Signetics

Linear Products

TDA2582
Control Circuit For Power Supplies

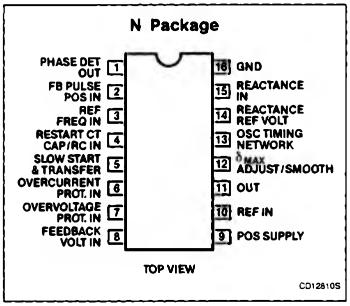
Product Specification

DESCRIPTION
The TDA2582 is a monolithic integrated circuit for controlling power supplies which are provided with the drive for the horizontal deflection stage.

FEATURES
- **Voltage-controlled horizontal oscillator**
- **Phase detector**
- **Duty factor control for the negative-going transient of the output signal**
- **Duty factor increases from zero to its normal operation value**
- **Adjustable maximum duty factor**
- **Overvoltage and overcurrent protection with automatic restart after switch-off**
- **Counting circuit for permanent switch-off when n-times overcurrent or overvoltage is sensed**
- **Protection for open-reference voltage**
- **Protection for too-low supply voltage**
- **Protection against loop faults**
- **Positive tracking of duty factor and feedback voltage when the feedback voltage is smaller than the reference voltage minus 1.5V**
- **Normal and "smooth" remote ON/OFF possibility**

APPLICATIONS
- **Video monitors**
- **Power supplies**

PIN CONFIGURATION



ORDERING INFORMATION

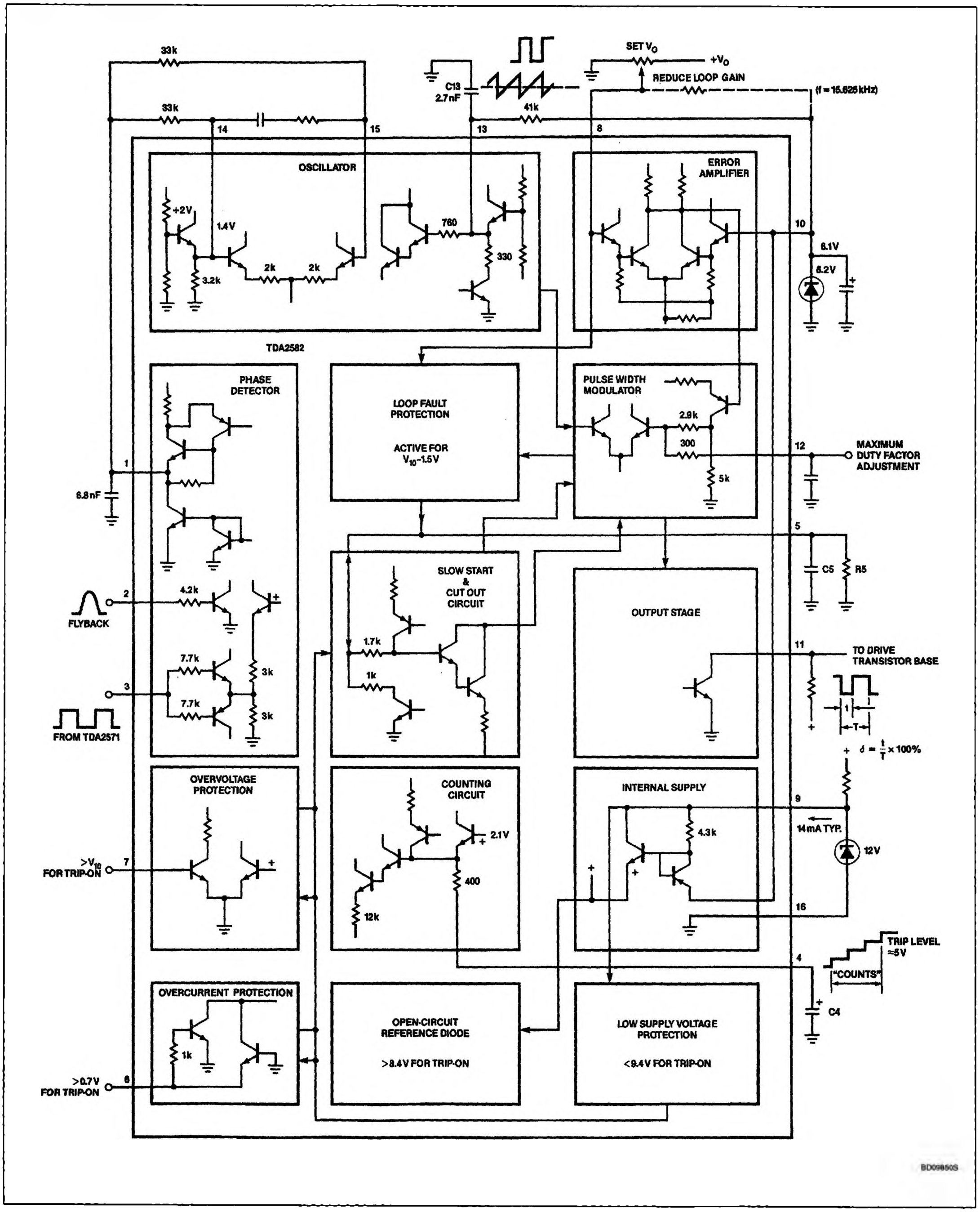
DESCRIPTION	TEMPERATURE RANGE	ORDER CODE
16-Pin Plastic DIP (SOT-38)	−25°C to +80°C	TDA2582N

