

HA178L02/56/06/09/10 Series

3-terminal Fixed Voltage Regulators

REJ03D0918-0100

Rev.1.00

Jan 16, 2009

Description

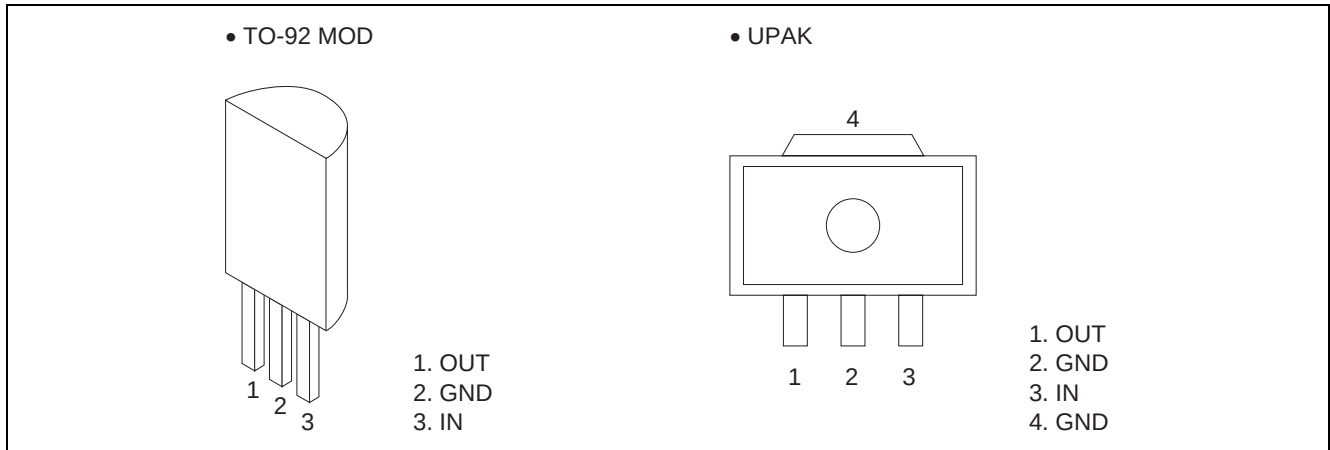
The HA178L02/56/06/09/10 series three-terminal fixed output voltage regulators. Can be used not only as stabilized power sources, but also as Zener diodes because of their small outline package.

Features

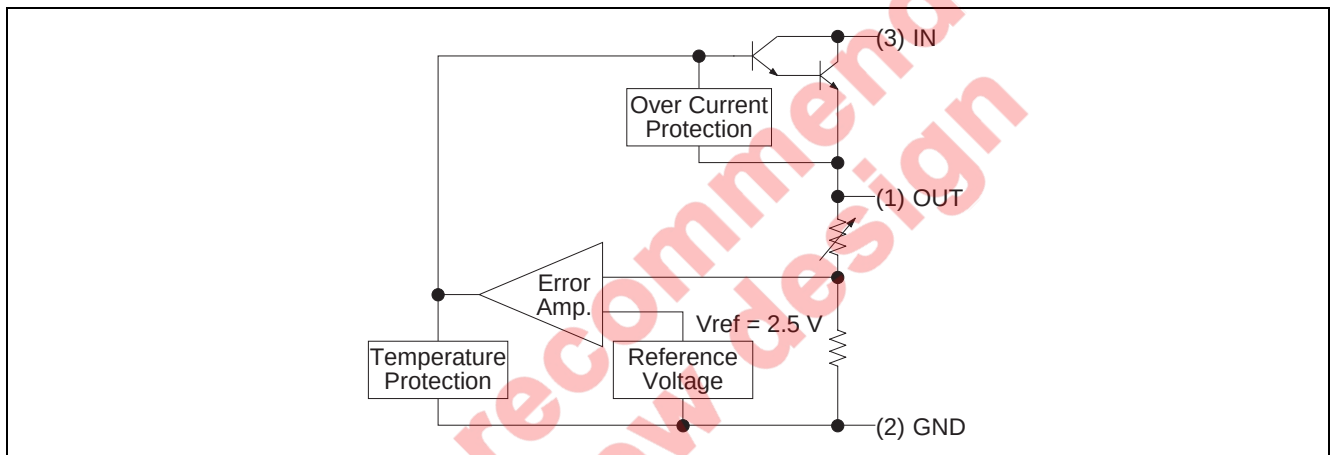
- Maximum output current: 150 mA ($T_j = 25^\circ\text{C}$)
- Large maximum power dissipation: 800 mW
- Over current protection
- Temperature protection circuit
- Ordering Information

