



STK750-010

Chopper Regulator using MOS FET with Multi-Scan Support (1 A Output Current)

Overview

These days, the variety of horizontal frequencies output from personal computers (PCs) include 15 kHz, 24 kHz, 31 kHz and even 33 kHz. These differences are dependent on the device and maker, and the market itself contains many PCs and a wide array of frequencies; in other word, the need to remain compatible is stronger then ever. As the number of video signal formats created with new-media devices becomes more diversified, the search for circuit technology capable of supporting such a wide range of scanning frequencies (multiscan support) becomes even harder.

The STK750-010 is a chopper regulator using MOS FET with multi-scan support. This IC is also designed for output voltage variable control supporting a wide range of horizontal frequencies. For these reasons, the STK750-010 helps reduce streamlined power supply designs, shorten overall development time, and reduce total costs while providing high-precision CRT display performance with the highest quality.

Applications

- Multi-scan supporting CRT displays (secondary voltage variable regulator)

Features

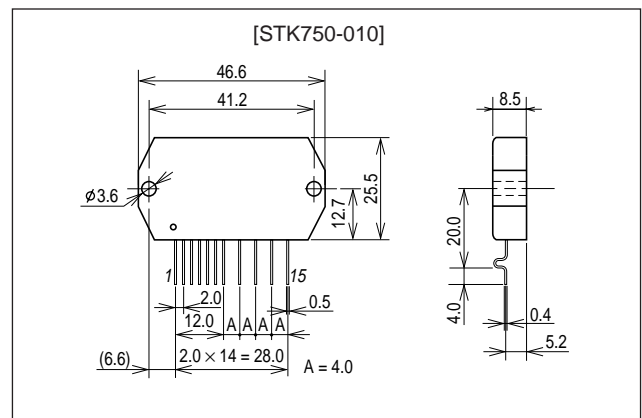
- High efficiency (97%) provided by power MOS FET. Compared with bi-polar chopper regulators used until now, power dissipation is less than half while supporting compact heat sink and lighter weight design.

- Multi-scan support (output voltage variability). Supports horizontal frequency external control.
- Wider output voltage control range (50 to 130 V), compared with dropper type ICs used until now. The resonance condenser changeover circuit and the vertical dummy coil changeover circuit of horizontal deflection coil are eliminated within the horizontal autoscanning circuit.
- IC operating frequency supports horizontal frequency synchronization.
- Standard chopper type eliminates need for complicated transformers and supports choke coil applications.

Package Dimensions

unit: mm

4136



■ 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

Specifications

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

| Parameter | Symbol | Conditions | Ratings | Unit |
|---------------------------------|---------------------|------------|-------------|---------------------------|
| Maximum DC input voltage | V_{in} (DC) max | | 190 | V |
| Maximum output current | I_o max | | 1 | A |
| Thermal resistance | $\theta_j\text{-c}$ | | 2.5 | $^\circ\text{C}/\text{W}$ |
| Junction temperature | T_j max | | 150 | $^\circ\text{C}$ |
| Operating substrate temperature | T_c max | | 105 | $^\circ\text{C}$ |
| Storage temperature | T_{stg} | | -30 to +105 | $^\circ\text{C}$ |

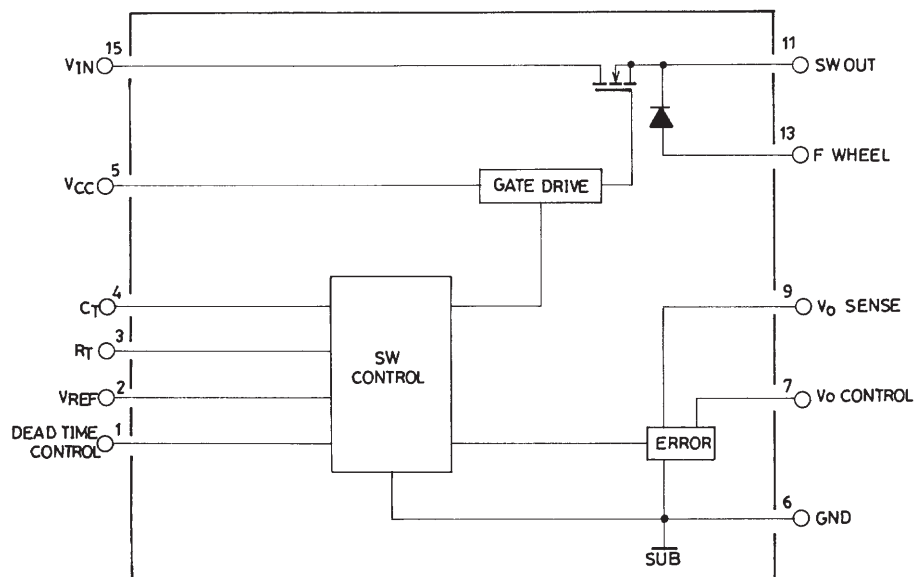
Recommended Operating Conditions at $T_a = 25^\circ\text{C}$

