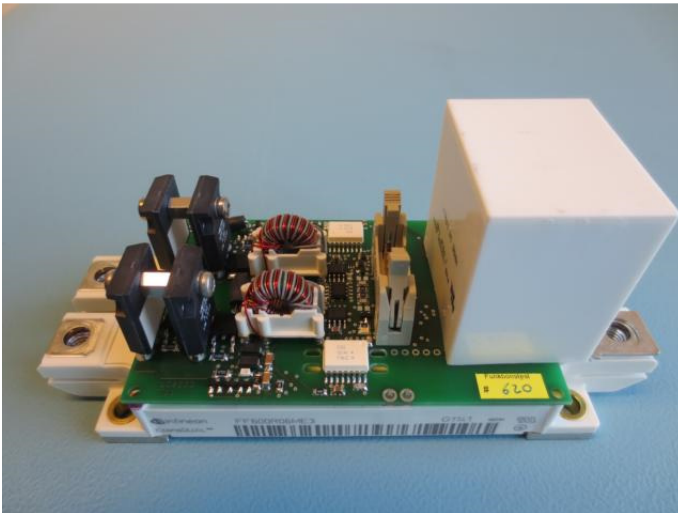


IGBT Half-Bridge Driver for EconoDUAL Packages

Preliminary Data Sheet Rev.7, Driver Rev.F



- Fast and Safe Switching of Large Gates: Dual 4W/15A Ready-To-Use Gate-Driver
- DESAT Protection with Soft Switch-Off
- Isolated Module NTC Temperature Sensing
- Up to 1200V Peak DC-Link Voltage*
- 8mm Creepage Distance
- Temperature Range -40°C to 100°C, (Full Load up to 50°C)
- Small 10-Pole Ribbon Cable Controller-Interface contains Reserved Signal Lines for Future Connection of External Current Sensor and Fan
- Reserved Space for Snubber Capacitor mounting in extreme compact Designs

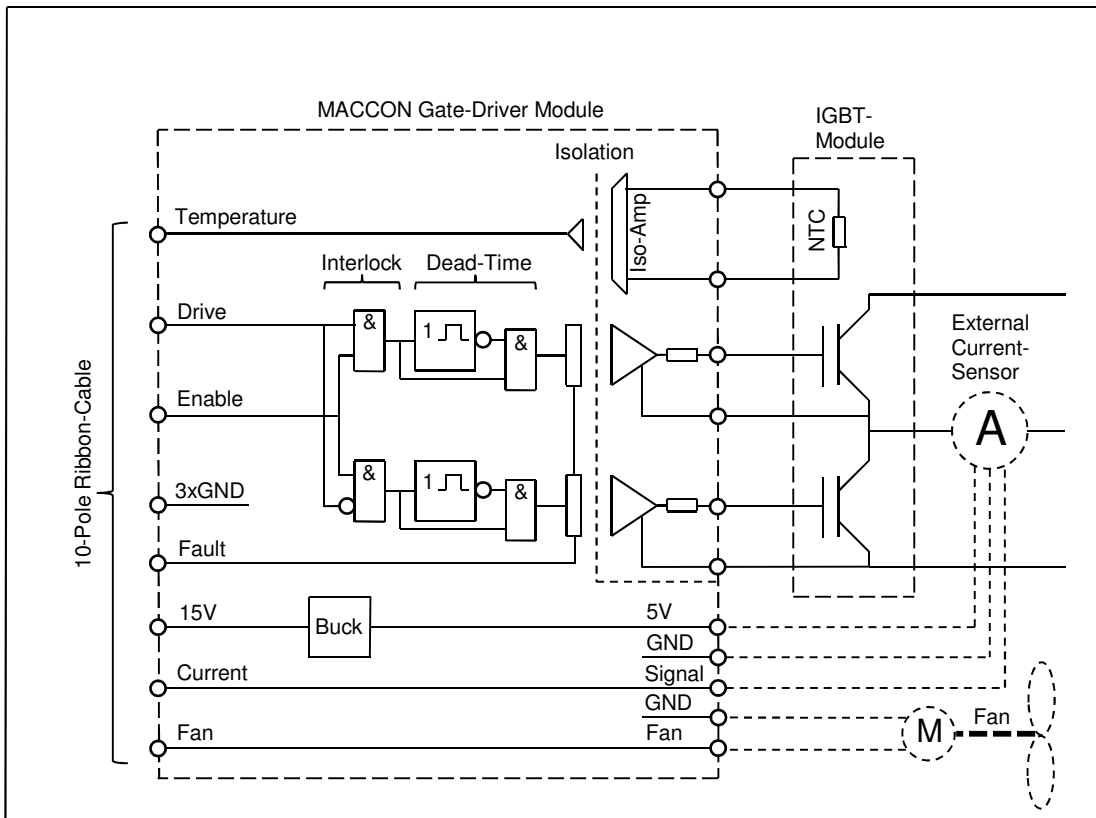
Driver-PCB, Standard IGBT-Module, Snubber Capacitor

