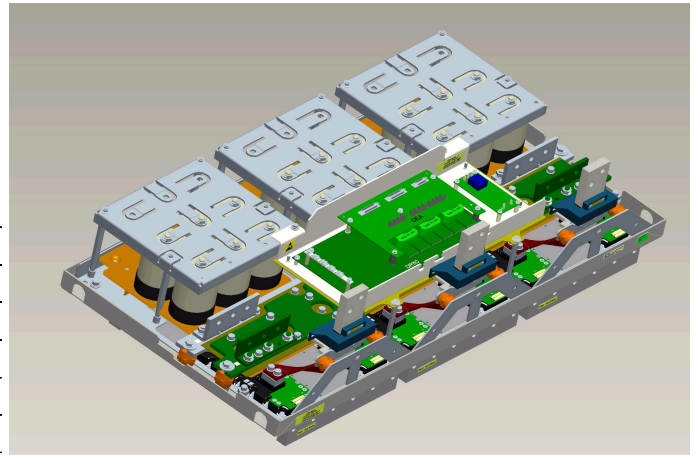


General information

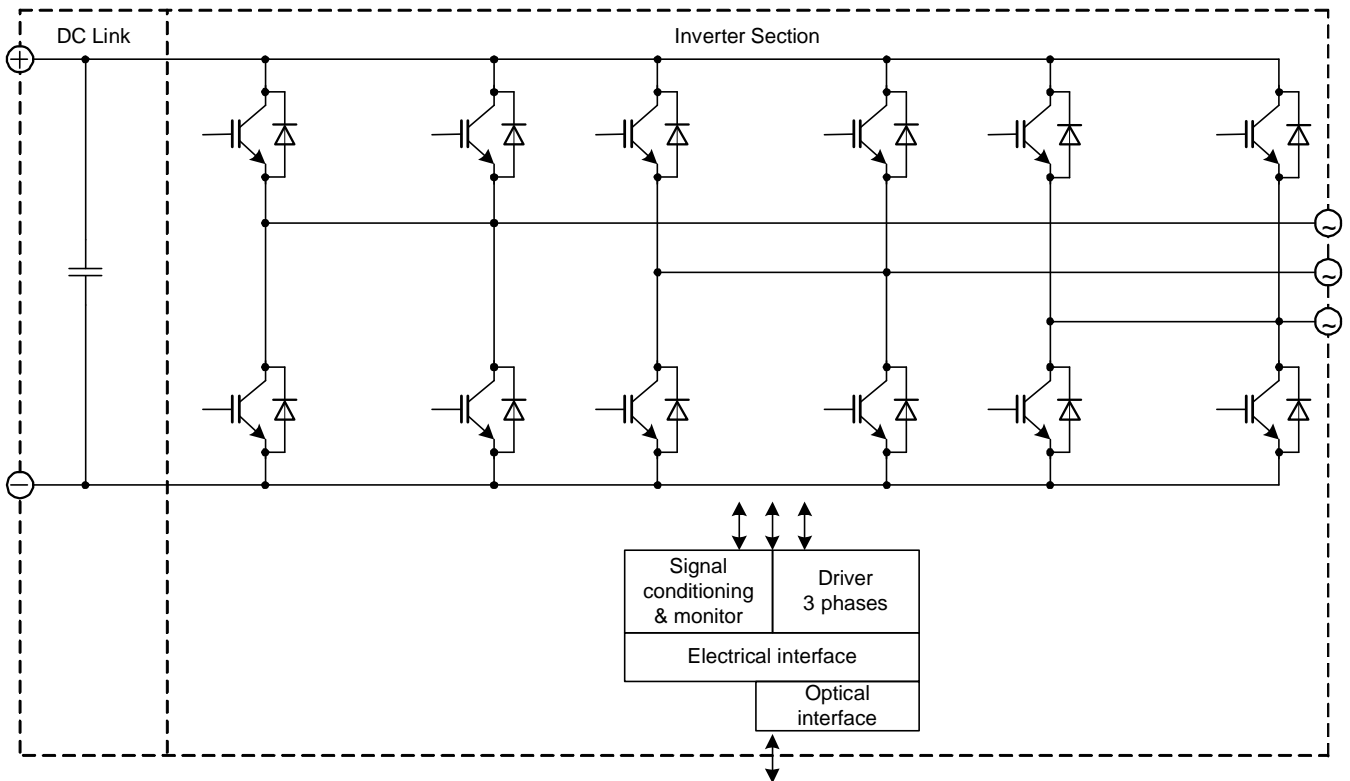
IGBT Stack for typical voltages of up to 690 V_{RMS}
Rated output current 1200 A_{RMS}

