

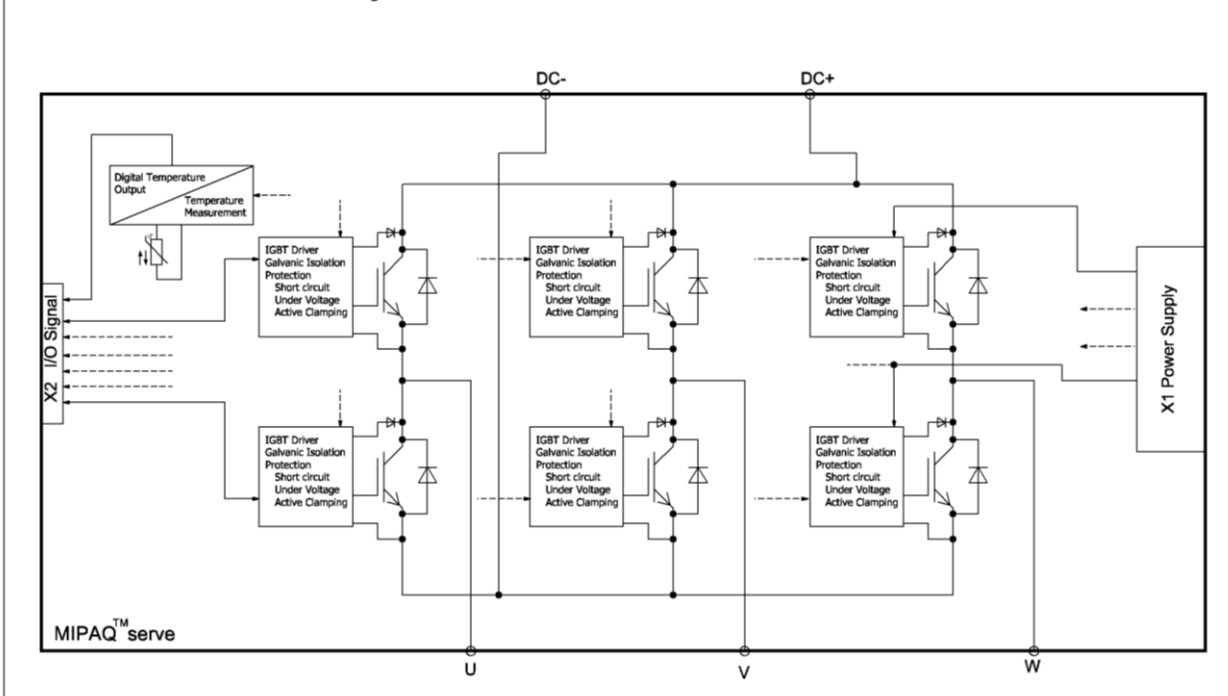
#### Key data

Power module using IGBT4 technology in sixpack configuration.  
Isolated IGBT driver, protection and temperature sensor included.

Topology	B6I
Rated semiconductor data	1200V, 150A
Load type	Inductive, resistive
Typical applications	Industrial drives, UPS, solar inverters, auxiliary inverters
Sensors and protection	temperature, short circuit, signal transmission, UVLO for all power supplies
Interface IGBT	Electrical, 5V-CMOS, Galvanic Isolation according to IEC61800-5-1
Standards	IEC61800-5-1, UL94, RoHS



