



STK391-020

2-Channel Convergence Correction Circuit (I_C max = 6A)

Overview

The STK391-020 is a convergence correction circuit IC for video projectors. It incorporates two output amplifiers in a single package, making possible the construction of CRT horizontal and vertical convergence correction output circuits for each of the RGB colors using just three hybrid ICs.

Applications

- Video projectors

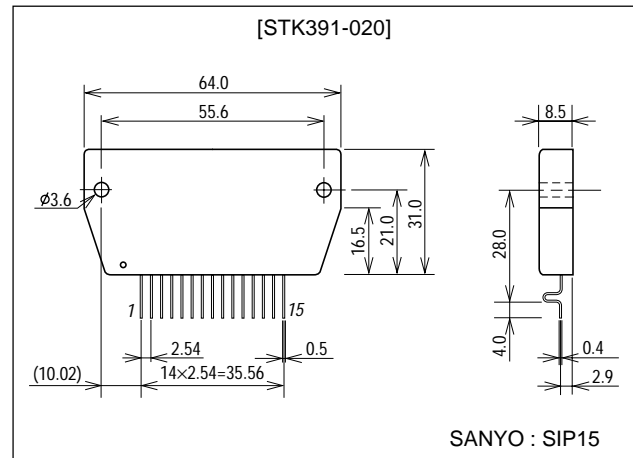
Features

- 2 output amplifier circuits in a single package
- High maximum supply voltage (V_{CC} max = $\pm 44V$)
- Low thermal resistance ($\theta_{j-c}=2.7^{\circ}C/W$)
- High temperature stability (good idling current temperature compensation)
- Low correction coil inductance for improved oscillator stability (up to $f_H = 64kHz$)
- Pin compatible with the STK4274 for easy replacement

Package Dimensions

unit:mm

4062



Specifications

Maximum Ratings at $T_a = 25^{\circ}C$

Parameter	Symbol	Conditions	Ratings	Unit
Maximum supply voltage	V_{CC} max		± 44	V
Maximum collector current	I_C	Tr9, 11, 20, 22	6.0	A
Thermal resistance	θ_{j-c}	Tr9, 11, 20, 22 (per transistor)	2.7	$^{\circ}C/W$
Junction temperature	T_J		150	$^{\circ}C$
Operating temperature	T_c		105	$^{\circ}C$
Storage temperature	T_{stg}		-30 to +105	$^{\circ}C$

Operating Characteristics at $T_a = 25^{\circ}C$, $R_g=50\Omega$, $V_{CC}=\pm 24V$

Parameter	Symbol	Conditions	Ratings			Unit
			min	typ	max	
Output noise voltage	V_{NO}				0.2	mVrms
Quiescent current	I_{CCO}			20	40	mA
Neutral voltage	V_N		-50	0	+50	mV
Output delay time	t_D	$f=15.75kHz$, triangular wave input, $V_{OUT}=1.5Vp-p$			1	μs

■ Any and all SANYO products described or contained herein do not have specifications that can handle applications that require extremely high levels of reliability, such as life-support systems, aircraft's control systems, or other applications whose failure can be reasonably expected to result in serious physical and/or material damage. Consult with your SANYO representative nearest you before using any SANYO products described or contained herein in such applications.

