DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 0049- (0)8243-9693-0
Fax: 0049- (0)8243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30A(automotive) & HVxHHS-30I(industrial)

IGBT DRIVER MODULES

HARD TURN ON / ***PROFILED TURN OFF

2 STEP TURN OFF SWITCHING

NEW since date code 1115, which is week 15/2011
much lower pick up/ start up current 0,8A peak instead of 1,8A peak as before
Therefore a less powerful pre-converter for the 15V supply requested

IGBT Driver Module Application Note

for a selectable time HARD TURN OFF until Supply Voltage Level has been reached
after set time is elapsed driver turns to SOFT TURN OFF

FEATURES

- Application NPT-SPT & Trench IGBT's 1200 to 6500V
- Profiled Turn Off each cycle; Hard ON / Hard-SOFT OFF
- Very limited-controlled Vce voltage overshoots
- works reliable without active clamp from low power level to highest power switching with controlled Vce max overshoots
- Suitable for Existing Interface Cards
- Protects IGBT from Short Circuit Failure I &II
- High Reliability
- Gate Current to +30A/-30A profiled
- Electrical Isolation min. 10kV AC rms
- Partial Discharge Free From 2300 to 6000V AC rms
- Supply Voltage Monitoring, UVLO
- Switching Frequency DC to >100kHz
- Limitation Input Current 900mA at 15V IN
- Duty Cycle 0 to 100%
- Built-in Isolated DC/DC Power Supply starts at Uin >9V and draws approx. 0,8A peak at start up

APPLICATIONS

- Industrial Drives
- Multi Level Converters
- Railway Traction Drives and Auxilliaries
- Power Supplies
- Wind Turbines

This application note features an IGBT Driver Solution designed and manufactured by Floeth Electronic is a compact single channel intelligent gate drive module which in combination with the appropriate interface board can be used to drive high power IGBT modules from major manufacturers. The module incorporates a DC/DC power supply and features functional options selectable via jumpers on the Interface Card.

Complete driver solutions consisting of these modules mounted on suitable Interface-CORE cards are available. please contact us tech-support@floeth--electronic.de

The information presented herein is provided in good faith but it is the users responsibility to determine the performance suitability of this drive solution in any actual application

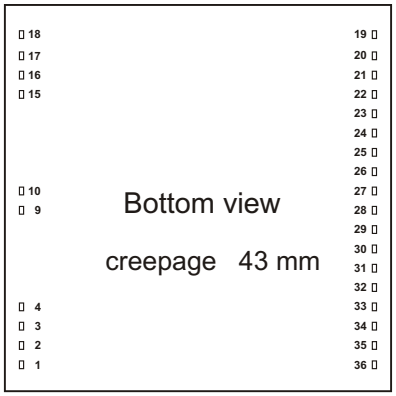
* 15W; 20W upon request

** measured with Rg ON/OFF = 1Ω info 470nF polypropelene cap.

KEY PARAMETERS

	Drive Voltage	**±15V**
*	**Drive Power**	**±6W total 12W**
**	**Gate Drive Current**	**+30A/-30A profiled**
	Logic supply	**5V**
	Ref. Voltage	**30V**

peak Start-up current@15V /0,8 A



(see package details for further information)

Fig. 1 Electrical connections - (not to scale)

ORDERING INFORMATION

Order As: **Industrial Version**

HV2 HHS - 30I
2300V AC rms partial discharge free

HV4 HHS - 30I
4000V AC rms partial discharge free

HV5 HHS - 30I
5000V AC rms partial discharge free

Hv6 HHS - 30I
6000V AC rms partial discharge free

Note: When ordering, please use the complete part number.

Can be delivered with greater creepage upon demand.

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

ABSOLUTE MAXIMUM RATINGS

Stresses above those listed under ´Absolute Maximum Ratings` may cause permanent damage to the device. In extreme conditions, as with all semiconductors, this may include potentially hazardous rupture of the package.Appropriate safety precautions should always be followed. Exposure to Absolute Maximum Ratings may affect device reliabillity.

T_{case} = +25°C unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Max.	Units
V_{DC}	Supply voltage	V_{DC} to GND	0	16	V
I_{OUT}	Gate peak output current	-	-	≤30	A
V_{logic}	Internal logic supply - linear regulated	-	-	5	V
I_{DC}	Average supply current	peak start-up 0,8A No load	-	150	mA
$I_{DC(max.)}$	Maximum supply current	-	-	900	mA
P_{OUT}	Output power DC/DC converter	-	1	12	W
f	Swiching frequency	Depending on load characteristics	-	100	kHz
$V_{ISOL.}$	Isolation voltage	AC RMS 1 min.	-	10	$kV_{AC(RMS)}$
V_{REF}	Internal reference voltage	Line regulated	-	30	V
T_{amb}	Ambient temperature range - Industrial - HVxHHS-30I	-	-40	+71	°C
	Ambient temperature range - Automotive - HVxHHS-30A	-	-55	+85	°C
T_{stg}	Storage temperature range	-	-55	+90	°C

ELECTRICAL CHARACTERISTICS - POWER SUPPLY

T_{case} = +25°C and V_{DC} = 15V unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{DC}	Nominal supply voltage	V_{DC} to GND	14.25	15	15.75	V
UVLO	Undervoltage lockout (driver input voltage)	Internally generated,	-	U 13,4 D 11,2	-	V **
I_{DC}	Supply current	Zero load	-	-	150	mA
P_{MOD}	Power consumption of driver module	15V supply, zero load	-	1.5	-	W

** They driver OUTPUT VOLTAGE is always higher than the input voltage depending on load characteristics.
U= up sloop UVLO circuit activates drive during power on
D= down sloop UVLO circuit deactivates drive during power off

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

ELECTRICAL CHARACTERISTICS - LOGIC INPUT

T_{case} = +25°C and V_{DC} = 15V unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{INH}	Input H - level voltage	-	3,8	-	15	V
V_{INL}	Input L - level voltage	-	-0,3	-	0.8	V

