

48-CELL BOOSTER RING MODEL

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* Normally Booster runs with I_{max}= 970 amps and I_{min}= 103 amps

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* TA. RAMPING PS1&2&3&4 ,No Rd, PS Filters with 1uF ComMode C

*RGND=50K

*

* plot v(1)-v(8) v(7)-v(6) v(5)-v(4) v(3)-v(2)

*

* .OPTIONS RELTOL = 0.0001

*

* LIN Np Fstart Fstop

*.AC LIN 200 4Hz 1KHZ

*** Transient analysis definition:

** TSTEP TSTOP <TSTART <TMAX>>

.TRAN 10uS 10S 8.0s 200us UIC

*

*

* Note: All the following save cammands cannot be used

* simultaneously with WinSpice - it will error-out

*

.SAVE IM_D1 IM_F1 I_CHK1 I_CAP1 I_GND1 V_CAP1

.SAVE IM_D5 IM_F5 I_CHK5 I_CAP5 I_GND5 V_CAP5

.SAVE IM_D9 IM_F9 I_CHK9 I_CAP9 I_GND9 V_CAP9

.SAVE IM_D13 IM_F13 I_CHK13 I_CAP13 I_GND13 V_CAP13

*.SAVE IM_D17 IM_F17 I_CHK17 I_CAP17 I_GND17 V_CAP17

.SAVE IM_D21 IM_F21 I_CHK21 I_CAP21 I_GND21 V_CAP21

*.SAVE IM_D25 IM_F25 I_CHK25 I_CAP25 I_GND25 V_CAP25

.SAVE IM_D29 IM_F29 I_CHK29 I_CAP29 I_GND29 V_CAP29

*.SAVE IM_D33 IM_F33 I_CHK33 I_CAP33 I_GND33 V_CAP33

.SAVE IM_D37 IM_F37 I_CHK37 I_CAP37 I_GND37 V_CAP37

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*.SAVE IM_D41 IM_F41 I_CHK41 I_CAP41 I_GND41 V_CAP41
.SAVE IM_D45 IM_F45 I_CHK45 I_CAP45 I_GND45 V_CAP45
.SAVE A2 A3 A4 A5 A6 A7 A8 A9 A10 A11 A12
*.SAVE B2 B3 B4 B5 B6 B7 B8 B9 B10 B11 B12
.SAVE C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12
*.SAVE D2 D3 D4 D5 D6 D7 D8 D9 D10 D11 D12
.SAVE 1 2 3 4 5 6 7 8 101 I(VT1)
*
* PS Locations:
XPS1 3 4 101 PS
XPS2 1 2 102 PS
XPS3 7 8 103 PS
XPS4 5 6 104 PS
*
* PS Voltages using sine waves
*      Sin( Voff  Vamp  Freq Tdelay Tdamping)
VPS1 101 0 Sin( 520.0V 322.01V 15.0)
VPS2 102 0 Sin( 520.0V 322.01V 15.0)
VPS3 103 0 Sin( 520.0V 322.01V 15.0)
VPS4 104 0 Sin( 520.0V 322.01V 15.0)
*
* PS Voltages using sloped square waves
*      Pulse(Vinit Vfinal Tdelay Trise Tfall Pwidth Period)
* VPS1 101 0 PULSE(75V 750V 0us 5ms 5ms 28.3ms 66.7ms)
* VPS2 102 0 PULSE(75V 750V 0us 5ms 5ms 28.3ms 66.7ms)
* VPS3 103 0 PULSE(75V 750V 0us 5ms 5ms 28.3ms 66.7ms)
* VPS4 104 0 PULSE(75V 750V 0us 5ms 5ms 28.3ms 66.7ms)
*
* Reference Magnet connection:
XRM B4 RM1 0 REF_MAGNET
VT1 RM1 RM2 DC 0V
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* RBPREF B4 RM2 0.000001

