



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.

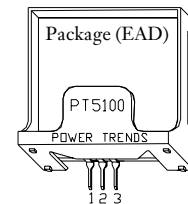
Ordering Information

PT5101□	= +5.0 Volts
PT5102□	= +12.0 Volts
PT5103□	= +3.3 Volts
PT5105□	= +6.5 Volts
PT5107□	= +15.0 Volts
PT5109□	= +5.6 Volts
PT5110□	= +9.0 Volts
PT5111□	= +10.0 Volts
PT5112□	= +8.0 Volts

PT Series Suffix (PT1234x)

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

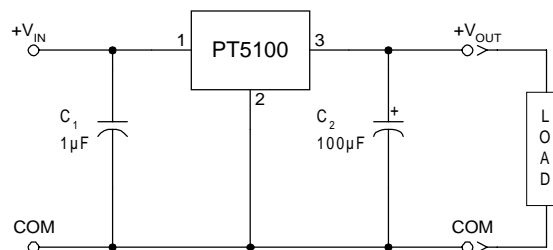
(Reference the applicable package code drawing for the dimensions and PC board layout)



Pin-Out Information

Pin	Function
1	V _{in}
2	GND
3	V _{out}

Standard Application



C₁ = Optional 1µF ceramic capacitor
C₂ = Required 100µF electrolytic

PT5100 Series

1-A Positive Step-down Integrated Switching Regulator

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

Characteristic	Symbol	Conditions	PT5100 SERIES			Units	
			Min	Typ	Max		
Output Current	I_o	Over V_{in} range	0.1 ⁽¹⁾	—	1.0	A	
Input Voltage Range	V_{in}	Over I_o Range	$V_o = 3.3\text{V}$	9	—	26	VDC
			$V_o = 5.0\text{V}$	9	—	38	
			$V_o > 5.0\text{V}$	$V_o + 4$	—	38	
Set Point Voltage Tolerance	$V_o\text{tol}$		—	± 1	± 2	$\%V_o$	
Temperature Variation	Reg_{temp}	$0^\circ \leq T_a \leq +60^\circ\text{C}$, $I_o = I_{o\text{min}}$	—	± 0.5	—	$\%V_o$	
Line Regulation	Reg_{line}	Over V_{in} range	—	± 5	± 10	mV	
Load Regulation	Reg_{load}	Over I_o range	—	± 5	± 10	mV	
Total Output Voltage Variation	$\Delta V_{o\text{tot}}$	Includes set-point, line, load, $0^\circ \leq T_a \leq +60^\circ\text{C}$	—	± 1.5	± 3	$\%V_o$	
Efficiency	η		$V_o = 15\text{V}$	—	95	—	%
			$V_o = 12\text{V}$	—	94	—	
			$V_o = 10\text{V}$	—	92	—	
			$V_o = 5.0\text{V}$	—	90	—	
			$V_o = 3.3\text{V}$	—	82	—	
V_o Ripple (pk-pk)	V_r	20MHz bandwidth	—	2	—	$\%V_o$	
Transient Response	t_{tr}	1A/ μs load step, 50% to 100% $I_{o\text{max}}$	—	100	200	μs	
	ΔV_{tr}	V_o over/undershoot	—	± 5.0	—	$\%V_o$	
Current Limit	I_{lim}	$\Delta V_o = -1\%$	1.2	2.6	—	A	
Switching Frequency	f_s	Over V_{in} range	$V_o \geq 5.0\text{V}$	500	650	800	kHz
			$V_o \leq 3.3\text{V}$	575	725	875	
External Output Capacitance	C_{out}		100	—	—	μF	
Operating Temperature Range	T_a	Over V_{in} range	-40 ⁽²⁾	—	$+85$ ⁽³⁾	$^\circ\text{C}$	
Thermal Resistance	θ_{ja}	Free-air convection (40-60LFM)	$V_o = 3.3\text{V}$	—	45	—	$^\circ\text{C}/\text{W}$
			$V_o = 5.0\text{V}$	—	50	—	
			$V_o \geq 12\text{V}$	—	60	—	
Storage Temperature	T_s	—	-40	—	$+125$	$^\circ\text{C}$	
Reliability	MTBF	Per Bellcore TR-332 50% stress, $T_a = 40^\circ\text{C}$, ground benign	11.3	—	—	10^6 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	—	4.5	—	grams	
		Suffixes L & M	—	6.5	—		
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_2 .

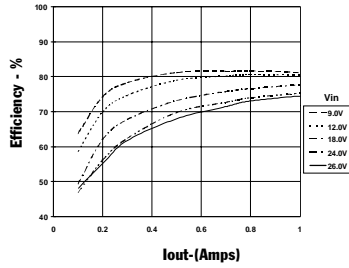
(3) See Thermal Derating curves.

(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.

