Ordering number: EN3528

FBET Hybrid IC

No. 3528

SANYO

VPA10

Video Pack, Video Output Amplifier for High-resolution CRT Displays

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OVERVIEW

The VPA10 is a composite, single-channel, video output amplifier IC for high-resolution monochrome or RGB CRT displays. It is fabricated using hybrid technology and incorporates high-precision FBET and LSBT transistors to provide high output voltages over a wide bandwidth with minimal external components. The single-in-line, metal package reduces EMI and simplifies circuit board design.

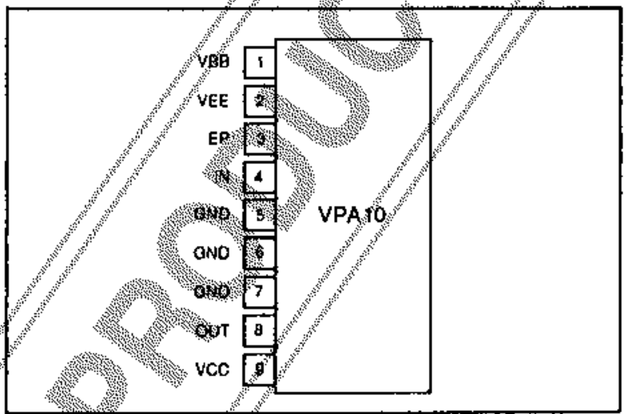
The VPA10 is ideally suited to medium-resolution monitors which use a 64 kHz line frequency. Applications include high-end CAD/CAM monitors and other high-resolution graphics displays. The VPA12 and VPA13 three-channel amplifiers are recommended for RGB applications.

The VPA10 operates from a 90 V supply (typ) and is available in 9-pin SIPs.

FEATURES

- Up to 45 V_{p-p} output
- High-precision FBET and LSBT transistors
- 100 MHz bandwidth
- Low external component count
- Metal case reduces EMI
- Single-in-line package simplifies circuit board design
- Up to 100 V supply and 15 V bias
- 9-pin SIP

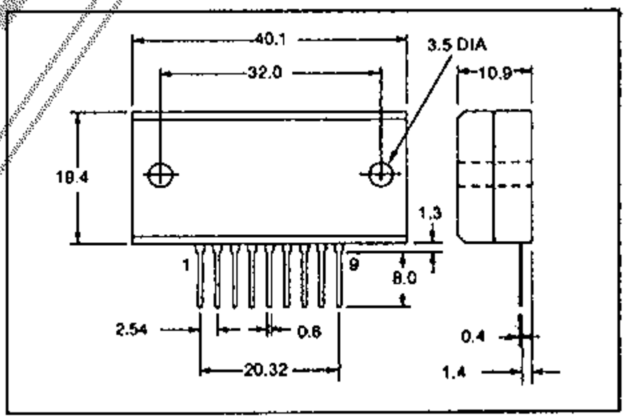
PINOUT



PACKAGE DIMENSIONS

Unit: mm

2060



Specifications and information herein are subject to change without notice.

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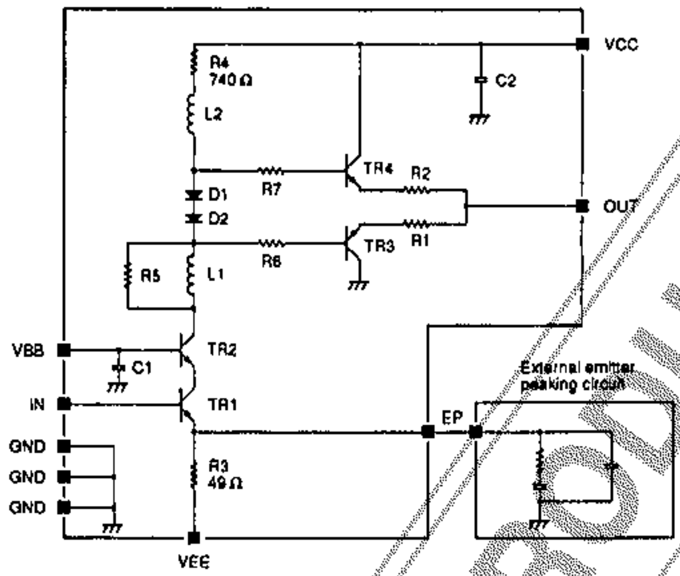
INTERNAL CIRCUIT