ELECTRICAL CHARACTERISTICS - ELECTRICAL ISOLATION

T_{case} = +25°C and V_{DC} = 15V unless stated otherwise * = stay for either I or A

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
V_{TEST}	Test voltage - Primary to output	50Hz / 1 min.	-	-	10	$kV_{AC(RMS)}$
V_{ISOL}	Isolation voltage - HV2HHS-30x*	-	-	-	2.3	$kV_{AC(RMS)}$
V_{ISOL}	Isolation voltage - HV4HHS-30x*	-	-	-	4	$kV_{AC(RMS)}$
V_{ISOL}	Isolation voltage - HV5HHS-30x*	-	-	-	5	$kV_{AC(RMS)}$
V_{ISOL}	Isolation voltage - HV6HHS-30x*	-	-	-	6	$kV_{AC(RMS)}$
-	Creepage distance - primary to output		-	-	43	mm

ELECTRICAL CHARACTERISTICS - POWER SUPPLY

T_{case} = +25°C and V_{DC} = 15V unless stated otherwise

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Units
$t_{d(out)}$	Tum-on delay time	Refer to Figs. 9 and 10	-	550	-	ns
$t_{d(out)}$	Tum-off delay time	Refer to Figs. 9 and 10	-	550	-	ns
$t_{r(out)}$	Output current rise time	Refer to Figs. 9 and 10	-	100	-	ns

Drivers with higher insulation from HV6HHS-30 up
are available in long version 100x50 mm to obtain clearance/creepage >85mm