MIPAQ™ serve Internal Function Block Diagram



### Electrical data – power part

			min	typ	max	
DC link voltage	$L_s = 30\text{nH}$ $-40 < T_{vj} < 150^\circ\text{C}$ $0 < I_{C, \text{turn off}} < 2 \cdot I_{C, \text{max}}$	$U_{DC}$			850V	V
IGBT continuous DC collector current	$T_{\text{case}} = 100^\circ\text{C}$ $T_{vj} = T_{vj, \text{op max}}$	$I_{C, \text{nom}}$			150	A
IGBT collector-emitter voltage	$T_{vj} = 25^\circ\text{C}$	$U_{CES}$			1200	V
IGBT collector-emitter saturation voltage	$T_{vj} = 25^\circ\text{C} @ I_C = 150\text{A}$ $T_{vj} = 150^\circ\text{C} @ I_C = 150\text{A}$	$U_{CEsat}$		1,75 2,10	2,15	V
Diode repetitive peak reverse voltage	$T_{vj} = 25^\circ\text{C}$	$U_{RRM}$			1200	V
Diode forward voltage	$T_{vj} = 25^\circ\text{C} @ I_C = 150\text{A}$ $T_{vj} = 150^\circ\text{C} @ I_C = 150\text{A}$	$U_F$		1,70 1,65	2,20	V
Operating junction temperature	IGBT and Diode	$T_{vj, \text{op}}$			150	°C
Turn on energy loss per pulse	IGBT, $U_{DC} = 600\text{V}$ , $I_C = 150\text{A}$ $T_{vj} = 150^\circ\text{C}$ , $di/dt = 2,8\text{kA}/\mu\text{s}$	$E_{\text{on}}$		15,0		mJ
Turn off energy loss per pulse	IGBT, $U_{DC} = 600\text{V}$ , $I_C = 150\text{A}$ $T_{vj} = 150^\circ\text{C}$ , $du/dt = 3,5\text{kV}/\mu\text{s}$	$E_{\text{off}}$		13,9		mJ
Reverse recovery energy	Diode, $U_{DC} = 600\text{V}$ , $I_F = 150\text{A}$ $T_{vj} = 150^\circ\text{C}$ , $di/dt = 2,8\text{kA}/\mu\text{s}$	$E_{\text{rec}}$		12,0		mJ

### Electrical data – control part

Auxiliary power supply: IGBT Gate (on X1)			min	typ	max	
IGBT driver positive supply	Voltage	$U_{GS P1,2,3,4}$	13	16	18	V
	Current at $f_{sw} = 20\text{kHz}$ , $U_{GSP1,2,3} = +15\text{V}$ $T_{vj} = 25^\circ\text{C}$	$I_{GS P1,2,3}$			19	mA
		$I_{GS P4}$			31	mA
IGBT driver negative supply	Voltage	$U_{GS N1,2,3,4}$	-10	-8	-5	V
	Current @ $f_{sw} = 20\text{kHz}$ , $U_{GSN} = -8\text{V}$ $T_{vj} = 25^\circ\text{C}$	$ I_{GS N1,2,3} $			18	mA
		$ I_{GS N4} $			23	mA
IGBT driver undervoltage lockout threshold	For each channel	$U_{GS\_UVLO}$	10,4		12,6	V
IGBT driver undervoltage lockout hysteresis	For each channel	$U_{GS\_UVLO\_H}$	0,7			V

Auxiliary power supply: Logic (on X2)			min	typ	max	
Logic power supply	Voltage	$U_{LS}$	4,5	5	5,5	V
	Current @ $f_{sw} = 20\text{kHz}$ , $U_{LS} = +5\text{V}$	$I_{LS}$			55	mA
Logic power supply undervoltage lockout threshold		$U_{LS\_UVLO}$	3,5		4,3	V
Logic power supply undervoltage lockout hysteresis		$U_{LS\_UVLO\_H}$	0,3			V

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preliminary data

Driver logic input/output, protection and sensors (on X2)		min	typ	max		
Digital input (IGBT turn-on/off and RESET)	High level voltage	$U_{IN\_H}$	3,5		5,5	V
	Low level voltage	$U_{IN\_L}$	-0,3		1,5	V
	Input current per input	$I_{IN}$		100	400	$\mu$ A
	Minimum pulse width on /RST for ENABLE/SHUTDOWN	$t_{min\_RST1}$		40		ns
	Minimum pulse width on /RST for resetting /FLT <sub>BOT</sub> , /FLT <sub>TOP</sub>	$t_{min\_RST2}$		500		ns
Digital output level	Open drain, internally pulled up, max. 10 mA	$U_{RDYT}$ , $U_{RDYB}$ , $U_{FLTT}$ , $U_{FLTB}$ , $U_{TMP}$	0		$U_{LS}$	V
Digital temperature output	Frequency depends on measured temperature	$f_{TMP}$	0,2		18	kHz
	Pulses counted in 100ms	N	20		1800	
Minimum pulse width	IGBT-turn-on signal (=high) on each channel @ $U_{DC\_max}$	$t_{PW\_min}$	1			$\mu$ s
Minimum dead time	Between TOP IGBT and BOT IGBT	$t_{dead}$	1			$\mu$ s
Switching frequency	Each driver channel	$f_{sw}$	0		20	kHz
Short circuit protection	Desaturation threshold. Shutdown when exceeded. Each channel	$U_{CE\_desat}$	8,5	9	9,5	V
	Reaction time. Shutdown after short circuit was detected. Each channel	$t_{desat}$			8	$\mu$ s
Propagation delay	Each channel	$t_{prop\_delay}$		320		ns
Propagation delay deviation	Between two channels	$t_{prop\_delay\_dev}$			15	ns

