TEA2018A

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
- DEMAGNETIZATION SENSING
- FULL OVERLOAD AND SHORT-CIRCUIT PROTECTION
- PROPORTIONAL BASE CURRENT DRIVING
- LOW STANDBY CURRENT BEFORE STARTING (< 1.6 mA)
- THERMAL PROTECTION

DESCRIPTION

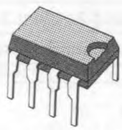
The TEA2018A is an 8-pin mini-dip low cost integrated circuit designed for the control of switch mode power supplies.

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

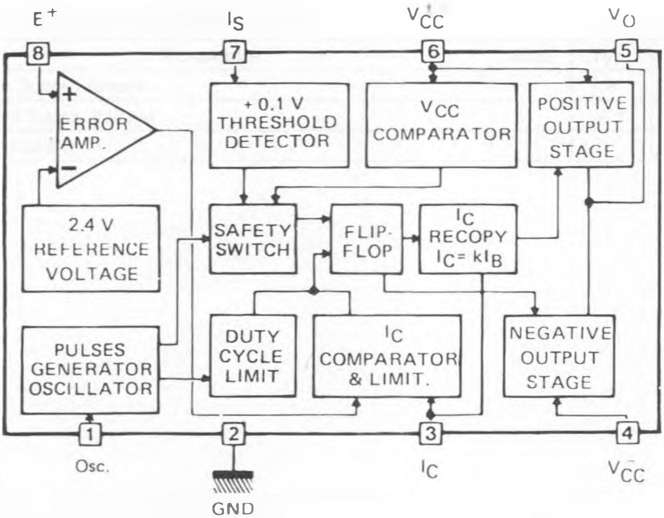
Typical applications : Video Display Units, TV sets, typewriters, microcomputers and industrial applications

Where synchronization is required, use the TEA2019.



TEA2018A
DIP8
(Plastic Package)

BLOCK DIAGRAM



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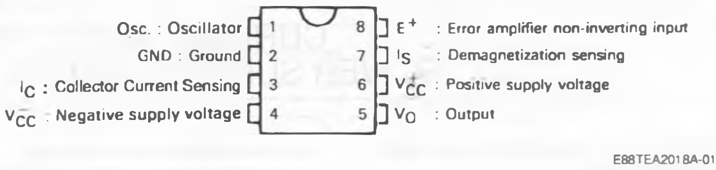
PIN CONNECTIONS



ABSOLUTE MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V_{CC}^+	Positive Supply Voltage	15	V
V_{CC}^-	Negative Supply Voltage	– 5	V
I_O(peak)	Peak Output Current (duty cycle < 5 %)	± 1	A
I_I	Input Current (pin 3)	± 5	mA
T_j	Junction Temperature	+ 150	°C
T_{oper}	Operating Ambient Temperature Range	– 20 to 70	°C
T_{stg}	Storage Temperature Range	– 40 to 150	°C

THERMAL DATA

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

ELECTRICAL OPERATING CHARACTERISTICS

T_{amb} = + 25 °C, potentials referenced to ground (unless otherwise specified)

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
$V_{CC(start)}$	Minimum positive supply voltage required for starting (V_{CC}^{+} rising)		6	6.6	V
$V_{CC(stop)}$	Minimum positive voltage below wich device stops operating (V_{CC}^{+} falling)	4.2	4.9	5.6	V
ΔV_{CC}^{+}	Hysteresis on V_{CC}^{+} Threshold	0.7	1.1	1.6	V
$I_{CC(sb)}$	Standby 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		Ω
I_S	Demagnetization Sensing Threshold	75	100	125	mV
	Demagnetization Sensing Input Current (pin 7 grounded)		1		μA
τ_{max}	Maximum Duty Cycle	60	70		%
A_V	Error Amplifier Gain		50		
I_I^{+}	Error Amplifier Input Current (non–inverting input)		2		μA
$V_{(ref)}$	Internal Reference Voltage	2.3	2.4	2.5	V
$\frac{\Delta V_{(ref)}}{\Delta T}$	Reference Voltage Temperature Drift		10^{-4}		V/°C
$\frac{\Delta f_{osc}}{\Delta T}$	Oscillator Frequency Drift with Temperature (V_{CC}^{+} = + 8 V)		0.05		%/°C
$\frac{\Delta f_{osc}}{\Delta V_{CC}}$	Oscillator Frequency Drift with V_{CC}^{+} (+ 8 V < V_{CC}^{+} < + 14 V)		0.5		%/V
t_{on}(min)	Minimum Conducting Time (C_t = 1 nF)		2		μs

