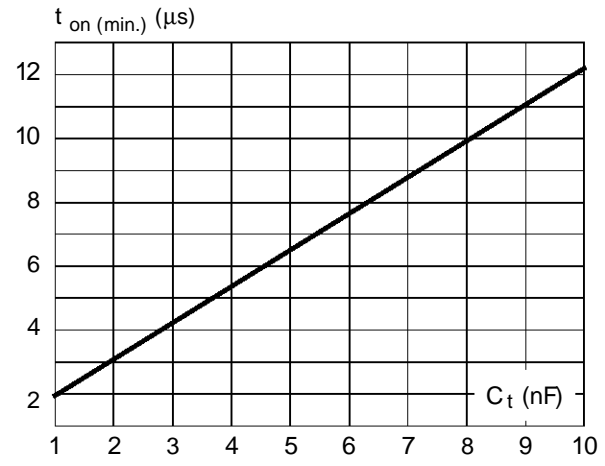


$V_{CC}$  rising].

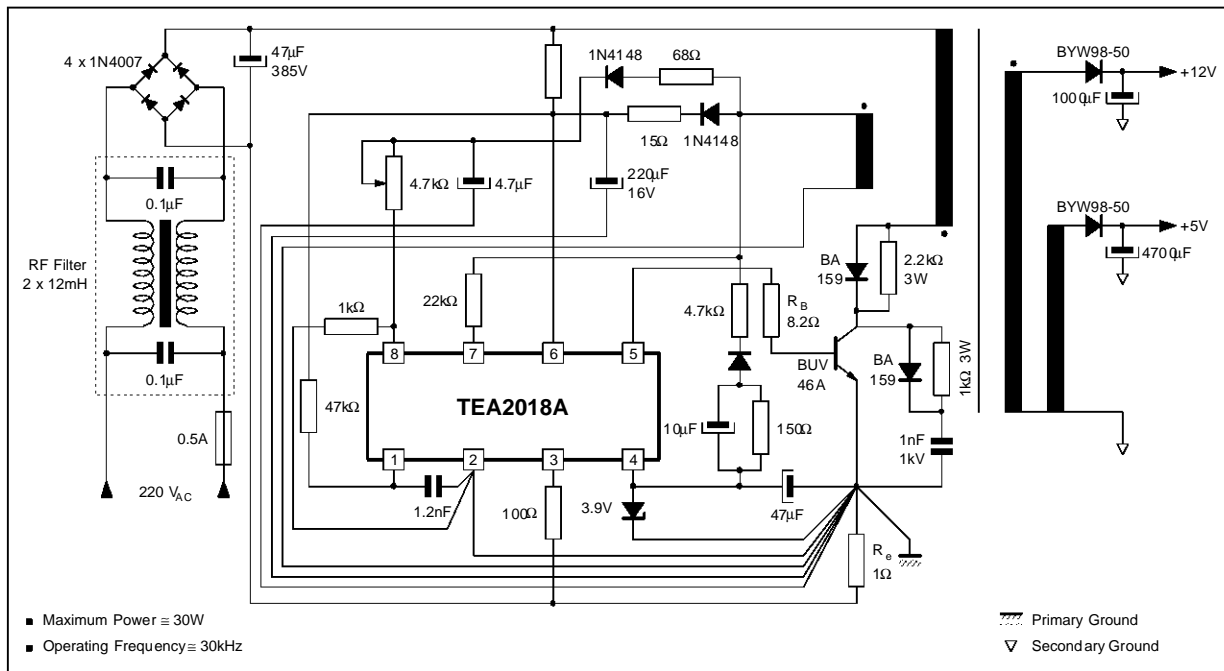
During this time the TEA2018A draws only 1mA (typically). When the voltage on pin 6 reaches this threshold, base drive pulses appear.

The energy drawn by these pulses tends to discharge the power supply storage capacitor. However a hysteresis of about 1.1V (typically) ( $\Delta V_{CC}$ ) is implemented to avoid the device from stopping.

**Figure 4** :  $t_{ON}$  (min.) versus  $C_t$

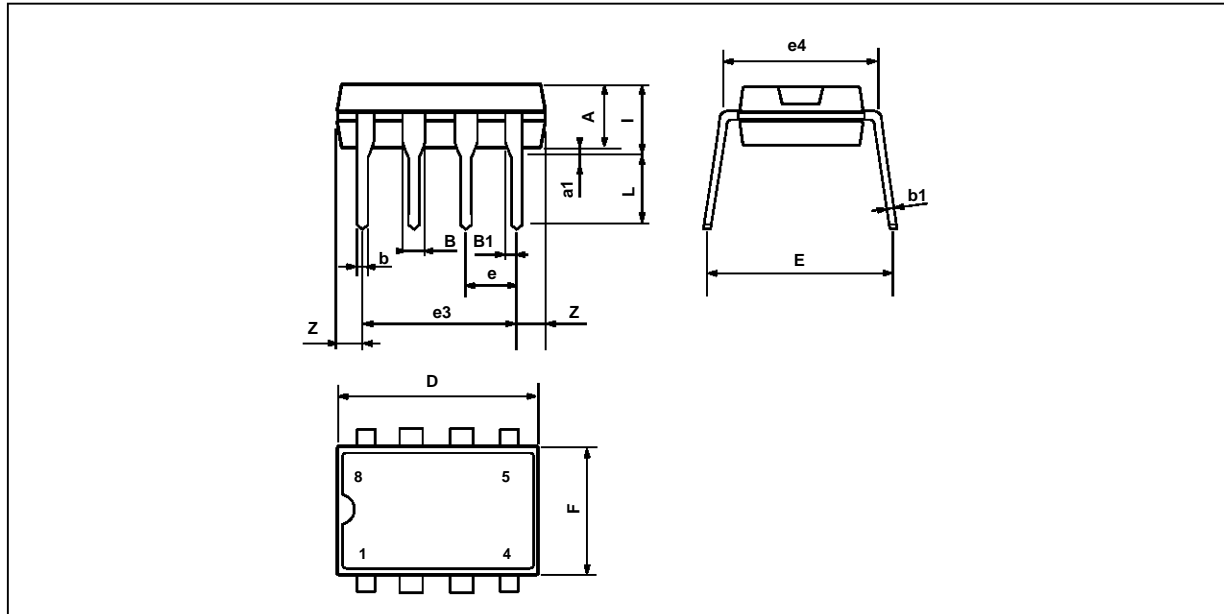


## TYPICAL APPLICATION



## PACKAGE MECHANICAL DATA

## 8 PINS - PLASTIC DIP



PM-DIP8.EPS

Dimensions	Millimeters			Inches		
	Min.	Typ.	Max.	Min.	Typ.	Max.
A		3.32			0.131	
a1	0.51			0.020		
B	1.15		1.65	0.045		0.065
b	0.356		0.55	0.014		0.022
b1	0.204		0.304	0.008		0.012
D			10.92			0.430
E	7.95		9.75	0.313		0.384
e		2.54			0.100	
e3		7.62			0.300	
e4		7.62			0.300	
F			6.6			0.260
i			5.08			0.200
L	3.18		3.81	0.125		0.150
Z			1.52			0.060

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