HARRIS

HV-1205

UL RECOGNIZED

August 1991

Single Chip Power Supply

Features

- **Direct AC to DC Conversion**
- **Wide Input Voltage Range 18Vrms-132Vrms**
- **Multiple Output Voltages**
- **Guaranteed Output Current 50mA**
- **Output Voltage........................... 5V to 24V**
- **Line and Load Regulation .... <2%**
- **UL Recognition, File # E130808**

Applications

- **Compact, Low Cost, Power Supply for Non-Isolated Applications**
- **Appliance Control**
- **Battery Back-Up Systems**
- **Dual Output Supply for OFF-LINE Motor Controls**

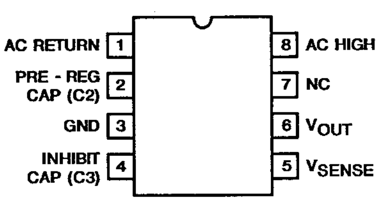
Description

The HV-1205 is a single chip power supply that can supply 5V to 24V at 50mA output current. Just a few inexpensive external components are needed to provide a compact, light weight, cost effective power supply. The HV-1205 replaces a transformer, rectifier, and voltage regulator. This chip is made in the new Harris High Voltage Dielectric Isolation Process. This high breakdown process (400V) allows a patented switching circuit to draw current from the AC line only as necessary to supply the load. The HV-1205 operates from -40°C to +85°C (with no derating necessary due to package power dissipation). The HV-1205 is available in an 8 Pin Plastic Mini-DIP.

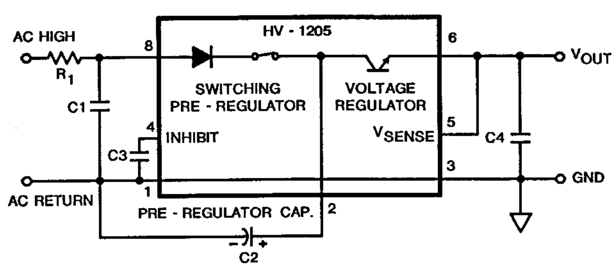
CAUTION: This Product Does Not Provide Isolation From the AC Line

Pinout

HV3-1205 (PLASTIC MINI-DIP)
TOP VIEW



Functional Diagram



HV 1205

Absolute Maximum Ratings

Voltage Between Pin 1 and 8, Continuous Vrms 132Vrms
Voltage Between Pin 1 and 8, Peak 400V
Voltage Between Pin 2 and 6 .... 15V
Input Current, Peak 1.1A
Output Current .... Short Circuit Protected
Output Voltage 30V
Maximum Junction Temperature .... +150°C

Operating Temperature Range

HV3-1205-9 .... -40°C to +85°C
HV3-1205-5 .... 0°C to +75°C
Storage Temperature Range .... -65°C to +175°C

Thermal Constants (°C/W)	θ_{ja}	θ_{jc}
Plastic DIP	82	16

Electrical Specifications

Unless Otherwise Specified: V_{IN} =120Vrms at 60Hz, C1 = 0.05μF, C2 = 470μF, C3 = 150pF, V_{OUT} = 5V, I_{OUT} = 50mA, Source Impedance, R_1 = 150Ω. Parameters are Guaranteed at the Specific V_{IN} and Frequency Conditions, Unless Otherwise Specified. See Functional Diagrams for Component Location.

PARAMETER	V_{IN}	TEMP	HV-1205-9 -40°C to +85°C			HV-1205-5 0°C to +75°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage (At Preset 5V)	120V	+25°C	4.75	5.0	5.25	4.75	5.0	5.25	V
	120V	Full	4.65	5.0	5.35	4.65	5.0	5.35	V
Output Voltage TC	120V	Full	-	0.02	-	-	0.02	-	%/°C
Output Ripple (Vp-p) (C4 = 1μF, f = 60Hz)	120V	+25°C	-	10	-	-	10	-	mV
	120V	Full	-	20	-	-	20	-	mV
Line Regulation	80Vrms to 132Vrms	+25°C	-	-	15	-	-	20	mV
		Full	-	-	30	-	-	40	mV
Load Regulation (I_{OUT} = 5mA to 50mA)	120V	+25°C	-	-	15	-	-	20	mV
	120V	Full	-	-	30	-	-	40	mV
Output Current	120V	Full	0	-	50	0	-	50	mA
Short Circuit Current Limit	120V	Full	55	95	-	55	95	-	mA
Drop-Out Voltage	Pin 2 - Pin 6	+25°C	-	2.2	-	-	2.2	-	V
Quiescent Current Post Regulator	$11V_{DC}$ to $30V_{DC}$ On Pin 2	+25°C	-	2	-	-	2	-	mA

Equivalent Circuit For Output Voltage Adjustment

$R_2 = V_{OUT} - 5V$ Where R_2 is the Approximate Value of Resistor Between Pin 5 and Pin 6 (in KΩ), V_{OUT} is the Desired Output Voltage. See Graph.

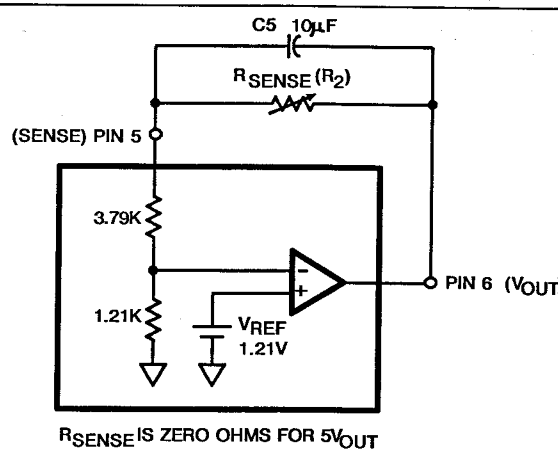
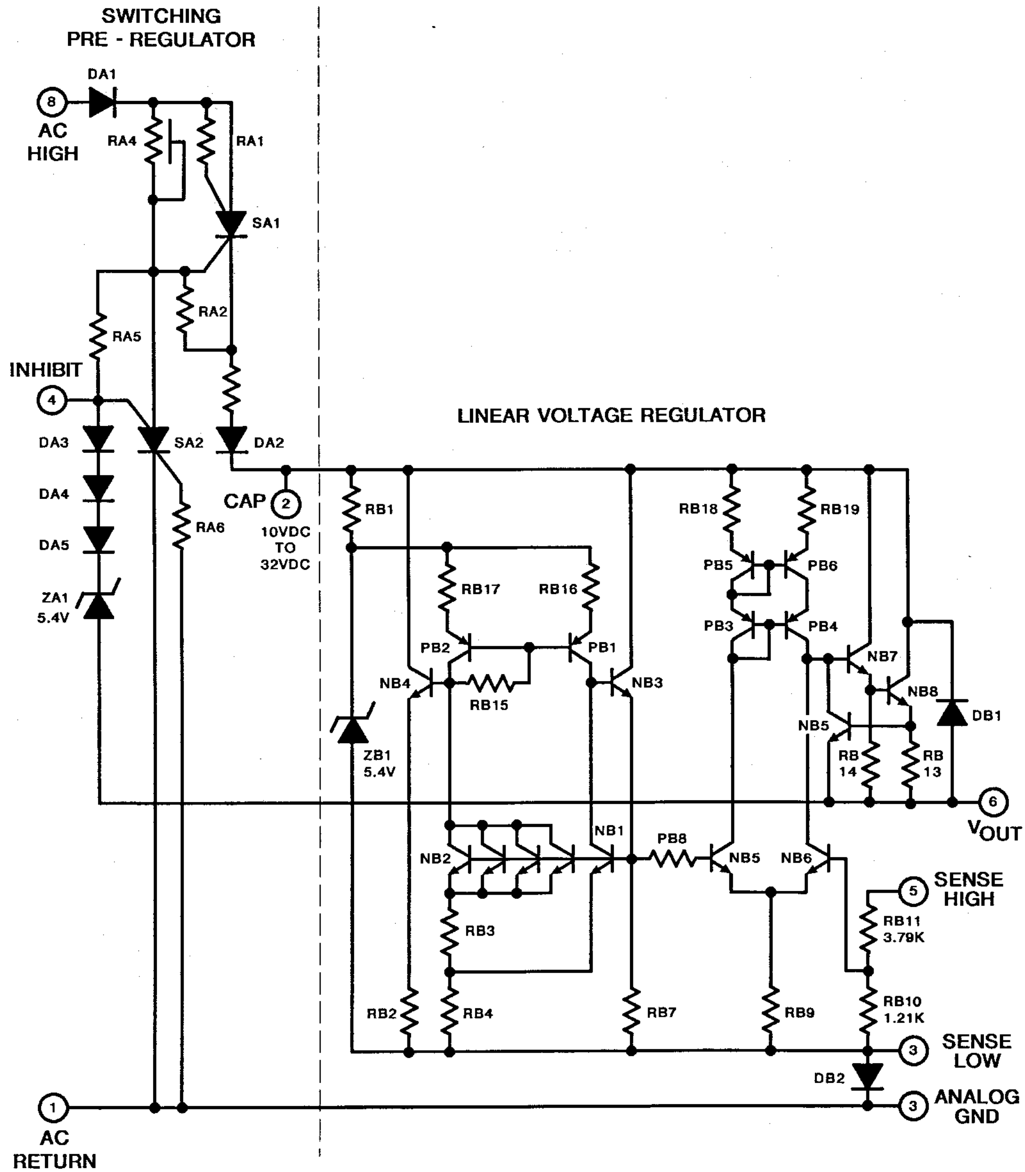


FIGURE 1.