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

GENERAL DESCRIPTION

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 :

$$T_{osc} = 0.66\ C_t\ (R_t + 2000)$$

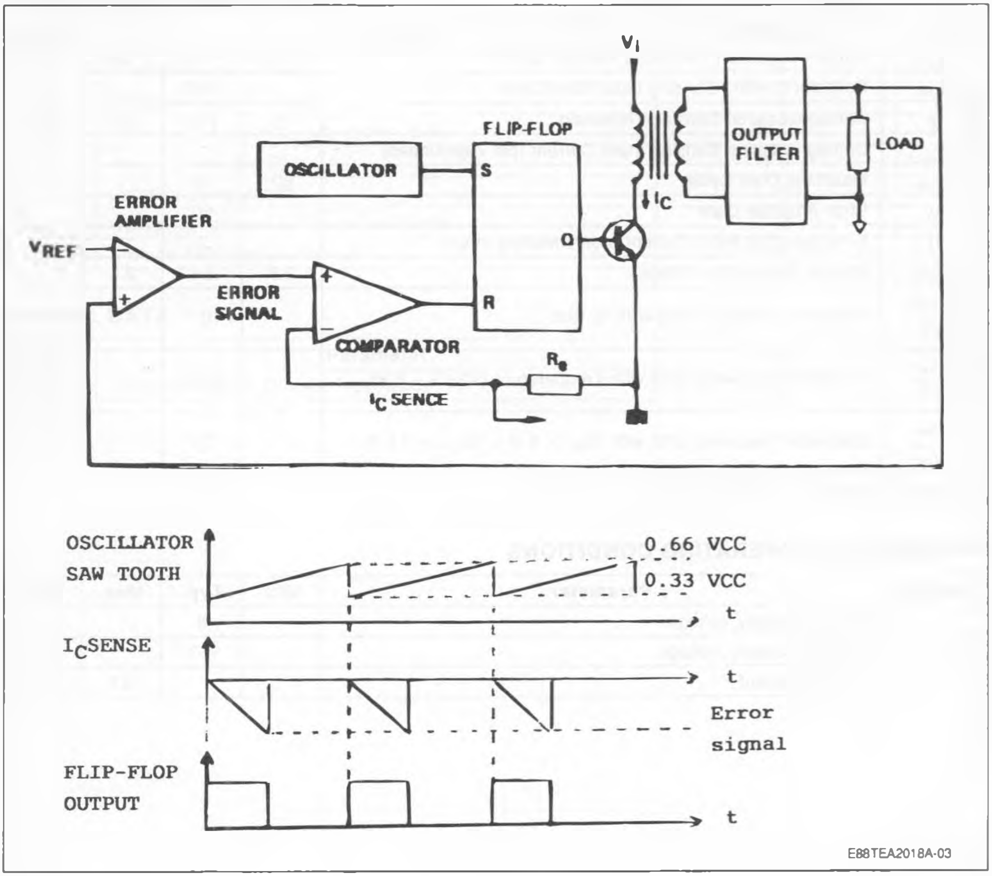
(T_{osc} in seconds, C_t in Farad, R_t in Ohm)

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.

Figure 1 : Current Mode Control.