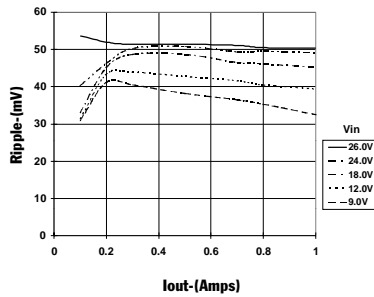
1-A Positive Step-down
Integrated Switching Regulator

PT5103, 3.3 VDC (See Note A)

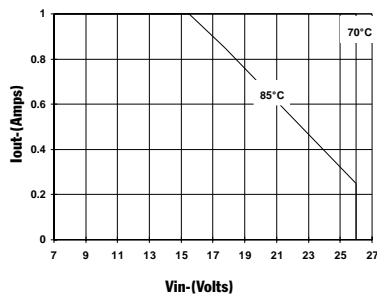
Efficiency vs Output Current



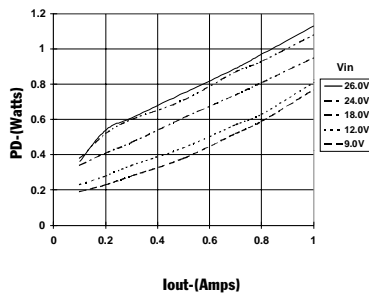
Ripple vs Output Current



Thermal Derating (TA) (See Note B)

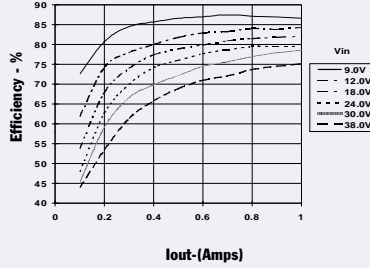


Power Dissipation vs Output Current

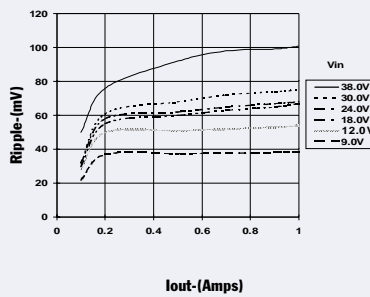


PT5101, 5.0 VDC (See Note A)

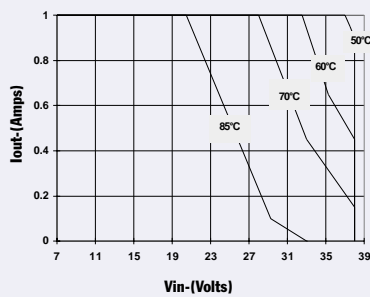
Efficiency vs Output Current



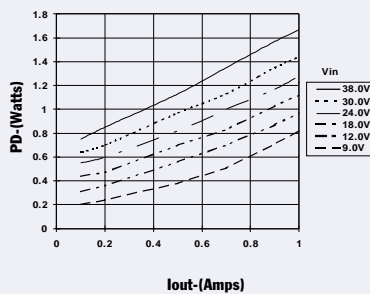
Ripple vs Output Current



Thermal Derating (TA) (See Note B)

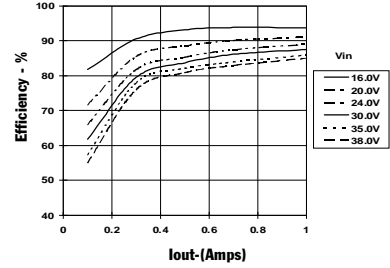


Power Dissipation vs Output Current

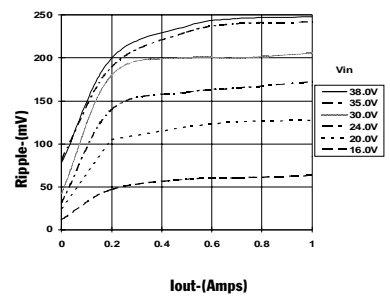


PT5102, 12.0 VDC (See Note A)

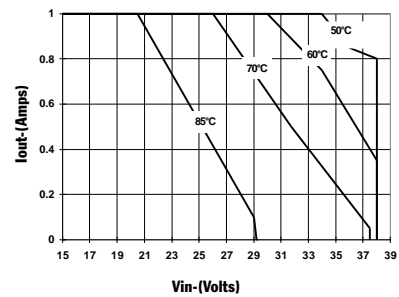
Efficiency vs Output Current



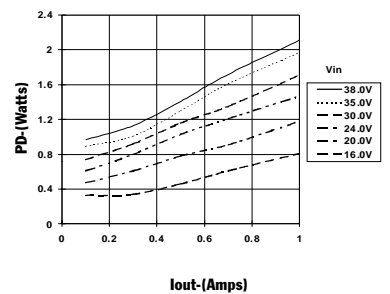
Ripple vs Output Current



Thermal Derating (TA) (See Note B)



Power Dissipation vs Output Current



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.



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PACKAGE OPTION ADDENDUM

28-Aug-2010

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
PT5101A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5101CT	NRND	SIP MODULE	EAC	3	200	TBD	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5101G	NRND	SIP MODULE	EAG	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101H	NRND	SIP MODULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101J	NRND	SIP MODULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5101L	NRND	SIP MODULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5101M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101S	NRND	SIP MODULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5101U	NRND	SIP MODULE	EAU	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5102A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5102C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5102CT	NRND	SIP MODULE	EAC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5102H	NRND	SIP MODULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5102M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5102N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5103A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5103C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5103L	NRND	SIP MODULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5103M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5103N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5105A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5105C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5105N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5107A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5107C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5107J	NRND	SIP MODULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5107M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5107N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available



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PACKAGE OPTION ADDENDUM

28-Aug-2010

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/ Ball Finish	MSL Peak Temp ⁽³⁾	Samples (Requires Login)
PT5109A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5109C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5109M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5109N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5110A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5110C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5110N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5111A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5111M	NRND	SIP MODULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5111N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5112A	NRND	SIP MODULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available
PT5112C	NRND	SIP MODULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM	Samples Not Available
PT5112N	NRND	SIP MODULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type	Samples Not Available

⁽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.