example HV8HHS-30I/L

/L stays for 100mm long version

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

BLOCK DIAGRAM

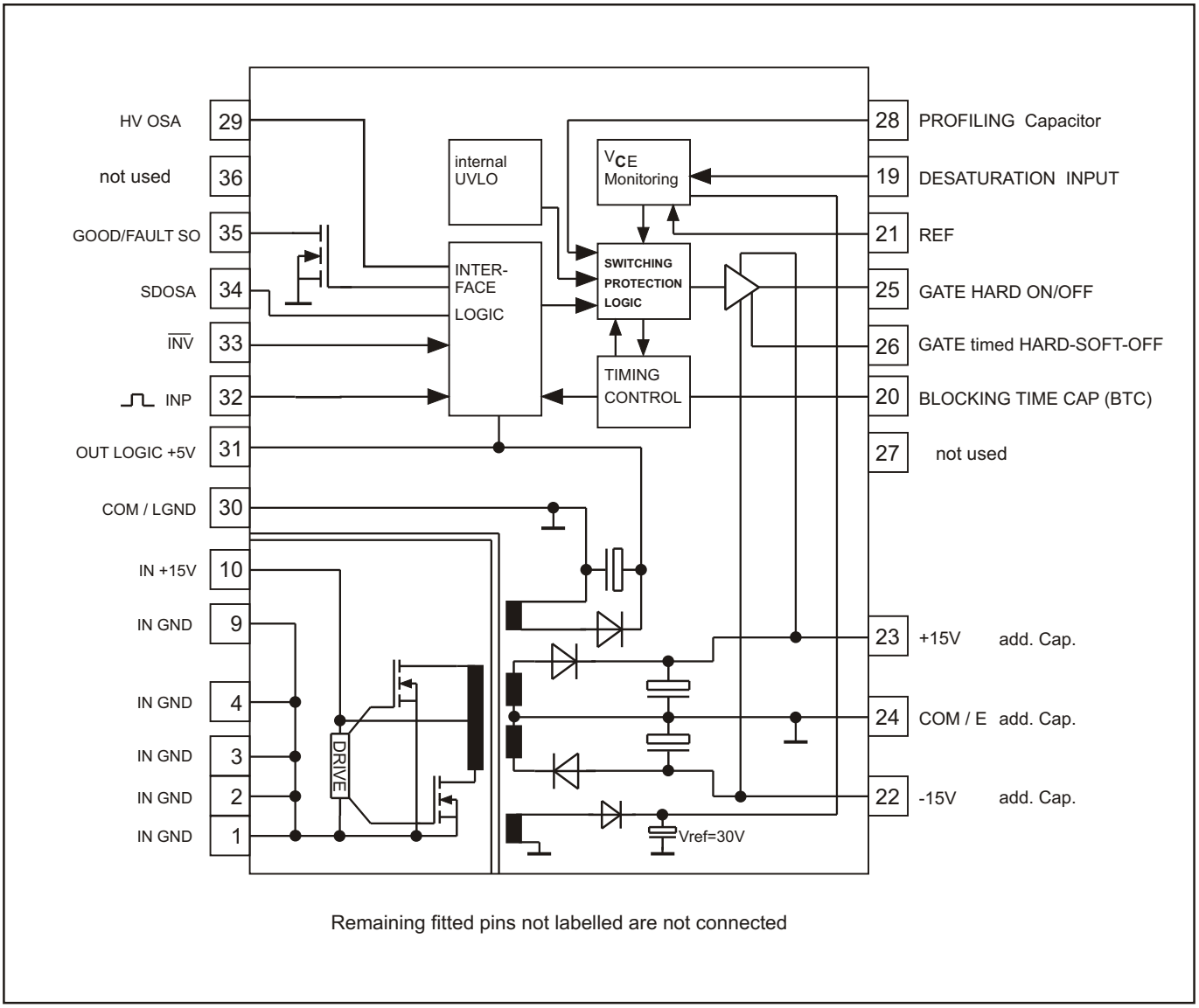


Fig. 2 Module block diagram

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

FLOETH ELECTRONIC

issued: 11/15

HVxHHS-30 I/A Series Application Note

PIN CONNECTIONS

Pin No.	Description	Note
1	INPUT GND	New DC.DC converter section from date code 1115
2	INPUT GND	start up from > 9V Vin only
3	INPUT GND	
4	INPUT GND	start up current 0,8A peak
5 to 8	NOT CONNECTED	against older version with 1,8A peak
9	INPUT GND	
10	INPUT +15V ±5%	With those two new features the 15V pre-converter requires less power
11 to 18	NOT CONNECTED	
19	V_{CE} /DES	Monitoring input with reference to COM, to be connected to collector of power switch via fast HV-bloking diode and resistor
20	BLOCKING TIME CAPACITOR (BTC)	Value determines time $\overline{\text{FAULT}}$ signal remains Low after removal of fault condition.
21	REF Voltage Pin	Level to be adjusted to suit actual IGBT. VCE / DES in turn ON mode, to be set by appropriate Zener diode or resistor. Intenal Ref. Suppy-Voltage is 30V which allows VCE / DES to be monitored up to 28v approx.
22	- 15V Supply voltage	Decoupling capacitor required.
23	+ 15V Supply voltage	Decoupling capacitor required.
24	COM / E	Secondary side common / Power switch emitter connection point.
25	Gate Drive power output HARD TURN ON/OFF	Connect via Gate Resistor
26	Gate Drive timed HARD-SOFT Turn OFF for profiled turn off	Connect via 2nd Gate Resistor in series with Rg HARD ON/OFF to Gate
27	not used	
28	C profile	Profile Timing Capacitor to set time for HARD-TURN-OFF
29	HV OSA	Out of saturation activation pin - normally while Vref 30V sufficient, connected to COM. For higher Vce /Desat an external ERVM modul must be used- pls consult.
30	LGND / COM	GND for all small signal and logic connection
31	+5V LOGIC SUPPLY	From internal converter
32	SIGNAL INPUT	Connect to FOL - Receiver
33	INPUT / OUTPUT REVERSAL	Input Low (connected to pin 30 LGND/COM): Gate Output (pin 25) is antiphase to Input (pin 32). Input High (open): Gate output (pin 25) is in phase to input (pin 32).
34	SDOSA	Shutdown out of saturation - two options. 1. Normally pin 34 pulled to COM -in this condition the driver turns the IGBT off immediately and reports fault to control unit via SO. 2. Set to +15V Level, at fault the driver does not turn off the IGBT, but reports the fault immediately to the control unit, (which may subsequently turn off all the IGBTs in the systems at once).
35	GOOD/ FAULT SO	Open drain output 470 Ohms used as pull up resistor to +15V connect to FOL transmitter (Fibre Optic Link) transmitter LED
36	not used	

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

INTRODUCTION

HVxHHS-30A series offers a complete solution for driving and protecting IGBT module and only a few additional components are required in the control circuit and in the power section.

Hvx HHS-30A is suitable for high frequency switching up to 100kHz.

This module may also be used in conjunction with Floeth Electronic Interface Card.
a) low voltage applications IG1-HHS-CORE Card & DE-IFC-12
b) high voltage applications IG1-HHS-CORE Card & DE-IFC-20

RELIABLE OPERATION

A gate voltage between ±14V to ±16V low noise ensures reliable operation of IGBT modules. High immunity is achieved with the negative gate voltage, and a number of IGBT's may be connected in parallel without problems from parasitics.

The module incorporates short circuit protection for the IGBT, supply monitoring, status acknowledgement, and an electrically isolated supply for the drive electronics.

SHORT CIRCUIT PROTECTION I & II

I switch into a short
II short appears during turn on

One of the fundamental functions of the driver module is to ensure reliable protection of the controlled IGBT against short circuit and over current. The current measurement is based on colector-emitter voltage of the IGBT in the on-state. Once the predetermined threshold has been exceeded the IGBT is fast turned off and remains "blocked" in normal mode for a minimum predetermined time (blocking time) Once the period elapsed the IGBT is released and may switch.

This is a simple and reliable method of protection for the IGBT removing the requirement for additional components.

PIN DESCRIPTIONS

Pins 1, 2, 3, 4, 9 and 10 GND and V_{CE}

The nominal feed on the power supply pins is + 15V ±5% For reliable operation of the integrated DC/DC converter a low impedance, high ripple current rated electrolytic capacitor must be positioned in the immediate vicinity of Pins 9 and 10, The capacitance of this component should typically be the same value as the capacitor connected to Pin 23. The DC/DC converter current consumption is dictated by the number of IGBTs in parallel being driven, their gate charge energy and by the switching frequency.

Pins 19 - V_{CE} /DES Monitor

This is used to monitor the voltage drop across the collector-emitter of the controlled IGBT at turn-on in order to detect a short circuit condition. **Note: Do not connect directly to the auxiliary collector of the IGBT.** To block the high collector voltage that is present when the IGBT is turned off, a high voltage diode (or several diodes) must be connected in series. The voltage rating of these diodes must exceed the maximum voltage seen at the IGBT collector in transient turn-off conditions.

A current source in the driver module ensures that current flows through the blocking diodes (D1to D3), the attenuation resistor (Rs) and the IGBT at turn-on. The function of Rs is to attenuate spikes caused by reverse recovery of diodes D1 to D3. Typically Rs has a value of 68Ω.

When the IGBT is turned on, the potential present at the measurement input of V_{CE} /DES corresponds to the forward voltage of the IGBT plus the forward voltage of the diodes and the voltage drop across RS.
The integrated voltage/current source and the external capacitor C sense produce a measurement delay after the IGBT has switched on. The delay is known as the "response time" and C sense must be selected to provide a delay greater than the turn-on time (or switch through time) of the IGBT.

When C sense and Vref are well selected the IGBT works fine and has a safe time window for short I and II.