| Parameter | Symbol | Conditions | Ratings | Unit |
|-------------------------------|-----------|------------|--------------------|-----------|
| V_{IN} voltage | V_{in} | | 165 to 175 | V |
| V_{CC} voltage | V_{CC} | | 11 to 13 | V |
| Error amplifier input voltage | V_{amp} | 7 pin | -0.3 to $V_{CC}-2$ | V |
| Timing condenser | G_T | 4 pin | 0.47 to 10000 | nF |
| Timing resistor | R_T | 3 pin | 1.8 to 500 | $k\Omega$ |
| Oscillation frequency | f_{osc} | | 20 to 100 | kHz |
| Maximum duty | D max | | 90 | % |

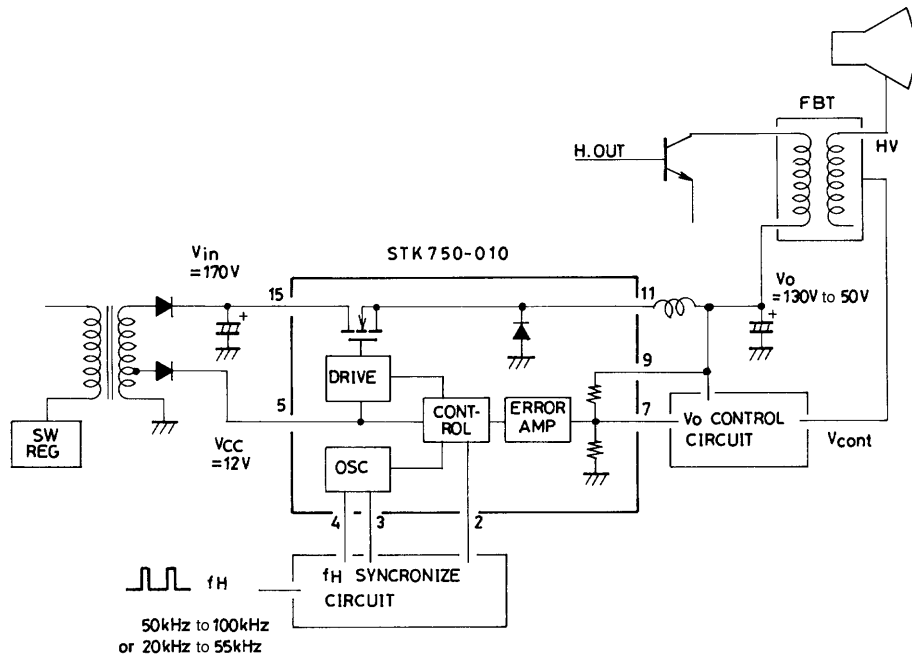
Operating Characteristics at $T_a = 25^\circ\text{C}$, see specified Test Circuit, $f = 50\text{kHz}$

| Parameter | Symbol | Conditions | Ratings | | | Unit |
|--|-----------|--|---------|---------------|------|----------------------------|
| | | | min | typ | max | |
| Output voltage | V_o | V_{in} (DC) = 170V, $I_o = 0.5\text{A}$ | | 130 ± 1.5 | | V |
| Input regulation | Reg-IN | V_{in} (DC) = 160 to 180V, $I_o = 0.5\text{A}$ | | | 0.05 | V/V |
| Load regulation | Reg-L | V_{in} (DC) = 170V, $I_o = 0.2$ to 1A | | | 0.5 | V/A |
| Efficiency | η | V_{in} (DC) = 170V, $I_o = 0.5\text{A}$ | | 97 | | % |
| Output voltage temperature coefficient | T_{CVO} | V_{in} (DC) = 170V, $I_o = 0.5\text{A}$ | | 17 | | $\text{mV}/^\circ\text{C}$ |

