Ordering number: EN3527

FBET Hybrid IC

No. 3527

# VPM04F

## Video Pack, Three-channel, RGB Video Output Amplifier for Medium-resolution CRT Displays



## OVERVIEW

The VPM04F is a composite, three-channel, video output amplifier IC for medium-resolution RGB 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 dual-in-line metal package reduces EMI and simplifies circuit board design.

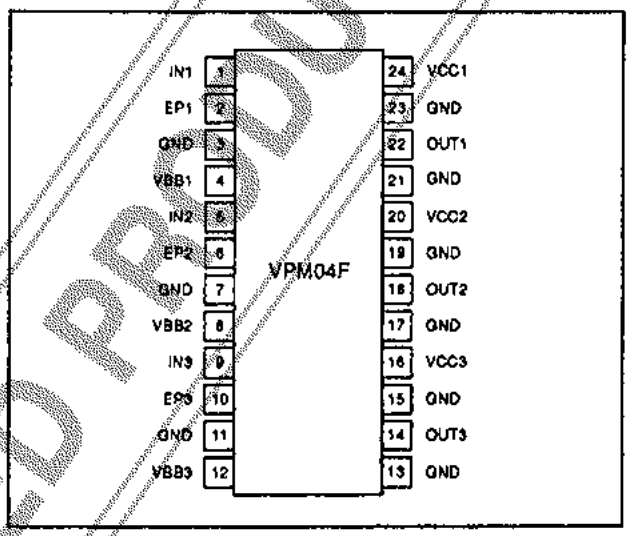
The VPM04F is ideally suited to medium-resolution RGB monitors which use a 39 kHz line frequency. Applications include EGA, VGA, MacII and television displays. The VPA05 and VPA07 single-channel amplifiers are recommended for monochrome applications.

The VPM04F operates from a 80 V supply (typ) and is available in 24-pin DIPs.

## FEATURES

- Up to 40 $V_{P-P}$ output
- High-precision FBET and LSBT transistors
- 45 MHz bandwidth
- Metal case reduces EMI
- Dual-in-line package simplifies circuit board design
- Up to 120 V supply and 15 V bias
- 24-pin DIP

