Main Power Losses in MECPRO-Inverter

Thermal resistance of Heat Sink (Fischer electronics)

$$R_{thK} = \frac{\vartheta_i - \vartheta_u}{P} - (R_{thG} + R_{thM})$$

$\vartheta_i = Maximum\ Junction\ Temperature$

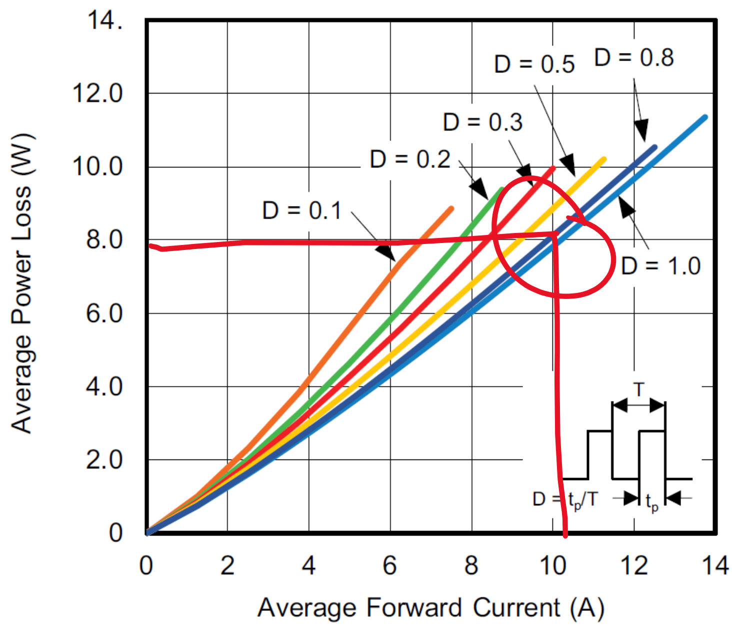
$\vartheta_u = Ambient\ Temperature$

$R_{thG} = Thermal\ Resistance\ of\ Semiconductor$

$R_{thM} = Thermal\ Resistance\ of\ Mounting\ Area$

Bridge rectifier

- Maximum Operating Temperature $T_{jmax} = 150°C = \vartheta_i$
- Thermal resistance without heat sink $R_{0JA} = 24\frac{°C}{W}$
- Thermal resistance with heat sink $R_{0JC} = 1\frac{°C}{W} = (R_{thG} - R_{thM})$
- Power dissipation $P_{tot}(@Dutycycle = 0{,}8 - 1\ \&@10A)\ \cong 8\,W - 10\,W$



Heat Sink Requirements

Compensation Temperature and Thermal Resistance of Heat Sink:

$$T_{BR} = R_{0JA} * P_{tot} = \frac{1K}{W} * 10\,W = 10K = \vartheta_i$$

$$R_{thK} = \frac{T_{BR}}{P_{tot}} - R_{0JC} = \frac{10K}{8W} - \frac{1K}{W} = \frac{0{,}25K}{W}$$

Outer Dimensions

Cooling Area

$$A_{CBR} = (30 \pm 0{,}3 * 20 \pm 0{,}3)mm^2$$

CIPOS

- Maximum Operating Temperature $T_{max} = 125°C = \vartheta_i$
- Thermal resistance Single IGBT $R_{TH1} = 4{,}28\frac{K}{W}$
- Thermal resistance Single Diode $R_{TH2} = 4{,}87\frac{K}{W}$
- Power dissipation $P_{tot}(per\ IGBT) = 29{,}2\,W$

Inverter Section

Description	Condition	Symbol	Value		Unit
			min	max	
Max. blocking voltage	$I_C = 250\mu A$	V_{CES}	600	-	V
DC link supply voltage of P-N	Applied between P-N	V_{PN}	-	450	V
DC link supply voltage (surge) of P-N	Applied between P-N	$V_{PN(surge)}$	-	500	V
Output current	$T_C = 25°C, T_J < 150°C$ $T_C = 80°C, T_J < 150°C$	I_C	-20 -15	20 15	A
Maximum peak output current	less than 1ms	$I_{C(peak)}$	-40	40	A
Short circuit withstand time[1]	$V_{DC} \leq 400V, T_J = 150°C$	t_{SC}	-	5	µs
Power dissipation per IGBT		P_{tot}	-	29.2	W
Operating junction temperature range		T_J	-40	150	°C
Single IGBT thermal resistance, junction-case		R_{thJC}	-	4.28	K/W
Single diode thermal resistance, junction-case		R_{thJCD}	-	4.87	K/W

Heat Sink Requirements

$$T_{CiPOS} = (R_{TH1} + R_{TH2}) * P_{tot} = \frac{(4{,}28 + 4{,}87)K}{W} * 29{,}2W = 267{,}18K$$

Compensation Temperature and Thermal Resistance of Heat Sink:

$$\Delta T_{CIPOS} = T_{CIPOS} - (\vartheta_i - 25K) = 267{,}18K - 100K = 167{,}18K$$

$$\boxed{\Rightarrow R_{thK} = \frac{\Delta T_{CIPOS}}{P_{tot}} - (R_{TH1} + R_{TH2}) = \frac{167{,}18K}{29{,}2W} - \frac{4{,}87 * 4{,}28K}{(4{,}87 + 4{,}28)W} = \frac{3{,}467K}{W}}$$

Outer Dimensions

Cooling Area:

$$\boxed{A_{CCIPOS} = (33{,}8 \pm 0{,}3 \times 21 \pm 0{,}3)mm^2}$$