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Updates in Test:

Main choke was Coilcraft DO3308P-473 which was supposed to have about 300mW losses and less than 40 degrees C rise at room ambient and full load off 40Vin per Coilcraft loss calculator. However, about a 60 degrees C rise was seen in test. It was replaced with Sumida CDRH104R with same 47uHy value. Based upon input power measurements, losses were reduced by about 150mW and temperature rise reduced to 35 degrees Celsius at same load and Vin.

Main switch Q1 was FDS3692, but went into linear mode with Vin about 32V and gate drive about 4V and blew up.

For reliable operation with Vin below 40V:

Q1 must be fully on before Vgs reaches 4V which is turn on threshold of TPS40210

Vishay SUD06N10-225L is fully on before Vgs=3V.

Replacing Q1 with this part allowed continuous full load operation with Vin just above shutdown threshold of 31V with a clean switching waveform (see page 3) and the Sumida choke only reaching 66 degrees Celsius and Q1 reaching 54 degrees Celsius.

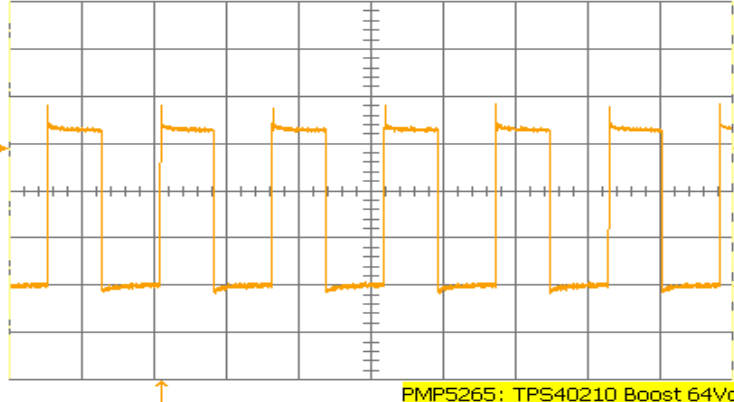
Regulation, losses and efficiency: 40Vin and 55Vin with no external airflow:

Vin Volts	Iin mA	Vout1 Volts	Iout1 mA	Losses in mW	Efficiency %
40.1	843	63.98	509	1238	96.3
Q1 at 45degC	L1 at 58degC	D1 at 45degC	Ambient: 23-25		
40.0	632	63.97	379	1035	95.9
40.0	425	64.19	252	824	95.2
40.0	209	64.20	121	592	92.9
40.0	101	64.15	56.5	416	89.7
40.0	3	64.34	0	120	
55.0	609	64.01	509.5	882	97.4
55.1	454	64.01	379	756	97.0
55.1	305	64.03	252	670	96.0
55.0	151	64.15	121	543	93.5
55.0	73	64.14	56.5	391	90.3
55.0	3	64.36	0	165	
Just	Above	Continuous	conduction	308-9kHz	
40.0	507	64.09	301.5	957	95.3
55.0	269.5	64.15	221	645	95.6
Just	Before	Turn off	Due to	Low Vin	
31.32	1103	64.54	510	1631	95.3
Q1 at 54degC	L1 at 66degC	Ambient: 23-25			

Main waveform when Vin just above turn off threshold of about 31V (full load)

6-Jan-10
13:01:24

2 μ s
20.0 V



maximum(1) 76.9 V
Freq(1) 322.613 kHz
pkpk(1) 80.6 V
mean(1) 30.06 V
mean(4) -23mV