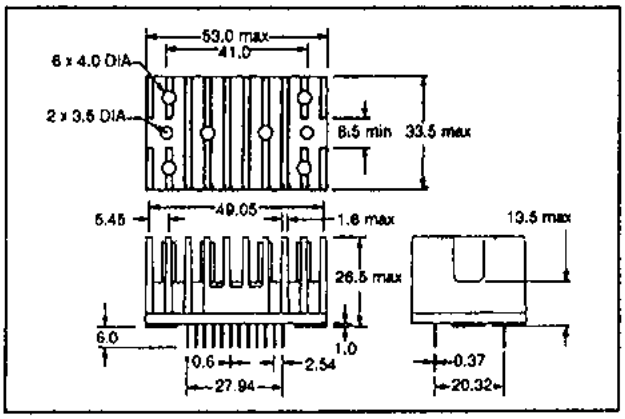
## PINOUT



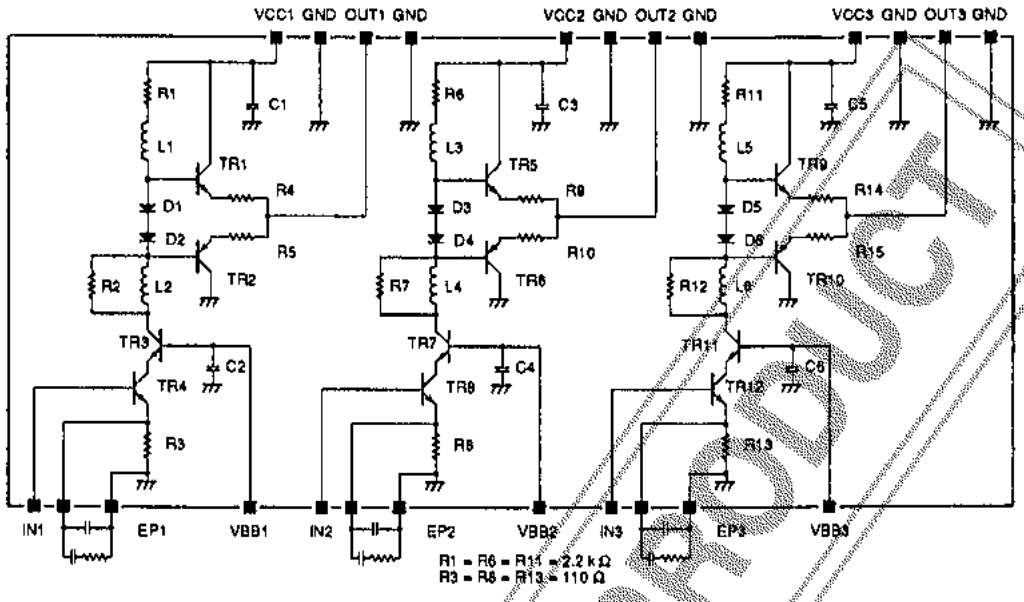

## PACKAGE DIMENSIONS

Unit: mm

**2082**



## INTERNAL CIRCUIT




## PIN DESCRIPTION

| Number | Name | Description |
|---|---|---|
| 1 | IN1 | Channel 1 input |
| 2 | EP1 | Channel 1 external peaking input |
| 3, 7, 11, 13, 15, 17, 19, 21, 23 | GND | Ground |
| 4 | VBB1 | Channel 1 bias voltage |
| 5 | IN2 | Channel 2 input |
| 6 | EP2 | Channel 2 external peaking input |
| 8 | VBB2 | Channel 2 bias voltage |
| 9 | IN3 | Channel 3 input |
| 10 | EP3 | Channel 3 external peaking input |
| 12 | VBB3 | Channel 3 bias voltage |
| 14 | OUT3 | Channel 3 output |
| 16 | VCC3 | Channel 3 supply voltage |
| 18 | OUT2 | Channel 2 output |
| 20 | VCC2 | Channel 2 supply voltage |
| 22 | OUT1 | Channel 1 output |
| 24 | VCC1 | Channel 1 supply voltage |

# SPECIFICATIONS

## Absolute Maximum Ratings

| Parameter | Symbol | Rating | Unit |
|---|---|---|---|
| Supply voltage | $V_{CC}$ max | 120 | V |
| Bias voltage | $V_{BB}$ max | 15 | V |
| Power dissipation | $P_D$ | 15 | W |
| Junction temperature | $T_j$ | 150 | deg. C |
| Operating temperature | $T_{opg}$ | 85 | deg. C |
| Storage temperature range | $T_{stg}$ | -20 to 110 | deg. C |

## Recommended Operating Conditions

$T_a$ = 25 deg. C

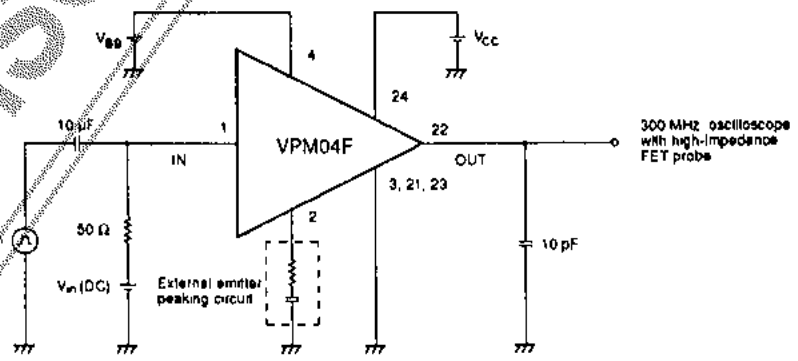
| Parameter | Symbol | Condition | Rating | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Supply voltage | $V_{CC}$ | $V_{out}$ = 40 $V_{p-p}$, $V_{in}$(DC) = 2.5 V | – | 80 | – | V |
| Bias voltage | $V_{BB}$ | | – | 10 | – | V |