- High power converter
- Wind power
- Motor drives

- PrimePACK™3 module with integrated NTC
- Extended operational temperature
- Low V_{cesat}



Topology	B6I
Application	Inverter
Load type	Resistive, inductive
Semiconductor (Inverter Section)	6x FF1000R17IE4
DC Link	7.2 mF
Heatsink	Water cooled
Implemented sensors	Current, voltage, temperature
Driver signals IGBT	Optical HFBR-1521;HFBR-2521
Sales - name	6MS20017E43W38170
SP - No.	SP001036766



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Technical Information

ModSTACK™ HD

6MS20017E43W38170



Preliminary data

Absolute maximum rated values

Collector-emitter voltage	IGBT; $T_{vj} = 25^{\circ}\text{C}$	V_{CES}	1700	V
Repetitive peak reverse voltage	Diode; $T_{vj} = 25^{\circ}\text{C}$	V_{RRM}	1700	V
DC link voltage		V_{DC}	1250	V
Insulation management	according to installation height of 2000 m	V_{line}	690	V_{RMS}
Insulation test voltage	according to EN 50178, $f = 50\text{ Hz}$, $t = 1\text{ s}$	V_{ISOL}	2.5	kV_{RMS}
Repetitive peak collector current inverter section (IGBT)	$t_p = 1\text{ ms}$	I_{CRM2}	2500	A
Repetitive peak forward current inverter section (Diode)	$t_p = 1\text{ ms}$	I_{FRM2}	2500	A
I^2t -value inverter section (Diode)	$V_R = 0\text{ V}$, $t_p = 10\text{ ms}$, $T_{vj} = 125^{\circ}\text{C}$	I^2t	252	kA^2s
Continuous current inverter section		I_{AC2}	1200	A_{RMS}
Junction temperature	under switching conditions	T_{vjop}	150	$^{\circ}\text{C}$
Switching frequency inverter section		f_{sw2}	4	kHz

Notes

Further maximum ratings are specified in the following dedicated sections

Characteristic values

DC Link

			min.	typ.	max.	
Rated voltage		V_{DC}		1100	1200	V
Over voltage shutdown				1250		V
Capacitor	1 s, 18 p, rated tol. $\pm 10\%$	C_{DC}		7.2		mF
		type		Foil		
Maximum ripple current	per device	I_{ripple}			49	A_{RMS}
Balance or discharge resistor	per DC link unit	R_b		15.7		$\text{k}\Omega$