Part No.	Output Voltage (V)	Output Voltage Tolerance (%)	Package Name	Package Code	Taping Abbreviation (Quantity)	Application
HA178L02-TZ	2.5	± 8	TO-92MOD	PRSS0003DC-A	TZ (2,500pcs/box)	Commercial use
HA178L02P-TZ						Industrial use
HA178L02A-TZ		± 5	UPAK	PLZZ0004CA-A	TL (1,000pcs/reel)	Commercial use
HA178L02PA-TZ						Industrial use
HA178L02UA-TL						Commercial use
HA178L56-TZ	5.6	± 8	TO-92MOD	PRSS0003DC-A	TZ (2,500pcs/box)	Commercial use
HA178L56P-TZ						Industrial use
HA178L56A-TZ		± 5	UPAK	PLZZ0004CA-A	TL (1,000pcs/reel)	Commercial use
HA178L56PA-TZ						Industrial use
HA178L56UA-TL						Commercial use
HA178L06-TZ	6	± 8	TO-92MOD	PRSS0003DC-A	TZ (2,500pcs/box)	Commercial use
HA178L06P-TZ						Industrial use
HA178L06A-TZ		± 5	UPAK	PLZZ0004CA-A	TL (1,000pcs/reel)	Commercial use
HA178L06PA-TZ						Industrial use
HA178L06UA-TL						Commercial use
HA178L09-TZ	9	± 8	TO-92MOD	PRSS0003DC-A	TZ (2,500pcs/box)	Commercial use
HA178L09P-TZ						Industrial use
HA178L09A-TZ		± 5	UPAK	PLZZ0004CA-A	TL (1,000pcs/reel)	Commercial use
HA178L09PA-TZ						Industrial use
HA178L09UA-TL						Commercial use
HA178L10-TZ	10	± 8	TO-92MOD	PRSS0003DC-A	TZ (2,500pcs/box)	Commercial use
HA178L10P-TZ						Industrial use
HA178L10A-TZ		± 5	UPAK	PLZZ0004CA-A	TL (1,000pcs/reel)	Commercial use
HA178L10PA-TZ						Industrial use
HA178L10UA-TL						Commercial use