## Electrical Characteristics

$T_a$ = 25 deg. C

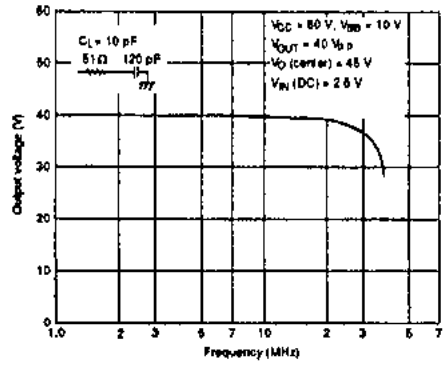
| Parameter | Symbol | Condition | Rating | | | Unit |
|---|---|---|---|---|---|---|
| | | | min | typ | max | |
| Frequency bandwidth | $f_c$ (-3 dB) | $V_{out}$ = 40 $V_{p-p}$, $V_{CC}$ = 80 V, $V_{BB}$ = 10 V, $V_{in}$(DC) = 2.5 V | – | 45 | – | MHz |
| Voltage gain | $G_v$ | | 17 | 19 | 21 | |
| Current consumption | $I_{CC}$ | f = 10 MHz, $V_{CC}$ = 80 V, $V_{BB}$ = 10 V | – | 22 | – | mA |
| | | f = 45 MHz, $V_{CC}$ = 80 V, $V_{BB}$ = 10 V | – | 30 | – | |

