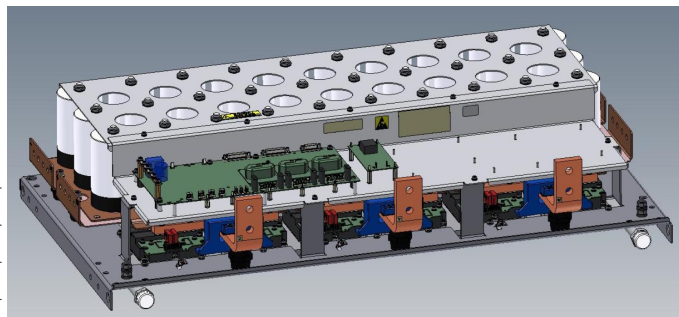


General information

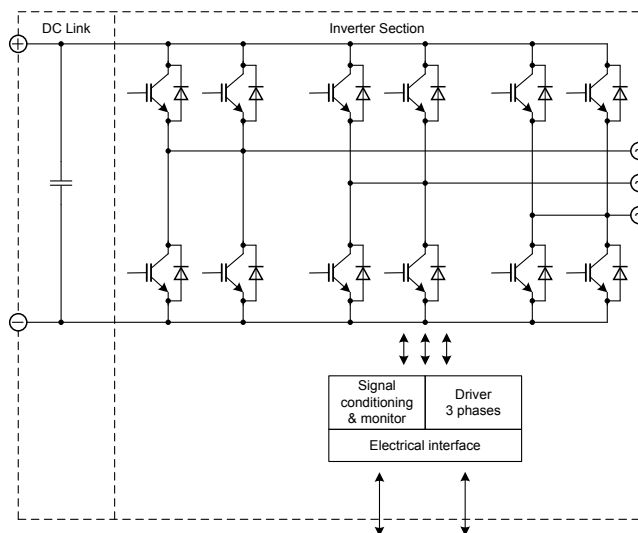
**IGBT Stack for typical voltages up to 690 V_{RMS}
Rated output current 1175_{RMS}**

- High power converter
- Wind power
- Motor drives

- IHM module with IGBT4
- AISiC baseplate



Topology	B6I
Application	Inverter
Load type	Resistive, inductive
Semiconductor (Inverter Section)	6x FF1200R17KP4_B2
DC Link	12 mF
Heatsink	Water cooled
Implemented sensors	Current, voltage, temperature
Driver signals IGBT	Electrical
Sales - name	6MS24017P43W41646
SP - No.	SP001420674



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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	No switching; $t=5\text{s}$, once a day	V_{DC}	1450	V
Insulation management	according to installation height of 2000 m	V_{line}	690	V_{RMS}
Insulation test voltage	according to EN 50178, $f = 50\text{ Hz}$, $t = 5\text{ s}$	V_{ISOL}	2.5	kV_{RMS}
Junction temperature	under switching conditions	T_{vjop}	150	$^{\circ}\text{C}$
Storage temperature min.		T_{stor}	-40	$^{\circ}\text{C}$
Storage temperature max.		T_{stor}	65	$^{\circ}\text{C}$
Operational ambient temperature min.		T_{amb}	-25	$^{\circ}\text{C}$
Operational ambient temperature max.		T_{amb}	55	$^{\circ}\text{C}$
Auxiliary voltage		V_{aux}	30	V
Switching frequency inverter section		f_{sw2}	3.5	kHz

Notes

Further maximum ratings are specified in the following dedicated sections

Characteristic values

DC Link

			min.	typ.	max.	
Rated voltage	Continuous mode	V_{DC}		1050		V
Over voltage shutdown	within 150 μs			1300		V
Capacitor	1 s, 30 p, rated tol. $\pm 10\%$	C_{DC}		12		mF
		type	Foil			
Maximum ripple current	per device, $T_{amb} = 55^{\circ}\text{C}$	I_{ripple}			49	A_{RMS}
Balance or discharge resistor	per DC link unit	R_b	6			k Ω

