

Endüstriyel Otomatik Kontrol Sistemleri

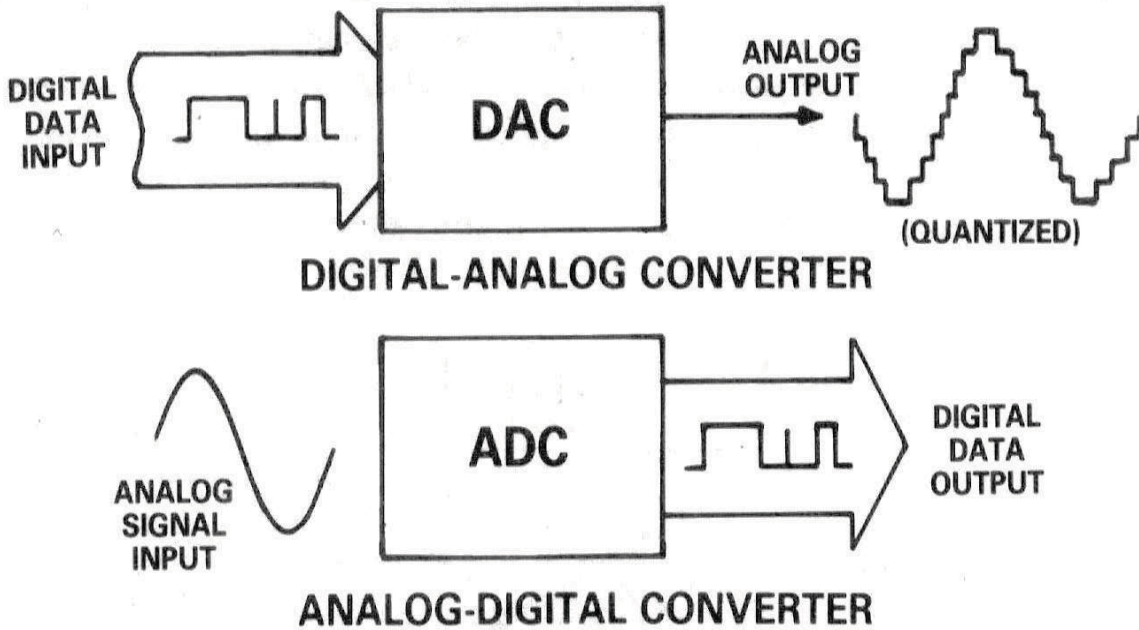
Y.Doç.Dr. Tuncay UZUN, EHM 6105

Dersin Konusu: Veri Dönüştürücüler (ADC,DAC,F/V,V/F) ve Uygulamaları

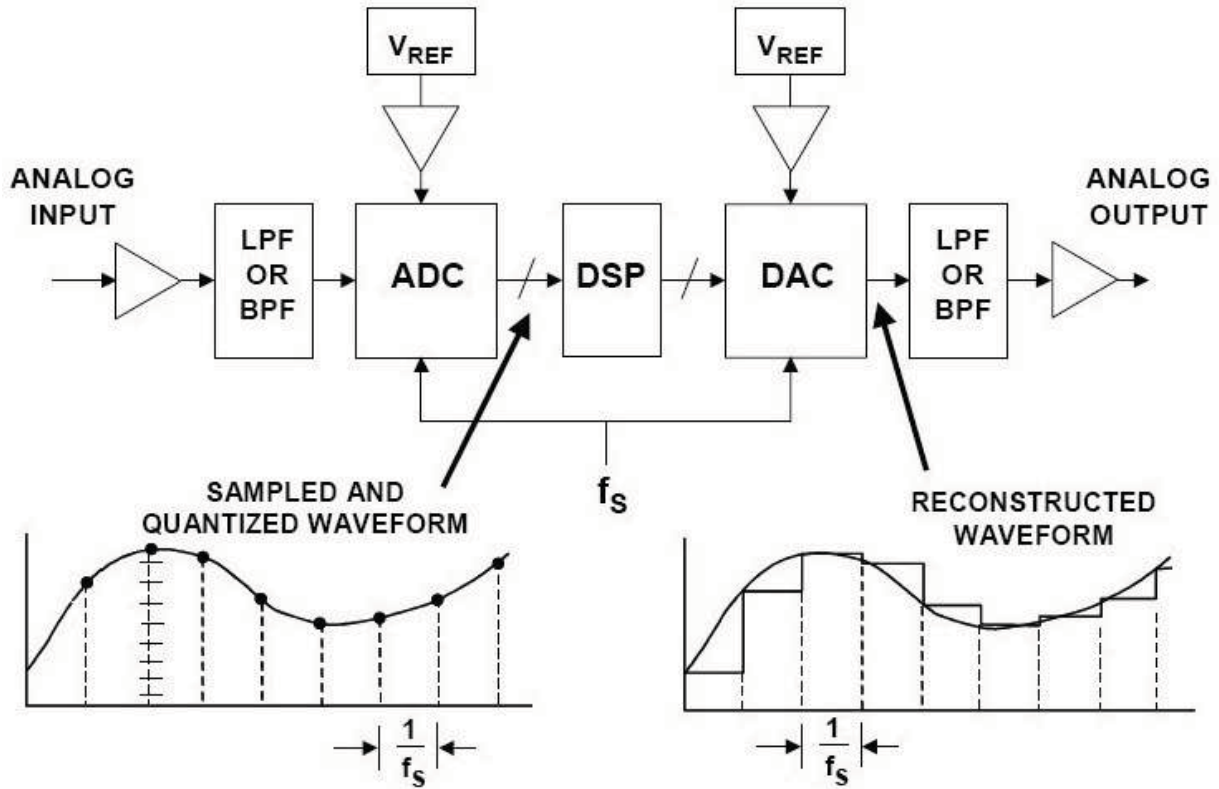
Dersin Amacı:

Endüstriyel otomatik kontrol sistemlerinde kullanılan veri dönüştürücülerin özellikleri, iç donanımı ve elektronik devrelerinin incelenmesi, uygulama devrelerinin analizi, incelenmesi ve tasarlanmasının öğretilmesidir.

Veri Dönüştürücüler

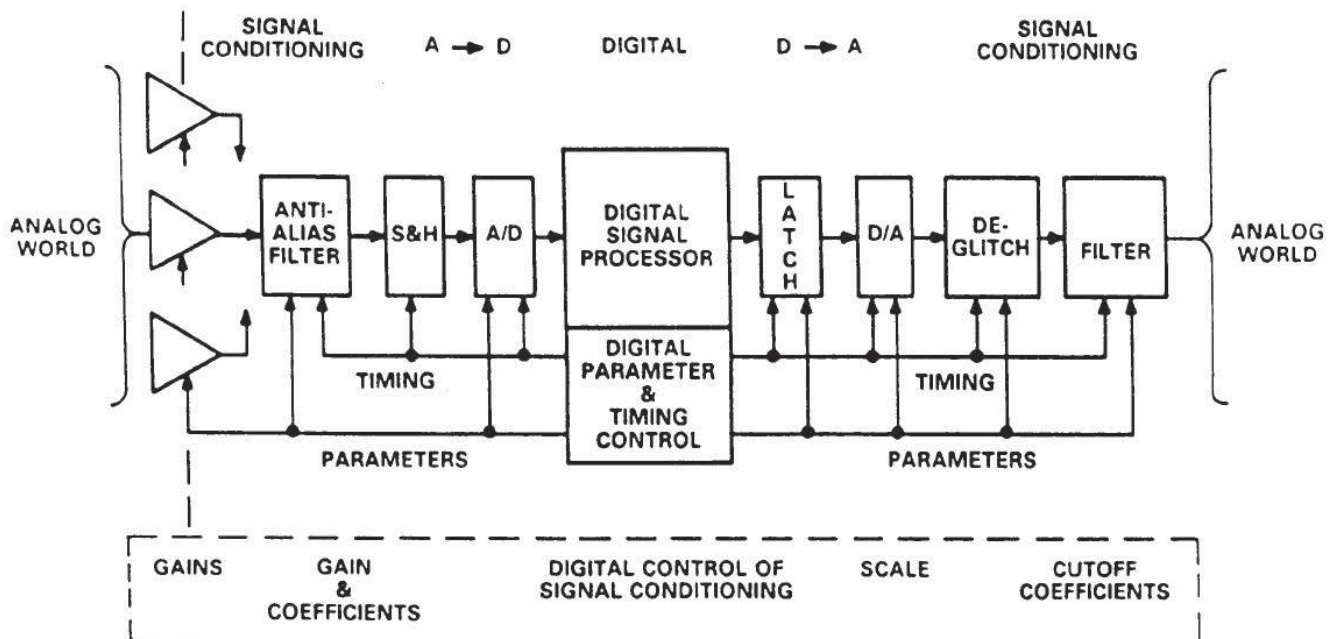


ÖRNEKSEL (ANALOG) SAYISAL (DIGITAL) VERİ İŞLEME



3

ÖRNEKSEL SAYISAL VERİ İŞLEME (DEVAM)



4

SAYISAL ÖRNEKSEL DÖNÜŞTÜRÜCÜLER (DAC)

GİRİŞ ÖZELLİKLERİ

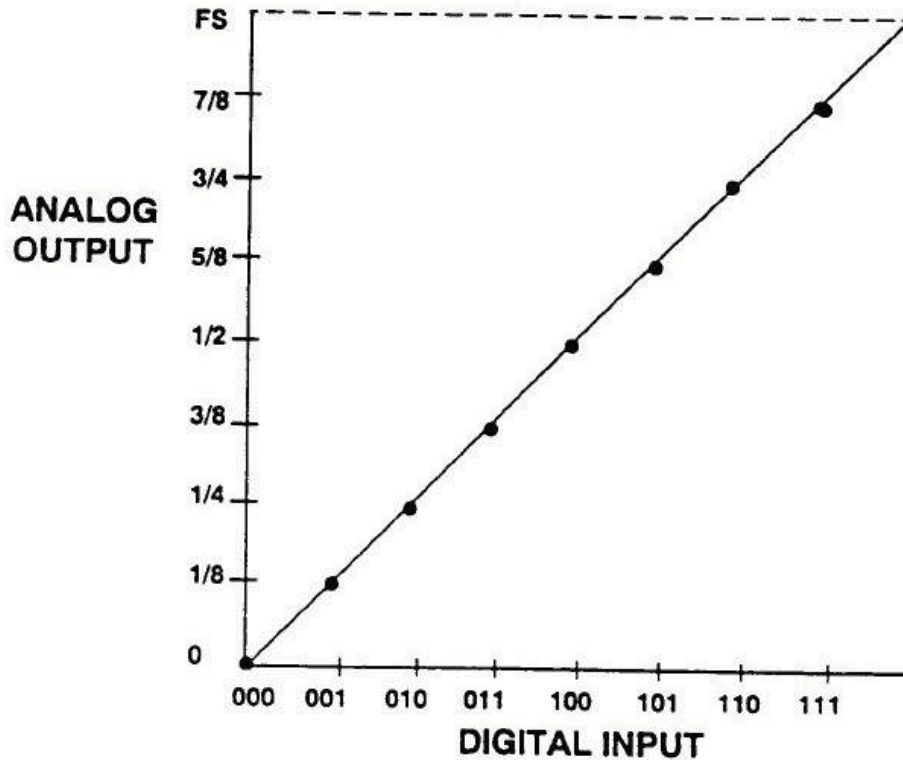
Lojik Tipi	TTL, ECL, CMOS, $\pm 4\text{mA}$ vb.
Veri Biçimi	İkili, Tümleyen ikili, BCD, Gray Kodu vs.
Yapısı	Paralel veya Seri
Ayırıcılık	8,10,12,14,16,24 Bit ikili, $2\frac{1}{2}$, $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$ Basamak BCD vb.