*Isolation surge test voltage is 4250Vrms. Please refer to the EN-Standard (e.g. DIN EN 61800-5-1) to define your maximum DC-Link Voltage according to the required overvoltage category for your application.

Description

The MACCON Gate Driver Module is a highly integrated, powerful gate driver for standard EconoDUAL IGBT-modules. It offers an interesting combination of many features to build high-performance motor drives.

- **Powerful ready-to-use half-bridge gate-driver** (2x4W DC/DC converter combined with 2x15A driver and integrated gate resistors) ensures a compact, high-performance solution for large gates up to 100°C ambient temperature at free air convection, full load up to 50°C (see derating curve).
- **DESAT protection circuitry** can protect modules which are specified to withstand short circuit times larger than 6µs at the specified DC-link voltage. If a DESAT-error occurs, a fault signal will be sent over the ribbon cable to the controller. The error signal logic is fail-safe: An unplugged driver or a broken fault signal line will cause the controller to indicate an error signal. The DESAT protection circuit produces insignificant leakage on the DC-link compared to the IGBT-leakage current.
- **Isolated temperature sensing circuit** to safely measure the module's NTC temperature. The temperature signal is transmitted in the common ribbon cable to provide a robust and efficient wiring concept. The online baseplate temperature sensing offers the possibility to build converters working close to the limits to reach high power-densities at pulsed loads. Conventional drivers need an external isolation amplifier to read out the NTC-Temperature with additional connection lines. In the case of an IGBT-failure, high voltage can reach the internal NTC. Infineon and Fuji EconoDUAL-Modules use the same internal NTC, they are compatible from the temperature sensing perspective.
- **Special driver output stage minimizes gate-ringing** during the Miller-Plateau Phase.



Block Diagram showing a Sample Application

- **Reserved signal lines for connection of external current sensor and fan:** Often, the phase current sensor needs to be placed close to the IGBT for short high current traces. For this case, the MACCON-module generates a 5V sensor supply and offers the possibility to route the current signal together with the other driver signals over the 10-pole ribbon cable to the controller. Also a GND-based connection for an external fan is prepared in the 10-pole ribbon cable. A modular fan-cooled half-bridge block with current sensor can easily be created, connected by a single 10-pole ribbon cable to the controller.
- **Reserved space for module snubber capacitor:** It is strongly recommended to connect a snubber capacitor close to the DC-Link terminals of the IGBT-module. The snubber capacitor can be directly mounted on the driver PCB by using an additional isolating plate between capacitor and driver PCB. This saves height for a compact converter design.
- **Status LEDs for quick debugging:** Two green LEDs indicate if the secondary supply voltage for each driver channel is available. One green LED close to the ribbon cable connector indicates a fault when it is not lit. In normal operation, three green LEDs are lit.