OBSELETE: 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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PACKAGE OPTION ADDENDUM

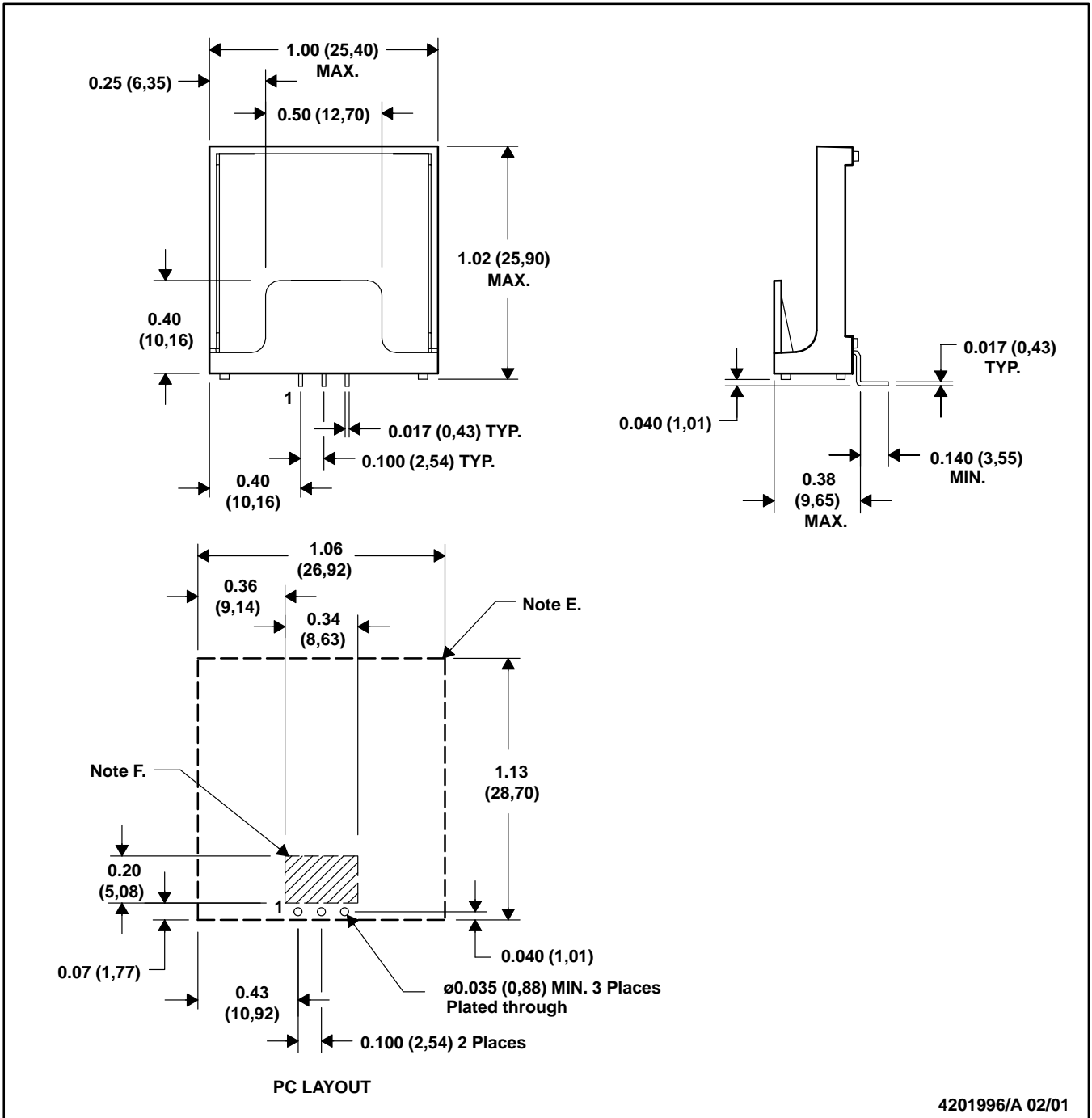
28-Aug-2010

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In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

EAA (R-PSIP-T3)

