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GEC PLESSEY
SEMICONDUCTORS

ZN423

PRECISION VOLTAGE REFERENCE SOURCE

The ZN423 is a monolithic integrated circuit using the energy bandgap voltage of a base-emitter junction to produce a precise, stable, reference source of 1.26V. This is derived via an external dropping resistor for supply voltages of 1.5V upwards. The temperature coefficient of the ZN423, unlike conventional Zener diodes, remains constant with reference current. the noise figure associated with breakdown mechanisms is also considerably reduced.

FEATURES

- Low Voltage
- Low Temperature Coefficient
- Very Good Long Term Stability
- Low Slope Resistance
- Low RMS Noise
- Tight Tolerance
- High Power Supply Rejection Ratio
- 2-Lead TO-18 Metal Can Package

ABSOLUTE MAXIMUM RATINGS

Reference current, I_{REF}	20mA
Operating temperature range:	-55°C to +125°C
Storage temperature range:	-65°C to +165°C

ORDERING INFORMATION

Device Type	Operating Temperature	Package
ZN423	-55°C to +125°C	CM2

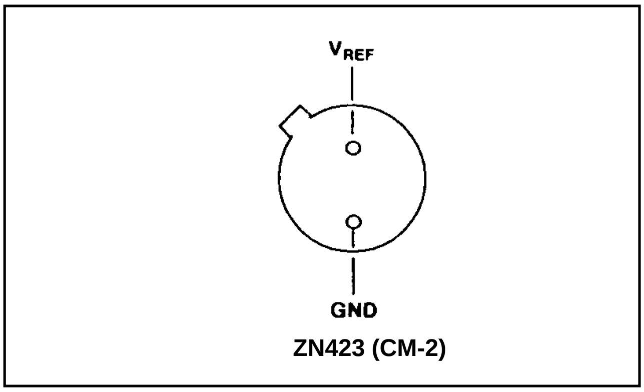

Fig.1 Pin connections (bottom view)

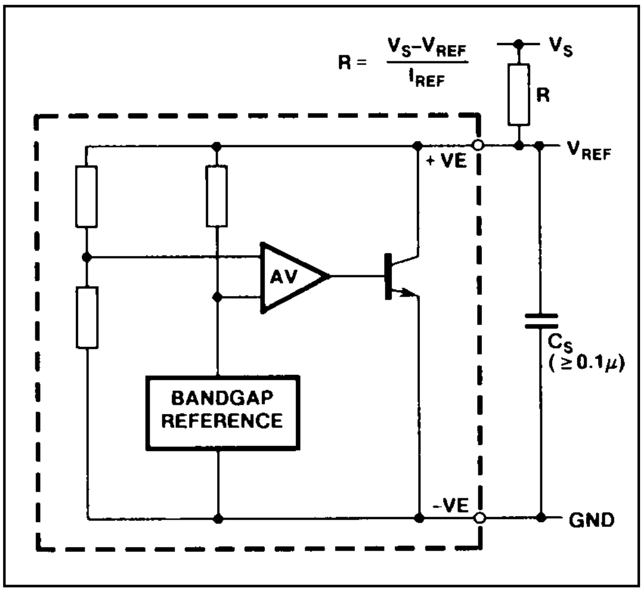

Fig.2 Circuit diagram

ELECTRICAL CHARACTERISTICS

Test conditions (unless otherwise stated):
T_{amb} = 25°C, Shaping capacitor, C_S = 0.1µF

Characteristic	Symbol	Value			Unit	Conditions
		Min.	Typ.	Max.		
Output voltage	V_{REF}	1.2	1.26	1.32	V	
Slope resistance	R_{REF}		0.5	1.5	Ω	I_{REF} = 5mA
Reference current	I_{REF}	1.5		12	mA	
Temperature coefficient			30		ppm/°C	
External resistor	R_{EXT}	100			Ω	$R_{EXT} = (V_{CC}-V_{REF})/I_{REF}$
RMS noise voltage			6		µV	1Hz to 10kHz
Power supply ratio	P_{SRR}		60		dB	$P_{SRR} = R_{EXT}/R_{REF}$, V_{REF} = 1.26V, I_{REF} = 2.5mA, V_{CC} = 5.0V

Reference current I_{REF} (max.) v operating temperature.