*

* All choke secondaries are connected to nodes T3 and T4

RX1 T3 0 100MEG

RX2 T4 0 100MEG

*

*COMMON MODE REJECTION

* VCOM COM 0 DC 0V AC 1V

* VT2 COM 2 DC 0V

*

*

*SECTION A CELLS

*

X1 2 A2 0 T3 T4 IM_D1 IM_F1 I_CHK1 I_CAP1 I_GND1 V_CAP1 CELL02

*X1 2 A2 0 T3 T4 CELL01

X2 A2 A3 0 T3 T4 CELL01

X3 A3 A4 0 T3 T4 CELL01

X4 A4 A5 0 T3 T4 CELL01

*

X5 A5 A6 0 T3 T4 IM_D5 IM_F5 I_CHK5 I_CAP5 I_GND5 V_CAP5 CELL02

*X5 A5 A6 0 T3 T4 CELL01

X6 A6 A7 0 T3 T4 CELL01

X7 A7 A8 0 T3 T4 CELL01

X8 A8 A9 0 T3 T4 CELL01

*

X9 A9 A10 0 T3 T4 IM_D9 IM_F9 I_CHK9 I_CAP9 I_GND9 V_CAP9 CELL02

*X9 A9 A10 0 T3 T4 CELL01

X10 A10 A11 0 T3 T4 CELL01

X11 A11 A12 0 T3 T4 CELL01

X12 A12 3 0 T3 T4 CELL01

*

*SECTION B CELLS

*

X13 4 B2 0 T3 T4 IM_D13 IM_F13 I_CHK13 I_CAP13 I_GND13 V_CAP13 CELL02

*X13 4 B2 0 T3 T4 CELL01

X14 B2 B3 0 T3 T4 CELL01

X15 B3 RM2 0 T3 T4 CELL01

X16 B4 B5 0 T3 T4 CELL01

*

X17 B5 B6 0 T3 T4 IM_D17 IM_F17 I_CHK17 I_CAP17 I_GND17 V_CAP17 CELL02

*X17 B5 B6 0 T3 T4 CELL01

X18 B6 B7 0 T3 T4 CELL01

X19 B7 B8 0 T3 T4 CELL01

X20 B8 B9 0 T3 T4 CELL01

*

X21 B9 B10 0 T3 T4 IM_D21 IM_F21 I_CHK21 I_CAP21 I_GND21 V_CAP21 CELL02

*X21 B9 B10 0 T3 T4 CELL01

X22 B10 B11 0 T3 T4 CELL01

X23 B11 B12 0 T3 T4 CELL01

X24 B12 5 0 T3 T4 CELL01

*

*SECTION C CELLS

*

X25 6 C2 0 T3 T4 IM_D25 IM_F25 I_CHK25 I_CAP25 I_GND25 V_CAP25 CELL02

*X25 6 C2 0 T3 T4 CELL01

X26 C2 C3 0 T3 T4 CELL01

X27 C3 C4 0 T3 T4 CELL01

X28 C4 C5 0 T3 T4 CELL01

*

X29 C5 C6 0 T3 T4 IM_D29 IM_F29 I_CHK29 I_CAP29 I_GND29 V_CAP29 CELL02

*X29 C5 C6 0 T3 T4 CELL01

X30 C6 C7 0 T3 T4 CELL01

X31 C7 C8 0 T3 T4 CELL01

X32 C8 C9 0 T3 T4 CELL01

*

X33 C9 C10 0 T3 T4 IM_D33 IM_F33 I_CHK33 I_CAP33 I_GND33 V_CAP33 CELL02

*X33 C9 C10 0 T3 T4 CELL01

X34 C10 C11 0 T3 T4 CELL01

X35 C11 C12 0 T3 T4 CELL01

X36 C12 7 0 T3 T4 CELL01

*

*SECTION D CELLS

*

X37 8 D2 0 T3 T4 IM_D37 IM_F37 I_CHK37 I_CAP37 I_GND37 V_CAP37 CELL02

*X37 8 D2 0 T3 T4 CELL01

X38 D2 D3 0 T3 T4 CELL01

X39 D3 D4 0 T3 T4 CELL01

X40 D4 D5 0 T3 T4 CELL01

*

X41 D5 D6 0 T3 T4 IM_D41 IM_F41 I_CHK41 I_CAP41 I_GND41 V_CAP41 CELL02

*X41 D5 D6 0 T3 T4 CELL01

X42 D6 D7 0 T3 T4 CELL01

X43 D7 D8 0 T3 T4 CELL01

X44 D8 D9 0 T3 T4 CELL01

*

X45 D9 D10 0 T3 T4 IM_D45 IM_F45 I_CHK45 I_CAP45 I_GND45 V_CAP45 CELL02

