Description:

The 1363HV/1364HV series high voltage power supplies are miniature flyback boost converters operating from 2 to 16VDC input, with an output of 150 to 250VDC set by a single resistor to ground and below 150V with an external bias (See Fig 6b). An enable pin allows the module to be controlled by an external logic signal, drawing only 40uA in shut down.

Table 1: Electrical Specifications

Specification	Min	Typ	Max	Units	Notes
[1]V_{IN} (Input voltage)	---	---	16.00	Volts	Absolute maximum for survivability
	2.00	---	---	Volts	P_{OUT} < 4.0W (See Fig 8/9)
	---	---	16.00	Volts	P_{OUT} < 11.5W (See Fig 8/9)
[2]$V_{EN-Thresh}$ (Enable pin)	---	---	0.45	Volts	Module off
	1.20	---	---	Volts	Module on, $V_{EN-Max} = V_{IN}$
$V_{EN-Current}$	-2	---	+4	uAmps	In-to/Out-of enable pin: V_{EN} = 0-16V
Shutdown current	---	---	40	uAmps	Into module: V_{IN}=16V, V_{EN}=0V, T_{amb}+85C
[3]R_{ADJUST}	0.00	---	Open	Ohms	To ground, for 200V-150V respectively
[4]V_{OUT}	150	---	250	Volts	Open ≥ R_{ADJUST} ≥ 0 = Ground, +/-5%
Efficiency	---	80	---	%	At 50-100% rated load, V_{IN} = 5-16VDC

Notes:

1. No input reverse polarity protection is provided.
2. Enable pin must be driven at all times, a floating enable may destroy the module. Do not switch module on and off rapidly for extended periods, minimum on time should be 10 seconds. See Linear Tech LT1619 datasheet for using this pin for clock synchronization.
3. R_{ADJUST} connected to ground; Gnd = 83uA / Open = 1.24V / Z_{IN} = 15K. See Fig 6b for setting output voltage below 150V.
4. Output of module is short circuit protected via pulse-pulse current limiting.
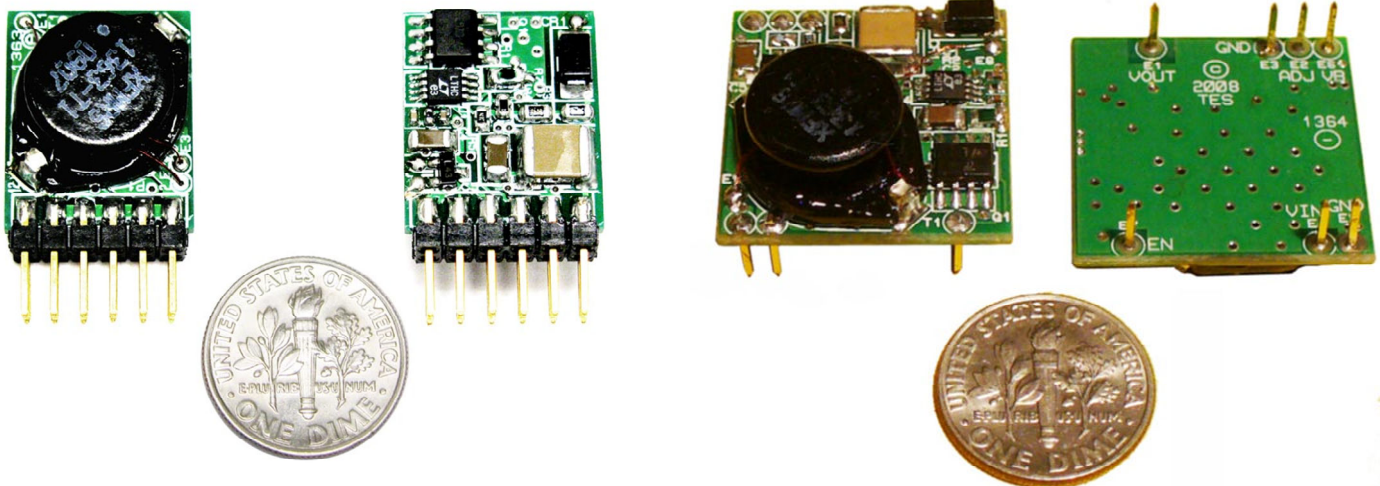5. Bias output may not be loaded at any time, for module testing only.

