CONTROL CIRCUIT FOR SMPS

The TDA2581 is a monolithic integrated circuit for controlling switched-mode power supplies (SMPS) which are provided with the drive for the horizontal deflection stage.

The circuit features the following:
- Voltage controlled horizontal oscillator.
- Phase detector.
- Duty factor control for the positive-going transient of the output signal.
- Duty factor increases from zero to its normal operation value.
- Adjustable maximum duty factor.
- Over-voltage and over-current protection with automatic re-start after switch-off.
- Counting circuit for permanent switch-off when n-times over-current or over-voltage 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 1,5 V.

QUICK REFERENCE DATA

Supply voltage	$V_{9\text{-}16}$	typ.	12	V
Supply current	I_9	typ.	15	mA
Input signals				
Horizontal drive pulse (peak-to-peak value)	$V_{3\text{-}16(p\text{-}p)}$	typ.	11	V
Flyback pulse (differentiated deflection current); peak-to-peak value	$V_{2\text{-}16(p\text{-}p)}$	typ.	5	V
External reference voltage	$V_{10\text{-}16}$	typ.	6,7	V
Output signals				
Duty factor of output pulse	δ	$>$	0	%
		$<$	98 ± 0,6	%
Output voltage at $I_o < 20$ mA (peak value)	$V_{11\text{-}16M}$	typ.	11,8	V
Output current (peak value)	I_{11M}	$<$	40	mA

PACKAGE OUTLINES

TDA2581: 16-lead DIL; plastic (SOT-38).
TDA2581Q: 16-lead QIL; plastic (SOT-58).

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

Supply voltage	$V_{9\text{-}16}$	max.	14 V
Voltage at pin 11	$V_{11\text{-}16}$		0 to 14 V
Output current	I_{11}	max.	40 mA
Total power dissipation	P_{tot}	max.	340 mW
Storage temperature	T_{stg}		−25 to +125 °C
Operating ambient temperature	T_{amb}		−25 to +80 °C

CHARACTERISTICS

$V_{9\text{-}16}$ = 12 V; $V_{10\text{-}16}$ = 6,7 V; T_{amb} = 25 °C; measured in the circuit on page 2

Supply voltage range	$V_{9\text{-}16}$	typ.	12 V 10 to 14 V
Protection voltage too low supply voltage	$V_{9\text{-}16}$	typ.	9,4 V 8,6 to 9,9 V
Supply current at δ = 50%	I_9	typ.	15 mA
Supply current during protection	I_9	typ.	15 mA
Minimum required supply current	I_9	<	18,5 mA*
Power consumption	P	typ.	180 mW
Required input signals			
Reference voltage	$V_{10\text{-}16}$	typ.	6,7 V 5,6 to 7,5 V**
High reference voltage protection: threshold voltage	$V_{10\text{-}16}$	typ.	8,4 V 7,9 to 8,9 V
Feedback input impedance at pin 8	$\lvert Z_{8\text{-}16}\rvert$	typ.	200 kΩ
Horizontal drive pulse (square-wave or differentiated; negative transient is reference) peak-to-peak value	$V_{3\text{-}16(p\text{-}p)}$	typ.	11 V 5 to 12 V
Flyback pulse or differential deflection current	$V_{2\text{-}16}$		1 to 5 V
Over-current protection: threshold voltage	$-V_{6\text{-}16}$	typ.	640 mV 690 to 695 mV▲
	$+V_{6\text{-}16}$	typ.	680 mV 640 to 735 mV▲
Over-voltage protection: threshold voltage	$V_{7\text{-}16}$	typ. $V_{10\text{-}16}$ $V_{10\text{-}16}$ −130 to $V_{10\text{-}16}$	−60 mV −0 mV

* This value refers to the minimum required supply current that will start all devices under the following conditions: $V_{9\text{-}16}$ = 10 V; $V_{10\text{-}16}$ = 6,8 V; δ = 50%.

** Voltage obtained via an external reference diode. Specified voltages do not refer to the nominal voltages of reference diodes.

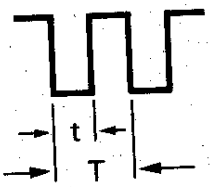
▲ This spread is inclusive temperature rise of the IC due to warming up. For other ambient temperatures the values must be corrected by using a temperature coefficient of typical −1,85 mV/°C.