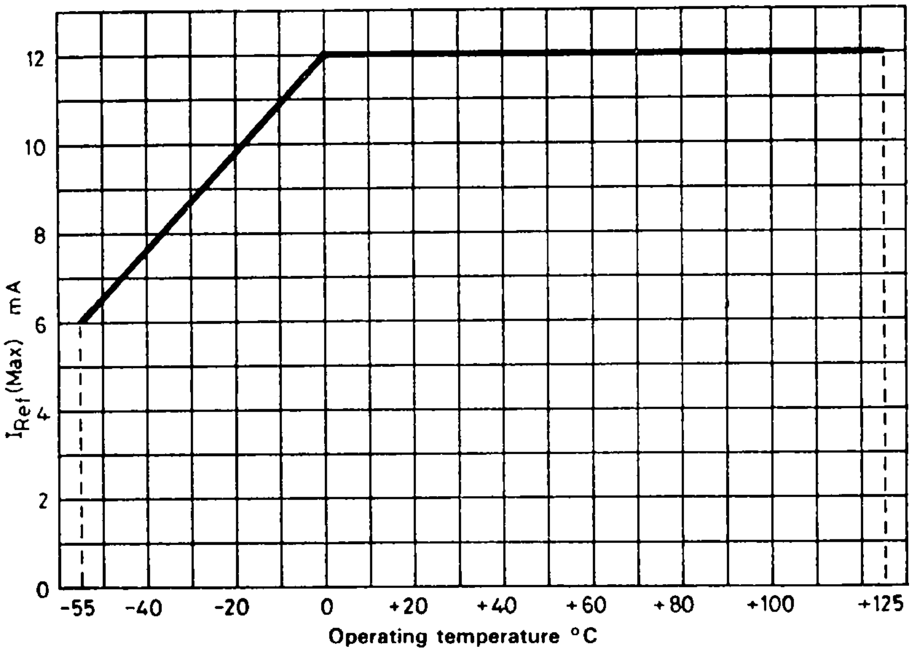

Fig.3 Derating curve

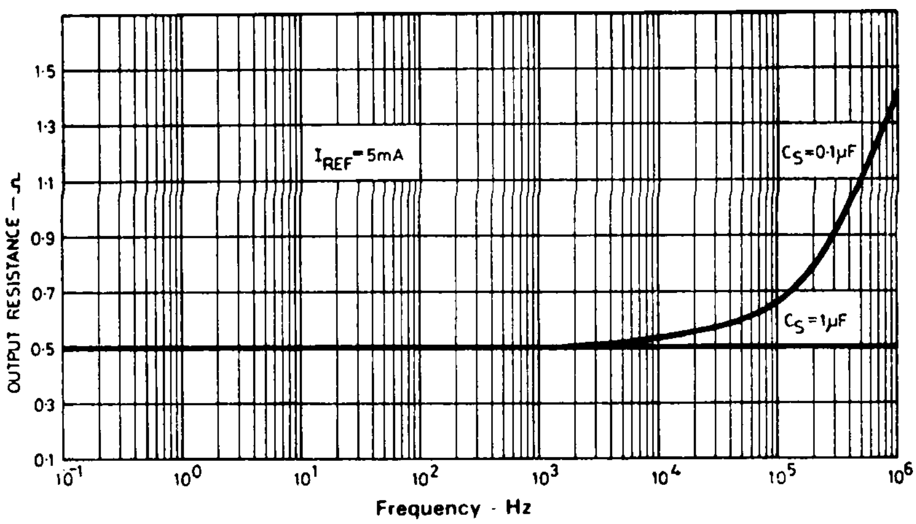

Fig.4 Slope resistance v frequency (I_{REF} = 5mA)