Notes

Operation above 1100 V subject to reduced operating time according to EN 61071

Inverter Section

			min.	typ.	max.	
Rated continuous current	$V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $\cos(\varphi) = 0.85$, $f_{AC\ sine} = 50\text{ Hz}$, $f_{sw} = 3000\text{ Hz}$, $T_{inlet} = 40^{\circ}\text{C}$, $T_j \leq 150^{\circ}\text{C}$	I_{AC}			1200	A_{RMS}
Rated continuous current for 150% overload capability	$I_{AC\ 150\%} = 1290\text{ A}_{RMS}$, $t_{on\ over} = 60\text{ s}$, $T_j \leq 150^{\circ}\text{C}$	$I_{AC\ over1}$			860	A_{RMS}
Rated continuous current for 150% overload capability	$I_{AC\ 150\%} = 1410\text{ A}_{RMS}$, $t_{on\ over} = 3\text{ s}$, $T_j \leq 150^{\circ}\text{C}$	$I_{AC\ over2}$			940	A_{RMS}
Over current shutdown	within 15 μs	$I_{AC\ OC}$		2500		A_{peak}
Power losses	$I_{AC} = 1200\text{ A}$, $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $\cos(\varphi) = 0.85$, $f_{AC\ sine} = 50\text{ Hz}$, $f_{sw} = 3000\text{ Hz}$, $T_{inlet} = 40^{\circ}\text{C}$, $T_j \leq 150^{\circ}\text{C}$	P_{loss}		19500		W

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Technical Information

ModSTACK™ HD

6MS20017E43W38170



Preliminary data

Controller interface

Driver and interface board	ref. to separate Application Note				DR110	
Optical interface board	ref. to separate Application Note				OEA101	
				min.	typ.	max.
Auxiliary voltage		V_{aux}	18	24	30	V
Auxiliary power requirement	$V_{aux} = 24\text{ V}$	P_{aux}		40		W
Digital input level	resistor to GND 1.8 k Ω , capacitor to GND 4 nF, logic high = on, min. 15 mA	$V_{in\ low}$	0		4	V
		$V_{in\ high}$	11		15	V
Digital output level	open collector, logic low = no fault, max. 15 mA	$V_{out\ low}$	0		1.5	V
		$V_{out\ high}$		15		V
Analog current sensor output inverter section	load max 1 mA, @ 1200 A _{RMS}	$V_{IU\ ana2}$ $V_{IV\ ana2}$ $V_{IW\ ana2}$	3.7	3.8	3.9	V
Analog DC link voltage sensor output	load max 1 mA, @ 1100 V	$V_{DC\ ana}$	7.7	7.9	8.1	V
Analog temperature sensor output inverter section (NTC)	load max 1 mA, @ $T_{NTC} = 71\text{ }^{\circ}\text{C}$, corresponds to $T_j = 148\text{ }^{\circ}\text{C}$ at rated conditions	$V_{\Theta\ NTC2}$		8.3		V
Analog temperature sensor output inverter section (Simulated)	load max 1 mA, @ $T_{NTC} = 71\text{ }^{\circ}\text{C}$, corresponds to $T_j = 148\text{ }^{\circ}\text{C}$ at rated conditions	$V_{\Theta\ sim2}$		8.7		V
Over temperature shutdown inverter section		$V_{Error\ OT2}$		9.1		V
Optical input power		$P_{opt\ in}$		12		μW
Optical output power		$P_{opt\ out}$			60	μW

System data

				min.	typ.	max.	
EMC robustness	according to IEC 61800-3 at named interfaces	power	V_{Burst}		2		kV
		control	V_{Burst}		1		kV
		aux (24V)	V_{surge}		1		kV
Storage temperature		T_{stor}	-40		80	$^{\circ}\text{C}$	
Operational ambient temperature	PCB, DC link capacitor, bus bar, excluding cooling medium	$T_{op\ amb}$	-25		55	$^{\circ}\text{C}$	
Cooling air velocity	PCB, DC link capacitor, bus bar, standard atmosphere	V_{air}	2			m/s	
Humidity	no condensation	Rel. F	0		95	%	
Vibration	according to IEC 60721				5	m/s^2	
Shock	according to IEC 60721				40	m/s^2	
Protection degree					IP00		
Pollution degree					2		
Dimensions	width x depth x height		1090	596	342	mm	
Weight				153		kg	

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Technical Information

ModSTACK™ HD

6MS20017E43W38170



Preliminary data

Heatsink water cooled

			min.	typ.	max.	
Water flow	according to coolant specification from Infineon	$\Delta V/\Delta t$	45			dm ³ /min
Water pressure					8	bar
Water pressure drop	at 45 dm ³ /min water flow	Δp		200		mbar
Coolant inlet temperature		T_{inlet}	-40		55	°C
Thermal resistance heatsink to ambient	per switch	$R_{th,ha}$		0.038		K/W
Cooling channel material				Copper		

