HB-HVI-5N002

Power Semiconductor Half-Bridge Module™
Data Sheet (Rev 0 - 02/06/09)

Application: IUT HV Resonant Stage

Description

This module contains 2 Solidtron (CCS) Size 12 SGTOs and 10 Si Diodes (D2PAK), packaged for use in a resonant converter or similar applications. This module provides connections for AC output and positive and negative DC bus connections. The module includes an electrically isolated base-plate. The module is typically used at 20kHz.

The current controlled Solidtron (CCS) SGTO is an n-type Thyristor in a high performance ThinPakTM package. The device gate is similar to that found on a traditional GTO Thyristor. The CCS features the high peak current capability and low On-state voltage drop common to SCR thyristors combined with high dI/dt capability.

The ThinPakTM Package is a perforated, metalized ceramic substrate attached to the silicon using 302oC solder. It's small size and low profile make it extremely attractive for high di/dt applications where stray series inductance must be kept to a minimum.

Features

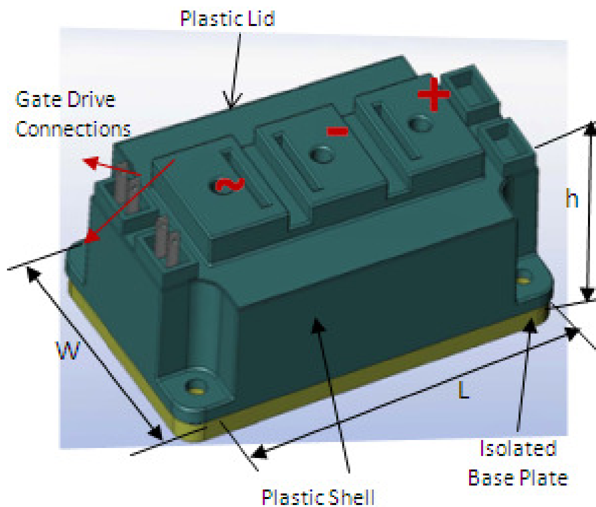
- Low On-State Voltage
- Low trigger current
- Low Inductance Package

Application Specific Operating Conditions

For Each Device(SGTO+5 Si Diodes):

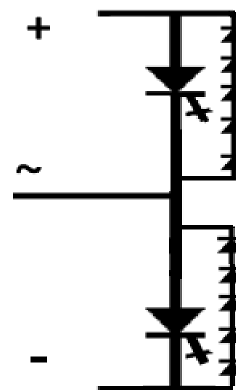
- Frequency = 10 kHz
- Voltage (rms) = 2.4 kV
- Voltage (peak) = 3.9kV
- Current (rms) = 14.6 Amps
- Current (peak) = 53.6 Amps

Package



Size:	W	L	h	
	2.48 in	4.25 in	1.21 in	203 gms

Schematic Symbol



This **SILICON POWER** product is protected by one or more of the following U.S. Patents:

5,521,436	5,446,316	5,105,536	5,209,390	4,958,211	5,206,186	4,857,983	5,082,795	4,644,637
5,585,310	5,557,656	5,777,346	5,139,972	5,111,268	5,757,036	4,888,627	4,980,741	4,374,389
5,248,901	5,564,226	5,446,316	5,103,290	5,260,590	5,777,346	4,912,541	4,941,026	4,750,666
5,366,932	5,517,058	5,577,656	5,028,987	5,350,935	5,995,349	5,424,563	4,927,772	4,429,011
5,497,013	4,814,283	5,473,193	5,304,847	5,640,300	4,801,985	5,399,892	4,739,387	5,293,070
5,532,635	5,135,890	5,166,773	5,569,957	5,184,206	4,476,671	5,468,668	4,648,174	

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SGTO Module

Performance Ratings (TJ=25oC unless otherwise specified)

