Technical Explanation Draft Data Sheet SKYPER® 12 press-fit

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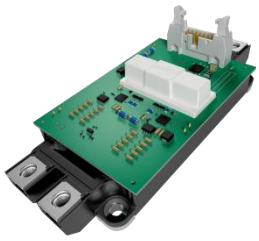
Keyword: IGBT Driver

1. Introduction

The SKYPER 12 press-fit is an IGBT driver for SEMIX pressfit and Econodual pressfit modules. The half bridge driver can be mounted directly onto 17mm press fit modules. With 30% fewer components than available plug&play solutions, the driver achieves an MTBF (mean time between failures as per SN 29500) rate of over 5 million hours at full load.

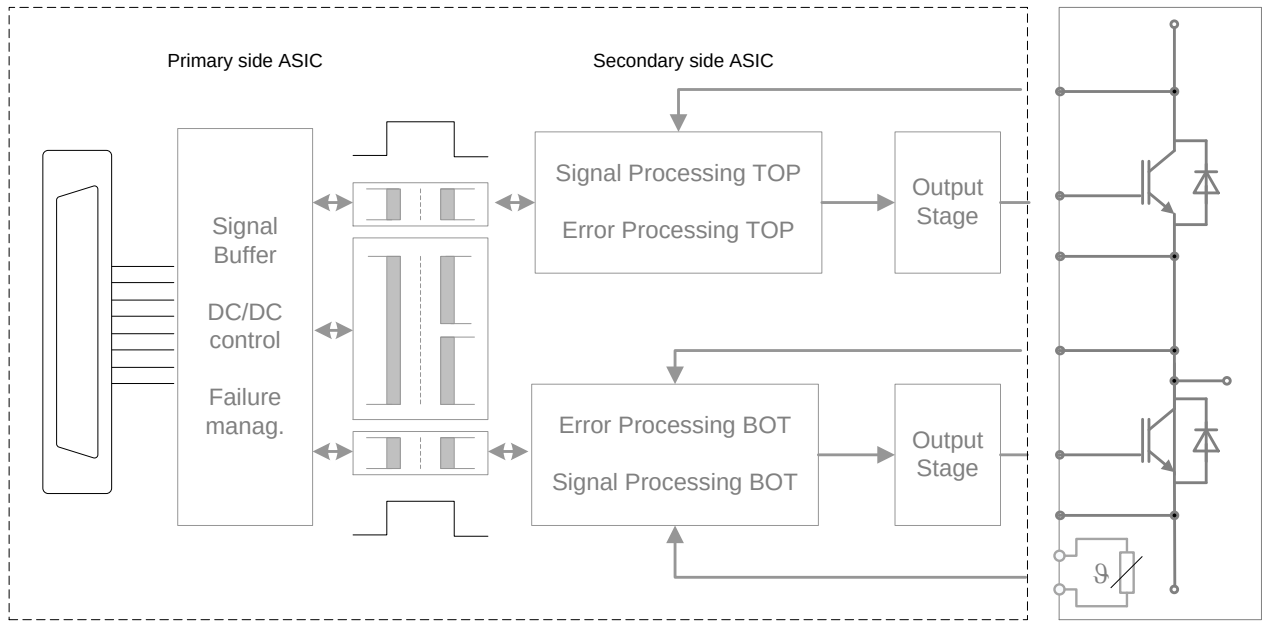
With 1W per channel SKYPER 12 press-fit can drive IGBTs up to 600 Ampere and 1700V.

Figure 1: SKYPER 12® press-fit



- Fits to 1200V & 1700V modules
- Drives Econodual and SEMIX pressfit modules
- Qualified safe operating area ensure best performance
- Safe short circuit handling over the hole temperature range
- Available with SEMIKRON and second source interface
- Robust rectangle signal transmission
- Two output channels
- Highest noise immunity with short pulse suppression and robust interface
- Insulated over temperature trip on secondary side
- Under voltage protection (UVP) primary and secondary
- Dynamic Short Circuit Protection (DSCP) by VCE monitoring and direct SoftOff
- Integrated isolated power supply for the secondary side
- 1W output power per channel
- Up to 8 µC gate charge
- MTBF rate > 5 Million hours

Figure 2: Block diagram of SKYPER® 12 press-fit

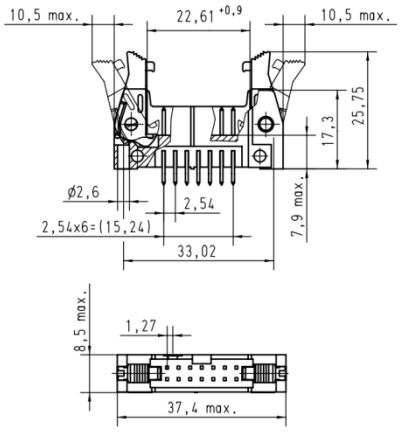


2. Driver interface

2.1 Controller interface

2.1.1 SEMIKRON interface – 14P primary side pinning – L50666xx

Figure 3: Connector X10 (Harting DIN 41651 – 14 P)

