

CY7C380 Family Quick Power Calculator

This brief is intended to provide a rapid method of calculating the approximate power consumed by a CY7C380 family device. Because the intent is a first-estimate calculation, some details are neglected. The quiescent power of about 20 mW is not included. There is no estimate of the power for the number of columns and number of loads per column of the clock distribution tree. Wiring capacitance is neglected. High drive cell power is taken to be the same as a normal input cell. I/O cell power is averaged over input and output. The power calculation does not include the power of an output driving an external load. This approach was taken to simplify the calculation. The average toggle rate and percent of the device used are assumed to be rough estimates, thus there is no need to strive for great accuracy. For detailed considerations refer to the application note “Power Characteristics of Cypress Products.”

The equations used to create the curves are:

$$P(I/O) = (\text{number of I/Os}) * F_{AV} * (0.3)$$

$$P(\text{cells}) = (\% \text{ used}) * F_{AV} * (0.38) \text{ for 7C381/C382 (Figure 1)}$$

$$P(\text{cells}) = (\% \text{ used}) * F_{AV} * (0.77) \text{ for 7C383/C384 (Figure 2)}$$

$$P(\text{cells}) = (\% \text{ used}) * F_{AV} * (1.54) \text{ for 7C385/C386 (Figure 3)}$$

Where F_{AV} is the average toggle rate frequency

Quick Power Calculation Process

1. Estimate the toggle rate (frequency in MHz) for each of the major blocks of the design.
2. Select a CY7C380 family device.
3. Estimate the percent of the device that will be utilized to implement each block.
4. For each block, use the power vs. toggle rate curves for the selected device and read the power for the estimated toggle rate and percent utilization. Enter the power in the work sheet.
5. Sum the individual powers for an estimate of the total power.

Table 1. Power Calculations

Block	Percent of Device	Toggle Rate (MHz)	No. of I/Os switching at toggle rate	Power _{I/O} (from eqn)	Power _{cells} (from table)	Power _{Block} (Power _{I/O} + Power _{cells})
Block 1						
Block 2						
Block 3						
Block 4						
	100%					

