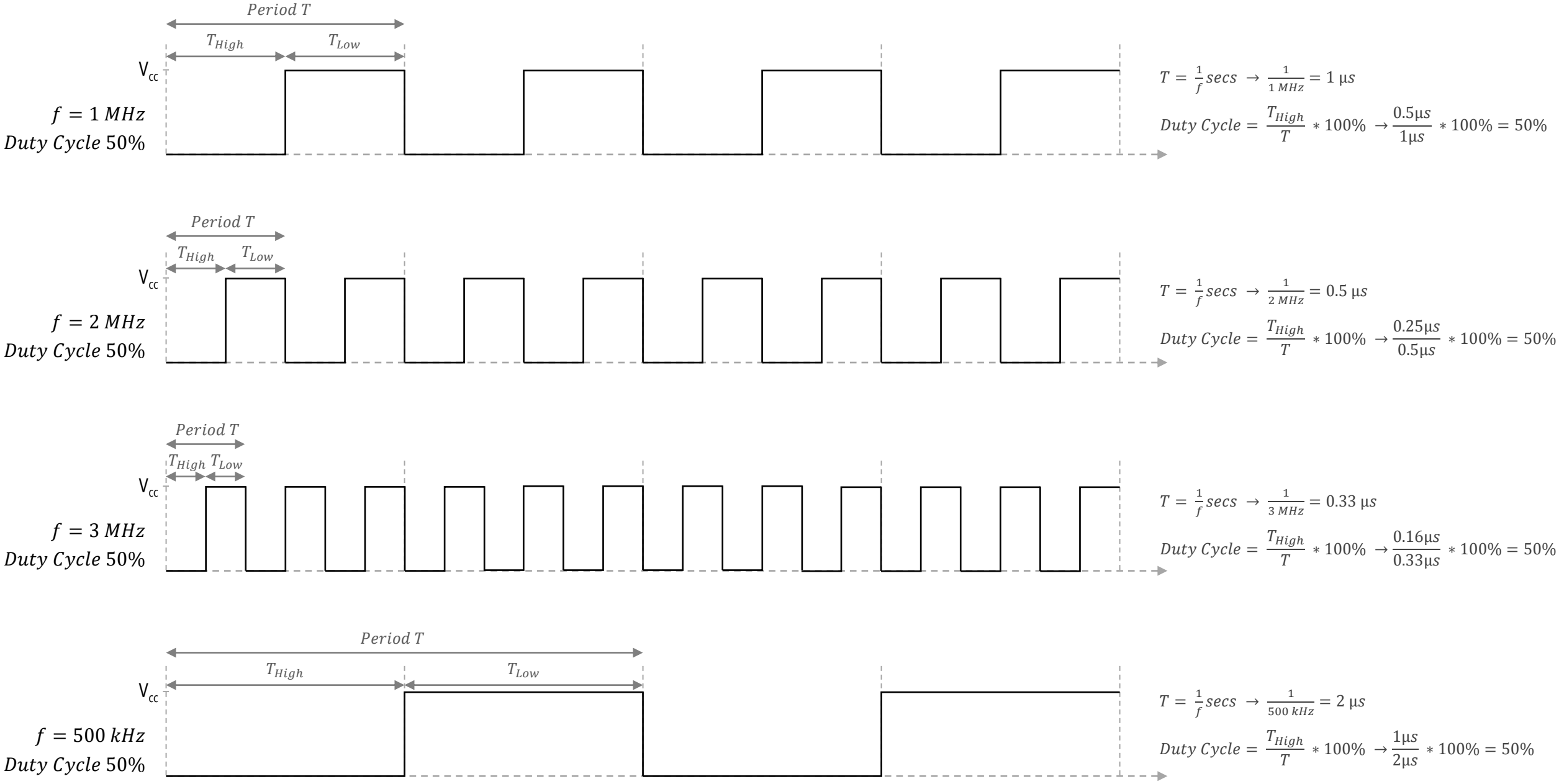
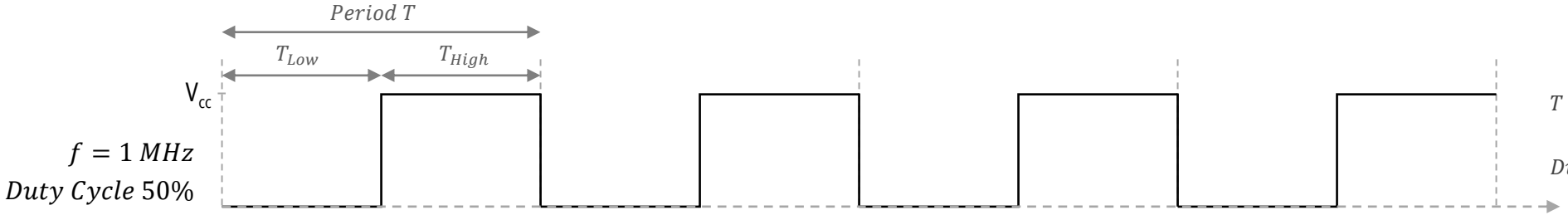
SAME DUTY CYCLE (50%), DIFFERENT FREQUENCIES