Schematic


SWITCHING
PRE - REGULATOR
DA1
8
AC
HIGH
RA4
RA1
SA1
RA2
RA5
INHIBIT
4
DA3
SA2
DA2
DA4
DA5
ZA1
5.4V
RA6
CAP
2
10VDC
TO
32VDC
LINEAR VOLTAGE REGULATOR
RB1
RB17
RB16
RB18
RB19
PB5
PB6
PB3
PB4
PB2
PB1
NB4
NB3
RB15
NB7
NB8
DB1
NB5
ZB1
5.4V
RB
14
RB
13
6
VOUT
NB1
PB8
NB2
NB5
NB6
5
SENSE
HIGH
RB11
3.79K
RB3
RB2
RB4
RB7
RB9
RB10
1.21K
3
SENSE
LOW
DB2
3
ANALOG
GND
1
AC
RETURN

Application Information

How The HV-1205 Works

The HV-1205 converts AC voltage into regulated DC voltage to power low voltage components such as integrated circuits. This is accomplished in two stages on the monolithic chip. First, the pre-regulator momentarily connects a large capacitor to the AC high line until it charges to about 6V above the selected output voltage. The pre-regulator then switches to a blocking mode and stays in that blocking mode until the next line cycle begins. The large capacitor supplies power to the series pass regulator, providing DC current to power the user's circuit. Providing current to the post regulator causes the large cap to discharge at a rate dependent on load current. Each line cycle refreshes the charge on the electrolytic capacitor. For a detailed explanation of HV-1205 operation see Application Note 558.

Input Voltage

The HV-1205 operates over a wide range of input voltages. Most applications will use the 120Vrms line from the power grid. A standard circuit for this application is shown in Figure 2. Much smaller input voltages can be used. The size of the external components used will be determined by the output voltage and current required and the input voltage available. Several graphs have been provided to help choose component values for a specific application. The section below called Component Selection discusses trade-offs related to component sizing.

Input Frequency

The HV-1205 is designed to operate from 48Hz to 380Hz. Higher operating frequency in possible. Keep in mind that the HV-1205 will refresh C2 once per line cycle.

Setting Output Voltage

The HV-1205 can be set to provide a regulated output voltage anywhere from 5V to $24V_{DC}$. Refer to Figures 4, 5 and 6 for several ways of adjusting output voltage. Any time an output voltage greater than 5V is chosen, a 10μF capacitor between the output and the sense pin is required. That capacitor allows C2 to charge gradually.

As seen in Figure 1, output voltage is set by feedback to the sense pin. The output will rise to the voltage necessary to keep the sense pin at 5V. For a 5V output , pins 5 and 6 are shorted together. There are three ways to increase the output voltage beyond 5V. The simplest method is to increase the feedback resistor by adding an external resistor between pins 5 and 6. The disadvantage is that the internal circuit resistors have a tolerance of approximately ±15% which limits the accuracy of the predicted output (see graph). The internal thin film resistors have low temperature coefficients.

An external voltage divider as shown in Figure 5 improves the accuracy as long as the external resistors are much lower in value than those of the internal divider. Approximately 1mA flows into pin 5. If a potentiometer is used as the divider, an additional resistor between the lower leg and ground will insure that the output never exceeds its maximum rated voltage.

A zener diode between pins 5 and 6, as shown in Figure 6, sets the output voltage above 5V by the zener's breakdown voltage at 1mA. This voltage has the accuracy and tolerance of the zener. An added advantage is that two outputs are now available, pin 5 at 5V and pin 6 at V_Z + 5V. All the current from the 5V supply flows through the reference diode. The sum of both output currents should not exceed 50mA.

Output Current

Any current draw up to 50mA continuous is acceptable. More current can be drawn momentarily. Care should be taken to make sure C2 is not discharged below the dropout voltage and that the duty cycle of the excess current is low enough to not cause a package power dissipation problem. The output is current limited as shown in the graph to protect against shorted loads.

Component Selection

One of the most powerful features of the HV-1205 is its flexibility. One standard configuration allows enormous variation in input voltage and output current while still maintaining a regulated output. For example, with R_1 = 150Ω, C2 = 470μF and V_{OUT} = 5V, the HV-1205 will provide a regulated 50mA output when input voltage is anywhere from $132V_{AC}$ down to about $28V_{AC}$. The designer can choose components tailored to his application in order to save cost, space, power dissipation etc.

Below is a list of external components, description of their purpose, and a recommended value. This is a full list of possible components all of which may not be required for an intended application. Most designs will use a subset of this list.

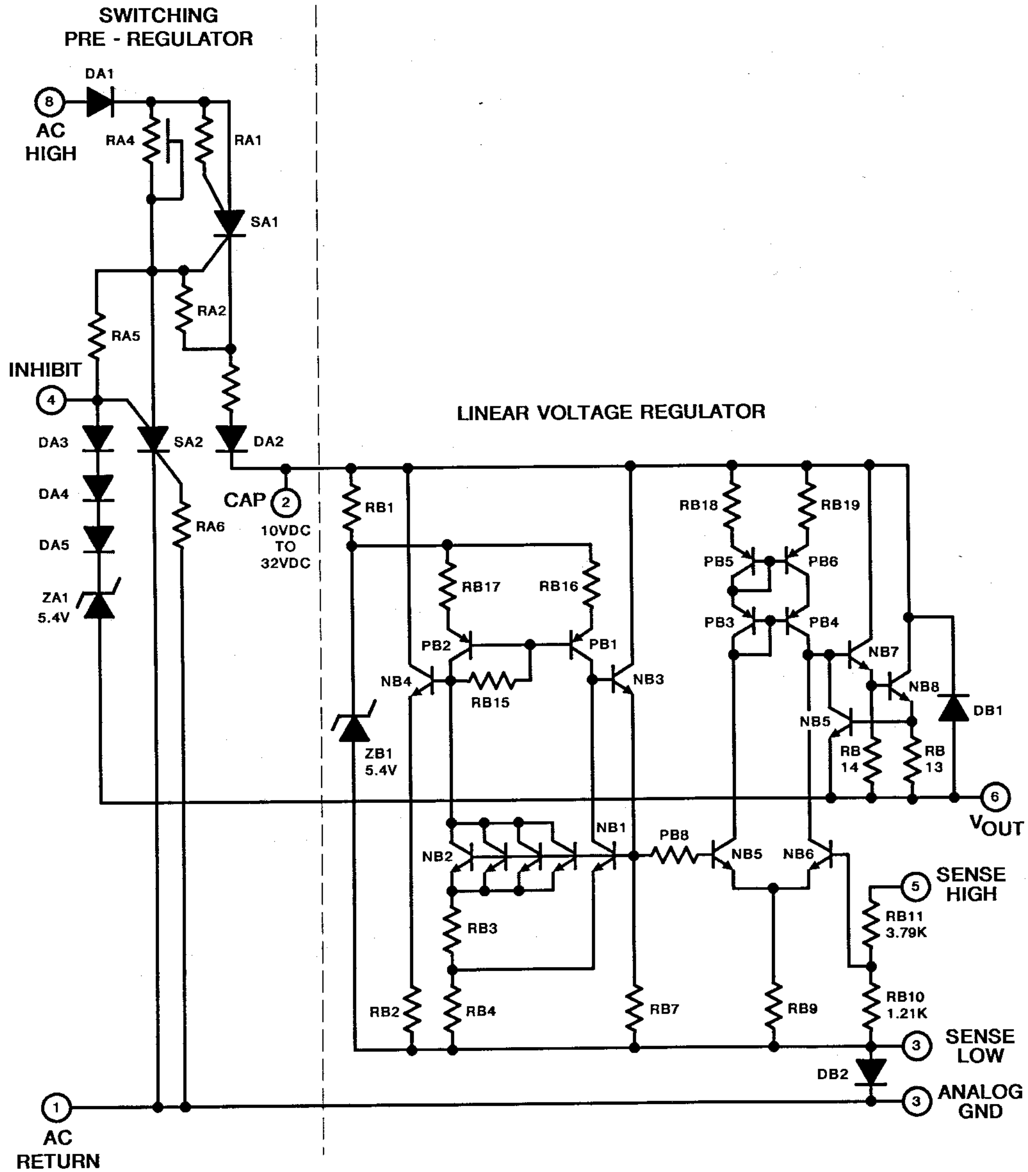
F1: Fuse. Opens the connections to the power line should chip fail. Recommended value = 1/4A, 2AG similar to Littlefuse 225.250®.

