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# **User's Manual**

**Loss Simulator v1.0**  
**Document version 1.0**

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## INTRODUCTION

The Loss Simulator is an application intended to estimate power losses of Power Modules, IPM. The software computes this power loss values using 3 sections of inputs.

1. Module/Device Parameter
2. Circuit Algorithm
3. User Input Conditions/Parameters

When computation finished, the software will provide 2 outputs

1. Power Loss Result display
2. CSV export of step by step computation

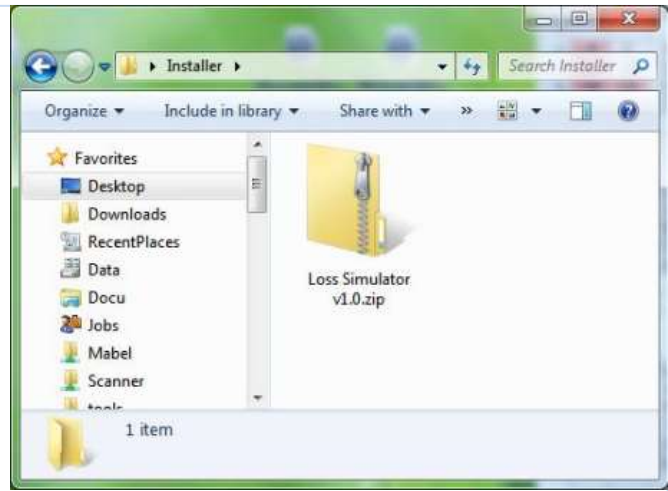


## ***RECOMMENDED SYSTEM REQUIREMENTS***

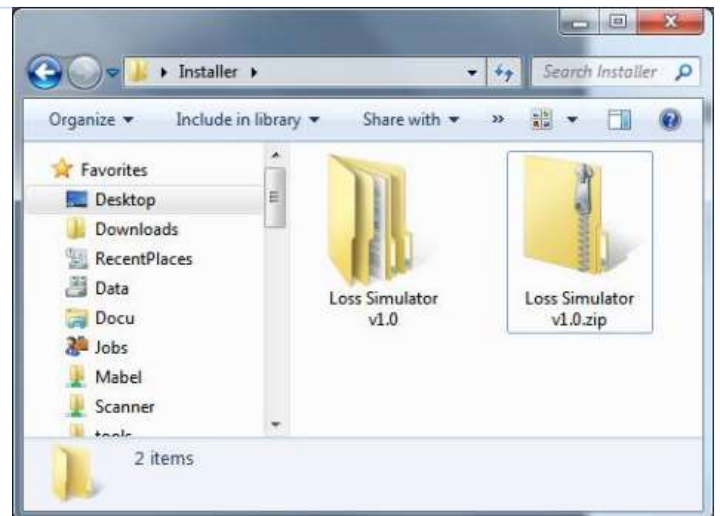
Operating System	Microsoft Windows XP, Microsoft Windows Vista, Microsoft Windows 7 32-bit & 64-bit, Microsoft Windows 8 32-bit & 64-bit
Memory	1GB or better
Screen Resolution	At least 800 x 600

## ***EASY INSTALLATION***

1. Copy and Paste the zip file to the target directory



2. Unzip the file



3. Open the folder and run the Loss Simulator Application



NOTE: Simply delete the whole folder of the application to remove/uninstall the software.

## USING THE SOFTWARE

### Input Window

Loss Simulator v1.0

**Input** **Output**

Module: BSM120D12P2C005

Circuit: 3 Phase Inverter

Gate Resistor: 1.0

**Condition**

Vcc: 600.0 V

Io: 100.0 Ipeak

PF: 0.8

Mod: 0.8

Fc: 5.0 kHz

Tf: 50.0 °C

**Execute**

**Stop**

#### A. Module/Device

- Select a Module or Device to be estimated
- If no Module is selected, computation is not available.

#### B. Circuit

- Select a type of circuit to be used for the selected device
- If no Circuit is selected, computation is not available

#### C. Gate Resistor

- Select the gate resistor of the device to be used
- If no Gate resistor is selected, the default gate resistor of the module/device will be used.

#### D. $V_{CC}$ (P-N Voltage)

- Used by recommended operation conditions although it is calculated.

- Value must be greater than or equal to Zero only ( $V_{CC} \geq 0$ ).

E.  $I_O$  (Output Current)

- Used by recommended operation conditions although it is calculated.
- Value must be greater than or equal to Zero only ( $I_O \geq 0$ ).

F. Current Setup

- $I_{PEAK}$
- $A_{RMS}$

G. PF (Power Factor)

- Value is ranging from -1 to 1 only ( $-1 \leq PF \leq 1$ ).

H. Mod (Modulation Ratio)

- Available only for 3-Phase-Inverter
- Value is ranging from 0 to 1 only ( $0 \leq Mod \leq 1$ ).

I. Duty (Duty Cycle)

- Available only for Chopper
- Value is ranging from 0 to 100 only ( $0 \leq Duty \leq 100$ ).