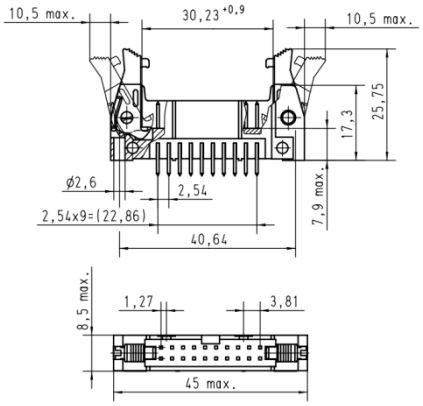


Product information of suitable female connectors and distributor contact information is available at e.g. http://www.harting.com (part number 09 18 514 7 904).

Table 1: Controller Interface			
PIN	**Signal**	**Function**	**Specification**
X10:01	reserved		To be connected to ground
X10:02	IF_HB_BOT	Switching signal input (BOT)	Positive 15V CMOS logic, LOW = BOT switch off; HIGH = BOT switch on
X10:03	IF_nERROR_OUT	ERROR output	HIGH = NO ERROR; open collector out; max. 30V / 15mA (external pull up resistor)
X10:04	IF_HB_TOP	Switching signal input (TOP)	Positive 15V CMOS logic LOW = TOP switch off; HIGH = TOP switch on
X10:05	PRIM_nERROR_IN	ERROR input	LOW (GND) = External error HIGH (VP) = No error
X10:06	reserved		To be connected to ground
X10:07	reserved		To be connected to ground
X10:08	IF_PWR_15P	Drive power supply	Stabilised +15V ±4%
X10:09	IF_PWR_15P	Drive power supply	Stabilised +15V ±4%
X10:10	IF_PWR_GND	GND	To be connected to ground
X10:11	IF_PWR_GND	GND	To be connected to ground
X10:12	reserved		To be connected to ground
X10:13	reserved		To be connected to ground
X10:14	reserved		To be connected to ground

2.1.2 Second source interface – 20P primary side pinning – L50669xx

Figure 4: Connector X10 (Harting DIN 41651 – 20 P)



Product information of suitable female connectors and distributor contact information is available at e.g. http://www.harting.com (part number 09 18 520 7 904).

Table 2: Controller Interface			
PIN	**Signal**	**Function**	**Specification**
X10:01	reserved		Open pin
X10:02	IF_PWR_GND	GND	To be connected to ground
X10:03	reserved	ERROR output	Open pin
X10:04	IF_PWR_GND	GND	To be connected to ground
X10:05	IF_PWR_15P	Drive power supply	Stabilised +15V ±4%
X10:06	IF_PWR_GND	GND	To be connected to ground
X10:07	PRIM_nERROR_IN	ERROR input	LOW (GND) = External error HIGH (VP) = No error
X10:08	IF_PWR_GND	GND	To be connected to ground
X10:09	IF_nERROR_OUT	ERROR output	HIGH = NO ERROR; open collector output; max. 30V / 15mA (external pull up resistor)
X10:10	IF_PWR_GND	GND	To be connected to ground
X10:11	IF_HB_TOP	Switching input (TOP)	Positive 15V CMOS logic LOW = TOP switch off; HIGH = TOP switch on
X10:12	IF_PWR_GND	GND	To be connected to ground
X10:13	IF_nERROR_OUT	ERROR output	HIGH = NO ERROR; open collector output; max. 30V / 15mA (external pull up resistor)
X10:14	IF_PWR_GND	GND	To be connected to ground
X10:15	IF_HB_BOT	Switching nput (BOTTOM)	Positive 15V CMOS logic, LOW = BOT switch off; HIGH = BOT switch on
X10:16	IF_PWR_GND	GND	To be connected to ground
X10:17	reserved		To be connected to ground
X10:18	IF_PWR_GND	GND	To be connected to ground
X10:19	reserved		To be connected to ground
X0:20	IF_PWR_GND	GND	To be connected to ground

3. Protection features

3.1 Failure management

The SKYPER 12 PF detects under voltages on primary and secondary side, short circuits and over temperature conditions. Any error detected will force the output PRIM_nERROR_OUT into low state and has to be reset by the controller. The IGBTs will be switched off (IGBT driving signals set to LOW). The input side switching signals of the driver will be ignored. The input signals have to be set to low status for 9µs for reset.