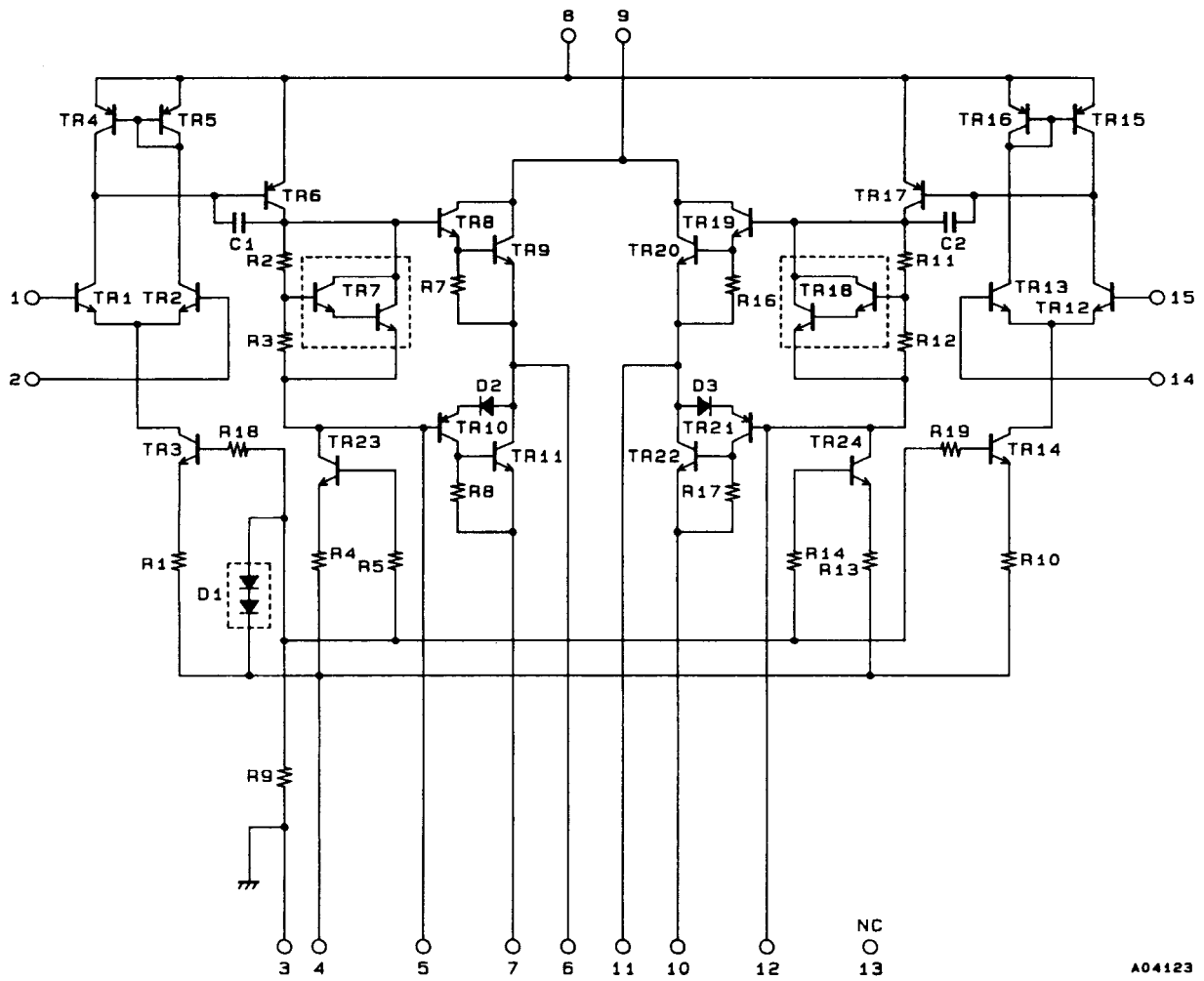
■ SANYO assumes no responsibility for equipment failures that result from using products at values that exceed, even momentarily, rated values (such as maximum ratings, operating condition ranges, or other parameters) listed in products specifications of any and all SANYO products described or contained herein.