ABSOLUTE MAXIMUM RATINGS

SYMBOL	PARAMETER	RATING	UNIT
V_{9-16}	Supply voltage at Pin 9	14	V
V_{11-16}	Voltage at Pin 11	0 to 14	V
I_{11M}	Output current (peak value)	40	mA
P_{TOT}	Total power dissipation	280	mW
T_{STG}	Storage temperature	−65 to +150	°C
T_A	Operating ambient temperature	−25 to +80	°C

Control Circuit For Power Supplies TDA2582

BLOCK DIAGRAM



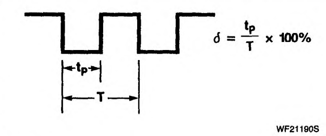
DC ELECTRICAL CHARACTERISTICS V_{CC} = 12V; $V_{10\text{-}16}$ = 6.1V; T_A = 25°C, measured in Figure 3.

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Typ	Max	
V_{9-16}	Supply voltage range	10	12	14	V
V_{9-16}	Protection voltage too-low supply voltage	8.6	9.4	9.9	V
I_9	Supply current at δ = 50%		14		mA
I_9	Supply current during protection		14		mA
I_9	Minimum required supply current[1]			17	mA
P	Power consumption		170		mW
Required input signals					
V_{10-16}	Reference voltage[2]	5.6	6.1	6.6	V
$\lvert Z_{8-16} \rvert$	Feedback input impedance		200		kΩ
V_{10-16}	High reference voltage protection: threshold voltage	7.9	8.4	8.9	V
	Horizontal reference signal (square-wave or differentiated; negative transient is reference)				
$V_{3-16(P\text{-}P)}$	voltage-driven (peak-to-peak value)	5		12	V
I_{3M}	current-driven (peak value)	−1		1.5	mA
$\pm I_3$	switching-level current			100	μA
V_{2-16}	Flyback pulse or differential deflection current	1		5	V
I_{2M}	Flyback pulse current (peak value)			1.5	mA
$-V_{6-16}$	Overcurrent protection:[3] threshold voltage	600	640	695	mV
$+V_{6-16}$		640	680	735	mV
V_{7-16}	Overvoltage protection: ($V_{REF} = V_{10-16}$) threshold voltage	V_{REF} −130	V_{REF} −60	V_{REF} −0	mV
V_{4-16}	Remote-control voltage; switch-off[4]	5.6			V
V_{4-16}	Remote-control voltage; switch-on			4.5	V
V_{5-16}	'Smooth' remote control; switch-off[5]	4.5			V
V_{5-16}	'Smooth' remote control; switch-on			3	V
I_4	Remote-control switch-off current			1	mA
Delivered output signals					
$V_{11-16(P\text{-}P)}$	Horizontal drive pulse (loaded with a resistor of 560Ω to +12V peak-to-peak value	11.6			V
I_{11M}	Output current; peak value			40	mA
	Saturation voltage of output transistor				
V_{CESAT}	at I_{11} = 20mA		200	400	mV
V_{CESAT}	at I_{11} = 40mA			525	mV
δ	Duty factor of output pulse[6]	0		98 ±0.8	%
I_4	Charge current for capacitor on Pin 4		110		μA
I_5	Charge current for capacitor on Pin 5		120		μA
I_{10}	Supply current for reference	0.6	1	1.45	mA