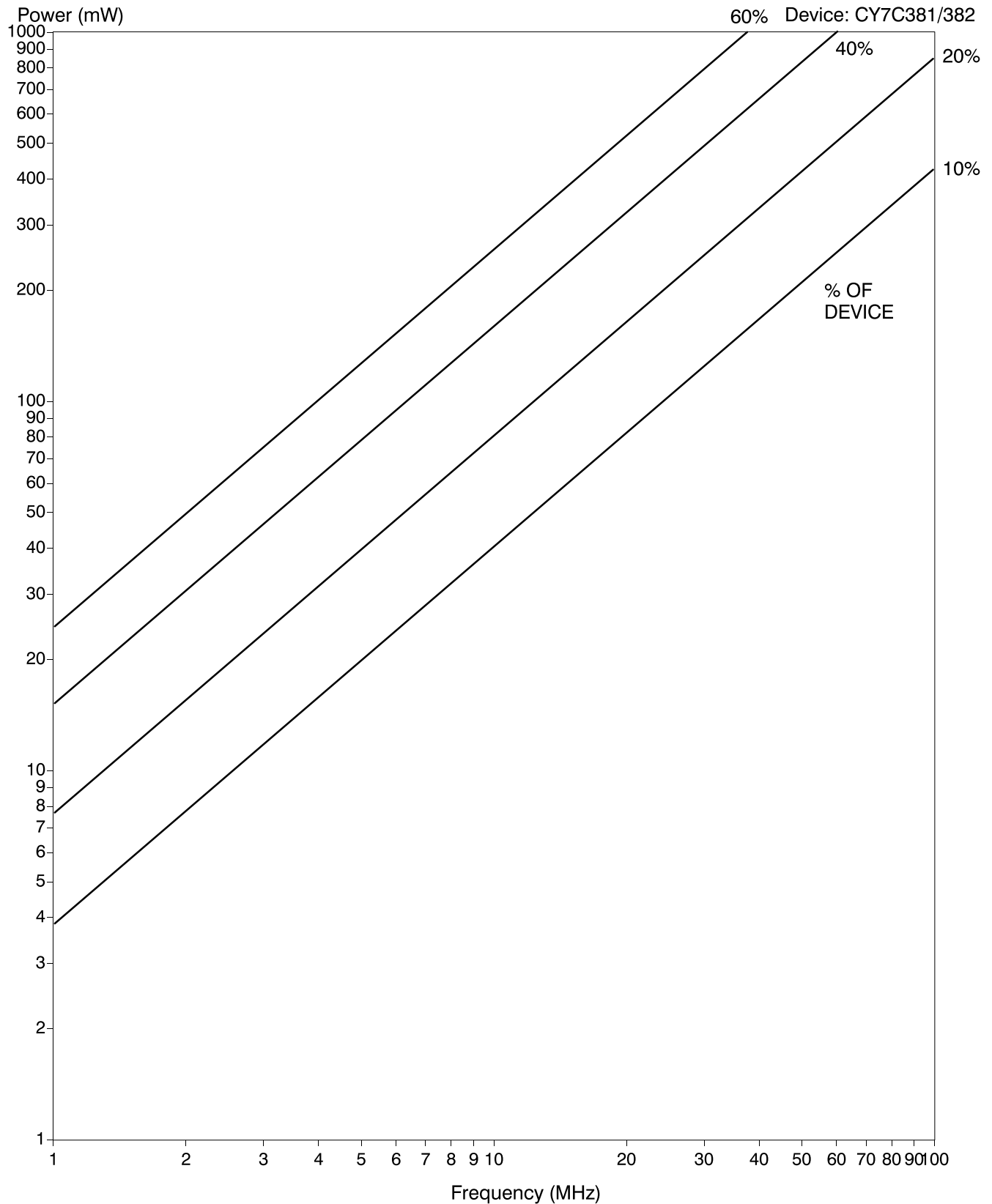


Figure 1. Average Toggle Range for CY7C381/2

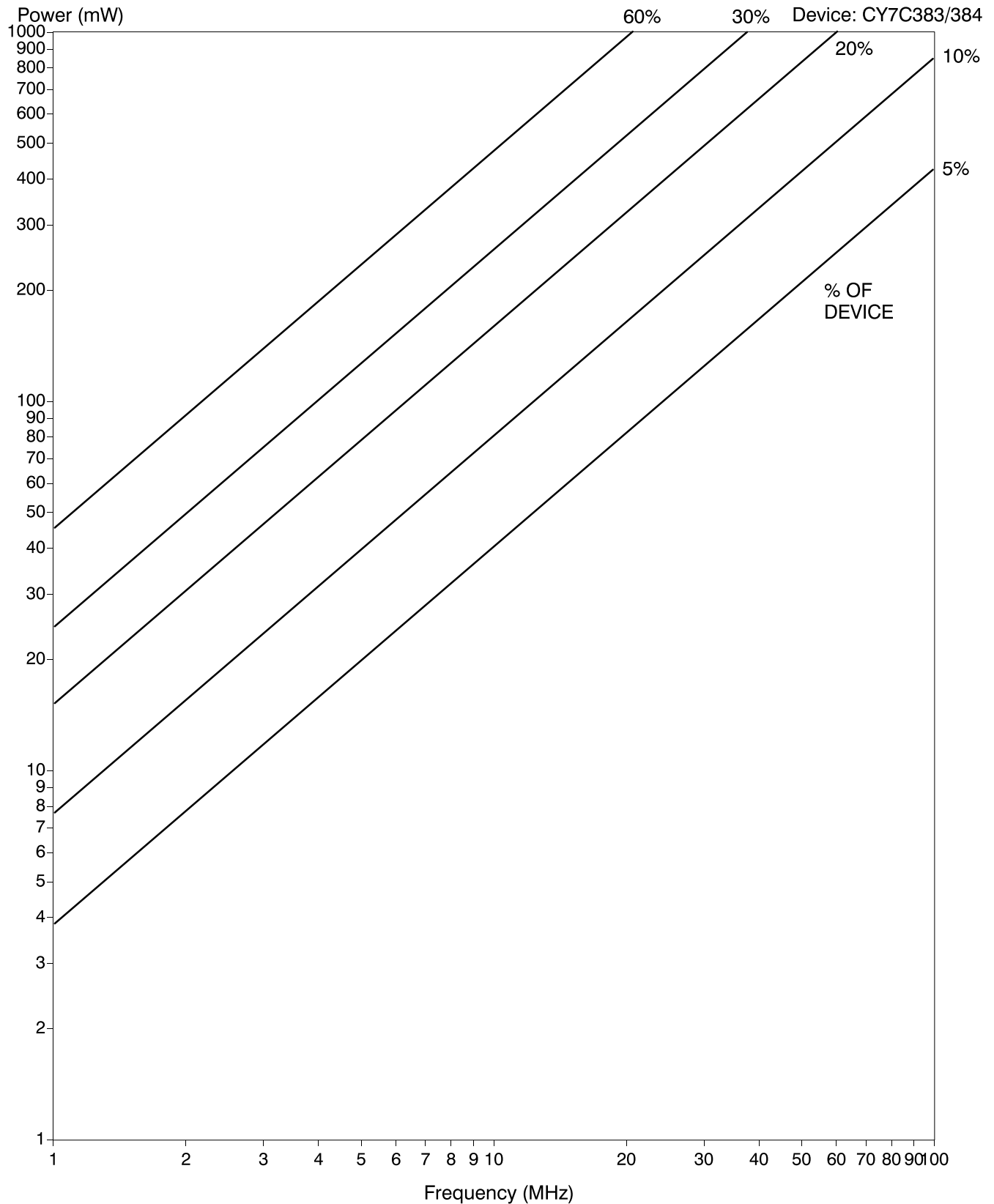


Figure 2. Average Toggle Range for CY7C383/4

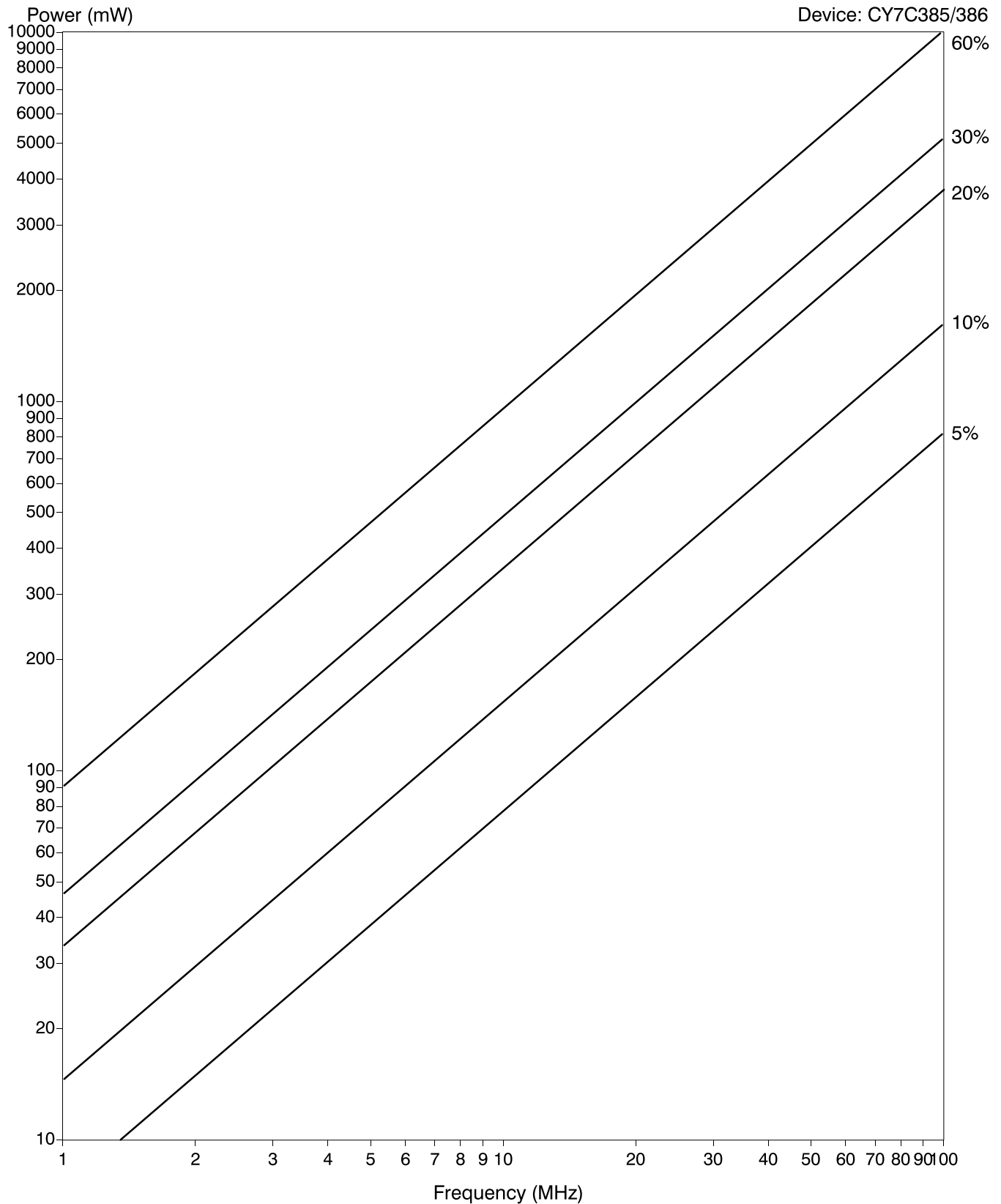


Figure 3. Average Toggle Range for CY7C385/6

Example

A CY7C382 FPGA is to be used with the following estimates:

- 32 I/Os are connected to a 40-MHz bus (half are assumed to be changing at this rate on the average).
- The remaining I/Os have a low duty cycle.

- 10% of the device is going to be toggling at the 40-MHz rate.
- 60% of the device is estimated to be toggling at 10 MHz.

The work sheet is filled in as shown below. The number of I/Os is taken to be 16 because half are assumed to change in any clock (on the average). The next two entries are taken from the graph for the 7C382 and entered into the Power column. Total power is summed at the bottom.

Table 2. Power Calculations— An Example

Block	Percent of Device	Toggle Rate (MHz)	No. of I/Os switching at toggle rate	Power _{I/O} (from eqn)	Power _{cells} (from curve)	Power _{Block} (Power _{I/O} + Power _{cells})
Block 1	10	40	16	192	150	342
Block 2	60	10	0	0	220	220
Block 3*	30	0	0	0	0	0
Block 4						
	100%					562

* Block 3 represents 30% of the device that goes unused.