Z diode 30V parallel to C sense a mere protection function for the internal voltage comparator. The component capacitance approx. 60 pF must be considered as parallel cap. and be deducted from the approximation result below.

$$C\ sense\ (pF) \sim \frac{response\ time\ t(ns) - 600ns}{33 \ln((29{,}886V/(30V - Vref\ at\ P21))} - 30$$

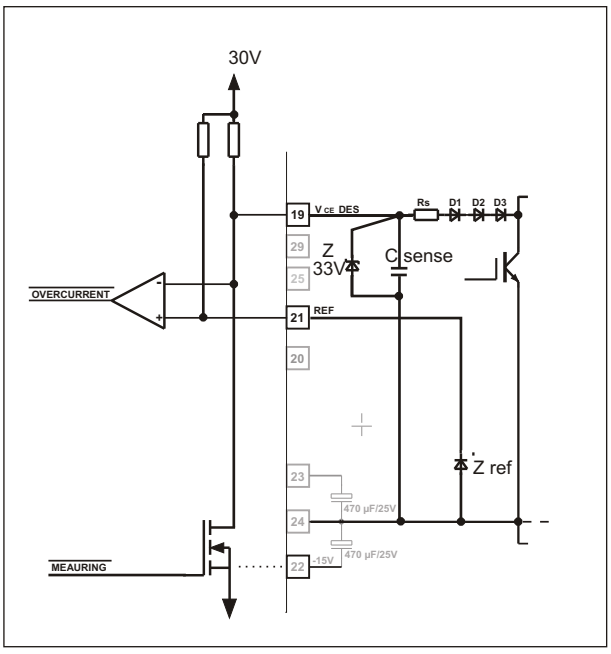


Fig. 3 V_{CE} monitoring

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

Pin 20 - Blocking Time Capacitor (BTC)

Once the current monitoring curcuit has detected thal the IGBT is in a desaturation state, the IGBT is tumed off in normal mode by the driver module´s protection function and remains in the state until overload is removed. This function is used to protect the IGBT from thermal overload during continuous or repeated short circuits. An error signal on status output SO appears for the duration of the blocking time. The blocking time is determined by connecting Pin 20 (BTC) to Pin 24 (COM) via a capacitor.

BTC value ~ C (nF) = 21,267 x t b (ms)

The value of BTC typically is 470nF, gives 22ms blocking.
After the blocking time has been elapsed
the IGBT is immediately released for operation.

Pin 21 - Reference Voltage, REF

The external zener diode connected to this pin defines the voltage drop across the driven IGBT at which the desaturation detection function of the drive circuit is activated.

The protection function becomes active when the voltage at Pin 19 (V_{CE} / DES Monitor) is higher than that at REF.

The reference potential is the emitter of the IGBT. The reference zener diode must be positioned as close to the driver moduls as possible.

Pin 22 -15V

A low impedance, high ripple current rated electrolytic capacitor is connected at Pin 22. This de-couples the DC/DC converter on the secondary side. The capacitor must supply the pulses of current that discharge the IGBT gate capacitance. The capacitor is connected between Pin 22 and Pin 24 (COM). As the discharging currents for the gate are drawn mainly trom the capacitor it is imperative that it is positioned as near to the driver module as is physically possible. The recommended value for the capacitor is 470µF. Values significantly greater than this may prevent the DC/DC converter from starting at power - up. .

If flying leads are used between the driver module and the IGBT emitter or drain terminals then their length should not exceed 100mm. The leads should run to each IGBT in twisted form,

Pin 23- +15V

A low impedance high ripple current rated electrolytic capacitor is connected at Pin 23. This de-couples the DC/DC converter on the secondary side. The capacitor must supply the pulses of current that charge the IGBT gate capacitance. The capacitor is connected between Pin 23 and Pin24(COM). As the charging currents for the gate are drawn mainly form the capacitor it is imperative that it is positioned as near to the driver module as is physically possible. The recommended value for the capacitor is 470µF. Values significantly greater than this may prevent the DC/DC converter from starting at power-up.

Pin 24 - Power Switch Emitter, COM

This pin should be connected directly to the IGBT emitter terminal (Or auxiliary emitter terminal where available) using as short a laed as possible. It is also used as the zero voltage reference point for reference voltage REF.

Pin 25 - Output Gate HARD ON/OFF

This is the driver output for the IGBT gate. Depending on the module supply voltage tolerance, potential is about +/-15V.

The output stages of the HVxHHS-30x series delivers a maximum possible gate charge current of +30A. The charging current can be limited by an external gate resistor. Remember that when the gate is driven with an alternating voltage arround zero, the potential difference across the gate capacitance is usually (depending operating frequency and therfore load) about 30V.

During IGBT turn-off the Miller effect may cause the gate voltage to rise and this can delay device turn-off. It is advisable to connect zener diodes (Z18V) immediately between the IGBT gate and emitter to clamp the gate voltage to a predetermined level. Z- Diodes to be min. 18V Diodes !!!.

The gate of the IGBT must be connected to Pin 25 by a lead as short as possible.

Consider also the internal IGBT gate resistance while calculating the numbers for Rg's.

Internal Gate Resistances can vary from 0,2 to 0,6 ohms depending on products and different manufactureres design.

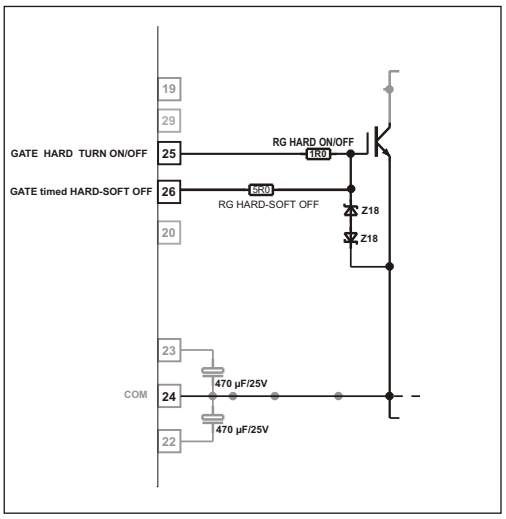


Fig. 4 Gate Drive

Pin 26 - Output Gate timed HARD-SOFT Turn OFF

turn ON-OFF resistor value as low as possible, (3,3-5Ω) in connection with C profile see description Pin 28

HOW it works:
during timed HARD turn OFF periode both channels P 25 & 26 are pulled against -15V when time elapsed channel P25 turns off and the SOFT leg channel P 26 stays activated only.

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

FLOETH ELECTRONIC

HVxHHS-30 I/A Series Application Note

issued: 11/15

Pin 27

Not used

Pin 28 - C Profile

Determines the time after which the profiled HARD turn-off procedure is completed in applications with specified deadtime between conduction intervals in opposite phases, e. g. one bridge leg in motor controls or high power fullbridge converters.