Notes

Composition of coolant: Water and 52 vol. % Antifrogen N

Overview of optional components

	Unit 1	Inverter Section	Unit 3
Parallel interface board			
Optical interface board		×	
Voltage sensor		×	
Current sensor		×	
Temperature sensor		×	
Temperature simulation		×	
DC link capacitors		×	
Collector-emitter Active Clamping		×	

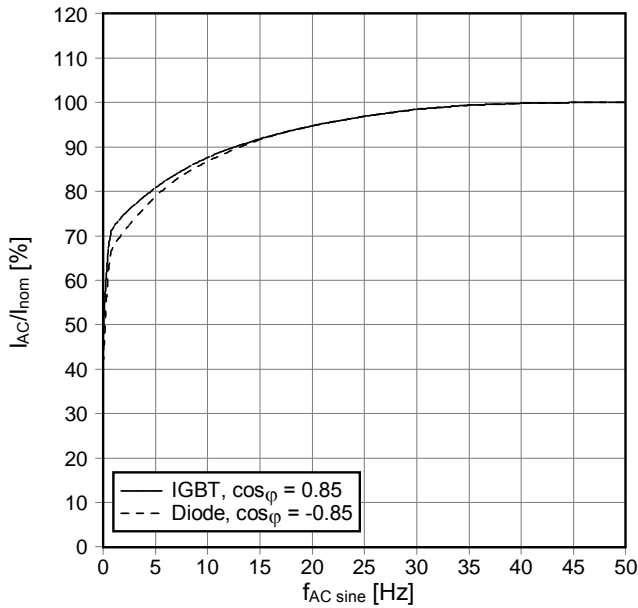
Notes

Setting of Active Clamping TVS-Diodes: $V_z = 1280 \text{ V}$

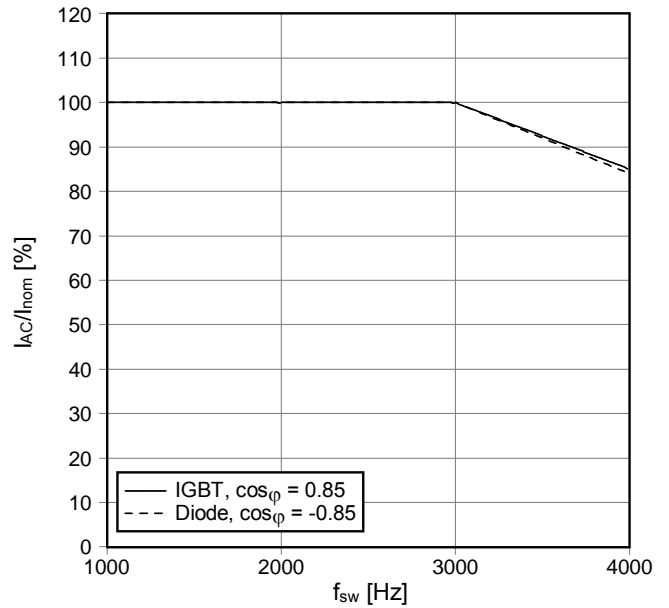
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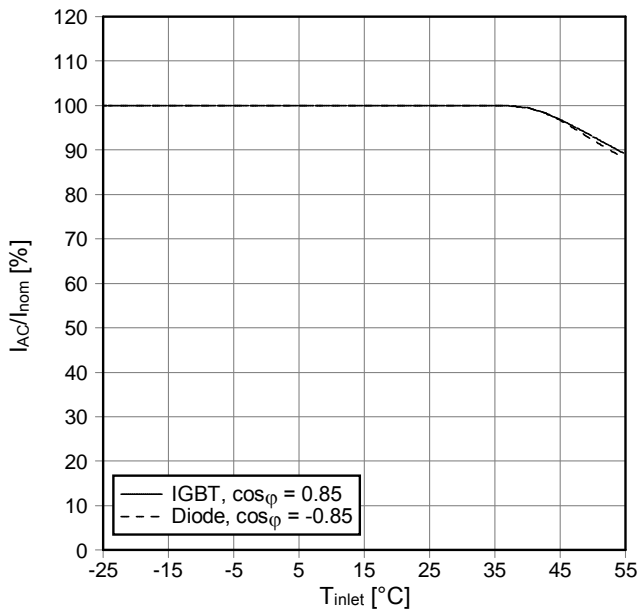
$f_{AC\ sine}$ - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{sw} = 3\text{ kHz}$, $\cos\phi = \pm 0.85$
 $T_{inlet} = 40^\circ\text{C}$ and nom. cooling conditions