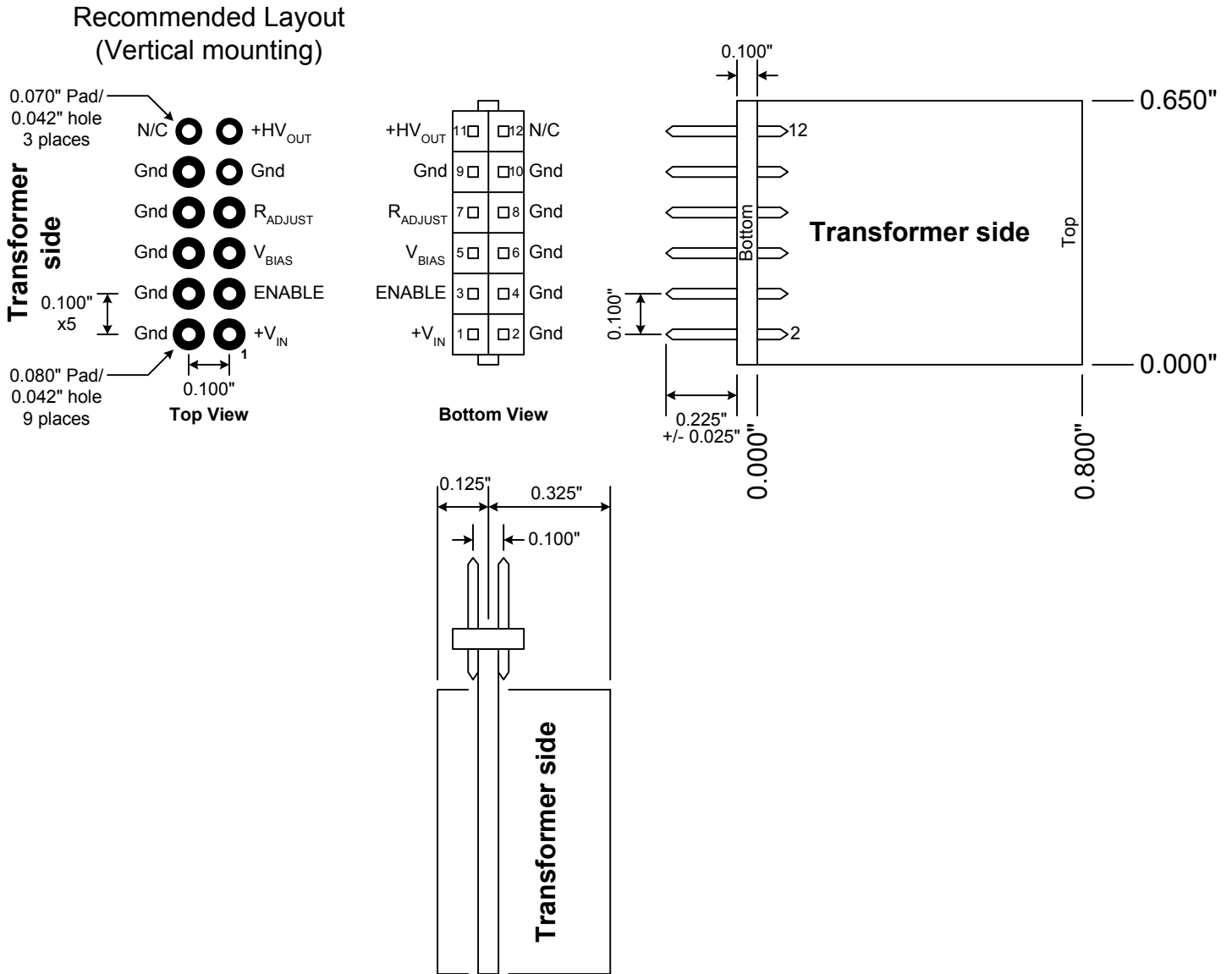
Fig 1. 1363HV and 1364HV modules

Recommended Layout
(Vertical mounting)

