HA17800V/VP/VPJ Series

3-terminal Fixed Voltage Regulators

HITACHI

ADE-204-053 (Z)
Rev. 0
Dec. 2000

Description

HA17800V series is positive output 1 A three-terminal regulator IC. Which features are as follows. It is designed to suit to the power supply of various equipments and to stabilize the multi switching regulator voltage, and to supply power to some kind of control devices.

Features

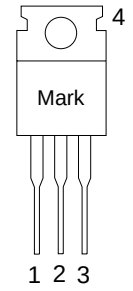
- High ripple rejection ratio up to high frequency
  (f 20 kHz): 60 dB(in the case of HA17805V/VP/VPJ)
- Protected against oscillation
- Regulated output voltage against temperature
  (0 Ta 125°C, 80 ppm/°C typ)
- Hard to breakdown against irrelevant connection
- Built–in circuits as over current control circuit, temperature protection circuit, and area of safety operation control circuit

Ordering Information

Output Voltage (V)	Automotive Use	Industrial Use	Commercial Use	Package
5	HA17805VPJ	HA17805VP	HA17805V	TO - 220AB
6	HA17806VPJ	HA17806VP	HA17806V	
7	HA17807VPJ	HA17807VP	HA17807V	
8	HA17808VPJ	HA17808VP	HA17808V	
12	HA17812VPJ	HA17812VP	HA17812V	
15	HA17815VPJ	HA17815VP	HA17815V	
18	HA17818VPJ	HA17818VP	HA17818V	
24	HA17824VPJ	HA17824VP	HA17824V	

Hitachi semiconductor

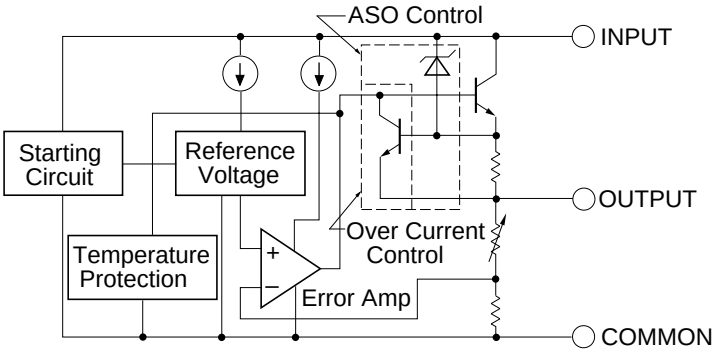
Pin Arrangement



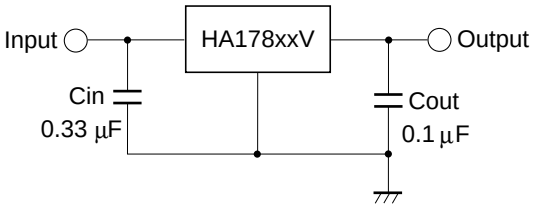
1. Input
2. Common
3. Output
4. Common

(Top View)

Block Diagram



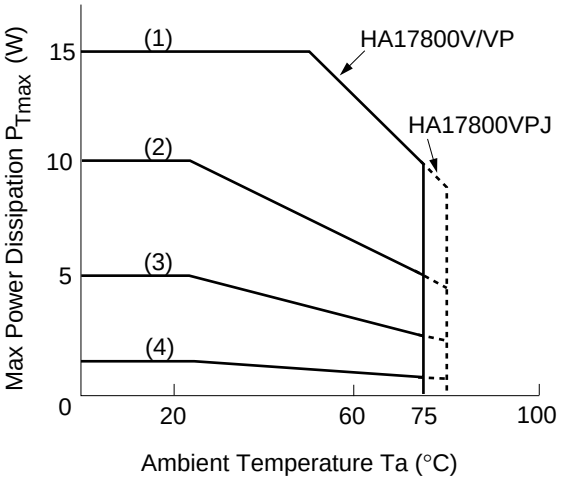
Standerd Circuit



Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings		Unit	Notes
		HA17800V/VP	HA17800VPJ		
Input voltage	V_{IN}	35	35	V	1
Power dissipation	P_T	15	15	W	2
Operating ambient temperature	Topr	–20 to +75	–40 to +85	°C	
Storage temperature	Tstg	–55 to +125	–50 to +125	°C	
Operating junction temperature	Tj	–20 to +125	–40 to +125	°C	

