Appendix D
Nomenclature

Abstract

This appendix presents all the common used abbreviations and symbols. The items are listed in groups of units, e.g. [V], [A] *and so forth. Instantaneous values are presented with lower case letters. Average and RMS values are written with uppercase letters and peak values are distinguished with a hat.*
A list of computer terminology is also included in the final part of the appendix.
Items from all the lists are arranged in alphabetical order.

Common used abbreviations

ACS – Attitude Control System

BAT – Battery Unit

COM – Communication Module

CAM – Camera Module

EMC – Electromagnetic Compatibility

EME – Electromagnetic Environment

EMI – Electromagnetic Interference

LEO – Low Earth Orbit

MCU – Microcontroller Unit

MLI – Multilayer Insulation

MPPT – Maximum Power Point Tracker

OBC – Onboard Computer

PSU – Power Supply Unit

PSC – Power Supply Source (referred to MCU)

PV – Photovoltaics

RTG – Radioisotope Thermal Generator

Symbols

Parameter/Symbol	Description	Unit
Voc	Open circuit voltage	[V]
V_{mpp}	Maximum power point voltage	[V]
V_D	Voltage drop across diode	[V]
V_{serial}	Batteries voltage on serial connection	[V]
$V_{parallel}$	Batteries voltage on parallel connection	[V]
V_{batt}	Battery voltage	[V]
V_d	Input voltage for converter	[V]
V_o	Output voltage for converters	[V]
U_{min}	Minimum voltage for a Li-Ion battery	[V]
U_{max}	Maximum voltage for a Li-Ion battery	[V]
$V+$, V_{cc}	Positive supply voltage	[V]
V_{OUT}	Output voltage	[V]
V_{IN}	Input voltage	[V]

Parameter/Symbol	Description	Unit
$C_{parallel}$	Equivalent capacity for parallel connection of batteries	[Ah]
C_{series}	Equivalent capacity for serial connection of batteries	[Ah]
C_{batt}	Battery capacity	[Ah]
I_D	Current across diode	[A]
I_{rs}	Reverse saturation current	[A]
I_{ph}	Photocurrent in the solar cells	[A]
I_{sc}	Shortcircuit current	[A]
I_{RR}	Reverse saturation current at cell reference temperature	[A]
I_o	Output current for the converter	[A]
I_d	Input current for the converter	[A]
I_{GATE}	Gate current for switch	[A]
I_{LIM}	Limit current	[A]

Parameter/Symbol	Description	Unit
R_P	Series resistance of the cell	[Ω]
R_S	Parallel resistance of the cell	[Ω]
$R_{DS(on)}$, $r_{DS(on)}$	Switch on-resistance	[Ω]
R_{thjc}	Thermal resistance junction-case	[°C/W]
R_{thca}	Thermal resistance case-ambient	[°C/W]
R_{th_rad}	Thermal resistance due to radiation	[K/W]
R_{th_cond}	Thermal resistance due to conduction	[K/W]

Parameter/Symbol	Description	Unit
P^*_{in1}	Input power for one side of the satellite	[W]
P_{sun}	Amount of energy radiated by Sun	[W/m^2]
P_{diode}	Losses across Schottky diode	[W]
P_{in1}	One side input power, considering Schottky diode losses	[W]
P_{av}	Average input power	[W]
P_{max}	Maximum power for three sides illuminated	[W]
P_{in2}	Input power for two sides illuminated	[W]
P^*_{IR}	Input power from infrared radiation	[W]
P_{IR_Earth}	Amount of infrared radiation, due to Earth	[W]
P_{mIR}	Maximum of input power, due to infrared radiation	[W]
P^*_{ALB}	Input power from albedo radiation	[W]
P_{mALB}	Maximum of input power, due to albedo radiation	[W]
P_{ALB_Earth}	Amount of albedo radiated energy	[W]
P_{cond}	Heat transferred through conduction	[W]
P_{rad}	Heat transferred through radiation	[W]
E_{total}	Minimum available energy	[J]
E_{sun}	Energy from solar cells	[J]
E^n_{batt}	Energy needed from batteries	[J]
E_{OBC}	Energy required by OBC	[J]
E_{ATC}	Energy required by ACS	[J]
E_{charge}	Energy available at each orbit to charge batteries	[J]
E^r_{charge}	Energy required to charge the batteries from solar panels	[J]
E_G	Band-gap energy of semiconductor used in cells	[eV]
S	Solar irradiation	[mW/cm^2]

Parameter/Symbol	Description	Unit
L	Inductor	[H]

Parameter/Symbol	Description	Unit
T	Absolute temperature	[K]
ΔT	Temperature difference	[K]
T_e	Equilibrium temperature	[K]

Parameter/Symbol	Description	Value	Unit
A	Cross sectional area		[m^2]
α	Absorbitivity for a material		
D	Duty cycle ratio	[0,1]	
E	Electric field strength		[V/m]
ε	Emissivity for a material		
f	Frequency		[Hz]
H	Magnetic field strength		[A/m]
h_r	Radiation heat transfer coefficient		[W/m^2K]
k_i	Shortcircuit current temperature coefficient		
k	Boltzmann constant	$1.38 \cdot 10^{-23}$	[J/K]
λ	Thermal conductivity		[J/s·m·K]
n	Number of cells		
η	Efficiency		[%]
q	Charge of an electron	$1.6 \cdot 10^{-19}$	[eV]
Q_g	Charge		[C]
σ	Steffan-Boltzmann constant	$5.67 \cdot 10^{-8}$	[W/m^2K^4]
σ_r	Material relative conductivity in relation with copper		
μ_r	Relative permeability		
t_{on}	Switch conduction period		[s]
t_{DLY}	Delay time		[s]
T_s	Switching period		[s]

Computer terminology

EEPROM (Electrically Erasable Program Memory) – type of stable memory, which can be erased after programming by electric current.

EPROM (Erasable Program Memory) – type of stable memory, which can be deleted after programming, this deletion is done by illumination by UV light, these memories have ceramic window for the die.

FLASH – Subtype of EEPROM memory type family, usually have thousands of possible rewrites.

High level (high state) – logic status of the MCU pin, high state represents logic 1 and is implemented as a supply voltage.

Interrupt – special state of processor, when after some event normal run of code is interrupted and special part of code is started.

ISR (Interrupt Service Routine) – part of code, which will be started after an interrupt occurs.

Low level (low state) – logic status of the MCU pin, low state represents logic 0 and is implemented as a zero volts.

OTP (One Time Programmable) – type of stable memory, which can be programmed only once and after programming is not possible to change memory content. Technology is the same as EPROM only window is covered.

Port – input/output pins on microcontrollers are associated to the groups with similar properties and behaviors. These groups are called *ports.* Usually ports are 8-bit, but is not a rule.

RAM (Random Access Memory) – type of memory, which can be read and write without any limitation. Memory content is not stable, so after disconnecting power supply everything is deleted which can be read and write without any limitation.

RISC (Reduced Instruction Set Computer) – A RISC CPU contains fewer instructions than a non CISC CPU (Complete Instruction Set Computer). On first thought, one might think the RISC would be inferior to the CISC one. Actually a RISC CPU is faster because of the fewer instructions. Some of the eliminated instructions are deemed fairly obsolete anyway. A disadvantage might be that a RISC CPU may make software more complex if the program has to work around the eliminated instruction(s).

Watchdog – autonomous part of the microcontroller, which consist of independent oscillator and timer. This timer must be cleared in software or when overflows, watchdog resets microcontroller. This function is useful to prevent never-ending loops.