DIFFERENT DUTY CYCLE, SAME FREQUENCY (1MHZ)

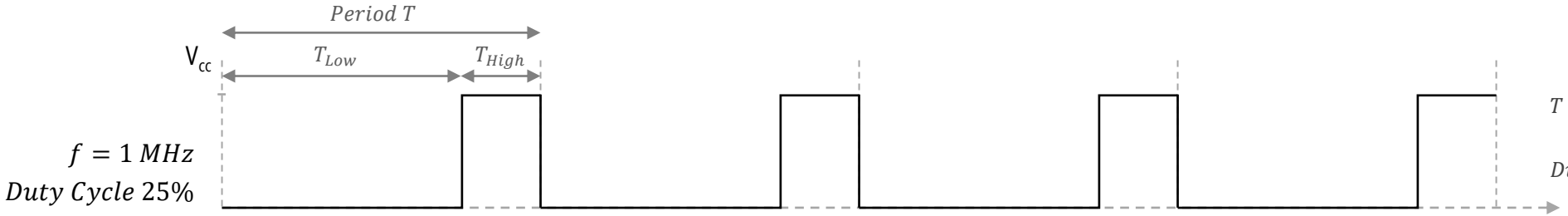


$f = 1\ MHz$

$Duty\ Cycle\ 50\%$

$$T = \frac{1}{f} secs \rightarrow \frac{1}{1\ MHz} = 1\ \mu s$$

$$Duty\ Cycle = \frac{T_{High}}{T} * 100\% \rightarrow \frac{0.5\mu s}{1\mu s} * 100\% = 50\%$$

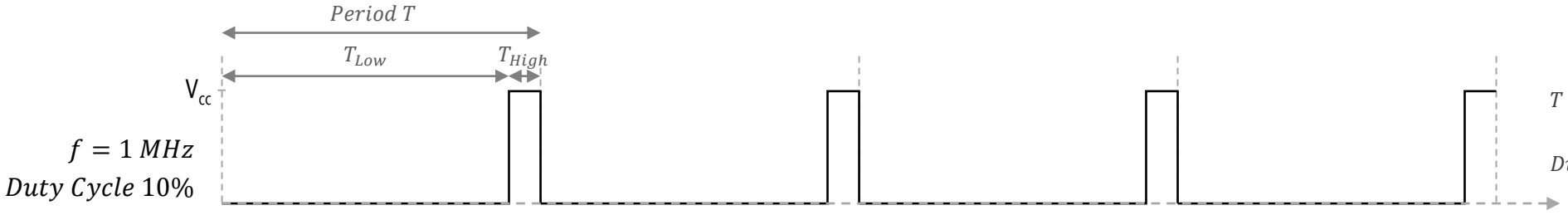


$f = 1\ MHz$

$Duty\ Cycle\ 25\%$

$$T = \frac{1}{f} secs \rightarrow \frac{1}{1\ MHz} = 1\ \mu s$$

$$Duty\ Cycle = \frac{T_{High}}{T} * 100\% \rightarrow \frac{0.25\mu s}{1\mu s} * 100\% = 25\%$$

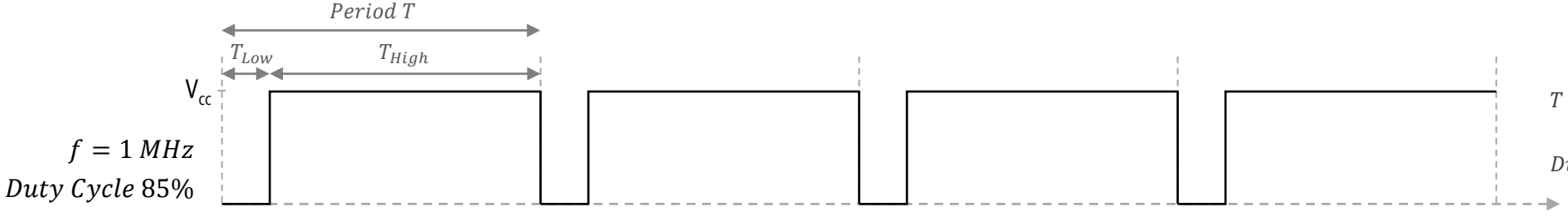


$f = 1\ MHz$

$Duty\ Cycle\ 10\%$

$$T = \frac{1}{f} secs \rightarrow \frac{1}{1\ MHz} = 1\ \mu s$$

$$Duty\ Cycle = \frac{T_{High}}{T} * 100\% \rightarrow \frac{0.10\mu s}{1\mu s} * 100\% = 10\%$$