Notes: 1. HA17824V/VP/VPJ, 40 V
2. Follow derating curve



(1) With infinitely large heat sink
(2) 5°C/W heat sink
(3) 15°C/W heat sink
(4) Without heat sink
) Include additional thermal resistance

Thermal resistance
θj-c = 5.0°C/W (max)
θj-a = 83°C/W (max)

HA17805V/VP/VPJ Electrical Characteristics

(V_{IN} = 10 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	4.8	5.0	5.2	V	Tj = 25°C
	V_{OUT2}	4.75	—	5.25	V	7 V ≤ V_{IN} ≤ 20 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	30	100	mV	Tj = 25°C, 7 V ≤ V_{IN} ≤ 25 V
	δV_{OLine2}	—	10	50	mV	Tj = 25°C, 8 V ≤ V_{IN} ≤ 12 V
Load regulation	δV_{OLoad1}	—	30	100	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	10	50	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.5	7.0	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.3	mA	7 V ≤ V_{IN} ≤ 25 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	60	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.5	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	120	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	1.25	—	A	Tj = 25°C
Peak output current	Iop	—	2.2	—	A	Tj = 25°C

HA17806V/VP/VPJ Electrical Characteristics

(V_{IN} = 11 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	5.75	6.00	6.25	V	Tj = 25°C
	V_{OUT2}	5.7	—	6.3	V	8 V ≤ V_{IN} ≤ 21 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	36	120	mV	Tj = 25°C, 8 V ≤ V_{IN} ≤ 25 V
	δV_{OLine2}	—	12	60	mV	Tj = 25°C, 9 V ≤ V_{IN} ≤ 13 V
Load regulation	δV_{OLoad1}	—	36	120	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	12	60	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.5	7.0	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.3	mA	8 V ≤ V_{IN} ≤ 25 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	60	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.5	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	120	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	1.2	—	A	Tj = 25°C
Peak output current	Iop	—	2.2	—	A	Tj = 25°C

HA17807V/VP/VPJ Electrical Characteristics

(V_{IN} = 12.5 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	6.72	7.00	7.28	V	Tj = 25°C
	V_{OUT2}	6.65	—	7.35	V	9 V ≤ V_{IN} ≤ 22 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	45	140	mV	Tj = 25°C, 9 V ≤ V_{IN} ≤ 25 V
	δV_{OLine2}	—	15	70	mV	Tj = 25°C, 10 V ≤ V_{IN} ≤ 15 V
Load regulation	δV_{OLoad1}	—	45	140	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	15	70	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.5	7.0	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.3	mA	9 V ≤ V_{IN} ≤ 25 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	58	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.6	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	140	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	1.1	—	A	Tj = 25°C
Peak output current	Iop	—	2.2	—	A	Tj = 25°C

HA17808V/VP/VPJ Electrical Characteristics

(V_{IN} = 14 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	7.70	8.00	8.30	V	Tj = 25°C
	V_{OUT2}	7.6	—	8.4	V	10.5 V ≤ V_{IN} ≤ 23 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	58	160	mV	Tj = 25°C, 10.5 V ≤ V_{IN} ≤ 25 V
	δV_{OLine2}	—	20	80	mV	Tj = 25°C, 11 V ≤ V_{IN} ≤ 17 V
Load regulation	δV_{OLoad1}	—	58	160	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	20	80	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.5	7.0	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.0	mA	10.5 V ≤ V_{IN} ≤ 25 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	58	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.6	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	150	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	1.0	—	A	Tj = 25°C
Peak output current	Iop	—	2.2	—	A	Tj = 25°C

