

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

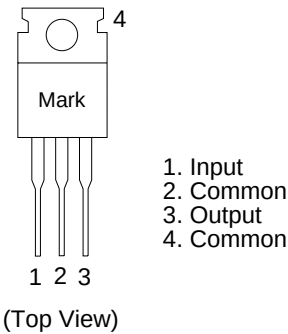
- High ripple rejection ratio up to high frequency
(f 20 kHz): 60 dB(in the case of HA17805V/VP/VPJ)
- Protected against oscillation
- Regulated output voltage against temperature
(0 Ta 125°C, 80 ppm/°C typ)
- Hard to breakdown against irrelevant connection
- Built-in circuits as over current control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

Ordering Information

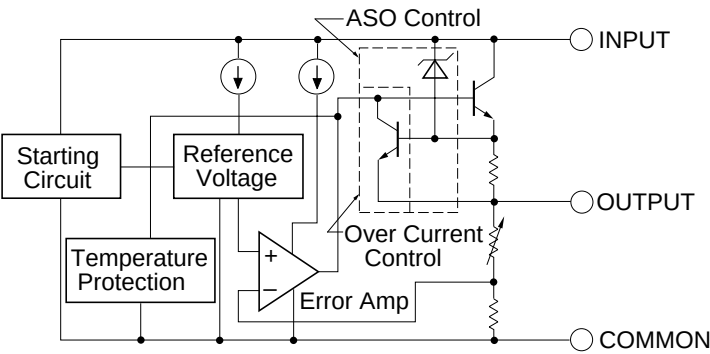
Output Voltage (V)	Automotive Use	Industrial Use	Commercial Use	Package
5	HA17805VPJ	HA17805VP	HA17805V	TO - 220AB
6	HA17806VPJ	HA17806VP	HA17806V	
7	HA17807VPJ	HA17807VP	HA17807V	
8	HA17808VPJ	HA17808VP	HA17808V	
12	HA17812VPJ	HA17812VP	HA17812V	
15	HA17815VPJ	HA17815VP	HA17815V	
18	HA17818VPJ	HA17818VP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

HA17800V/VP/VPJ Series

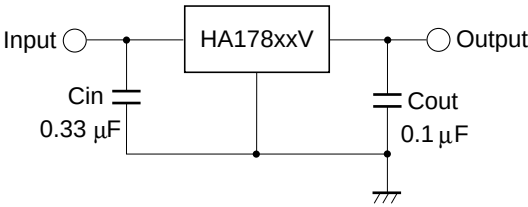
Pin Arrangement



Block Diagram



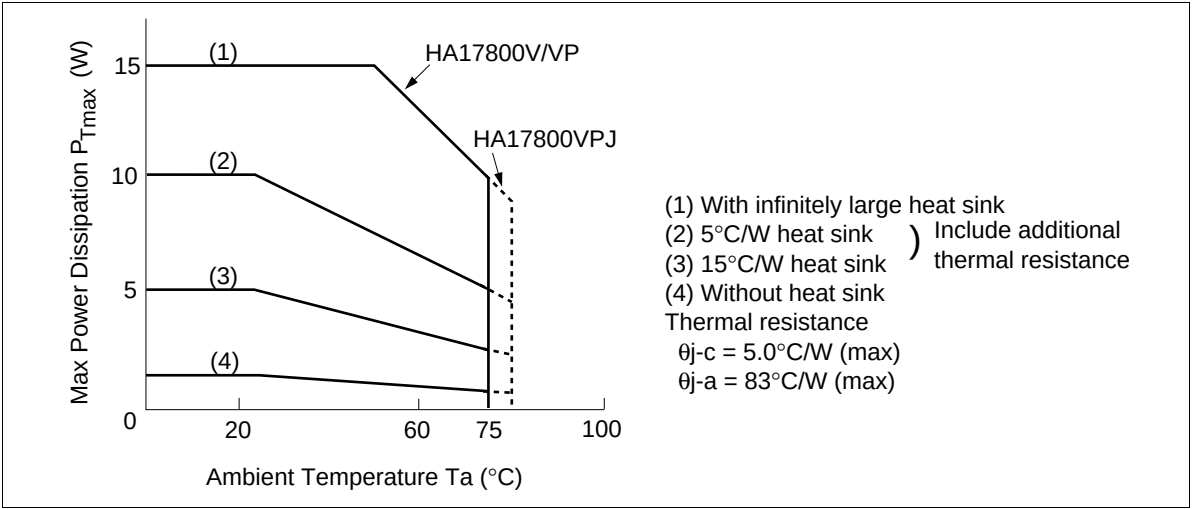
Standard Circuit



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	T_{opr}	−20 to +75	−40 to +85	°C	
Storage temperature	T_{stg}	−55 to +125	−50 to +125	°C	
Operating junction temperature	T_j	−20 to +125	−40 to +125	°C	

