

## Speed Controller

**TCA 955**

### Features

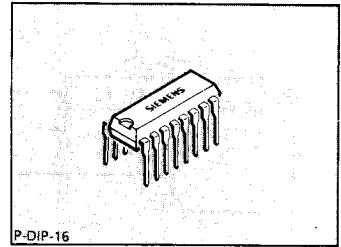
- High control accuracy
- Large supply voltage range

### Typical Applications

Speed control in

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

**Bipolar IC**

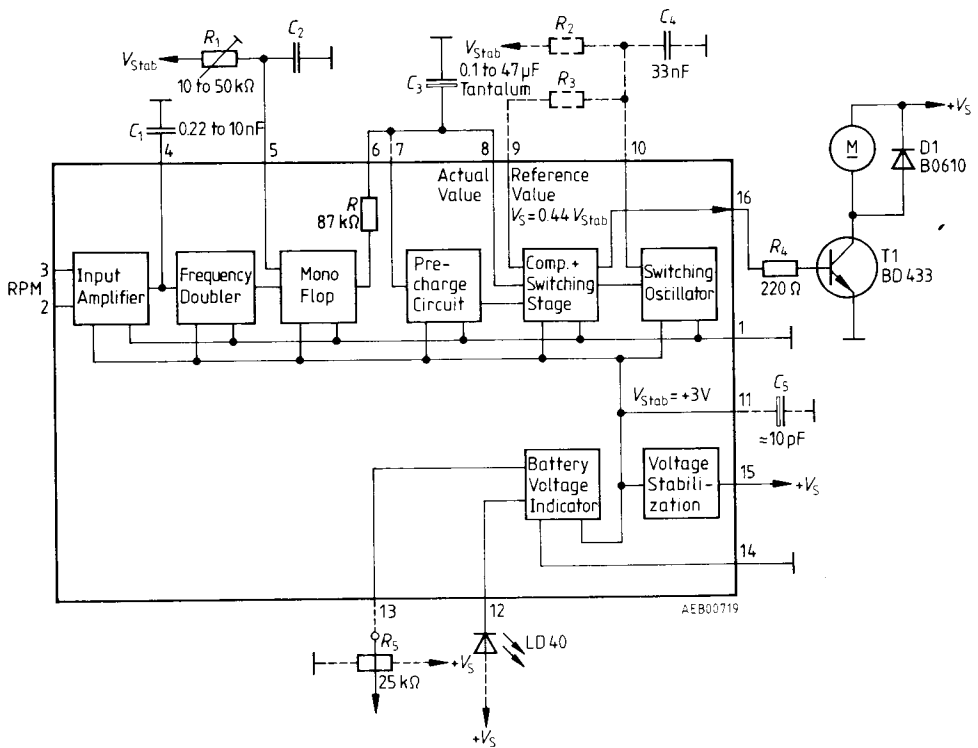


Type	Ordering Code	Package
■ TCA 955	Q67000-A983	P-DIP-16

- 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**

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**

$V_S = 2.2\text{ V to }16.0\text{ V}; T_A = 25\text{ °C}$

Parameter	Symbol	Limit Values			Unit
		min.	typ.	max.	

**Controller**

Current consumption $V_S = 4.8\text{ V}$ $V_S = 16\text{ V}$	$I_S$ $I_S$		8.3 15.5	12.0 24.0	mA mA
Stabilized voltage $V_S = 4.8\text{ to }16\text{ V}$	$V_{stab}$	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	$\Delta V_I$		$0.015 \times V_{11}$	$0.03 \times V_{11}$	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 $I_Q = 50\text{ mA}$	$V_{Q\ sat}$		0.84	1.00	V
$I_Q = 100\text{ mA}$	$V_{Q\ sat}$		0.92	1.25	V
Output transistor cutoff current	$I_{Q\ H}$			30	μA
Duty cycle – control range <sup>1)</sup>	$D$	0		1	

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

Parameter	Symbol	Limit Values			Unit
		min.	typ.	max.	