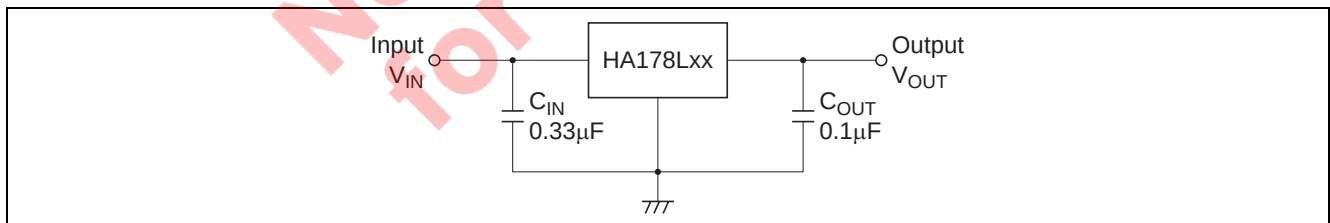
Pin Arrangement



Block Diagram



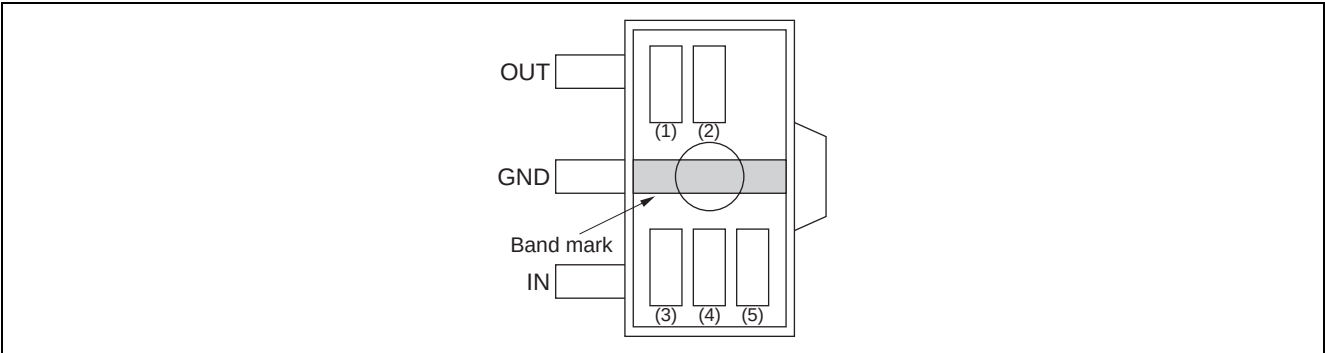
Standard Circuit



UPAK Product (HA178LxxUA) Mark Patterns

The mark patterns shown below are used on UPAK products, as the package is small. Note that the product code and mark pattern are different.

The pattern is laser-printed.



- Notes: 1. Boxes (1) to (5) in the figures show the position of the letters or numerals, and are not actually marked on the package.
2. (1) and (2) show the product-specific mark pattern.

Output Voltage (V)	Part No.	Mark Pattern (2 digit)
2.5	HA178L02UA	8A
5.6	HA178L56UA	8C
6	HA178L06UA	8D
9	HA178L09UA	8F
10	HA178L10UA	8G

3. (3) shows the production year code (the last digit of the year).
4. (4) shows the production month code.

Production Month	1	2	3	4	5	6	7	8	9	10	11	12
Marked Code	A	B	C	D	E	F	G	H	J	K	L	M

5. (5) shows the production week code.

Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Rating	Unit	Note
Input voltage	V_{IN}	35	V	
Power dissipation	P_T	800	mW	TO-92 MOD * ¹
		800		UPAK * ²
Operating ambient temperature	Topr	−40 to +85	°C	
Storage temperature	Tstg	−55 to +150	°C	

Note: 1. Ta ≤ 25°C, If Ta > 25°C, derate by 6.4 mW/°C (See figure A)

2. 15mm × 25mm × 0.7 mm alumina ceramic board, Ta ≤ 25°C (See figure B)