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



HA17805V/VP/VPJ Electrical Characteristics

(V_{IN} = 10 V, I_{OUT} = 500 mA, 0°C ≤ T_j ≤ 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	T _j = 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	T _j = 25°C, 7 V ≤ V _{IN} ≤ 25 V
	ΔV _{OLine2}	—	10	50	mV	T _j = 25°C, 8 V ≤ V _{IN} ≤ 12 V
Load regulation	ΔV _{OLoad1}	—	30	100	mV	T _j = 25°C, 5 mA ≤ I _{OUT} ≤ 1.5 A
	ΔV _{OLoad2}	—	10	50	mV	T _j = 25°C, 250 mA ≤ I _{OUT} ≤ 750 mA
Quiescent current	I _Q	0.8	3.5	7.0	mA	T _j = 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	V _{drop}	—	2.0	2.5	V	T _j = 25°C, I _{OUT} = 1.0 A
Ripple rejection ratio	R _{REJ}	—	60	—	dB	T _j = 25°C, f = 10 kHz
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _a	—	−0.5	—	mV/°C	I _{OUT} = 5 mA
Output noise voltage	V _n	—	120	—	μVrms	T _j = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I _{OS}	—	1.25	—	A	T _j = 25°C
Peak output current	I _{op}	—	2.2	—	A	T _j = 25°C

HA17806V/VP/VPJ Electrical Characteristics

($V_{IN} = 11\text{ V}$, $I_{OUT} = 500\text{ mA}$, $0^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

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

HA17800V/VP/VPJ Series

HA17807V/VP/VPJ Electrical Characteristics

($V_{IN} = 12.5\text{ V}$, $I_{OUT} = 500\text{ mA}$, $0^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

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

HA17808V/VP/VPJ Electrical Characteristics

($V_{IN} = 14\text{ V}$, $I_{OUT} = 500\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

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

HA17812V/VP/VPJ Electrical Characteristics

(V_{IN} = 19 V, I_{OUT} = 500 mA, 0°C ≤ T_j ≤ 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	T _j = 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	T _j = 25°C, 14.5 V ≤ V _{IN} ≤ 30 V
	ΔV _{OLine2}	—	33	120	mV	T _j = 25°C, 16 V ≤ V _{IN} ≤ 22 V
Load regulation	ΔV _{OLoad1}	—	100	240	mV	T _j = 25°C, 5 mA ≤ I _{OUT} ≤ 1.5 A
	ΔV _{OLoad2}	—	33	120	mV	T _j = 25°C, 250 mA ≤ I _{OUT} ≤ 750 mA
Quiescent current	I _Q	0.8	3.6	7.2	mA	T _j = 25°C, I _{OUT} = 0
Quiescent current change	ΔI _{Q1}	—	—	1.0	mA	14.5 V ≤ V _{IN} ≤ 30 V
	ΔI _{Q2}	—	—	0.5	mA	5 mA ≤ I _{OUT} ≤ 1.0 A
Voltage drop	V _{drop}	—	2.0	2.5	V	T _j = 25°C, I _{OUT} = 1.0 A
Ripple rejection ratio	R _{REJ}	—	58	—	dB	T _j = 25°C, f = 10 kHz
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _a	—	−0.8	—	mV/°C	I _{OUT} = 5 mA
Output noise voltage	V _n	—	290	—	μV _{rms}	T _j = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I _{OS}	—	0.6	—	A	T _j = 25°C
Peak output current	I _{op}	—	2.1	—	A	T _j = 25°C

HA17815V/VP/VPJ Electrical Characteristics

($V_{IN} = 23\text{ V}$, $I_{OUT} = 500\text{ mA}$, $0^\circ\text{C} \leq T_j \leq 125^\circ\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