*X45 D9 D10 0 T3 T4 CELL01

X46 D10 D11 0 T3 T4 CELL01

X47 D11 D12 0 T3 T4 CELL01

X48 D12 1 0 T3 T4 CELL01

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* SUBCIRCUITS SUBCIRCUITS SUBCIRCUITS SUBCIRCUITS

*

.SUBCKT CELL01 TT1 T2 T3 T4 T5

R1 TT1 TT2 10.0e-3

L1 TT2 T1 0.20e-3

CC T1 T3 40.0e-9

X1 T1 A T3 D_MAGNET

X2 B T2 T3 F_MAGNET

X3 A B T4 T5 T3 CHOKE

* C1 A B 8341e-6

* C1 A B 7690.0e-6

* C1 A B 7892.0e-6

C1 A B 8250.0e-6

*

XD TT1 T2 RDAMP

*

.ENDS CELL01

*

.SUBCKT CELL02 1 2 3 4 5 IM_D IM_F I_CHK I_CAP I_GND V_CAP

R1 1 A1 10.0e-3

L1 A1 A2 0.20e-3

CC A2 A9 40.0e-9

VT1 A2 A3 DC 0V

VT2 A4 A5 DC 0V

VT3 A6 A7 DC 0V

VT4 A6 A8 DC 0V

VT5 A9 3 DC 0V

X1 A3 A6 A9 D_MAGNET

X2 A5 2 A9 F_MAGNET

X3 A7 A4 4 5 A9 CHOKE

* C1 A8 A4 8341e-6

* C1 A8 A4 7690.0e-6

* C1 A8 A4 7892.0e-6

C1 A8 A4 8250.0e-6

*

B1 IM_D 0 V=-I(VT1)

B2 IM_F 0 V=-I(VT2)

B3 I_CHK 0 V=-I(VT3)

B4 I_CAP 0 V=-I(VT4)

B5 I_GND 0 V=I(VT5)

B6 V_CAP 0 V=(V(A7) - V(A4))

rrr1 IM_D 0 1000.0

rrr2 IM_F 0 1000.0

rrr3 I_CHK 0 1000.0

rrr4 I_CAP 0 1000.0

rrr5 I_GND 0 1000.0

rrr6 V_CAP 0 1000.0

XD A2 2 RDAMP

.ENDS CELL02

*

.SUBCKT D_MAGNET 1 2 3

R1 1 4 17.3e-3

L2 4 5 6.10e-3

RD 5 2 38.0

LD 5 2 4.1e-3

R2 4 2 3000.0

C1 1 3 29.0e-9

C2 2 3 29.0e-9

.ENDS D_MAGNET

*

.SUBCKT F_MAGNET 1 2 3

R1 1 4 17.3e-3

L2 4 5 6.10e-3

RD 5 2 38.0

LD 5 2 4.10e-3

R2 4 2 3000.0

C1 1 3 22.0e-9

C2 2 3 22.0e-9

.ENDS F_MAGNET

*

.SUBCKT CHOKE 1 2 3 4 5

Rgnd 2 5 10.0e6

R1 1 6 36.00e-3

R2 3 7 295.0e-3

LP 6 2 40.0e-3

LS 7 4 40.0e-3

CA 6 7 92.0e-9

CB 2 4 92.0e-9

C1 1 5 2.0e-9

C2 2 5 2.0e-9

RP 6 2 5000.0

CP 6 2 5.0e-9

KPS LP LS 0.999

.ENDS CHOKE

*

.SUBCKT REF_MAGNET 1 2 3

R1 1 4 9.64e-3

L2 4 2 2.32e-3

R2 4 2 1800.0

CR2 4 2 3.0e-9

C1 1 3 2.4e-9

C2 2 3 2.4e-9

.ENDS REF_MAGNET

*


```
.SUBCKT PS P N C
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```
B1 P1 N1 V=V(C)
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```
L1 P1 P 0.9e-3
```

```
L2 N1 N 0.9e-3
```

```
R1 P 1 1.76
```

```
C1 1 N 2422.0e-6
```

```
C2 P N 486.0e-6
```

```
RG1 P 0 50.0e3
```

```
RG2 N 0 50.0e3
```

```
CP P 0 1.0e-6
```

```
CN N 0 1.0e-6
```

```
rrrc C 0 1000.0
```

```
.ENDS PS
```

```
*
```

```
.SUBCKT RDAMP 1 2
```

```
RD 1 2 50.0e6
```

```
.ENDS RDAMP
```

```
*
```

```
.end
```