ÇIKIŞ ÖZELLİKLERİ

Çıkış Tipi	Gerilim, Akım veya Direnç (zayıflatma)
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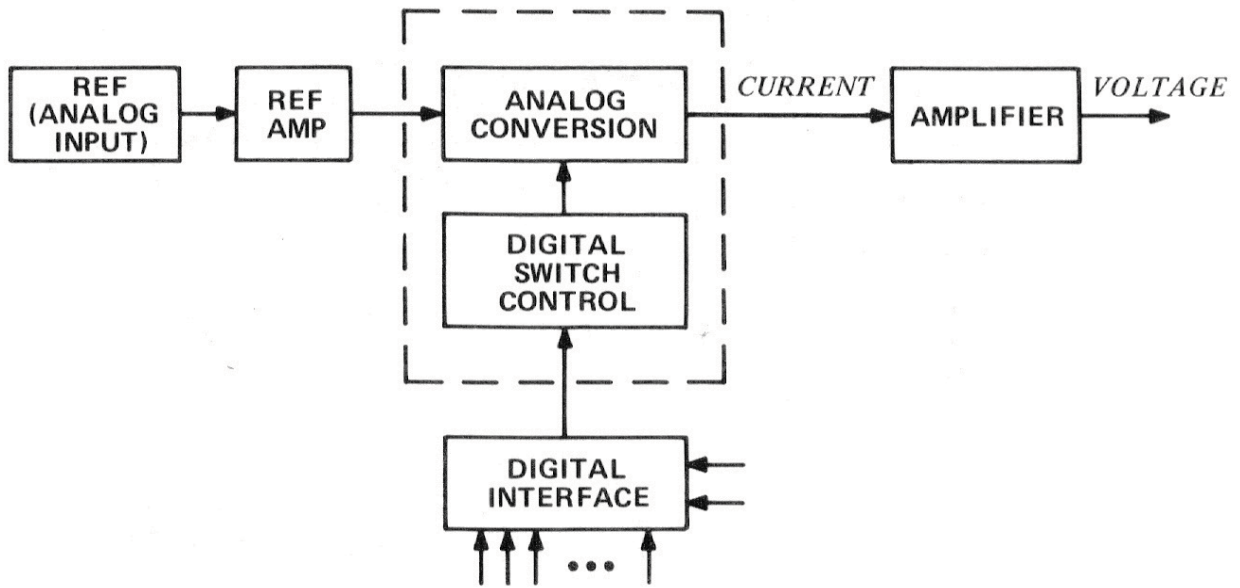
5

DAC DÖNÜŞÜM KARAKTERİSTİĞİ



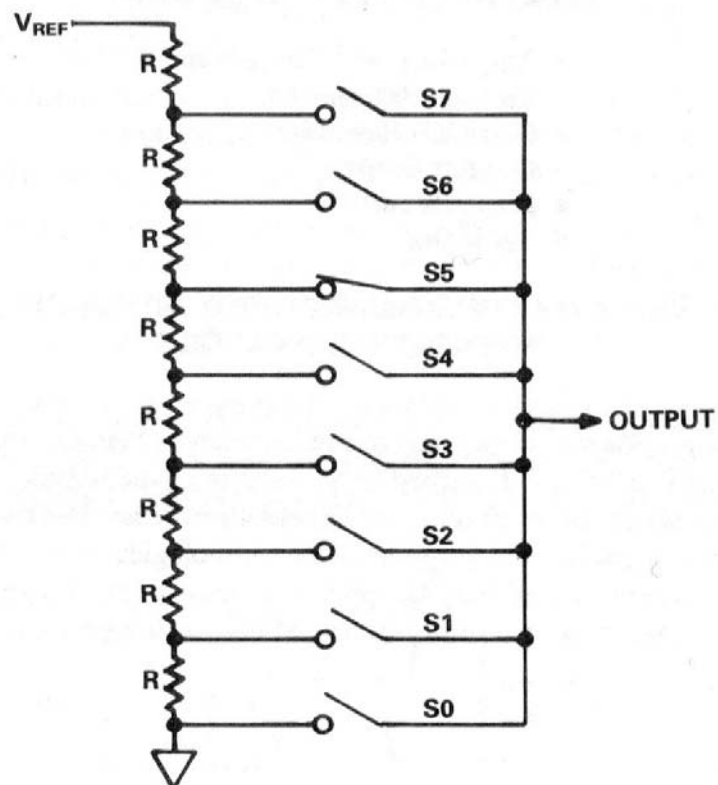
6

DAC GENEL BLOK DİYAGRAMI



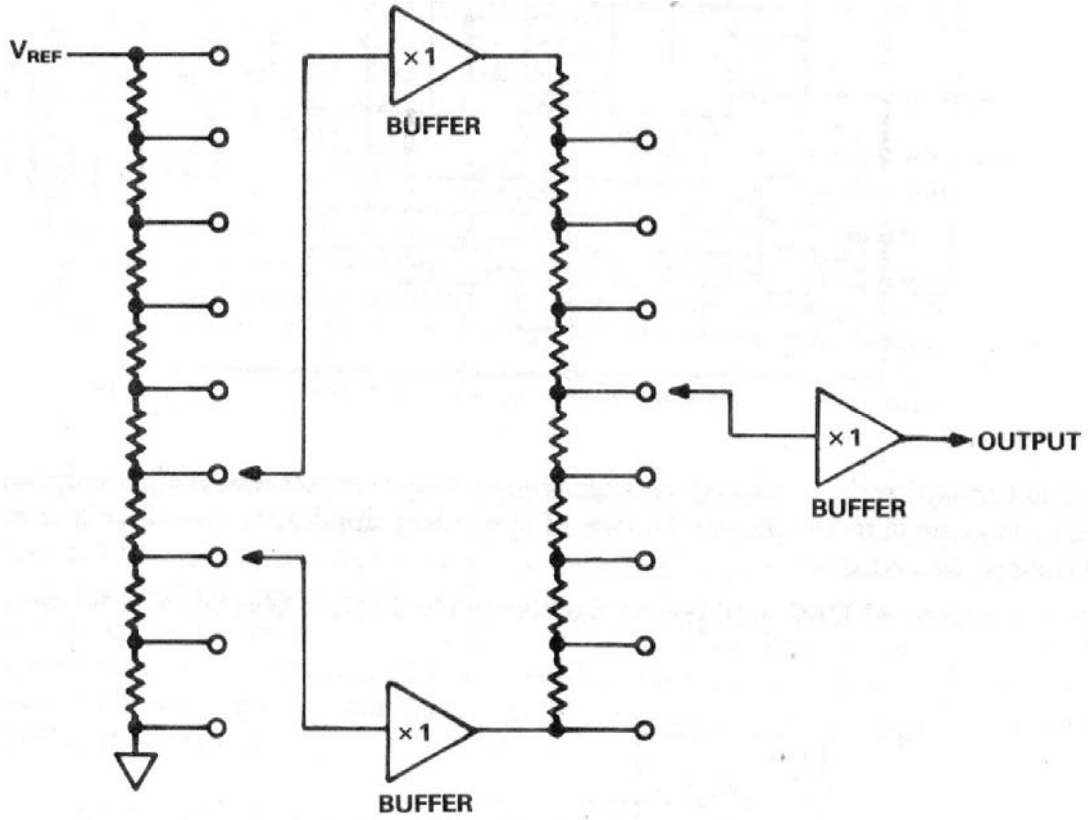
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DAC DEVRELERİNİN TEMEL YAPISI