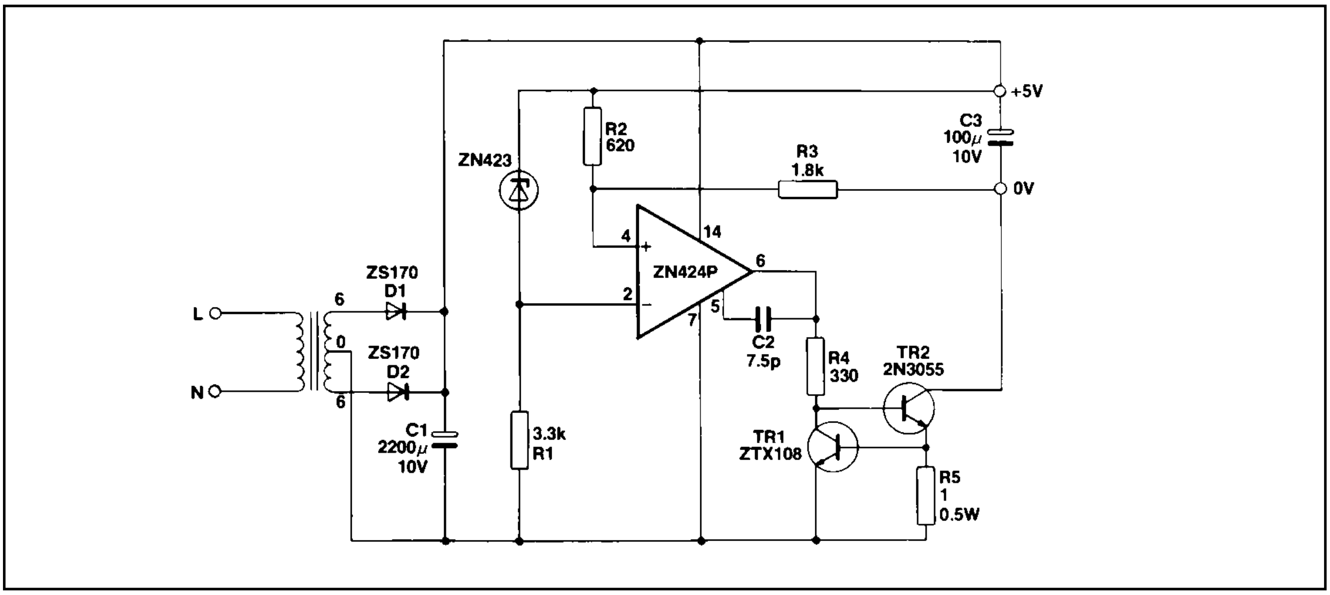

Fig.5 5V, 0.5A power supply

APPLICATIONS

5V, 0.5A Power Supply

The circuit shown in Fig.5 is essentially a constant current source modified by the feedback components R2 and R3 to give a constant voltage output.

The output of the ZN424P need only be 2V above the negative rail, by placing the load in the collector of the output transistor TR2. Current control is achieved by TR1 and R5. The simple circuit has the following performance characteristics:

Output noise and ripple (full load) = 1mV rms
Load regulation (0 to 0.5A) = 0.1%
Temperature coefficient = ±100ppm/°C
Current limit = 0.65A

5V, 1.0A Power Supply

The circuit detailed in Fig.6 provides improved performance over that in Fig.5. This is achieved by feeding the ZN423 reference and the ZN424P error amplifier from a more stable source, derived from the emitter-follower stage (TR1). The supply rejection ratio is improved by the factor R1/R5, where R5 is the slope resistance of the ZN423.

The output voltage is given by:

$$\frac{(R3 + R4)}{R3} \quad V_{REF}$$

and may be adjusted by replacing R3 with a 220 and a 500Ω preset potentiometer.