CHARACTERISTICS (continued)

Remote control voltage; switch off	$V_{4\text{-}16}$	>	5,8 V*
switch on	$V_{4\text{-}16}$	<	4,5 V*
Delivered output signals			
Horizontal drive pulse (loaded with a resistor of 560 Ω to +12 V) peak-to-peak value	$V_{11\text{-}16(p\text{-}p)}$	>	11,6 V
Output current; peak value	I_{11M}	<	40 mA
Saturation voltage of output transistor at I_{11} = 20 mA	V_{CEsat}	typ.	200 mV
		<	400 mV
at I_{11} = 40 mA	V_{CEsat}	<	525 mV
Duty factor of output pulse**	δ	>	0 %
		<	98 ± 0,6 %
Charge current for capacitor on pin 4	I_4	typ.	120 μA
Charge current for capacitor on pin 5	I_5	typ.	130 μA
Supply current for reference	I_{10}	typ.	1 mA
			0,6 to 1,45 mA
Oscillator			
Temperature coefficient		typ.	−300 ppm/°C
		<	−400 ppm/°C
Relative frequency deviation for $V_{10\text{-}16}$ changing from 6 to 7 V		typ.	−1,5 %
		⩽	−2 %
Oscillator frequency spread (with fixed external components)		⩽	±3 %
Frequency control sensitivity at pin 15		typ.	4,5 kHz/V▲
Phase control loop			
Loop gain of APC-system (automatic phase control)		typ.	5 kHz/μs
Catching range	Δf	typ.	±1,5 kHz
Phase relation between negative transient of sync pulse and middle of flyback	t	typ.	1 μs
Tolerance of phase relation	Δt	⩽	±0,4 μs

* See pin 4 on pages 7 and 8.

** The duty factor is specified as follows:



$$\delta = \frac{t}{T} \times 100\%.$$

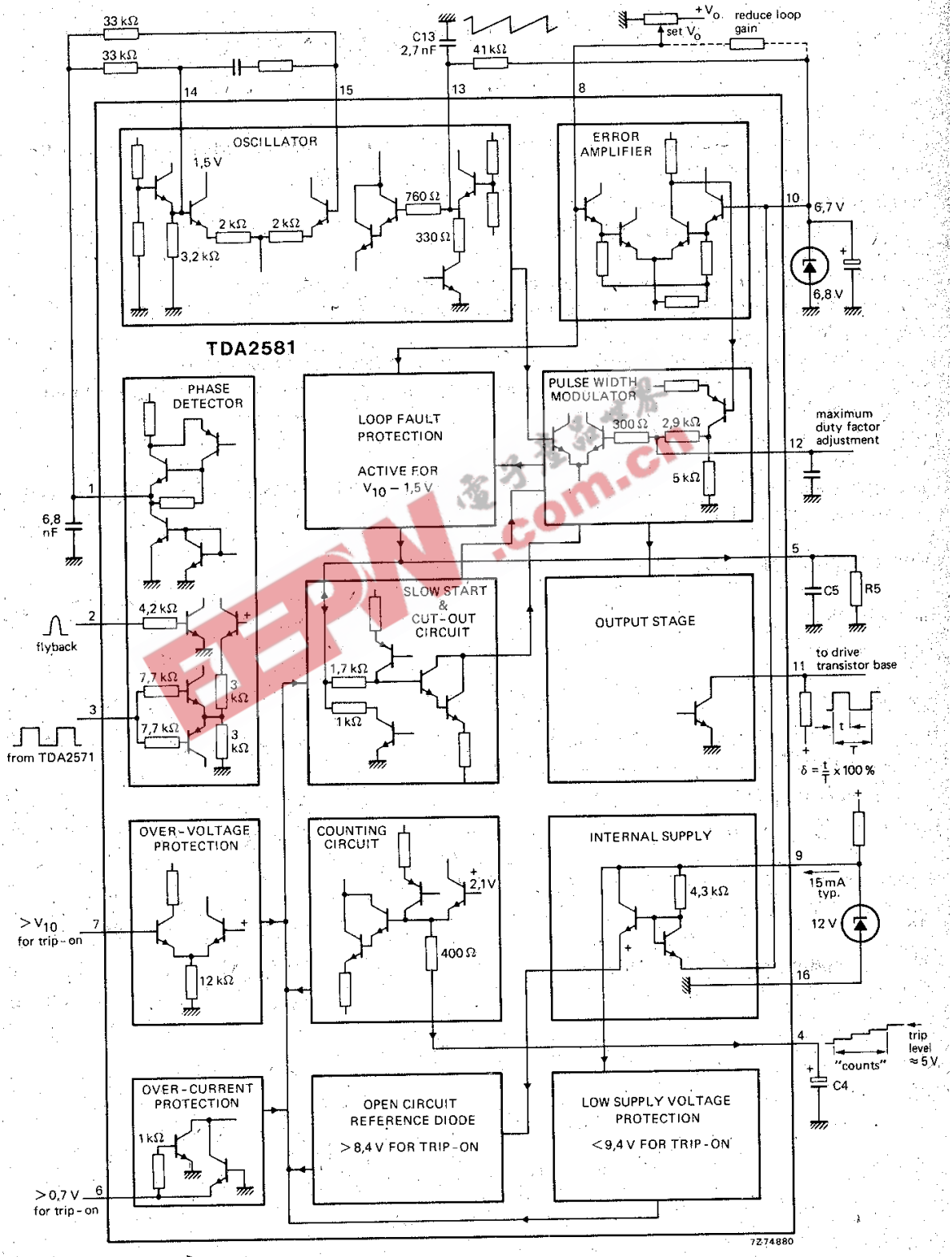
The maximum duty factor value can be set to a desired value (see application information pin 12 on page 9).