0.070" Pad/
0.042" hole
3 places

Transformer side

N/C ○ ○ +HV$_{OUT}$
Gnd ○ ○ Gnd
Gnd ○ ○ R$_{ADJUST}$
Gnd ○ ○ V$_{BIAS}$
Gnd ○ ○ ENABLE
Gnd ○ ○ +V$_{IN}$

0.100"
x5

0.080" Pad/
0.042" hole
9 places

0.100"
1

Top View

+HV$_{OUT}$ |11☐ ☐12| N/C
Gnd |9☐ ☐10| Gnd
R$_{ADJUST}$ |7☐ ☐8| Gnd
V$_{BIAS}$ |5☐ ☐6| Gnd
ENABLE |3☐ ☐4| Gnd
+V$_{IN}$ |1☐ ☐2| Gnd

Bottom View

0.100"

0.650"

12

Bottom

Transformer side

Top

0.100"

2

0.225"
+/- 0.025"

0.000"

0.000"

0.800"

0.000"

0.125"   0.325"

0.100"

Transformer side

Fig 2. 1363HV module outline and recommended PCB layout
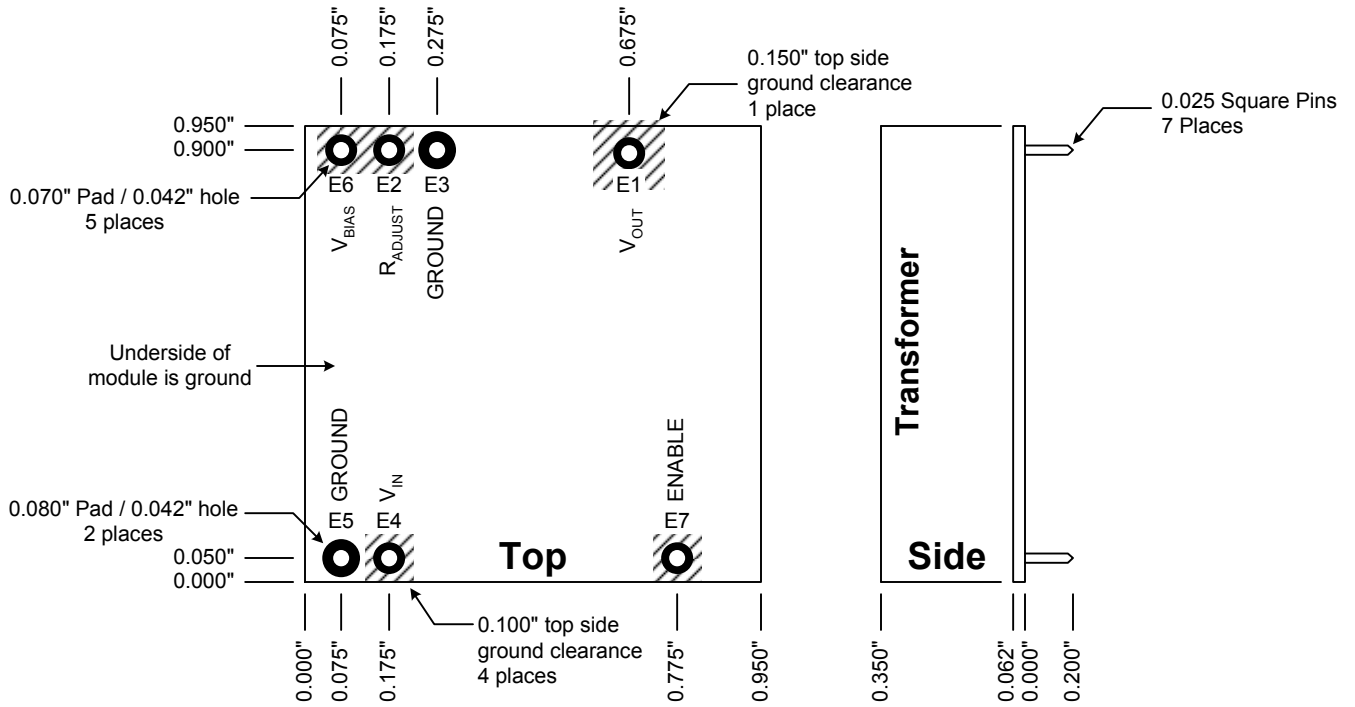
Fig 3. 1364HV module outline and recommended PCB layout

2-16VDC in ○───●────────────── 4 | V_IN   HV_OUT | 1 ──────────○ 150-250VDC out

                                            V_{BIAS} | 6 ── N/C

1.24V to V_{IN} ○──── 7 | ENABLE R_{ADJUST} | 2

330uF / 16V
EEU-FC1C331
(Recommended input capacitor
if the module is located far from
the main system filtering. Not
required for most applications.)