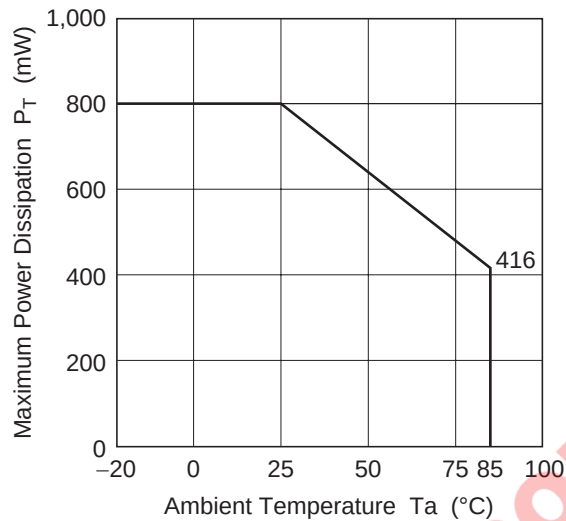


Figure A

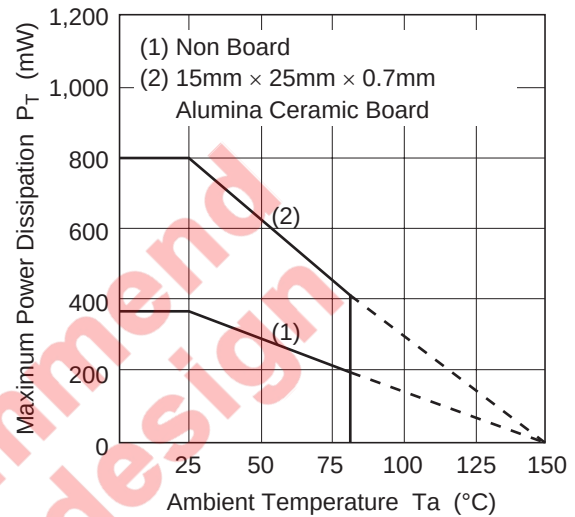


Figure B

Electrical Characteristics

HA178L02

(V_{IN} = 10 V, I_{OUT} = 40 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Item	Symbol	HA178L02P HA178L02			HA178L02PA HA178L02A HA178L02UA			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Output voltage	V _{OUT}	2.32	2.48	2.64	2.38	2.48	2.58	V	T _j = 25°C
Line regulation	ΔV _{OLINE}	—	35	125	—	35	95	mV	T _j = 25°C
		—	30	100	—	30	75		7 V ≤ V _{IN} ≤ 20 V 8 V ≤ V _{IN} ≤ 20 V
Load regulation	ΔV _{OLOAD}	—	14	—	—	14	—	mV	T _j = 25°C
		—	9.5	50	—	9.5	50		1.0 mA ≤ I _{OUT} ≤ 150 mA 1.0 mA ≤ I _{OUT} ≤ 100 mA
		—	4.5	25	—	4.5	25		1.0 mA ≤ I _{OUT} ≤ 40 mA
Output voltage	V _{OUT}	2.28	—	2.68	2.35	—	2.61	V	7 V ≤ V _{IN} ≤ 20 V, 1.0 mA ≤ I _{OUT} ≤ 40 mA
		2.28	—	2.68	2.35	—	2.61		V _{IN} = 9 V, 1.0 mA ≤ I _{OUT} ≤ 70 mA
Quiescent current	I _Q	—	3.0	6.0	—	3.0	6.0	mA	T _j = 25°C
Quiescent current change	ΔI _Q	—	—	1.5	—	—	1.5	mA	8.0 V ≤ V _{IN} ≤ 20 V, T _j = 25°C
		—	—	0.2	—	—	0.1		1.0 mA ≤ I _{OUT} ≤ 40 mA, T _j = 25°C
Ripple rejection ratio	R _{REJ}	—	60	—	—	60	—	dB	f = 120 Hz, 8.0 V ≤ V _{IN} < 18 V, T _j = 25°C
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _j	—	+0.2	—	—	+0.2	—	mV/°C	I _{OUT} = 5 mA

HA178L56

(V_{IN} = 11 V, I_{OUT} = 40 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Item	Symbol	HA178L56P HA178L56			HA178L56PA HA178L56A HA178L56UA			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Output voltage	V _{OUT}	5.24	5.6	5.96	5.38	5.6	5.82	V	T _j = 25°C
Line regulation	ΔV _{OLINE}	—	50	200	—	50	150	mV	T _j = 25°C
		—	45	150	—	45	100		7.6 V ≤ V _{IN} ≤ 21 V 8.5 V ≤ V _{IN} ≤ 21 V
Load regulation	ΔV _{OLOAD}	—	17	—	—	17	—	mV	T _j = 25°C
		—	11	60	—	11	60		1.0 mA ≤ I _{OUT} ≤ 150 mA 1.0 mA ≤ I _{OUT} ≤ 100 mA
		—	5.0	30	—	5.0	30		1.0 mA ≤ I _{OUT} ≤ 40 mA
Output voltage	V _{OUT}	5.16	—	6.04	5.32	—	5.88	V	7.6 V ≤ V _{IN} ≤ 21 V, 1.0 mA ≤ I _{OUT} ≤ 40 mA
		5.16	—	6.04	5.32	—	5.88		V _{IN} = 11 V, 1.0 mA ≤ I _{OUT} ≤ 70 mA
Quiescent current	I _Q	—	3.0	6.0	—	3.0	6.0	mA	T _j = 25°C
Quiescent current change	ΔI _Q	—	—	1.5	—	—	1.5	mA	8.5 V ≤ V _{IN} ≤ 2.0 V, T _j = 25°C
		—	—	0.2	—	—	0.1		1.0 mA ≤ I _{OUT} ≤ 40 mA, T _j = 25°C
Ripple rejection ratio	R _{REJ}	—	58	—	—	58	—	dB	f = 120 Hz, 8.5 V ≤ V _{IN} < 18.5 V, T _j = 25°C
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _j	—	+0.1	—	—	+0.1	—	mV/°C	I _{OUT} = 5 mA
Dropout voltage	V _{DROP}	—	1.7	—	—	1.7	—	V	T _j = 25°C