▲ For component values see circuit diagram on page 2.

PINNING

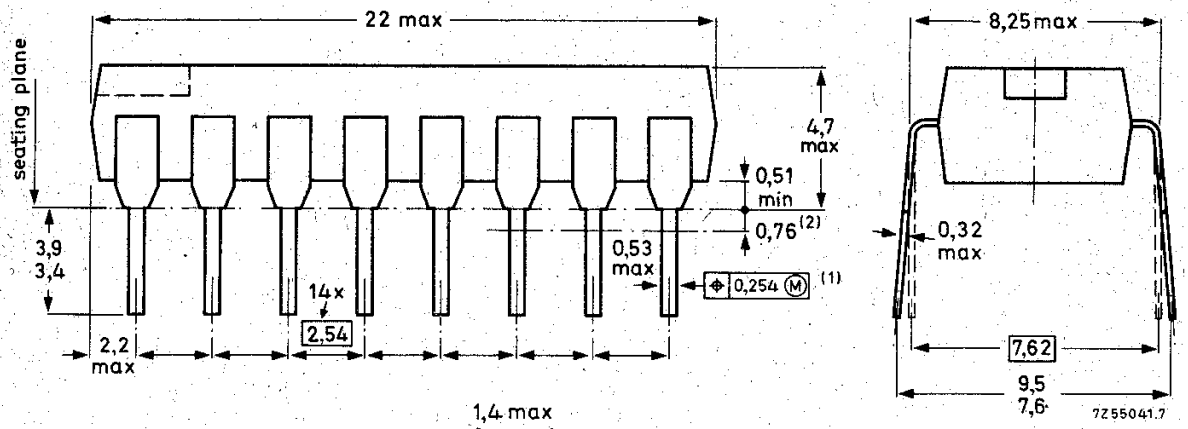
1. Phase detector output
2. Flyback pulse position input
3. Reference frequency input
4. Re-start count capacitor/remote control input
5. Slow start and transfer characteristic for low feedback voltages
6. Over-current protection input
7. Over-voltage protection input
8. Feedback voltage input
9. Positive supply
10. Reference input
11. Output
12. Maximum duty factor adjustment/smoothing
13. Oscillator timing network
14. Reactance stage reference voltage
15. Reactance stage input
16. Negative supply (ground)

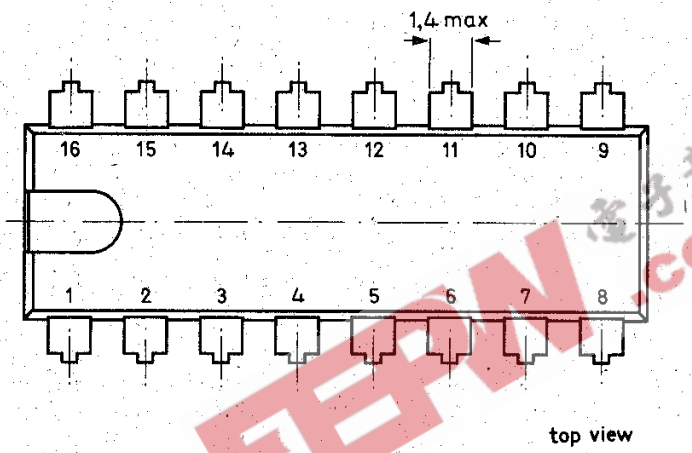
BLOCK DIAGRAM



Note: trip levels are nominal values.