5 | GROUND   GROUND | 3

R_{ADJUST}

V_{ADJUST} = 0 to 5.5V
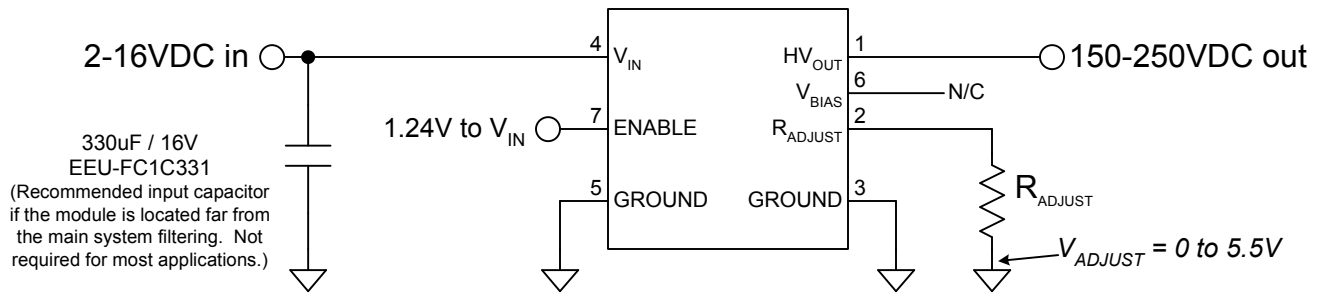
Fig 4. Typical connection (1364HV pin numbering shown)

Vset — — — —
HV_OUT
0V ————
Undefined operation

Vin — — — —

V_{ENABLE} 1.20V — — — —
0.45V — — — —
0V ————

0-0.45V = Shutdown
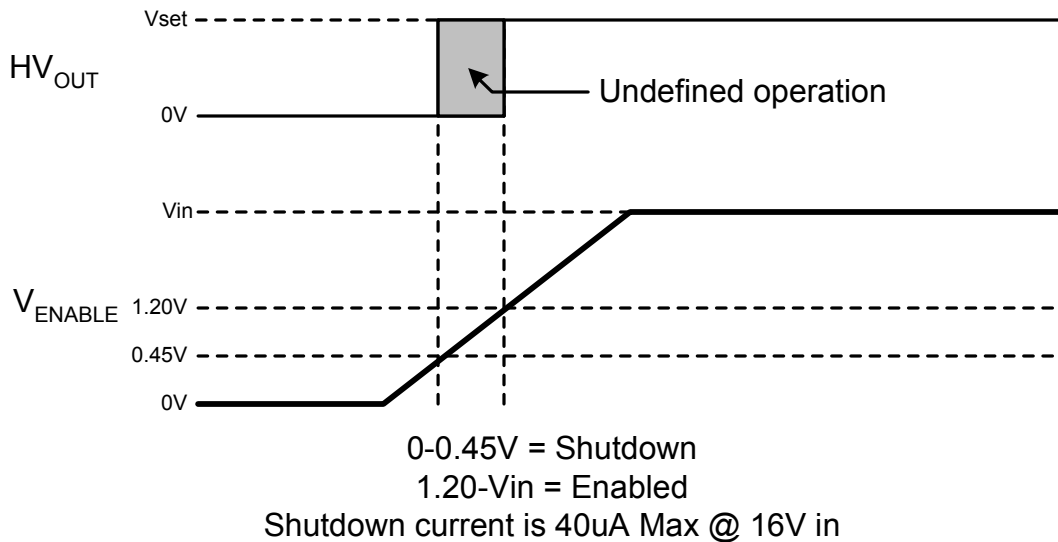1.20-Vin = Enabled
Shutdown current is 40uA Max @ 16V in

Fig 5. Enable function

Fig 6a: V_{ADJUST} = 0V

$$R_{ADJUST\ (kOhms)} = \left(\frac{-1.24}{0.124 - \dfrac{V_{OUT} - 1.24}{1208}} \right) - 15$$

The value of R_{ADJUST} can range from open to short-to-ground for 150V to 200V output respectively.