R_1: Source Resistance. Limits current into HV-1205. Needs to be large enough to limit inrush current when C2 is discharged fully. V_{PEAK}/R_1 = 1.1A Maximum. R_1 will dissipate power as shown in the graphs. The equation for Pd in R_1 is: $Pd = 1.33\ \sqrt{\pi R_1}\ V_{PEAK}(I_{OUT})^3$. Low average output currents would allow for source resistors with lower Pd ratings. Similarly, lower V_{AC} or smaller value R_1 will cause less dissipation in R_1. Sizing of R_1 should be tailored to the intended application keeping in mind not to let the maximum inrush current be exceeded. Should an external method of limiting inrush current be used (such as NTC resistors) then the value of R_1 and its associated heat could be reduced. Recommended value = 150Ω. To reduce Pd see App. Note AN9107.

C1: Snubber Capacitor. R_1 and C1 form a low pass filter thereby limiting the rate of voltage rise at the input of the HV-1205. Recommended value = 0.05μF, AC rated.

MOV: Surge suppressor. Metal Oxide Varistor clamps voltage to a level that the HV-1205 can handle. Recommended value = V130LA20 or equivalent.

Schematic


SWITCHING
PRE - REGULATOR
DA1
AC
HIGH
RA4
RA1
SA1
RA2
RA5
INHIBIT
DA3
SA2
DA2
DA4
DA5
ZA1
5.4V
RA6
CAP
10VDC
TO
32VDC
LINEAR VOLTAGE REGULATOR
RB1
RB18
RB19
PB5
PB6
RB17
RB16
PB3
PB4
PB2
PB1
NB7
NB4
RB15
NB3
NB8
DB1
NB5
ZB1
5.4V
RB
14
RB
13
VOUT
NB1
PB8
NB2
NB5
NB6
SENSE
HIGH
RB11
3.79K
RB3
RB10
1.21K
RB2
RB4
RB7
RB9
SENSE
LOW
DB2
ANALOG
GND
AC
RETURN

Application Information (Continued)

C2: Pre-Regulator capacitor. This capacitor is charged once each line cycle. The post-regulator portion of HV-1205 is powered by C2 for most of the line cycle. Normally the smallest C2 that will supply the load current (see graph) is used. Using a large C2 will supply temporary high load currents or normal load current during a short power loss. Using a larger C2 will reduce ripple at Pin 2, the input to the post regulator, which will reduce output ripple. C2 should have a ripple current rating consistent with the application. Small capacitors with high ESR may not store enough charge to maintain load current. See graph. Recommended value = 470μF, voltage rating should be about 10V greater than chosen V_{OUT}.

C3: Inhibit capacitor. Keeps the HV-1205 from turning on during input transients. If sized too large, HV-1205 will never turn on. If sized too small, no protection from transients is offered. For 60Hz (or 50Hz) use the recommended value of 150pF, voltage rating should be at about 10V greater than V_{OUT}. For 400Hz use 47pF.

C4: Output filter capacitor. At least 1μF is required to maintain stability of the output stage. Larger values will not reduce ripple but will reduce spiking which may occur on the output coincident with the HV-1205 going into blocking mode. 100μF reduces the spike amplitude to about 25mVp-p.

R2: Feedback component. A resistor or diode that causes a voltage drop between the SENSE and OUTPUT pins and thereby adjusting the output voltage. See voltage adjustment equivalent circuit. Also see graph for approximate resistor value.

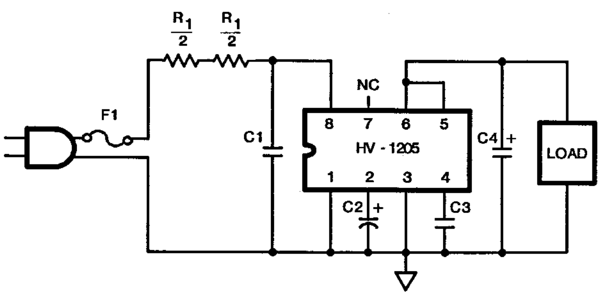


FIGURE 2. HV-1205 STANDARD +5V APPLICATION

V_{OUT} ADJUSTMENT

FIGURE 4 METHOD		FIGURE 5 METHOD		FIGURE 6 METHOD	
R_2	V_O	R_A/R_B	V_O	V_Z*	V_O
0	5V	0/00	5V	-	5V
1K	6V	160/1K	6V	1V	6V
3K	8V	510/1K	8V	3V	8V
5K	10V	820/1K	10V	5V	10V
7K	12V	1.2K/1K	12.2V	7V	12V
9K	14V	1.5K/1K	14V	9V	14V
11K	16V	1.8K/1K	15.8V	11V	16V
13K	18V	2.2K/1K	18.2V	13V	18V
15K	20V	2.4K/1K	19.4V	15V	20V
17K	22V	3.0K/1K	23V	17V	22V
19K	24V	3.17K/1K	24V	19V	24V

*V_Z @ 1mA

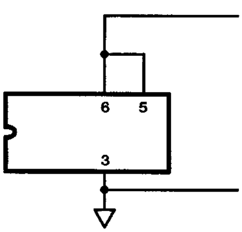


FIGURE 3. V_{OUT} = +5V

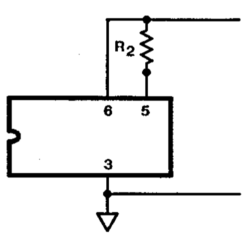


FIGURE 4. V_{OUT} > +5V

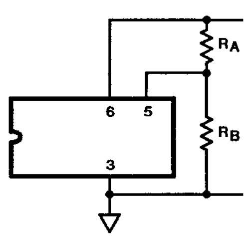


FIGURE 5. V_{OUT} > +5V

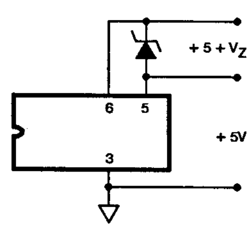
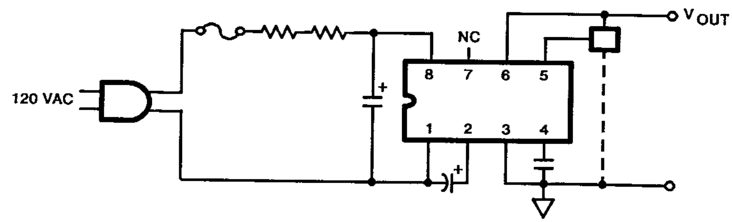


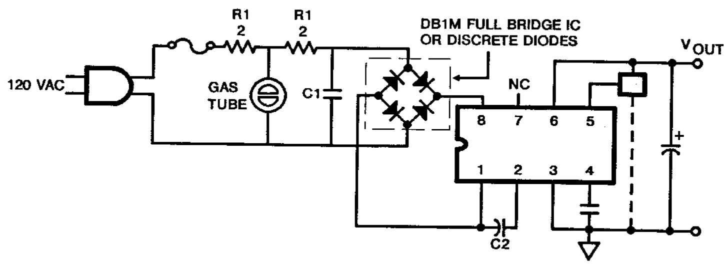
FIGURE 6. V_{OUT} = +5V, +5 +V_Z

Application Information (Continued)