DC ELECTRICAL CHARACTERISTICS (Continued) V_{CC} = 12V; V_{10-16} = 6.1V; T_A = 25°C, measured in Figure 3.

SYMBOL	PARAMETER	LIMITS			UNIT
		Min	Typ	Max	
Oscillator					
	Temperature coefficient		0.0003	0.0004	$°C^{-1}$
	Relative frequency deviation for V_{10-16} changing from 5.6 to 6.6V		−1.4	−2	%
	Oscillator frequency spread (with fixed external components)			3	%
	Frequency control sensitivity at Pin 15 f_{NOM} = 15.625kHz		5		kHz/V
Phase control loop					
	Loop gain of APC-system (automatic phase control)[7]		5		kHz/μs
Δf	Catching range (f_{NOM} = 15,625kHz)	1300		2100	Hz
t	Phase relation between negative transient of sync pulse and middle of flyback		1		μs
Δt	Tolerance of phase relation			±0.4	μs

NOTES:
1. This value refers to the minimum required supply current that will start all devices under the following conditions: V_{9-16} = 10V; V_{10-16} = 6.2V; δ = 50%.
2. Voltage obtained via an external reference diode. Specified voltages do not refer to the nominal voltages of reference diodes.
3. This spread is inclusive temperature rise of the IC due to warming up. For other ambient temperatures the values must be corrected by using a temperature coefficient of typical − 1.85mV/°C.
4. See application information Pin 4.
5. See application information Pin 5.
6. The duty factor is specified as follows: $\delta = \frac{t_P}{T} \times 100\%$ (see Figure 1). After switch-on, the duty factor rises gradually from 0% to the steady value. The relationship between V_{8-16} and the duty factor is given in Figure 6 and the relationship between V_{12-16} and the duty factor is shown in Figure 8.
7. For component values, see Block Diagram.



NOTE:
$\delta = \frac{t_P}{T} \times 100\%$.