Example, For 170V out with V_{ADJUST} = 0V: R_{ADJUST} = 63.971K to ground
Using standard 5% resistor values: 62K=170.5V

Fig 6b: V_{ADJUST} >= 0V

$$R_{ADJUST\ (kOhms)} = \left(\frac{V_{RADJUST} - 1.24}{0.124 - \dfrac{V_{OUT} - 1.24}{1208}} \right) - 15$$

The value of R_{ADJUST} can range from open to short-to-V_{ADJUST}.

Example, For 125V out with V_{ADJUST} = 5V: R_{ADJUST} = 159.481K to 5V
Using standard 5% resistor values: 160K = 125.077V
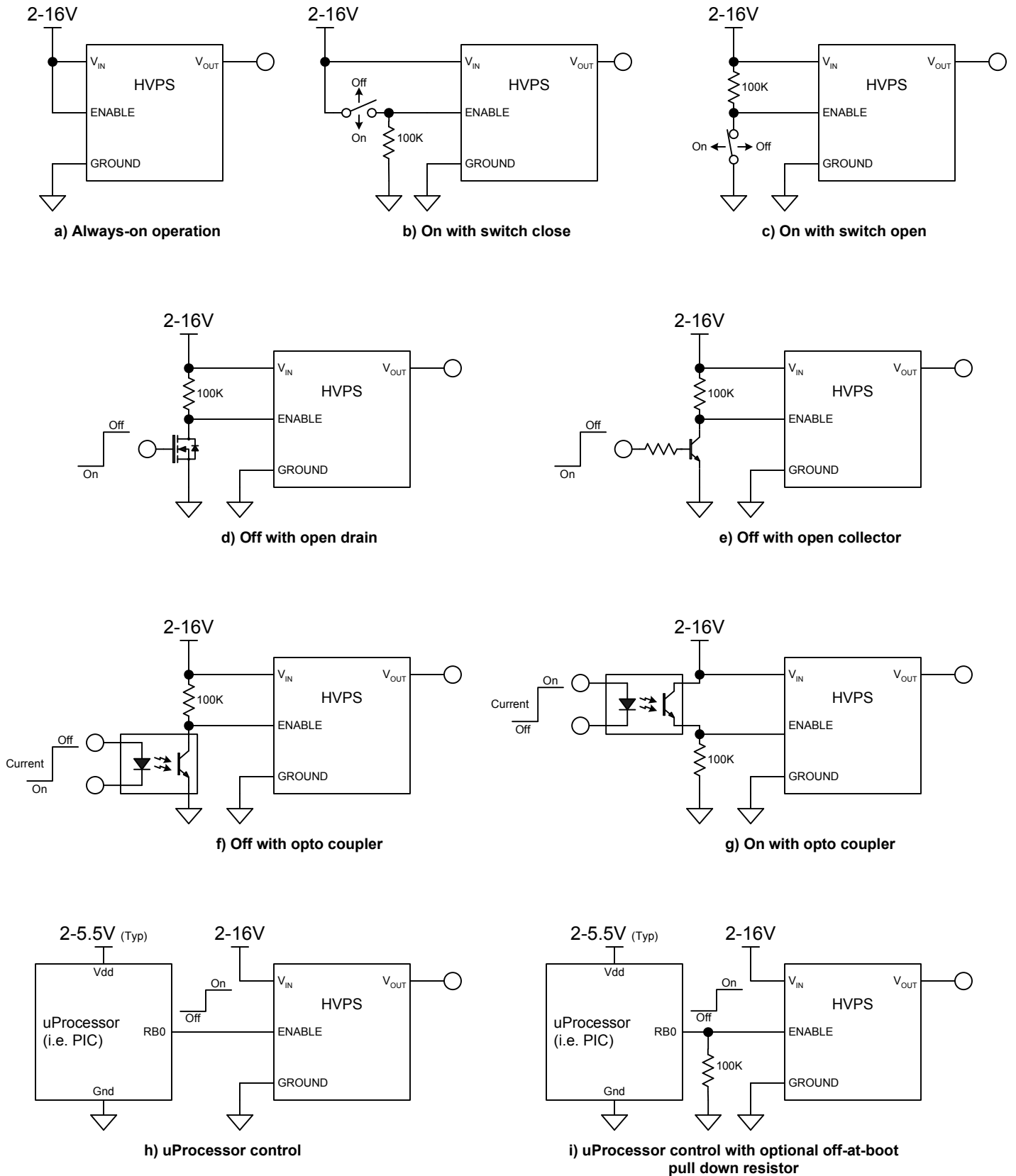
Fig 6. R_{ADJUST} calculations