Parameters	Symbol	Min.	Typ.	Max.	Units	Test Conditions	
Peak Off-State Forward Voltage(+/- or ~)	V_{DRM}			5	kV		
Off-State rate of Change of Voltage Immunity	dv/dt			>1	kV/us		
Anode-Cathode Off-State Forward Leakage Current	I_D		50	100	uA	V_{GK}=0V, V_{AK}=10kV	T_J=25°C
			100	800	uA	Note: 3 & 4	T_J=125°C
Peak Gate Current (1 uS)	IGpk			100	A		
Gate Threshold Voltage	V_{GTH}			0.7	V		
Gate Breakdown Voltage	V_B	10	12	TBD	V		
Turn-On Gate Threshold Voltage	$V_{GK(TH)}$		5		V		
Continuous Anode Current at Tj = 125 °C	I_{A110}			100	A		
Peak Anode Current (150 uSec)	$I_{P\ at\ 150\mu s}$	5			KA		
Peak Anode Current (1mSec)	$I_{P\ at\ 1ms}$	3			kA	R_{gk} = 10 ohms	V_{AK} = 1500 V
Pk Rate of Change of Current (measured)	dI/dt			30	kA/us	Gate di/dt =100 A/us	T_c=25°C
Turn-on Delay Time	$t_{D(ON)}$	100		250	ns	Ls=8.2nH	
Turn-off Delay Time	$t_{D(OFF)}$	100		250	ns	C=0.15 uF Capacitor discharge	
Anode-Cathode On-State Voltage	V_T	1		1.8	V	I_T=50A	T_J=25°C
					V	Ig = 500 mA	T_J=125°C
Peak Reverse Voltage	V_{RRM}			-10	V		
Max. Reverse Gate-Cathode Voltage	V_{GR}			-9	V		
Gate-Cathode Leakage Current	$I_{GK(lkg)}$			20	uA	V_{GK}=-9V, see Note: 1	
Max. Junction Temperature	T_{JM}			140	°C		
Thermal Resistance	R_{JC}			0.04	°C/W		

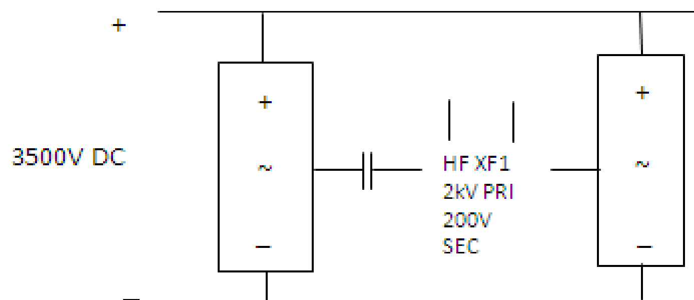
Notes:

1.) 10 Ohm shorting resistor connected between the gate and cathode.

2.) Case Exterior Assummed to be 0.002" of 63Sn/37Pb solder applied directly to cathode bond area of ThinPak.

3.) Characterization accomplished using Rgk=10 ohms.

Application Note: IUT Series Resonant Inverter Stage



Diode Cond. loss	0.3 W
Diode Switching loss	0.2 W
Device Conduction loss	5.9 W
Device Switching loss	108 W
Module loss	229 W

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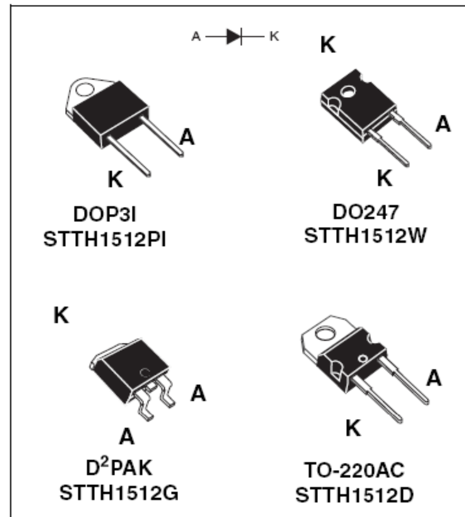
STTH1512 (5 Diodes in Series)
http://www.st.com/stonline/books/pdf/docs/12157.pdf