Figure 1

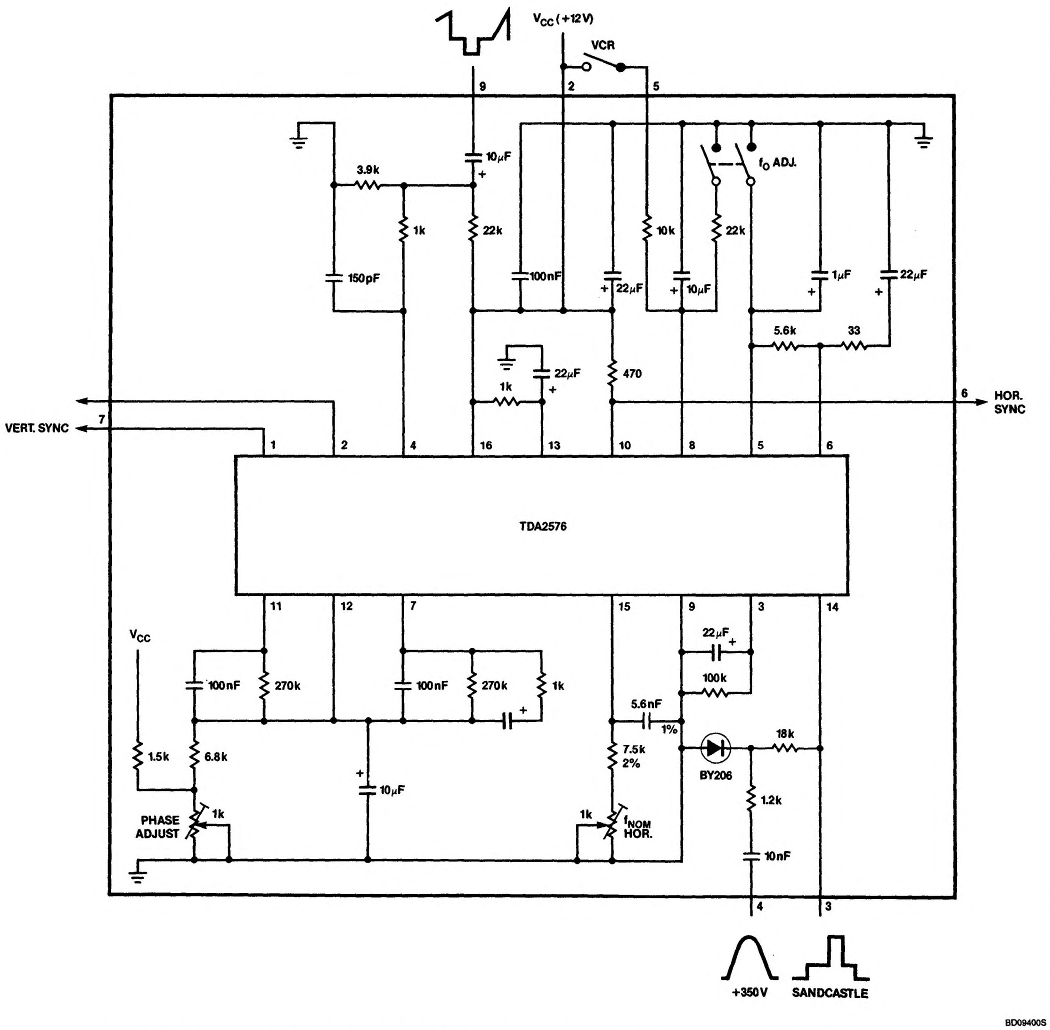


Figure 2a. Lead 6 (Pin 10) of Circuit TDA2576 Connected to Lead 2 (Pin 14) of Circuit TDA2582