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) :

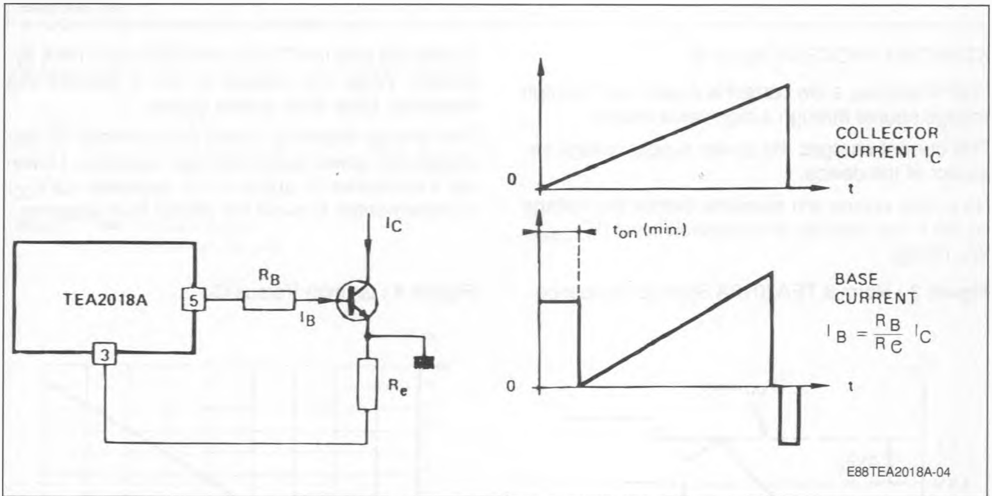
$$\frac{I_C}{I_B} = \frac{R_B}{R_e}$$

- Efficient and fast switch-off
  When the positive base drive is removed, 500 ns (typically) will elapse before the application of negative current therefore allowing a safe and rapid collector current fall.

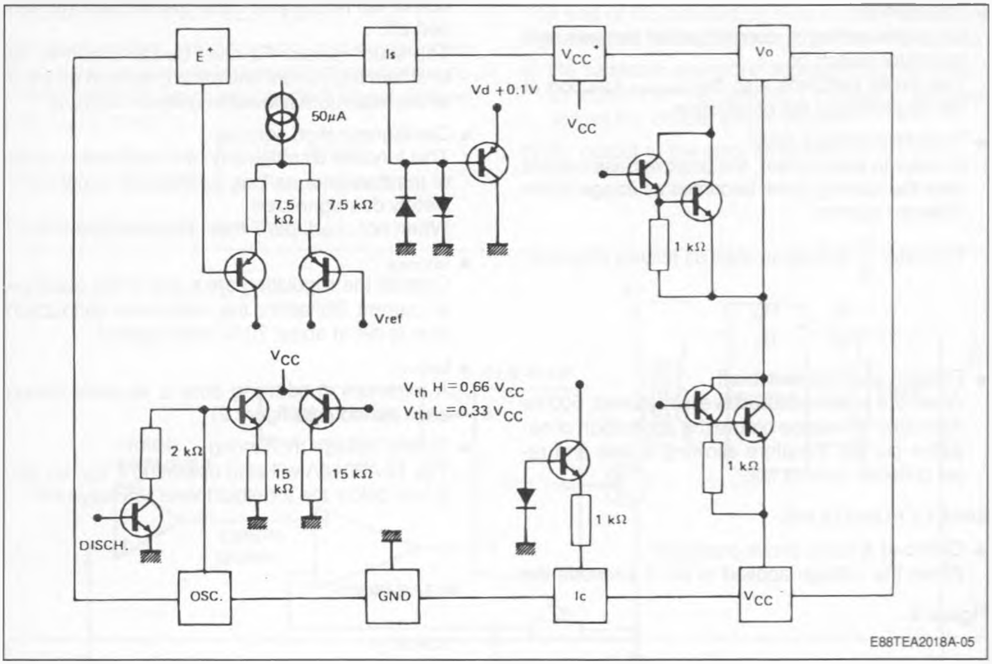
SAFETY FUNCTIONS

- 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 $V_{CC\,(stop)}^+$.

Figure 2.