SANYO Electric Co., Ltd. Semiconductor Company

TOKYO OFFICE Tokyo Bldg., 1-10, 1 Chome, Ueno, Taito-ku, TOKYO, 110-8534 JAPAN

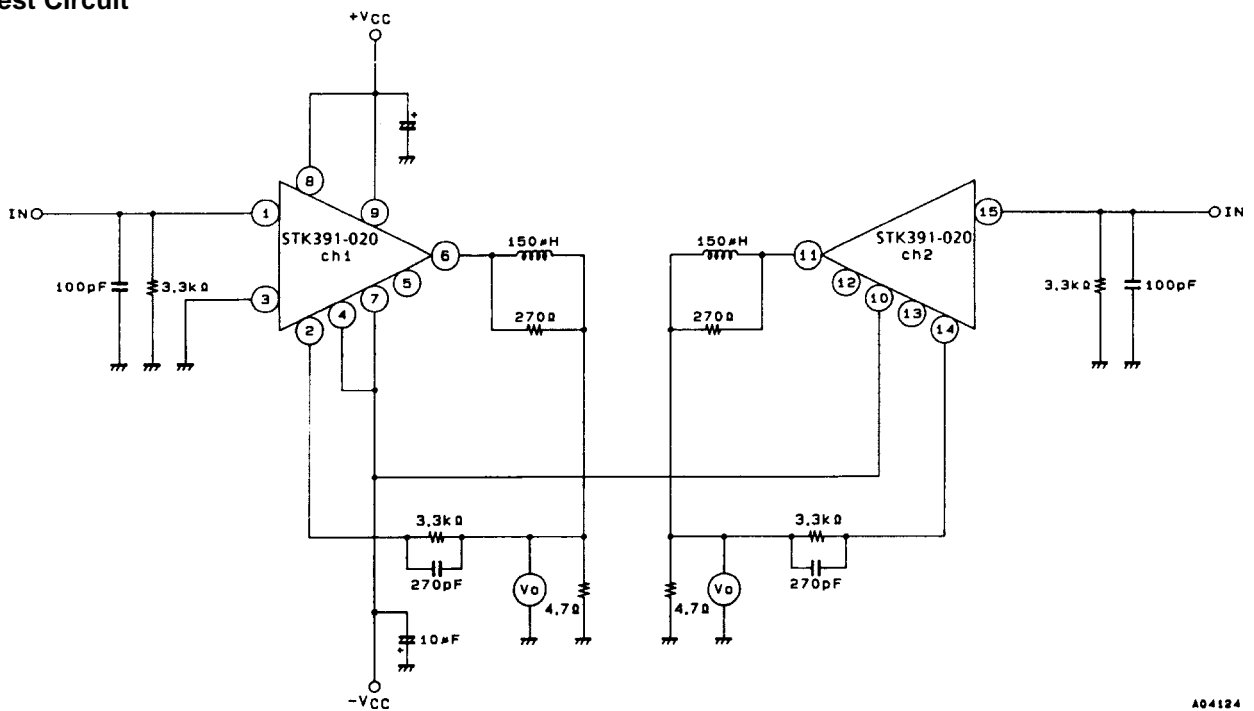
STK391-020

Equivalent Circuit



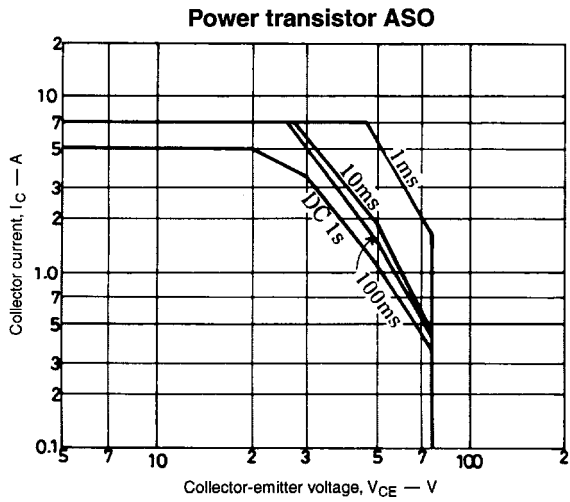
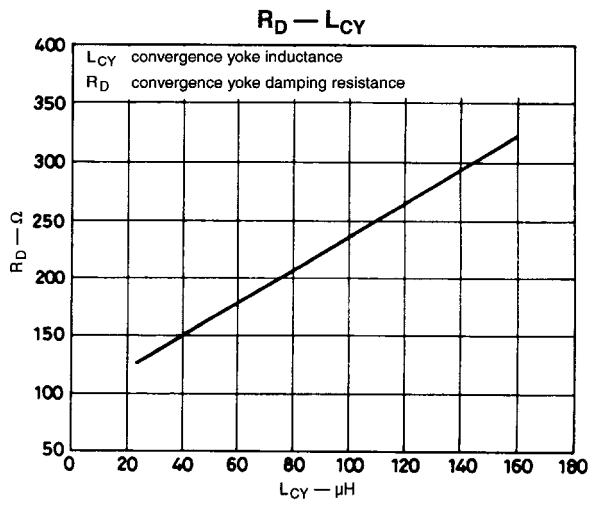
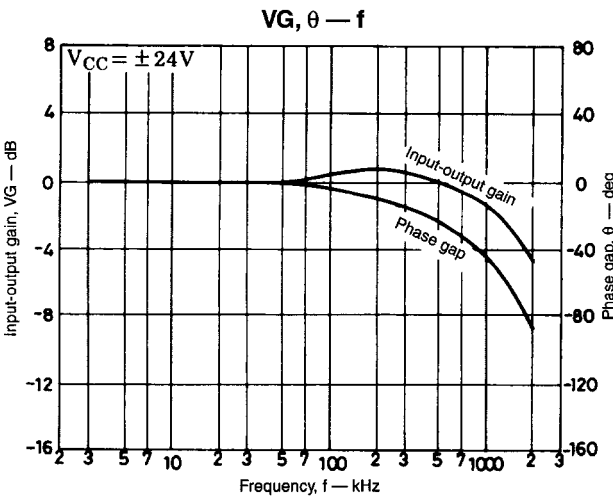
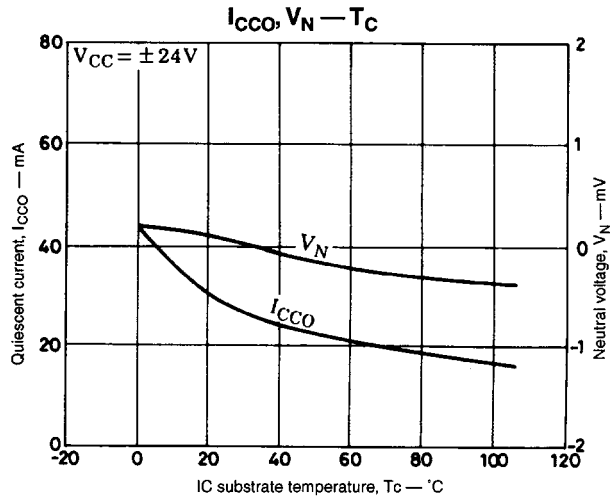
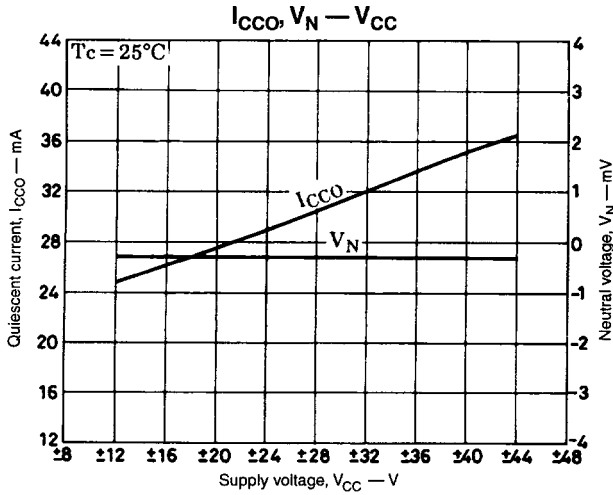
A04123

Test Circuit



A04124

Vo : V_{NO} is measured by connecting a VTVM.
 V_N is measured by connecting a DC voltmeter.
 t_D is measured by connecting an oscilloscope.



Maximum Ratings

Tj max, Tc max, θj-c

The heatsink design is determined by the maximum ratings of several key parameters—Tj max, Tc max and θj-c.

- Tj max (junction temperature)
Tj max is dependent on the physical structure of each functional element. A junction temperature exceeding this rating can lead to device deterioration and breakdown, so the design must not exceed this rating.
- Tc max (operating substrate temperature)
Tc max is dependent on the materials used within an element and on the circuit design, and should be selected on the basis of reliability. Operation exceeding this value is not guaranteed.
- θj-c (thermal resistance)
θj-c is dependent on the heatsink design, which can vary greatly. the heatsink necessary is determined by calculation using the maximum rating for Tj.

As Tj and Tc operating conditions are independent, the heatsink must be designed to satisfy the maximum ratings for both parameters.