2 μ s
1 2 V DC $\times 10$
2 50 mV DC $\times 10$
3 50 mV DC
4 1 V DC

1 DC 58.4 V

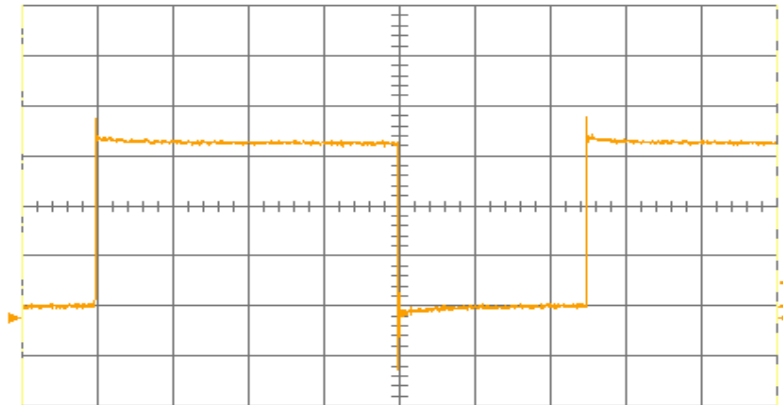
PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 31.3V just above shutdown
Main switching waveform at full load
Even with minimum gate drive voltage of about 4V
the main switch Vishay SUD06N10-225L is fully
switched on when gate drive applied, no "active
region" operation
Transistor rises to 54 degrees Celsius

Qq

Now Vin at 40V :

7-Jan-10
16:21:15

.5 μ s
20.0 V



maximum(1) 75.6 V
Freq(1) 307.335 kHz
pkpk(1) 101.3 V
mean(1) 42.50 V
mean(4) -25mV

.5 μ s
1 2 V DC $\times 10$
2 50 mV DC $\times 10$
3 50 mV DC
4 1 V DC

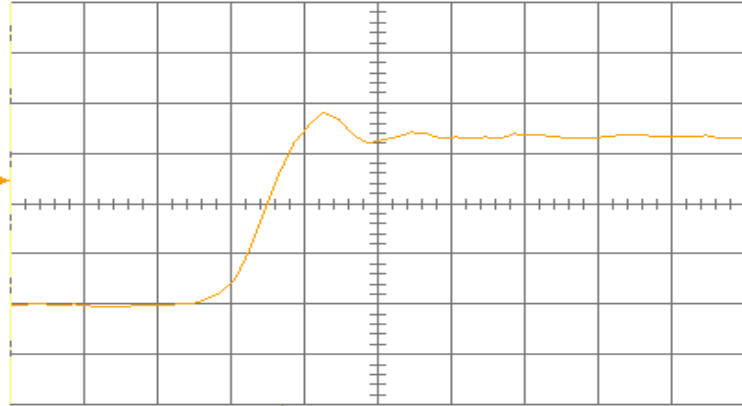
1 DC -4.0 V

PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 40V
Main switching waveform at full load
Drain of Q1 (SUD06N10-225L)
Transistor rises to 45 degrees Celsius
period about 3.22usec
about 10V positive overshoot and 26V maximum
undershoot

Main waveform rise shown:

7-Jan-10
16:22:40

5 ns
20.0 V



maximum(1) 76.3 V
Freq(1) - - -
pkpk(1) 76.9 V
mean(1) 44.49 V
mean(4) -26mV

5 ns
1 2 V DC $\times \frac{10}{10}$
2 50 mV DC $\times \frac{10}{10}$
3 50 mV DC
4 1 V DC

1 DC 49.6 V

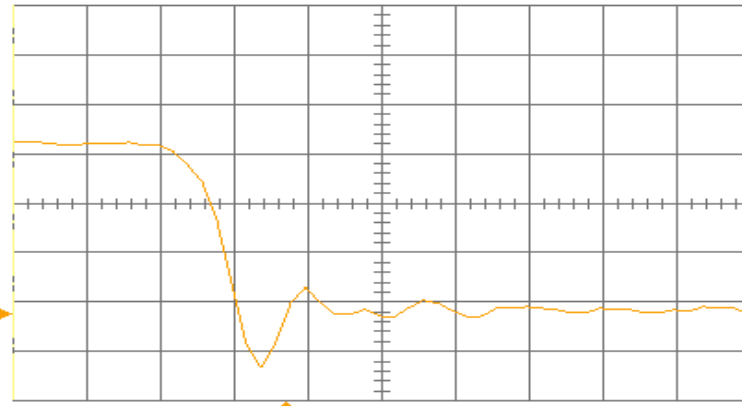
PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 40V
Main switching waveform at full load - rise time when Q1 turns off
Drain of Q1 (SUD06N10-225L)
rise time about 9nsec
11V overshoot or max of 76V across drain - source of main FET rated to 100Vds