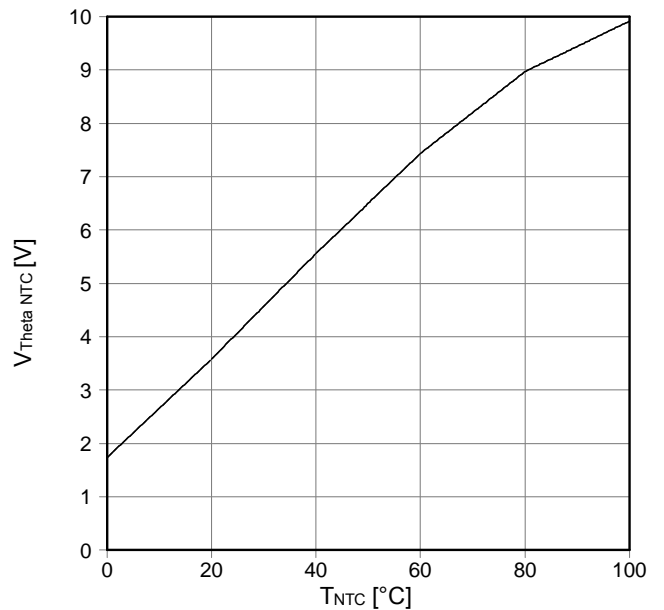
f_{sw} - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{AC\ sine} = 50\text{ Hz}$, $\cos\phi = \pm 0.85$
 $T_{inlet} = 40^\circ\text{C}$ and nom. cooling conditions



T_{inlet} - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{AC\ sine} = 3\text{ kHz}$, $f_{AC\ sine} = 50\text{ Hz}$
 $\cos\phi = \pm 0.85$ and nom. cooling conditions



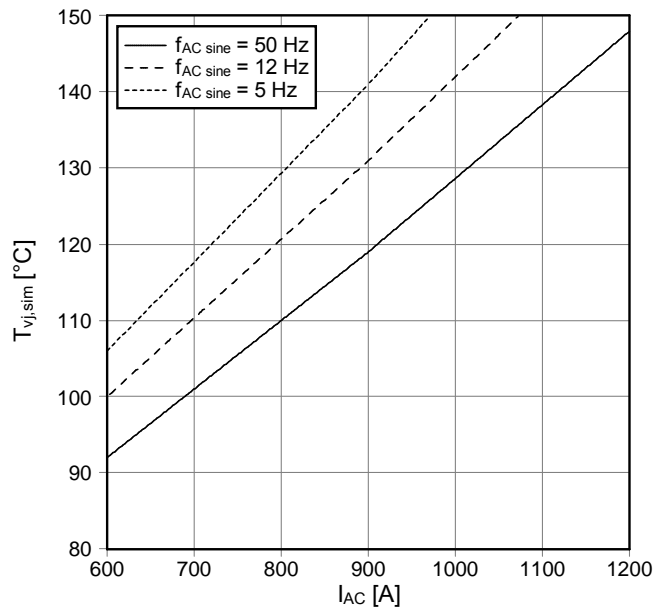
Analog temperature sensor output $V_{Theta\ NTC}$
 Sensing NTC of IGBT module