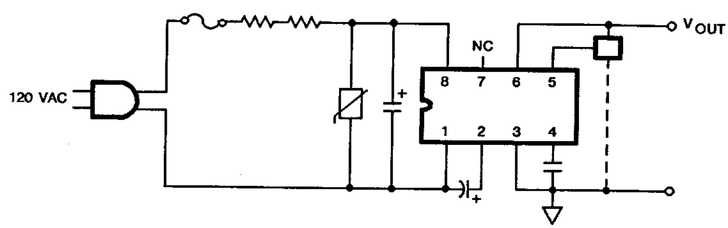
OPERATION WITH $V_{OUT} > 5V$



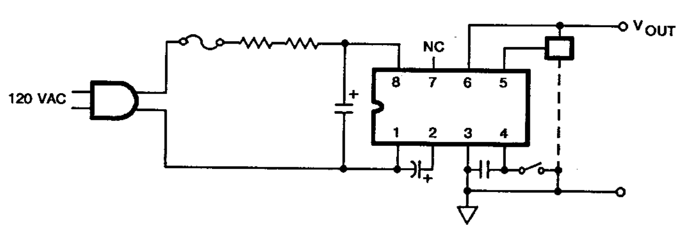
OPERATION FROM A BRIDGE RECTIFIER



SURGE PROTECTION USING MOV

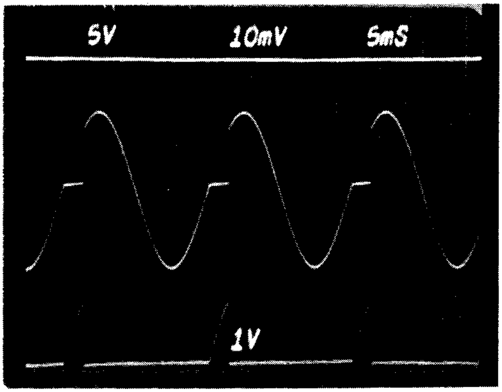


USING SWITCH TO TURN OFF OUTPUT

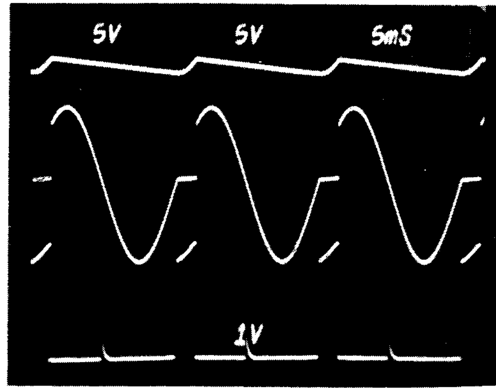


HV-1205 Waveforms Unless Otherwise Specified: T_A = +25°C, V_{AC} = 120Vrms, f = 60Hz, R_1 = 150Ω, C1 = 0.05μF, C2 = 470μF, C3 = 150pF, C4 = 1μF, V_{OUT} = 5V

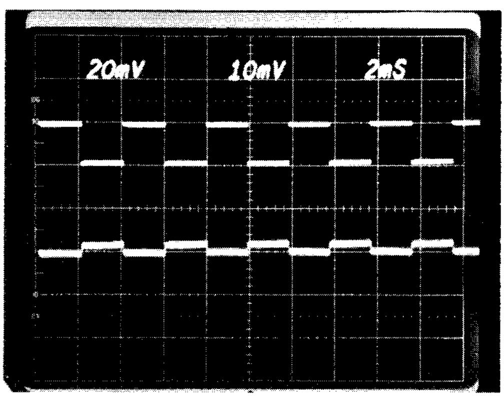
Top Trace: Regulated $5V_{OUT}$
Middle Trace: Input Voltage at Pin 8, AC HIGH (100V/Div)
Bottom Trace: Current into Pin 8, (0.5A/Div)



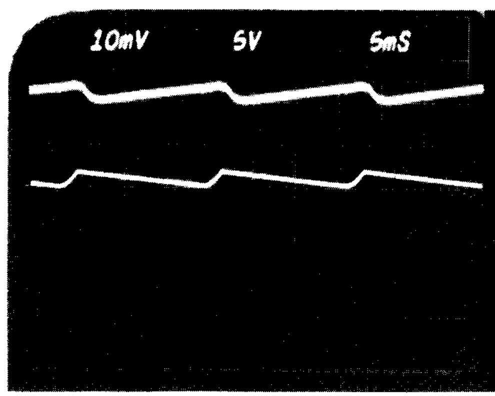
Top Trace: Pre-Regulator Capacitor Voltage, C2 (5V/Div) @ Approximately 11VDC
Middle Trace: Input Voltage at Pin 8, AC HIGH (100V/Div)
Bottom Trace: Inhibit Capacitor Voltage (5V/Div)



Top Trace: Load Current Step (50mA/Div)
Bottom Trace: Output Voltage (20mV/Div) @ 5VDC

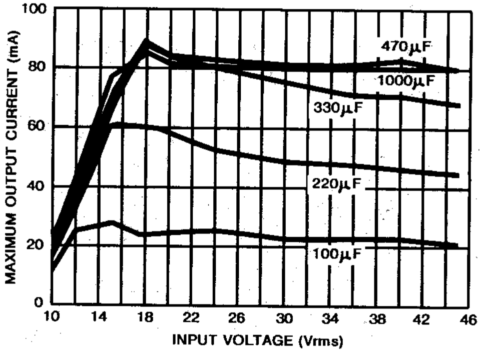


Top Trace: Ripple on Regulated 5V Out with 50mA Out (10mV/Div)
Bottom Trace: Ripple on C2, Input to Linear Regulator. C2 = 470μF (5V/Div)

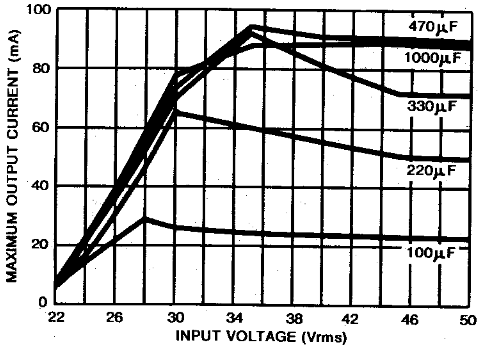


Typical Performance Curves Unless Otherwise Specified: T_A = +25°C, V_{AC} = 120Vrms, f = 60Hz, R_1 = 150Ω, C1 = 0.05μF, C2 = 470μF, C3 = 150pF, C4 = 1μF, V_{OUT} = 5V

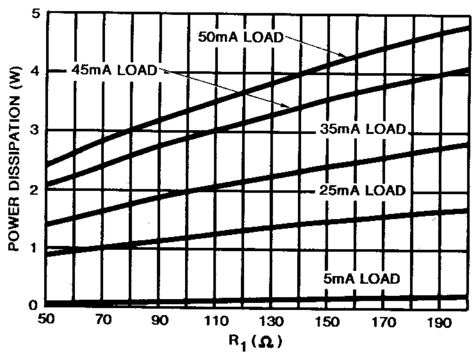
MAXIMUM OUTPUT CURRENT FOR 5V REGULATED OUTPUT vs. INPUT VOLTAGE AND PRE-REGULATOR CAPACITOR SIZE (C2)
R_1 = 24Ω



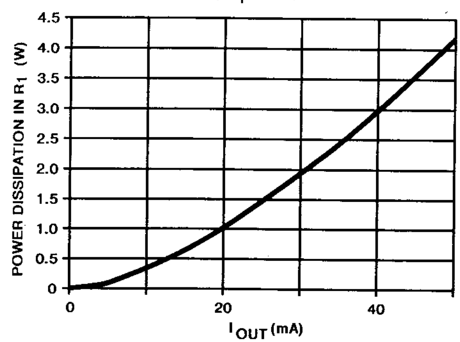
MAXIMUM OUTPUT CURRENT FOR 24V REGULATED OUTPUT vs. INPUT VOLTAGE AND PRE-REGULATOR CAPACITOR SIZE (C2)
R_1 = 24Ω



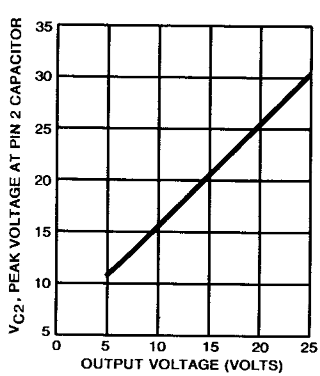
Pd IN R_1 vs. R_1 VALUE
Vrms = 120V



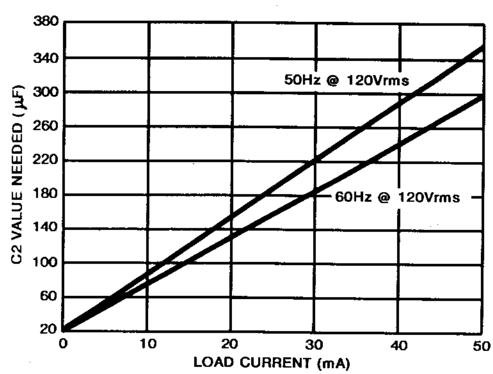
Pd IN R_1 vs. I_{OUT}
120Vrms, R_1 = 150Ω