Notes

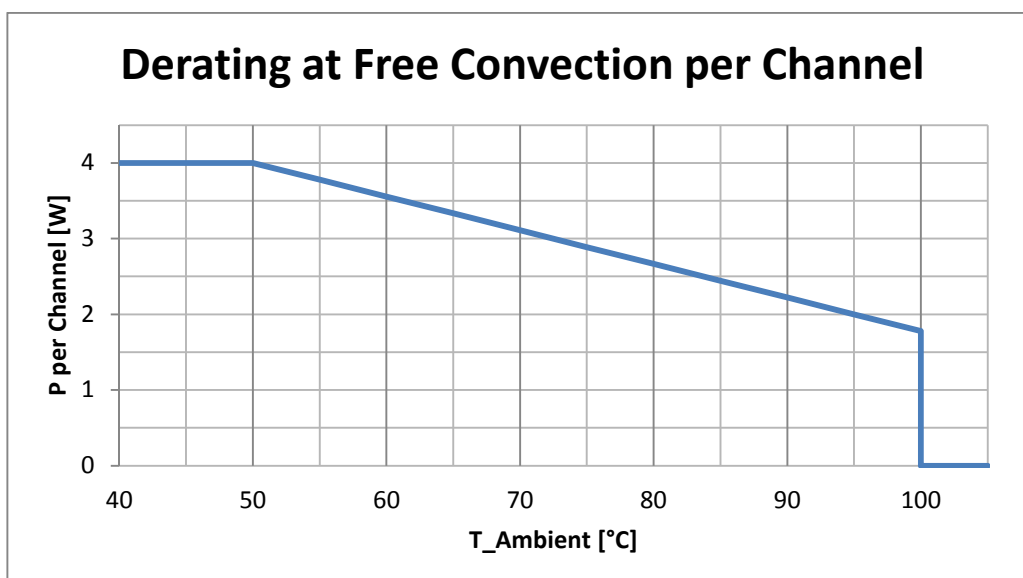
- **Danger of hazardous voltages! Only trained and certified personal should use this device!**
- **The test voltage of the driver isolation is 4250Vrms (6000Vpk). Before choosing this driver for your application, please define the required supply voltage conditions for the system including overvoltage category and perform an isolation coordination analysis for your system.**
- **Prevent excessive isolation testing, this will degrade isolation!**
- **AWG24 ribbon cable is required for the controller interface. Ribbon interface cable should be as short as possible. Twisted-pair ribbon cables are recommended. Ribbon cables have only low voltage isolation, they must be safely isolated from high-voltage traces according to the required technical standards for the system.**
- **Isolation Angle is required when Snubber Capacitor is mounted directly on top of the Driver-PCB.**

Electrical Characteristics

Parameter	Min.	Typ.	Max.	Unit
DC Supply Voltage	14,5	15	15,5	V
UVLO Threshold		tbd		V
UVLO Hysteresis		tbd		V
Quiescent Current: No Load		97		mA
Quiescent Current: 40kHz Switching on Both Channels, No Load		106		mA
Input Voltage Range Enable and Drive Signal	0		6	V
Input Low Level Enable and Drive Signal			1,5	V
Input High Level Enable and Drive Signal	3,5			V
Input Resistance Enable and Drive Signal		10		kOhm
Positive Output Voltage		15		V
Negative Output Voltage, No Load		15V		
Negative Output Voltage, 4W Dynamic Load	9			V
Failure Signal Current (Open Collector)				
Dynamic Driver Power per Channel (Ta<85°C, Free Convection)			4	W
Internal Gate Resistor		1,5		Ohm
Maximum Peak Current per Gate-Driver			15	A
Positive Gate Voltage	14		17	V
Negative Gate Voltage (is Decreasing with Increasing Dynamic Power)	-9		-17	V
Rise Time 10% to 90% for Module FF600R06ME3		1,12		ns
Fall Time 10% to 90% for Module FF600R06ME3		0,92		ns
Dead Time		1,2		us
DESAT Delay		3,4		us
Switching Frequency (Maximum 4W per Channel)			40	kHz
Maximum dV/dt for Ta=25°C			10	kV/us
DC-Link Voltage, Isolation Working Voltage			1200	V
Creepage Distance	8			mm
Ambient Temperature at Free Air Convection Full Load (4W) on Both Channels	-40		+50	°C
Storage Temperature and Powered Derated-Load Temperature	-40		+100	°C