PIN DESCRIPTION

Number	Name	Description
1	VBB	Bias voltage
2	VEE	Emitter biasing input
3	EP	External peaking input
4	IN	Input
5, 6, 7	GND	Ground
8	OUT	Output
9	VCC	Supply voltage

SPECIFICATIONS

Absolute Maximum Ratings

Parameter	Symbol	Rating	Unit
Supply voltage	V_{CC} max	100	V
Bias voltage	V_{BB} max	15	V
Power dissipation	P_D	3.5 (T_a = 25 deg. C)	W
		20 (T_c = 25 deg. C)	
Junction temperature	T_j	150	deg. C
Operating temperature	T_{opg}	85	deg. C
Storage temperature range	T_{stg}	−20 to 110	deg. C

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Recommended Operating Conditions

T_a = 25 deg. C

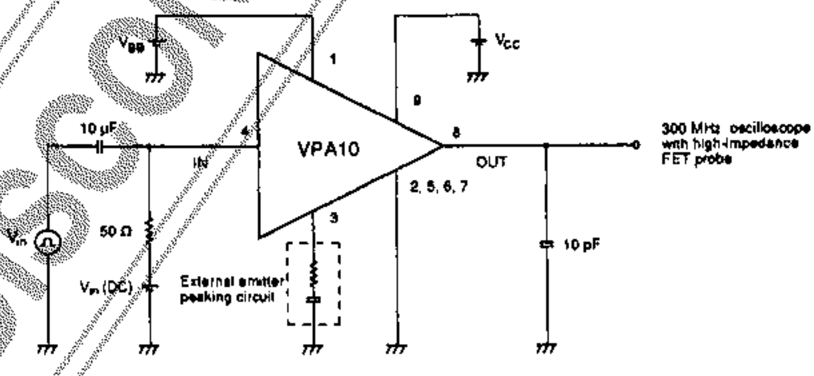
Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Supply voltage	V_{CC}	V_{out} = 40 $V_{p\text{-}p}$, V_{in}(DC) = 3.0 V	–	80	–	V
Bias voltage	V_{BB}		–	10	–	V
Supply voltage	V_{CC}	V_{out} = 45 $V_{p\text{-}p}$, V_{in}(DC) = 3.4 V	–	90	–	V
Bias voltage	V_{BB}		–	10	–	V

Electrical Characteristics

T_a = 25 deg. C

Parameter	Symbol	Condition	Rating			Unit
			min	typ	max	
Frequency bandwidth	f_c (–3 dB)	V_{out} = 40 $V_{p\text{-}p}$, V_{CC} = 80 V, V_{BB} = 10 V, V_{IN}(DC) = 3.0 V	–	100	–	MHz
		V_{out} = 45 $V_{p\text{-}p}$, V_{CC} = 90 V, V_{BB} = 10 V, V_{IN}(DC) = 3.4 V	–	100	–	
Voltage gain	G_V		12	14	16	
Current consumption	I_{CC}	f = 10 MHz, V_{CC} = 80 V, V_{BB} = 10 V	–	57	–	mA
		f = 100 MHz, V_{CC} = 80 V, V_{BB} = 10 V	–	86	–	
		f = 10 MHz, V_{CC} = 90 V, V_{BB} = 10 V	–	67	–	
		f = 100 MHz, V_{CC} = 90 V, V_{BB} = 10 V	–	105	–	