## Isolation Management

		min	typ	max	
Isolation management designed for		$U_{Line}$	480		$V_{RMS}$
Isolation test voltage	Logic to power side $f=50\text{Hz}$ , $t=1\text{s}$	$V_{isol}$	2,5		$kV_{RMS}$
	Life parts to base plate $F=50\text{Hz}$ , $1=1\text{min}$	$V_{isol}$	2,5		$kV_{RMS}$
Comparative tracking index		CTI	225		
Clearance distance, including internal clearance DIN7984 with flat head, SKS-5 spring washer, DIN125 flat washer,	terminal – terminal (AC-DC, AC-AC, DC-DC)	$l_{cl1}$	11		mm
	power side – heat sink	$l_{cl2}$	11		mm
	Logic side - heatsink	$l_{cl3}$	4,5		mm
	Logic side - power side	$l_{cl4}$	8		mm
Creepage distance Under usage of screws according DIN7984 with flat head, SKS-5 spring washer, DIN125 flat washer	terminal – terminal (AC-DC, AC-AC, DC-DC)	$l_{cr1}$	25		mm
	terminal – heat sink	$l_{cr2}$	20		mm
	Logic side - heatsink	$l_{cr3}$	8,5		mm
	Logic side - power side	$l_{cr4}$	8		mm

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## preliminary data

Environmental conditions			min	typ	max	
Storage temperature		$T_{stg}$	-40		+125	°C
Operating ambient temperature	$f_{sw} \leq 20kHz$		-40		+65	°C
Humidity	no condensation	Rel. H.	5		85	%
Installation height					1000	m
Vibration	according to IEC60721				12	g
Shock	according to IEC60721				10	g
Protection degree			IP00			
Pollution degree			2			
Terminal connection torque	Screw M6	$M_{M6}$	3,0		6,0	Nm
Mounting torque	Screw M5	$M_{M5}$	3,0		6,0	Nm
Dimensions	length x width x height		130 x 103 x 28,5			mm <sup>3</sup>
Weight				419		g

### Thermal data

			min	typ	max	
Thermal resistance junction to case	Each IGBT	$R_{thjc\_IGBT}$			0,22	K/W
Thermal resistance junction to case	Each Diode	$R_{thjc\_FWD}$			0,4	K/W
Thermal resistance case to heatsink	Complete module	$R_{thch\_Module}$			0,009	K/W

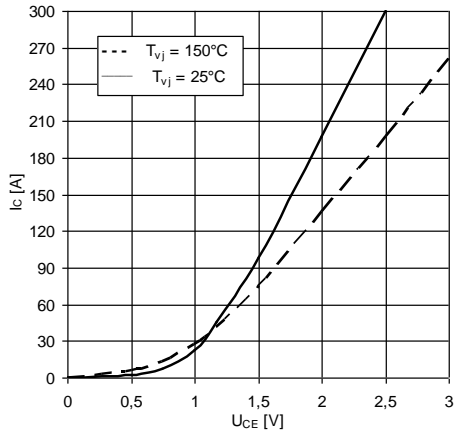
### Module

			min	typ	max	
Stray inductance module		$L_{sCE}$		20		nH
Material of module baseplate			Cu			