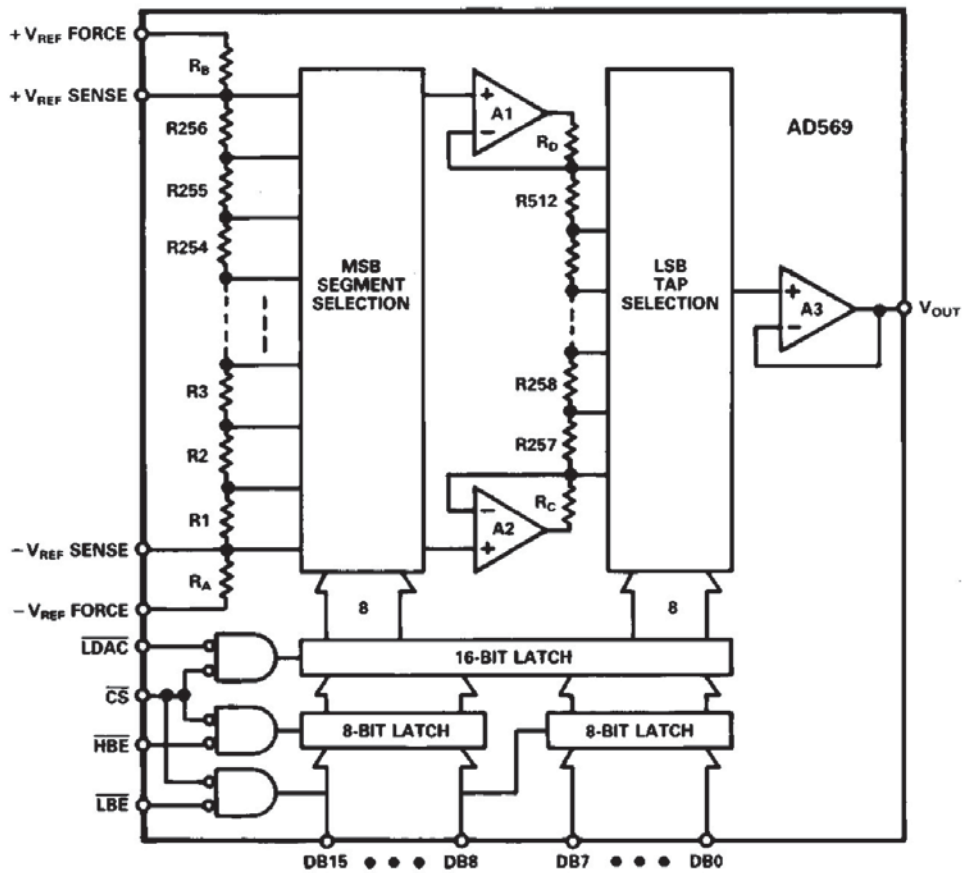


8

GERİLİM BÖLMELİ DAC

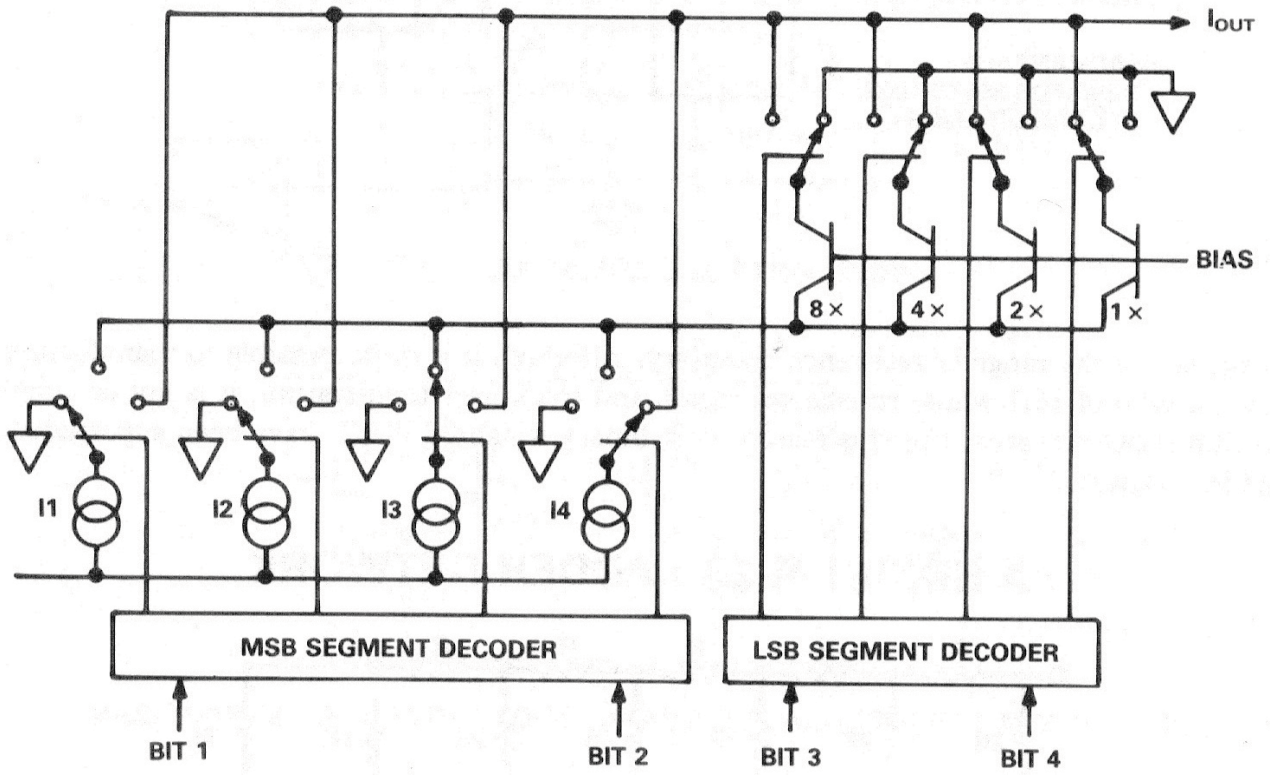


9



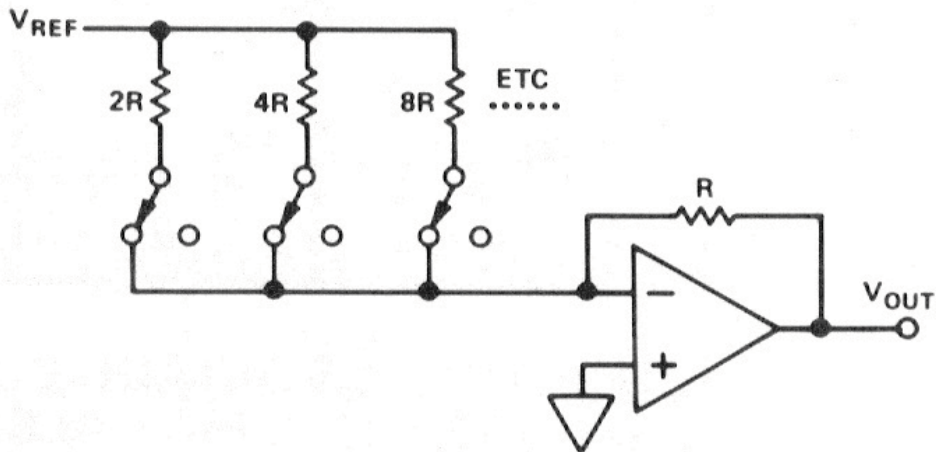
10

AKIM BÖLMELİ DAC



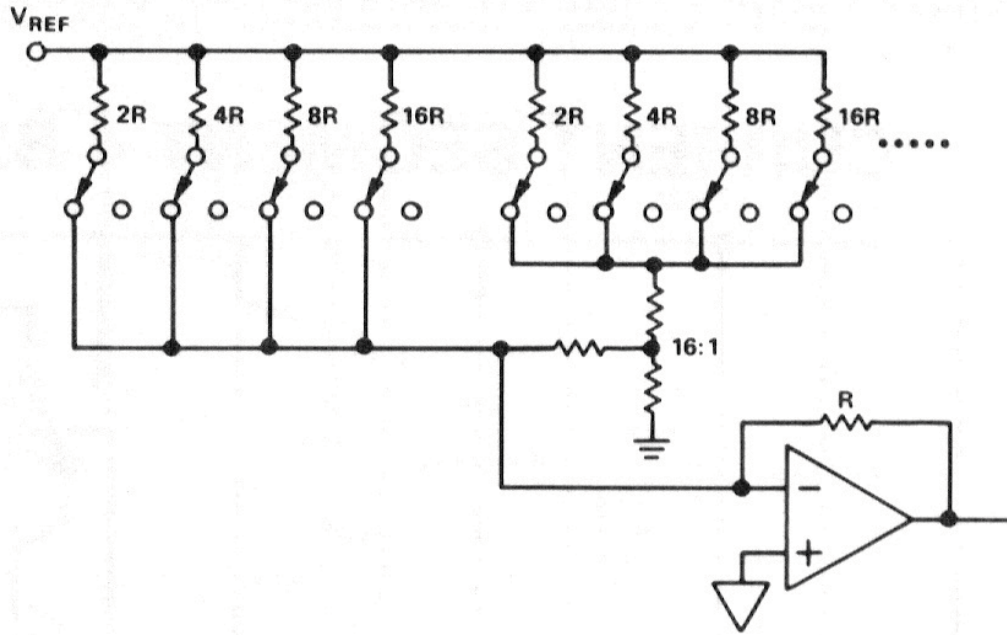
11

İKİLİ-AĞIRLIKLI DİRENÇLİ DAC



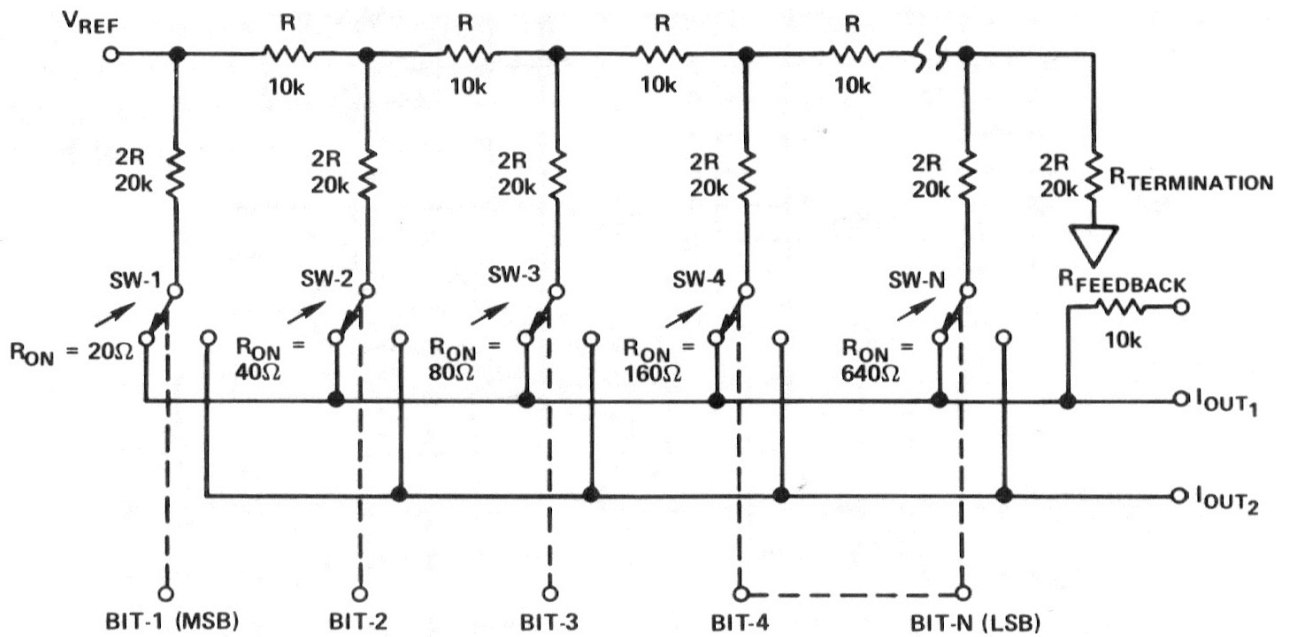
12

ARDIŞIL İKİLİ-AĞIRLIKLI DİRENÇLİ DAC



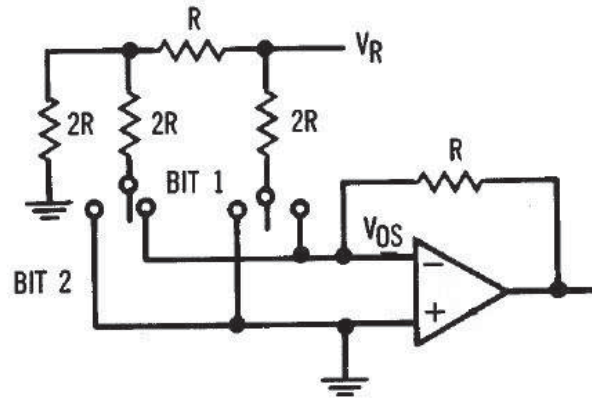
13

N-Bit R-2R MERDİVEN DEVRESİ



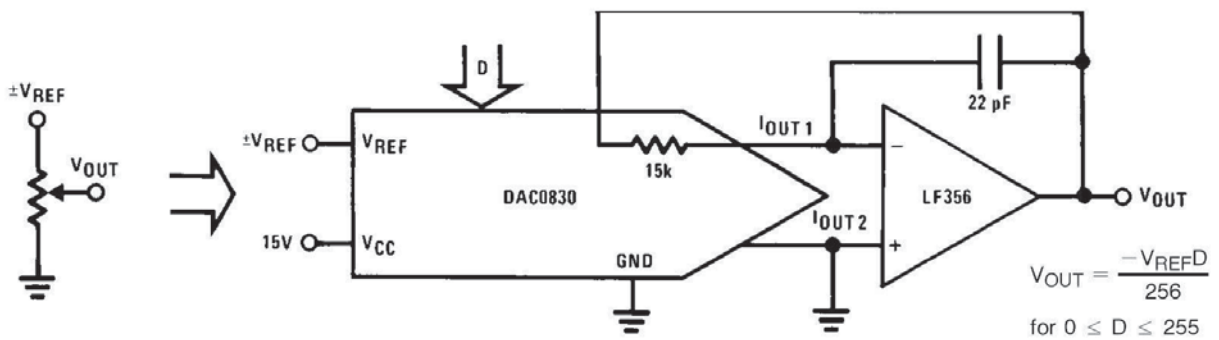
14

R-2R DİRENÇLİ DAC



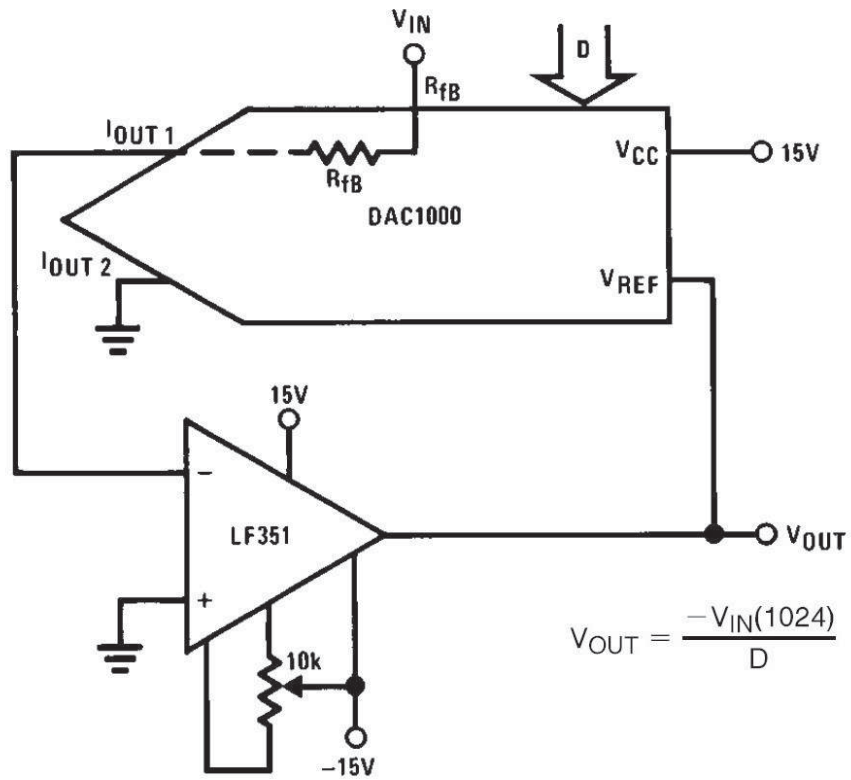
15

DAC UYGULAMALARI

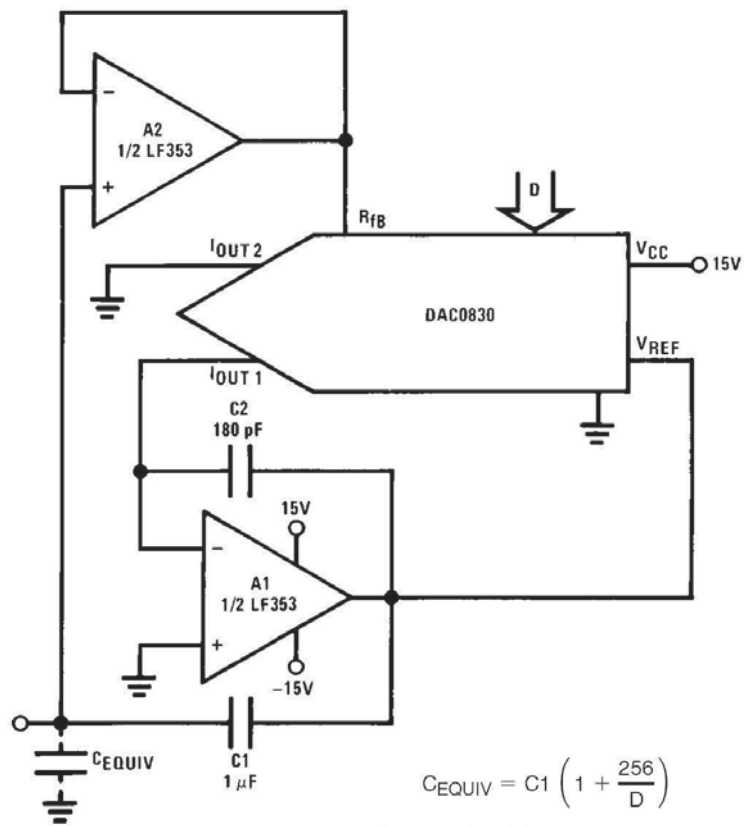


The Digital Pot

16



DAC Controlled Amplifer



Capacitance Multiplier

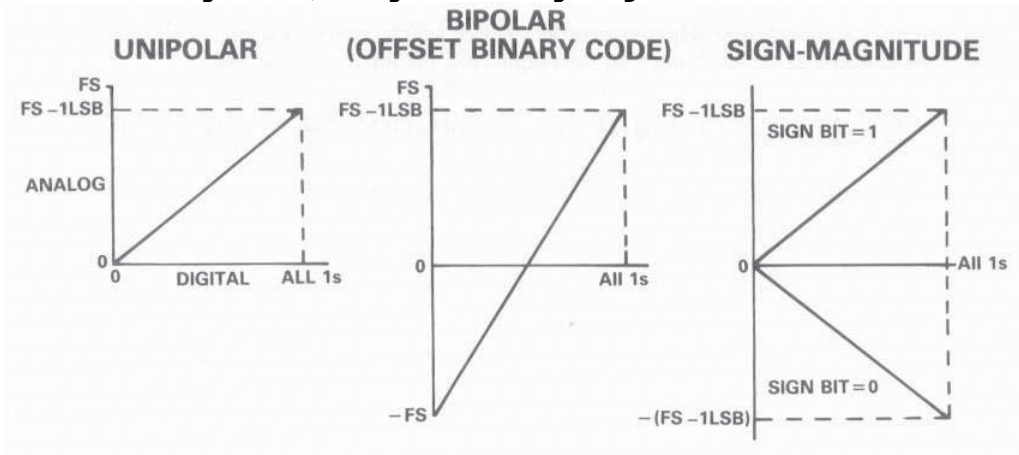
ÖRNEKSEL SAYISAL DÖNÜŞTÜRÜCÜLER (ADC)

Flash and Half-Flash	<ul style="list-style-type: none">● Fast● Power-Hungry● Lower Resolution
Integrating	<ul style="list-style-type: none">● High Resolution● Inexpensive● Slow● Noise Immune
Voltage-Frequency Converters (VFCs)	<ul style="list-style-type: none">● Fast Response But Slow Conversion● Serial● High Resolution● Noise Immune
Tracking (Counter/Comparator)	<ul style="list-style-type: none">● Fast in Track● Slow in Multi-Channel Applications● Susceptible to Noise
Successive Approximation	<ul style="list-style-type: none">● Quite Fast● Flexible and Versatile● Accurate
Floating-Point	<ul style="list-style-type: none">● Uses Any Type of ADC● Wide Dynamic Range● Complex