HA178L06

(V_{IN} = 11 V, I_{OUT} = 40 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Item	Symbol	HA178L06P HA178L06			HA178L06PA HA178L06A HA178L06UA			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Output voltage	V _{OUT}	5.61	6.0	6.39	5.76	6.0	6.24	V	T _j = 25°C
Line regulation	ΔV _{OLINE}	—	50	200	—	50	150	mV	8.1 V ≤ V _{IN} ≤ 21 V
		—	45	150	—	45	110		9.0 V ≤ V _{IN} ≤ 21 V
Load regulation	ΔV _{OLOAD}	—	17.5	—	—	17.5	—	mV	1.0 mA ≤ I _{OUT} ≤ 150 mA
		—	12	70	—	12	70		1.0 mA ≤ I _{OUT} ≤ 100 mA
		—	5.5	35	—	5.5	35		1.0 mA ≤ I _{OUT} ≤ 40 mA
Output voltage	V _{OUT}	5.52	—	6.48	5.7	—	6.3	V	8.1 V ≤ V _{IN} ≤ 21 V, 1.0 mA ≤ I _{OUT} ≤ 40 mA
		5.52	—	6.48	5.7	—	6.3		V _{IN} = 11 V, 1.0 mA ≤ I _{OUT} ≤ 70 mA
Quiescent current	I _Q	—	3.0	6.0	—	3.0	6.0	mA	T _j = 25°C
Quiescent current change	ΔI _Q	—	—	1.5	—	—	1.5	mA	9.0 V ≤ V _{IN} ≤ 20 V, T _j = 25°C
		—	—	0.2	—	—	0.1		1.0 mA ≤ I _{OUT} ≤ 40 mA, T _j = 25°C
Ripple rejection ratio	R _{REJ}	—	57	—	—	57	—	dB	f = 120 Hz, 9.0 V ≤ V _{IN} < 19 V, T _j = 25°C
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _j	—	+0.1	—	—	+0.1	—	mV/°C	I _{OUT} = 5 mA
Dropout voltage	V _{DROP}	—	1.7	—	—	1.7	—	V	T _j = 25°C

HA178L09

(V_{IN} = 15 V, I_{OUT} = 40 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Item	Symbol	HA178L09P HA178L09			HA178L09PA HA178L09A HA178L09UA			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Output voltage	V _{OUT}	8.42	9.0	9.58	8.64	9.0	9.36	V	T _j = 25°C
Line regulation	ΔV _{OLINE}	—	80	230	—	80	200	mV	11.4 V ≤ V _{IN} ≤ 24 V
		—	20	160	—	20	160		12 V ≤ V _{IN} ≤ 24 V
Load regulation	ΔV _{OLOAD}	—	24.5	—	—	24.5	—	mV	1.0 mA ≤ I _{OUT} ≤ 150 mA
		—	17	90	—	17	90		1.0 mA ≤ I _{OUT} ≤ 100 mA
		—	8.0	45	—	8.0	45		1.0 mA ≤ I _{OUT} ≤ 40 mA
Output voltage	V _{OUT}	8.28	—	9.72	8.55	—	9.45	V	11.4 V ≤ V _{IN} ≤ 24 V, 1.0 mA ≤ I _{OUT} ≤ 40 mA
		8.28	—	9.72	8.55	—	9.45		V _{IN} = 15 V, 1.0 mA ≤ I _{OUT} ≤ 70 mA
Quiescent current	I _Q	—	3.1	6.5	—	3.1	6.5	mA	T _j = 25°C
Quiescent current change	ΔI _Q	—	—	1.5	—	—	1.5	mA	12 V ≤ V _{IN} ≤ 24 V, T _j = 25°C
		—	—	0.2	—	—	0.1		1.0 mA ≤ I _{OUT} ≤ 40 mA, T _j = 25°C
Ripple rejection ratio	R _{REJ}	—	55	—	—	55	—	dB	f = 120 Hz, 12 V ≤ V < 24 V, T _j = 25°C
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _j	—	−0.15	—	—	−0.15	—	mV/°C	I _{OUT} = 5 mA
Dropout voltage	V _{DROP}	—	1.7	—	—	1.7	—	V	T _j = 25°C