Measurement Circuit



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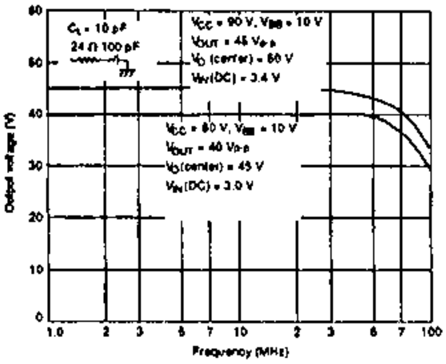
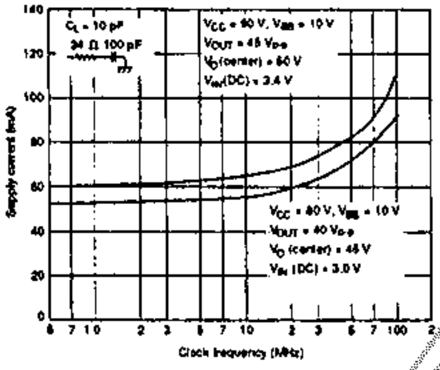
Typical Performance Characteristics

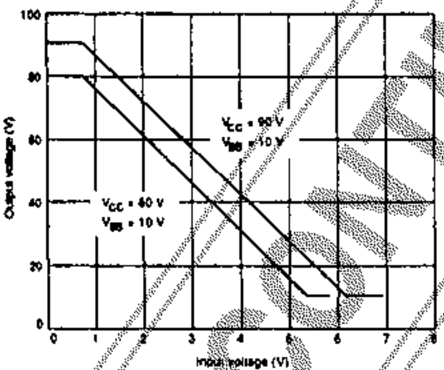
Output voltage vs. frequency



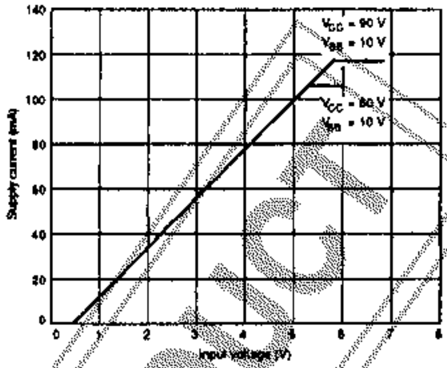
Supply current vs. frequency



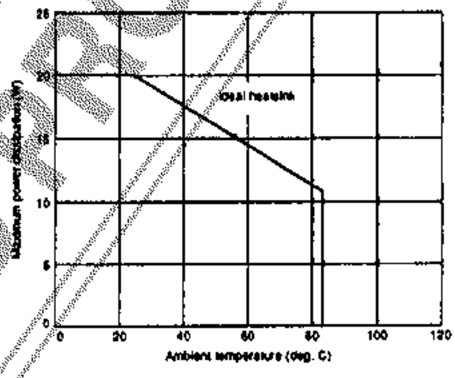
Output voltage vs. DC input voltage



Supply current vs. input voltage



Power dissipation vs. ambient temperature



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HEATSINK DESIGN

The transistor junction temperature should be kept below 150 deg. C. To achieve this, heatsinks should be designed to keep the case temperature below 80 deg. C. Note that the quantity of heat dissipated is proportional to the operating frequency. Thermal calculations should be carried out using the thermal dissipation specified at the maximum operating frequency of 100 MHz. Transistor TR2 generates the most heat—24% of the total dissipation—and is used in the following heatsink design calculations.

The transistor junction temperature, T_j, is calculated using the following equation.

$$T_j = (\theta_{j-c} \times P_c) + \Delta T_c + T_a \text{ (deg. C)}$$

where the symbols are defined as follows.

θ_{j-c}	Junction-to-case thermal resistance
P_c	Collector loss of the transistor
ΔT_c	Case temperature rise
T_a	Ambient temperature
θ_h	Heatsink thermal resistance

The junction-to-case thermal resistance, θ_{j-c}, of transistors TR1 to TR4 is 30 deg. C/W.

