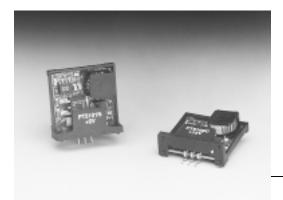
1-A Positive Step-down Integrated Switching Regulator

(Revised 11/8/2001)



#### **Features**

- 90%+ Efficiency
- Internal Short-Circuit Protection
- Pin-Compatible with 3-Terminal Linear Regulators
- Laser-Trimmed Output Voltage
- Over-Temperature Protection
- Small Footprint
- Wide Input Range
- 5-Pin Mount Option (Suffixes L & M)

#### **Description**

The PT5100 modules are a series of economical, easy-to-use 1-A positive step-down, Integrated Switching Regulators (ISRs). These ISRs are compatible with most TO-220 style linear regulators, and when employed as a linear replacement, provide significant benefits in both efficiency and power dissipation. They are recommended for use in a wide variety of on-board power regulation applications. These include computer, data storage, industrial controls, and battery powered equipment. Modules are laser-trimmed for optimal output voltage accuracy, and exhibit excellent line and load regulation. The PT5100 also features output current limiting and thermal shutdown protection.

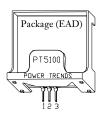
## **Ordering Information**

PT5101□ = +5.0 Volts PT5102□ = +12.0 Volts PT5103□ = +3.3 Volts PT5105□ = +6.5 Volts PT5107□ = +15.0 Volts PT5110□ = +5.6 Volts PT5111□ = +9.0 Volts PT5111□ = +10.0 Volts PT5112□ = +8.0 Volts



Case/Pin Configuration	Order Suffix	Package Code
Vertical	N	(EAD)
Horizontal	Α	(EAA)
SMD	C	(EAC)
Horizontal, 2-pin Tab	M	(EAM)
SMD, 2-Pin Tab	L	(EAL)

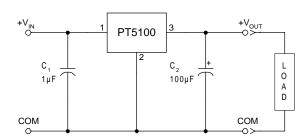
(Reference the applicable package code drawing for the dimensions and PC board layout)



#### Pin-Out Information

Pin	Function
1	$V_{in}$
2	GND
3	V <sub>out</sub>

#### **Standard Application**



 $C_1$  = Optional 1 $\mu$ F ceramic capacitor  $C_2$  = Required 100 $\mu$ F electrolytic



# PT5100 Series

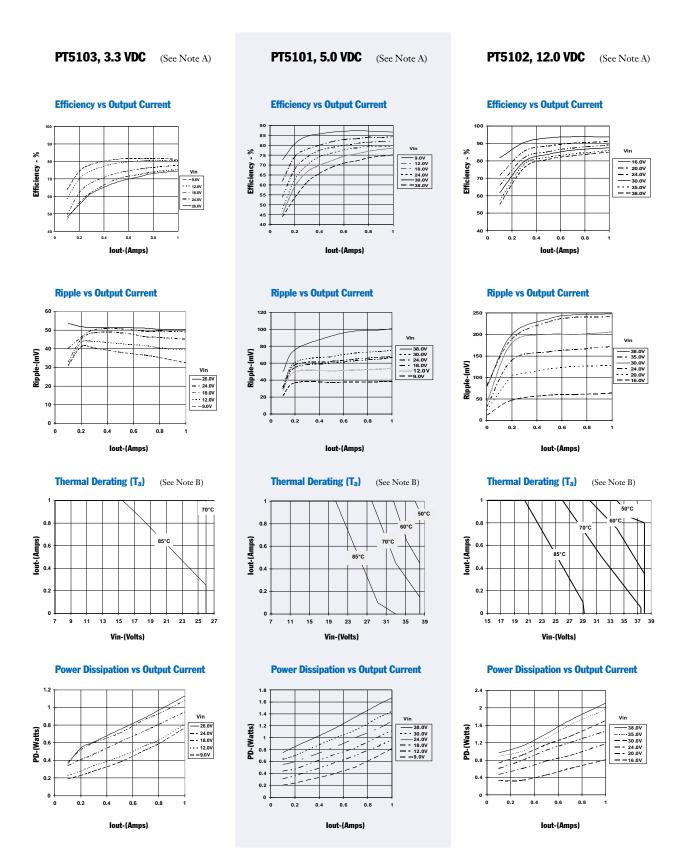
## 1-A Positive Step-down **Integrated Switching Regulator**