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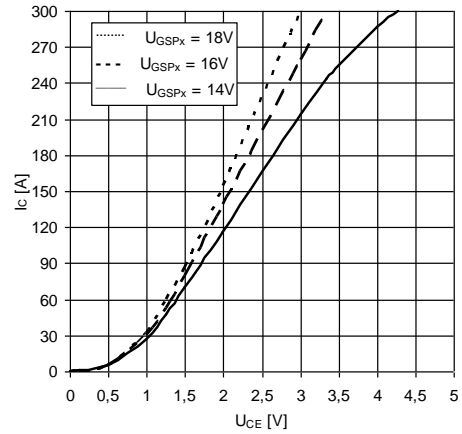
### Output characteristic IGBT

$I_c = f(U_{CE}) @ U_{GSPx} = 16V$



### Output characteristic IGBT

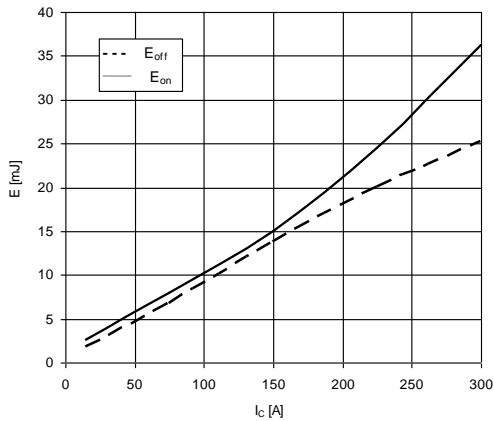
$I_c = f(U_{CE}) @ T_{vj} = 150^\circ C$