## Measurement Circuit

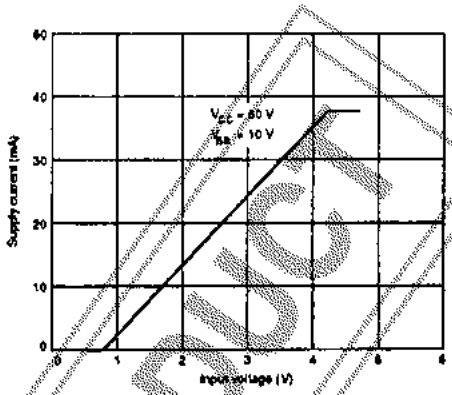


## Typical Performance Characteristics

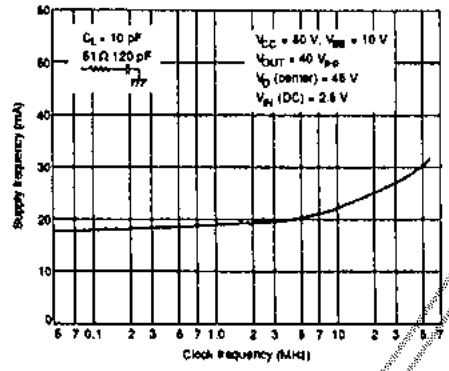
### Output voltage vs. frequency



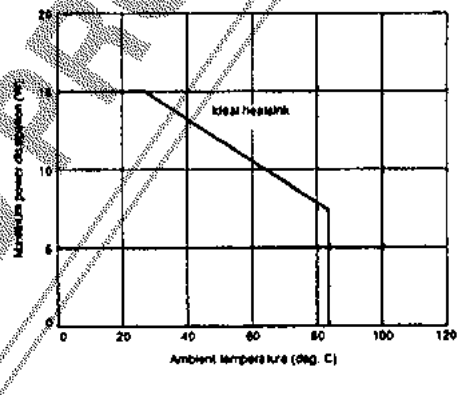

### Supply current vs. DC Input voltage



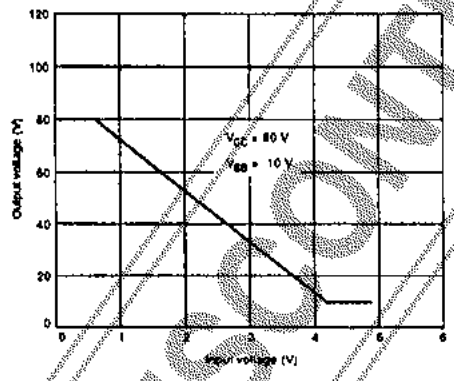

### Supply current vs. frequency




### Power dissipation vs. ambient temperature




### Output voltage vs. DC Input voltage




## 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 100 deg. C. The VPM04 is designed for use with an external heatsink whereas the VPM04F has a composite heatsink package. The VPM04 heatsink should be designed according to its drive conditions as shown in table 1. The VPM04F maximum drive conditions are determined by the ambient temperature as shown in table 2.

Table 1. VPM04 recommended heatsink characteristics

| Parameter | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Thermal resistance | $\theta_h$ | $V_{CC}$ = 80 V, $V_{BB}$ = 10 V, $V_{OUT}$ = 40 $V_{p-p}$, $f_c$ = 45 MHz, $T_a$ = 60 deg. C | 8.8 | deg. C/W |
| | | $V_{CC}$ = 90 V, $V_{BB}$ = 10 V, $V_{OUT}$ = 50 $V_{p-p}$, $f_c$ = 45 MHz, $T_a$ = 40 deg. C | 5.7 | |

Table 2. VPM04F recommended drive conditions

| Parameter | Symbol | Condition | Rating | Unit |
|---|---|---|---|---|
| Supply voltage | $V_{CC}$ | $T_a$ = 60 deg. C | 80 | V |
| | | $T_a$ = 40 deg. C | 90 | |
| Output voltage | $V_{OUT}$ | $T_a$ = 60 deg. C | 40 | $V_{p-p}$ |
| | | $T_a$ = 40 deg. C | 50 | |
| Operating frequency | $f_c$ | $T_a$ = 60 deg. C | 45 | MHz |
| | | $T_a$ = 40 deg. C | 45 | |

**Note**
Composite heatsink package. $\theta_h$ = 8.0 deg. C/W

The power dissipation versus supply voltage is shown in figure 1, and thermal resistance versus supply voltage, in figure 2.

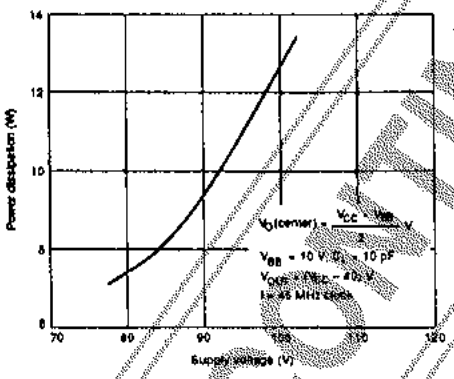



Figure 1. Power dissipation vs. supply voltage

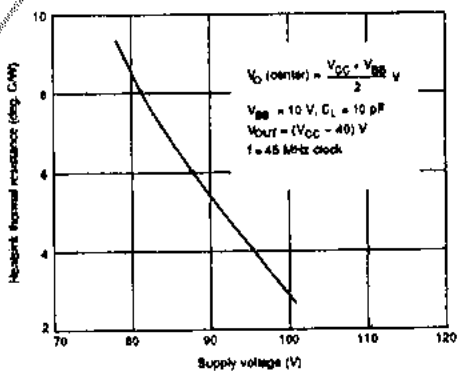



Figure 2. Thermal resistance vs. supply voltage

## PRECAUTIONS

- Pins should not be short-circuited while power is applied.
- Correct heatsinking should be used to keep the case temperature below 100 deg. C.
- Note that the case is connected to ground.
- The recommended mounting torque is 4 to 6 kg/cm.