19

GİRİŞ ÖZELLİKLERİ

Giriş Tipi Tek yönlü, İki yönlü veya işaretli

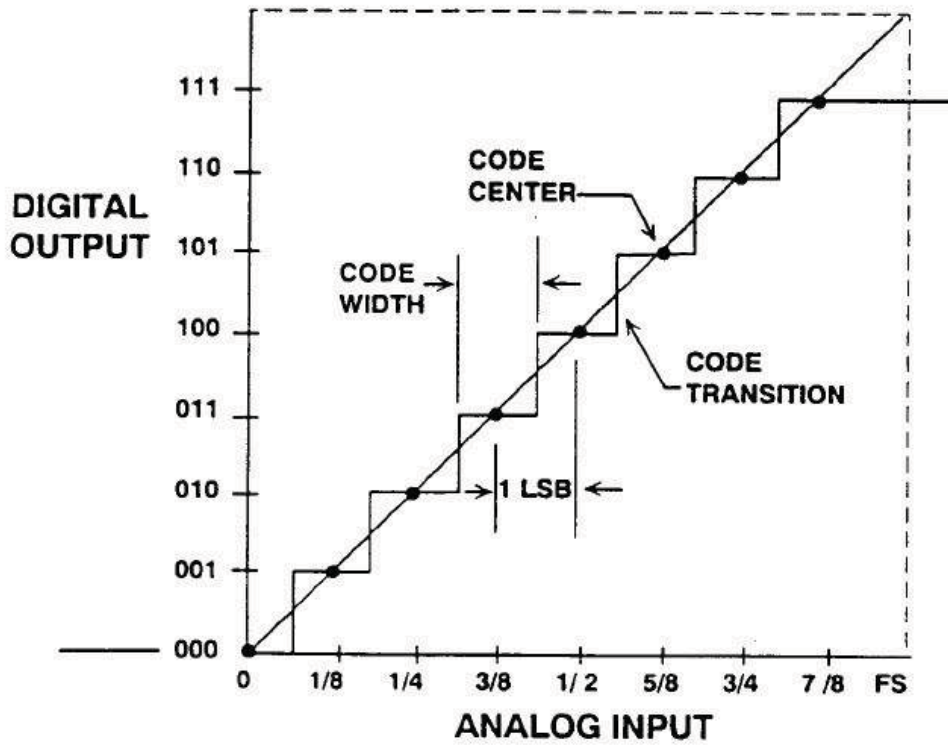


ÇIKIŞ ÖZELLİKLERİ

Lojik Tipi TTL, ECL, CMOS, $\pm 4\text{mA}$ vb.
Veri Biçimi İkili, Tümleyen ikili, Kayan noktalı ikili, BCD, Gray Kodu, Gösterge vs.
Yapısı Paralel veya Seri
Ayırıcılık 8,10,12,14,16,24-Bit ikili, $2\frac{1}{2}$, $3\frac{1}{2}$, $4\frac{1}{2}$, $5\frac{1}{2}$ -Basamak BCD vb.