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

HA17818V/VP/VPJ Electrical Characteristics

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

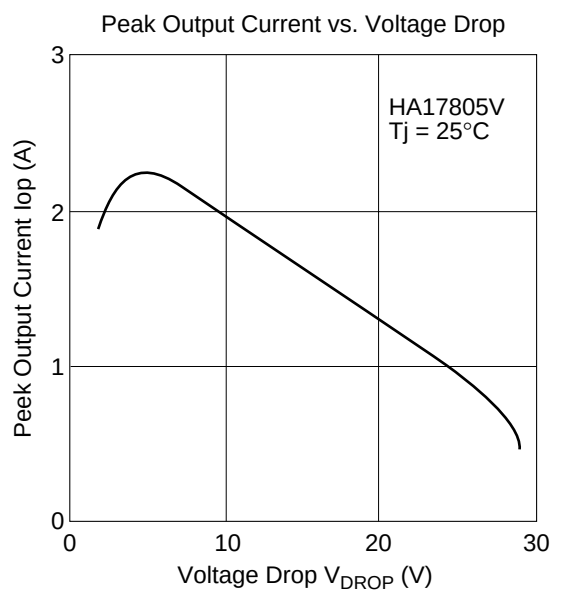
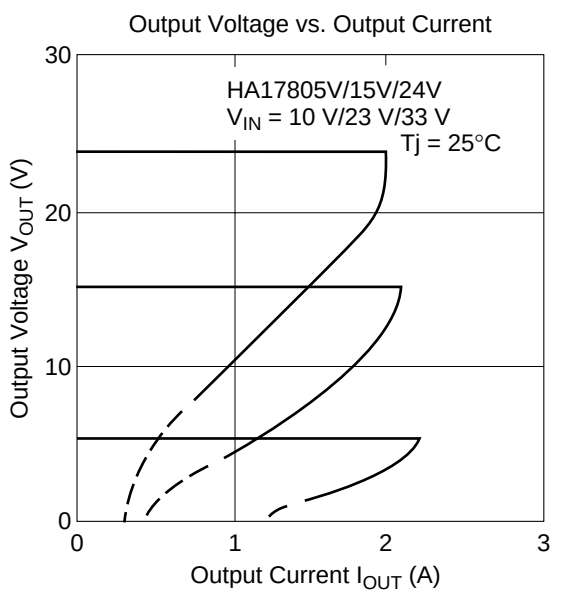
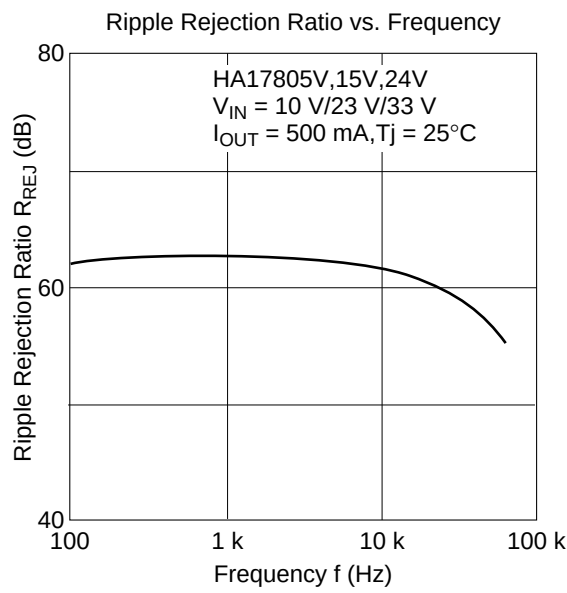
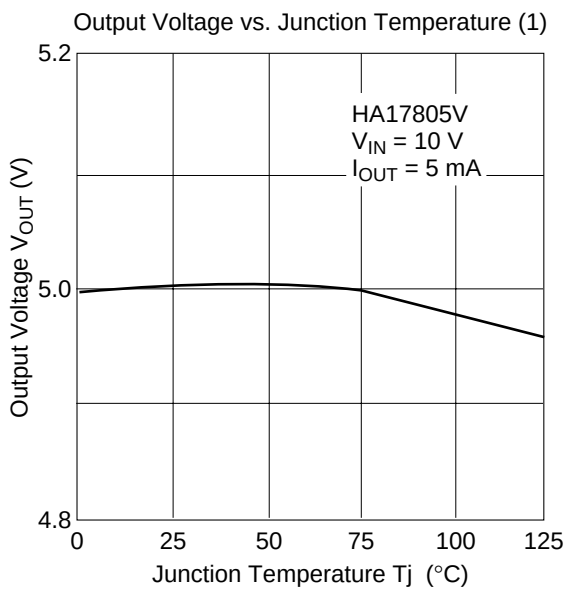
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Output voltage	V _{OUT1}	17.3	18.0	18.7	V	T _j = 25°C
	V _{OUT2}	17.1	—	18.9	V	21 V ≤ V _{IN} ≤ 33 V, 5 mA ≤ I _{OUT} ≤ 1.0 A, P _T ≤ 15 W
Line regulation	ΔV _{OLine1}	—	195	360	mV	T _j = 25°C, 21 V ≤ V _{IN} ≤ 33 V
	ΔV _{OLine2}	—	65	180	mV	T _j = 25°C, 24 V ≤ V _{IN} ≤ 30 V
Load regulation	ΔV _{OLoad1}	—	195	360	mV	T _j = 25°C, 5 mA ≤ I _{OUT} ≤ 1.5 A
	ΔdV _{OLoad2}	—	65	180	mV	T _j = 25°C, 250 mA ≤ I _{OUT} ≤ 750 mA
Quiescent current	I _Q	0.8	3.6	7.2	mA	T _j = 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	T _j = 25°C, I _{OUT} = 1.0 A
Ripple rejection ratio	R _{REJ}	—	56	—	dB	T _j = 25°C, f = 10 kHz
Temperature coefficient of output voltage	ΔV _{OUT} /ΔTa	—	−0.8	—	mV/°C	I _{OUT} = 5 mA
Output noise voltage	Vn	—	430	—	μVrms	T _j = 25°C, 10 Hz ≤ f ≤ 100 kHz
Output short circuit current	I _{OS}	—	0.35	—	A	T _j = 25°C
Peak output current	Iop	—	2.1	—	A	T _j = 25°C