HA17812V/VP/VPJ Electrical Characteristics

(V_{IN} = 19 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	11.5	12.0	12.5	V	Tj = 25°C
	V_{OUT2}	11.4	—	12.6	V	14.5 V ≤ V_{IN} ≤ 27 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, PT ≤ 15 W
Line regulation	δV_{OLine1}	—	100	240	mV	Tj = 25°C, 14.5 V ≤ V_{IN} ≤ 30 V
	δV_{OLine2}	—	33	120	mV	Tj = 25°C, 16 V ≤ V_{IN} ≤ 22 V
Load regulation	δV_{OLoad1}	—	100	240	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	33	120	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.6	7.2	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current	δI_{Q1}	—	—	1.0	mA	14.5 V ≤ V_{IN} ≤ 30 V
change	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	58	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.8	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	290	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	0.6	—	A	Tj = 25°C
Peak output current	Iop	—	2.1	—	A	Tj = 25°C

HA17815V/VP/VPJ Electrical Characteristics

(V_{IN} = 23 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	14.4	15.0	15.6	V	Tj = 25°C
	V_{OUT2}	14.25	—	15.75	V	17.5 V ≤ V_{IN} ≤ 30 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	144	300	mV	Tj = 25°C, 17.5 V ≤ V_{IN} ≤ 30 V
	δV_{OLine2}	—	48	150	mV	Tj = 25°C, 20 V ≤ V_{IN} ≤ 26 V
Load regulation	δV_{OLoad1}	—	144	300	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	48	150	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.6	7.2	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current	δI_{Q1}	—	—	1.0	mA	17.5 V ≤ V_{IN} ≤ 30 V
change	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	58	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.8	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	300	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	0.4	—	A	Tj = 25°C
Peak output current	Iop	—	2.1	—	A	Tj = 25°C

HA17818V/VP/VPJ Electrical Characteristics

(V_{IN} = 27 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	17.3	18.0	18.7	V	Tj = 25°C
	V_{OUT2}	17.1	—	18.9	V	21 V ≤ V_{IN} ≤ 33 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	195	360	mV	Tj = 25°C, 21 V ≤ V_{IN} ≤ 33 V
	δV_{OLine2}	—	65	180	mV	Tj = 25°C, 24 V ≤ V_{IN} ≤ 30 V
Load regulation	δV_{OLoad1}	—	195	360	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δdV_{OLoad2}	—	65	180	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.6	7.2	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.0	mA	21 V ≤ V_{IN} ≤ 33 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	56	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–0.8	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	430	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	0.35	—	A	Tj = 25°C
Peak output current	Iop	—	2.1	—	A	Tj = 25°C

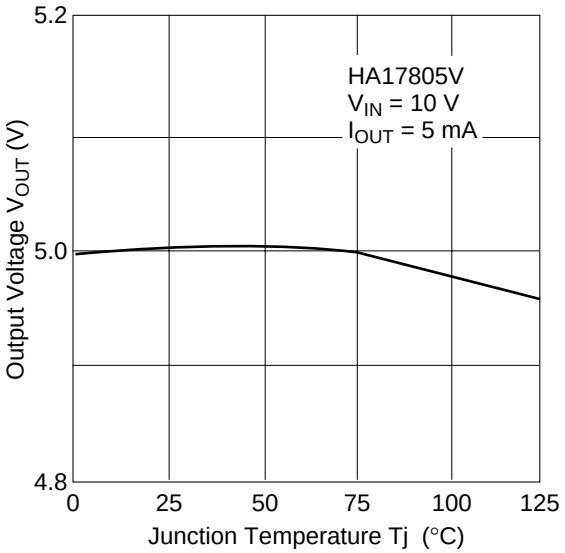
HA17824V/VP/VPJ Electrical Characteristics