$f = 1\ MHz$

$Duty\ Cycle\ 85\%$

$$T = \frac{1}{f} secs \rightarrow \frac{1}{1\ MHz} = 1\ \mu s$$

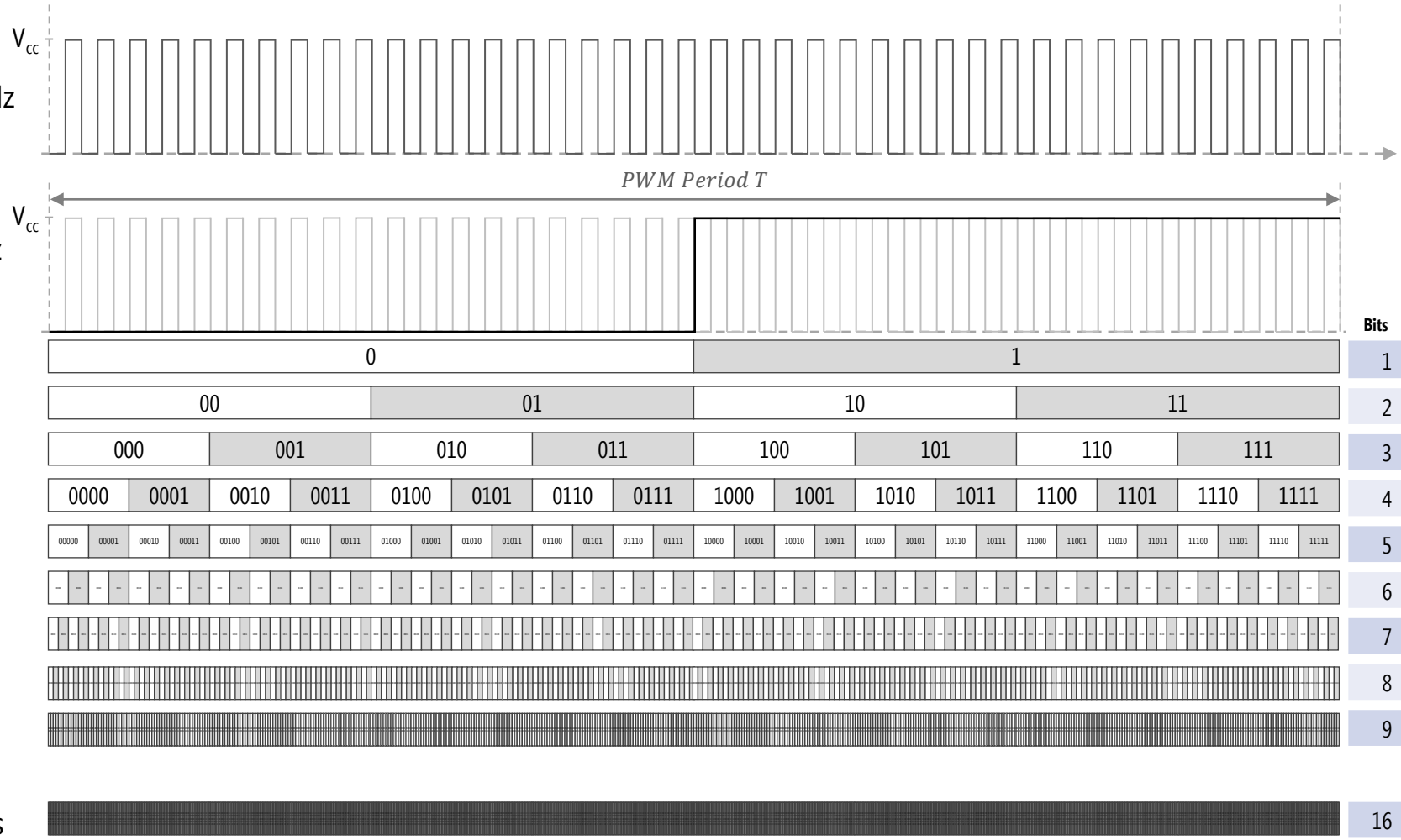
$$Duty\ Cycle = \frac{T_{High}}{T} * 100\% \rightarrow \frac{0.85\mu s}{1\mu s} * 100\% = 85\%$$

FREQUENCY AND DUTY CYCLE RESOLUTION

Clock frequency = 40 MHz

PWM frequency = 1 MHz
PWM duty cycle = 50%

PWM resolution = 1 bit
2 bits
3 bits
4 bits
5 bits
6 bits
7 bits
8 bits
9 bits
…
16 bits



Bits	Duty Cycle Resolution	Voltage Resolution	Minimum Required Clock* with PWM freq=1MHz
1	Fixed at 50%	Fixed at 1.65V	1 MHz
2	25%	825 mV	4 MHz
3	12.5%	412.5 mV	8 MHz
4	6.25%	206.25 mV	16 MHz
5	3.125%	103.13 mV	32 MHz
6	1.5625%	51.56 mV	64 MHz
7	0.78125%	25.78 mV	128 MHz
8	0.39063%	12.89 mV	256 MHz
9	0.19531%	6.45 mV	512 MHz
16	0.00153%	0.0504 mV	65.536 GHz

*Min clock freq = PWM freq * $2^{\text{resolution}}$