HA17824V/VP/VPJ Electrical Characteristics

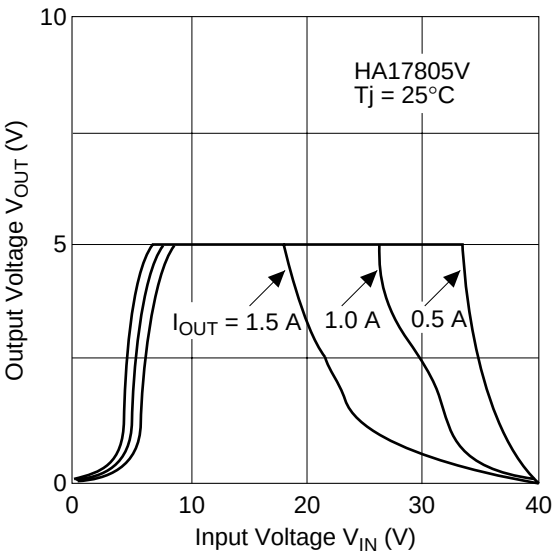
($V_{IN} = 33\text{ V}$, $I_{OUT} = 500\text{ mA}$, $0^{\circ}\text{C} \leq T_j \leq 125^{\circ}\text{C}$, $C_{IN} = 0.33\text{ }\mu\text{F}$, $C_{OUT} = 0.1\text{ }\mu\text{F}$)