The output is protected against short circuits by TR2 setting a current limit of 1.6A.

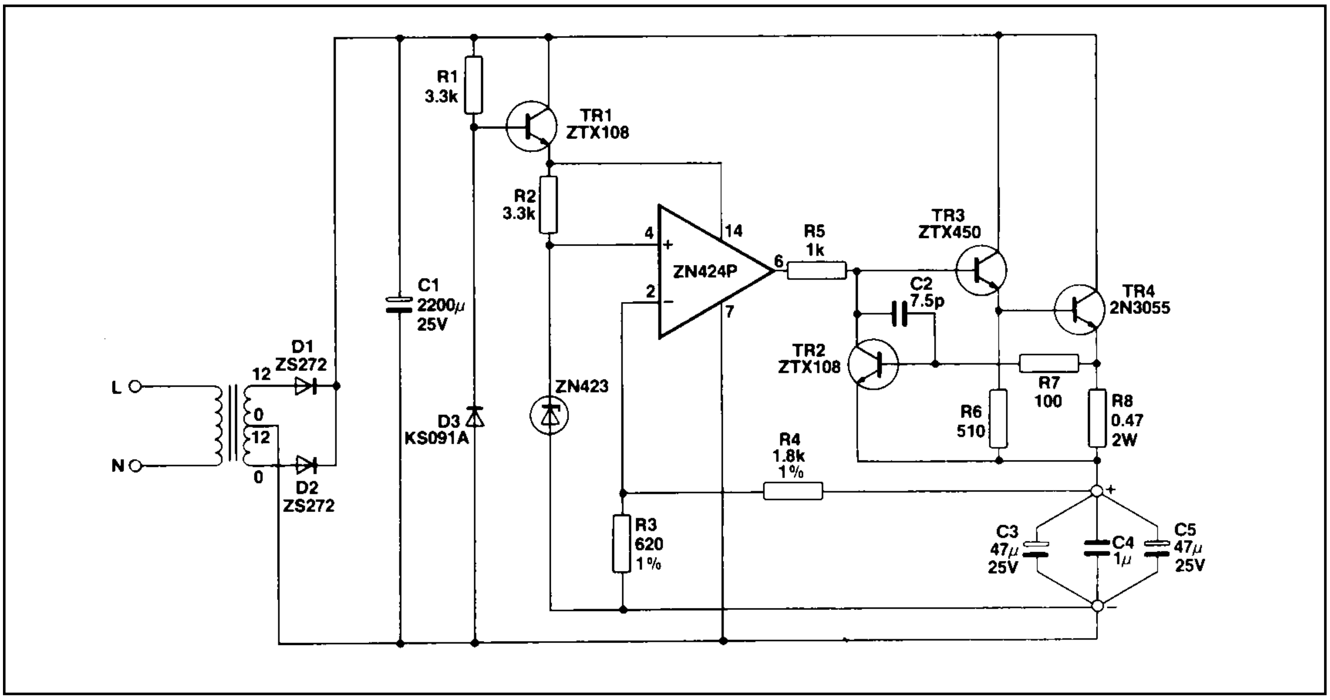

Fig.6 5V, 1.0A power supply

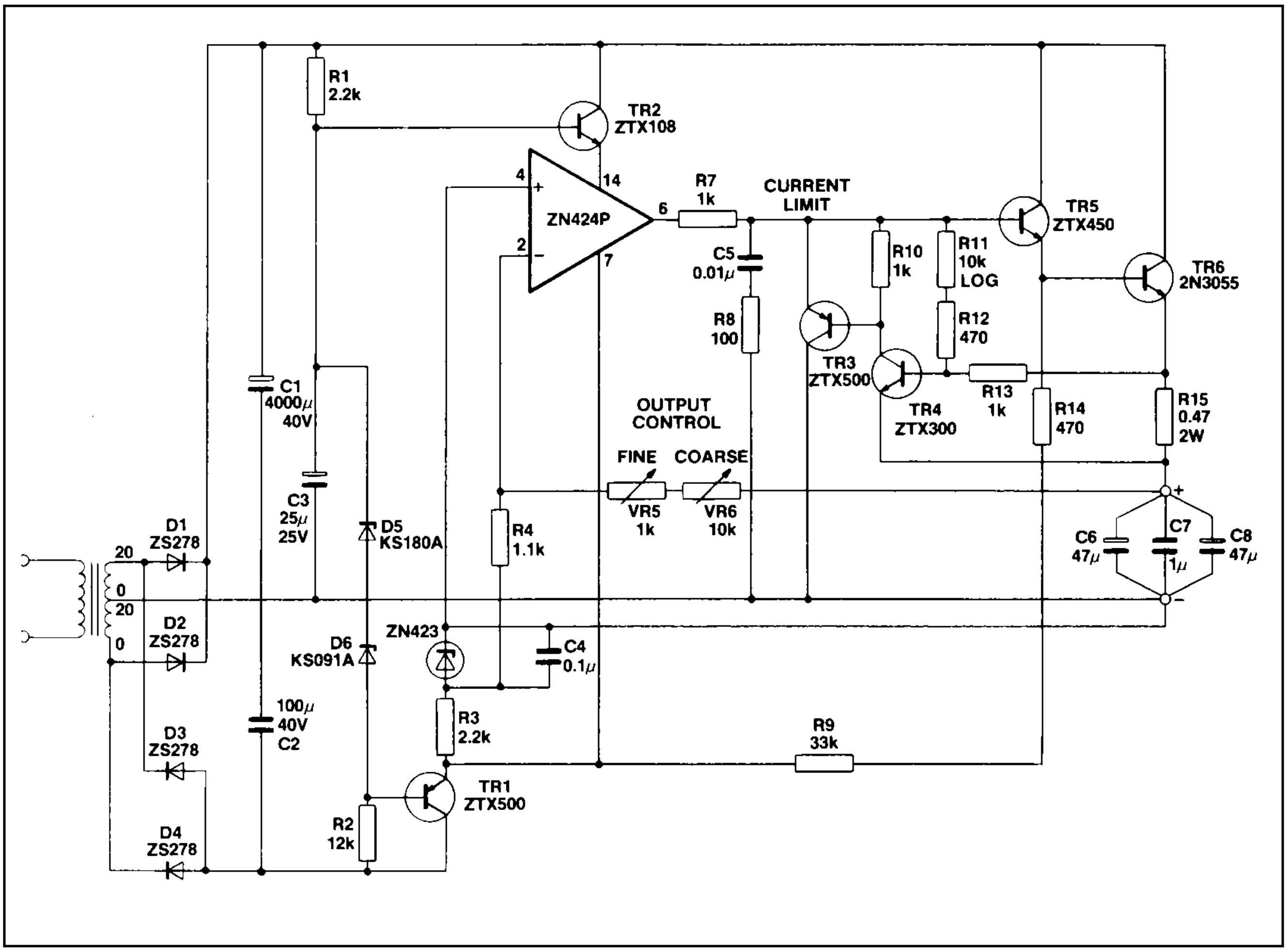

Fig.7 0V to 12V, 1A power supply

0V to 12V, 1A Power Supply

The circuit of Fig.7 provides a continuously variable, highly stable voltage for load currents up to 1A. The output voltage is given by:

$$V_O = \frac{(VR5 + VR6)}{R4} \; V_{REF}$$

and is controlled by VR5 and VR6 which should be high quality components (preferably wire wound).

The emitter follower stages TR1 and TR2 buffer the bias and reference from the output stages. The negative rail allows the output to operate down to 0V.

The current limit stage monitors output current through R15. As the potential across R15 increases due to load current, TR4 conducts and supplies base current for TR3, thus diverting part of the output from the ZN424P via TR3 to TR5.