 $\textbf{Specifications} \hspace{0.2cm} \text{(Unless otherwise stated, $T_a=25^{\circ}$C, $V_{in}=V_{in}$min, $C_{out}=100\mu$F, and $I_o=I_o$max)} \\$ 

				PT5100 SERIES				
Characteristic	Symbol	Conditions	Min	Тур	Max	Units		
Output Current	$I_{o}$	Over V <sub>in</sub> range	0.1(1)	_	1.0	A		
Input Voltage Range	V <sub>in</sub>	$\begin{array}{c} \text{Over I}_{o}  \text{Range} & V_{o} = \\ V_{o} = \\ V_{o} > \end{array}$	5.0V 9		26 38 38	VDC		
Set Point Voltage Tolerance	Votol		_	±1	±2	$%V_{o}$		
Temperature Variation	Reg <sub>temp</sub>	$0^{\circ} \le \Gamma_a \le +60^{\circ}\text{C}$ , $I_o = I_o \text{min}$	_	±0.5	_	$%V_{o}$		
Line Regulation	Regline	Over V <sub>in</sub> range	_	±5	±10	mV		
Load Regulation	Regload	Over I <sub>o</sub> range	_	±5	±10	mV		
Total Output Voltage Variation	$\Delta V_{o}$ tot	Includes set-point, line, load, $0^{\circ} \le \Gamma_a \le +60^{\circ}C$	_	±1.5	±3	$%V_{o}$		
Efficiency	η	$\begin{array}{c} V_o = \\ V_o = \end{array}$	12V — 10V — 5.0V —	95 94 92 90 82		%		
V <sub>o</sub> Ripple (pk-pk)	$V_{r}$	20MHz bandwidth	_	2	_	$%V_{o}$		
Transient Response	t <sub>tr</sub>	1A/µs load step, 50% to 100% I <sub>o</sub> max	_	100	200	μs		
	$\Delta V_{tr}$	V <sub>o</sub> over/undershoot	_	±5.0	_	$%V_{o}$		
Current Limit	$I_{ m lim}$	$\Delta V_o = -1\%$	1.2	2.6	_	A		
Switching Frequency	$f_{s}$	Over $V_{in}$ range $V_o \ge 1$	5.0V 500 3.3V 575	650 725	800 875	kHz		
External Output Capacitance	Cout		100		_	μF		
Operating Temperature Range	$T_a$	Over V <sub>in</sub> range	-40 (2)		+85 (3)	°C		
Thermal Resistance	$\theta_{\mathrm{j}a}$	Free-air convection (40-60LFM) $ \begin{array}{c} V_o = \\ V_o = \\ V_o \geq \end{array} $	5.0V —	45 50 60	_ _ _	°C/W		
Storage Temperature	$T_s$	_	-40	_	+125	°C		
Reliability	MTBF	Per Bellcore TR-332 50% stress, T <sub>a</sub> =40°C, ground benign	11.3	_	_	106 Hrs		
Mechanical Shock	_	Per Mil-Std-883D, method 2002.3, 1mS, half-sine, mounted to a fixture	_	500	_	G's		
Mechanical Vibration	_	Per Mil-Std-883D, Method 2007.2 20-2000Hz, soldered in PC board		5 (4)	_	G's		
Weight	_	Suffixes N, A, & C Suffixes L & M		4.5 6.5		grams		
Flammability	_	Materials meet UL 94V-0						

- Notes: (1) The ISR will operate at no load with reduced specifications.
  (2) For operation below 0°C, use a tantalum type capacitor for C<sub>2</sub>.
  (3) See Thermal Derating curves.
  (4) The tab pins on the 5-pin mount package types (suffixes L & M) must be soldered. For more information see the applicable package outline drawing.