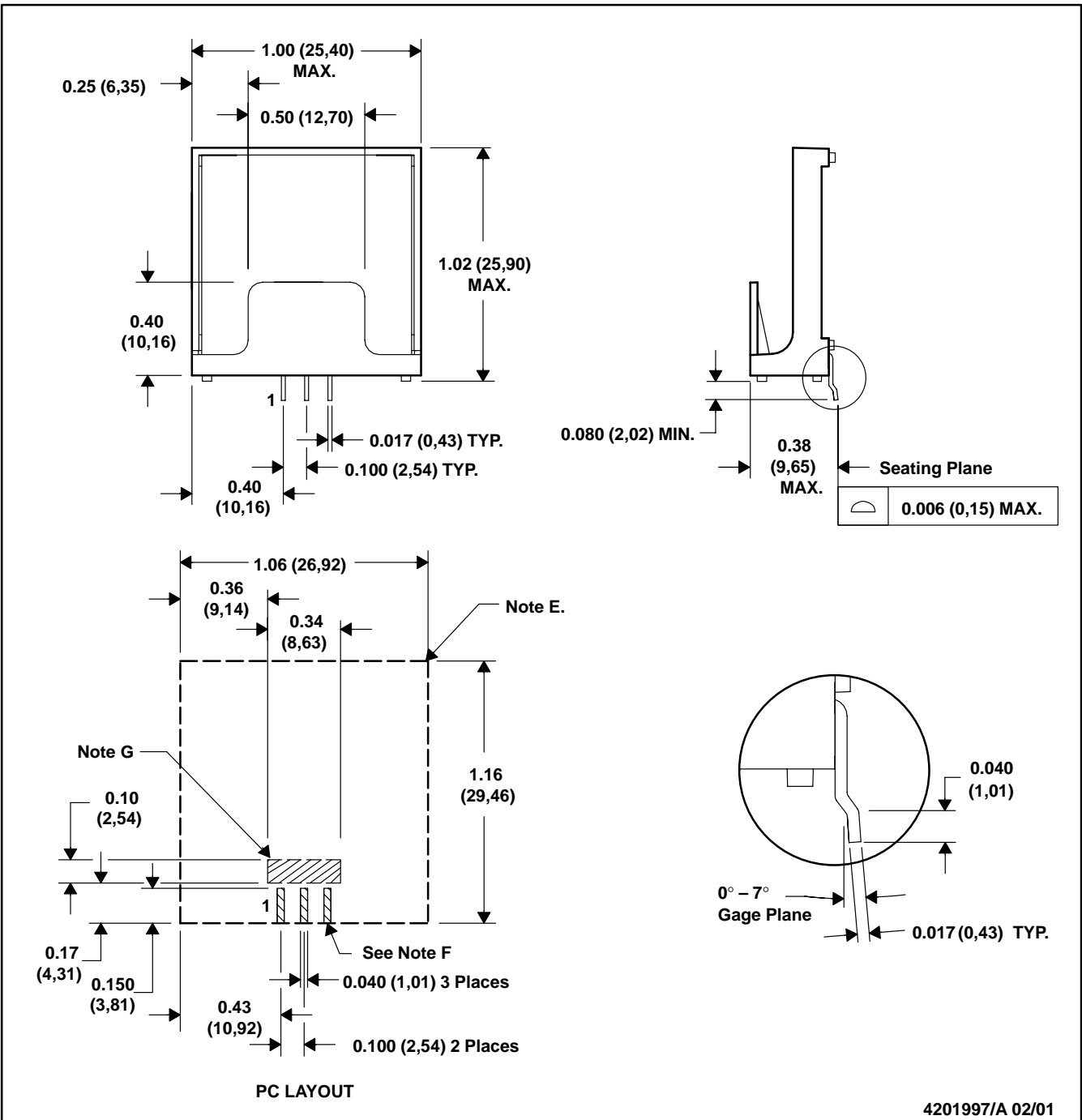
PLASTIC SINGLE-IN-LINE MODULE



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

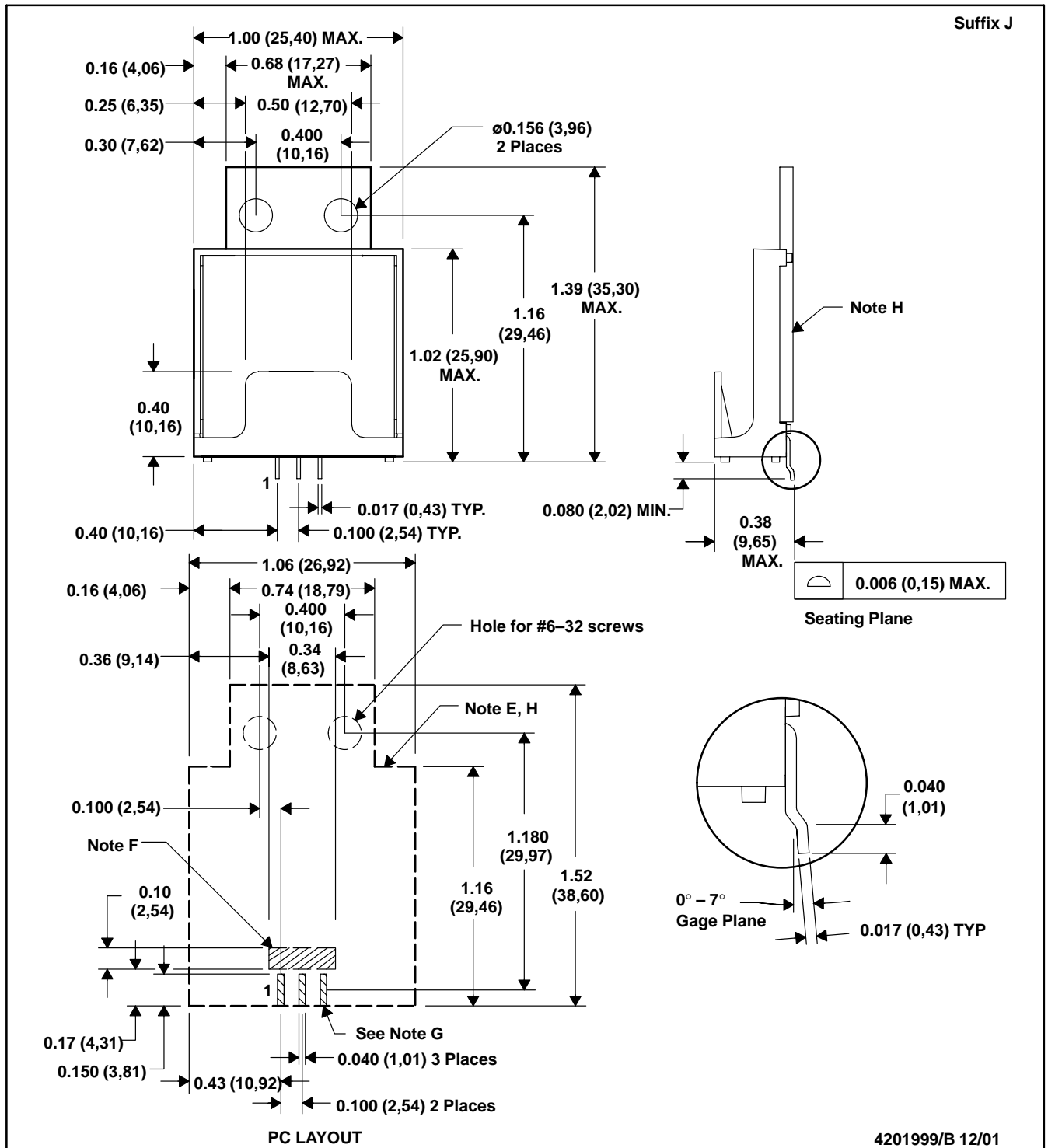
PLASTIC SINGLE-IN-LINE MODULE



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

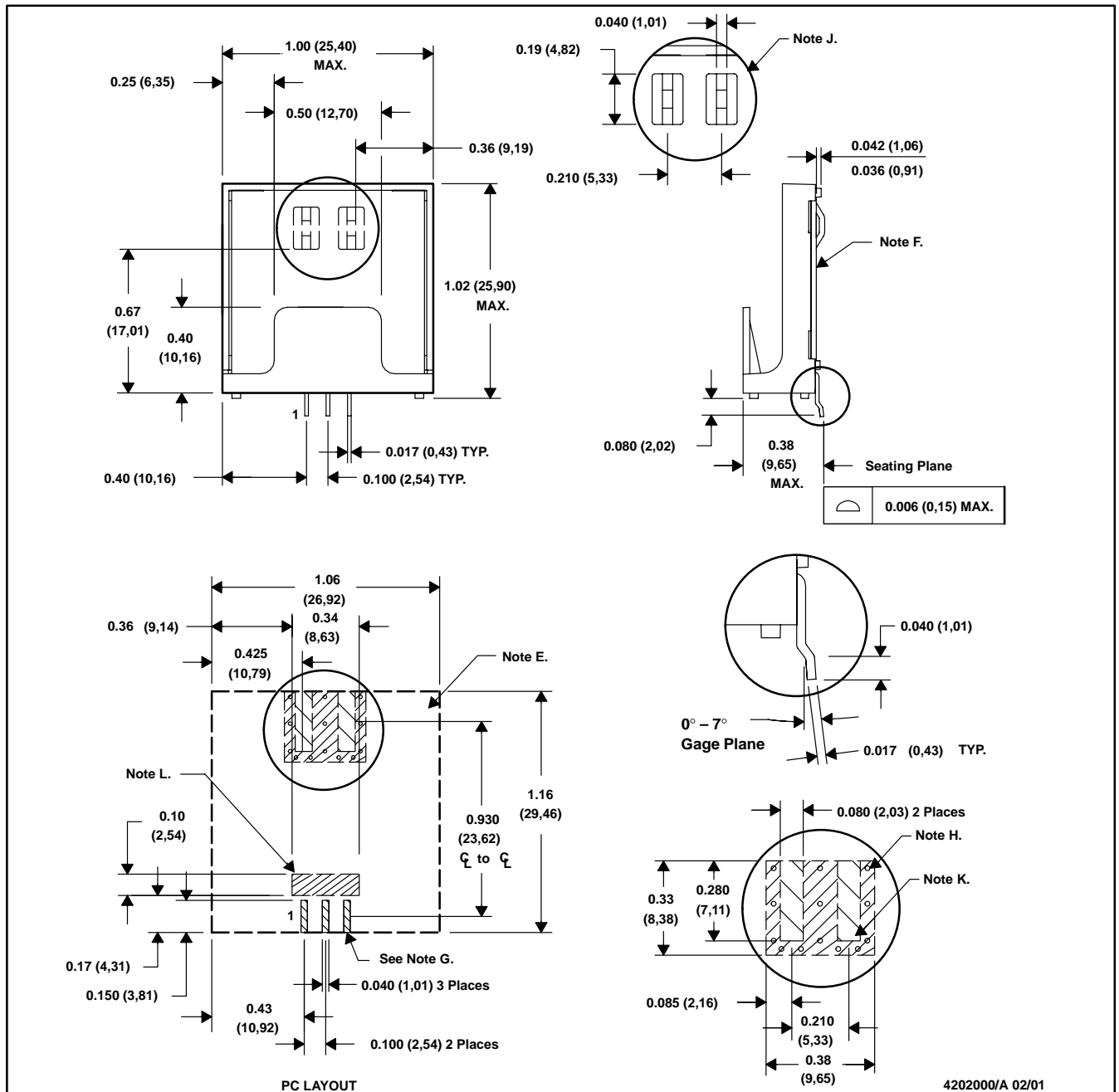
PLASTIC SINGLE-IN-LINE MODULE



- NOTES:
- A. All linear dimensions are in inches (mm).
 - B. This drawing is subject to change without notice.
 - C. 2-place decimals are ± 0.030 (± 0.76 mm).
 - D. 3-place decimals are ± 0.010 (± 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)