(V_{IN} = 33 V, I_{OUT} = 500 mA, 0°C Tj 125°C, C_{IN} = 0.33 µF, C_{OUT} = 0.1 µF)

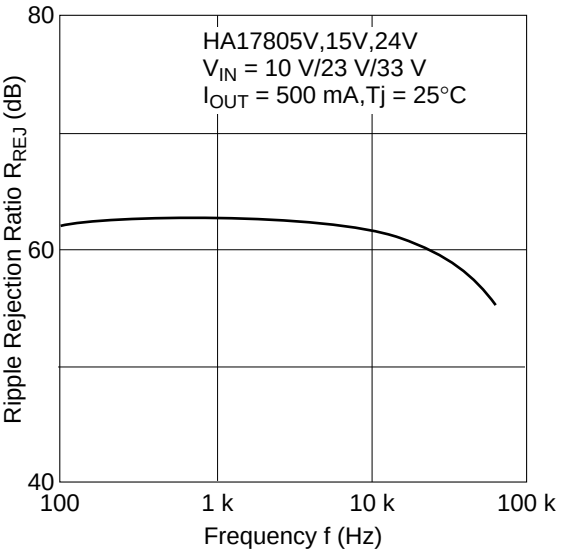
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V_{OUT1}	23.0	24.0	25.0	V	Tj = 25°C
	V_{OUT2}	22.8	—	25.2	V	27 V ≤ V_{IN} ≤ 38 V, 5 mA ≤ I_{OUT} ≤ 1.0 A, P_T ≤ 15 W
Line regulation	δV_{OLine1}	—	260	480	mV	Tj = 25°C, 27 V ≤ V_{IN} ≤ 38 V
	δV_{OLine2}	—	86	240	mV	Tj = 25°C, 30 V ≤ V_{IN} ≤ 36 V
Load regulation	δV_{OLoad1}	—	260	480	mV	Tj = 25°C, 5 mA ≤ I_{OUT} ≤ 1.5 A
	δV_{OLoad2}	—	86	240	mV	Tj = 25°C, 250 mA ≤ I_{OUT} ≤ 750 mA
Quiescent current	I_Q	0.8	3.7	7.4	mA	Tj = 25°C, I_{OUT} = 0
Quiescent current change	δI_{Q1}	—	—	1.0	mA	27 V ≤ V_{IN} ≤ 38 V
	δI_{Q2}	—	—	0.5	mA	5 mA ≤ I_{OUT} ≤ 1.0 A
Voltage drop	Vdrop	—	2.0	2.5	V	Tj = 25°C, I_{OUT} = 1.0 A
Ripple rejection ratio	R_{REJ}	—	50	—	dB	Tj = 25°C, f = 10 kHz
Temperature coefficient of output voltage	$\delta V_{OUT}/\delta Ta$	—	–1.2	—	mV/°C	I_{OUT} = 5 mA
Output noise voltage	Vn	—	570	—	µVrms	Tj = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I_{OS}	—	0.25	—	A	Tj = 25°C
Peak output current	Iop	—	2.0	—	A	Tj = 25°C

Characteristic Curves

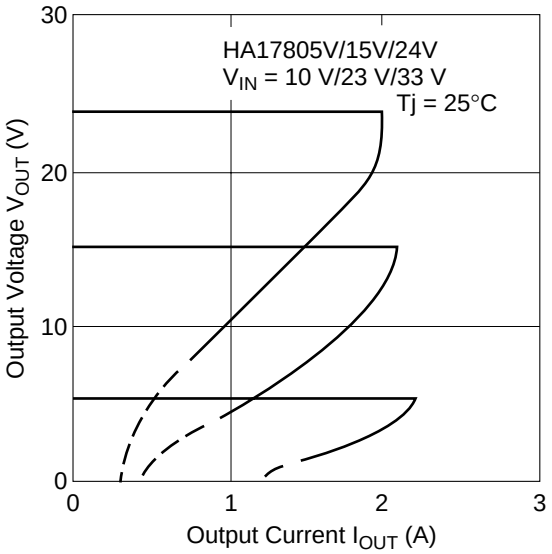
Output Voltage vs. Junction Temperature (1)