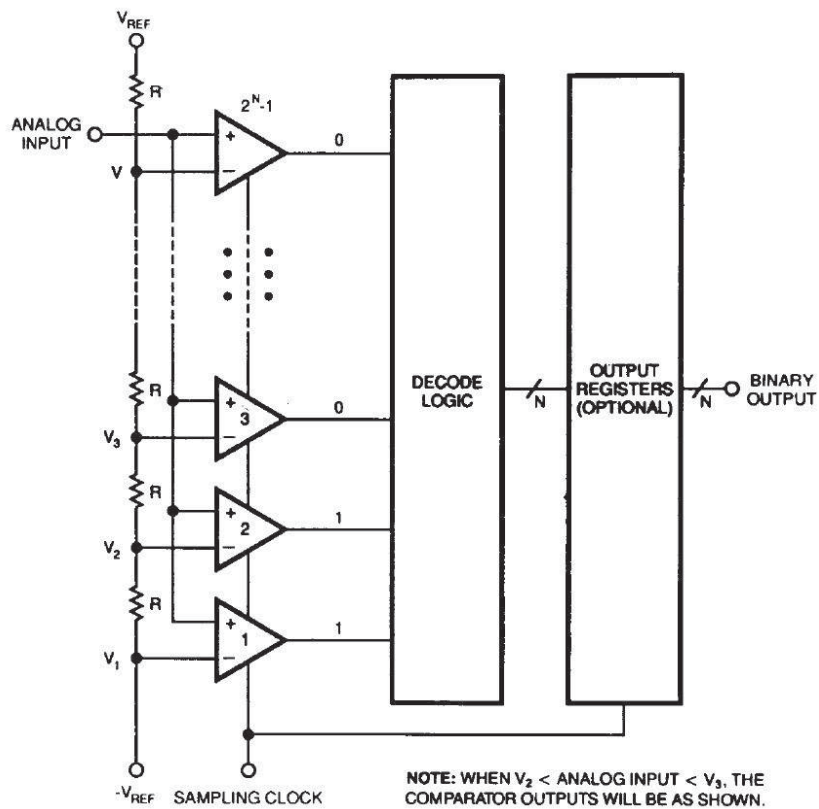
20

ADC DÖNÜŞÜM KARAKTERİSTİĞİ



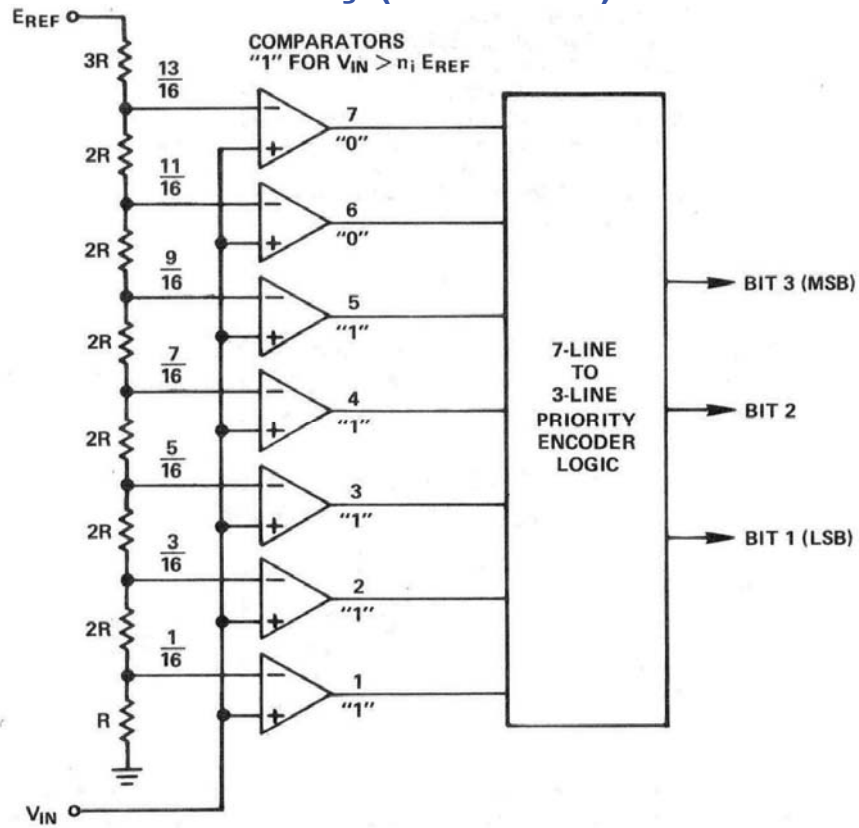
21

FLAŞ (PARALEL) ADC GENEL YAPISI

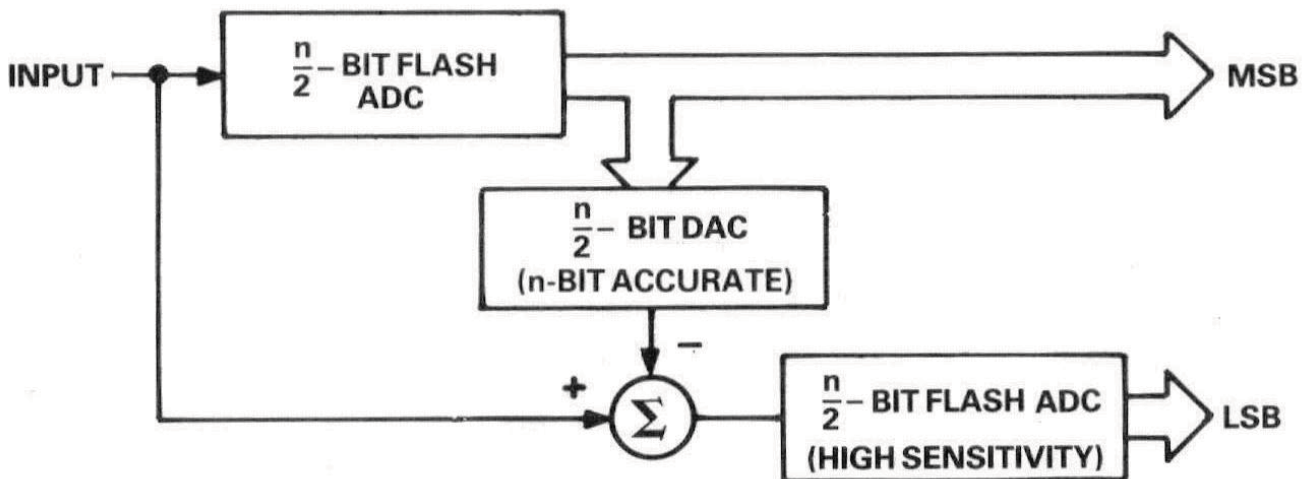


22

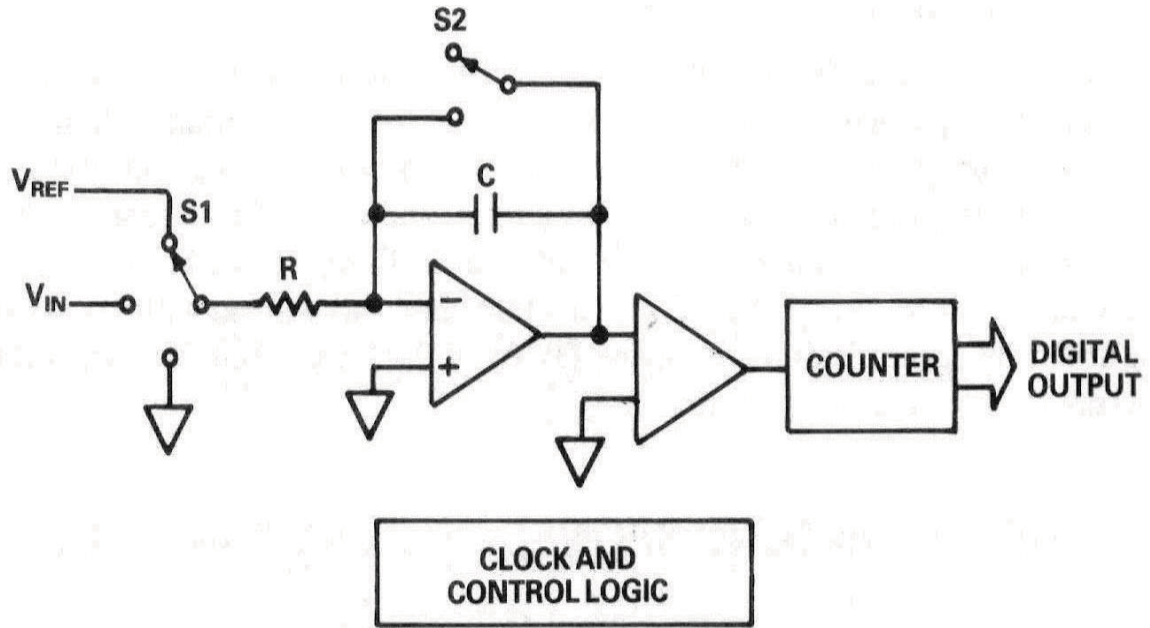
3-Bit FLAŞ (PARALEL) ADC



YARIM FLAŞ (PARALEL) ADC

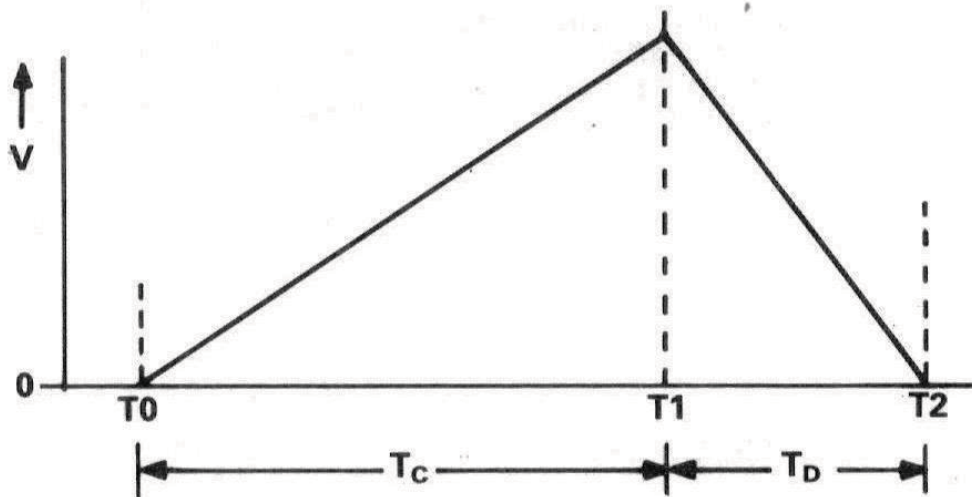


ENTEGRALLİ ADC



25

ENTEGRALLİ ADC nin ÇALIŞMA ŞEKLİ

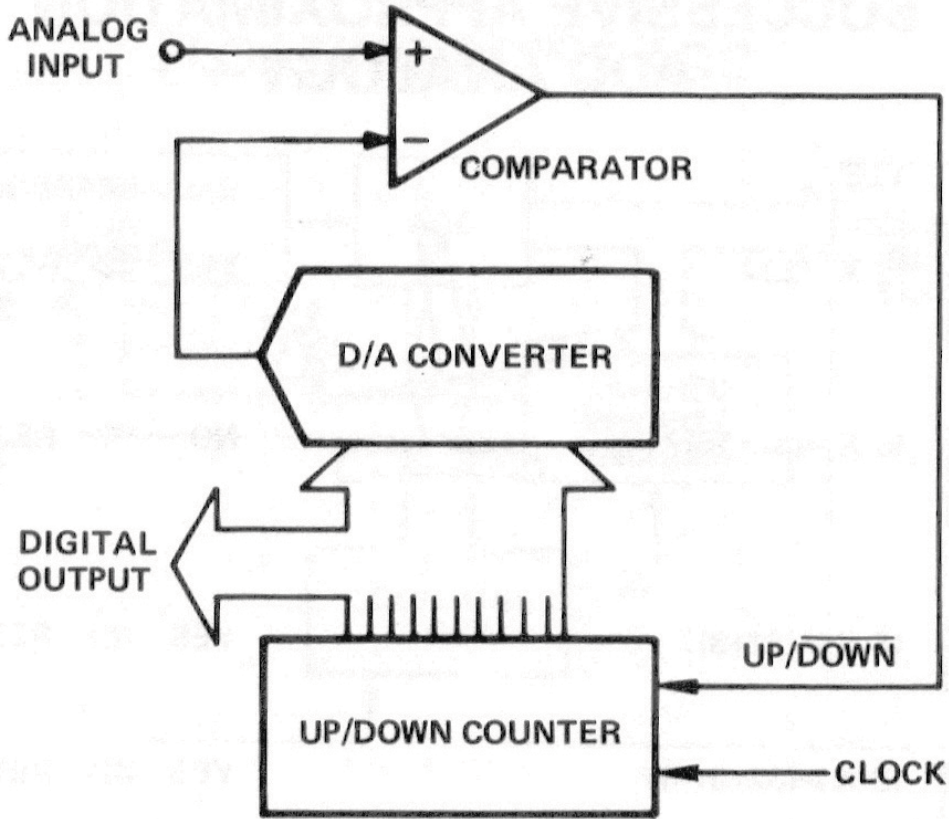


THE INTEGRATOR CHARGES FOR FIXED TIME T_C WITH V_{IN} . THE DISCHARGE TIME WITH A FIXED REFERENCE ($= V_{REF}$) INPUT IS THEN MEASURED (T_D).

$$V_{IN} = V_{REF} \frac{T_D}{T_C}$$

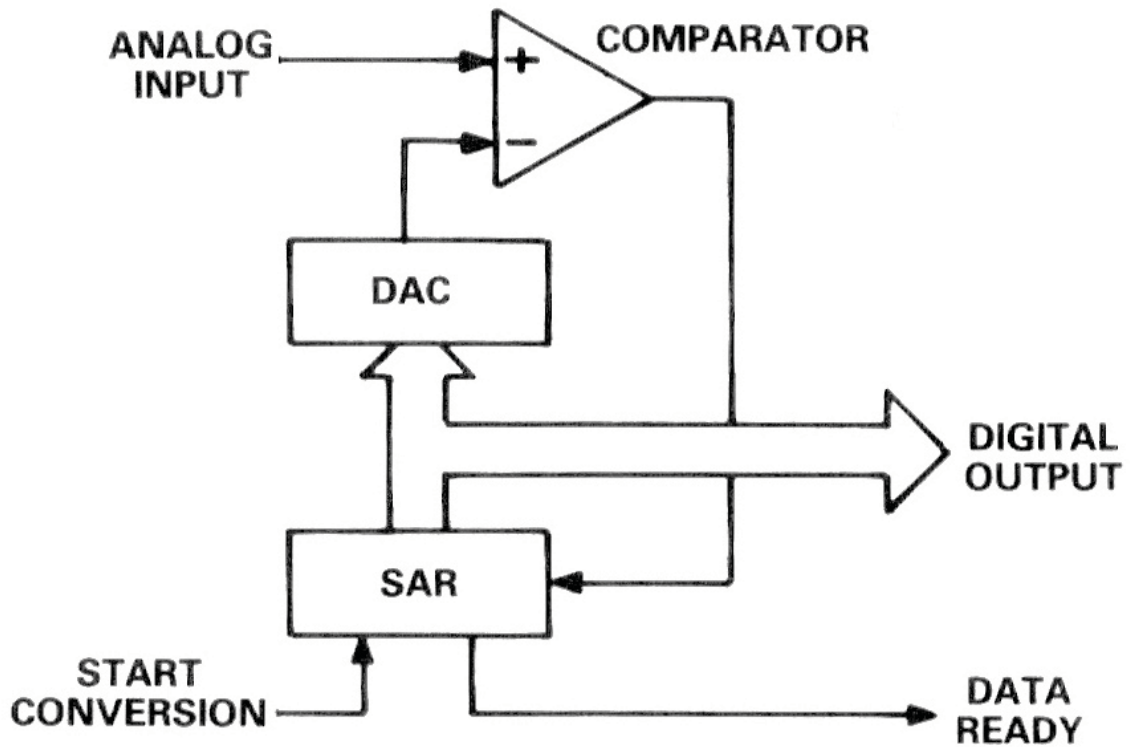
26

SAYICI-KARŞILAŞTIRICI (İZLEMELİ/TRACKING) ADC



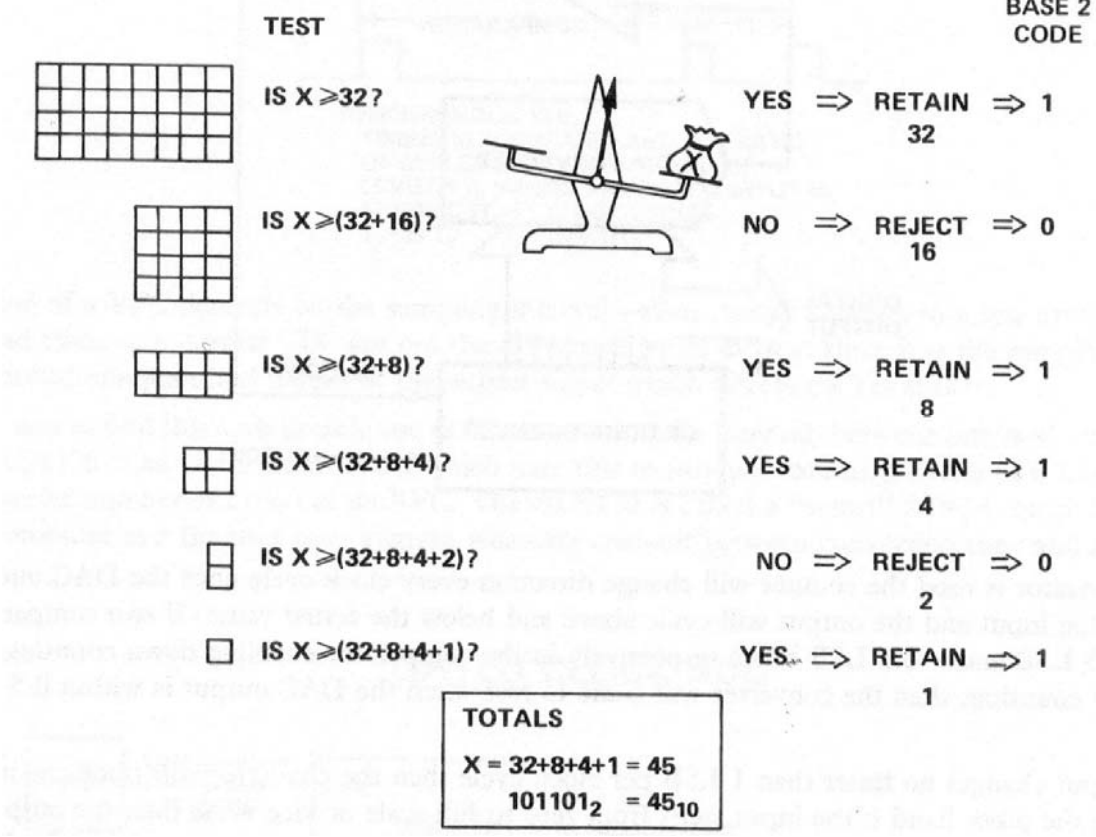
27

BAŞARILI YAKLAŞIM ADC

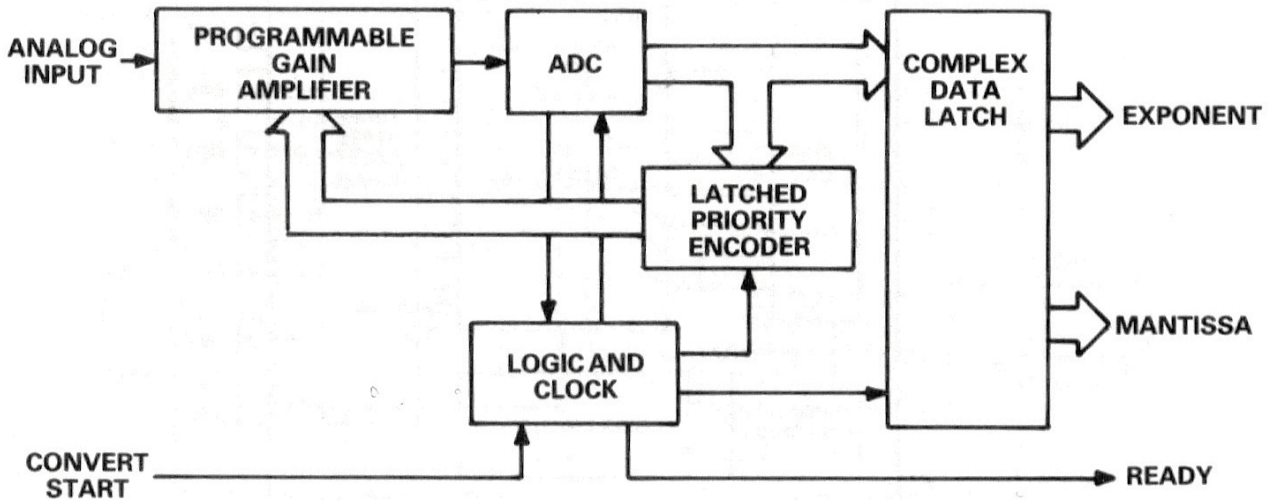


28

BAŞARILI YAKLAŞIM ADC ÇALIŞMA MANTIĞI



KAYAN NOKTALI ADC

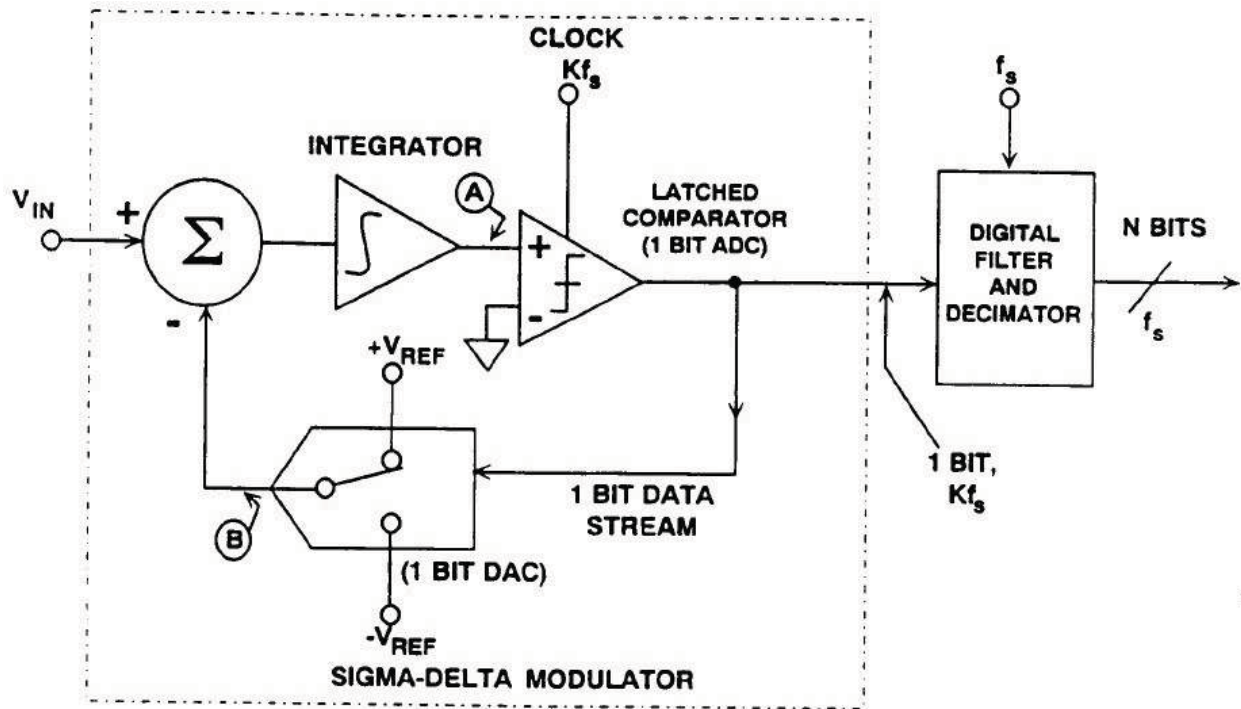


$$A = (-1)^S \cdot f \cdot 2^e$$

S: işaret biti, e: üst kısmı, f: kesir kısmı
(exponent) (mantissa) .