PEAK C2 VOLTAGE vs. OUTPUT VOLTAGE

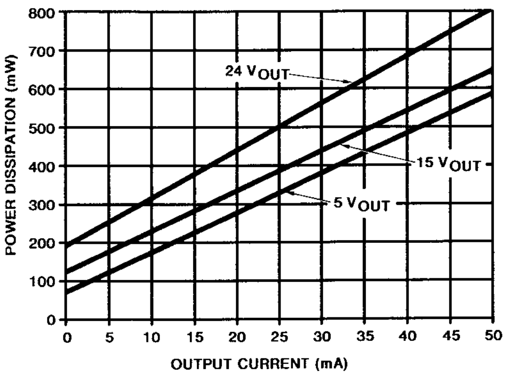


MINIMUM C2 VALUE vs. LOAD CURRENT

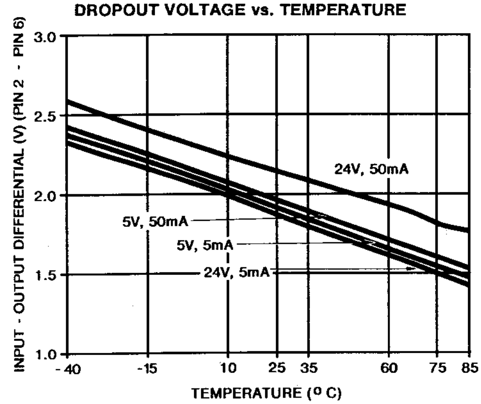


Typical Performance Curves Unless Otherwise Specified: $T_A = +25^oC$, $V_{AC} = 120Vrms$, f = 60Hz, $R_1 = 150\Omega$, C1 = 0.05μF, C2 = 470μF, C3 = 150pF, C4 = 1μF, $V_{OUT} = 5V$

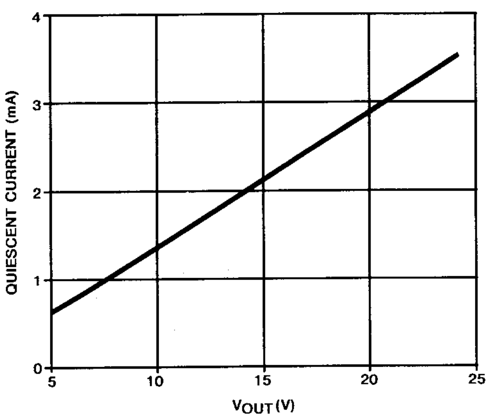
CHIP POWER DISSIPATION vs. OUTPUT CURRENT



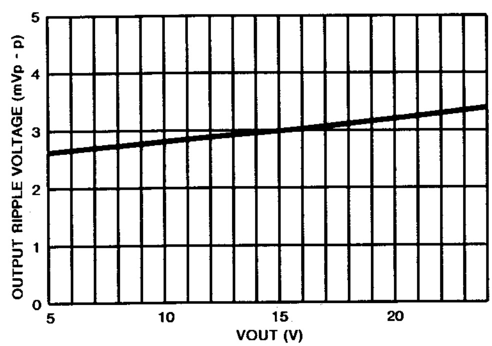
DROPOUT VOLTAGE vs. TEMPERATURE



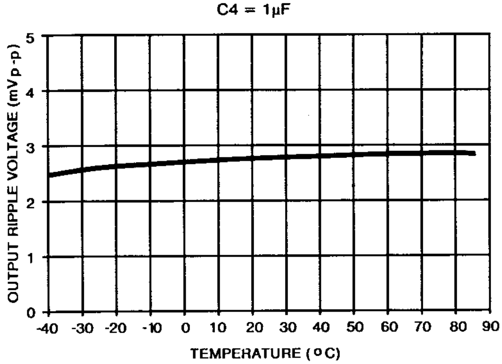
QUIESCENT CURRENT vs. OUTPUT VOLTAGE @ = +25°C
I_{OUT} = 5mA to 50mA



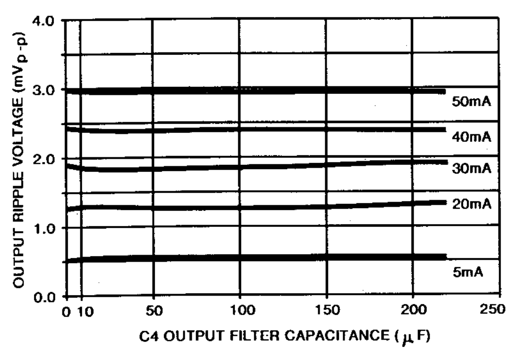
OUTPUT RIPPLE VOLTAGE vs. OUTPUT VOLTAGE
I_{OUT} = 50mA



OUTPUT RIPPLE VOLTAGE vs. TEMPERATURE
C4 = 1μF



OUTPUT RIPPLE VOLTAGE vs. LOAD CAPACITANCE AND OUTPUT CURRENT



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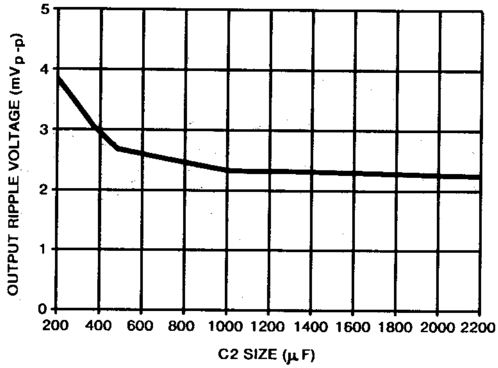
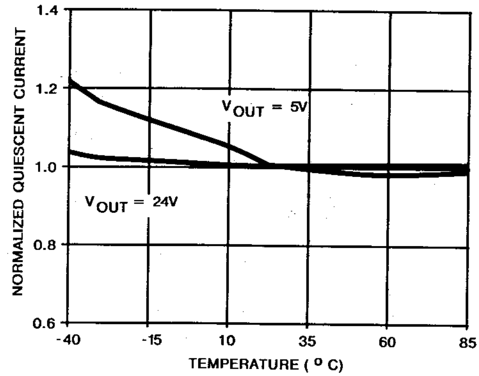
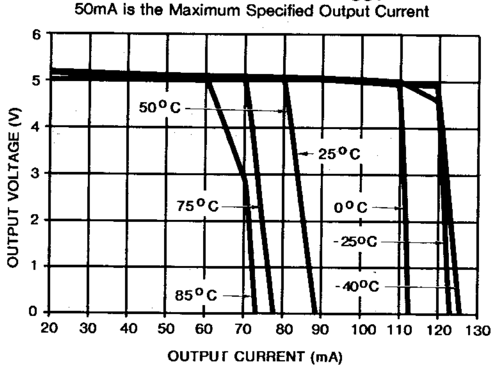
OUTPUT RIPPLE VOLTAGE vs. C2 SIZE
$I_{OUT} = 50mA$, $V_{OUT} = 5V$



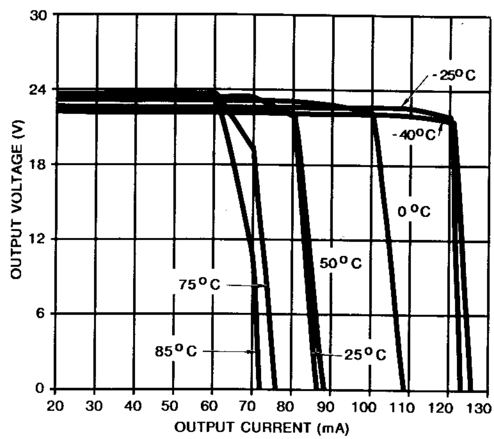
NORMALIZED QUIESCENT CURRENT vs. TEMPERATURE
Actual Quiescent Current at +25°C: V_{OUT} = 24V: 3.42mA
V_{OUT} = 5V: 0.41mA



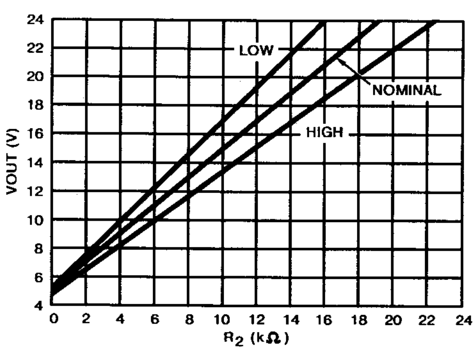
OUTPUT CURRENT LIMIT (5V_{OUT})
50mA is the Maximum Specified Output Current



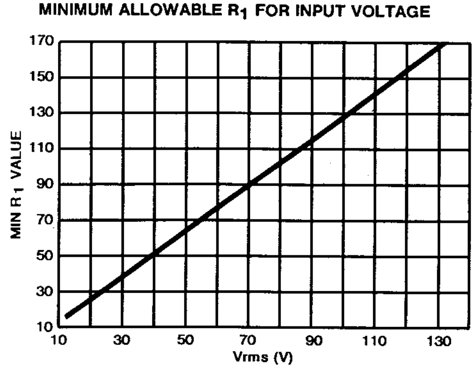
OUTPUT CURRENT LIMIT (24V_{OUT})
50mA is the Maximum Specified Output Current