Following failures are indicated by the failure output
- Under supply voltage primary side
- Under supply voltage secondary side
- Short circuit with SoftOff
- Over temperature

3.2 Dead time generation (Interlock TOP / BOT) adjustable

The internal dead time of SKYPER 12 PF is set to 2µs. The DT circuit prevents, that TOP and BOT IGBT of one half bridge are switched on at the same time (shoot through). The dead time is realised in the mixed signal ASIC. The dead time is not added to a dead time given by the controller. The highest dead time dominates.

Example:

Table 3: Dead time generation

	Controller dead time	SKYPER dead time	Total dead time
Controller > driver	4µs	2µs	4µs
Controller < driver	1µs	2µs	2µs
Controller no dead time	No dead time	2µs	2µs

It is possible to control the driver with one switching signal and its inverted signal. No error signal will be generated when signals are overlapped.

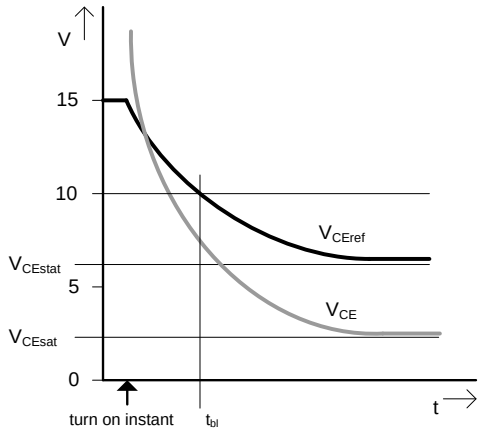
3.3 Short pulse suppression

This driver circuit suppresses short turn-on and off-pulses of incoming signals. This way the IGBTs are protected against spurious noise as they can occur due to bursts on the signal lines. Short or high noise pulses don't affect the driver on the controller side. The digital SPS is set to 390ns.

3.4 Dynamic short circuit protection by V_{CEsat} monitoring (DSCP)

The DSCP monitors the collector-emitter voltage V_{CE} of the IGBT during its on-state. Immediately after turn-on of the IGBT, a higher value is effective than in steady state.

Figure 5: Reference Voltage (V_{CEref}) Characteristic



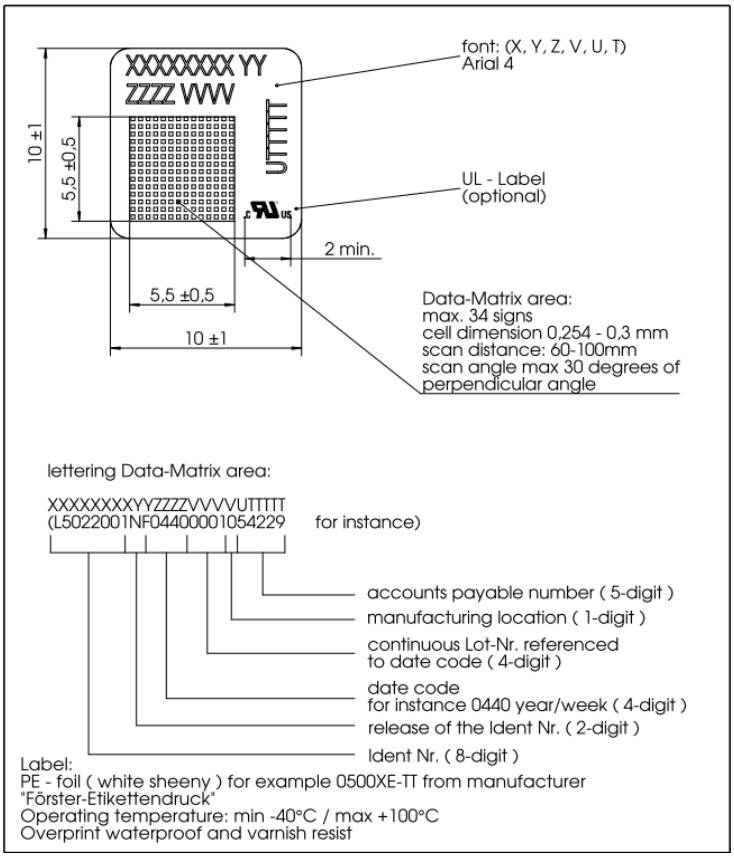
After t_{bl} has passed, the V_{CE} monitoring will be triggered as soon as $V_{CE} > V_{CEref}$ and will turn off the IGBT.

3.5 Soft Off

In the event of short circuit, the SoftOff feature increases the resistance in series with R_{Goff} and slows down the turn-off speed of the IGBT. The reduced di/dt reduces the voltage spike above the collector emitter in the short circuit case.

4. Marking

Figure 6: Label



References

[1] www.SEMIKRON.com
[2] A. Wintrich, U. Nicolai, W. Tursky, T. Reimann, "Application Manual Power Semiconductors", ISLE Verlag 2011, ISBN 978-3-938843-666

HISTORY

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