Model Usage Notes:

A. Features have been modelled

1. Frequency selection through pin strapping and I2C
2. Soft Start time selection through pin strapping and I2C
3. Low side current limit selection through pin strapping and I2C
4. PFM/FCCM selection through pin strapping and I2C
5. Hiccup duration selection through pinstrapping and I2C
6. Selectable Internal Compensation
7. Over Voltage Protection (OVP)
8. Under Voltage Protection (UVP)
9. High side current limit
10. Low side negative current limit
11. Power Good
12. Enable functionality
13. Prebias
14. UVLO Protection
15. Programmable Vout

B. Features have not been modelled

1. Operating Quiescent Current
2. Shutdown Current
3. Temperature dependent characteristics
4. COMP is not selected through pinstrapping and I2C instead used as parameters
5. SYNC

C. Application Notes

1. To run the POP/AC analysis, you must run complete Startup Transient simulation and then run the AC analysis also you must choose "Use snapshot from previous transient analysis" in POP Advanced options.
2. Pinstrapping and I2C programming selection settings
    a. Pinstrapping
    One way of selecting switching frequency, soft start time/mode of operation and LS current limit values of the model are from resistor which is connected between FSEL, ILIM and SS/PFM pins and gnd.
    To select pinstrapping in the model choose PINSTRAPPING = 1

Table 1 : Frequency Resistor Selection

R_{FSEL}(KΩ)	Short	10	16.2	23.7	33.2	44.2	61.9	82.5
Frequency (KHz)	1000	400	600	800	1000	1200	2000	2200

Example: If we connect R_{FSEL} = 33.2KΩ between FSEL and gnd then operating frequency of the device is 1000 KHz.

Table 2: Current Limit Resistor Selection

R_{ILIM} (kΩ)	Short	10	16.2	23.7	33.2	44.2	61.9
Typical limit (A)	20	5.5	8	10.5	13	16.5	20

Example: If we connect R_{ILIM} = 61.9KΩ between ILIM and gnd then LS current limit of the device is 20A.

Table 3: Soft-Start CLK and PFM Resistor Selection

$R_{SS/PFM}$ (kΩ)	Short	10	16.2	23.7	33.2	44.2	61.9	82.5	100
PFM	Disable	Enable				Disable			
SS CLK (MHz)	1	2	1	0.5	0.25	2	1	0.5	0.25
Hiccup Duration (ms)	25.2	12.6	25.2	50.4	100.8	12.6	25.2	50.4	100.8

Example: If we connect $R_{SS/PFM}$ = 61.9KΩ between SS/PFM and gnd then soft start time of the device is 0.9ms if Vout is in range between 0.5V-1.4V and mode of operation is FCCM.

Hiccup restart time duration is 25.2ms if parameter "Hiccup_Restart_Time_Scale=0" in F11 window or Hiccup restart time duration will be 10 times lesser (2.52ms) if parameter "Hiccup_Restart_Time_Scale=1" in F11 window. Scaling factor added into model to observe hiccup behaviour in less simulation time.

Note: Do not keep FSEL, SS/PFM, and ILIM pins left open. These pins either connect to gnd through resistors or directly connect to gnd. Model gives an error if these pins kept floating.

Table 4: Soft-Start Timing versus Output Voltage

VSET (V)	VOUT (V)	SS Timing (ms) at CLK: 2.0MHz	SS Timing (ms) at CLK: 1.0MHz	SS Timing (ms) at CLK: 0.5MHz	SS Timing (ms) at CLK:0.25MHz
0.1	0.5	0.45	0.9	1.8	3.6
0.2	1	0.45	0.9	1.8	3.6
0.28	1.4	0.45	0.9	1.8	3.6
0.3	1.5	0.9	1.8	3.6	7.2
0.4	2	0.9	1.8	3.6	7.2
0.5	2.5	0.9	1.8	3.6	7.2
0.56	2.8	0.9	1.8	3.6	7.2
0.6	3	1.8	3.6	7.2	14.4
0.7	3.5	1.8	3.6	7.2	14.4
0.8	4	1.8	3.6	7.2	14.4
0.9	4.5	1.8	3.6	7.2	14.4
1	5	1.8	3.6	7.2	14.4

b. I2C Programming

Other way of selecting switching frequency, soft start time/mode of operation and LS current limit values of the model are from I2C programming by giving exact decimal codes to the Fsw, SS, ILIM and FCCM parameters.

To select I2C programming in the model choose PINSTRAPPING = 0

Table 5: Frequency selection through I2C programming

Fsw (Decimal Code)	0	1	2	3	4	5	6
Frequency (KHz)	400	600	800	1000	1200	2000	2200

Example: If we select FSW = 3 in parameter section then operating frequency of the device is 1000 KHz.