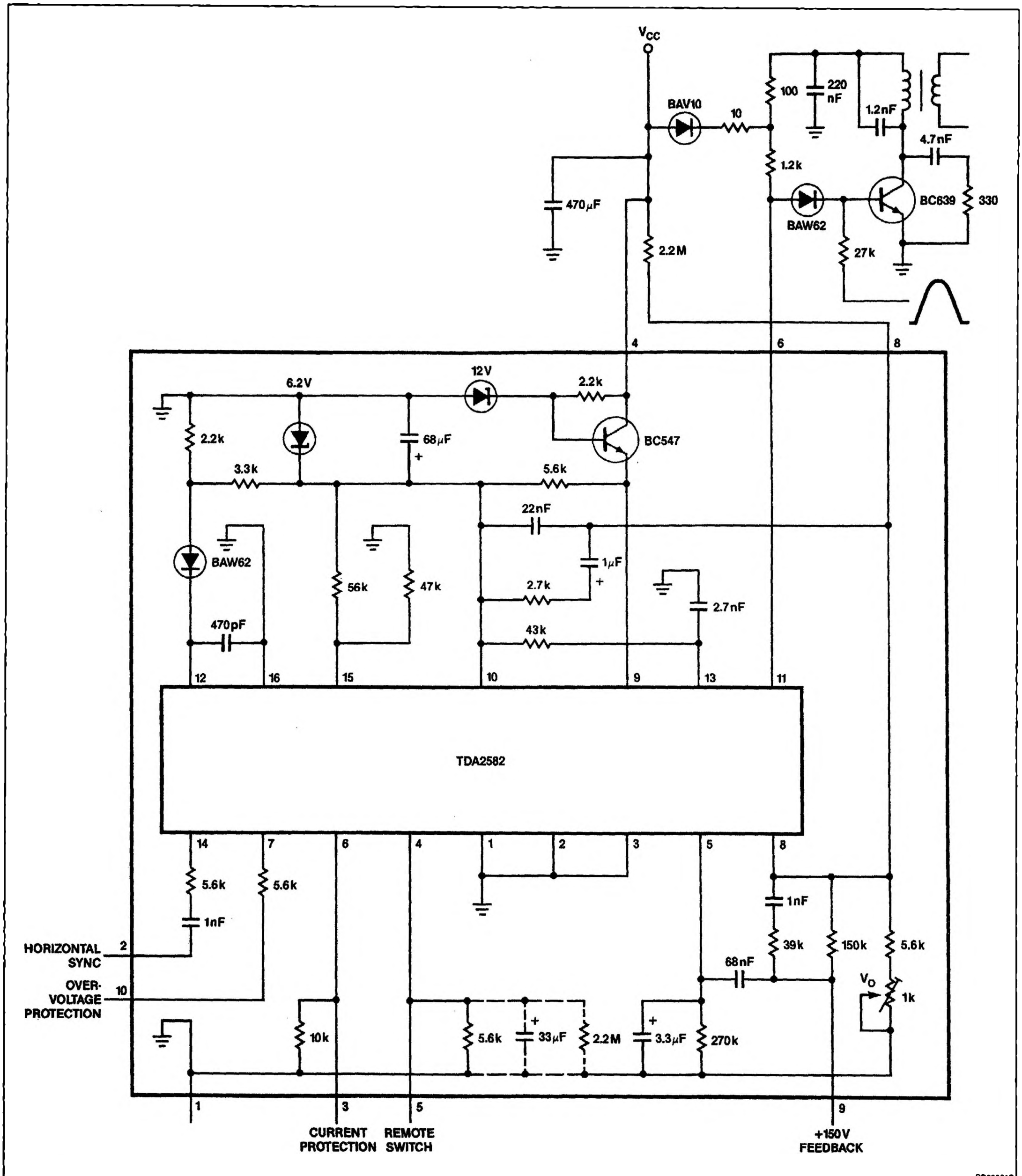
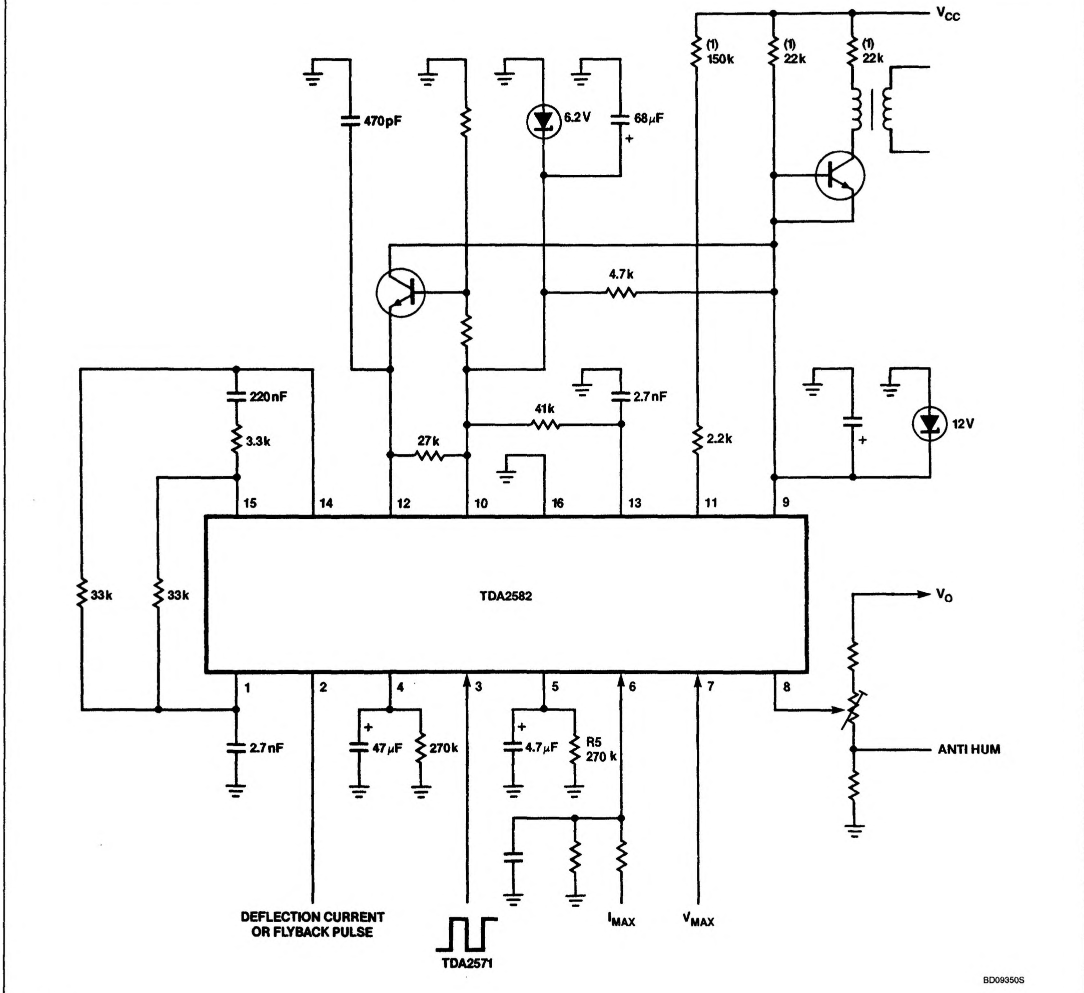