Notes

Operation above 1100 V subject to reduced operating time according to EN 61071
Reduce short circuit protection over 1200V

Inverter Section

			min.	typ.	max.	
Rated continuous current	$V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $\cos(\varphi) = 0.9$, $f_{AC\ sine} = 50\text{ Hz}$, $f_{sw} = 2600\text{ Hz}$, $T_{inlet} = 50^{\circ}\text{C}$	I_{AC}		1175		A_{RMS}
Rated continuous current for 150% overload capability	$I_{AC\ 150\%} = 1100\text{ A}_{RMS}$, $t_{on\ over} = 0.01\text{ s}$, $t_{recovery} = 135\text{ s}$	$I_{AC\ over1}$			1767	A_{RMS}
Over current shutdown	within 15 μs	$I_{AC\ OC}$		2500		A_{peak}
Power losses	$I_{AC} = 1175\text{ A}$, $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $\cos(\varphi) = 0.9$, $f_{AC\ sine} = 50\text{ Hz}$, $f_{sw} = 2600\text{ Hz}$, $T_{inlet} = 50^{\circ}\text{C}$	P_{loss}		14500		W

Inverter Section (specific condition)

			min.	typ.	max.	
Specific continuous current	$V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $\cos(\varphi) = -0.9$, $f_{AC\ sine} = 12\text{ Hz}$, $f_{sw} = 2100\text{ Hz}$, $T_{inlet} = 50^{\circ}\text{C}$, $T_j \leq 150^{\circ}\text{C}$	I_{ACsp}		1400		A_{RMS}

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Preliminary data

Controller interface

Driver and interface board	ref. to separate Application Note	DR112				
			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, @ 1175 A_{RMS}	$V_{IU\ ana2}$ $V_{IV\ ana2}$ $V_{IW\ ana2}$		3.6		V
Analog DC link voltage sensor output	load max 1 mA, @ 1100 V	$V_{DC\ ana}$		7.6		V
Analog temperature sensor output inverter section (NTC)	@ $T_{NTC} = 72\text{ }^{\circ}\text{C}$, corresponds to $T_j = 138\text{ }^{\circ}\text{C}$ at rated conditions	$V_{Theta\ NTC2}$		8.6		V
Analog temperature sensor output inverter section (Simulated)	@ $T_{NTC} = 72\text{ }^{\circ}\text{C}$, corresponds to $T_j = 138\text{ }^{\circ}\text{C}$ at rated conditions	$V_{Theta\ sim2}$		8.7		V
Over temperature shutdown inverter section	load max 1 mA	$V_{Error\ OT2}$		10		V
Minimum on time (IGBT)		$t_{on\ min}$	5			μs
Minimum off time (IGBT)		$t_{off\ min}$	5			μs

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		65	$^{\circ}\text{C}$
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		85	%
Vibration	according to IEC 60721				10	m/s^2
Shock	according to IEC 60721				100	m/s^2
Protection degree			IP00			
Pollution degree			2			
Dimensions	width x depth x height		1090	625	250	mm
Weight				90		kg

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Heatsink water cooled

			min.	typ.	max.	
Water flow	according to coolant specification from Infineon	$\Delta V/\Delta t$	35			dm ³ /min
Water pressure					8	bar
Coolant inlet temperature		T _{inlet}	-40		45	°C
Thermal resistance heatsink to ambient	per switch	R _{th,ha}		0.024		K/W
Cooling channel material			Aluminum			

Notes

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

Overview of optional components

	Unit 1 (not installed)	Inverter Section	Unit 3 (not installed)
Voltage sensor		x	
Current sensor		x	
Temperature sensor		x	
Temperature simulation		x	
DC link capacitors		x	
Collector-emitter Active Clamping		x	