b31	b30	...	b23	b22	b0
S	e					f

SİGMA-DELTA ADC (BİRİNCİ DERECE)



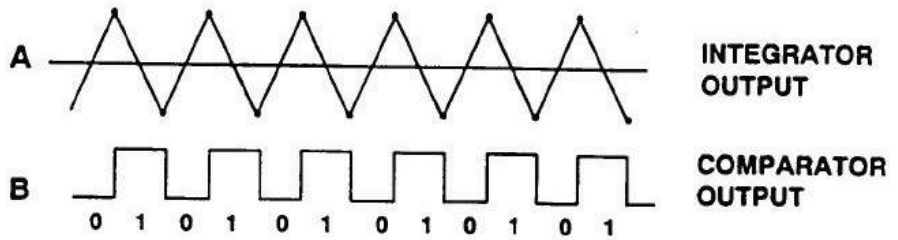
31

SİGMA-DELTA ADC ÇALIŞMA DALGA ŞEKİLLERİ

$$V_{IN} = 0V$$

$$= \frac{2}{4}$$

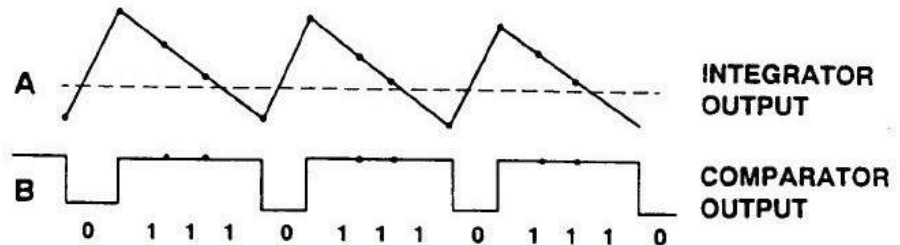
$$= \frac{4}{8}$$



$$V_{IN} = + \frac{V_{ref}}{2}$$

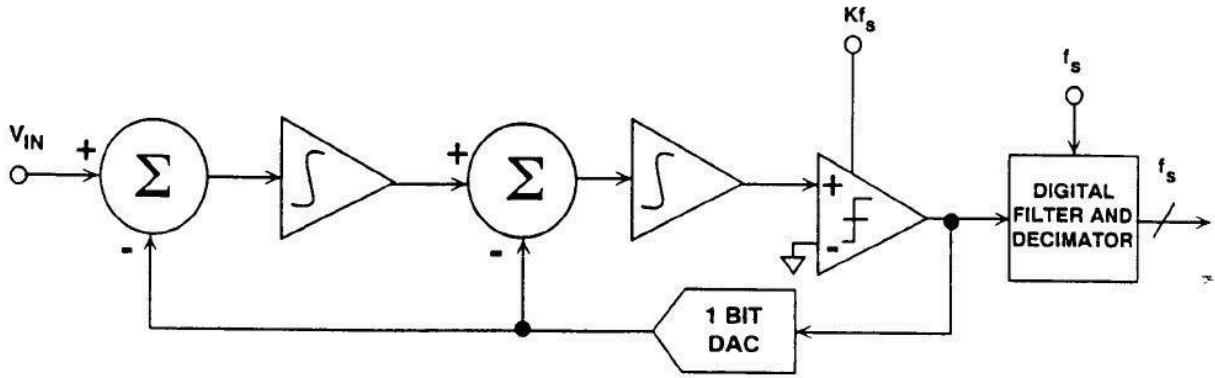
$$= \frac{3}{4}$$

$$= \frac{6}{8}$$



32

SIGMA-DELTA ADC (İKİNCİ DERECE)



33

ADC UYGULAMALARI

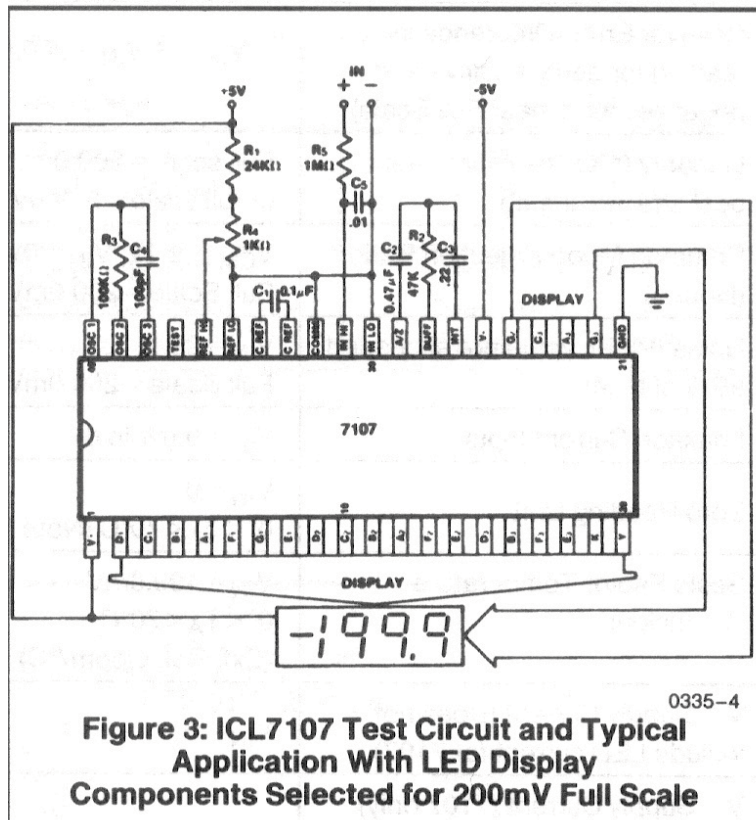
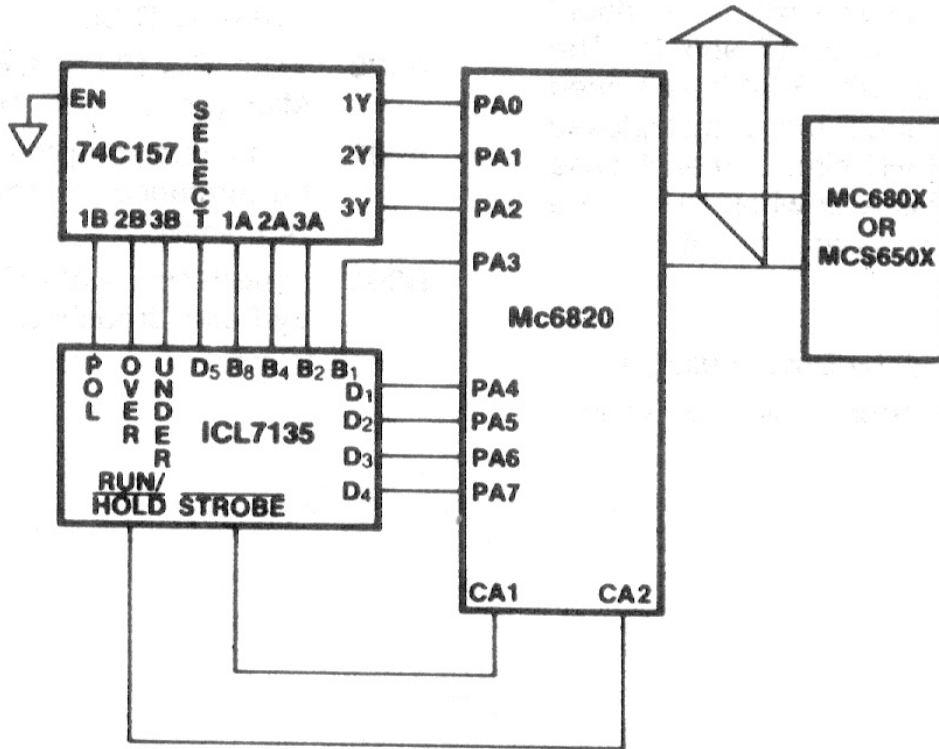


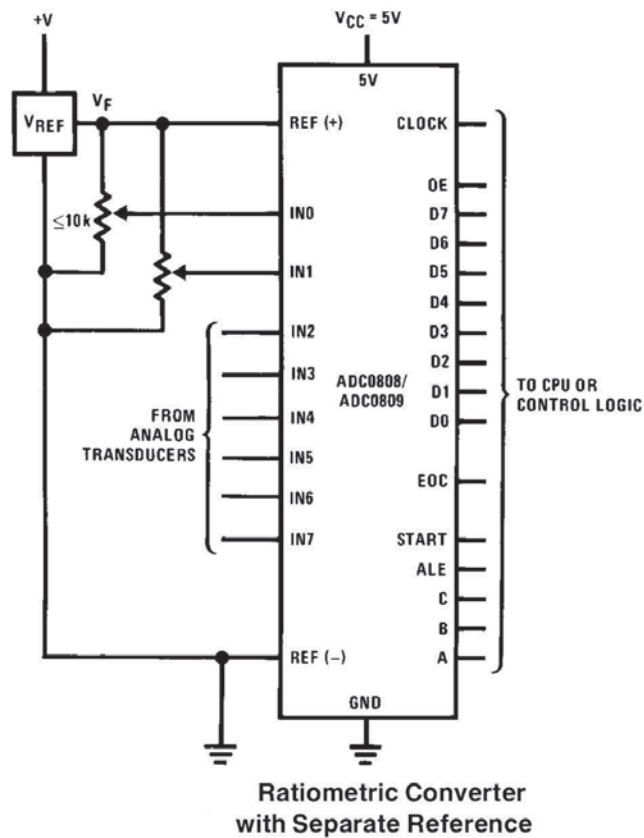
Figure 3: ICL7107 Test Circuit and Typical Application With LED Display Components Selected for 200mV Full Scale

34

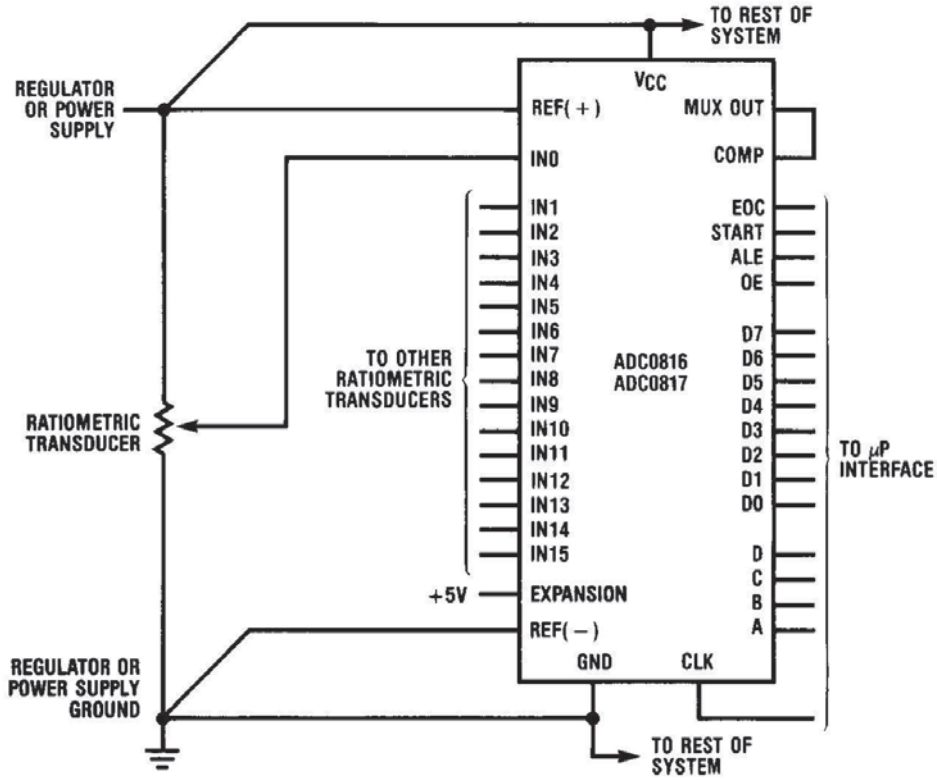
BCD ÇIKIŞLI ADC uP BAĞLANTISI



35



36



Simple Ratiometric Converter Using Power Supply as Reference

GERİLİM FREKANS DÖNÜŞTÜRÜCÜLER (V/F)

GİRİŞ ÖZELLİKLERİ

Giriş Tipi Tek yönlü, İki yönlü veya Farksal
Giriş Biçimi Gerilim veya Akım

ÇIKIŞ ÖZELLİKLERİ

Lojik Tipi TTL, CMOS vb.
Çıkış Tipi Seri Darbeler

FREKANS GERİLİM DÖNÜŞTÜRÜCÜLER (F/V)