Shaping is achieved by the network C5, R8 together with the output decoupling capacitors which also maintain low output resistance at frequencies above 100kHz.

The power supply has the following performace characteristics:

Output noise and ripple (full load) <100μV rms
Output resistance (0 to 1A) 1MΩ
Temperature coefficient ± 100ppm/°C

Variable 100mA to 2A Current Source

In the circuit of Fig.8 the output current is set by the resistor R in the collector of TR2, which may be switched to offer a range of output currents from 100mA to 2A with fine control by means of VR3 which varies the reference voltage to the non-inverting input of the ZN424P.

The feedback path from the output to the inverting input of the ZN424P maintains a constant voltage across R, equal to (V_{CC} - V_{IN}) and hence a constant current to the load given by (V_{CC} - V_{IN})/R.

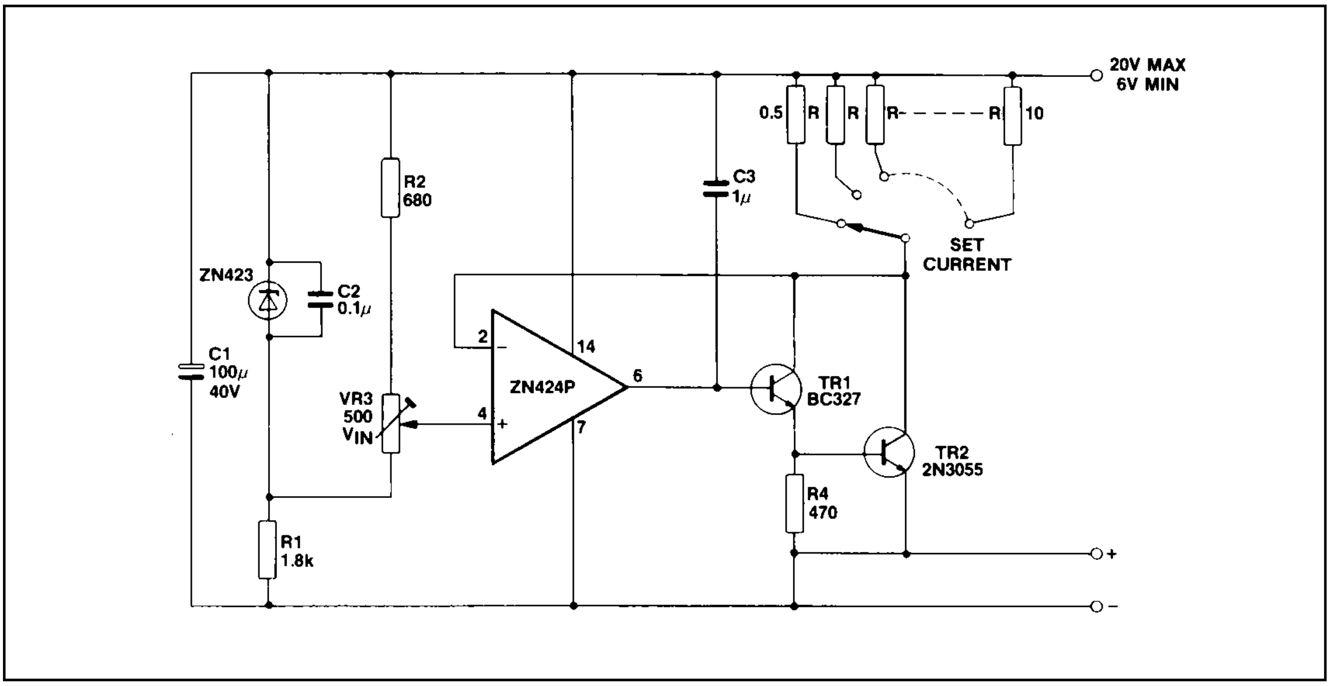

Fig.8 Variable current sources

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