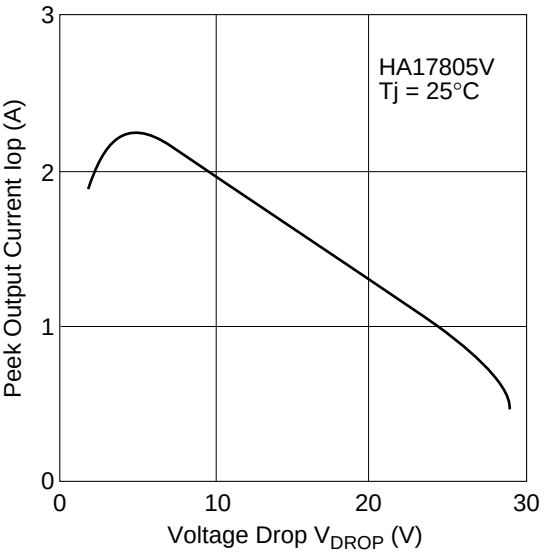
Ripple Rejection Ratio vs. Frequency



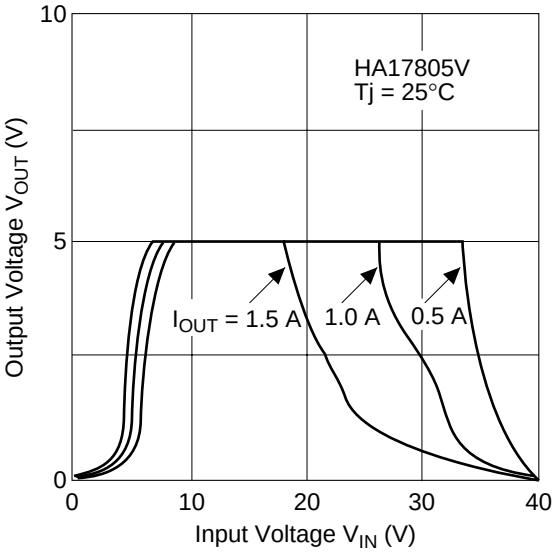
Output Voltage vs. Output Current



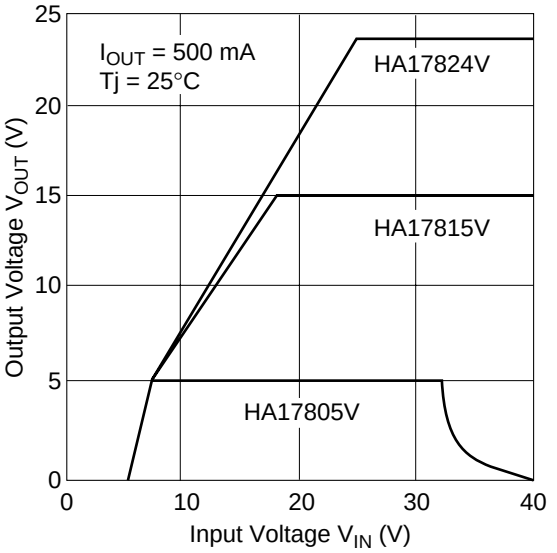
Peak Output Current vs. Voltage Drop



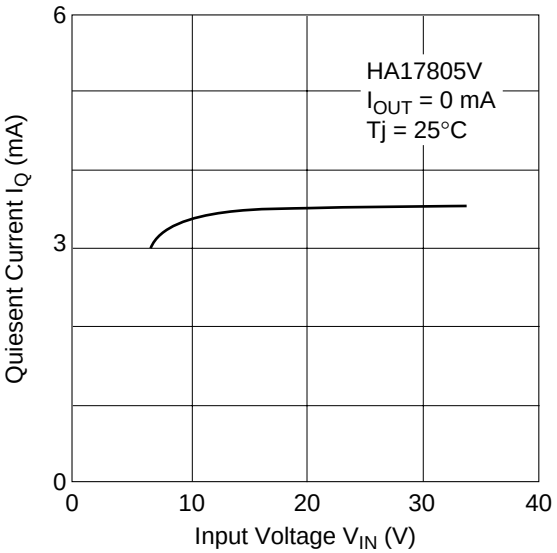