STOPPED

And fall time detail:

7-Jan-10
16:22:10

5 ns
20.0 V



maximum(1) 65.0 V
Freq(1) - - -
pkpk(1) 91.3 V
mean(1) 14.31 V
mean(4) -20mV

5 ns
1 2 V DC $\times \frac{10}{10}$
2 50 mV DC $\times \frac{10}{10}$
3 50 mV DC
4 1 V DC

1 DC -4.0 V

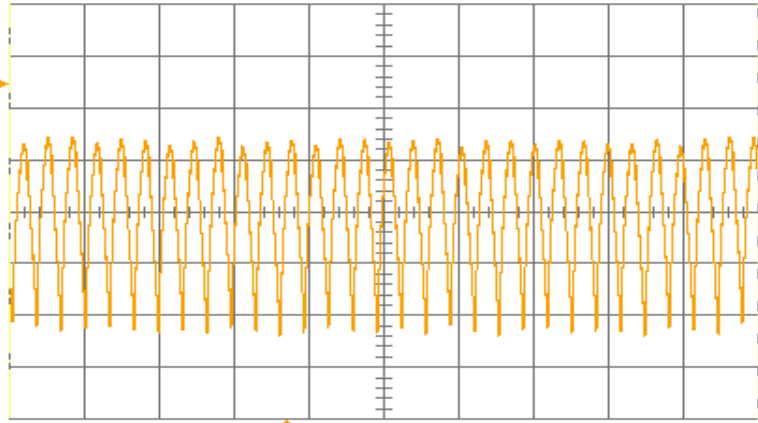
PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 40V
Main switching waveform at full load - fall time when Q1 turns on
Drain of Q1 (SUD06N10-225L)
fall time about 7nsec
26V undershoot or max of 91V reverse bias on main output diode rated to 100V

STOPPED

Output ripple:

7-Jan-10
16:25:16

10 μ s
100mV



maximum(1) 144 mV
Freq(1) 307.767 kHz
pkpk(1) 384 mV
mean(1) -2.2 mV
mean(4) -20 mV

PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 40V
Output ripple at last output cap C4
308mVp-p or about 1/2 of 1% of Vout
308kHz switching

10 μ s

- 1 .1 V AC
- 2 50 mV DC $\times 10$
- 3 50 mV DC
- 4 1 V DC

1 DC 248mV

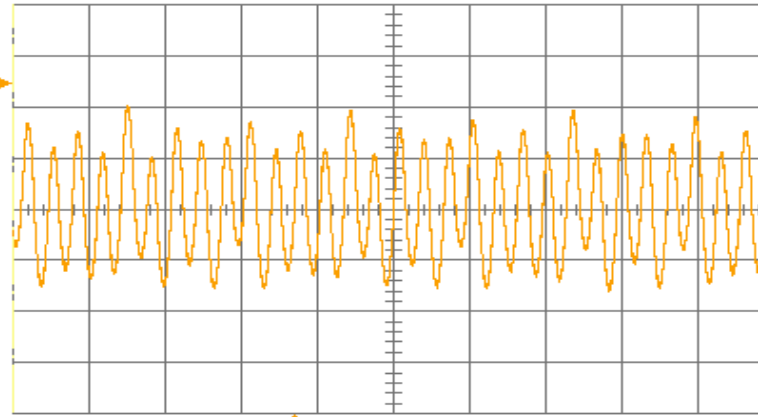
1 GS/s

STOPPED

Input ripple at C1:

7-Jan-10
16:26:50

10 μ s
200mV



maximum(1) 406 mV
Freq(1) 308.034 kHz
pkpk(1) 731 mV
mean(1) 2.6 mV
mean(4) -19 mV

PMP5265: TPS40210 Boost 64Vout at 500mA
Vin = 40V
Input ripple at only input cap C1 of 2.2uF
731mVp-p or almost 2% of Vin
308kHz switching
To reduce ripple adde another input cap

