SIEMENS

Speed Controller
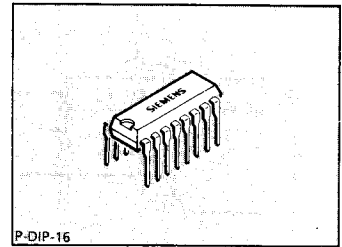
TCA 955

Features

Bipolar IC

- High control accuracy
- Large supply voltage range

Typical Applications

Speed control in

- Tape recorders
- Cassette recorders
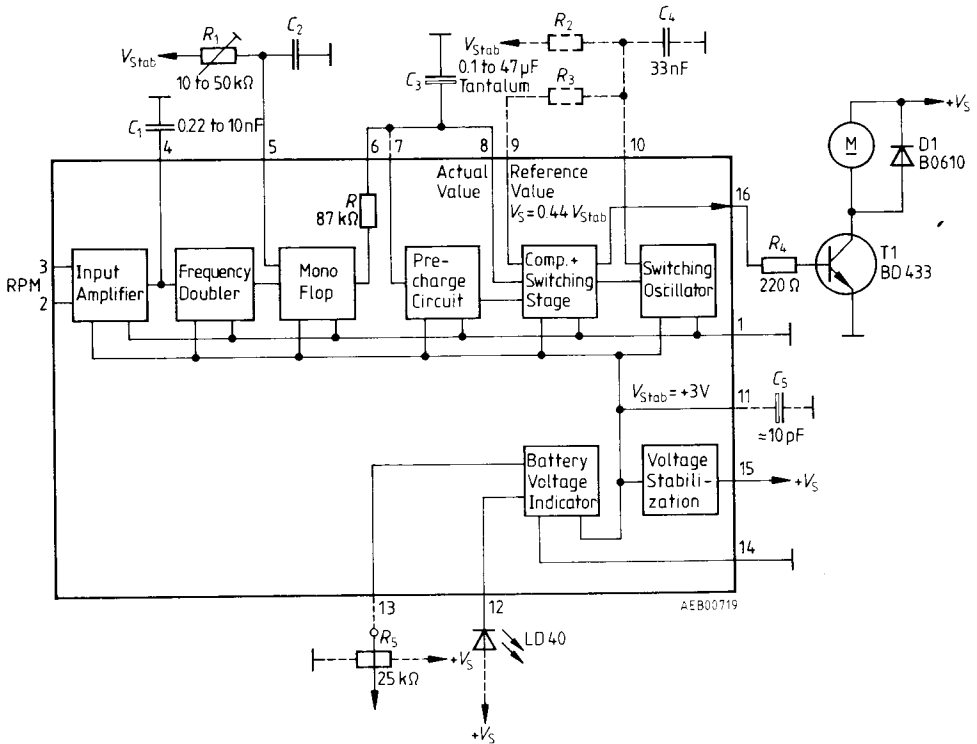- Record players
- Movie Cameras
- Control system drivers

P-DIP-16

Type	Ordering Code	Package
■ ⊡TCA 955	Q67000–A983	P-DIP-16

■ Not for new design

The TCA 955 is suited for the speed control of DC motors. The principle corresponds to a clocked control. Outstanding features are its high control accuracy, its large supply voltage range, and the possible current saving. Additionally, the IC features a battery voltage indicator.

Block Diagram for Speed Control with TCA 955

Dimensioning Notes

● The internal voltage stabilization offers the following advantages:
  – operation with highly varying supply voltage,
  – wide range of supply voltage.

● In order to receive pulses with a steady duty cycle at the output, symmetrical pulses must be applied to the input.

● It is recommended to use multipole tachometer generators as this improves the accuracy of control and possibly the power consumption.

● The power consumption can considerably be reduced by means of the switching frequency oscillator at low electric motor time constants.

● Higher accuracy can be obtained by using a second-order filter instead of C_3.

● When using rapidly starting motors, the precharge circuitry reduces overshoots.

Absolute Maximum Ratings

Parameter	Symbol	Limit Values	Unit
Supply voltage	V_S	16	V
Supply voltage (pin 11 and pin 15 connected)	V_S	6	V
Output current pin 16	I_Q	200	mA
Output current pin 12 (LED output)	$I_{Q\,LED}$	15	mA
Power dissipation, LED output	$P_{Q\,LED}$	150	mW
Junction temperature	T_j	150	°C
Storage temperature range	T_{stg}	−55 to 125	°C
Thermal resistance system – air	$R_{th\,SA}$	85	K/W

Operating Range

Parameter	Symbol	Limit Values	Unit
With internal short-circuit stabilization (pin 11 and pin 15 connected)	V_S	2 to 6	V
With internal stabilization (V_S to pin 15)	V_S	4.8 to 16.0	V
Ambient temperature	T_A	−25 to 85	°C

Characteristics

$V_S = 2.2$ V to 16.0 V; $T_A = 25\,°C$

Parameter	Symbol	Limit Values			Unit
		min.	typ.	max.	

Controller

Parameter	Symbol	min.	typ.	max.	Unit
Current consumption $V_S = 4.8$ V	I_S		8.3	12.0	mA
$V_S = 16$ V	I_S		15.5	24.0	mA
Stabilized voltage $V_S = 4.8$ to 16 V	V_{stab}	2.75	3.00	3.30	V
Input threshold (pin 3) to ground	V_I	$0.46 \times V_{11}$	$0.485 \times V_{11}$	$0.51 \times V_{11}$	V
Hysteresis of input threshold	ΔV_I		$0.015 \times V_{11}$	$0.03 \times V_{11}$	V
Offset voltage (pin 3 to pin 2)	V_{offset}		11	20	mV
Input current (pin 3)	I_I			1	μA
Output transistor saturation voltage $I_Q = 50$ mA	$V_{Q\,sat}$		0.84	1.00	V
$I_Q = 100$ mA	$V_{Q\,sat}$		0.92	1.25	V
Output transistor cutoff current	$I_{Q\,H}$			30	μA
Duty cycle – control range[1]	D	0		1	

Characteristics

$V_S = 2.2$ V to 16.0 V; $T_A = 25\,^{\circ}C$

Parameter	Symbol	Limit Values			Unit
		min.	typ.	max.	