J.  $F_C$  (Carrier Frequency)

- Value must be greater than or equal to One only ( $F_C \geq 1$ ).

K.  $T_F$  (Heat Sink Temperature)

- Used by module case temperature although it is calculated
- Error message will appear if  $T_j$  is over Junction Temperature

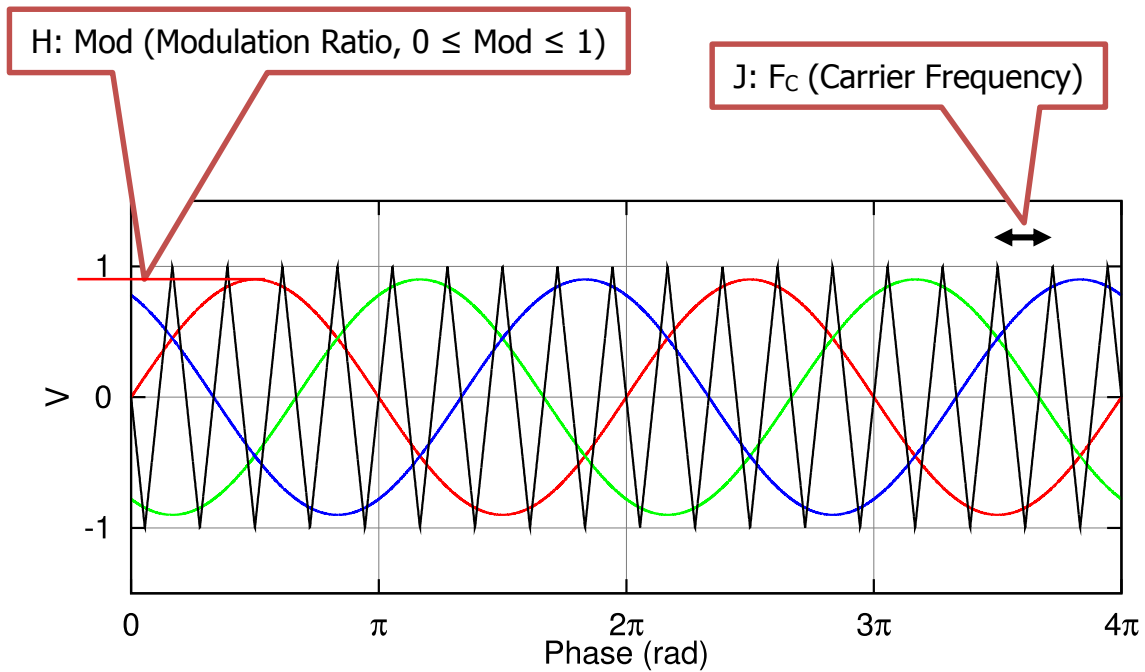
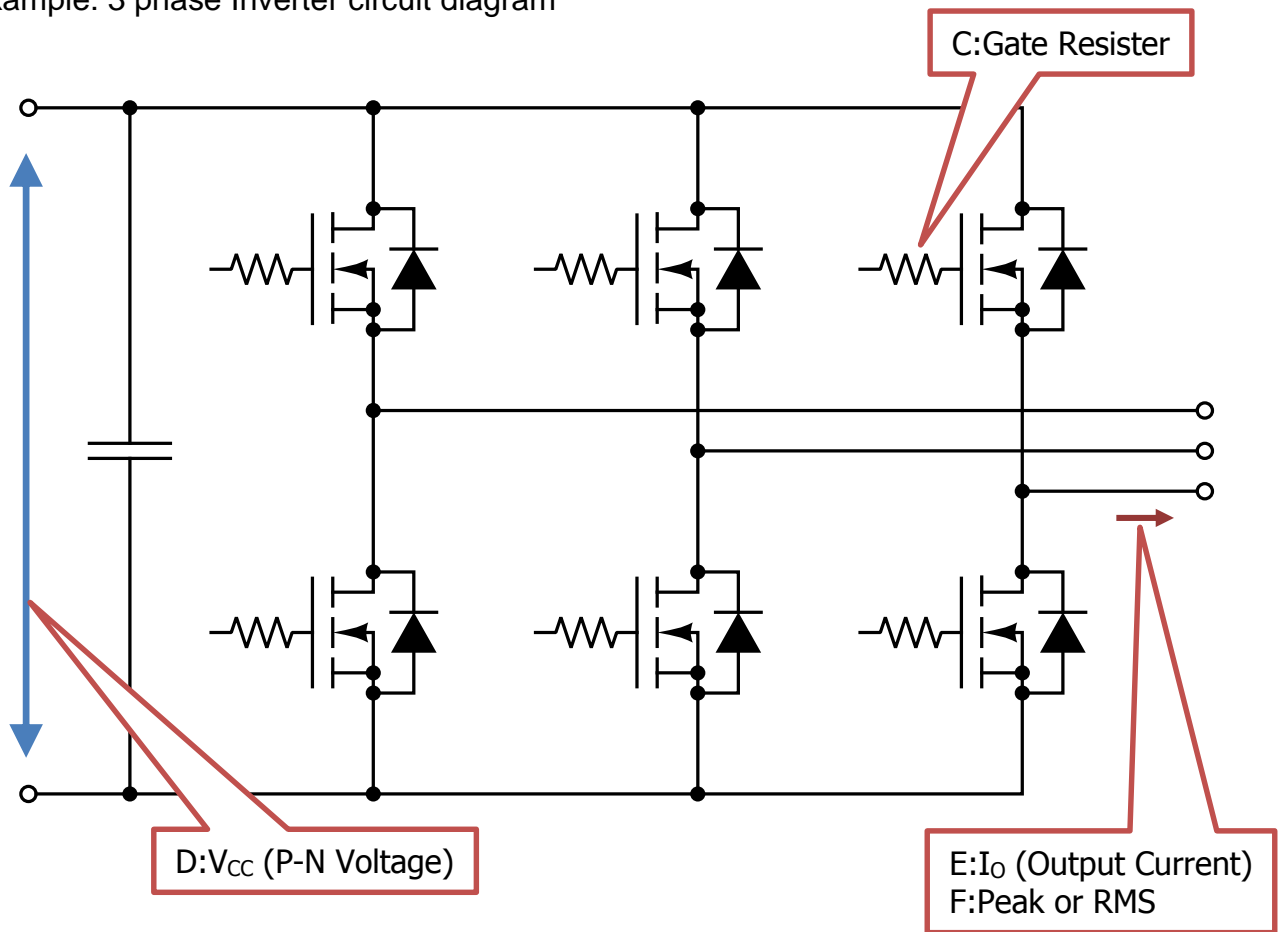
L. Execute

