Power Estimation in ispMACH™ 5000B Devices

May 2002 Technical Note TN1023

Introduction

Power estimation for a given design in a programmable logic device requires an understanding of several elements related to the device and the design. These elements include device utilization, operating frequency and I/O loading. This technical note presents formulas for estimating power dissipated by a given design for an ispMACH 5000B device. Refer to the *Thermal Management* document on the Lattice web site at www.latticesemi.com for additional information necessary to conduct a thermal analysis. Actual power consumption should be checked after implementation to ensure there will be no thermal issues.

The ispMACH 5000B Family features unique power management controls. Each device has two power settings, high power and lower power, on a per node basis.

Power Estimation

Power consumption in the ispMACH 5000B Family is the sum of three parameters:

$$I_{CC} = I_{DC\text{-}LOAD} + I_{AC\text{-}LOAD} + I_{DEVICE}$$

where:

$I_{DC\text{-}LOAD}$ is the component due to the resistive I/O loads.
$I_{AC\text{-}LOAD}$ is the I/O power component that scales with the average frequency of the design.
I_{DEVICE} is the DC and AC power component of the device itself determined with all I/Os excluded.

$I_{DC\text{-}LOAD}$ and $I_{AC\text{-}LOAD}$ are application-dependent and are not covered in this technical note.

Estimation of I_{DEVICE}

The device power, $I_{DEVICE,}$ is calculated from the following equation:

$$I_{DEVICE} = I_{DEVICE\text{-}AC} + I_{DEVICE\text{-}DC}$$

Each term in I_{DEVICE} is further defined as:

$$I_{DEVICE\text{-}AC} = F_{AVE} [(K0 * PT_{HP}) + (K1 * PT_{LP}) + K2 * GRP_{LINES})]$$
$$I_{DEVICE\text{-}DC} = K3 * PT_{HP} + K4 * PT_{LP} + I_{DC} + I_{DCO}$$

where:

PT_{HP} = Number of product terms in high power
PT_{LP} = Number of product terms in low power
F_{AVE} = Average output frequency of switching product terms in MHz
I_{DC} = Static device current with all product terms powered off
I_{DCO} = Static I/O bank current
K0..K4 = Device power constants listed in the device data sheet

I_{CC} estimates are based on typical conditions (V_{CC} = 2.5V, room temperature and material ambient temperature = 70°C). These values are for estimates only. Since the value of I_{CC} is sensitive to operating conditions and the program in the device, the actual I_{CC} should be verified.

Technical Support Assistance

Hotline: 1-800-LATTICE (Domestic)
1-408-826-6002 (International)
e-mail: techsupport@latticesemi.com