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

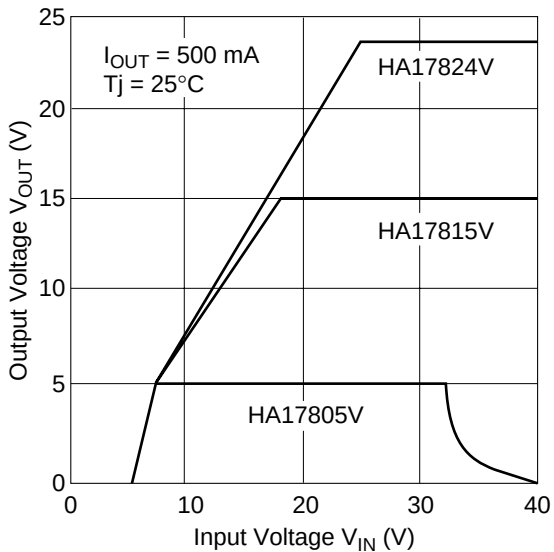
Characteristic Curves



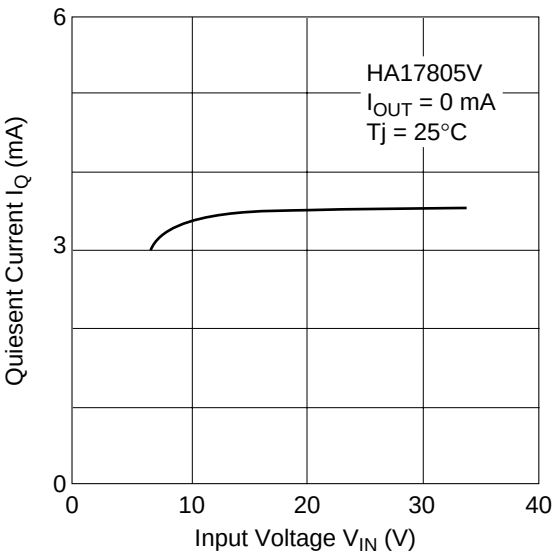
Output Voltage vs. Input Voltage (1)



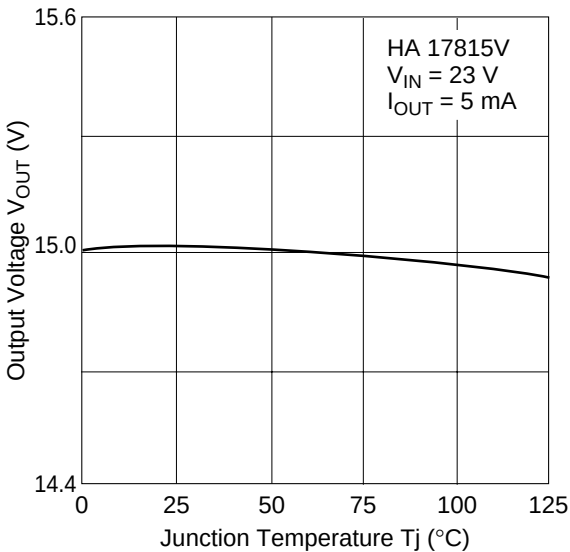
Output Voltage vs. Input Voltage (2)



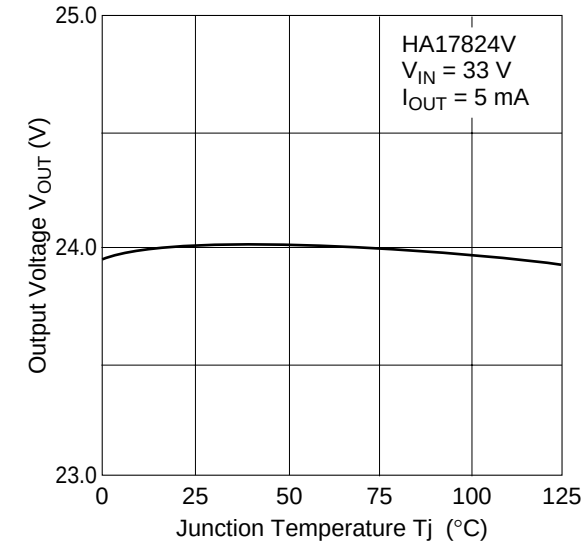
Quiescent Current vs. Input Voltage



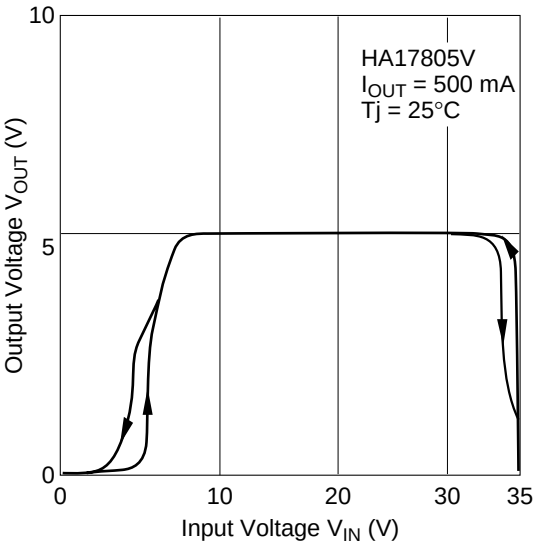
Output Voltage vs. Junction Temperature (2)