Output Voltage vs. Input Voltage (1)



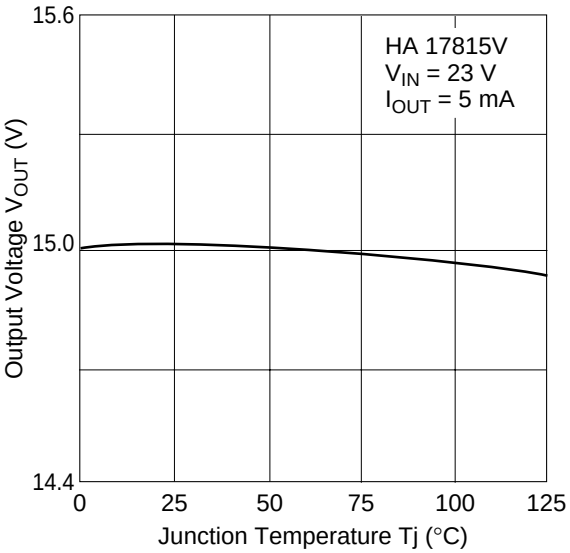
Output Voltage vs. Input Voltage (2)



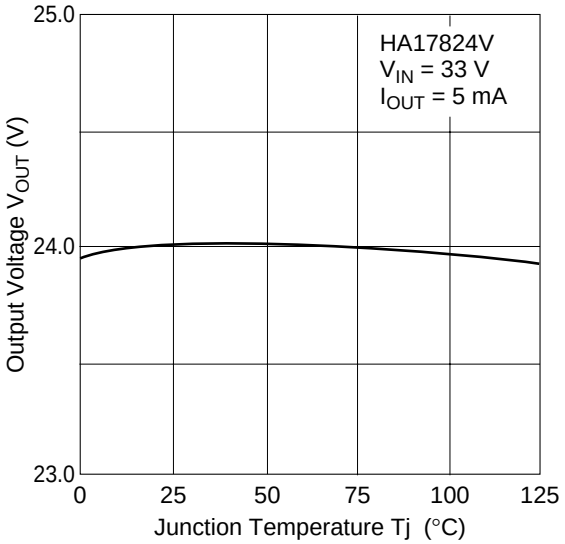
Quiescent Current vs. Input Voltage



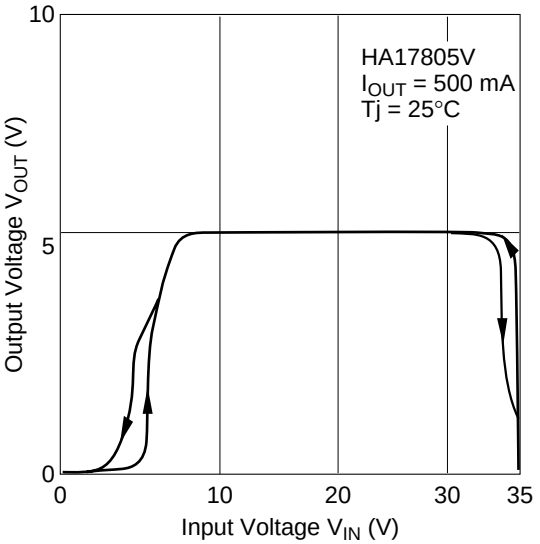
Output Voltage vs. Junction Temperature (2)