### Switching losses IGBT

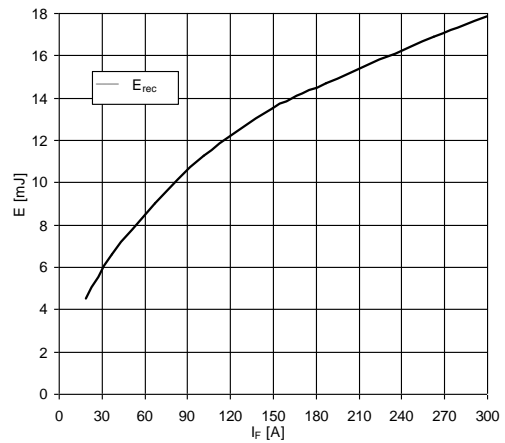
$E_{on} = f(I_c), E_{off} = f(I_c)$

$U_{GSPx} = 16V, U_{GSNx} = -8V, T_{vj} = 150^\circ C$



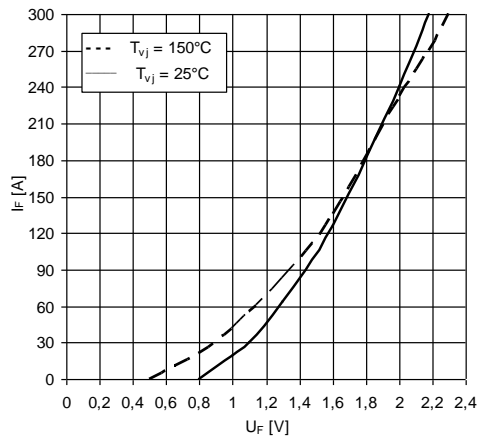
### Switching losses diode

$E_{rec} = f(I_F) @ U_{CE} = 600V, T_{vj} = 150^\circ C$



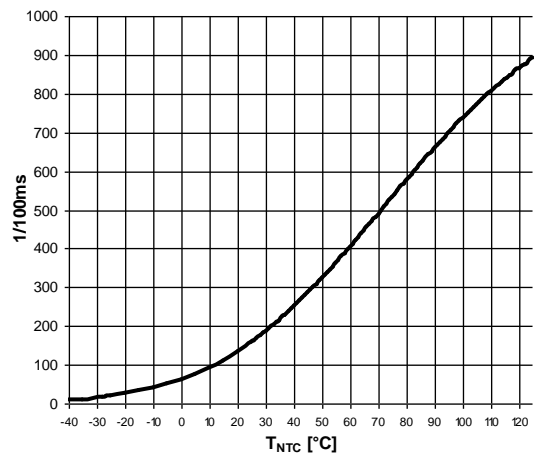
### Forward characteristic diode

$I_F = f(U_F)$

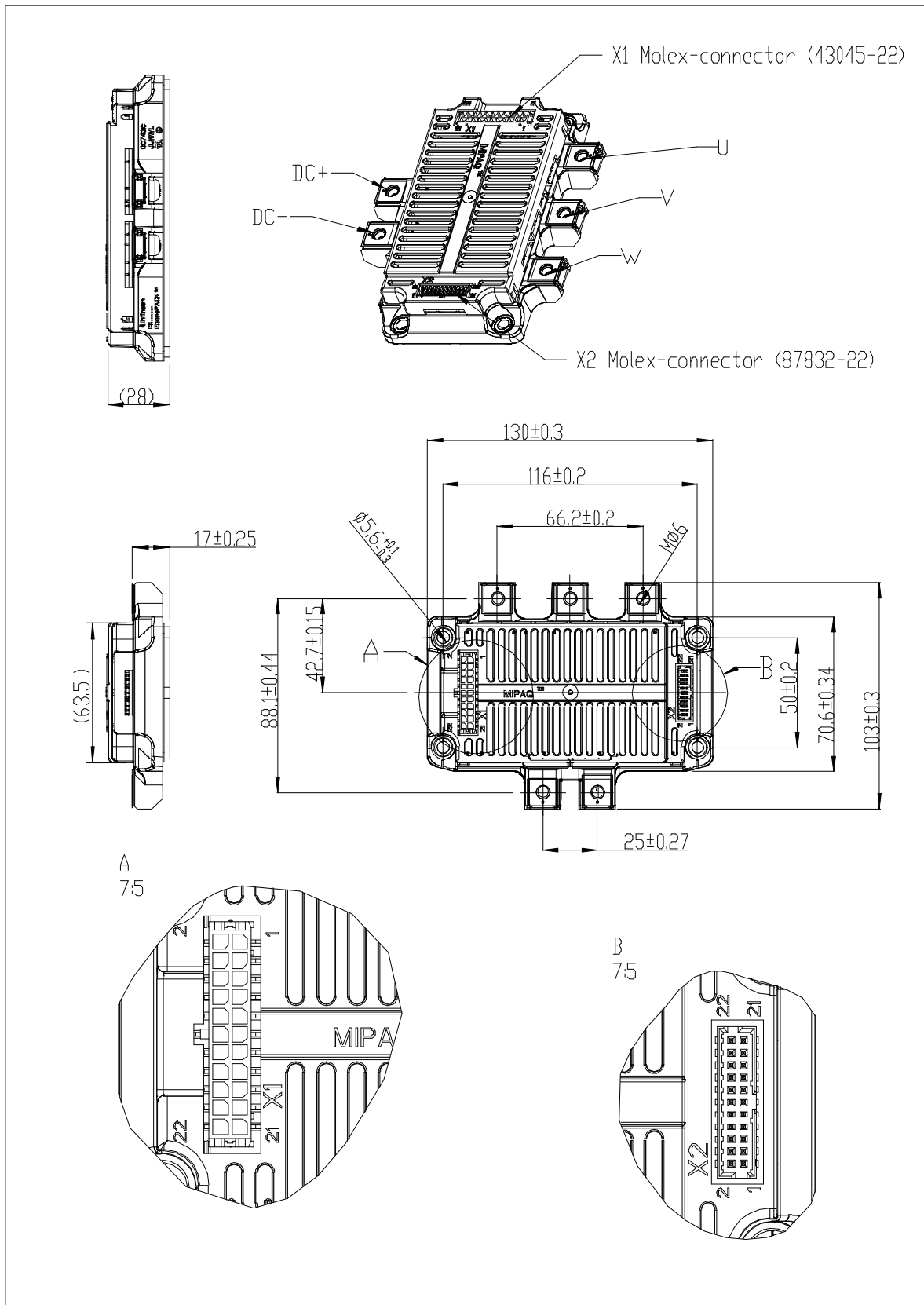