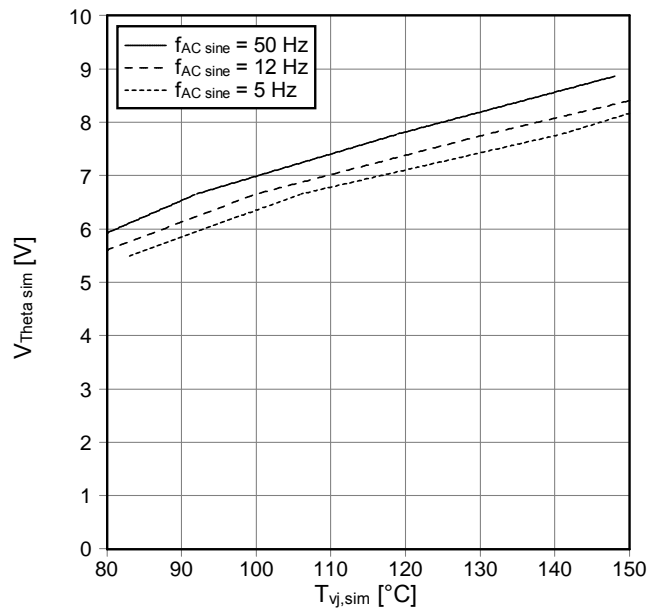
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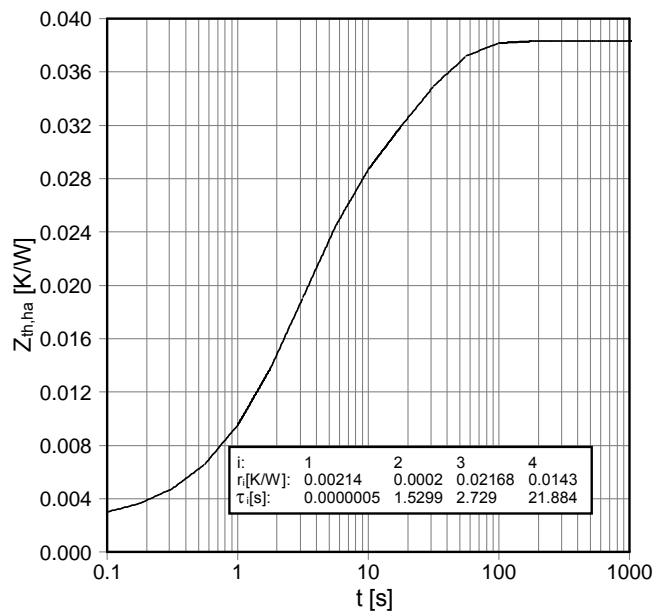
$T_{vj, sim}$ vs. I_{AC} - Simulated junction temperature
 $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{sw} = 3\text{ kHz}$
 $T_{inlet} = 40^\circ\text{C}$ and nom. cooling conditions



Analog temperature sensor output $V_{Theta sim}$
 $V_{DC} = 1100\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{sw} = 3\text{ kHz}$,
 $T_{inlet} = 40^\circ\text{C}$ and nom. cooling conditions