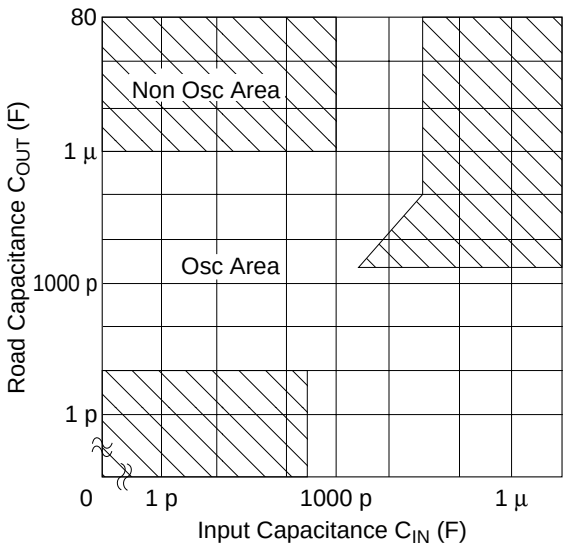
Output Voltage vs. Junction Temperature (3)



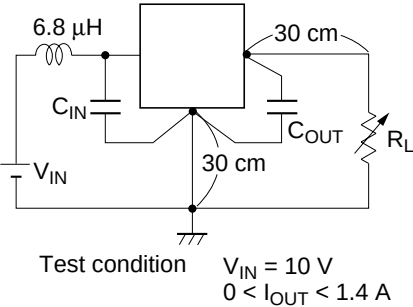
Output Voltage vs. Input Voltage (3)



Oscillation Area

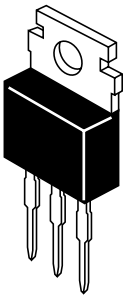
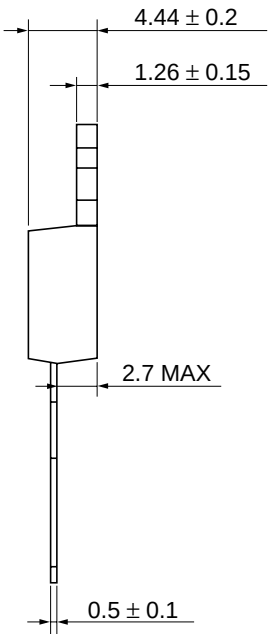
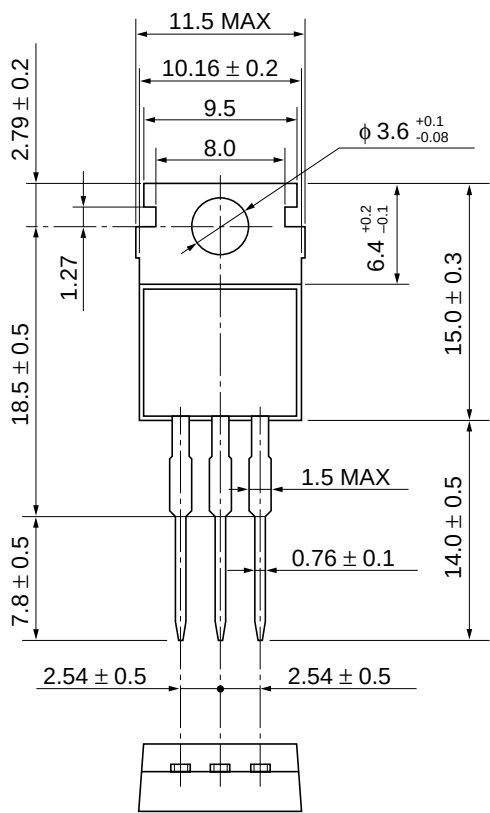


Measurement Circuit



Package Dimensions

Unit: mm



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

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