Figure 2b. Lead 6 (Pin 10) of Circuit TDA2576 Connected to Lead 2 (Pin 14) of Circuit TDA2582



NOTE:
1. Values depend on V_{CC}.

Figure 3. Circuit Diagram

APPLICATION INFORMATION

The function is described beside the corresponding pin number.

1 Phase Detector Output — The output circuit consists of a bidirectional current source which is active for the time that the signal on Pin 2 exceeds 1V.

The current values are chosen such that the correct phase relation is obtained when the output signal of the TDA2571 is applied to Pin 3.

With a resistor of 2 × 33kΩ and a capacitor of 2.7nF, the control steepness is 0.55V/μs (Figure 3).

2 Flyback Pulse Input — The signal applied to Pin 2 is normally a flyback pulse with a duration of about 12μs. However, the phase detector system also accepts a signal derived by differentiating the deflection current by means of a small toroidal core (pulse duration > 3μs).

The toroidal transformer in Figure 4a is for obtaining a pulse representing the midflyback from the deflection current. The connection of the picture phase information is shown in Figure 4b.

3 Reference Frequency Input — The input circuit can be driven directly by the square-wave output voltage from Pin 8 of the TDA2571.

The negative-going transient switches the current source connected to Pin 1 from positive to negative.

The input circuit is made such that a differentiated signal of the square-wave from the TDA2571 is also accepted (this enables power line isolation). The input circuit switching level is about 3V and the input impedance is about 8kΩ.

4 Restart Count Capacitor/Remote-Control Input —

Counting

An external capacitor (C4 = 47μF) is connected between Pins 4 and 16. This capacitor controls the characteristics of the protection circuits as follows.

If the protection circuits are required to operate, e.g., overcurrent at Pin 6, the duty factor will be set to zero, thus turning off the power supply.

After a short interval (determined by the time constant on Pin 5), the power supply will be restarted via the slow-start circuit.

If the fault condition has cleared, then normal operation will be resumed. If the fault condition is persistent, the duty factor of the pulses is again reduced to zero and the protection cycle is repeated.

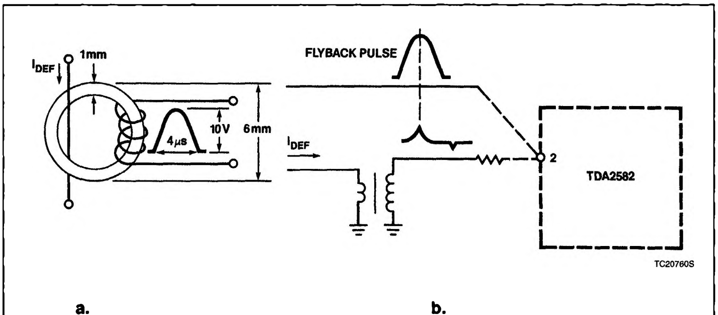


Figure 4

The number of times this action is repeated (n) for a persisting fault condition is now determined by: n = C4/C5.