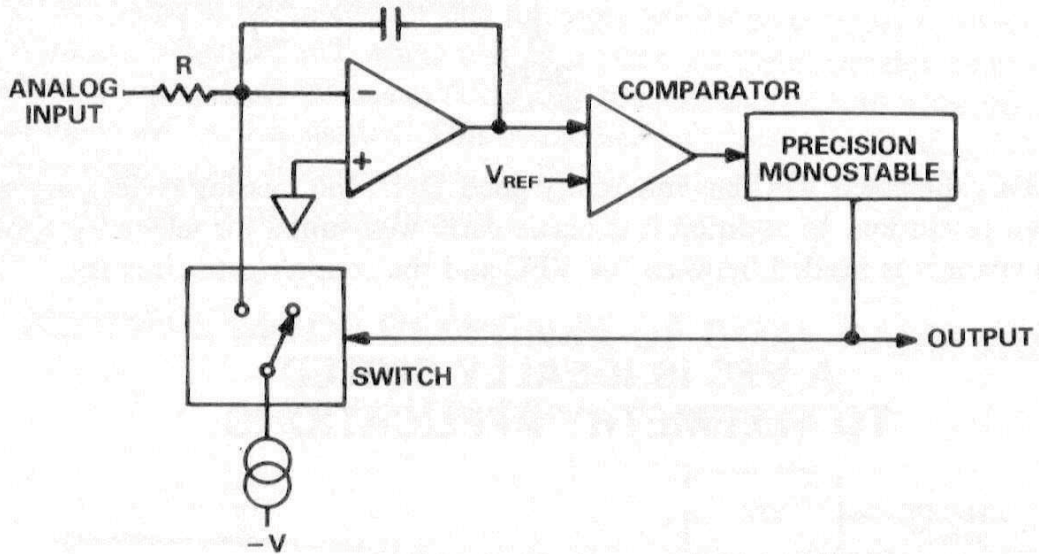
GİRİŞ ÖZELLİKLERİ

Lojik Tipi TTL, CMOS vb.
Yapısı Seri Darbeler

ÇIKIŞ ÖZELLİKLERİ

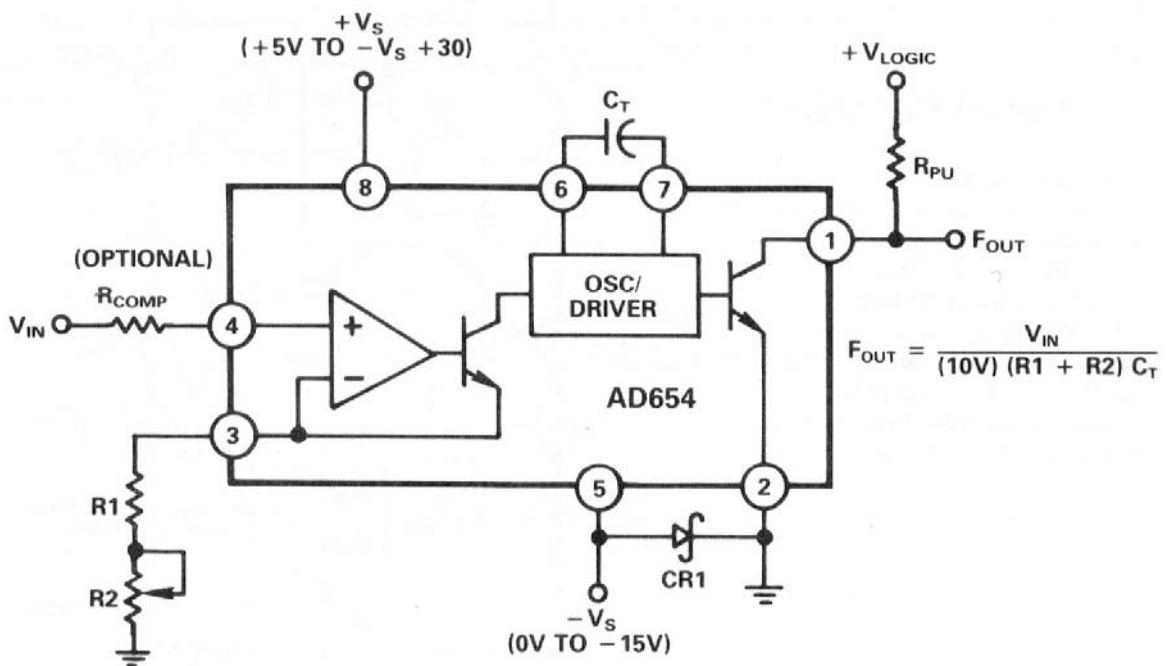
Çıkış Tipi Gerilim veya Akım

VFC USING AN INTEGRATOR



39

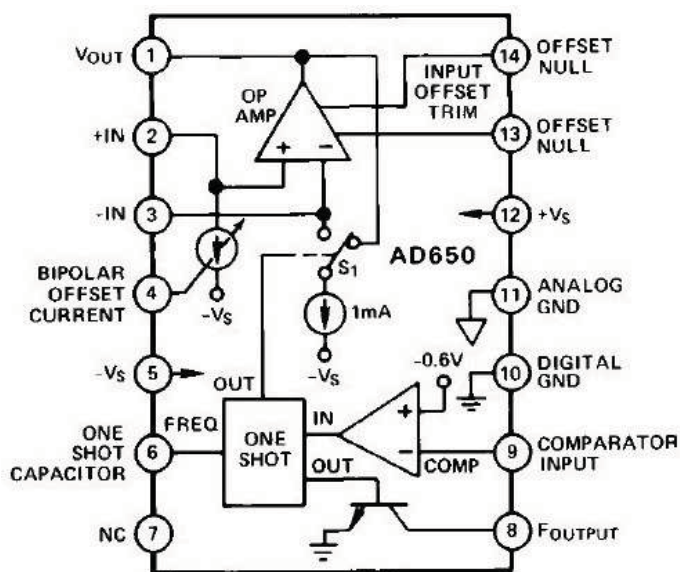
STANDARD V-F CONNECTION FOR POSITIVE INPUT VOLTAGES



40

V/F F/V ÖZELLİKLERİ

V/F Conversion to 1 MHz
Reliable Monolithic Construction
Very Low Nonlinearity
 0.002% typ at 10 kHz
 0.005% typ at 100 kHz
 0.07% typ at 1 MHz
Input Offset Trimmable to Zero
CMOS or TTL Compatible
Unipolar, Bipolar, or Differential V/F
V/F or F/V Conversion