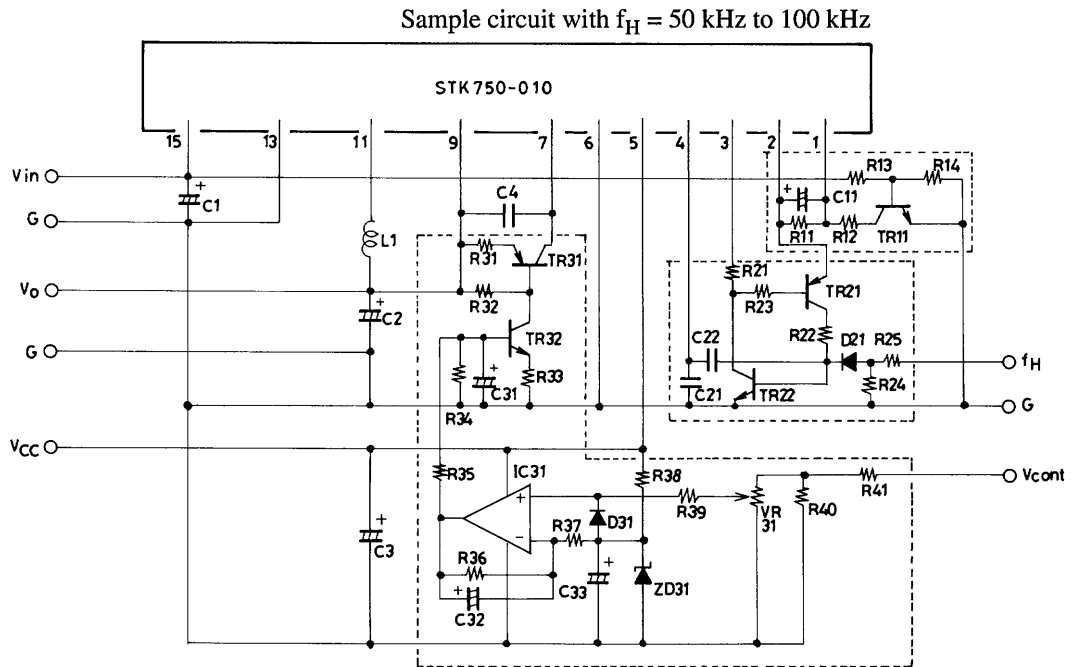
Block Diagram



Application Circuit Block Diagram



Test Circuit



| | | | | | | | |
|-----|--------------------------|------|---------------|------|----------|----|-------|
| C1 | 220 μ F / 200V | R11 | 130K Ω | TR11 | 2SC2274F | L1 | 4.8mH |
| C2 | 220 μ F / 200V | R12 | 8.2k Ω | TR21 | 2SA984F | | |
| C3 | 10 μ F / 25V | R13 | 470k Ω | TR22 | 2SC2274F | | |
| C4 | 0.047 μ F / 250V | R14 | 10k Ω | TR31 | 2SA1209S | | |
| C11 | 22 μ F / 25V | R21 | 2.0k Ω | TR32 | 2SC2911S | | |
| C21 | 2200pF | R22 | 47k Ω | | | | |
| C22 | 4700pF | R23 | 30k Ω | | | | |
| C31 | 22 μ F / 25V | R24 | 1k Ω | IC31 | LA6358 | | |
| C32 | 10 μ F / 50V (N. P.) | R25 | 100k Ω | | | | |
| C33 | 10 μ F / 25V | R31 | 56k Ω | | | | |
| | | R32 | 100k Ω | D21 | GMA01 | | |
| | | R33 | 3.9k Ω | D31 | GMA01 | | |
| | | R34 | 10k Ω | | | | |
| | | R35 | 1k Ω | | | | |
| | | R36 | 100k Ω | ZD31 | GZA5.6X | | |
| | | R37 | 4.7k Ω | | | | |
| | | R38 | 4.7k Ω | | | | |
| | | R39 | 100 Ω | | | | |
| | | R40 | 330k Ω | | | | |
| | | R41 | 10k Ω | | | | |
| | | VR31 | 500k Ω | | | | |