Heatsink Design Considerations

In the expressions below Pd represents the operating IC substrate internal power dissipation and Pc represents the power dissipation per transistor. The heatsink thermal resistance, θc-a, required to dissipate the total power dissipation, Pd, is determined as follows :

Condition 1: IC substrate temperature not to exceed 105°C
 $Pd \times \theta_{c-a} + Ta < 105^\circ C$ (Tc max) (1)

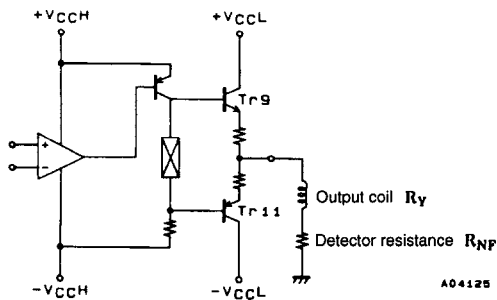
Where Ta is the guaranteed maximum ambient temperature.

Condition 2: Power transistor junction temperature, Tj, not to exceed 150°C
 $Pd \times \theta_{c-a} + Pc \times \theta_{j-c} + Ta < 150^\circ C$ (Tj max) (2)

Where θj-c is the power transistor thermal resistance per transistor. Therefore, the heatsink design must satisfy both these expression.

Design Process

A model circuit for a single channel in the STK319-020 is shown below.



The power dissipation, Pd, is the sum of channel 1, Pd1, and channel 2, Pd2, power dissipations.

$$Pd \text{ max} = Pd1 \text{ max} + Pd2 \text{ max}$$

Therefore, form equation (1),

$$\theta_{c-a} < \frac{Tc \text{ max} - Ta \text{ max}}{Pd \text{ max}} \dots\dots\dots (3)$$

the necessary heatsink resistance is determined (note that Tc max=105°C)

The power dissipation per power transistor per channel, Pc, is related to the transistor junction temperature by the following equation.

$$Tj = Pd \text{ max} \times \theta_{c-a} + Ta + Pc \times \theta_{j-c} \dots\dots\dots (4)$$

where Tj cannot exceed Tj max=105°C. Therefore, in order to maintain Tj below 150°C, a lower heatsink thermal resistance, θc-a, is necessary to lower Tc.

Heatsink Design Example

This example assumes the following worst-case conditions—Vcch=±35V, Vccl=±25V, output coil LY=80µH and Ry=0Ω, current detector resistance RNF=4.7Ω, Ip-o max=0.6Ap-o (Ip-o (Ip-p=1.2A) sawtooth wave input, Io (DC) max=0.6A DC input, both channels operating, Ta max=60°C (guaranteed maximum).

The channel1 power dissipation, Pd1, is given from Figures 1 and 2.

- Pd1 max=7.0W (AC) with sawtooth wave input
 - Pd1 max=13.2W (DC) with DC input
- As Pd1 max (AC) < Pd1 max (DC), the power dissipation is greater with DC input. Also, looking at the output transistor dissipation, Pc,
- Pc=0.5Pd1 with sawtooth wave input
 - Pc=Pd1 with DC input (one side transistor continuously ON)

the power dissipation is also higher with DC input. Accordingly, the heatsink design example below assumes DC input. The power dissipation in the predriver stage is ignored.

As Pd1 max=Pd2 max+13.2W, Pd max (both channels) is given by.

$$Pd \text{ max} = Pd1 \text{ max} + Pd2 \text{ max} = 26.4W$$

From equation (3) with Ta=60°C,

$$\theta_{c-a} = \frac{Tc \text{ max} - Ta}{Pd \text{ max}} = \frac{105 - 60}{26.4} = \dots\dots\dots 1.70^\circ C/W$$

For a 2mm aluminum heatsink with no surface coating, the necessary surface area, S, is given from Figure 3.

$$S = 780cm^2 (28cm \times 28cm)$$

Also from equation (4), the output stage power transistor junction temperature is given by

$$\begin{aligned}
 T_j &= P_{d \max} \times \theta_{c-a} + T_a + P_{c \max} \times \theta_{j-c} \\
 &= 26.4 \times 1.7 + 60 + 13.2 \times 2.7 \\
 &= 140.5^\circ\text{C}
 \end{aligned}$$

which provides a 9.5°C derating below $T_{j \max} = 150^\circ\text{C}$. However, an allowance for the predriver stage power dissipation (transistors, resistors, etc.) should also be included in the substrate internal power dissipation, P_d .