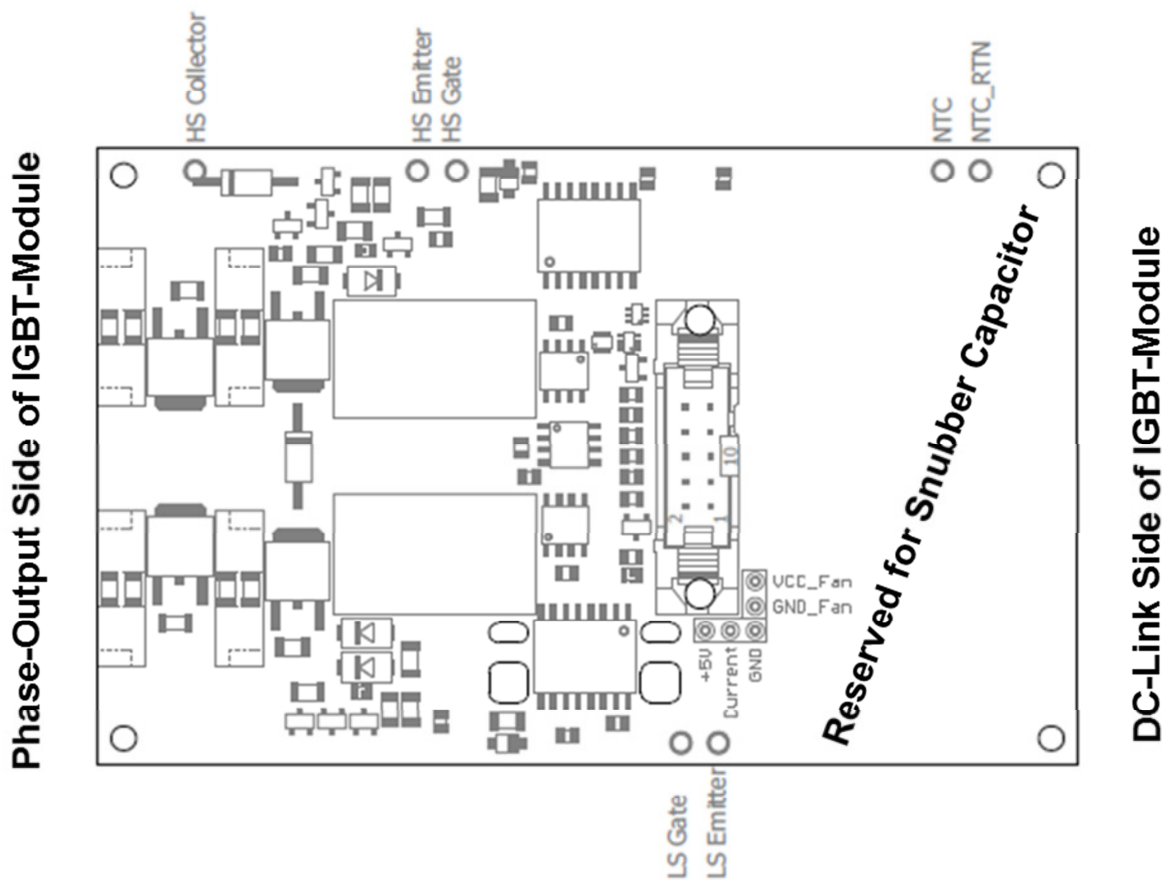
Parameter Table

Derating



Power (P) per Channel defines the Output Power of the internal DC/DC Converter of one Channel