### Digital temperature output

Number of pulses within 100ms

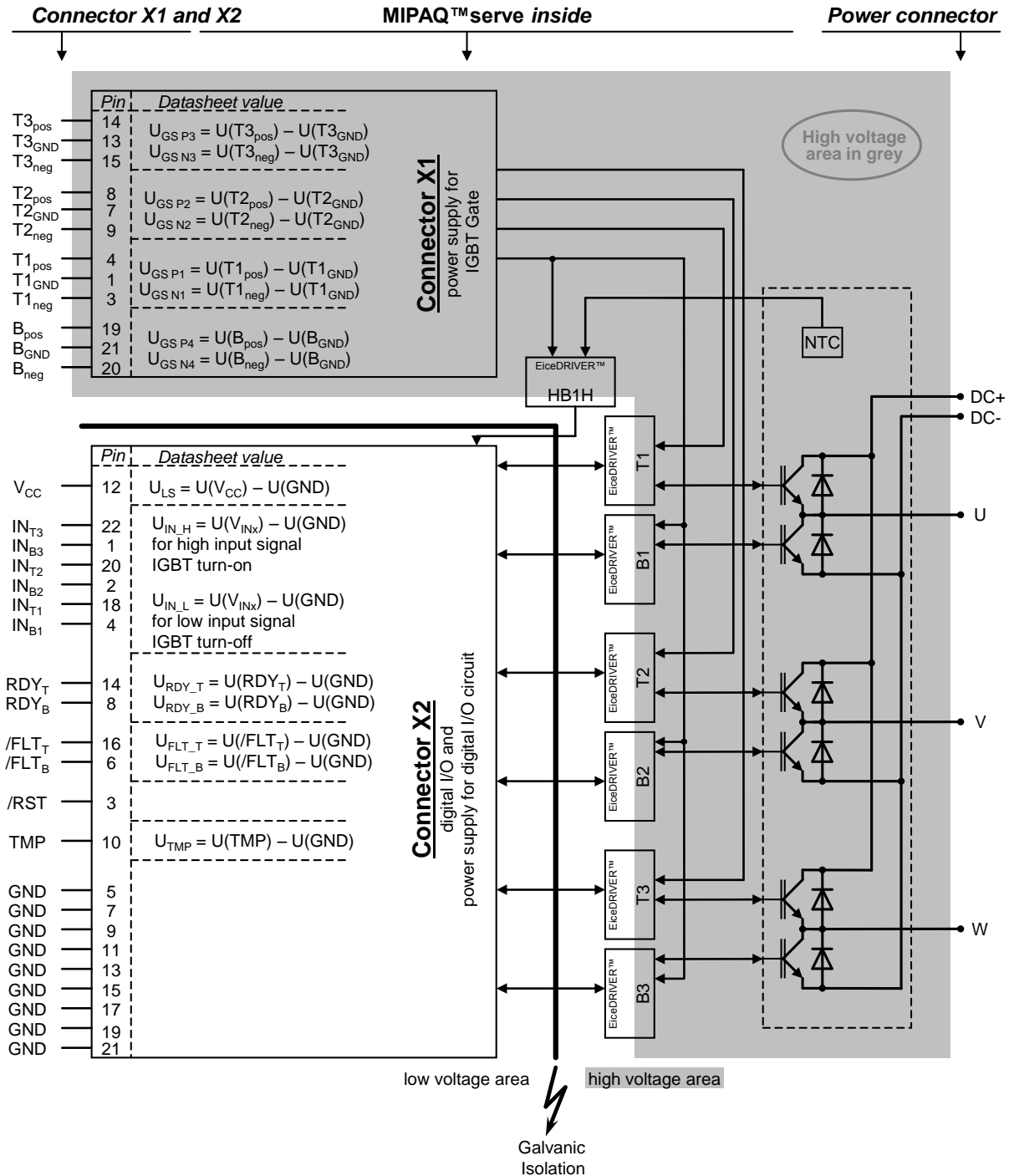


Mechanical drawing



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### Circuit diagram



### Further information

- X1: Molex Microfit 22 pins
- X2: Molex Milligrid 22 pins

All information regarding connectors can be found in AN2009-07

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