41

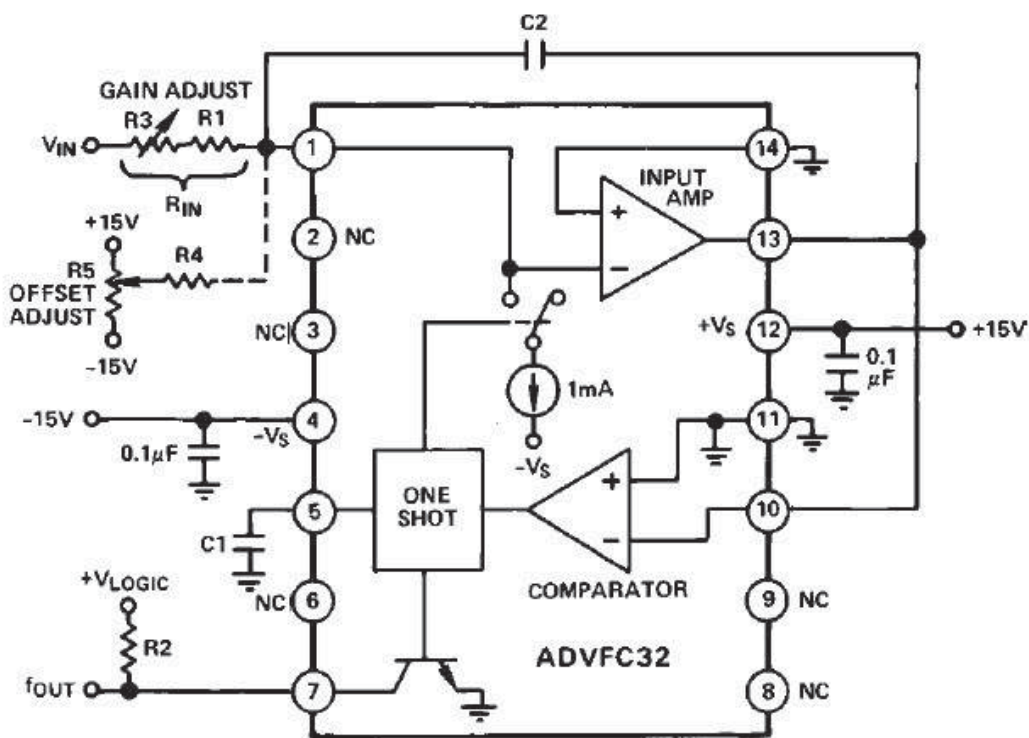


Figure 1. Connection Diagram for V/F Conversion, Positive Input Voltage

42

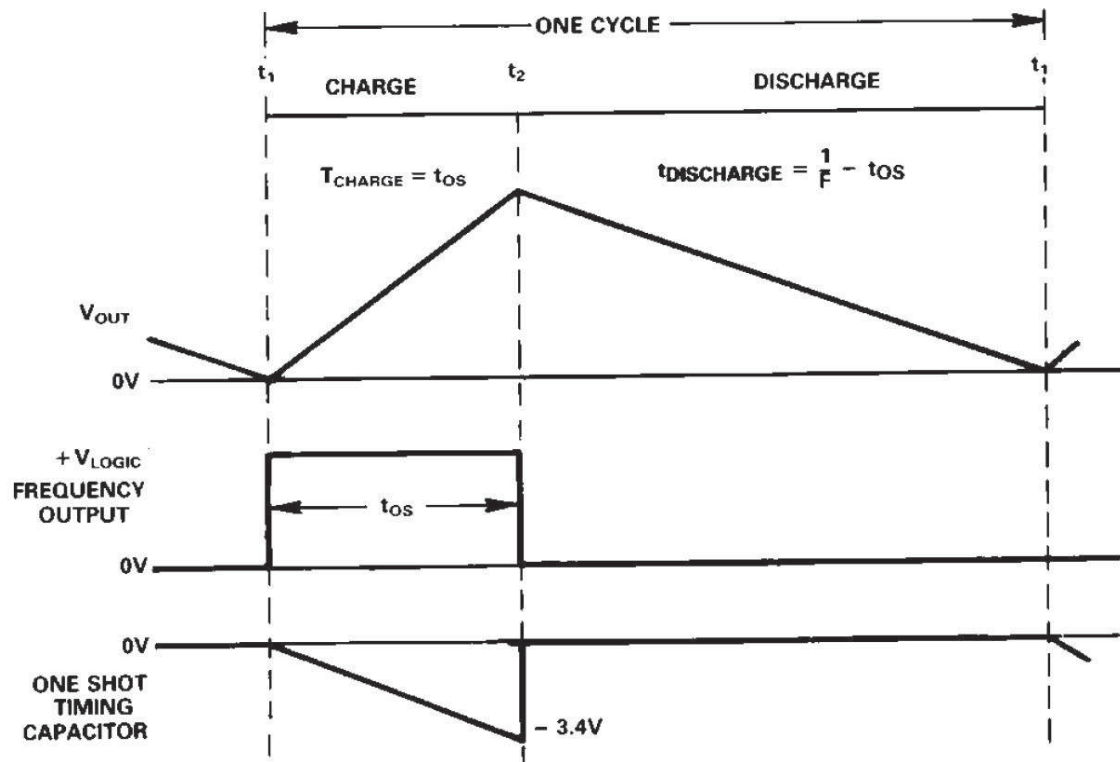


Figure 2. Voltage-to-Frequency Conversion Waveforms

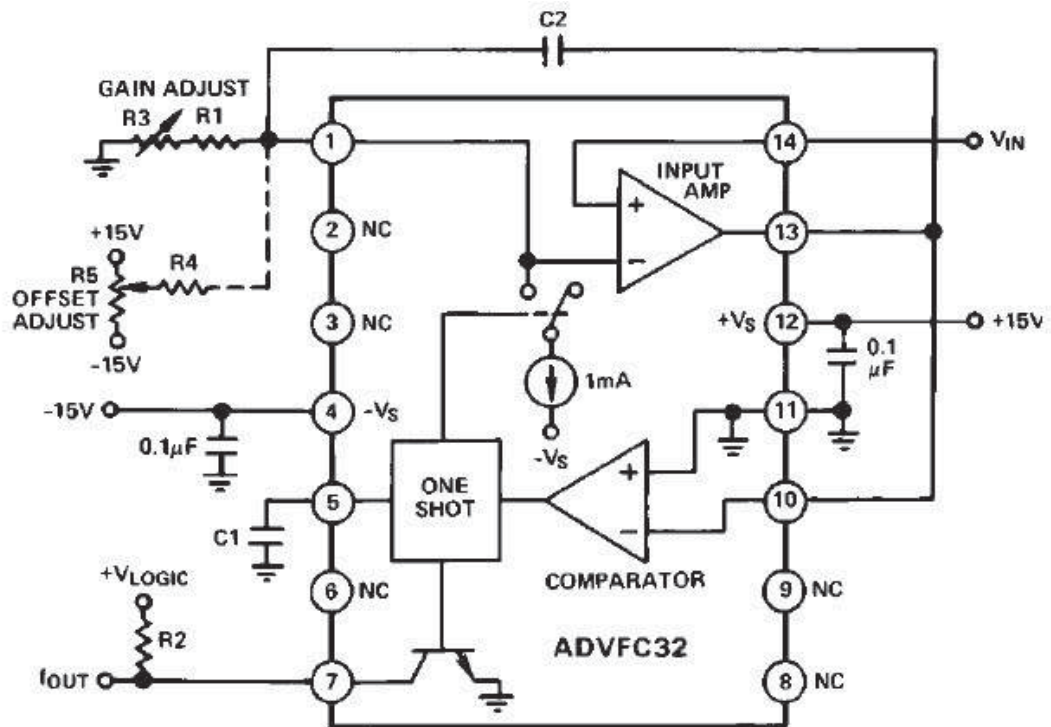


Figure 3. Connection Diagram for V/F Conversion, Negative Input Voltage

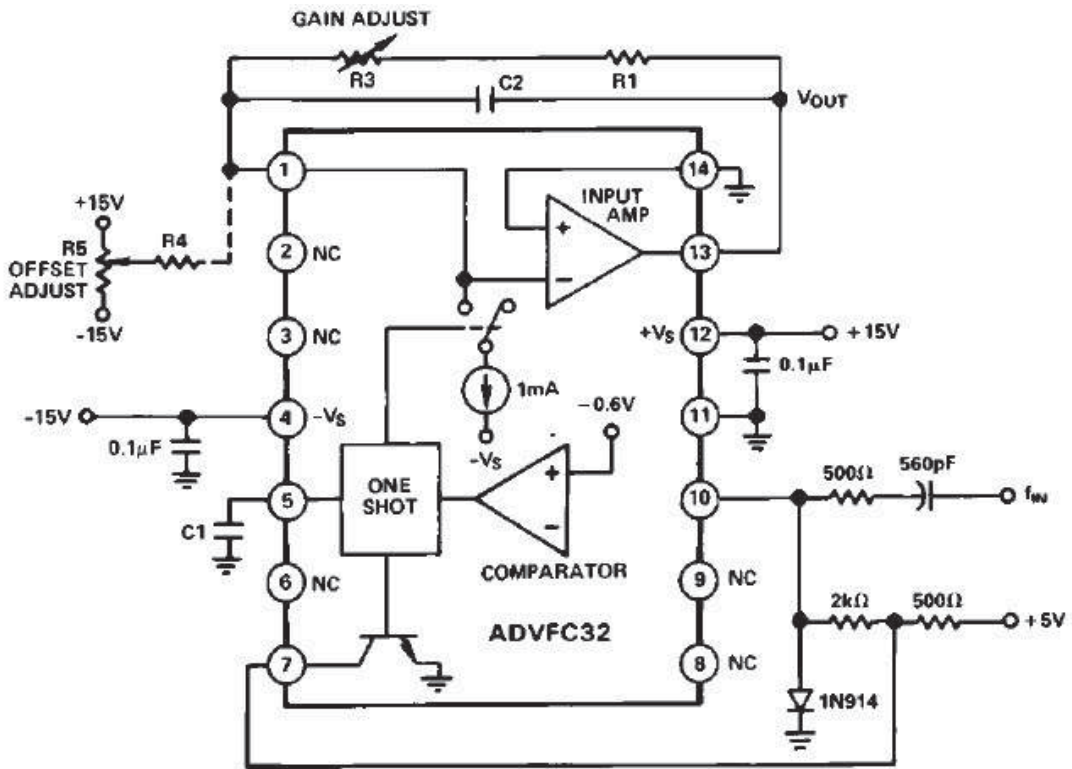
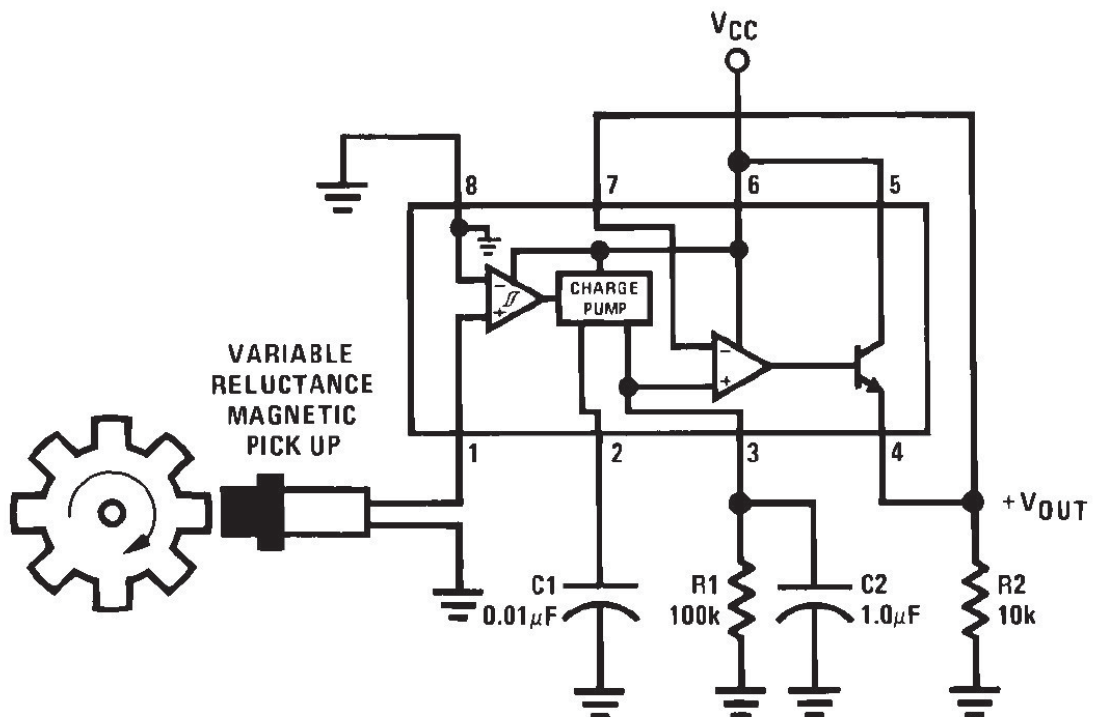
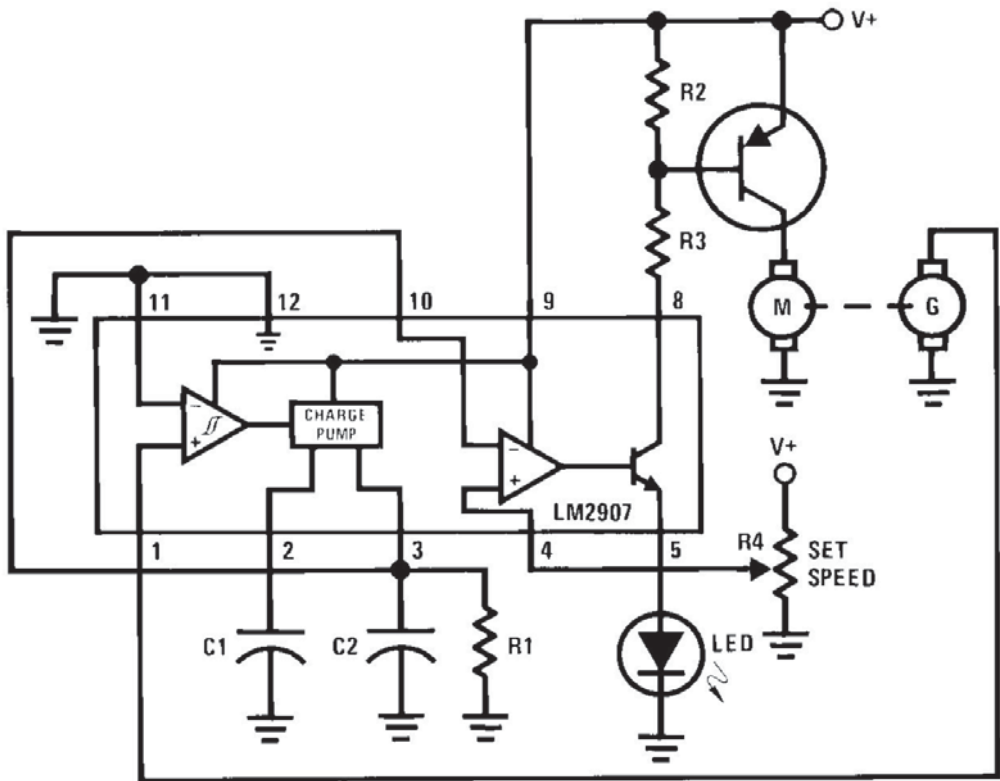


Figure 4. Connection Diagram for F/V Conversion, TTL Input

V/F F/V UYGULAMALARI

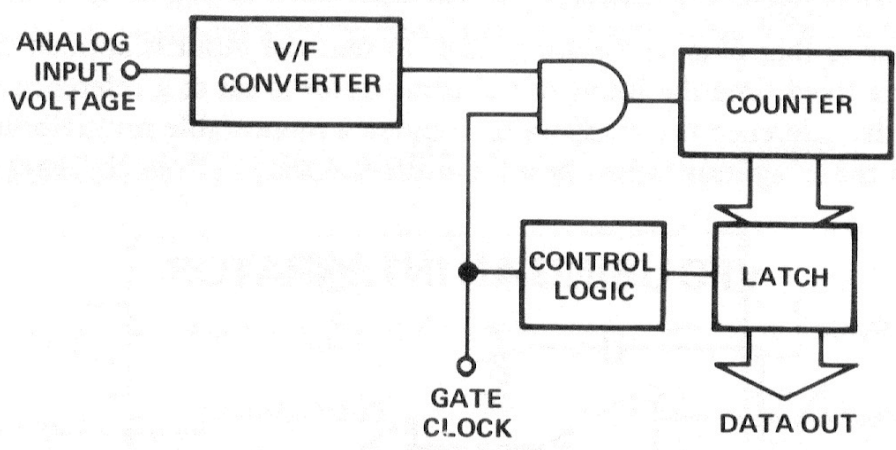


Basic f to V Converter

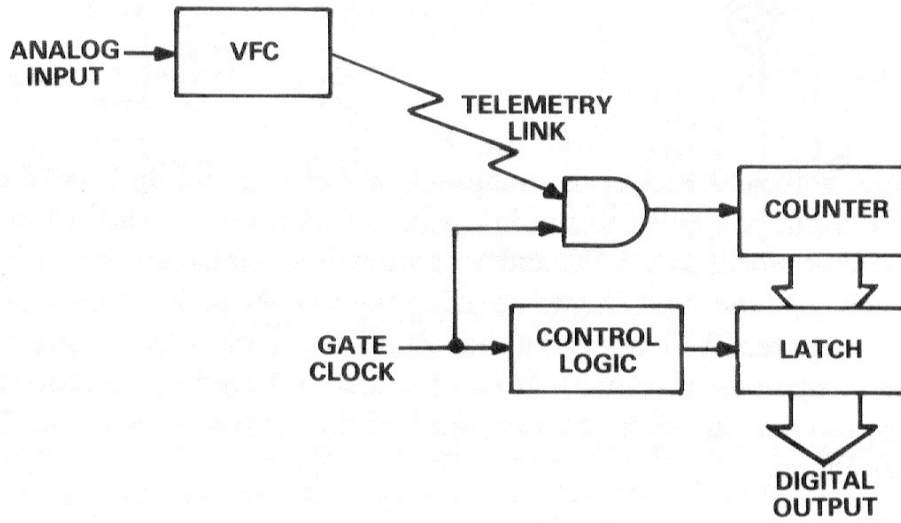


Motor Speed Control

VFC USED FOR ANALOG-TO-DIGITAL CONVERSION

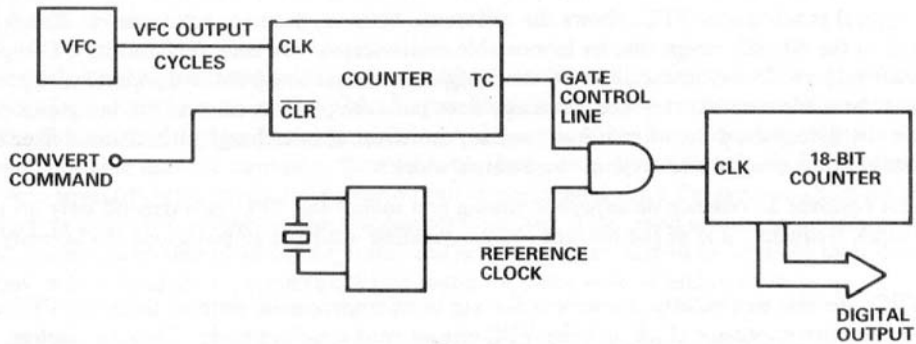


A VFC IS IDEALLY SUITED TO TELEMETRY APPLICATIONS

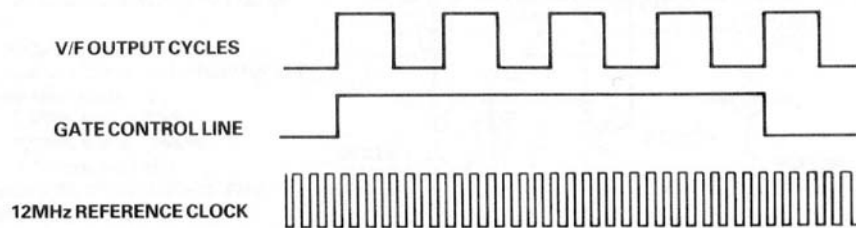


49

GATED CLOCK ADC



TIMING FOR GATED CLOCK ADC



$C = \text{NUMBER OF V/F CYCLES DURING } T_{(INT)}$

$N = \text{NUMBER OF REFERENCE CLOCKS DURING } T_{(INT)}$

50

KAYNAKLAR

- 1.Linear Design Seminar Handbook, Analog Devices, 1987
- 2.Analog Designer Reference CD-ROM, Analog Devices, 2002
- 3.Technical Literature Database CD-ROM, National Semiconductor Corporation, 1997
- 4.Linear Application Seminar Handbook, National Semiconductor Corporation, 1989
- 5.Linear Application Databook, National Semiconductor Corporation, 1986
- 6.Data Acquisition Handbook, Harris Semiconductor, 1991
- 7.LS/S/TTL Logic Databook, National Semiconductor, 1987