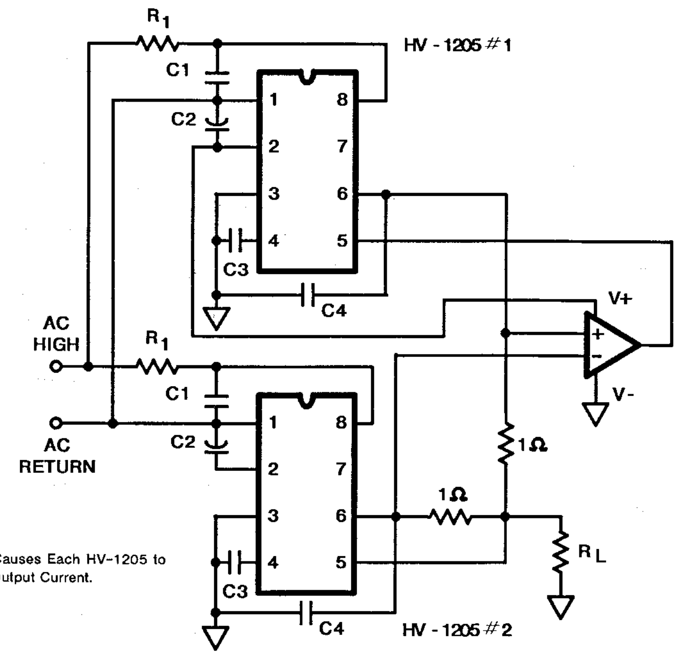
V_{OUT} vs. R_2 WITH TOLERANCES
Internal Resistors 15% High or Low



MINIMUM ALLOWABLE R_1 FOR INPUT VOLTAGE

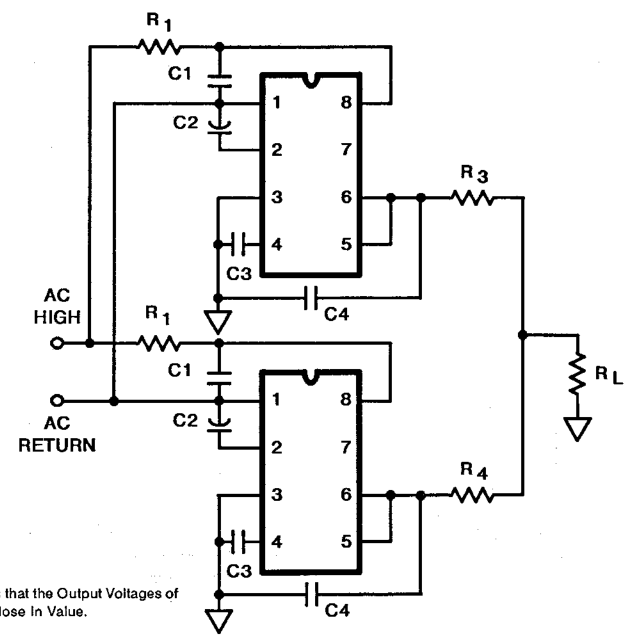


HV-1205 Parallel Operation (Method #1)



NOTE: Operational Amplifier Causes Each HV-1205 to Contribute Equally to Output Current.

HV-1205 Parallel Operation (Method #2)



$$\Delta I_{OUT} = \frac{\Delta V_{OUT}}{R_3}$$

$R_3 = R_4$

NOTE: This Method Requires that the Output Voltages of Each HV-1205 are Close In Value.

HARRIS

HV-2405E

UL RECOGNIZED

August 1991

World-Wide Single Chip Power Supply

Features

- **Direct AC to DC Conversion**
- **Wide Input Voltage Range 18Vrms-264Vrms**
- **Multiple Output Voltages**
- **Guaranteed Output Current 50mA***
- **Output Voltage .... 5V to 24V**
- **Line and Load Regulation .... <2%**
- **UL Recognition, File # E130808**

Applications

- **Compact, Low Cost, Power Supply for Non-Isolated Applications**
- **Appliance Control**
- **Battery Back-Up Systems**
- **Dual Output Supply for OFF-LINE Motor Controls**
- **Housekeeping Supply for Switch-Mode Power Supplies**

Ordering Information

PART NUMBER	OPERATING TEMPERATURE RANGE	PACKAGE DESCRIPTION
HV3-2405E-5	0°C to +75°C	8 Lead Plastic Mini-DIP
HV3-2405E-9	-40°C to +85°C	8 Lead Plastic Mini-DIP

CAUTION: This Product Does Not Provide Isolation From the AC Line

***See App Note AN9101 for 250mA output.**

Description

The HV-2405E is a single chip power supply that can supply 5V to 24V at 50mA output current. Just a few inexpensive external components are needed to provide a compact, light weight, cost effective power supply. The HV-2405E replaces a transformer, rectifier, and voltage regulator. This chip is made in the new Harris High Voltage Dielectric Isolation Process. This high breakdown process (500V) allows a patented switching circuit to draw current from the AC line only as necessary to supply the load.

The wide input voltage range makes the HV-2405E an excellent choice for use in equipment which must operate from either 240V or 120V. Unlike competitive AC-DC convertors, the HV-2405E can use the same external components for operation from either voltage. In addition the HV-2405E can be connected across any two phases of a 3-phase system (208Vrms)*. This great flexibility in input voltage allows a single design for worldwide use.

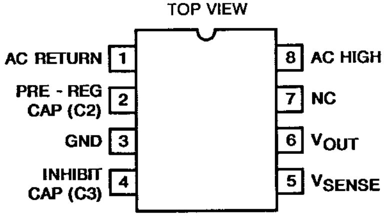
The HV-2405E is pin for pin compatible with the HV-1205 but allows twice the input voltage. Additionally, the output and sense pins are connected through a zener diode to limit output voltage should the sense pin to output connection become open.

Further flexibility can be obtained from the HV-2405E by using it with other Harris chips. For example, the high efficiency ICL-7660S and ICL-7662 provide positive to negative voltage conversion. For automatic switch-over to battery back-up use the ICL 7673. Harris also offers a line of extremely low power op amps.

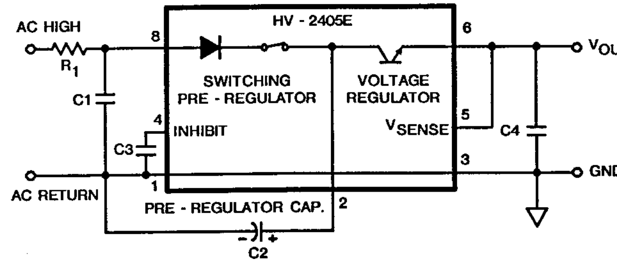
*** CAUTION: When used in this mode, GND and AC RETURN operate at high voltage with respect to earth ground.**

Pinout

HV3-2405E (PLASTIC MINI-DIP)
TOP VIEW



Functional Diagram



CAUTION: This Product Does Not Provide Isolation From the AC Line

File Number **2487.1**

Absolute Maximum Ratings

Voltage Between Pin 1 and 8, Continuous Vrms 264Vrms
Voltage Between Pin 1 and 8, Peak 500V
Voltage Between Pin 2 and 6 .... 10V
Input Current, Peak 2.5A
Output Current .... Short Circuit Protected
Output Voltage 30V
Maximum Junction Temperature .... +150°C

Operating Temperature Range

HV3-2405E-9 .... -40°C to +85°C
HV3-2405E-5 .... 0°C to +75°C
Storage Temperature Range .... -65°C to +175°C

Thermal Constants (°C/W)	θ_{ja}	θ_{jc}
Plastic DIP	82	16

Electrical Specifications Unless Otherwise Specified: V_{IN} = 264Vrms at 50Hz, C1 = 0.05µF, C2 = 470µF, C3 = 150pF, V_{OUT} = 5V, I_{OUT} = 50mA, Source Impedance, R_1 = 150Ω. Parameters are Guaranteed at the Specific V_{IN} and Frequency Conditions, Unless Otherwise Specified. See Functional Diagrams for Component Location.