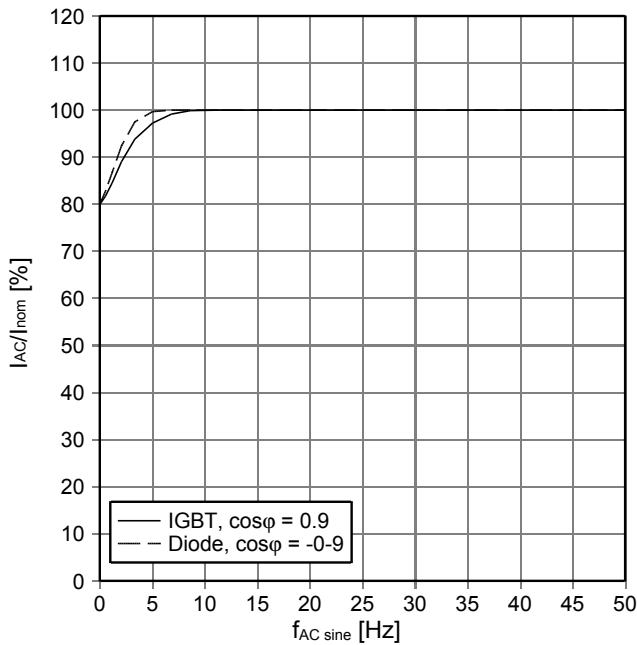
Notes

Setting of Active Clamping TVS-Diodes: V_Z = 1200V/1600V MA111. Reduce short circuit protection above 1200V DC.

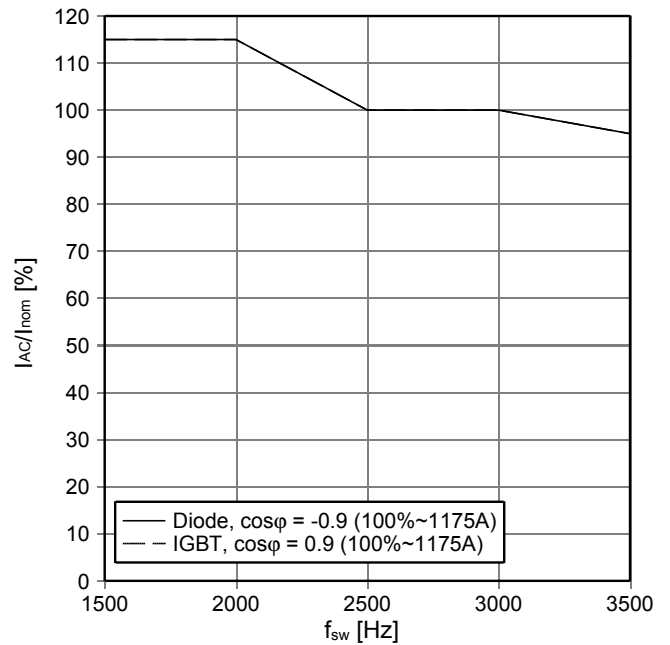
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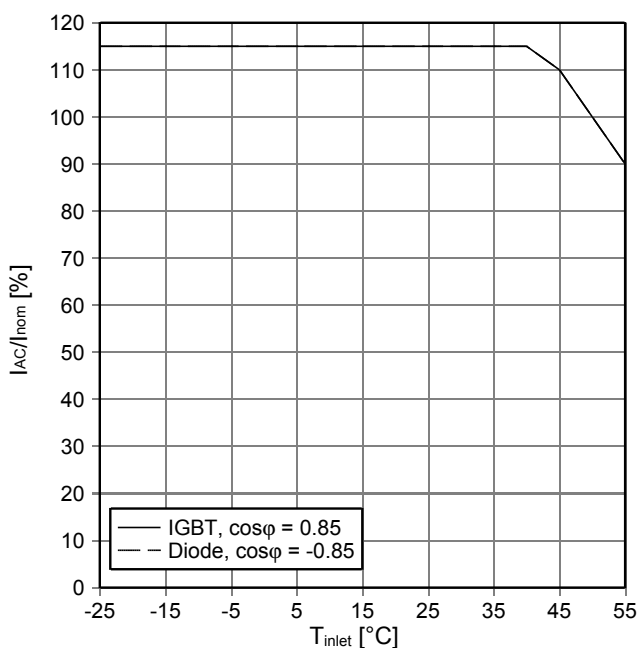
$f_{AC\ sine}$ - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}$, $f_{sw} = 2.6\text{ kHz}$, $\cos\phi = \pm 0.9$
 $T_{inlet} = 50\text{ }^\circ\text{C}$ and nom. cooling conditions