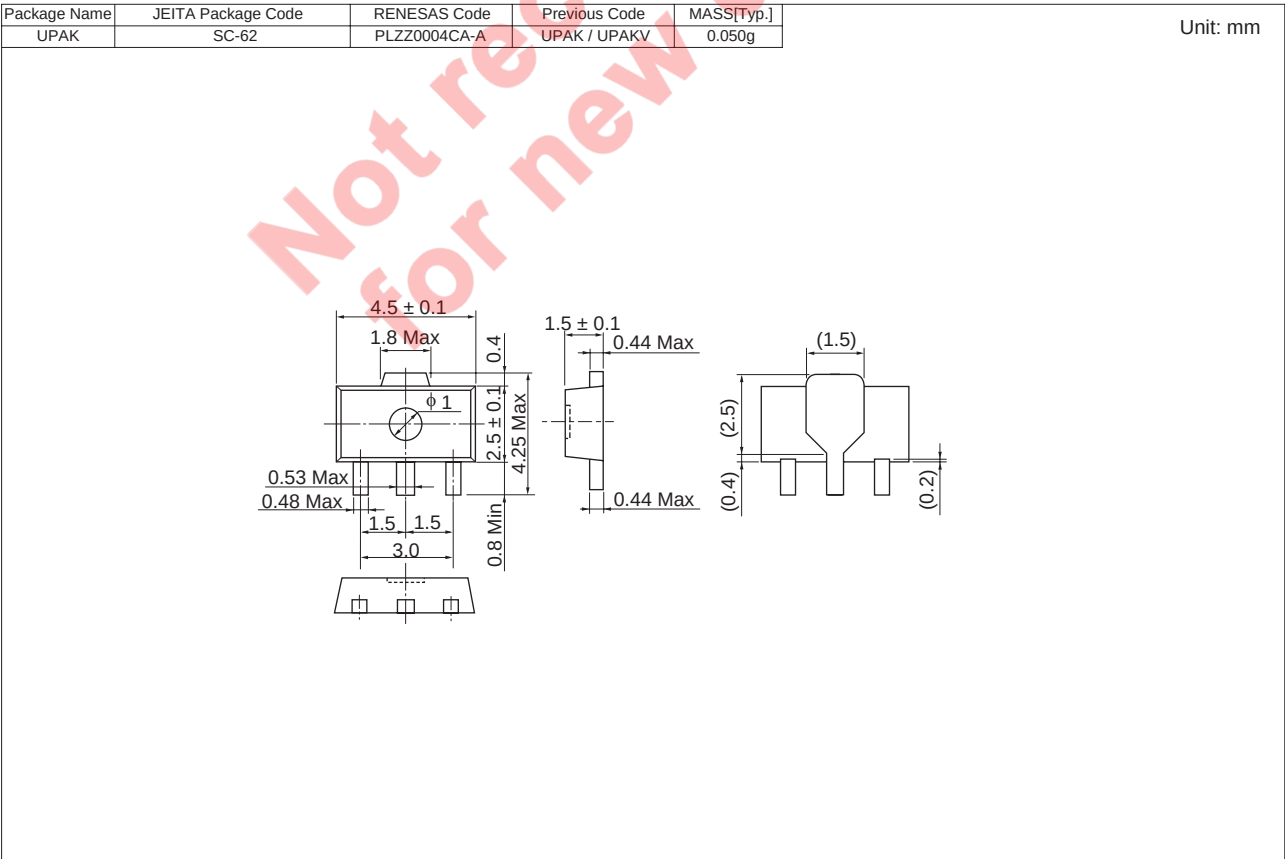