See: http://www.tayloredge.com/utilities/vbapps/Installers/iCalculators.exe

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Fig 7. Examples of alternative enable connections

a) Always-on operation

b) On with switch close

c) On with switch open

d) Off with open drain

e) Off with open collector

f) Off with opto coupler

g) On with opto coupler

h) uProcessor control

i) uProcessor control with optional off-at-boot pull down resistor

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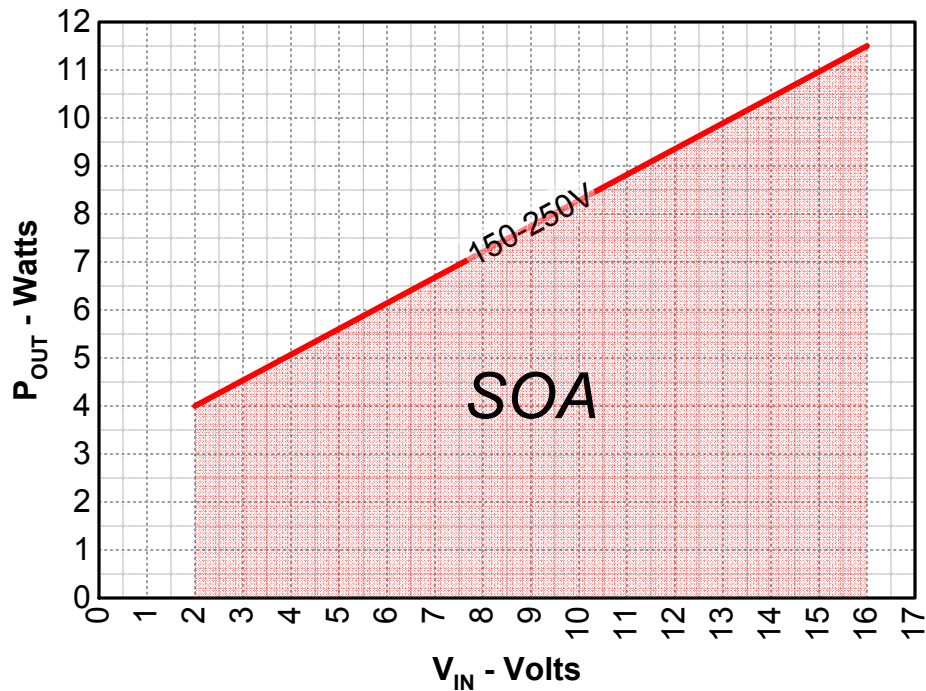
Fig 8. P$_{OUT}$ vs V$_{IN}$