Improper values can have the following effects:

* Too big: Fast, but hard turn-off with excessive voltage overshoot by parasitic inductance flybacks.

. Too small: longer delays and due to improper selecting of time and clearance resistance still too high Vce overshoots.

Fixing C profile size must be done under following points of view:

1. HARD turn off time must be set to highest Power figures you want to obtain.
   Approach has to be done by increasing pulse width step by step until full load while trimming the capacitance and HARD clearing time to proper figures.

2. HARD gate clearing time must be long enough that Vce does appraoch about Supply Voltage Level until SOFT path becomes activated only..

$$C_{(pF)} = t\ profile_{[\mu s]} \times 77{,}087 - 13{,}152$$

Practical values in the range of 47 -200pF
For easier fine tuning we offer 2 capacitor positions on our DE-HHS-CORE PC Board. (see.www.floeth-electronic.com)

Pin 29 - HV OSA

There are 2 modes, selctable by High/Low criteria.

1. Pin 29 pulled to COM/LGND turns low. (standard appl.) internal voltage comparator to control Vce sat is active in case of an out of saturation event driver terminates and Pin 35 turns low and reports FAULT.

2. When IGBT's with higher Vce sat. & higher current are used which require Vref higher than 28 V. (3300V and 6500V IGBT's; several 100 amps) Disable internal Vce sat comparator by: removing Z ref, insert a 8k2 ohm resistor to P 21 against COM, leave P19 open, disconnect Pin 29 from COM.

3. Connect our EVRM (external voltage reference and Vce comparator module) with output to P 29 (HVOSA).

   In case of Vce OUT OF SATURATION the EVRM turns LOW pulls P 29 LOW and disables driver and FAULT P 35 turns LOW.

Pin 30 - LGND / COM

Ground for all small signal and logic connections. See Fig. 5.

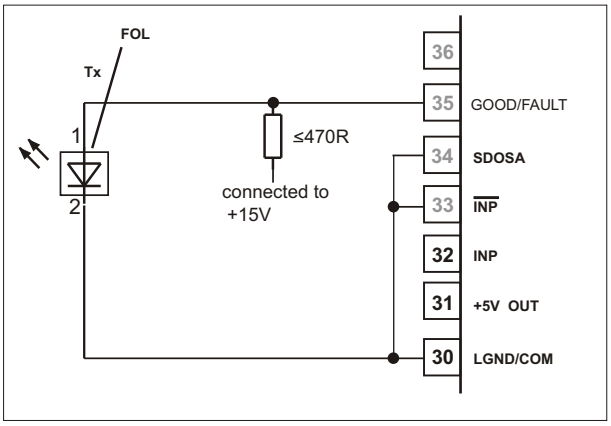


Fig. 5 Fibre optic transmitter wiring

Pin 31 - +5V Logic Supply, LGND

+5V with respect to LGND is available from this pin which is intended to supply the interface electronics, specifically the Fibre Optic Link (FOL) receiver. (See Fig. 6). The maximum current capability of 60mA for this output must not be exceeded. If an FOL receiver requiring more than 60mA is used then an exrernal 5V controller should be connected which can be supplied via Pin 23.

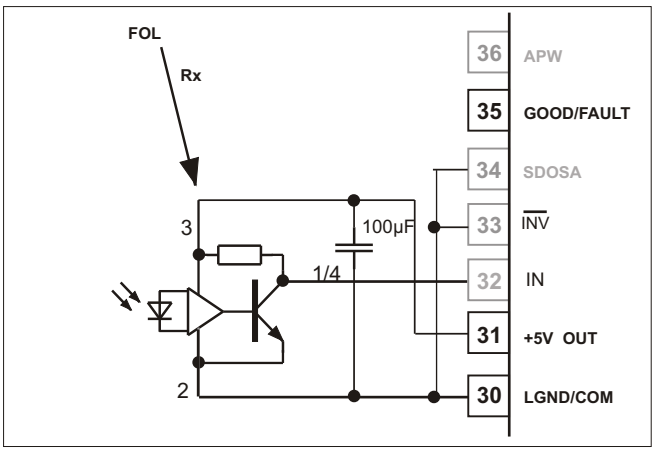


FIg. 6 Fibre optic receiver wiring

Pin 32 - INPUT Signal

The output signal of the FOL receiver is applied to this terminal. Recommended receiver/transmitter see page 10. The INPUT has a Schmitt trigger characteristic to provide improved signal-to-noise immunity. The logic sense of the INPUT terminal may be inverted by Pin 33 INV (INPUT / OUTPUT Reversal). With $\overline{\text{INV}}$ connected to LGND, a 5V signal at INPUT corresponds to "IGBT OFF", and a 0V signal to "IGBT ON". If $\overline{\text{INV}}$ is open, INPUT works in the opposite sense.

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

Pin 33 - $\overline{\text{INV}}$

The pin allows the sense of input signal INPUT to be inverted.
Input LOW (P 33 connected to COM) gate output Pin 25 is in antiphase to input.
Input HIGH (p 33 open) gate output is in phase to input signal

Pin 34 - SDOSA shutdown out of saturation (termination inhibit)

Used to select the response of the protection function. In normal operation, the SDOSA terminal is tied to COM with the consequence that when a fault (in the desaturation or supply voltage monitoring circuits) is detected, the IGBT is immediately turned off, even if the input signal continues to be applied. The fault situation is simultaneously reported via the status output, (FAULT).

The alternative operating mode is useful when driving IGBT´s connected in series. In this mode the SDSOA input is connected to +15V. When a fault is detected by desaturation the IGBT is not turned off. The SO, Status Output or $\overline{\text{FAULT}}$ Pin 35 goes low (error flag) and reports to the central microcontroller to turn-off all the series IGBT´s simultaneously.

The same approach may also be used for IGBTs connected in parallel but each having a dedicated driver. In this situation symmetrical current distribution is maintained by simultaneous turn-off of the drivers. The driver module is therefore suitable for any combination of series or parallel IGBT's and is also applicable to bridge circuits.

