Specifying the VCCM600 product for convection or forced air cooling

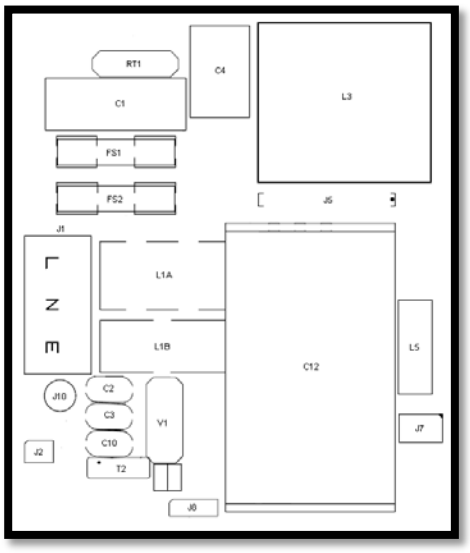
To specify a VCCM600 series product for an end application, the required output power, minimum input line voltage, maximum ambient, mounting orientation and air flow rate (if applicable) should be determined. Check the requirements against the closest characteristic plot from the tables above to ensure ratings can be achieved. Be conservative when specifying the product as convection and forced air cooling can be highly dependent on the end application enclosure and power supply mounting. The estimated performance must be verified in the end application and temperatures may exceed predicted levels. It is also important to note that ambient temperature refers to the ambient temperature immediately surrounding the PSU. If the PSU is mounted within an enclosure the enclosure ambient temperature is likely to be higher than the external air ambient temperature.

Evaluating the VCCM600 product in the end application

To ensure the product is operating within its ratings in the end application the following procedure should be performed during the design stage.

1. Install a thermocouple in position TS1 of the product. (See Mechanical dimensions and mounting for details.) The thermocouple wire should exit on the top side between slots 2 and 3. The bottom side should be flush for heatsink mounting if necessary. Glue should be used to hold the thermocouple in place.
2. Setup the application in worst case conditions, considering Input line voltage, Output power, ambient temperature, airflow and cooling restrictions.
3. Power the system and monitor the baseplate temperature until it reaches steady state.
4. Ensure that under worst case conditions, the baseplate temperature cannot exceed the rated temperature as outlined in the power ratings section of this manual.

If a cover is placed over the primary components, then the following component temperatures must also be measured to ensure they are below the maximum specified temperatures.

Description	Reference	Maximum allowed temperature	Drawing
Fuse	FS1, FS2	125°C	
Electrolytic capacitors	C12	105°C	
Inductors	L1, L2, L3, L5	130°C	
Other capacitors	C1, C4	110°C	

If excessive temperatures are measured during this evaluation, then one or more of the following remedies may improve thermal performance.

- Increase heatsink size
- Increase airflow rate
- Improve air intake & outlet
- Reduce power requirement

Using the internal temperature sensor to control external application cooling

An internal temperature sensor T_{SNS} is available on J3 pin 9 (See page 14 for details). The output voltage of this sensor gives a measurement of the internal transformer temperature and can be used to control external cooling systems or to provide a warning of impending over temperature protection.
The internal temperature (T_{SNS}) should never exceed 120^{0}C (2.74V), however, system reliability will be maximised if the PSU temperature is maintained as low as possible in any given application.

Reliability

The VCCM600 series has undergone extensive testing, including HALT and Environmental testing. Reliability data is collected on an ongoing basis. Please contact Vox Power or your distributor for the most up to date reliability data.

The reliability data quoted in the datasheets are the calculated *failures per million hours* (FPMH) using the Telcordia SR-332, issue 2 standard. The procedure defined in SR-332 allows several different techniques to be used for calculating MTBF and when evaluating competing MTBF figures it is important that only the same techniques are compared.
The quoted VCCM reliability figures use Method I Case 3, Ground, Fixed, Controlled which specifies an ambient temperature of 30°C and an upper confidence level of 90%. It is also assumed that the product is operated at 100% duty cycle, has an input voltage of $220V_{RMS}$, an output power of 600W and that the baseplate temperature is the same as the ambient temperature.