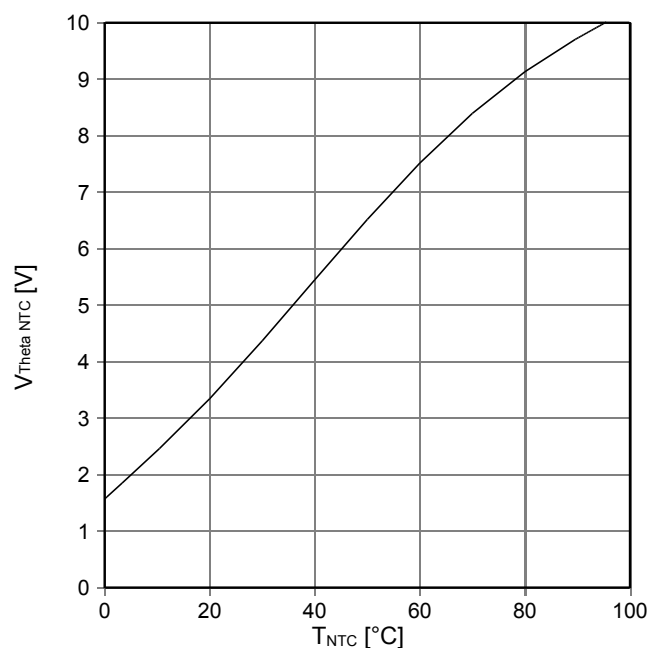
f_{sw} - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}$, $f_{AC\ sine} = 50/12\text{ Hz}$, $\cos\phi = \pm 0.9$
 $T_{inlet} = 50\text{ }^\circ\text{C}$ and nom. cooling conditions



T_{inlet} - derating curve IGBT (motor), Diode (generator)
 $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{AC\ sine} = 50\text{ Hz}$, $\cos\phi = 0.9$
 nom. cooling conditions



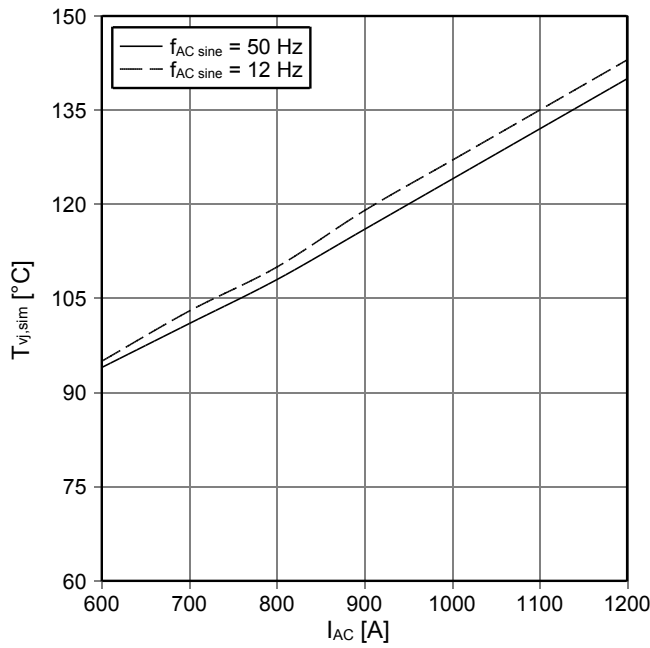
Analog temperature sensor output $V_{Theta\ NTC}$
 Sensing NTC of heatsink