In the event of a fault it is important in each case that the status acknowledgements are detcted quickly and as directly as possible. These signals should be monitored by a dedicated circuit such as a PAL or FPGA and not by a microprocessor which may take too long to react.

Pin 35 - SO, Good / Fault - Status Output

This is the driver status output. This signal can be relayed back to a central controller via an isolation FOL. (See Fig. 7). The +15V supply for the FOL transmitter is taken from pin 23. .

SO has the following states.

If the driver module supply voltage is within specification and there is no other fault condition then an Good (SO) signal (high) is transmitted even if the blanking time is high. .

If the protection function of the driver detects desaturation, terminals 30 and 35 are shorted together for the duration of the blanking time. SO is pulled low (FAILURE).

If the SO pulse is low for longer than usual then the control electronics may assume that there is a problem with the FOL. **Incorrectly installed FOL connections may have catastrophicresults**.

Pin 36 not used

POWER SECTION - CONFIGURATION

The driver module should be positioned as close as possible to the controlled IGBT with connection leads not more than 30 to 100mm in length, depending on the gate current and switching speed. The FOL cable lengths are not critical.

GATE RESISTOR - R_G -HARD ON/OFF

R_G determines the maximum gate current and protects the power switch and the driver against permanent damage. A low inductance metal band resistor is recommended.

For example, for type HVxHHS-30

R_G for a gate current of 30A = V_{gate} / I_{max} driver
= 30V / 30A = 1,0 Ohm min. **[3]**

Note that any internal gate resistance in the IGBT modules forms part of the charging circuit and must be taken into account when selecting the external gate resistor value.

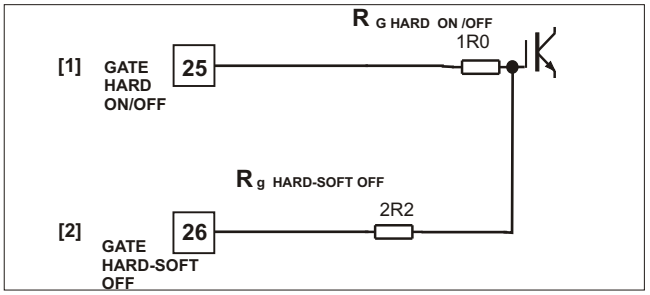


Fig. 7 Gate resistor networks

GATE RESISTOR-Rg HARD-SOFT-OFF
see description Pin 26 & 28

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

FLOETH ELECTRONIC

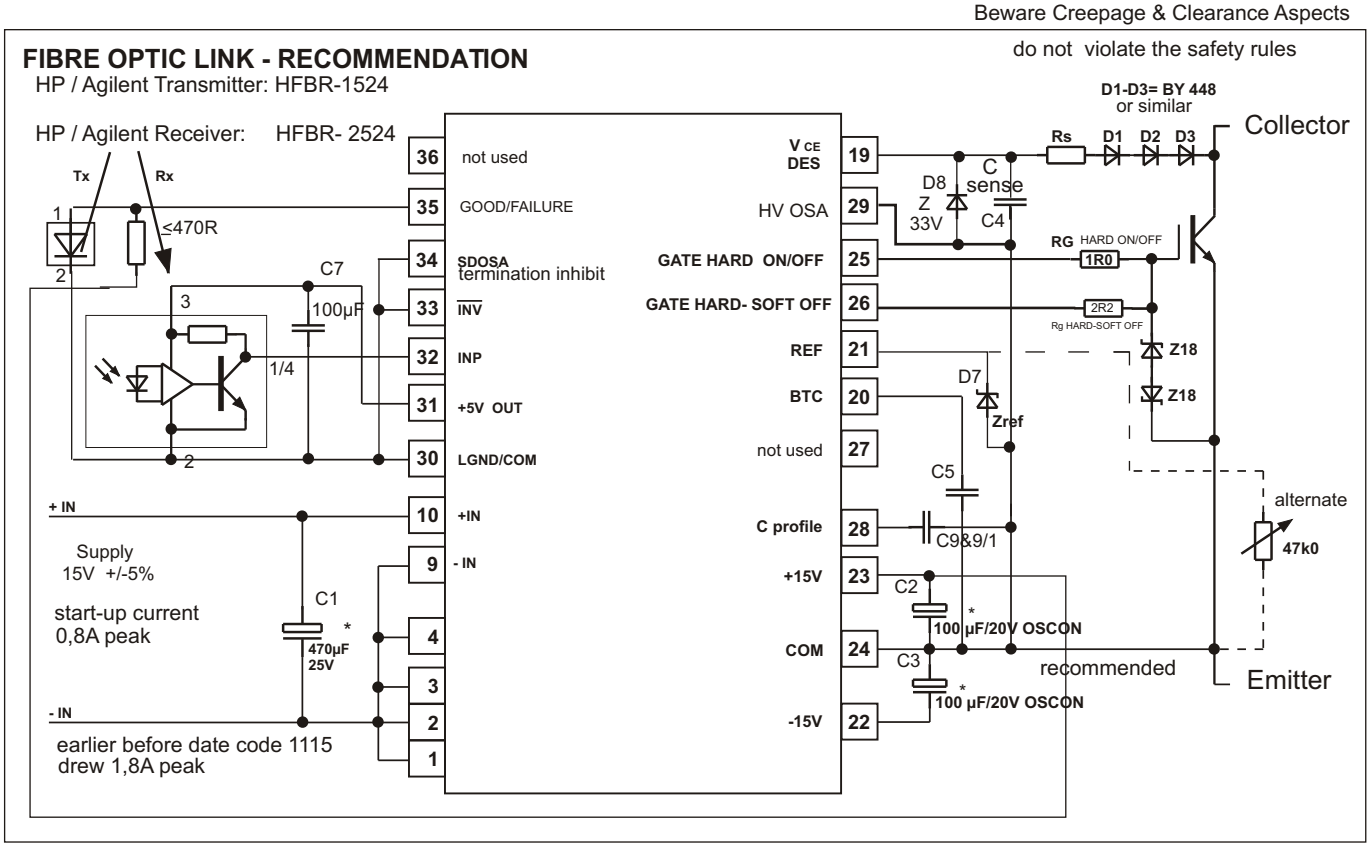
issued: 11/15

HVxHHS-30 I/A Series Application Note

REFERENCE VOLTAGE - Z_{REF}

The V_{CE} voltage at which overcurrent / short circuit condition is detected to be set by the Zener diode connected to Pin 21. Pin 34 must be connected to COM. Alternatively, a 47KΩ potentiometer may be used to allow easy adjustment.