PLASTIC SINGLE-IN-LINE MODULE

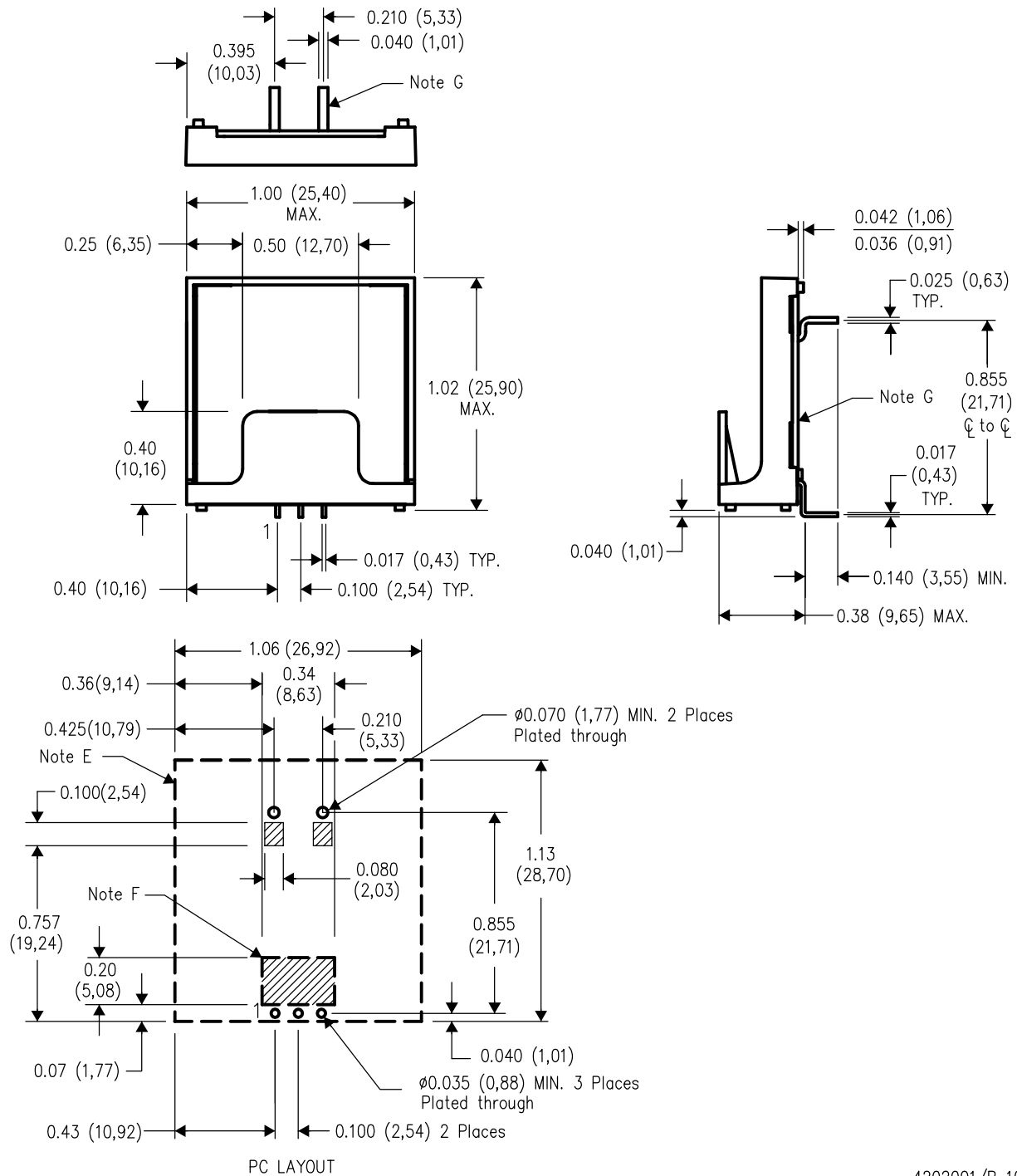


- NOTES:
- A. All linear dimensions are in inches (mm).
 - B. This drawing is subject to change without notice.
 - C. 2-place decimals are ± 0.030 ($\pm 0,76$ mm).
 - D. 3-place decimals are ± 0.010 ($\pm 0,25$ mm).
 - E. Recommended mechanical keep-out area.
 - F. The metal tab is isolated but electrically 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
- K. Solder mask openings to copper island for solder joints to mechanical pins.
- L. No copper, power or signal traces in this area.

EAM (R-PSIP-T3)