Connection Diagram

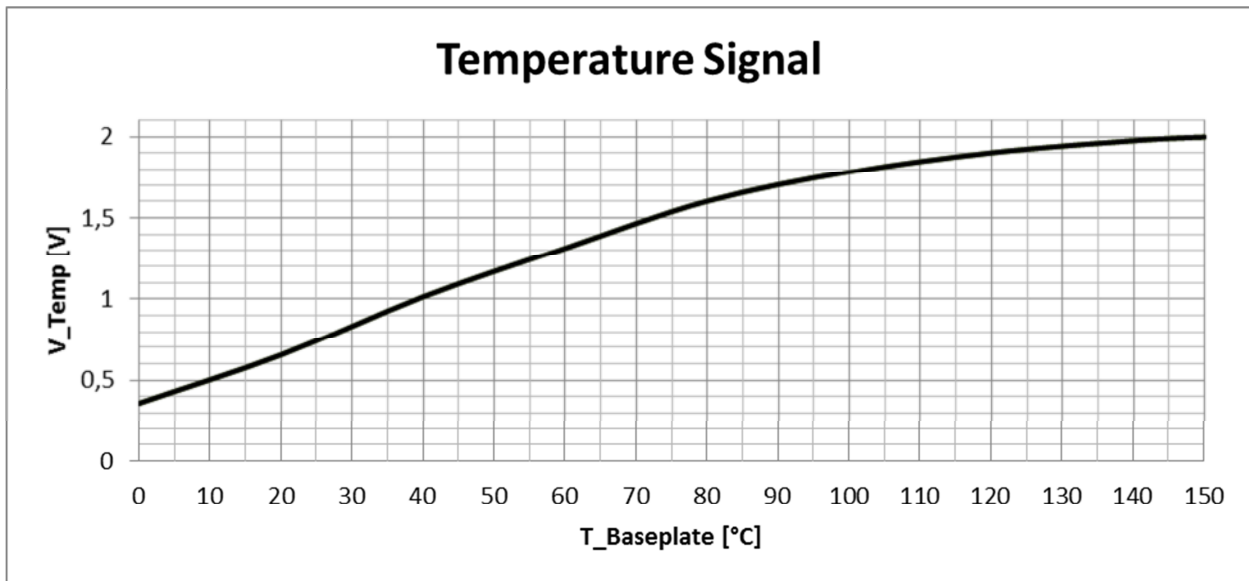


Mechanical Dimensions: L x W x H = 100mm x 63mm x 26mm

Connector Pin	Signal	Description
1	Vcc 15V	Supply Voltage
2	Failure	Open Collector pulls Signal always to GND at Normal Operation (Fail Safe)
3	GND	Common GND for Enable, Drive, Failure, Current, Temperature, Vcc and FAN
4	Current	Prepared Current Signal for Connection of External Current Sensors
5	GND	Common GND for Enable, Drive, Failure, Current, Temperature, Vcc and FAN
6	Drive	Drive = High, HS-IGBT is Conducting, Drive = Low, the LS-IGBT is Conducting
7	GND	Common GND for Enable, Drive, Failure, Current, Temperature, Vcc and FAN
8	Enable	When Enable is Low, both IGBTs are Blocking
9	Temperature Signal	Analog Voltage Output
10	FAN	max. 24V/300mA Fans (Voltage Spacing/Current Loading of Signal Line)

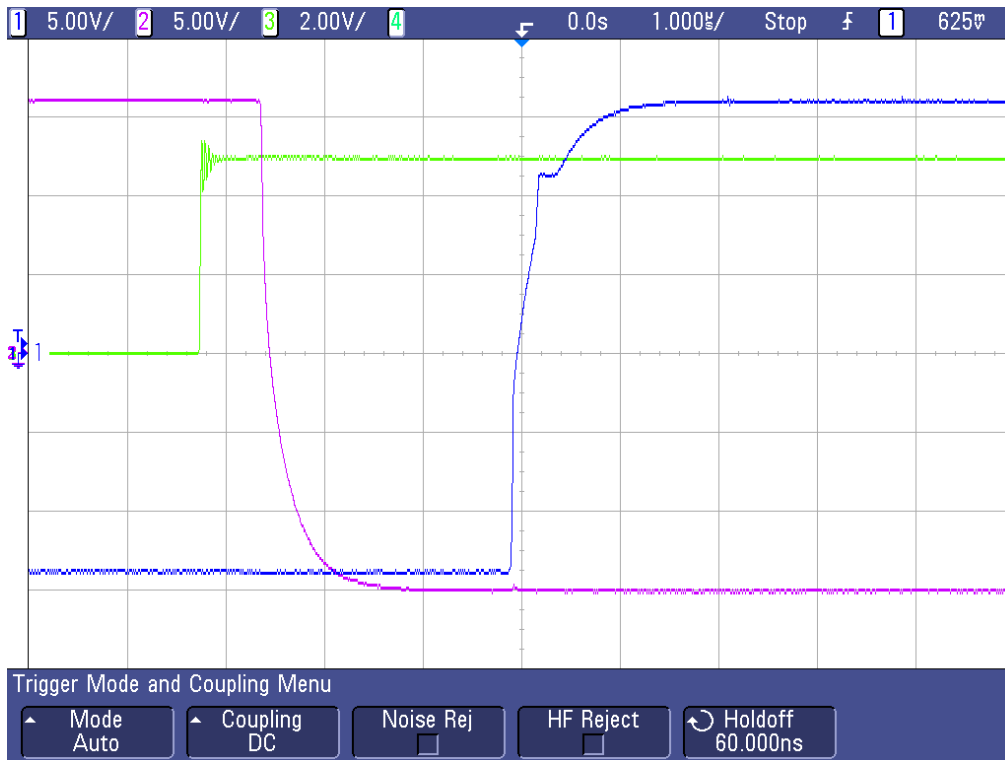
Signal Table for 10-Pole Ribbon Cable Connector

