
PRODUCT INFORMATION

Vol.92

Ultralow-Loss Inverter Power IC Developed

Incorporates the industry's first static induction transistor (SIT).

STK651-500

Overview

Inverter-based motor control systems were developed to provide end products with more pleasant operating characteristics and to contribute to increased energy savings. With the recent concern for the environmental problem of global warming and the introduction of Japan's legally mandated "Top Runner" system for benchmarking home appliances for energy efficiency, there are now demands for ever further energy savings and for the development of more efficient inverter control techniques. As a result there are now increasing efforts not only to improve the motors used in these products, but also to improve the inverter power circuits used for motor drive and their associated control techniques.

Sanyo has now developed a new ultralow-loss inverter power IC, the STK651-500, to respond to these needs. The STK651-500 is the industry's first inverter IC that uses the static induction transistor (SIT) in the output stage of the inverter power circuit. Sanyo has planned creating a full series of ultralow-loss inverter ICs as the STK651-000 Series, and has developed the STK651-500 as the first product in that series.

Previously, either a bipolar transistor, an IGBT (insulated gate bipolar transistor), or a MOSFET was used in the output stage of inverter circuits, depending on the application. The SIT device adopted in the output stage of these products features a lower on resistance and lower switching loss than these earlier devices. While this device is superlative from the standpoint of saving energy, its use in inverter control circuits presents several problems, such as its requirements on the circuit wiring and the generation of overvoltages and electromagnetic interference (EMI) due to its high-speed current-drive operation.

The STK651-000 Series adopts Sanyo's unique IMST™ (insulated metal substrate technology) to hold the wiring inductance to an absolute minimum. This allows SIT devices to be used in the output stage of the inverter power circuit and thus reduce loss to one-half that of earlier Sanyo products. Thus the STK651-000 Series can achieve even further energy savings in end products. The circuit structure is that of a hybrid IC that integrates six SIT devices, pre-drive circuits for optimal SIT drive, and a full complement of protection circuits in a single package. This structure is optimal for driving the three-phase compressor motors used in air conditioners as well as most general-purpose three-phase motors.

The STK651-000 Series products include the following integrated protection circuits.

PRODUCT INFORMATION

- Thermal protection circuit: Detects the substrate temperature with a temperature sensor and protects against abnormal temperatures.
- Overcurrent protection circuit: Detects the current with a shunt resistor provided in the bus line and protects against abnormally large currents.
- Excessive saturation voltage protection circuit: Detects the saturation voltage $V_{ds(sat)}$ for each of the six SIT devices and protects against regenerative overcurrents and shorting to ground.

The STK651-500 has a rated output current (I_o) of 20 A, and is pin compatible with Sanyo's earlier STK650-000 Series, which includes products with output stage bipolar transistors with ratings of 15, 20, 25, and 30 A. This allows easy standardization according to the designs of the end products in the product line.

Sanyo plans on expanding the STK651-000 Series so that it can serve as the next generation of inverter power ICs to provide even further energy savings in inverter control systems.

Features

Features Common to the STK651-000 Series

- Static induction transistor (SIT) devices adopted for the inverter power output stage.
- Built-in high-performance high-speed pre-drive circuits optimally designed for drive of the six SIT circuits.
- Thermal, overcurrent (bus line), and excessive saturation voltage protection circuits.
- These optimally designed IMST (insulated metal substrate technology) power ICs make it easier to design end products and support end product miniaturization.
- The use of photocouplers allows control signals to be handled at logic levels.
- Versions are available in packages that support either connectors or printed circuit board mounting for the signal lines. (The STK651-500 is provided in a connector package.)
- Snap-on connector power pins for easy connection to the load (motor)
- The STK651-000 Series can be used in applications that used Sanyo's earlier STK650-000 Series (bipolar transistor output stage products) for easy standardization of end product design.

Specifications

STK651-500

- Rated supply voltage (V_{CC}): 450 V
- Rated output current (I_o): 20 A
- Control system supply voltage: 5.5 V to 8.0 V

PRODUCT INFORMATION

- Operating temperature: -30°C to $+100^{\circ}\text{C}$
- Package dimensions: $87 \times 57.5 \times 11$ mm (L×W×T)

Applications

- Three-phase compressor motor drive
- General-purpose three-phase motor drive

Sample Availability

The STK651-500 will be available in sample quantities by mid-October 1999 and in production quantities in February 2000.

OCTOBER 7, 1999

PRODUCT INFORMATION

- 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.
- 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.