Ordering number: EN 3523A

No.3523A

Video Pack

# VPH05

Wideband Video Output Module (Video Pack)

## High Defintion Television, Projector Video Output Amplifier

## Overview

A single-package product designed specifically for use as the video output stage in ultrahigh-resolution color CRT displays.

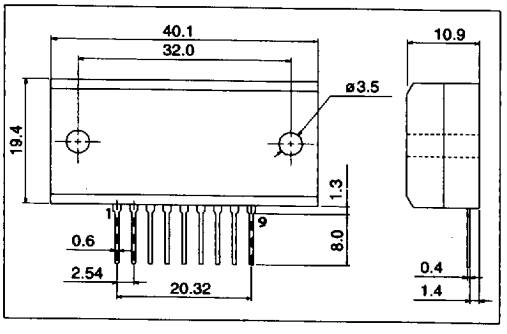
## Features

- High output voltage and wide bandwidth; best suited for HDTV.
  [ $f_C$(-3dB)(at $V_{OUT}$=100$V_{P-P}$) : 50MHz ]
- High performance because of adoption of FBET and LSBT structure transistor chips.

## Package Dimensions

unit : mm

**2060**




## Specifications

### Absolute Maximum Ratings at Ta=25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Maximum Supply Voltage | $V_{CC}$ max | | 230 | V |
| | $V_{BB}$ max | | 20 | V |
| Allowable Power Dissipation | $P_D$ max | | 3.5 | W |
| | | Tc=25°C | 20 | W |
| Junction Temperature | $T_j$ max | | 150 | °C |
| Operating Ambient Temperature | $T_{opr}$ | | 85 | °C |
| Storage Temperature | $T_{stg}$ | | -20 ~ +110 | °C |

### Recommended Operating Conditions at Ta=25°C

| Parameter | Symbol | Conditions | Ratings | Unit |
|---|---|---|---|---|
| Recommended Supply Voltage | $V_{CC}$ max | $V_{OUT}$ ~ 100$V_{p-p}$ | 170 | V |
| | $V_{BB}$ max | $V_{IN}$(DC)=3.4V | 12 | V |
| | $V_{CC}$ max | $V_{OUT}$ ~ 120$V_{p-p}$ | 200 | V |
| | $V_{BB}$ max | $V_{IN}$(DC)=4.0V | 12 | V |

### Electrical Characteristics at Ta=25°C

| Parameter | Symbol | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Frequency Band | $f_C$(-3dB) | $V_{OUT}$=100$V_{p-p}$ | | 50 | | MHz |
| | | $V_{OUT}$=120$V_{p-p}$ | | 45 | | MHz |
| Voltage Gain | $V_G$(DC) | | 26 | 29 | 32 | times |
| Suplly Current | $I_{CC}1$ | $f$=10MHz clock, $C_L$=10pF | | 60 | | mA |
| | $I_{CC}2$ | $f$=50MHz clock, $C_L$=10pF | | 100 | | mA |
| | $I_{CC}3$ | $f$=10MHz clock, $C_L$=10pF | | 76 | | mA |
| | $I_{CC}4$ | $f$=30MHz clock, $C_L$=10pF | | 96 | | mA |

Note : With optimum peaking

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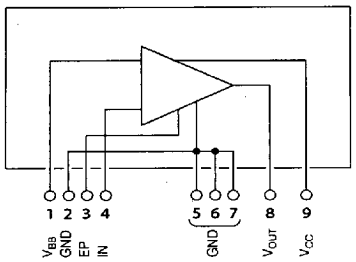
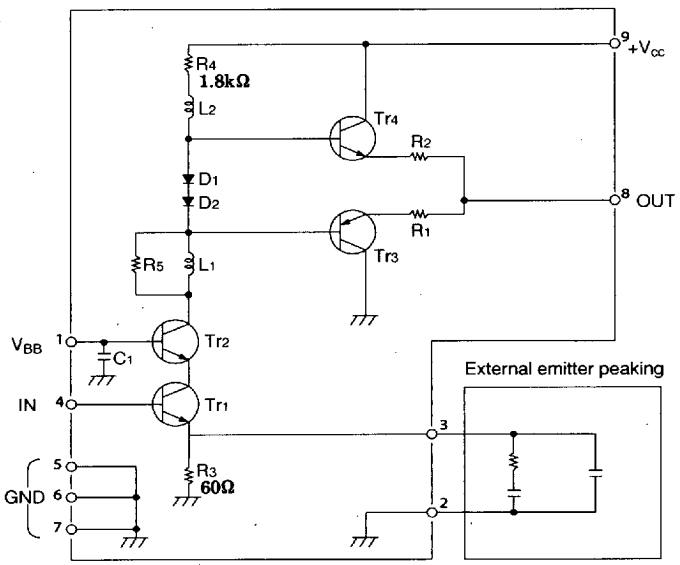
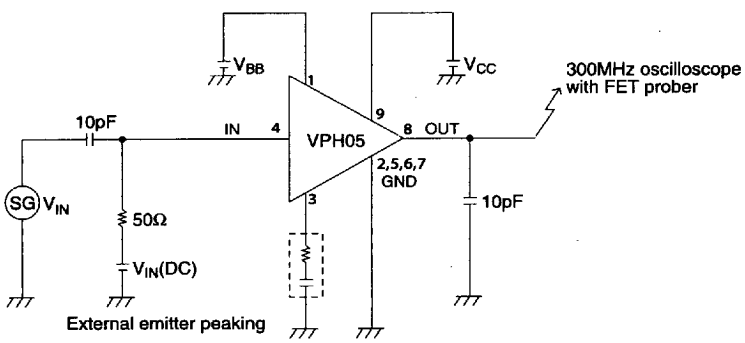
## Electrical Connection