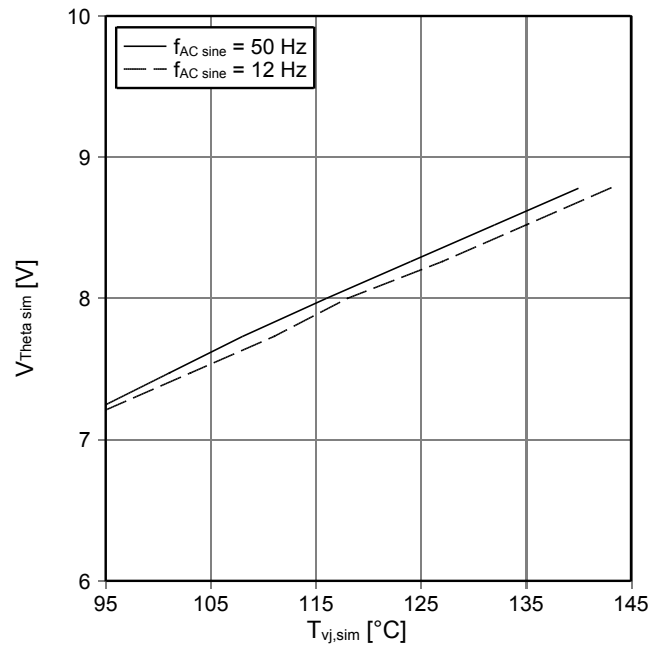
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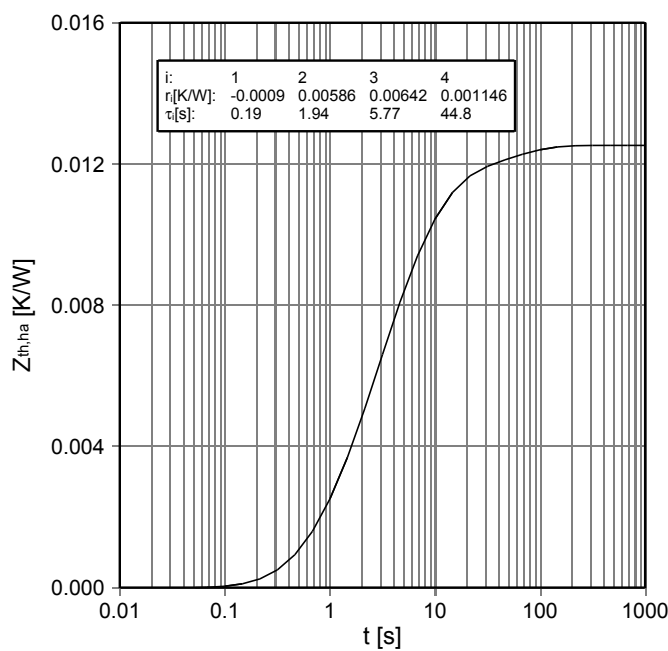
$T_{vj, sim}$ vs. I_{AC} - Simulated junction temperatur
 $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{sw} = 2.6\text{ kHz}$,
 $T_{inlet} = 50\text{ }^{\circ}\text{C}$ and nom. cooling conditions



Analog temperature sensor output $V_{Theta\ sim}$
 $V_{DC} = 1050\text{ V}$, $V_{AC} = 690\text{ V}_{RMS}$, $f_{sw} = 2.6\text{ kHz}$,
 nom. cooling conditions