Figure 1. $P_d - I_{p-o}$

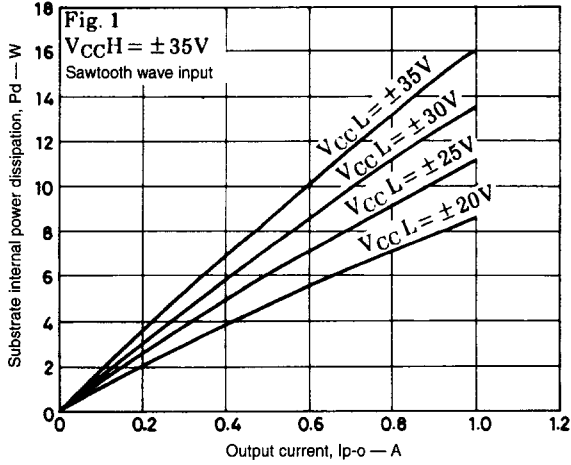


Figure 2. $P_d - I_o$

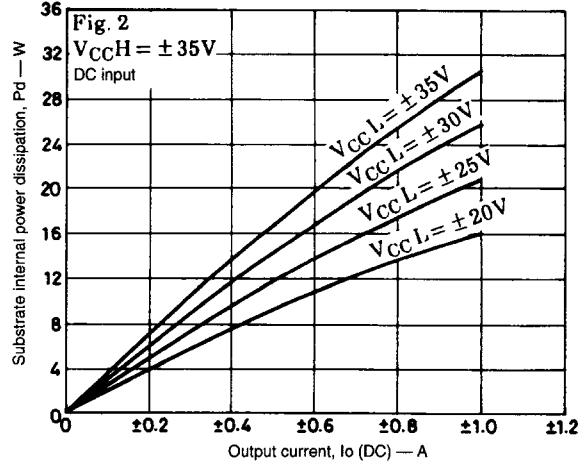
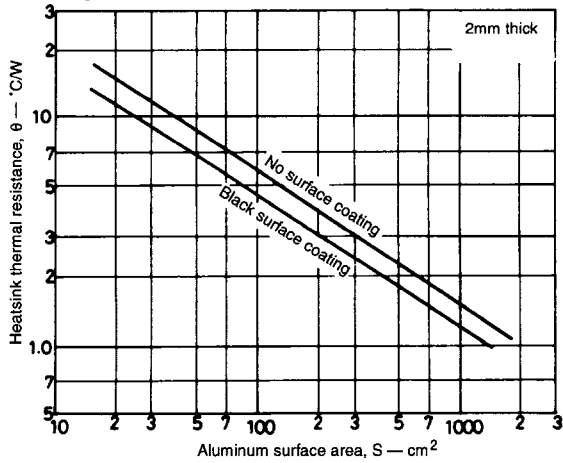


Figure 3. Al heatsink thermal resistance



- Specifications of any and all SANYO products described or contained herein stipulate the performance, characteristics, and functions of the described products in the independent state, and are not guarantees of the performance, characteristics, and functions of the described products as mounted in the customer's products or equipment. To verify symptoms and states that cannot be evaluated in an independent device, the customer should always evaluate and test devices mounted in the customer's products or equipment.
- SANYO Electric Co., Ltd. strives to supply high-quality high-reliability products. However, any and all semiconductor products fail with some probability. It is possible that these probabilistic failures could give rise to accidents or events that could endanger human lives, that could give rise to smoke or fire, or that could cause damage to other property. When designing equipment, adopt safety measures so that these kinds of accidents or events cannot occur. Such measures include but are not limited to protective circuits and error prevention circuits for safe design, redundant design, and structural design.
- In the event that any or all SANYO products(including technical data, services) described or contained herein are controlled under any of applicable local export control laws and regulations, such products must not be exported without obtaining the export license from the authorities concerned in accordance with the above law.
- No part of this publication may be reproduced or transmitted in any form or by any means, electronic or mechanical, including photocopying and recording, or any information storage or retrieval system, or otherwise, without the prior written permission of SANYO Electric Co., Ltd.
- Any and all information described or contained herein are subject to change without notice due to product/technology improvement, etc. When designing equipment, refer to the "Delivery Specification" for the SANYO product that you intend to use.
- 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.

This catalog provides information as of September, 1999. Specifications and information herein are subject to change without notice.