6 Electrical characteristics of the board

Stresses above the limits shown in *Table 2* may cause permanent damage to the devices present inside the board. These are stress ratings only and functional operation of the device under these conditions is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

A 15 V bias current measurement may be useful to check the working status of the board. If the measured value is considerably higher than the typical value, some damage has occurred to the board. Supply the control board using a 15 V power supply connected to J10, respecting the polarity.

Table 2. Board electrical characteristics

Board parameters	STEVAL-IHM021V2		Unit
	Min	Max	
15 V auxiliary supply range - J10	14.5	17	V
15 V bias current (typical)	8	10	mA
V_{mains} - J7	30	270	Vac

Warning: To avoid damaging the board when feeding the +15 V voltage supply through the auxiliary connector (J10), remove jumper J8 and supply the +15 V *before* connecting the mains.

7.2 Gate driving

As mentioned previously, gate driving of the switches is performed by the latest of the L6390 family of devices. Refer to *Section 8.1* for detailed information on the gate driving circuit and dead-time insertion. A fault signal is also fed back to the J5 connector if an overcurrent event is detected.

7.3 Amplifying network

The voltages across the three shunt resistors are amplified by K to correctly condition the current feedback signals and optimize the output voltage range for a given phase current range and A/D converter input dynamics. Refer to *Section 8.3* for more detailed information on how to dimension the op-amp conditioning network depending on your needs.

7.4 Brake feature

The brake feature performs motor braking by switching simultaneously to the low-side power MOSFET, thus shortening the motor phases.

Warning: **This feature is mandatory in applications that require the motor to operate in a flux-weakening region. In these conditions, the back-EMF generated by the rotor's spinning is greater than the bus voltage, and the brake feature prevents the motor from acting as a generator and destructively charging the bus capacitance. Refer to *Section 8.4* for additional information.**

7.5 Temperature feedback

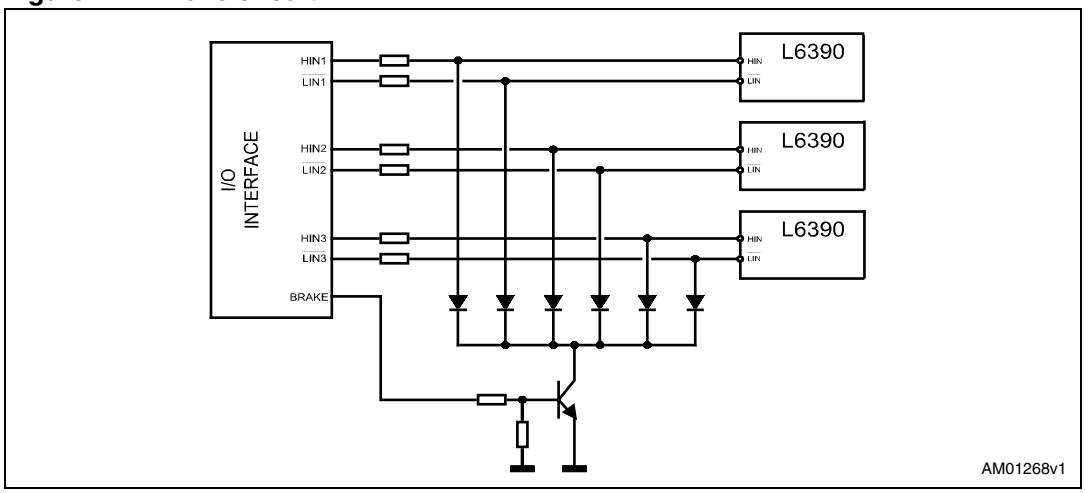
Temperature feedback is performed by way of an NTC. It enables monitoring of the power stage temperature so as to prevent any damage to the inverter caused by overtemperature.

Note that the I_{MAX} value can be modified by simply changing the values of the shunt resistors.

8.4 Brake function

The STEVAL-IHM021V2 demonstration board provides a brake function that, through the pull-up of a single brake signal, simultaneously turns the three low-side switches ON, shorting the 3-phase load. The feature is accessed using one single small-signal bipolar transistor (Q7), whose function is to pull down the cathodes of six small signal diodes connected to each of the six logic inputs (HIN1, $\overline{\text{LIN}}$ 1, HIN2, $\overline{\text{LIN}}$ 2, HIN3, $\overline{\text{LIN}}$ 3) of the L6390 gate drivers. The in-series resistors together with the input lines avoid any conflict with the external controller input signals, giving priority to the brake signal (see *Figure 11*).

Figure 11. Brake circuit



The brake signal is active high and 3.3/5 V compatible.

Table 3. Truth table

HINx	$\overline{\text{LIN}}$ x	$\overline{\text{SD}}$	Brake	LVGx	HVGx	Load
x	x	0	x	0	0	Tri-state
x	x	1	1	1	0	brake
0	0	1	0	1	0	Normal operation
0	1	1	0	0	0	
1	0	1	0	0	0	
1	1	1	0	0	1	

Warning: This feature is mandatory in applications that require the motor to operate in the flux-weakening region. In these conditions, the back-EMF generated by the rotor spinning is greater than the bus voltage and the brake feature prevents the motor from acting as a generator, and destructively charging the bus capacitance.

Refer to user manual UM1052 “STM32F103xx or STM32F100xx PMSM single/dual FOC SDK v3.0” for detailed information about *“STM32 PMSM FOC SDK v3.0”*

9.4 Configuration of STM32 PMSM FOC SDK v3.0 for the STEVAL-IHM021v2

When using the ST MC Workbench configuration PC tool, the following parameters should be set in the “Power stage” section:

Table 4. ST MC Workbench configuration PC tool: power stage parameters

Parameter	STEVAL-IHM032v1 default value	Unit
ICL Shutout	Disabled	
Dissipative brake	Disabled	
Bus voltage sensing	Enabled	
Bus voltage divider	125	
Min rated voltage	60	V
Max rated voltage	380	V
Nominal voltage	325	V
Temperature sensing	Enabled	
V0(1)	1055	mV
T0	25	°C
ΔV/ΔT(1)	22	mV/°C
Max working temperature on sensor	70	°C
Overcurrent protection	Enabled	
Comparator threshold	0.5	V
Overcurrent network gain	0.45	V/A
Expected overcurrent threshold	1.11	A
Overcurrent feedback signal polarity	Active low	
Overcurrent protection disabling network	Enabled	
Overcurrent protection disabling network polarity	Active high	
Current sensing	Enabled	
Current reading topology	Three shunt resistor	
Shunt resistor(s) value	0.45	Ω
Amplifying network gain	2.9	
T-noise	1250	ns
T-rise	1250	ns
Power switches: min dead-time	500	ns
Power switches: max switching frequency	50	kHz

Table 4. ST MC Workbench configuration PC tool: power stage parameters

Parameter	STEVAL-IHM032v1 default value	Unit
U,V,W driver: high side driving signal	Active high	
U,V,W driver: low side driving signal complemented from high side	Disabled	
U,V,W driver: low side driving signal polarity	Active low	

1. These values are computed for V_{dd_micro} = 3.3 V