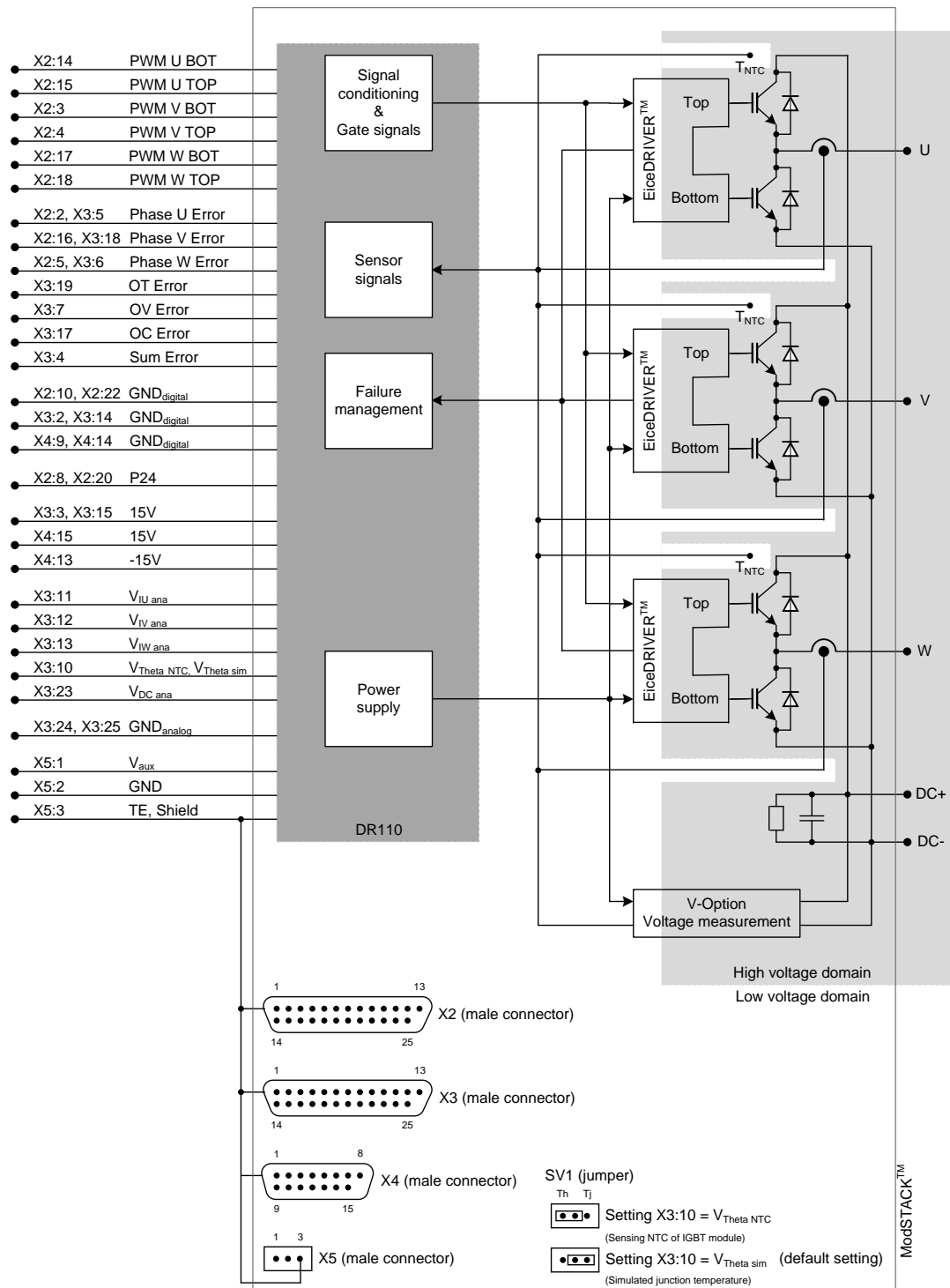


$Z_{th, ha}$ - thermal impedance heatsink to ambient per switch
 nom. cooling conditions



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Circuit diagram



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