Remote Control Input

For this application, the capacitor on Pin 4 has to be replaced by a resistor with a value between 4.7 and 18kΩ. When the externally-applied voltage $V_{4\text{-}16} > 5.6V$, the circuit switches off; switching on occurs when $V_{4\text{-}16} < 4.5V$ and the normal starting-up procedure is followed. Pin 4 is internally connected to an emitter-follower, with an emitter voltage of 1.5V.

5 Slow-Start and Transfer Characteristics for Low Feedback Voltage —

Slow-Start

An external shunt capacitor (C5 = 4.7μF) and resistor (R5 = 270kΩ) are connected between Pins 5 and 16. The network controls the rate at which the duty factor increases from zero to its steady-state value after switch-on. It provides protection against surges in the power transistor.

Transfer Characteristic for Low Feedback Voltages

The duty factor transfer characteristic for low feedback voltages can be influenced by R5.

The transfer for three different resistor values is given in Figure 6.

'Smooth' Remote ON/OFF

The ON/OFF information should be applied to Pin 5 via a high-ohmic resistor; a high OFF-level gives a slow rising voltage at Pin 5, which results in a slowly decreasing duty factor.

6 Overcurrent Protection Input — A voltage proportional to the current in the power switching device is applied to the integrated circuit between Pins 6 and 16. The circuit trips on both positive and negative polarity. When the tripping level is reached, the output pulse is immediately blocked and the starting circuit is activated again.

7 Over voltage Protection Input — When the voltage applied to this pin exceeds the threshold level, the protection circuit will operate.

The tripping level is about the same as the reference voltage on Pin 10.

8 Feedback Voltage Input — The control loop input is applied to Pin 8. This pin is internally connected to one input of a differential amplifier, functioning as an amplitude comparator, the other input of which is connected to the reference source on Pin 10.

Under normal operating conditions, the voltage on Pin 8 will be about equal to the reference voltage on Pin 10. For further information refer to Figures 6 and 7.

9 12V Positive Supply — The maximum voltage that may be applied is 14V. Where this is derived from an unstabilized supply rail, a regulator diode (12V) should be connected between Pins 9 and 16 to ensure that the maximum voltage does not exceed 14V. When the voltage on this pin falls below a minimum of 8.6V (typically 9.4V), the protection circuit will switch off the power supply.

10 Reference Input — An external reference diode must be connected between this pin and Pin 16.

The reference voltage must be between 5.6 and 6.6V. The IC delivers about 1mA into the external regulator diode. When the external load on the regulator diode approaches this current, replenishment of the current can be obtained by connecting a suitable resistor between Pins 9 and 10. A higher reference-voltage value up to 7.5V is allowed when use is made of a duty factor limiting resistor < 27kΩ between Pins 12 and 16.

11 Output — An external resistor determines the output current fed into the base of the driver transistor. The output circuit uses an NPN transistor with 3 series-connected clamping diodes to the internal 12V supply rail. This provides a low-impedance in the "ON" state, that is, with the drive transistor turned off.

12 Maximum Duty-Factor Adjustment/ Smoothing

Maximum Duty-Factor Adjustment

Pin 12 is connected to the output voltage of the amplitude comparator (V_{10-8}). This voltage is internally connected to one input of a differential amplifier, the other input of which is connected to the sawtooth voltage of the horizontal oscillator. A high voltage on Pin 12 results in a low duty factor. This enables the maximum duty factor to be adjusted by limiting the voltage by connecting Pin 12 to the emitter of an NPN transistor used as a voltage source.

Figure 8 plots the maximum duty factor as a function of the voltage applied to Pin 12. If some spread is acceptable, the maximum duty factor can also be limited by connecting a resistor from Pin 12 to Pin 16. A resistor of 12kΩ limits the maximum duty factor to about 50%. This application also reduces the total IC gain.