1-A Positive Step-down Integrated Switching Regulator



Note A: Characteristic data has been developed from actual products tested at 25°C. This data is considered typical data for the Converter. Note B: Thermal derating graphs are developed in free-air convection cooling, which corresponds to approximately 40–60LFM of airflow.



12-Jan-2013

# **PACKAGING INFORMATION**

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Samples (Requires Login)
PT5101A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5101CT	LIFEBUY	SIP MODULE	EAC	3	200	TBD	Call TI	Level-1-215C-UNLIM	
PT5101G	LIFEBUY	SIP MODULE	EAG	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101H	LIFEBUY	SIP MODULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101J	LIFEBUY	SIP MODULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5101L	LIFEBUY	SIP MODULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5101M	LIFEBUY	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101S	LIFEBUY	SIP MODULE	EAF	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5101U	LIFEBUY	SIP MODULE	EAU	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5102A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5102C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5102CT	LIFEBUY	SIP MODULE	EAC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5102H	LIFEBUY	SIP MODULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5102M	LIFEBUY	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5102N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	



12-Jan-2013

Orderable Device	Status	Package Type	Package Drawing	Pins	Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Samples (Requires Login)
PT5103A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5103C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5103L	LIFEBUY	SIP MODULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5103M	LIFEBUY	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5103N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5105A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5105C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5105N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5107A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5107C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5107J	LIFEBUY	SIP MODULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5107M	LIFEBUY	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5107N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5109A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5109C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5109N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5110A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5110C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	





www.ti.com 12-Jan-2013

Orderable Device	Status	Package Type	_		Package Qty	Eco Plan	Lead/Ball Finish	MSL Peak Temp	Samples
	(1)		Drawing			(2)		(3)	(Requires Login)
PT5110N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5111A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5111M	OBSOLETI	SIP MODULE	EAM	3		TBD	Call TI	Call TI	
PT5111N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5112A	LIFEBUY	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	
PT5112C	LIFEBUY	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	
PT5112N	LIFEBUY	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

(2) Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check http://www.ti.com/productcontent for the latest availability information and additional product content details.

**TBD:** The Pb-Free/Green conversion plan has not been defined.

**Pb-Free (RoHS):** TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

**Pb-Free (RoHS Exempt):** This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

(3) MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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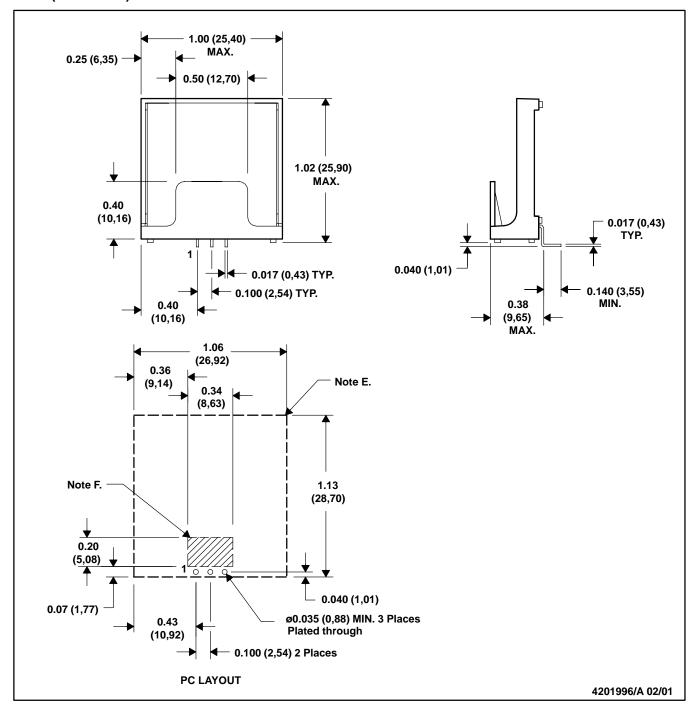