10 μ s

- 1 .2 V AC
- 2 50 mV DC $\times 10$
- 3 50 mV DC
- 4 1 V DC

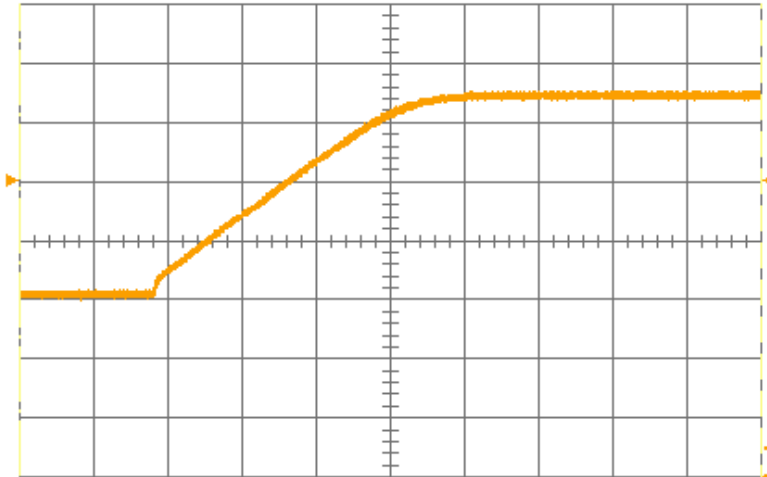
1 DC 0.496 V

STOPPED

Boost start up: Vin rises to 32V and Boost action started

7-Jan-10
16:31:26

5 ms
10.0 V



maximum(1)	65.3 V
Freq(1)	- - -
pkpk(1)	35.6 V
mean(1)	52.88 V
mean(4)	-20mV

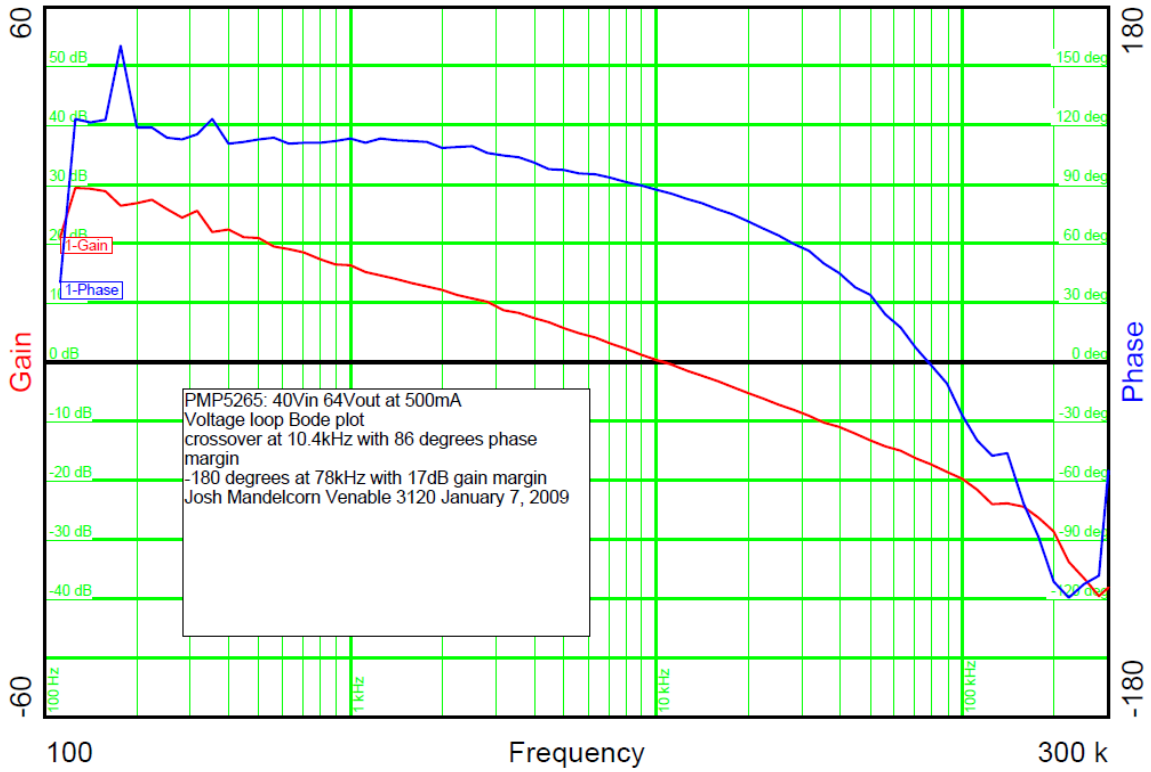
PMP5265: TPS40210 Boost 64Vout at 500mA
Boost action start up:
Vin rising above turn on threshold of about 32V
Output at last output cap C4
about 20msec rise time and no overshoot
Similar waveform seen at no load.