## Internal Circuit

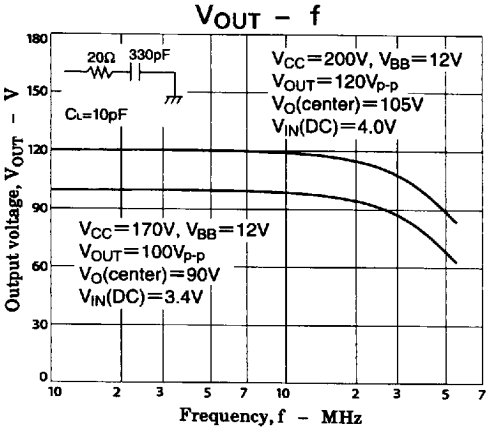


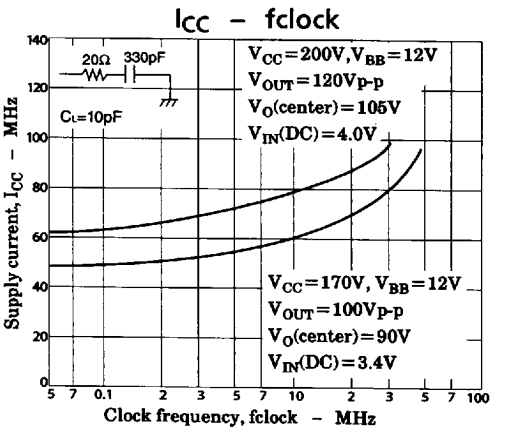

## Test Circuit

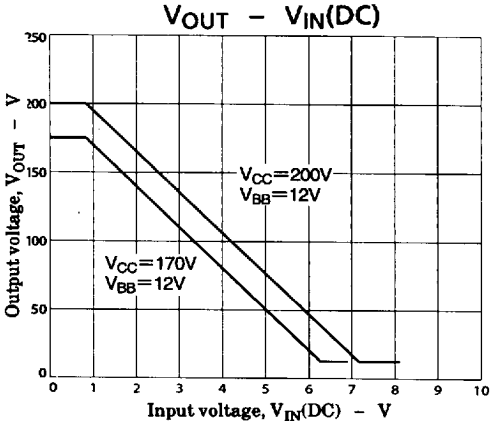


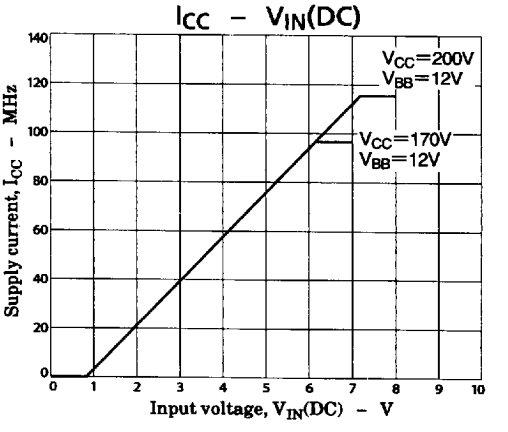

## Precautions

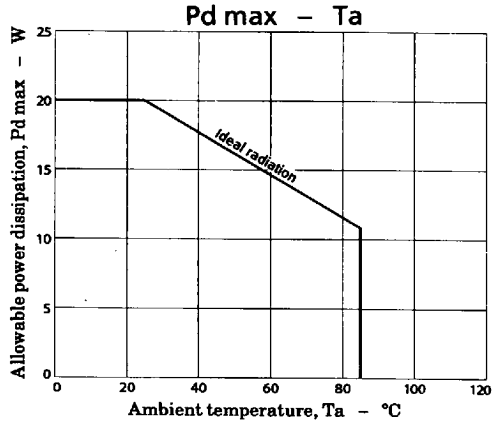
1. Pins shoud not be short-circuited while power is applied.
2. See the thermal characteristics in "Heatsink Design" when designing a heatsink.
3. The recommended mounting torque is 39 to 58 N·cm (typical : 49 N·cm)



## Heatsink Design

The data and example of heatsink design will be shown as follows.