12-Jan-2013

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# EAA (R-PSIP-T3)

## **PLASTIC SINGLE-IN-LINE MODULE**



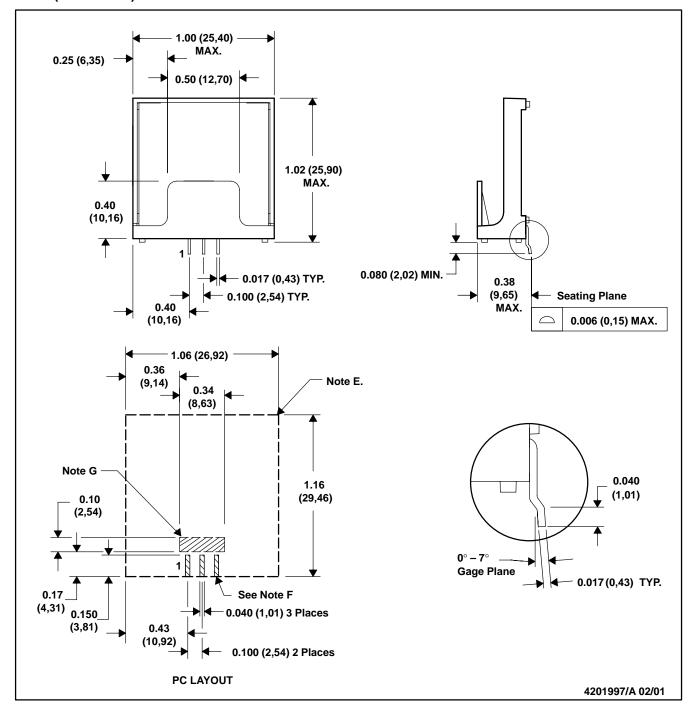
NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
- D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
- E. Recommended mechanical keep-out area.
- F. No copper, power or signal traces in this area.



## EAC (R-PSIP-G3)

#### PLASTIC SINGLE-IN-LINE MODULE

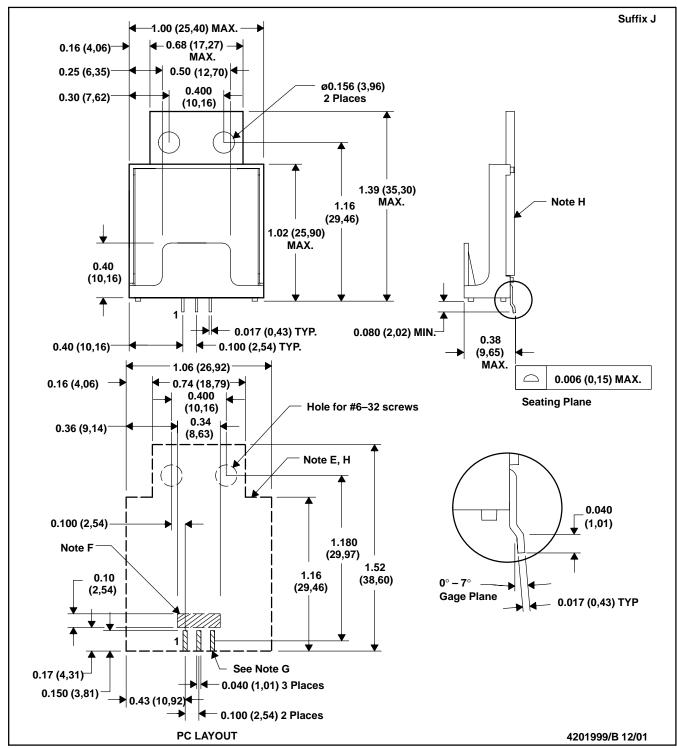


NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
- D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
- E. Recommended mechanical keep-out area.
- F. Power pin connections should utilize two or more vias per input, ground and output pin.
- G. No copper, power or signal traces in this area.