Fig 9. I$_{OUT}$ vs V$_{OUT}$ vs V$_{IN}$

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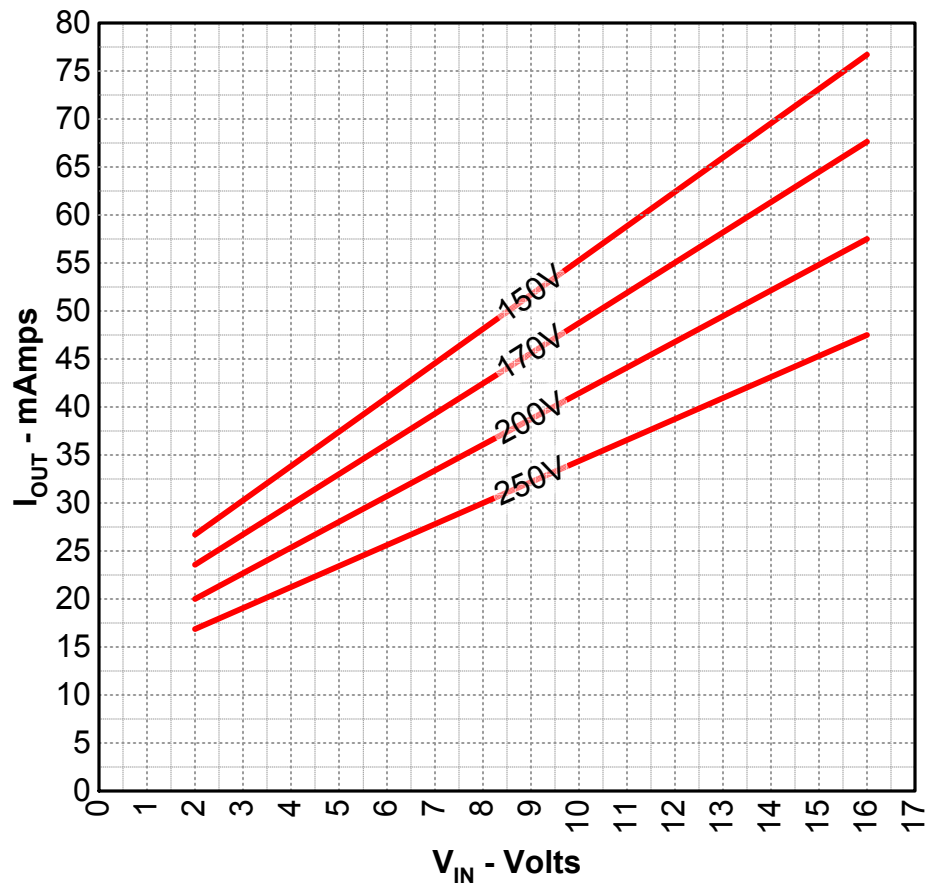
Conductive materials, such as metallic housings, heat sinks or your finger can couple energy out of the transformer resulting in poor efficiency and audible ringing. The underside of the transformer is isolated from the PWB ground by an insulating plastic mount and the thinness and discontinuities of the underlying copper limit eddy currents there.

1. Leakage flux from the core in the H field cut through conductive materials perpendicular to the axis of the core post generating circulating eddy currents that are reflected back into the primary. These shorted turns can draw amps of current and grow worse as the conductivity (Rho and thickness) of the material increases. This effect will also increase as the distance from the core to the conductor decreases.