Typical Performance Curves

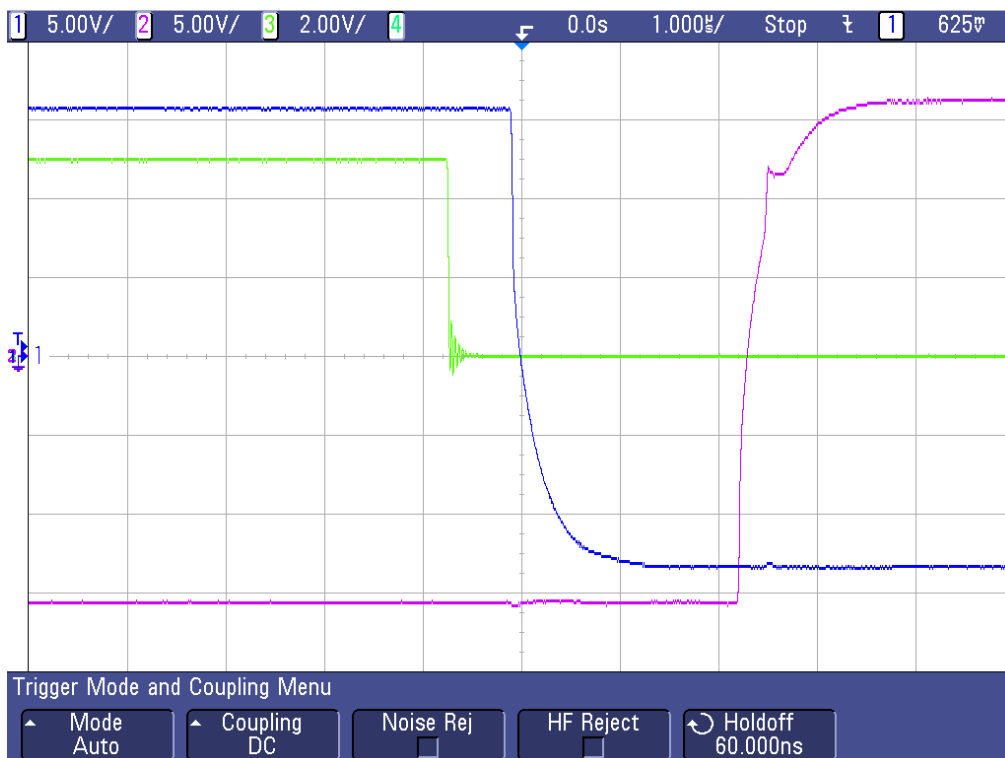


Typical Dependency between Baseplate Temperature and Temperature Output Signal for Infineon Module FF600R06ME3. There are a Number of Modules available from Infineon and Fuji using the same internal NTC. This Theoretical Curve matches Practical Measurements quite closely, but of course, it is directly dependent on the accuracy of the module's own NTC, which is not specified.