Table 6: Current limit selection through I2C programming

ILIM (Decimal Code)	0	1	2	3	4	5
Typical limit (A)	5.5	8	10.5	13	16.5	20

Example: If we select ILIM = 5 in parameter section then LS current limit of the device is 20A.

Table 7: Soft start time selection through I2C programming

SS (Decimal Code)	0	1	2	3
SS CLK (MHz)	2	1	0.5	0.25
Hiccup Duration (ms)	12.6	25.2	50.4	100.8

For soft start timing versus output voltage refer Table 4.

Example: If we select SS = 1 in parameter section then soft start time of the device is 0.9ms if the Vout range is in between 0.5V-1.4V.
Hiccup restart time duration is 25.2ms if parameter "Hiccup_Restart_Time_Scale=0" in F11 window or Hiccup restart time duration will be 10 times lesser (2.52ms) if parameter "Hiccup_Restart_Time_Scale=1" in F11 window. Scaling factor added into model to observe hiccup behaviour in less simulation time.

Table 8: FCCM selection through I2C programming

FCCM (Decimal Code)	0	1
Mode	PFM	FCCM

Example: If we select FCCM = 1 in parameter section then mode of operation of the device is FCCM.

Internal Comp Selection:

Neither pinstrapping nor I2C programming is performed on COMP due to increasing complexity of the model. To select comp values we have passed parameters Z1 (Zero 1), Z2 (Zero 2) and Rp from top level.

These are the equations written inside to select appropriate capacitor values based on Z1, Z2 and Rp.
Ci= {1/(2*3.14*(Rp+3e5)*Z1)}
Cz= {1/(2*3.14*(20+200)*1000*Z2)}

Table 9 : Selection of Rp versus output voltage

Vout (V)	0.5-1.1	1.2-1.5	1.6-2.8	2.9-4	4.1-5.5
Rp (KΩ)	30	50	100	150	300

Example: To select the COMP 2 as compensation setting for frequency of 1000 kHz and Vout of 1V then choose Z1=4.5k, Z2=18.1k and Rp=30k in parameter section.

Table 10: Z1 and Z2 values for selection of COMP versus different frequencies and Vout

FREQUENCY (kHz)	COMPENSATION SETTING	ZERO 1 (kHz) for VOUT = 0.5V-1.1V	ZERO 1 (kHz) for VOUT = 1.2V-1.5V	ZERO 1 (kHz) for VOUT = 1.6V-2.8V	ZERO 1 (kHz) for VOUT = 2.9V-4.0V	ZERO 1 (kHz) for VOUT = 4.1V-5.5V	ZERO 2 (kHz)
400	COMP 1	2.2	2.1	1.8	1.6	1.2	5.5
	COMP 2	2.2	2.1	1.8	1.6	1.2	7.3
	COMP 3	3.6	3.4	3.0	2.7	2.0	14.5
	COMP 4	7.2	7.0	6.1	5.4	4.1	28.4
600	COMP 1	2.2	2.1	1.8	1.6	1.2	5.5
	COMP 2	2.7	2.6	2.3	2.0	1.5	11.0
	COMP 3	4.5	4.3	3.8	3.4	2.5	18.1
	COMP 4	10.5	10.1	8.8	7.9	5.9	45.2
800	COMP 1	2.2	2.1	1.8	1.6	1.2	7.3
	COMP 2	3.6	3.4	3.0	2.7	2.0	14.5
	COMP 3	7.2	7.0	6.0	5.4	4.1	28.4
	COMP 4	13.5	13	11.4	10.1	7.6	55.6
1000	COMP 1	2.2	2.1	1.9	1.7	1.2	9.0
	COMP 2	4.5	4.3	3.8	3.4	2.5	18.1
	COMP 3	9.0	8.7	7.6	6.7	5.1	37.1
	COMP 4	18.8	18.2	15.9	14.1	10.6	72.3
1200	COMP 1	2.7	2.6	2.3	2.0	1.5	11.0
	COMP 2	4.5	4.3	3.8	3.4	2.5	18.1
	COMP 3	10.5	10.1	8.8	7.9	5.9	45.2
	COMP 4	23.5	22.7	19.9	17.7	13.3	90.4
2000&2200	COMP 1	4.5	4.3	3.8	3.4	2.5	18.1
	COMP 2	9	8.7	7.6	6.7	5.1	37.1
	COMP 3	18.8	18.2	15.9	14.1	10.6	72.3
	COMP 4	37.7	36.4	31.8	28.3	21.2	144.7