Beware Creepage & Clearance Aspects do not violate the safety rules



Flg. 8 Example driver circuit

Take care that supply power of 15V pre-converter is sufficient !!!!!
Voltage supply trace shall be lienar once the driver starts working >9V to 15V

see www.floeth-electronic.com IGBT section & Interface - cards

For Applications where big single IGBT's and single Driver be used due to MW-Power for thermal or Safety Reasons (Creepage & Clearances) we could offer an INTERFACE to drive the two single HALF-BRIDGE modules with to set INTERLOCK (dead time).

We can offer a Fibre Optic Link (FOL) Interfacing Solution to serve two single Modules in HB-mode.

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

issued: 11/15

HVxHHS-30 I/A Series Application Note

TIMING PATTERN I Input /Gate & other Traces

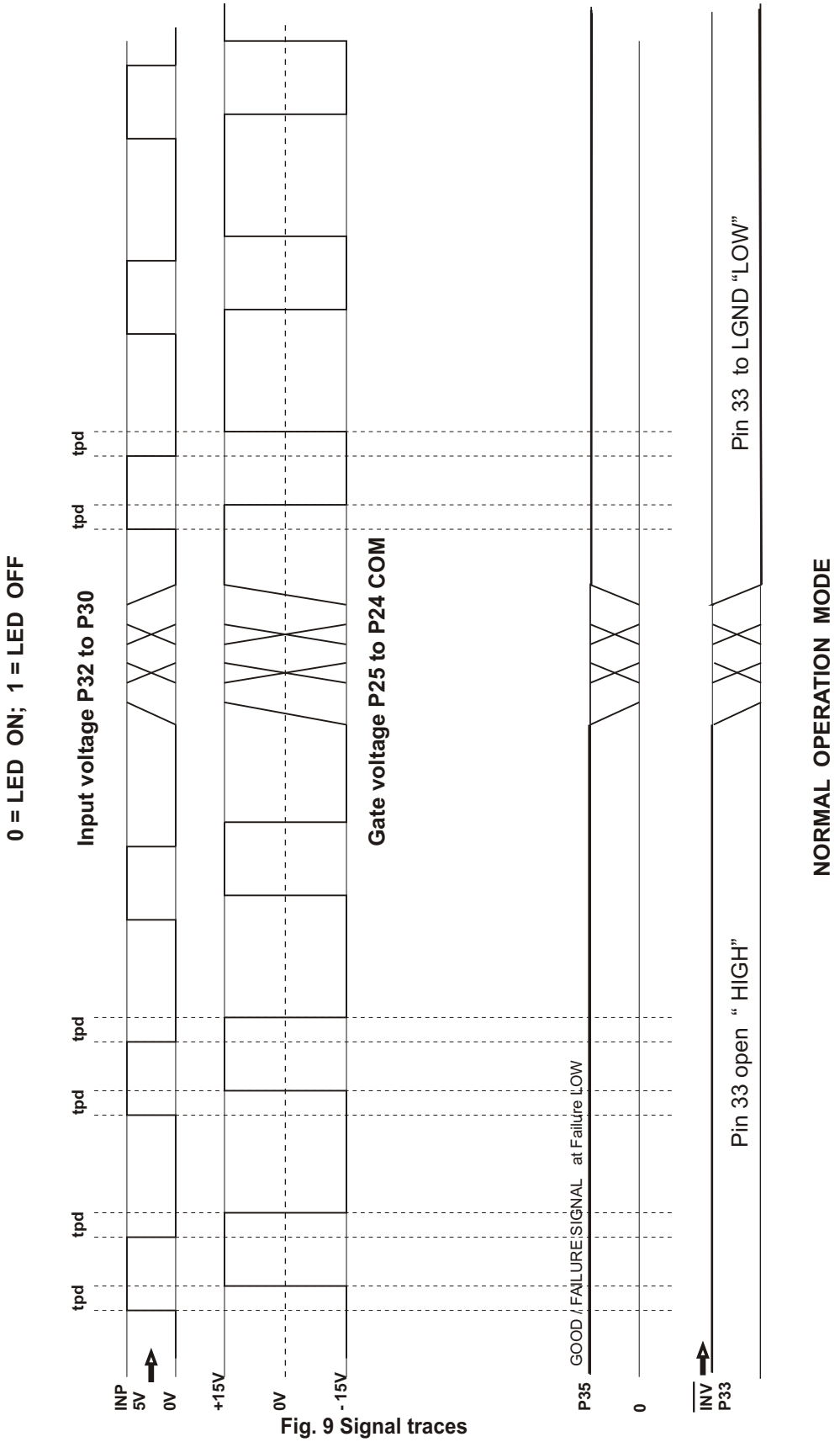


Fig. 9 Signal traces

DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

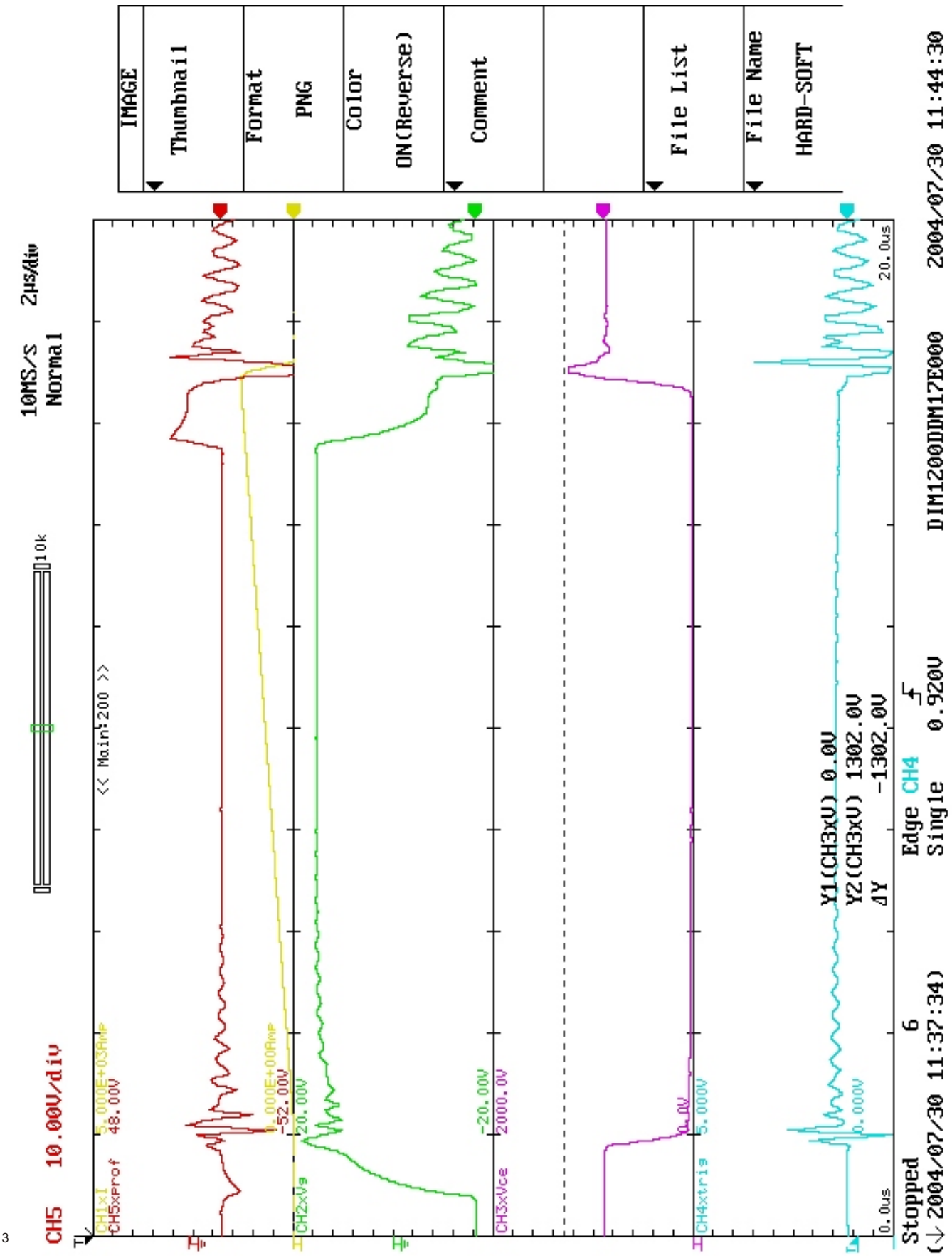
Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

FLOETH ELECTRONIC

issued: 11/15