## EAJ (R-PSIP-G3)

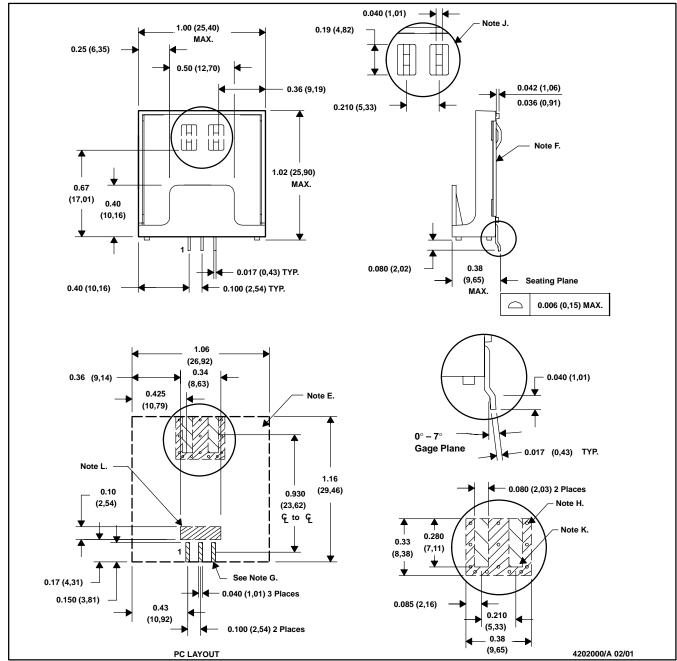


- NOTES: A. All linear dimensions are in inches (mm).
  - B. This drawing is subject to change without notice.
  - C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
  - D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
  - E. Recommended mechanical keep-out area.
  - F. No copper, power or signal traces in this area.

- G. Power pin connections should utilize two or more vias per input, ground and output pin.
- H. The metal tab is isolated but electrically conductive.
   No signal traces are allowed under the metal tab area.
   A solid copper island is recommended, which may be grounded.



## EAL (R-PSIP-G3)

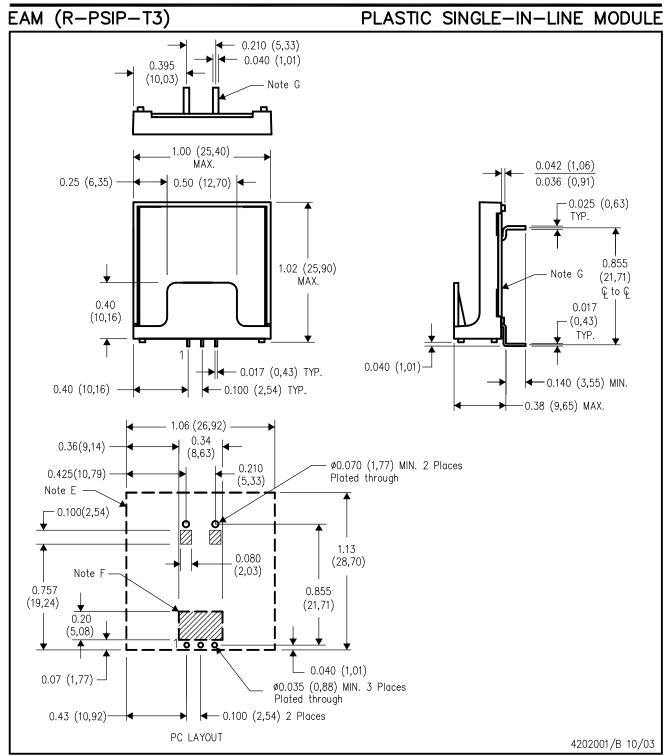


NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
- D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
- E. Recommended mechanical keep-out area.
- F. The metal tab is isolated but electrically conductive. No signal traces are allowed under the metal tab area. A solid copper island is recommended, which may be grounded.
- G. Power pin connections should utilize two or more vias per input, ground and output pin.

- H. Minimum copper land area required for solder tab. Vias are recommended to improve copper adhesion or connect land to other ground area.
- J. Underside solder tabs detail
- Solder mask openings to copper island for solder joints to mechanical pins.
- L. No copper, power or signal traces in this area.