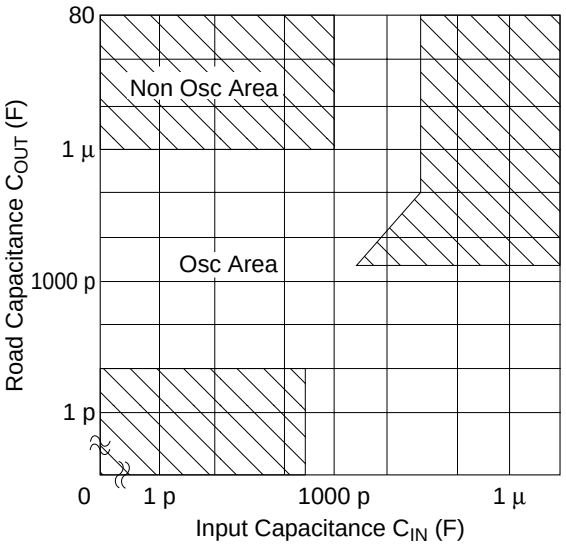
Output Voltage vs. Junction Temperature (3)



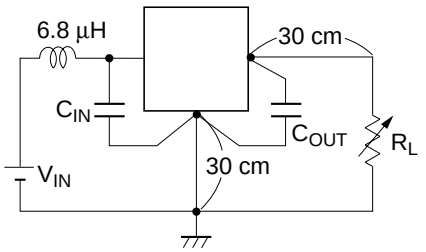
Output Voltage vs. Input Voltage (3)



Oscillation Area



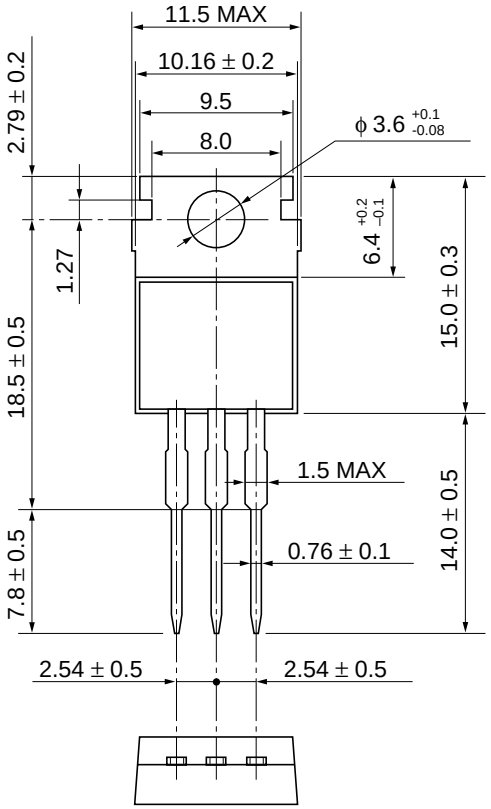
Measurement Circuit

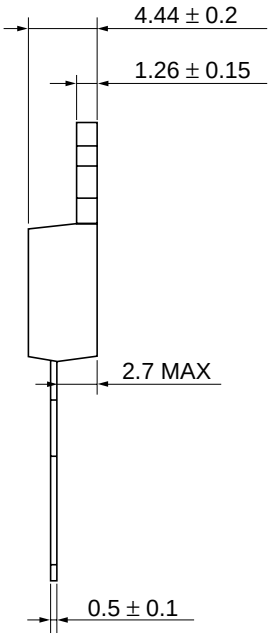


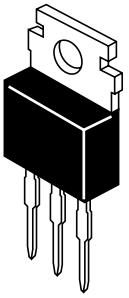
Test condition V_{IN} = 10 V
$0 < I_{OUT} < 1.4$ A

Package Dimensions

Unit: mm







Hitachi Code	TO-220AB
JEDEC	Conforms
EIAJ	Conforms
Mass (reference value)	1.8 g

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