Typical Waveforms

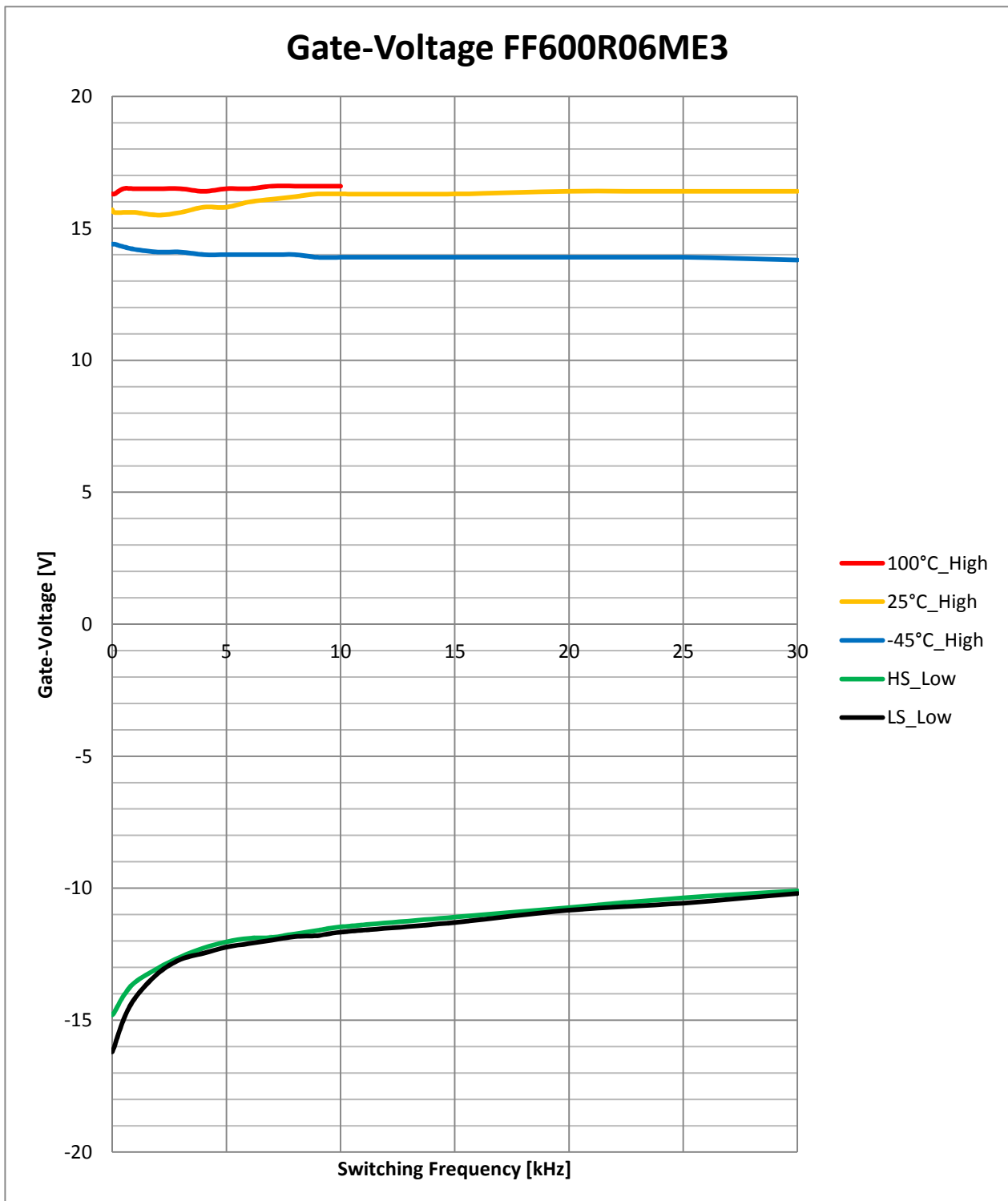


FF300R12MS4 Turn-On Dead-Time (Green: Control-Signal / Blue: High-Side Gate / Violet: Low-Side Gate)



FF300R12MS4 Turn-Off Dead-Time (Green: Control-Signal / Blue: High-Side Gate / Violet: Low-Side Gate)