PARAMETER	V_{IN}	TEMP	HV-2405E-9 -40°C to +85°C			HV-2405E-5 0°C to +75°C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
Output Voltage (At Preset 5V)	264V	+25°C	4.75	5.0	5.25	4.75	5.0	5.25	V
	264V	Full	4.65	5.0	5.35	4.65	5.0	5.35	V
Output Voltage TC	264V	Full	-	0.02	-	-	0.02	-	%/°C
Output Ripple (Vp-p) (C4 = 1µF, f = 50Hz)	264V	+25°C	-	22	-	-	22	-	mV
	264V	Full	-	24	-	-	24	-	mV
Line Regulation	80Vrms to 264Vrms	+25°C	-	10	15	-	10	20	mV
		Full	-	15	30	-	15	40	mV
Load Regulation (I_{OUT} = 5mA to 50mA)	264V	+25°C	-	-	15	-	-	20	mV
	264V	Full	-	-	30	-	-	40	mV
Output Current	264V	Full	0	-	50	0	-	50	mA
Short Circuit Current Limit	264V	Full	55	95	-	55	95	-	mA
Drop-Out Voltage	Pin 2 - Pin 6	+25°C	-	2.2	-	-	2.2	-	V
Quiescent Current Post Regulator	$11V_{DC}$ to $30V_{DC}$ On Pin 2	+25°C	-	2	-	-	2	-	mA

Equivalent Circuit For Output Voltage Adjustment

$R_2 = V_{OUT} - 5V$ Where R_2 is the Approximate Value of Resistor Between Pin 5 and Pin 6 (in KΩ), V_{OUT} is the Desired Output Voltage. See Graph.

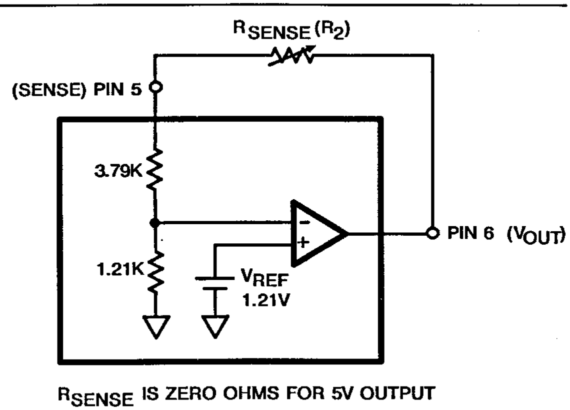
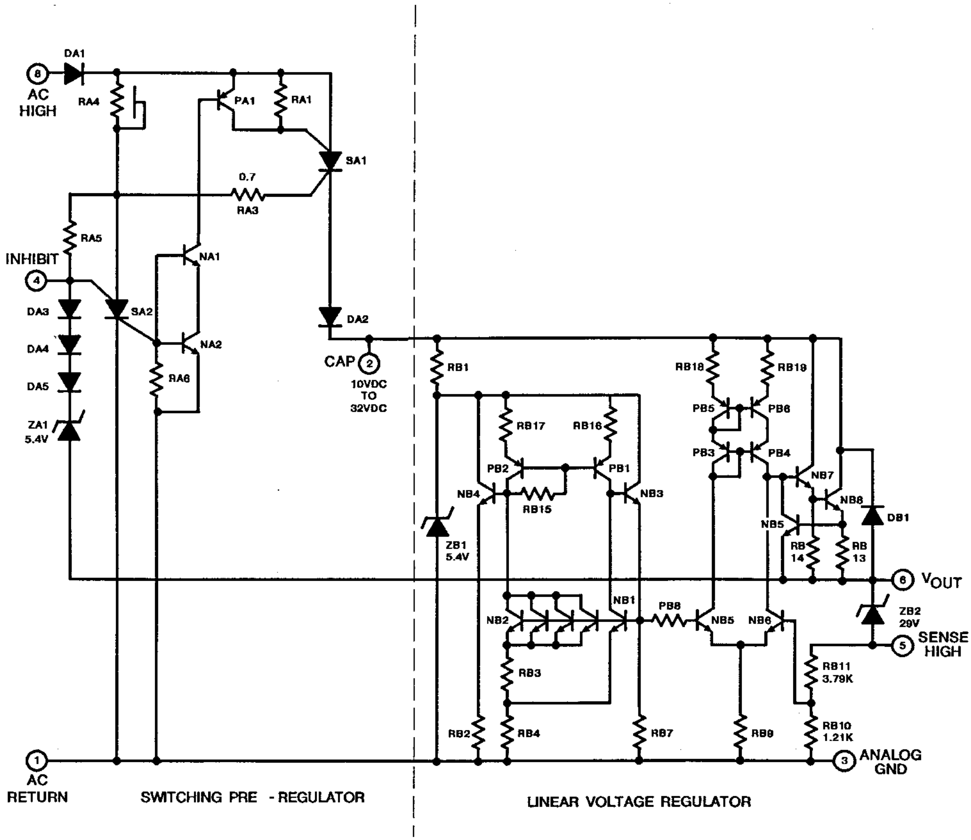


FIGURE 1.

Schematic

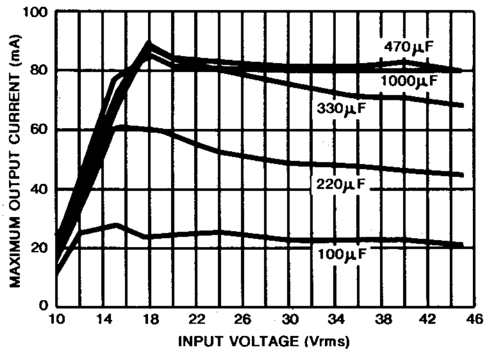


Patent pending on the above circuit.

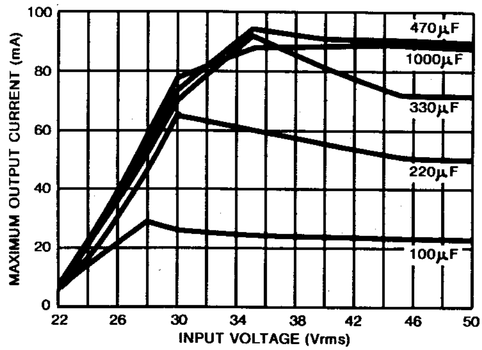
Typical Performance Curves

Unless Otherwise Specified: $T_A = +25^oC$, $V_{AC} = 240Vrms$, f = 50Hz, $R_1 = 150\Omega$, C1 = 0.05µF, C2 = 470µF, C3 = 150pF, C4 = 1µF, $V_{OUT} = 5V$

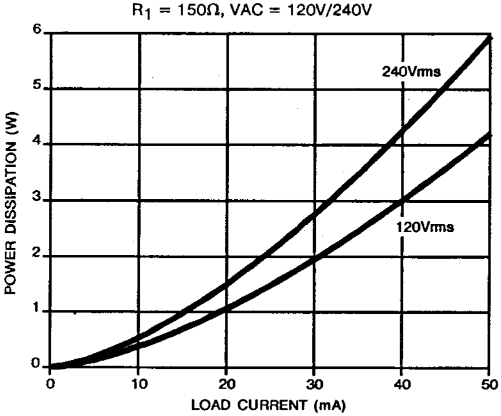
MAXIMUM OUTPUT CURRENT FOR 5V REGULATED OUTPUT vs. INPUT VOLTAGE AND PRE-REGULATOR CAPACITOR SIZE (C2)
$R_1 = 24\Omega$



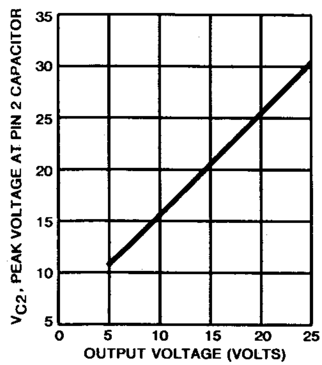
MAXIMUM OUTPUT CURRENT FOR 24V REGULATED OUTPUT vs. INPUT VOLTAGE AND PRE-REGULATOR CAPACITOR SIZE (C2)
$R_1 = 24\Omega$



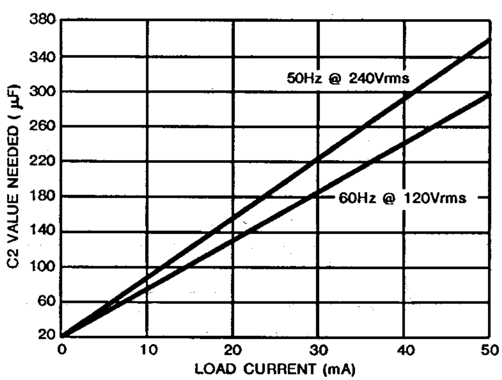
Pd IN R_1 vs. I_{OUT}
$R_1 = 150\Omega$, VAC = 120V/240V