Controller

Parameter	Symbol	min.	typ.	max.	Unit
Rated rpm[2]	n	$\dfrac{12.55}{p \cdot R_1 \cdot C_2}$	$\dfrac{14.85}{p \cdot R_1 \cdot C_2}$	$\dfrac{17.64}{p \cdot R_1 \cdot C_2}$	rpm
Error in rpm with duty cycle control[3] from 0 to 1				$\dfrac{0.224}{n \cdot p \cdot C_3}$	%

Switching Oscillator

Parameter	Symbol	min.	typ.	max.	Unit
Frequency	f		$\dfrac{1}{0.4 \cdot R_2 \cdot C_4}$		Hz
Average voltage pin 10	$V_{Q\,OSC}$		$0.48 \times V_{11}$		V
Voltage pin 11			$0.18 \times V_{11}$		V
peak to peak $V_{Q\,OSC}$					

Battery Voltage Indicator

Parameter	Symbol	min.	typ.	max.	Unit
Threshold voltage	$V_{I\,ON}$			1.5	V
	$V_{I\,OFF}$	1.0			V
Hysteresis	V_{hy}		220		mV
Input current	I_I			0.2	μA
Saturation voltage LED output[4]	$V_{Q\,LED}$			$0.5 + 500 \times I_{LED}$	V

Formulae

Rate rpm $\qquad n = \dfrac{14.85}{p \cdot R_1 \cdot C_2}$ [rpm]

Switching frequency $\quad f = \dfrac{n \cdot p}{30}$ [Hz]

in operation without switching oscillator.

Reference value $\qquad V_{REF} = 0.44 \times V_{11}$ [V]

Precharging voltage at C_3 $\quad V_F = 0.87 \times V_{REF}$ [V]

(pin 6 and pin 7 connected)
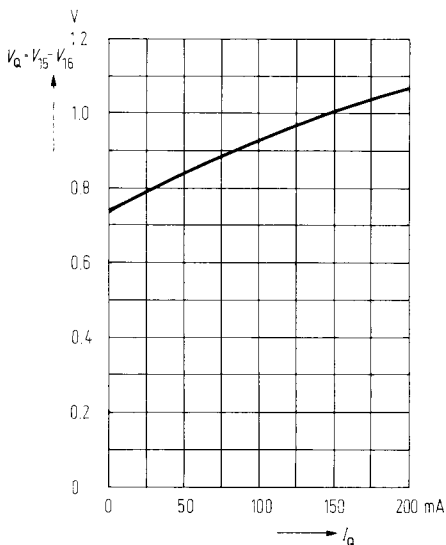
[1] Duty cycle

$v = \dfrac{t}{\tau}$

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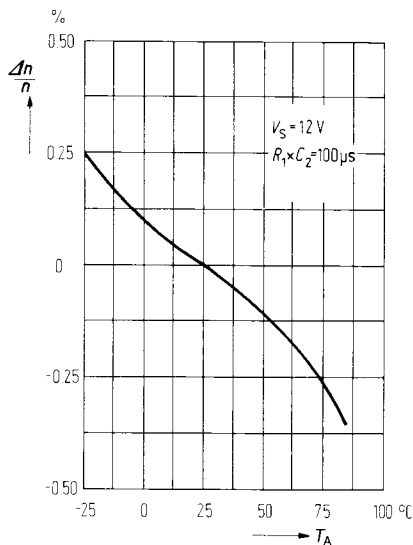[2] p = number of pole pairs of the tachometer generator.
[3] in applications without switching oscillator.
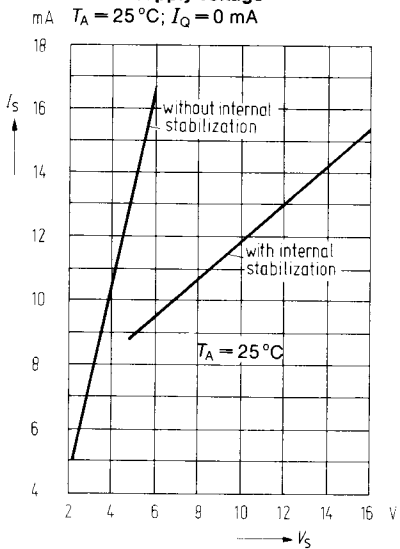[4] A protective resistor of 500 Ω ± 20% is integrated inside the IC.

Saturation voltage of output transistor
Output voltage versus output current

Rpm versus ambient temperature
$V_S = 12\ V;\ R_1 \times C_2 = 100\ \mu s$

$V_Q - V_{15} - V_{16}$

I_Q

$\frac{\Delta n}{n}$

$V_S = 12\ V$
$R_1 \times C_2 = 100\ \mu s$

T_A

Current consumption
versus supply voltage
$T_A = 25\,°C;\ I_Q = 0\ mA$

Rpm versus supply voltage
$T_A = 25\,°C;\ R_1 \times C_2 = 100\ \mu s$

I_S

without internal
stabilization

with internal
stabilization

$T_A = 25\,°C$

V_S

$\frac{\Delta n}{n}$

$T_A = 25\,°C$
$R_1 \times C_2 = 100\ \mu s$

with internal
stabilization

without internal
stabilization

V_S