2. Capacitive coupling from the secondary output end which is at the core center (to limit coupling to the primary) presents an AC short to this end of the secondary which has a high AC peak to peak amplitude. This effect gets worse as the grounding of the material improves and the distance is decreased.
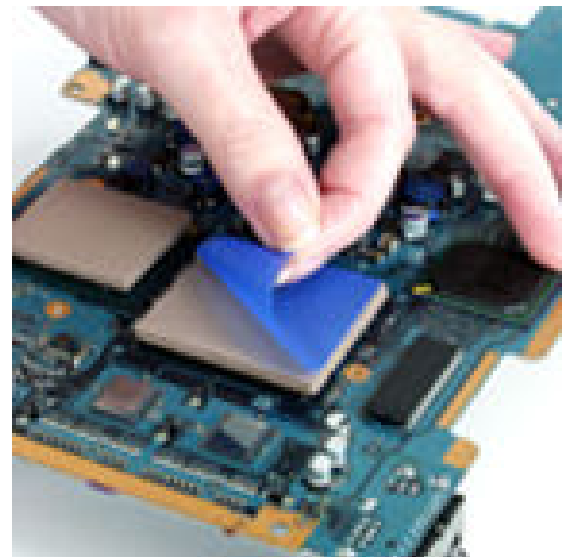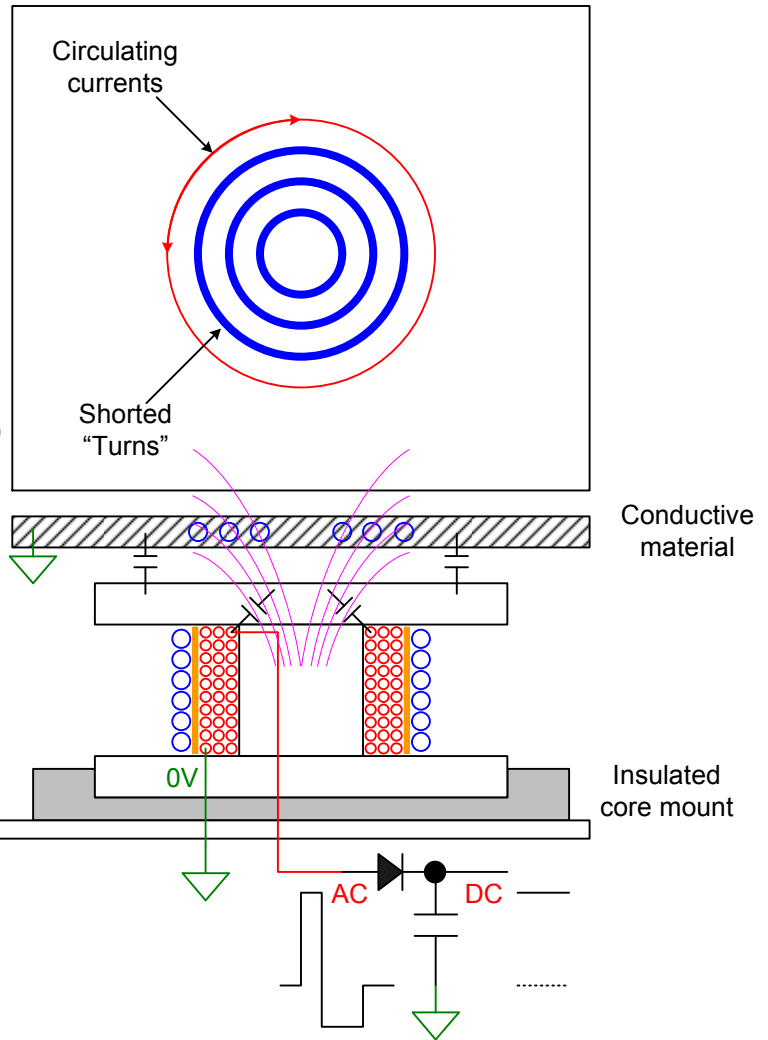
If heat sinking is desired, Gap-Pad from Bergquist serves as a very thermally conductive, electrically insulating and gap filling solution that avoids the efficiency stealing issues above. It is available from distributors such as Digikey in a variety of thickness, softness and mounting options.

GP1500-0.125-02-0816 is a good compromise between cost, thermal efficiency and softness, the 0.125" thickness providing for an easy application. This can be ordered on the power supply page in 1" squares (Enough for four power supplies).

Note that heat sinking is not generally required where the power supply has convective air currents and may operate up to 105C.

Fig 10. Transformer proximity cautions

Revision History

Revision	Description
-	Initial release.
A	Updated 1363 and 1364 individual datasheets.
B	Combined 1363 and 1364. Added Enable pin functional description. Simplified R_{ADJUST} calculation.
C	Added Fig. 7 to show various ways to enable the module. Clarified meaning of enable and disable currents in spec table.
D	Added Fig. 8/9 output power and current graphs
E	Changed Fig. 6 adjustment resistor from 56K to 51K to use standard 5% values just above and below calculated value. Changed Table 1 enable threshold note to indicate maximum enable voltage is equal to V_{IN}.
F	General cleanup and addition of R_{ADJUST} formula to Fig. 6 for V_{ADJUST} bias voltages other than ground to allow setting the voltage to less than 150V.
G	Added note to Fig. 4 indicating numbering is for 1364 module. Added Fig. 10 showing transformer proximity cautions.
H	Fig. 6b should have read "144.38K to 5V" and not "144.38K to ground"
J	Updated front page specs: Enable pin may not be unconnected when power is applied to the module.