STTH1512

Ultrafast recovery - 1200 V diode

Main product characteristics

$I_{F(AV)}$	15 A
V_{RRM}	1200 V
T_j	175° C
V_F (typ)	1.20 V
t_{rr} (typ)	53 ns



Features and benefits

- Ultrafast, soft recovery
- Very low conduction and switching losses
- High frequency and/or high pulsed current operation
- High reverse voltage capability
- High junction temperature
- Insulated packages: DOP3I
  Electrical insulation = 2500 V_{RMS}
  Capacitance = 12 pF

Characteristics

Table 1. Absolute ratings (limiting values at 25° C, unless otherwise specified)

Symbol	Parameter			Value	Unit
V_{RRM}	Repetitive peak reverse voltage			1200	V
$I_{F(RMS)}$	RMS forward current	TO-220AC / DO247 / DOP3I / D²PAK		50	A
$I_{F(AV)}$	Average forward current, δ = 0.5	TO-220AC / D²PAK / DO247	T_c = 130° C	15	A
		DOP3I	T_c = 105° C		
I_{FRM}	Repetitive peak forward current	t_p = 5 µs, F = 5 kHz square		200	A
I_{FSM}	Surge non repetitive forward current	t_p = 10 ms Sinusoidal		150	A
T_{stg}	Storage temperature range			-65 to + 175	°C
T_j	Maximum operating junction temperature			175	°C

Table 2. Thermal parameters

Symbol	Parameter		Value	Unit
$R_{th(j-c)}$	Junction to case	TO-220AC / D²PAK / DO247	1.3	°C/W
		DOP3I	2	°C/W

Table 3. Static electrical characteristics

Symbol	Parameter	Test conditions		Min.	Typ	Max.	Unit
I_R (1)	Reverse leakage current	$T_j = 25° C$	$V_R = V_{RRM}$			15	µA
		$T_j = 125° C$			10	100	
V_F (2)	Forward voltage drop	$T_j = 25° C$	$I_F = 15$ A			2.10	V
		$T_j = 125° C$			1.25	1.90	
		$T_j = 150° C$			1.20	1.80	

1. Pulse test: $t_p = 5$ ms, $\delta < 2$ %
2. Pulse test: $t_p = 380$ µs, $\delta < 2$ %

To evaluate the conduction losses use the following equation:
$P = 1.4 \times I_{F(AV)} + 0.027\ I_F^2{}_{(RMS)}$

Table 4. Dynamic characteristics

Symbol	Parameter	Test conditions	Min.	Typ	Max.	Unit
t_{rr}	Reverse recovery time	$I_F = 1$ A, $dI_F/dt = -50$ A/µs, $V_R = 30$ V, $T_j = 25° C$			105	ns
		$I_F = 1$ A, $dI_F/dt = -100$ A/µs, $V_R = 30$ V, $T_j = 25° C$		53	75	
I_{RM}	Reverse recovery current	$I_F = 15$ A, $dI_F/dt = -200$ A/µs, $V_R = 600$ V, $T_j = 125° C$		20	28	A
S	Softness factor	$I_F = 15$ A, $dI_F/dt = -200$ A/µs, $V_R = 600$ V, $T_j = 125° C$		1.5		
t_{fr}	Forward recovery time	$I_F = 15$ A $dI_F/dt = 50$ A/µs $V_{FR} = 1.5 \times V_{Fmax}$, $T_j = 25° C$			600	ns
V_{FP}	Forward recovery voltage	$I_F = 15$ A, $dI_F/dt = 50$ A/µs, $T_j = 25° C$		5.5		V

Revision History

Rev	Date	EA #	Nature of Change
0	02/06/2009	04242009-NB-0021	Initial Issue

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