The collector loss, P_c, of each transistor is calculated using the following equation.

$$P_c = P_D \times \text{heat dissipation ratio}$$

The heat dissipation ratio for TR2 is 0.24.

The case temperature rise is calculated using the following equation.

$$\Delta T_c = P_D \times \theta_h$$

Power dissipation vs. signal frequency is shown in figure 1, and collector loss vs. frequency, in figure 2.

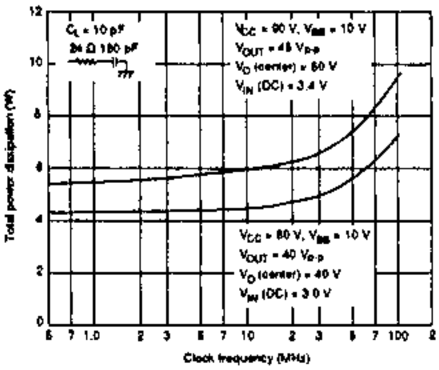

Figure 1. Power dissipation vs. signal frequency

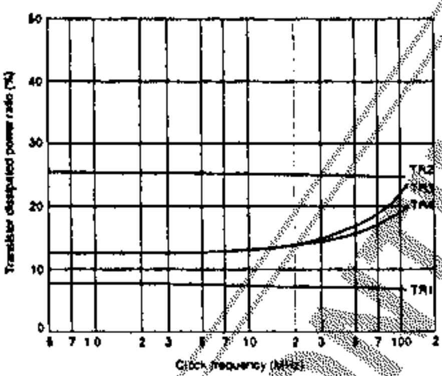

Figure 2. Collector loss vs. signal frequency

Sample Calculations

Example 1

This calculation uses the following conditions.

- Signal frequency = 100 MHz
- V_{CC} = 80 V
- V_{BB} = 10 V
- V_{out} = 40 V_{p-p}
- C_L = 10 pF
- T_a = 60 deg. C

TR2 collector loss

$$P_c = P_D \times \text{heat dissipation ratio}$$

$$= 7.2 \times 0.24$$

$$= 1.73 \text{ W}$$

P_D is read from figure 1.

Case temperature rise

$$T_j = (\theta_{j-c} \times P_c) + \Delta T_c + T_a$$

$$\Delta T_c = T_j - T_a - (\theta_{j-c} \times P_c)$$

$$= 150 - 60 - (30 \times 1.73)$$

$$= 38.1 \text{ deg. C}$$

Heatsink thermal resistance

$$\Delta T_c = P_D \times \theta_h$$

$$\theta_h = \Delta T_c \div P_D$$

$$= 38.1 \div 7.2$$

$$= 5.3 \text{ deg. C/W}$$

Heatsink thermal resistance should be less than 5.3 deg. C/W.

Example 2

The conditions are identical to those in example 1 except for the following.

- V_{CC} = 90 V
- V_{out} = 45 V_{p-p}

The thermal resistance of the heatsink, θ_h, is calculated to be 2.3 deg. C/W by using the steps given in example 1. However, the heatsink should have a thermal resistance less than this value.

Example 3

The conditions are identical to those in example 1 except for the following.

- V_{CC} = 90 V
- V_{out} = 45 V_{p-p}
- $T_a \leq 40$ deg. C

The thermal resistance of the heatsink, θ_h, is calculated to be 4.5 deg. C/W by using the steps given in example 1. However, the heatsink should have a thermal resistance less than this value.

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PRECAUTIONS

- Pins should not be short-circuited while power is applied.
- Correct heatsinking should be used to keep the case temperature below 80 deg. C.
- Note that the case is connected to ground.
- The recommended mounting torque is 4 to 6 kg/cm.

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Information (including circuit diagrams and circuit parameters) herein is for example only; it is not guaranteed for volume production. SANYO believes information herein is accurate and reliable, but no guarantees are made or implied regarding its use or any infringements of intellectual property rights or other rights of third parties.