5 ms
1 10 V DC
2 50 mV DC $\times 10$
3 50 mV DC
4 1 V DC

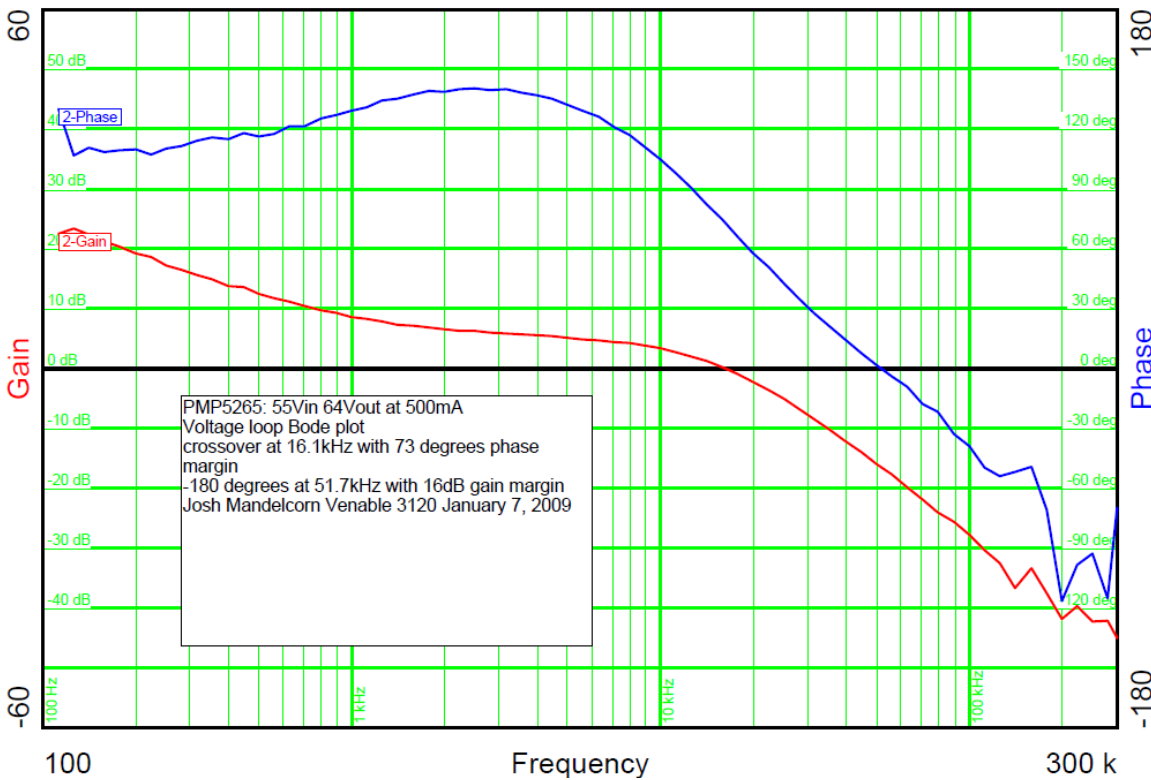
1 DC 50.4 V

5 MS/S
SLOW TRIGGER
 NORMAL

Bode Plots: First at 40Vin



Then at 55Vin:



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