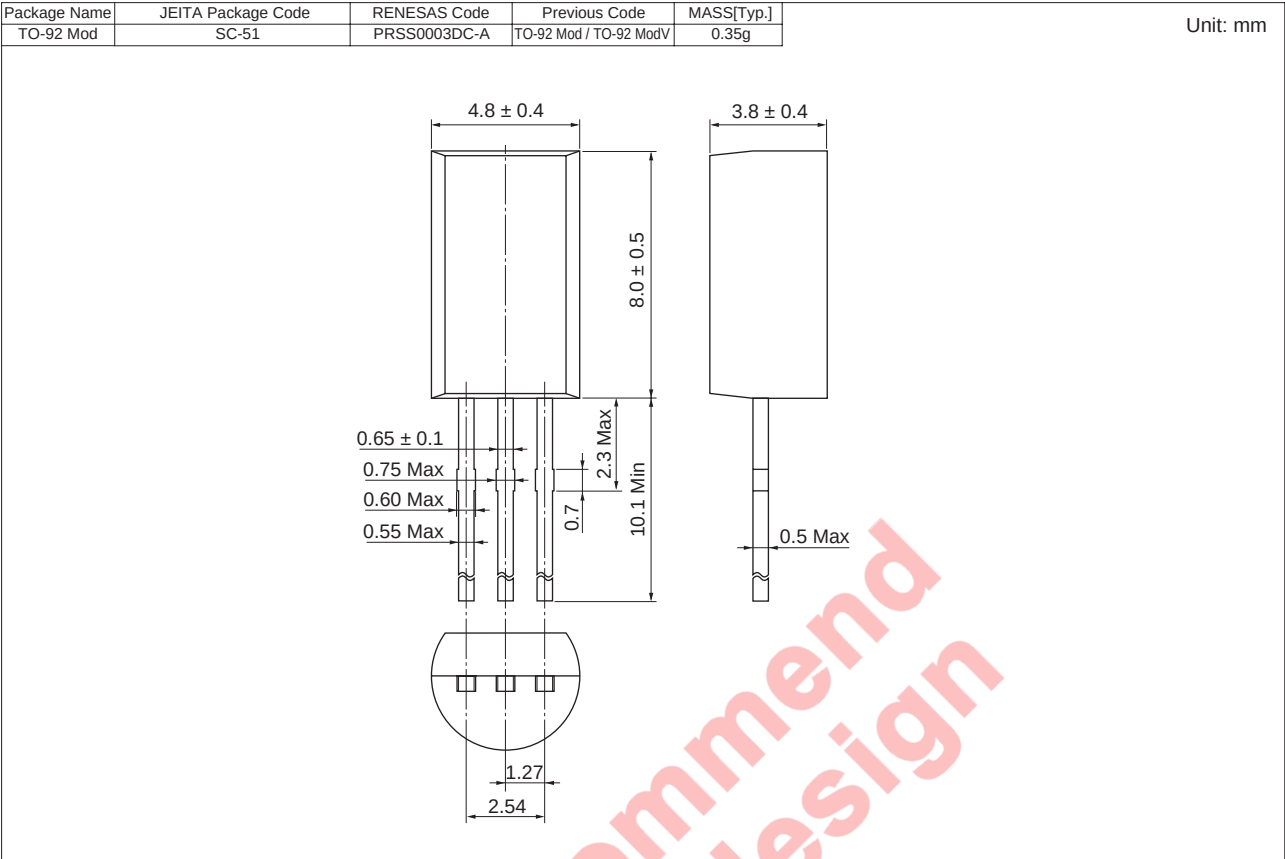
HA178L10