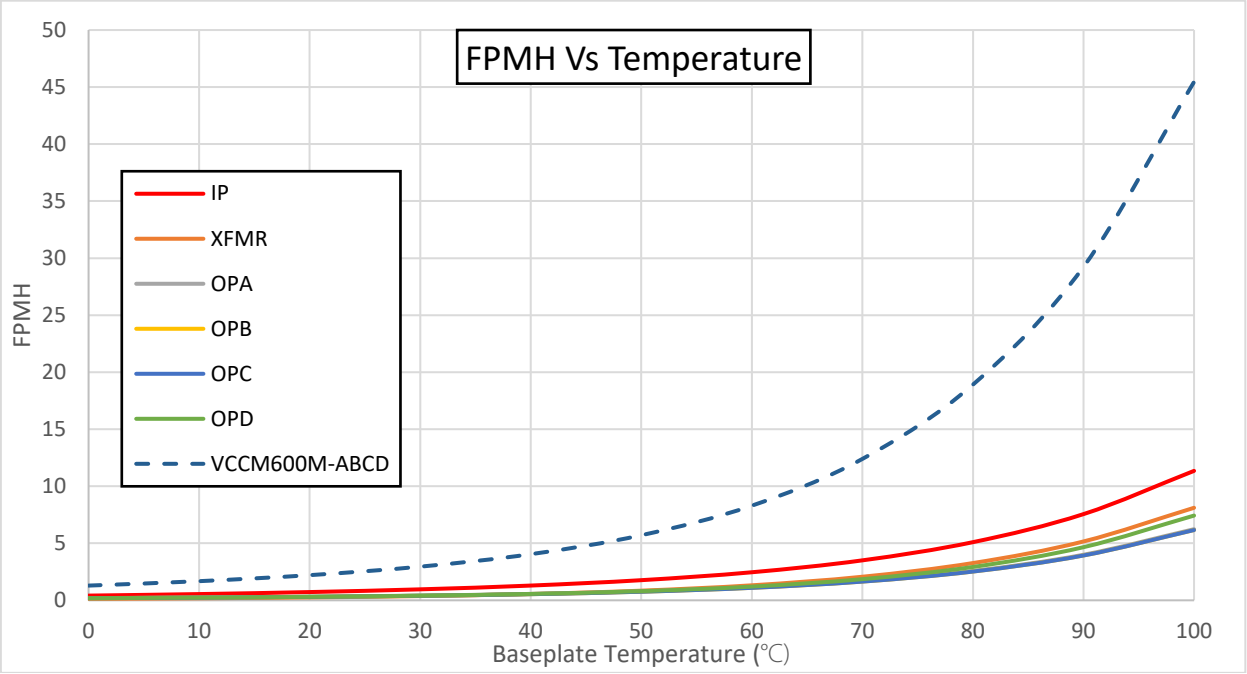
The table below shows a summary of the FPMH & MTBF for all system components and for a typical fully assembled system.

Assembly	Failure Rate (FPMH)	MTBF (Hrs)
IP	**0.962972**	1038452
XFMR	**0.371919**	2688754
OPA	**0.415368**	2407499
OPB	**0.397808**	2513774
OPC	**0.398170**	2511487
OPD	**0.405630**	2465300
VCCM600M-AAAA	2.996363	333737.934

To calculate the MTBF of any VCCM system,

- Add the FPMH figures for each system component to give the total FPMH.
- Get the MTBF by dividing 1,000,000 by the total FPMH.

The variation in FPMH is shown in the graph and table below.



Temp	IP	XFMR	OPA	OPB	OPC	OPD	VCCM600M-ABCD
0	0.41329578	0.127619	0.192619	0.185396	0.186105	0.186243	1.291276945
10	0.54688976	0.178886	0.245347	0.235357	0.235992	0.2362	1.678671789
20	0.72397837	0.255159	0.316147	0.302737	0.30326	0.305183	2.206465072
30	0.96297168	0.371919	0.415369	0.397808	0.39817	0.40563	2.951868534
40	1.29407059	0.555049	0.560829	0.538309	0.538452	0.559393	4.046103211
50	1.76616217	0.846405	0.782692	0.754326	0.754185	0.803972	5.707742381
60	2.46010898	1.315415	1.130884	1.095712	1.095216	1.202005	8.299340054
70	3.50420104	2.067304	1.686039	1.643019	1.642101	1.855247	12.39791075
80	5.09894211	3.266645	2.575169	2.523173	2.52177	2.925702	18.91140128
90	7.55815578	5.160517	3.995269	3.93316	3.931214	4.659641	29.23795696
100	11.3495991	8.112606	6.236851	6.163284	6.160733	7.430093	45.4531658