Description of Circuit Operations

1. Reference Voltage Circuit (REF REG.)

Reference voltage outputs at 5 V with built-in oscillator and protection circuits.

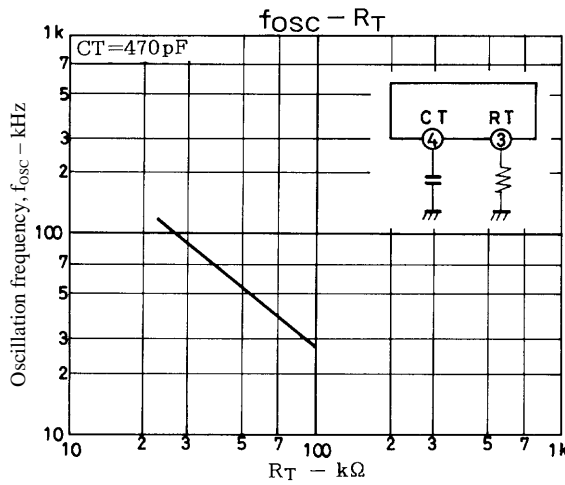
2. Oscillator (OSC)

When C and R are externally connected, self-oscillation of saw-tooth-wave forms begins. Charge current flows from the CT pin (pin 4) to the condenser and when the CT pin reaches approximately 3 V, the discharge transistor switches on and CT pin voltage drops to zero and one cycle ends. Charge current is determined by the current flowing to the external resistor connected to the RT pin (pin 3).

Oscillation frequency is determined approximately according to the following equation:

$$f = \frac{1.2}{C_T \cdot R_T} \text{ [kHz]}$$

$C_T : \mu\text{F}$
 $R_T : \text{k}\Omega$



3. Error Amplifier

Because the power supply error amplifier is supplied directly from V_{CC} , the common mode input voltage range is between -0.3 V and $V_{CC} - 2 \text{ V}$. Figure 1 illustrates the equivalent circuit.

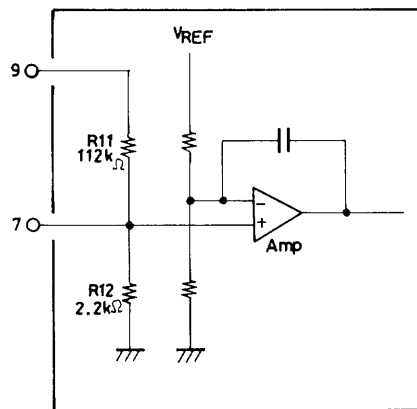


Figure 1

When output voltage is set to V_o , approximations are determined using the following equation:

$$V_o = V_{REF} \times \frac{R_{11} + R_{12}}{R_{12}} \quad V_{REF} = 2.5\text{V}$$

Supported Functions

1. Oscillation Circuit

When all devices are synchronized to the clock cycle, a circuit diagram similar to that shown in figure 2 can be synchronized.

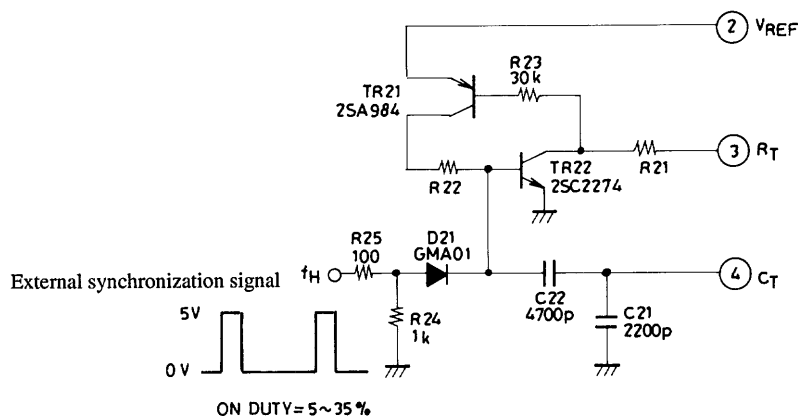


Figure 2

Unit (resistance: Ω, capacitance: F)