(V_{IN} = 16 V, I_{OUT} = 40 mA, 0°C ≤ T_j ≤ 125°C, C_{IN} = 0.33 μF, C_{OUT} = 0.1 μF)

Item	Symbol	HA178L10P HA178L10			HA178L10PA HA178L10A HA178L10UA			Unit	Test Conditions
		Min	Typ	Max	Min	Typ	Max		
Output voltage	V _{OUT}	9.35	10	10.65	9.6	10	10.4	V	T _j = 25°C
Line regulation	ΔV _{OLINE}	—	80	230	—	80	230	mV	12.5 V ≤ V _{IN} ≤ 25 V
		—	30	170	—	30	170		13 V ≤ V _{IN} ≤ 25 V
Load regulation	ΔV _{OLOAD}	—	26	—	—	26	—	mV	1.0 mA ≤ I _{OUT} ≤ 150 mA
		—	18	90	—	18	90		1.0 mA ≤ I _{OUT} ≤ 100 mA
		—	8.5	45	—	8.5	45		1.0 mA ≤ I _{OUT} ≤ 40 mA
Output voltage	V _{OUT}	9.2	—	10.8	9.5	—	10.5	V	12.5 V ≤ V _{IN} ≤ 25 V, 1.0 mA ≤ I _{OUT} ≤ 40 mA
		9.2	—	10.8	9.5	—	10.5		V _{IN} = 16 V, 1.0 mA ≤ I _{OUT} ≤ 70 mA
Quiescent current	I _Q	—	3.1	6.5	—	3.1	6.5	mA	T _j = 25°C
Quiescent current change	ΔI _Q	—	—	1.5	—	—	1.5	mA	13 V ≤ V _{IN} ≤ 25 V, T _j = 25°C
		—	—	0.2	—	—	0.1		1.0 mA ≤ I _{OUT} ≤ 40 mA, T _j = 25°C
Ripple rejection ratio	R _{REJ}	—	54	—	—	54	—	dB	f = 120 Hz, 13 V ≤ V _{IN} < 24 V, T _j = 25°C
Temperature coefficient of output voltage	ΔV _{OUT} /ΔT _j	—	−0.2	—	—	−0.2	—	mV/°C	I _{OUT} = 5 mA
Dropout voltage	V _{DROP}	—	1.7	—	—	1.7	—	V	T _j = 25°C

Not recommended
for new design

Package Dimensions



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Renesas Technology America, Inc.
450 Holger Way, San Jose, CA 95134-1368, U.S.A
Tel: <1> (408) 382-7500, Fax: <1> (408) 382-7501

Renesas Technology Europe Limited
Dukes Meadow, Millboard Road, Bourne End, Buckinghamshire, SL8 5FH, U.K.
Tel: <44> (1628) 585-100, Fax: <44> (1628) 585-900

Renesas Technology (Shanghai) Co., Ltd.
Unit 204, 205, AZIA Center, No.1233 Lujiazui Ring Rd, Pudong District, Shanghai, China 200120
Tel: <86> (21) 5877-1818, Fax: <86> (21) 6887-7858/7898

Renesas Technology Hong Kong Ltd.
7th Floor, North Tower, World Finance Centre, Harbour City, Canton Road, Tsimshatsui, Kowloon, Hong Kong
Tel: <852> 2265-6688, Fax: <852> 2377-3473

Renesas Technology Taiwan Co., Ltd.
10th Floor, No.99, Fushing North Road, Taipei, Taiwan
Tel: <886> (2) 2715-2888, Fax: <886> (2) 3518-3399

Renesas Technology Singapore Pte. Ltd.
1 Harbour Front Avenue, #06-10, Keppel Bay Tower, Singapore 098632
Tel: <65> 6213-0200, Fax: <65> 6278-8001

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Kukje Center Bldg. 18th Fl., 191, 2-ka, Hangang-ro, Yongsan-ku, Seoul 140-702, Korea
Tel: <82> (2) 796-3115, Fax: <82> (2) 796-2145

Renesas Technology Malaysia Sdn. Bhd
Unit 906, Block B, Menara Amcorp, Amcorp Trade Centre, No.18, Jln Persiaran Barat, 46050 Petaling Jaya, Selangor Darul Ehsan, Malaysia
Tel: <603> 7955-9390, Fax: <603> 7955-9510