HVxHHS-30 I/A Series Application Note

TIMING PATTERN II NORMAL OPERATION



DC/DC Converter
AC/DC Inverters
Delay-Lines
Pulsetransformers
Burst & Surge Filters
Harmonic Filters
Switching Power Supplies

Am Malfinger Steig 13
86920 Denklingen/Obb.
Germany

Tel.: 08243-9693-0
Fax: 08243-9693-33
www.floeth-electronic.com

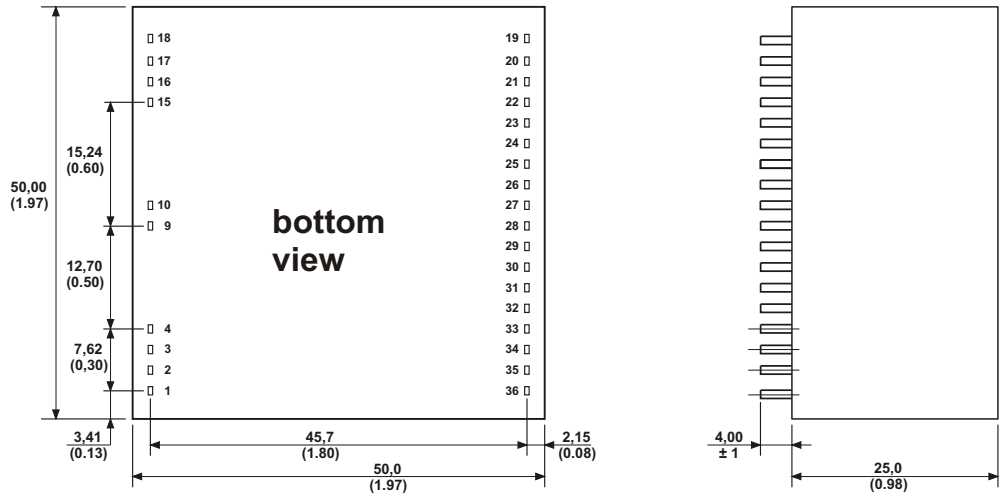
issued: 11/15

HVxHHS-30 I/A Series Application Note

PACKAGE DETAILS

For further package information, please visit our website or contact Customer Services. All dimensions in mm, unless stated otherwise. DO NOT SCALE.

clearance & creepage greater than 40mm depends on solder eye size



Material information:
Drivers are epoxy moulded within a 50 x50 x25mm enclosure.

PCB and Epoxy materials are self-extiguishing in accordance with UL/CSA requirements

Mechanical dimensions:
Grid; 2,54mm
Solder pads: 1,6mm
Drill holes: 0,9mm

Fig. 11 Driver module outline

Attention:
For HV6HHS and to HVHHS-30I we can offer 100mm long body for > 85mm clearance/creepage parts called e.g. HVHHS-30I/L L stays for long body