| Item | R21 | R22 | f _{OSC} | External Synchronization Support Range f _H |
|------|------|------|------------------|---|
| EX1 | 2.4k | 39k | 45kHz | 48k to 100kHz |
| EX2 | 3.3k | 47k | 37kHz | 39k to 81kHz |
| EX3 | 4.3k | 68k | 28kHz | 29k to 65kHz |
| EX4 | 5.1k | 120k | 18kHz | 19k to 56kHz |

2. Dead-time Adjustment Circuit (DT Pin)

Soft Start Circuit

R11 and R12 are dead-time setting resistors and vary DC input voltage. By modifying the slice level of the sawtooth wave, output maximum duty (on time) can be set. Maximum duty value should be set for approximately 90%.

If IC output pulse is operated at maximum duty when the power is turned on, a rush current flows to the output transistor. Therefore, the duty cycle should be slowly increased from 0 (this is generally referred to as a “soft start”). As shown in figure 3, configuration with the addition of a decay time constant circuit is possible using a condenser connected to the dead-time control pin (1 pin).

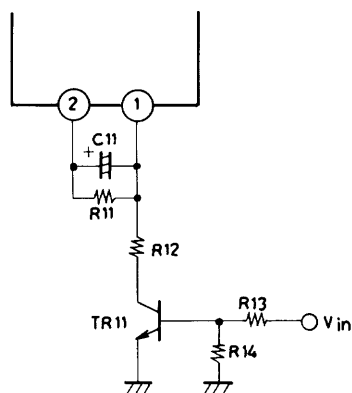
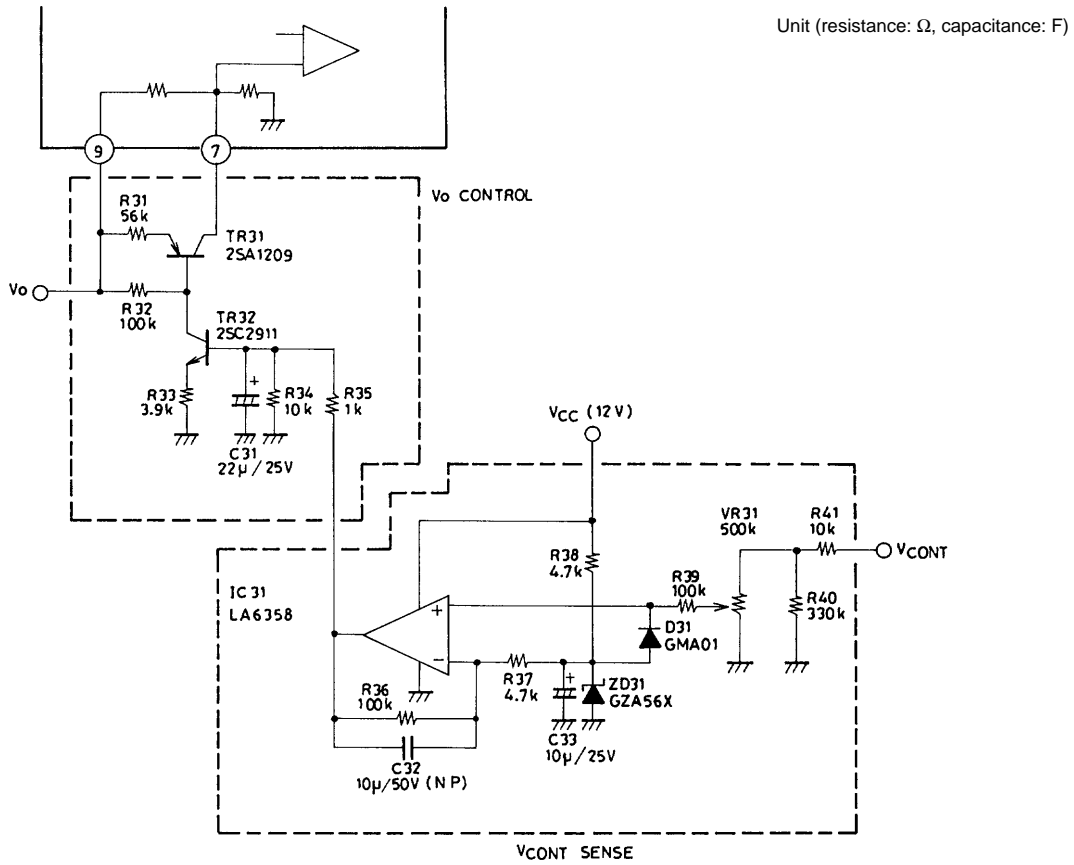