- Start the computation
- Software can't exit during computation.

M. Stop

- Stop the ongoing computation
- All controls will be disabled aside from "Stop" Button during computation

example: 3 phase Inverter circuit diagram



## Output Window

**Loss Simulator v1.0**

**Input** | **Output**

**Tr**

P-Tr	41.526776	W/Tr
SW	4.728033	W/Tr
DC	36.798743	W/Tr
SW(on)	3.634458	W/Tr
SW(off)	1.093576	W/Tr
$\Delta T_{j-c}(Ave)$	6.644284	$^{\circ}C$
$T_j(Ave)$	69.102317	$^{\circ}C$

**Di**

P-Di	12.921325	W/Di
SW	0.419581	W/Di
DC	12.501744	W/Di
$\Delta T_{j-c}(Ave)$	2.713478	$^{\circ}C$
$T_j(Ave)$	56.589876	$^{\circ}C$

**P\_Sum**

P-Sum	326.688607	W
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**Save to CSV**

### A. Tr (Transistor)

#### i. P-Tr

- Transistor Total Power Loss per Transistor

#### ii. SW

- SW(on) + SW(off) of Transistor

#### iii. DC

- DC Power Loss of the Transistor
- Displays the value of IGBT Power Loss.
- If no computation of IGBT Power Loss it will display a blank result

#### iv. SW(on)

- Switch On Power Loss
- Displays the value of Switch On Power Loss.
- If no computation of Switch On Power Loss it will display a blank result

v. SW(off)

- Switch Off Power Loss
- Displays the value of Switch Off Power Loss.
- If no computation of Switch Off Power Loss it will display a blank result

vi.  $\Delta T_{j-c}$  (Ave)

- Difference between Junction Temperature and Case Temperature of Transistor

vii.  $T_j$  (Ave)

- Junction Temperature of Transistor
- Displays the value of IGBT Temperature.
- If no computation of IGBT Temperature it will display a blank result
- If IGBT Temperature exceeded the maximum Junction temperature of a device/module, a warning message will be prompt

B. Di (Diode)

i. P-Di

- Diode Total Power Loss per Diode

ii. SW

- Recovery Power Loss
- Displays the value of Recovery Power Loss.
- If no computation of Recovery Power Loss it will display a blank result

iii. DC

- DC Power Loss of the Diode
- Displays the value of FWD Power Loss.
- If no computation of FWD Power Loss it will display a blank result

iv.  $\Delta T_{j-c}$  (Ave)

- Difference between Junction Temperature and Case Temperature of Diode

v.  $T_j$  (Ave)

- Junction Temperature of Diode
- Displays the value of FWD Temperature.
- If no computation of FWD Temperature it will display a blank result
- If FWD Temperature exceeded the maximum Junction temperature of a device/module, a warning message will be prompt



#### C. P-Sum

- Total Power Loss
- For Chopper,  $P\text{-Sum} = P\text{-Tr} + P\text{-Di}$
- For 3-Phase-Inverter,  $P\text{-Sum} = 6 \times (P\text{-Tr} + P\text{-Di})$

#### D. Save To CSV

- Saves Computation to CSV
- Saves the Display Power Loss Result, Module/Device Constant, User Input Parameters and Computation.
- No CSV data will be generated if error occurs during computation

### Release Note

2015 / 04 / 10

v 1.0

First release