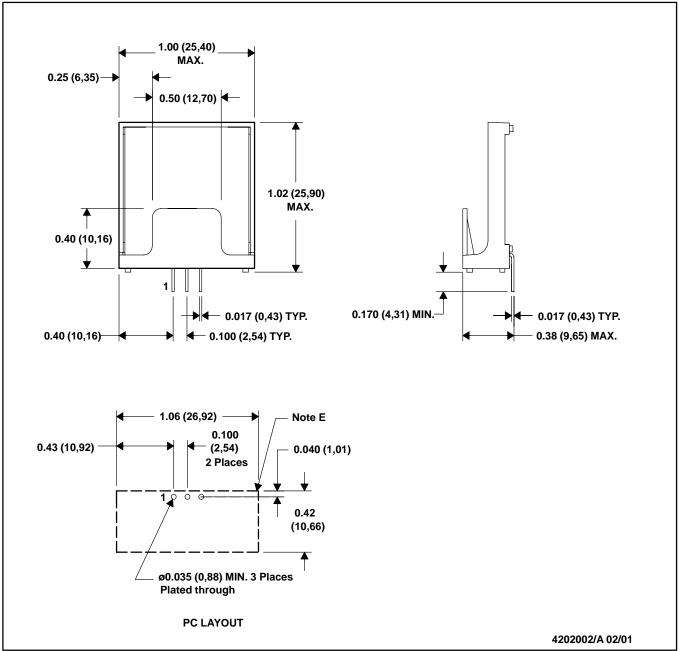
NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2 place decimals are  $\pm 0.030$  ( $\pm 0.76$ mm).
- D. 3 place decimals are  $\pm 0.010$  ( $\pm 0.25$ mm).
- E. Recommended mechanical keep out area.
- F. No copper, power or signal traces in this area.
- G. The metal tab is isolated but electrically conductive, No signal traces are allowed under the metal tab area. A solid copper island is recommended, which may be grounded to the two underside pins.



# EAD (R-PSIP-T3)

## **PLASTIC SINGLE-IN-LINE MODULE**

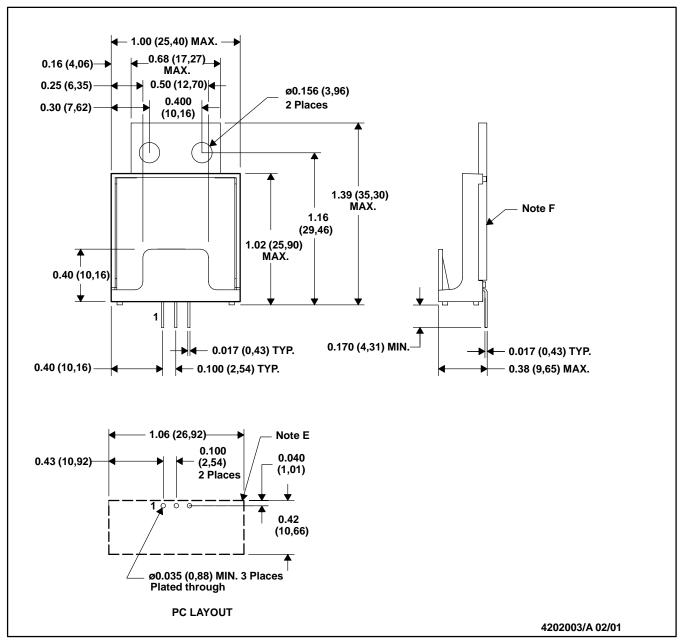


NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
- D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
- E. Recommended mechanical keep-out area.