16-LEAD DUAL IN-LINE; PLASTIC (SOT-38)





Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

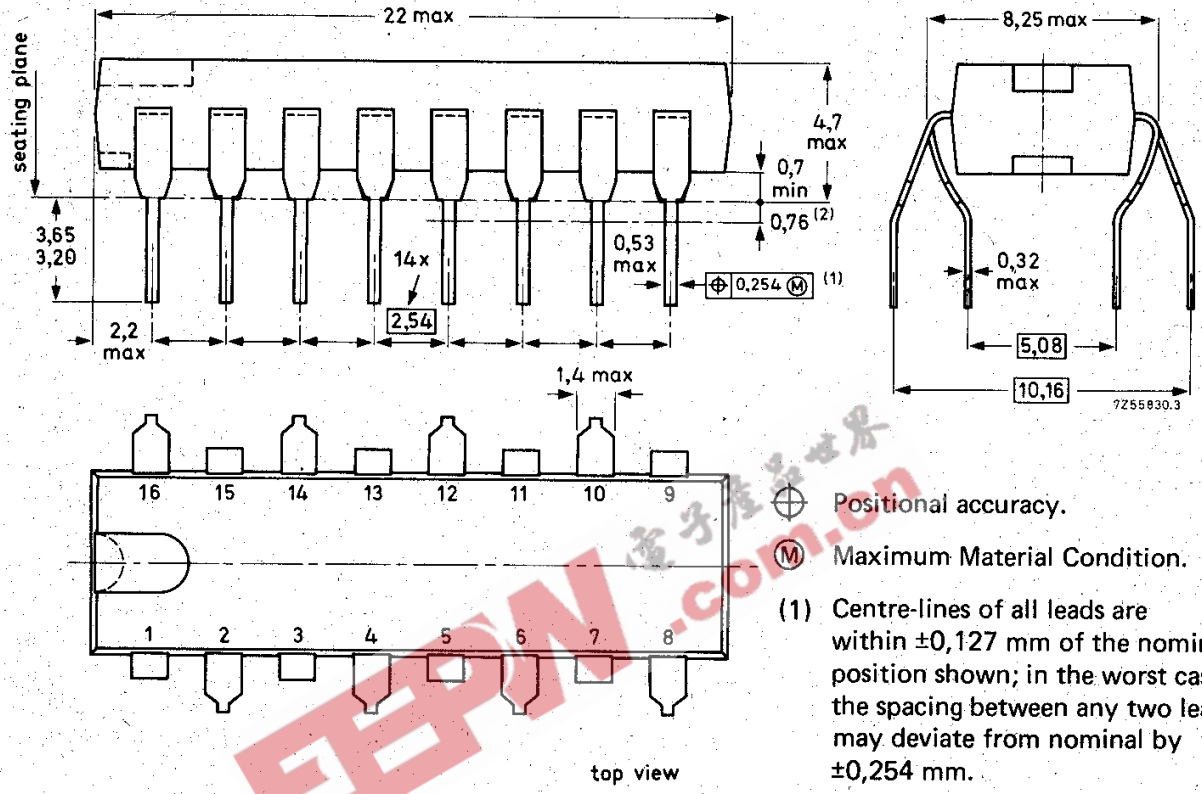
2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.

16-LEAD QUADRUPLE IN-LINE; PLASTIC (SOT-58)



Dimensions in mm

⊕ Positional accuracy.

Ⓜ Maximum Material Condition.

(1) Centre-lines of all leads are within ±0,127 mm of the nominal position shown; in the worst case, the spacing between any two leads may deviate from nominal by ±0,254 mm.

(2) Lead spacing tolerances apply from seating plane to the line indicated.

SOLDERING

1. By hand

Apply the soldering iron below the seating plane (or not more than 2 mm above it).
If its temperature is below 300 °C it must not be in contact for more than 10 seconds; if between 300 °C and 400 °C, for not more than 5 seconds.

2. By dip or wave

The maximum permissible temperature of the solder is 260 °C; this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.
The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified storage maximum. If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

3. Repairing soldered joints

The same precautions and limits apply as in (1) above.