The transistor junction temperature should be kept below 150°C. To achieve this, a heatsink should be designed to keep the case temperature below 85°C as a standard.

The temperature and the loss of the transistor chips depend on the operating frequency, and their values differ one another. Thermal calculations should be carried out for the largest-loss transistor at the maximum operating frequency of 30MHz (clock). The largest-loss transistor is Tr2 in the internal circuit schematic. It shares about 24% of the total loss shown in the Fig.1. Each transistor's Tj is calculated by next equation.

$$Tj(Tri) = \theta j\text{-}c(Tri) \times P_C(Tri) + \Delta Tc + Ta(°C) \quad \text{.....(1)}$$

$\theta j\text{-}c(Tri)$ : Junction-to-case thermal resistance of each chip.
$P_C(Tri)$ : Collector loss of each transistor.
$\Delta Tc$ : Case temperature rise.
Ta : Ambient temperature inside a set.

Each transistor's $\theta j\text{-}c(Tri)$ is,

$$\theta j\text{-}c(Tr1) = 30°C/W \quad \text{.....(2)}$$

$$\theta j\text{-}c(Tr2) \text{ to } (Tr4) = 20°C/W \quad \text{.....(3)}$$

From the equations (1) and (2) we get $P_C(Tr2)$ at 30MHz,

$$P_C(Tri)30MHz = P_D(total)30MHz \times 0.24 \quad \text{.....(4)}$$

There is a relation shown below between $\theta h$(thermal resistance of a heatsink) and $\Delta Tc$,

$$\Delta Tc = P_D(total) \times \theta h \quad \text{.....(5)}$$

You can calculate required $\theta h$ by the equations (1) and (5).

### Heatsink design example

Application conditions : $f_H$=32kHz (HDTV), $f$(video)=30MHz(clock)
$V_{CC}$=170V, $V_{BB}$=12V, $V_{OUT}$=100$V_{p\text{-}p}$, ($C_1$=10pF)
Ta≦60°C

When a monitor is operated at the maximum frequency of 30MHz, the recommended $\theta h$ is,

$$\theta h = 1.8°C/W$$

If it is possible to keep Ta less than 40°C, $\theta h$ would be shrunk into,

$$\theta h = 3.3°C/W$$

**(How to calculate $\theta h$)**

As mentioned above, the largest-loss transistor is Tr2, and the value is obtained from Figs. 1 and 2 and the equation (4) ;

$$P_C(Tr2) = 13.6 \times 0.24 = 3.26W \quad \text{.....(6)}$$

Substituiting the value of the equation (6) in the equation (1) and defining Tj<150°C, $\Delta Tc$ is,

$$150 > T_j = 20 \times 3.26 + \Delta Tc + 60$$

$$\therefore \Delta Tc < 25(°C)$$

Thus the case temperature rise, $\Delta Tc$, should be less than 25°C. To achieve this, $\theta h$ of the heatsink is obtained from the equation (5),

$$\theta h < \Delta Tc \div P_D(total) = 25 \div 13.6 \fallingdotseq 1.8$$

$$\therefore \theta h = 1.8°C/W$$

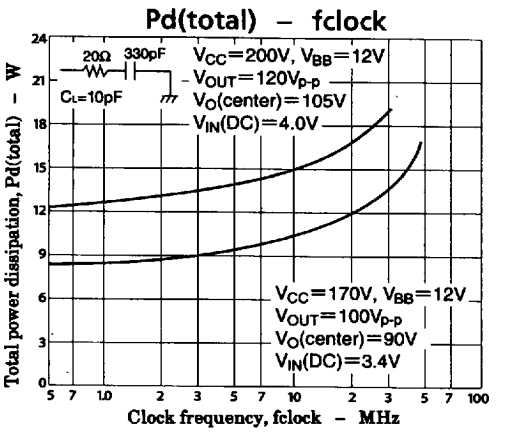


Fig.1

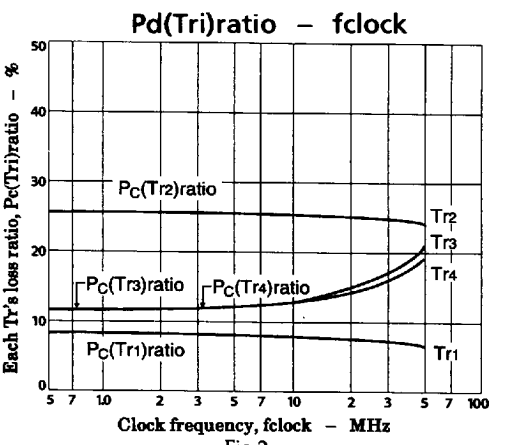


Fig.2