Smoothing

Any double pulsing of the IC due to circuit layout can be suppressed by connecting a capacitor of about 470pF between Pins 12 and 16.

13 Oscillator Timing Network — The timing network comprises a capacitor between Pins 13 and 16, and a resistor between Pin 13 and the reference voltage on Pin 10.

The charging current for the capacitor (C13) is derived from the voltage reference diode connected to Pin 10 and discharged via an internal resistor of about 330Ω.

14 Reactance-Stage Reference Voltage — This pin is connected to an emitter-follower which determines the nominal reference voltage for the reactance stage (1.4V for reference voltage V_{10-16} = 6.1V). Free-running frequency is obtained when Pins 14 and 15 are short-circuited.

15 Reactance-Stage Input — The output voltage of the phase detector (Pin 1) is connected to Pin 15 via a resistor. The voltage applied to Pin 15 shifts the upper level of the voltage sensor of the oscillator, thus changing the oscillator frequency and phase. The time-constant network is connected between Pins 14 and 15. Control sensitivity is typically 5kHz/V.

16 Negative Supply (Ground)

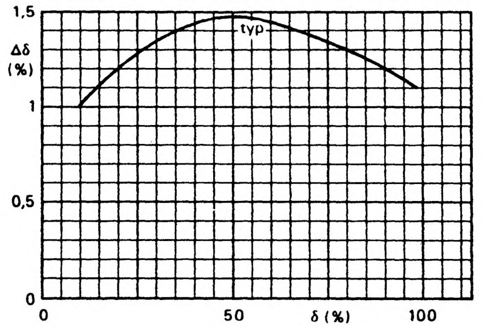


Figure 5. Duty Factor Change as a Function of Initial Duty Factor; at 1mV Error Amplifier Input Change; $\Delta V_{8-10(P-P)}$ = 1mV

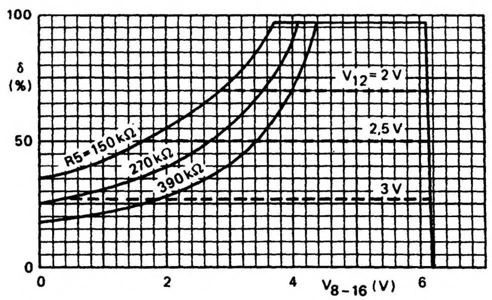


Figure 6. Duty Factor of Output Pulses as a Function of Feedback Input Voltage (V_{8-16}) With R5 as a Parameter and V_{12-16} as a Limiting Value; V_{10-16} = 6.1V

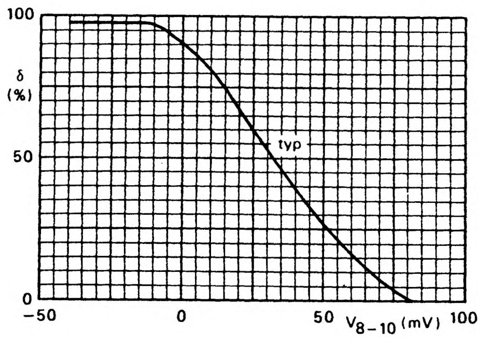


Figure 7. Duty Factor of Output Pulses as a Function of Error Amplifier Input (V_{8-10}); V_{10-16} = 6.1V

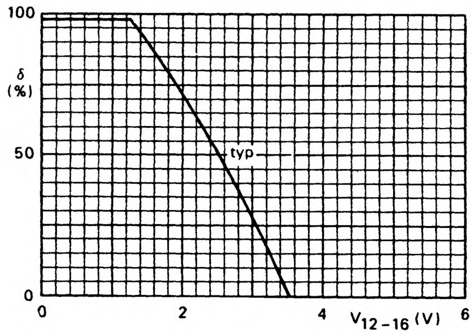


Figure 8. Maximum Duty Factor Limitation as a Function of the Voltage Applied to Pin 12; V_{10-16} = 6.1V