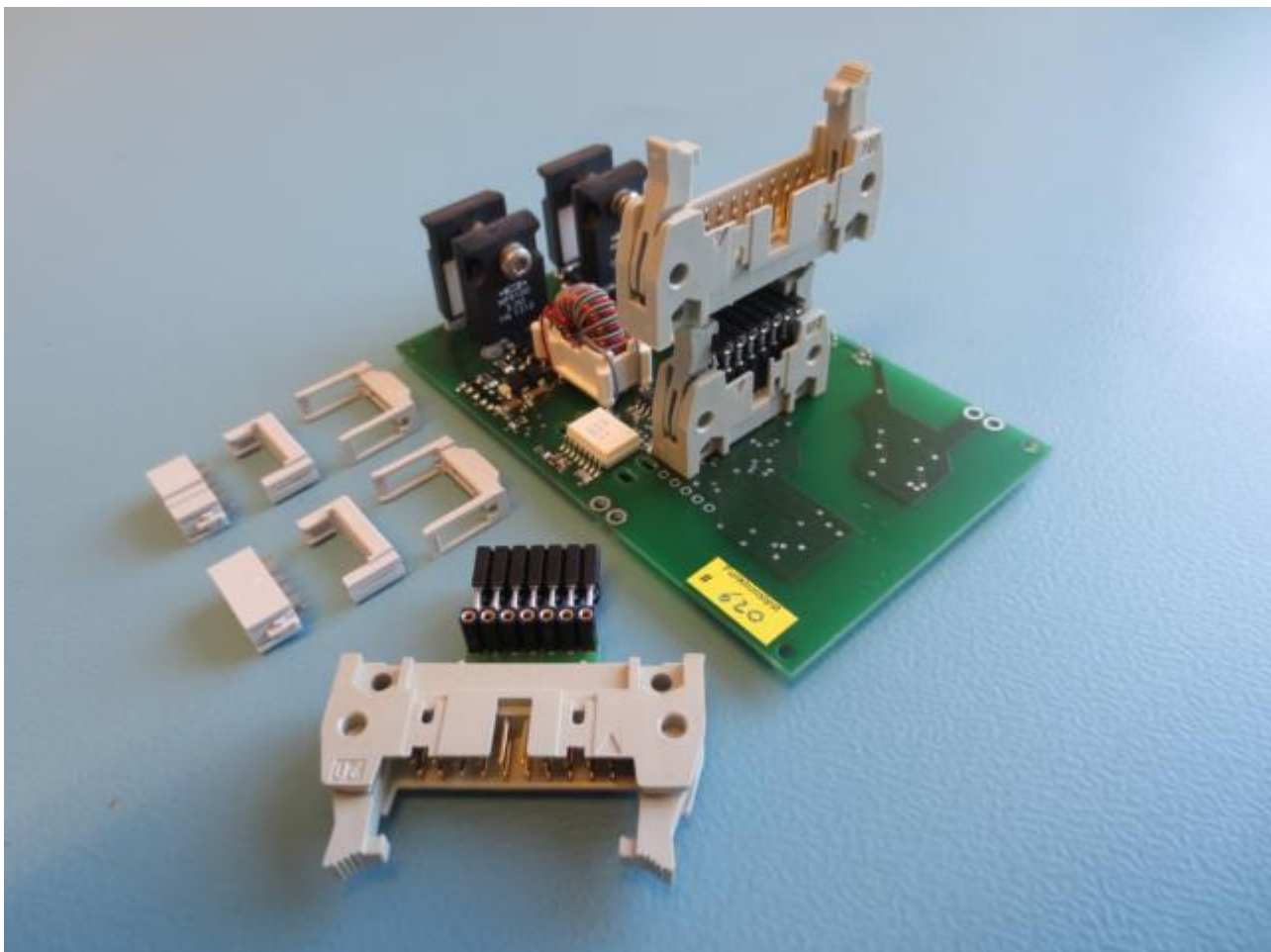
Gate Voltage-Drop Dependency on Dynamic Load and Temperature



Gate Voltage-Level Dependency on Dynamic Load at different Ambient Temperatures for the Infineon Module FF600R06ME3. The High-Level shows equal Temperature and Load Dependency on Both, the High-Side and the Low-Side Gate Channel. The Low-Level shows nearly no Temperature Dependency, but differs for High-Side and the Low-Side Gate Channel. At 100°C Ambient Temperature, the Maximum Frequency is 10kHz, see Thermal Derating Curve.

Accessories

- **Ribbon cable adapter for controllers prepared for Power-Integrations (CONCEPT) drivers:** this optional adapter can be plugged and mechanically fixed on the MACCON driver module. It offers limited compatibility to the widely used driver family from Power Integrations. Limitations are: temperature and current signals cannot be used, because they are not available in the Power Integrations driver connection scheme. The MACCON driver can only work in half-bridge mode, not with independently-controlled gates. The fault signal is ganged for both transistors of the half-bridge.
- **Isolation Angle for Snubber Capacitor** is required if the snubber capacitor shall be mounted directly on the driver PCB. It isolates the snubber capacitor from the signal interface lines on the driver PCB for the case of a failure event of the capacitor.
- **10-pole female ribbon cable connector** with two internal contact fingers per contact for reliable contacting (most standard connectors use only one internal contact finger). A set of two connectors is available.



Accessories:

- Set of 2 Quality Ribbon Cable Connectors with Two-Finger Contacts
- Cable Adapter (unplugged and plugged) to offer Limited Compatibility of MACCON Drivers and Drivers from Power Integrations