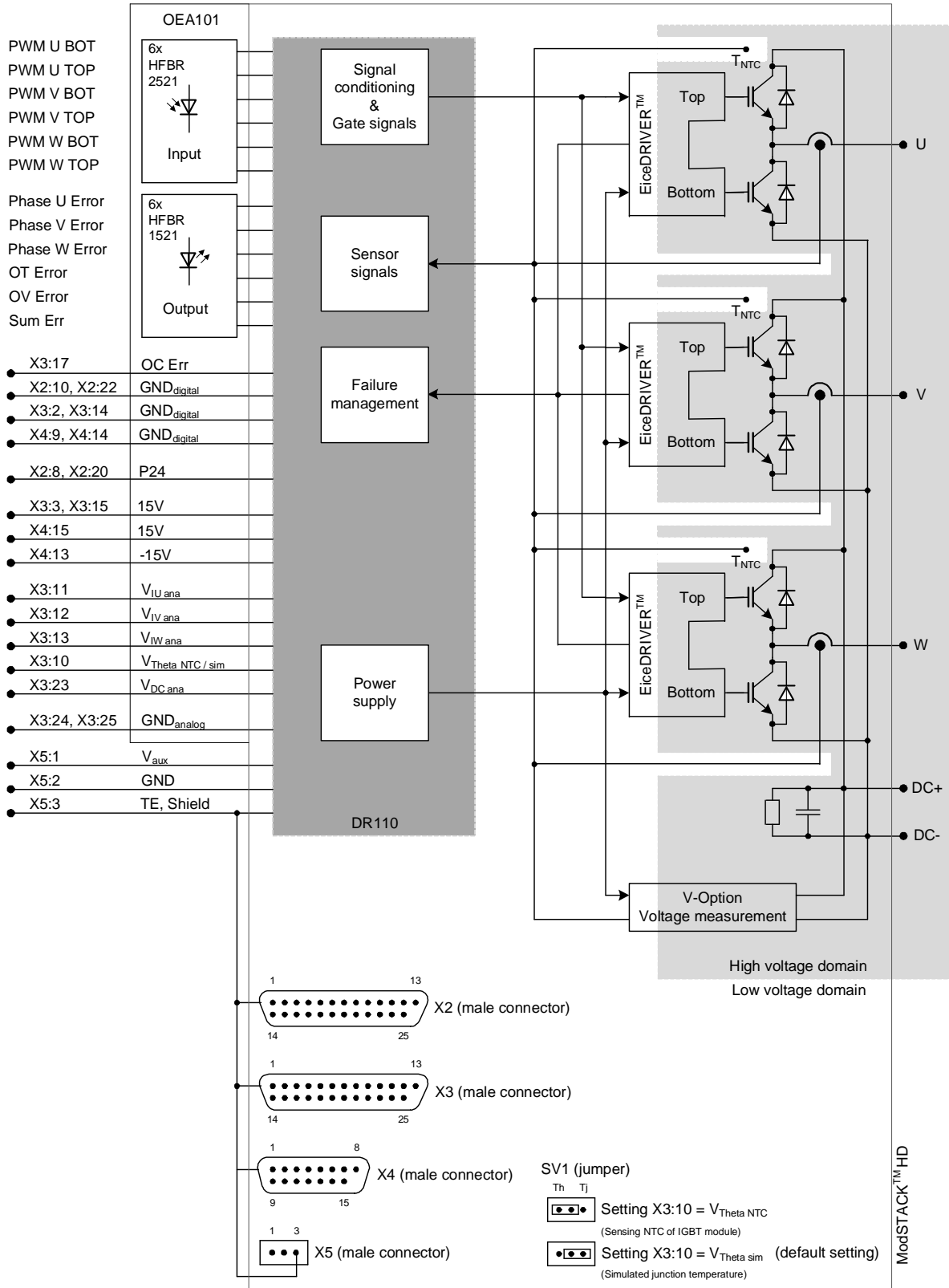


$Z_{th, ha}$ - thermal impedance heatsink to ambient per switch
 nom. cooling conditions



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Circuit diagram



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- the conclusion of Quality Agreements;
- to establish joint measures of an ongoing product survey, and that we may make delivery depended on the realization of any such measures.

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Prior to installation and operation, all safety notices and warnings and all warning signs attached to the equipment have to be carefully read. Make sure that all warning signs remain in a legible condition and that missing or damaged signs are replaced. To installation and operation, all safety notices and warnings and all warning signs attached to the equipment have to be carefully read. Make sure that all warning signs remain in a legible condition and that missing or damaged signs are replaced.

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