PLASTIC SINGLE-IN-LINE MODULE

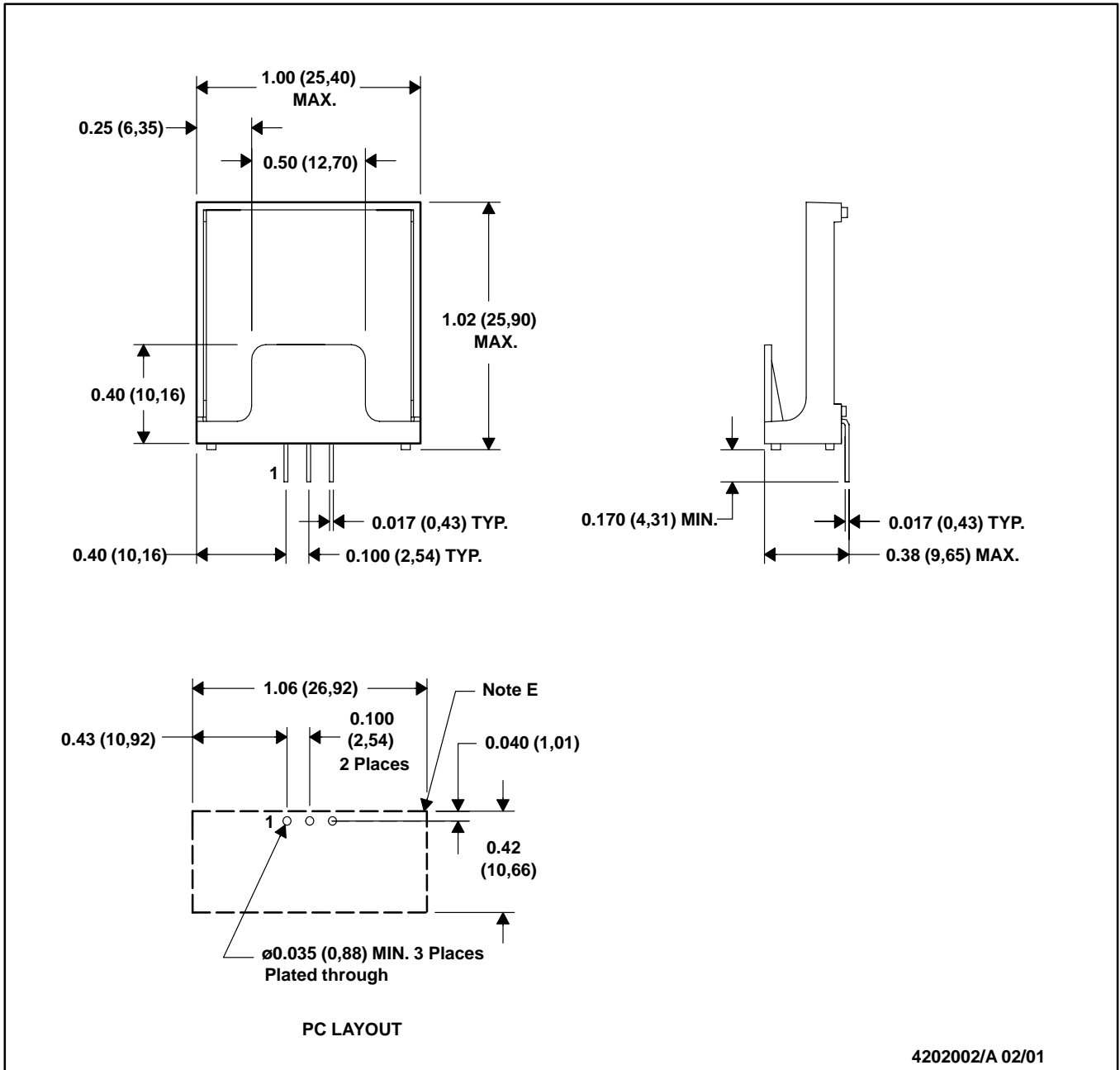


4202001/B 10/03

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

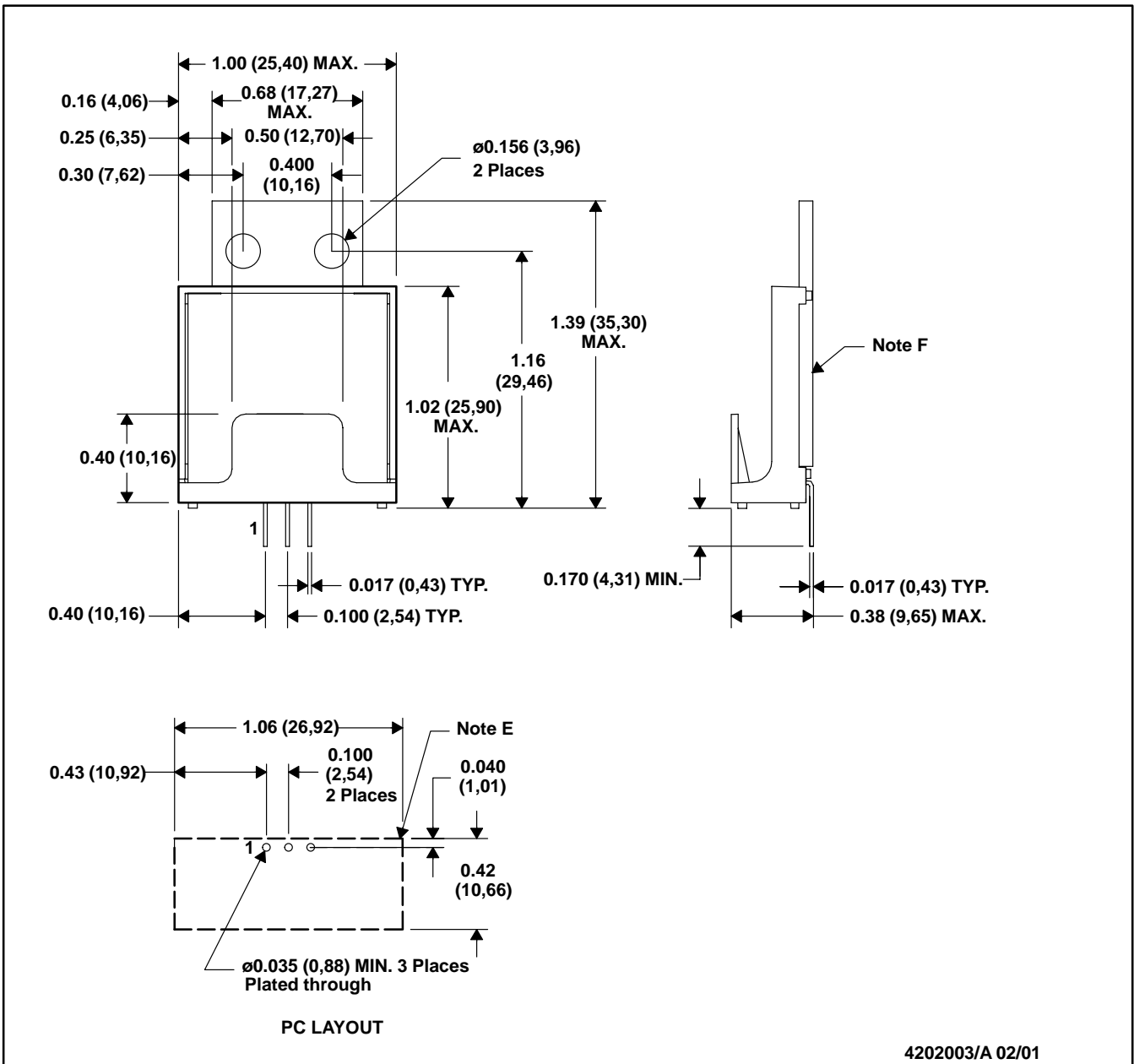
PLASTIC SINGLE-IN-LINE MODULE