SCHEMATICS OF INPUTS AND OUTPUTS



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 [$V_{CC(start)}$, V_{CC}^{+} rising].

During this time the TEA2018A draws only 1 mA (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 1.1 V (typically) (ΔV_{CC}^{+}) is implemented to avoid the device from stopping.

Figure 3 : Normal TEA2018A Start-up Sequence.

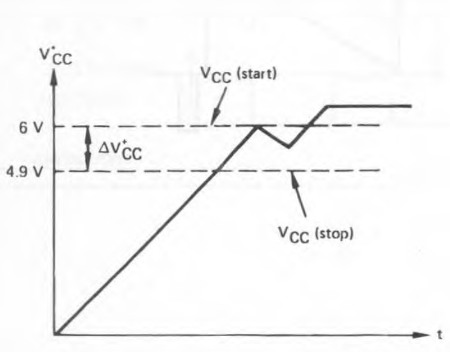


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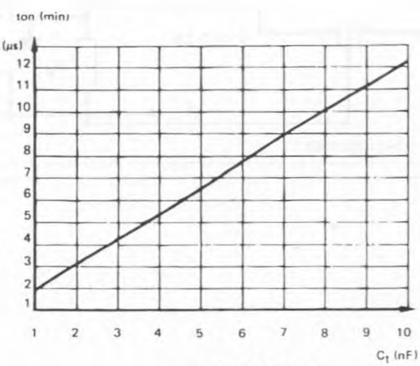
Figure 4 : t_{on}(min) Versus C_t.



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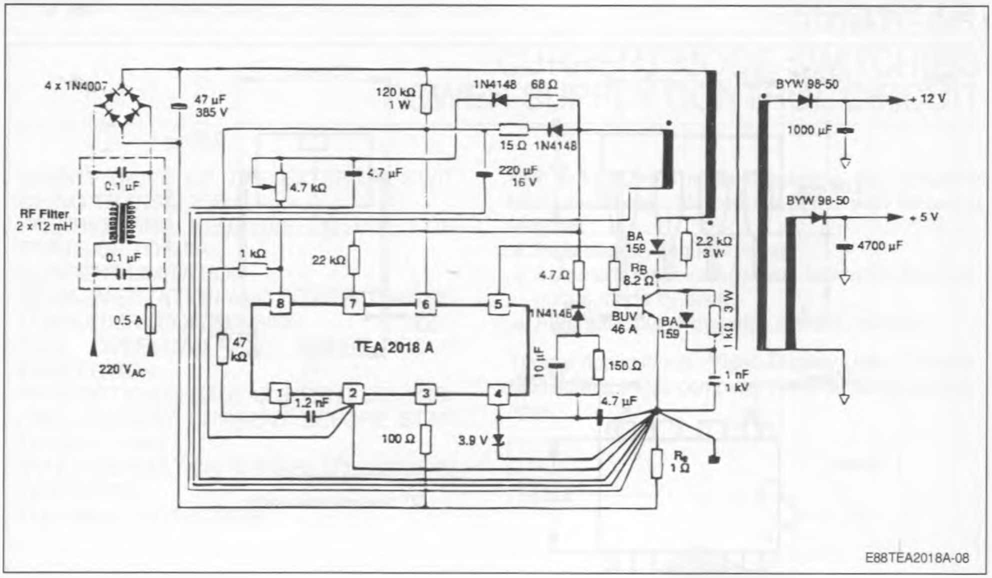
SGS-THOMSON MICROELECTRONICS

TYPICAL APPLICATION



MONITOR APPLICATION

- Maximum power ≈ 30 W
- Operating frequency ≈ 30 KHz
- $I_{nominal}$: 0.75 A
- I_{limit} : 1 A

$$R_e = \frac{1\ V}{1\ A} = 1\ \Omega$$

$$R_B = 8.2\ \Omega \Rightarrow \frac{I_C}{I_B} = 8.2$$

Note : Primary Ground. Secondary Ground.

PACKAGE MECHANICAL DATA

8 PINS – PLASTIC DIP