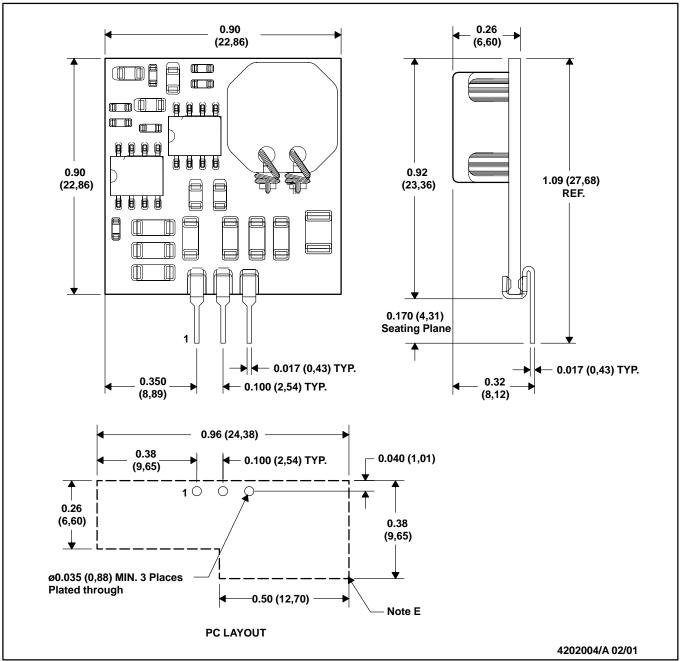
## EAF (R-PSIP-T3)



- NOTES: A. All linear dimensions are in inches (mm).
  - B. This drawing is subject to change without notice.
  - C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
  - D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0,25 mm).
  - E. Recommended mechanical keep-out area.
  - F. The metal tab is isolated but electrically conductive, it can be grounded.



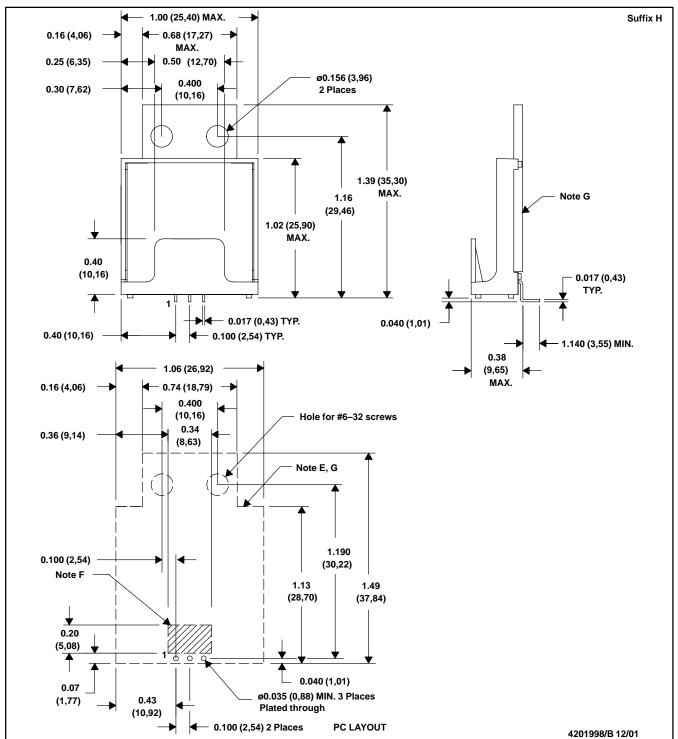
# EAU (S-PSIP-T3)



- NOTES: A. All linear dimensions are in inches (mm).
  - B. This drawing is subject to change without notice.
  - C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
  - D. 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
  - E. Recommended mechanical keep-out area.



## EAH (R-PSIP-T3)



NOTES: A. All linear dimensions are in inches (mm).

- B. This drawing is subject to change without notice.
- C. 2-place decimals are  $\pm$  0.030 ( $\pm$  0,76 mm).
- 3-place decimals are  $\pm$  0.010 ( $\pm$  0, 25 mm).
- E. Recommended mechanical keep-out area.

- F. No copper, power or signal traces in this area.
- G. The metal tab is isolated but electrically conductive. No signal traces are allowed under the metal tab area. A solid copper island is recommended, which may be grounded.



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