**Controller**

Rated rpm <sup>2)</sup>	$n$	$\frac{12.55}{p \cdot R_1 \cdot C_2}$	$\frac{14.85}{p \cdot R_1 \cdot C_2}$	$\frac{17.64}{p \cdot R_1 \cdot C_2}$	rpm
Error in rpm with duty cycle control <sup>3)</sup> from 0 to 1				$\frac{0.224}{n \cdot p \cdot C_3}$	%

**Switching Oscillator**

Frequency	$f$		$\frac{1}{0.4 \cdot R_2 \cdot C_4}$		Hz
Average voltage pin 10 Voltage pin 11 peak to peak $V_{Q \text{ OSC}}$	$V_{Q \text{ OSC}}$		$0.48 \times V_{11}$ $0.18 \times V_{11}$		V V

**Battery Voltage Indicator**

Threshold voltage	$V_{1 \text{ ON}}$ $V_{1 \text{ OFF}}$	1.0		1.5	V V
Hysteresis	$V_{\text{HY}}$		220		mV
Input current	$I_1$			0.2	$\mu\text{A}$
Saturation voltage LED output <sup>4)</sup>	$V_{Q \text{ LED}}$			$0.5 + 500 \times I_{\text{LED}}$	V

**Formulae**

$$\text{Rate rpm} \quad n = \frac{14.85}{p \cdot R_1 \cdot C_2} \quad [\text{rpm}]$$

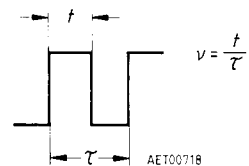
$$\text{Switching frequency} \quad f = \frac{n \cdot p}{30} \quad [\text{Hz}]$$

in operation without switching oscillator.

$$\begin{aligned} \text{Reference value} \quad V_{\text{REF}} &= 0.44 \times V_{11} \quad [\text{V}] \\ \text{Precharging voltage at } C_3 \quad V_F &= 0.87 \times V_{\text{REF}} \quad [\text{V}] \end{aligned}$$

(pin 6 and pin 7 connected)

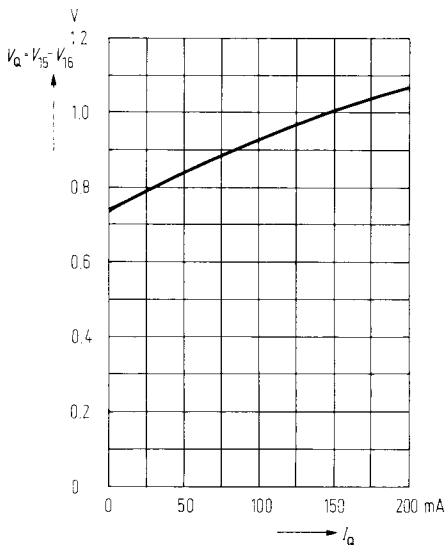
1) Duty cycle

2)  $p$  = number of pole pairs of the tachometer generator.

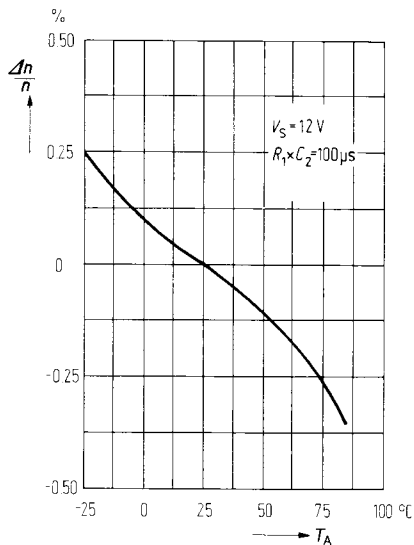
3) in applications without switching oscillator.

4) A protective resistor of  $500 \Omega \pm 20\%$  is integrated inside the IC.

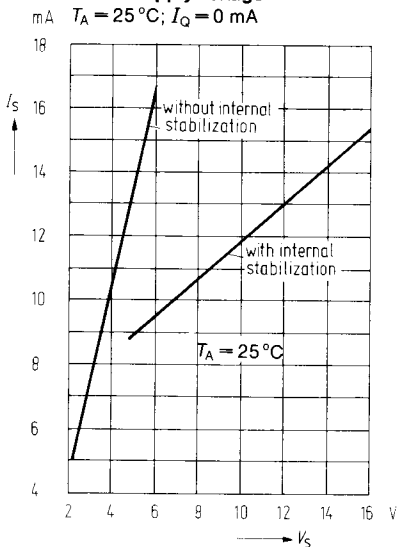
**Saturation voltage of output transistor**  
**Output voltage versus output current**



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



**Current consumption versus supply voltage**  
 $T_A = 25^\circ\text{C}; I_Q = 0 \text{ mA}$



**Rpm versus supply voltage**  
 $T_A = 25^\circ\text{C}; R_1 \times C_2 = 100 \mu\text{s}$