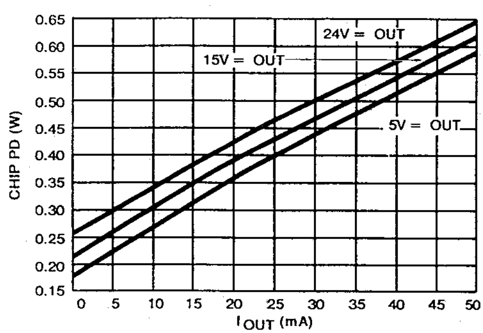
PEAK C2 VOLTAGE vs. OUTPUT VOLTAGE



MINIMUM C2 VALUE vs. LOAD CURRENT



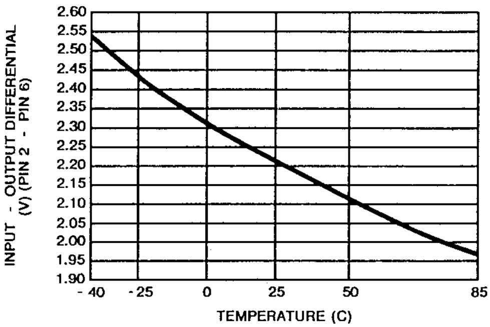
CHIP POWER DISSIPATION vs. OUTPUT CURRENT



Typical Performance Curves

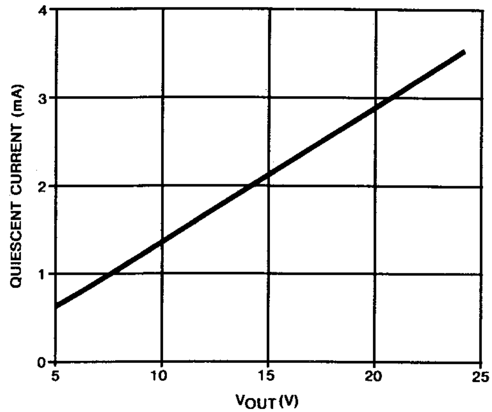
Unless Otherwise Specified: $T_A = +25^oC$, $V_{AC} = 240Vrms$, f = 50Hz, $R_1 = 150\Omega$, C1 = 0.05µF, C2 = 470µF, C3 = 150pF, C4 = 1µF, $V_{OUT} = 5V$

DROPOUT VOLTAGE vs. TEMPERATURE



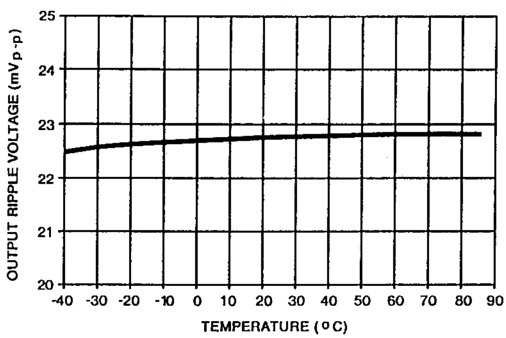
QUIESCENT CURRENT vs. OUTPUT VOLTAGE @ = +25°C

I_{OUT} = 5mA to 50mA

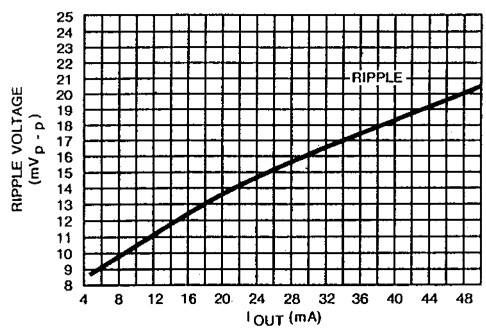


OUTPUT RIPPLE VOLTAGE vs. TEMPERATURE

C4 = 1µF

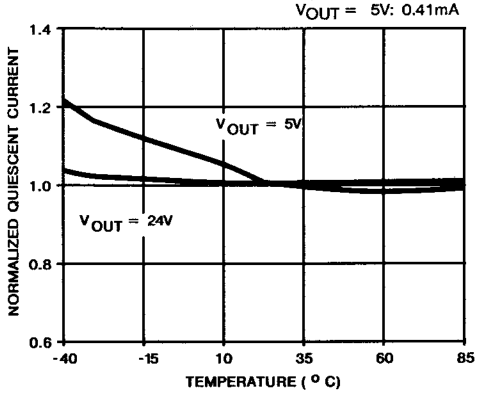


OUTPUT RIPPLE VOLTAGE vs. LOAD CURRENT



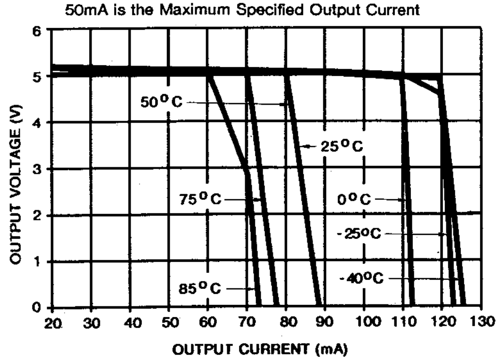
NORMALIZED QUIESCENT CURRENT vs. TEMPERATURE

Actual Quiescent Current at +25°C: V_{OUT} = 24V: 3.42mA
V_{OUT} = 5V: 0.41mA



OUTPUT CURRENT LIMIT ($5V_{OUT}$)

50mA is the Maximum Specified Output Current

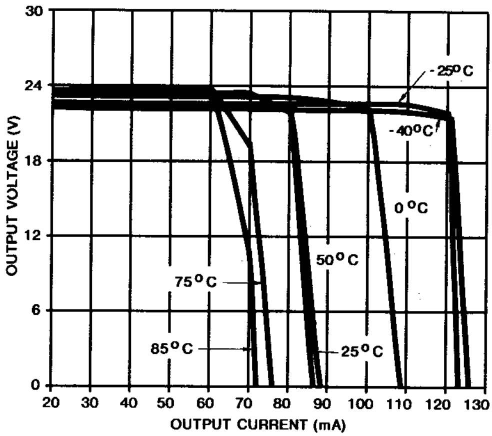


Typical Performance Curves

Unless Otherwise Specified: $T_A = +25^oC$, $V_{AC} = 240Vrms$, f = 50Hz, $R_1 = 150\Omega$, C1 = 0.05µF, C2 = 470µF, C3 = 150pF, C4 = 1µF, $V_{OUT} = 5V$

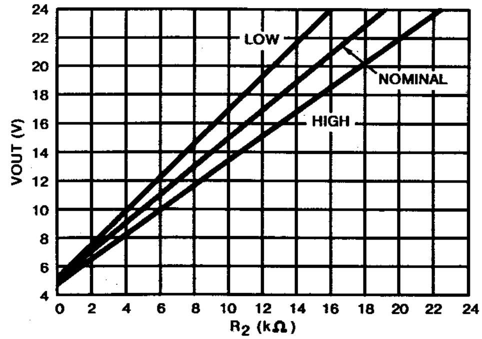
OUTPUT CURRENT LIMIT ($24V_{OUT}$)

50mA is the Maximum Specified Output Current

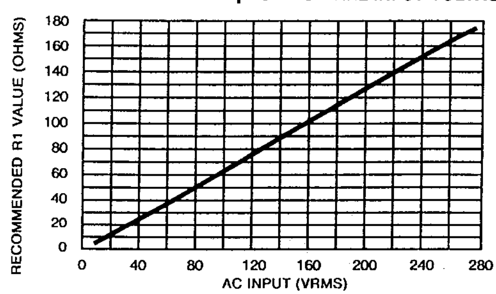


V_{OUT} vs. R_2 WITH TOLERANCES

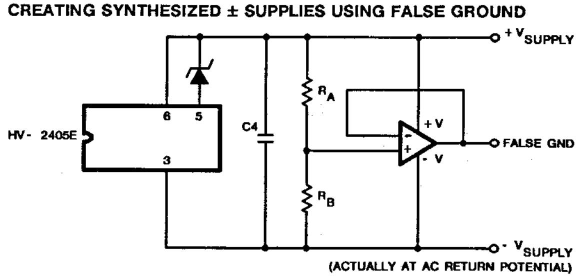
Internal Resistors 15% High or Low



MINIMUM RECOMMENDED R_1 FOR NOMINAL INPUT VOLTAGE



CREATING SYNTHESIZED ± SUPPLIES USING FALSE GROUND



NOTES:

1. RA, RB voltage divider sets voltage of false ground anywhere between VOUT of HV-2405E and ground.
2. RA and RB should be large values (e.g. 470K)
3. Circuits powered with this method must ALL be referred to "False Gnd"
4. Op amp must be able to source/sink load current
5. Example: RA = 470K, RB = 470K, VOUT set to 24V. +VSUPPLY would be ≈ +12V
   -VSUPPLY would be ≈ -12V