Figure 3

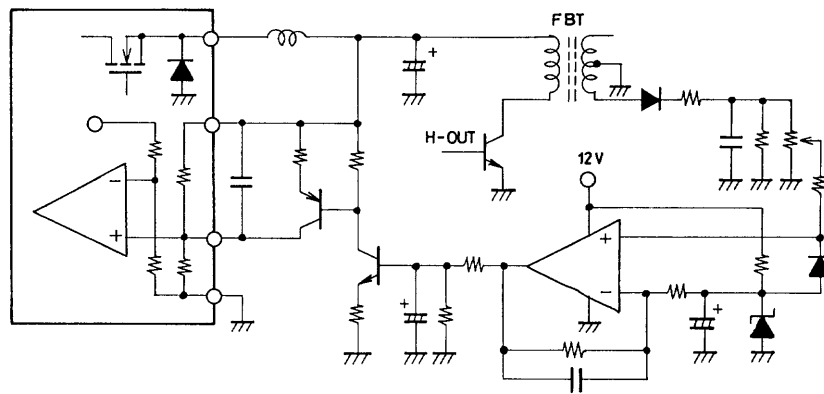
3. Output Voltage Vo Control Circuit

By supporting control voltage changes externally, output voltage Vo can be modified.

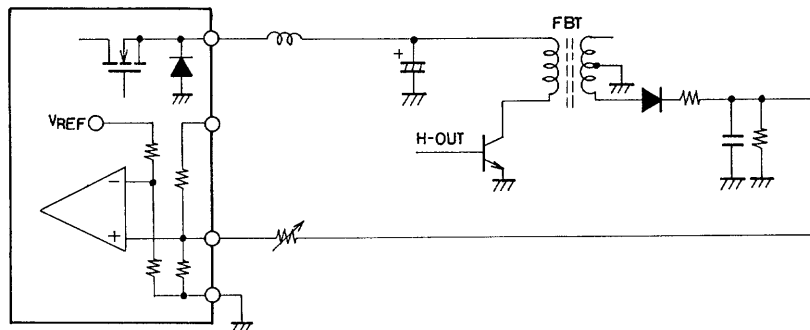


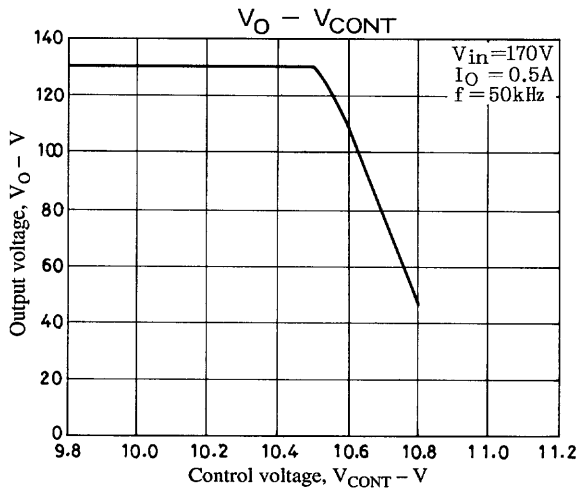
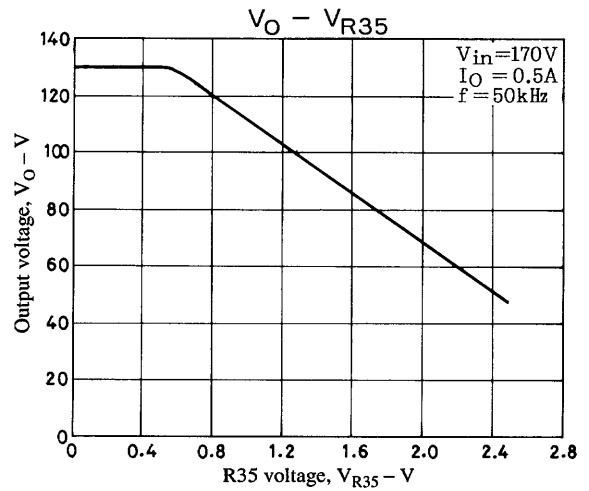
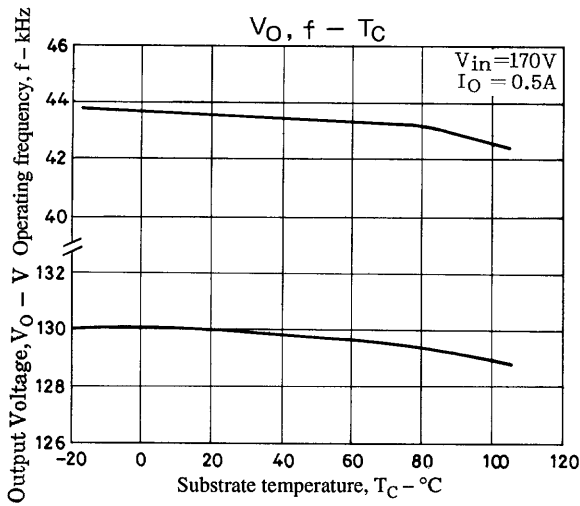
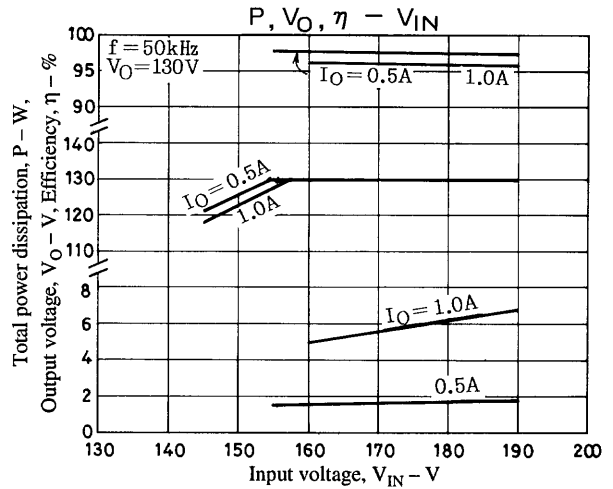
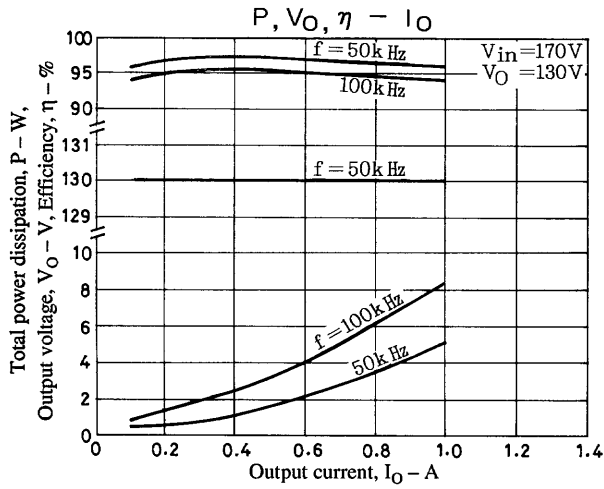
4. Support for Multi-Scan Applications

①



②





- 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.