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

EAF (R-PSIP-T3)

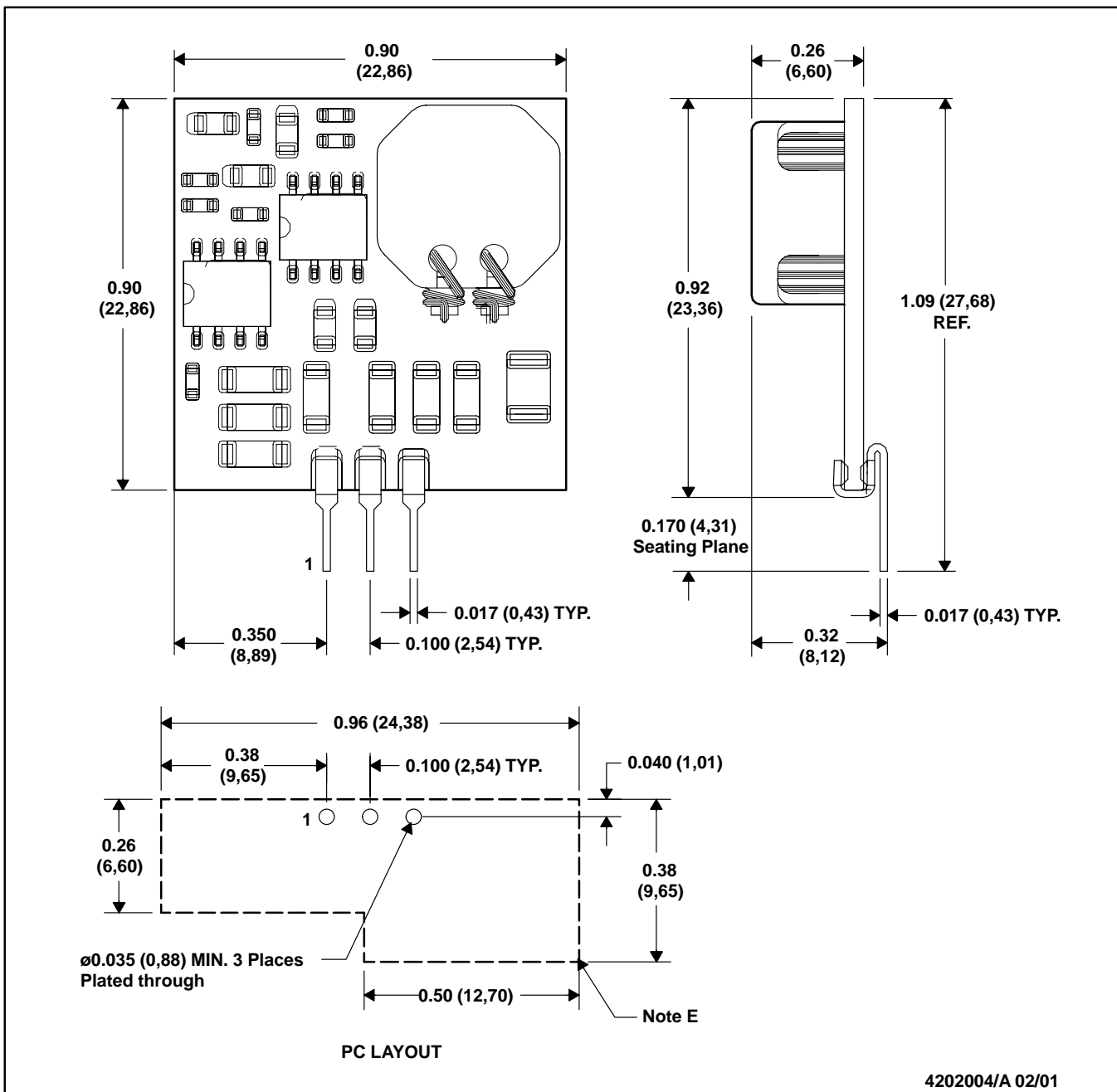
PLASTIC SINGLE-IN-LINE MODULE



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

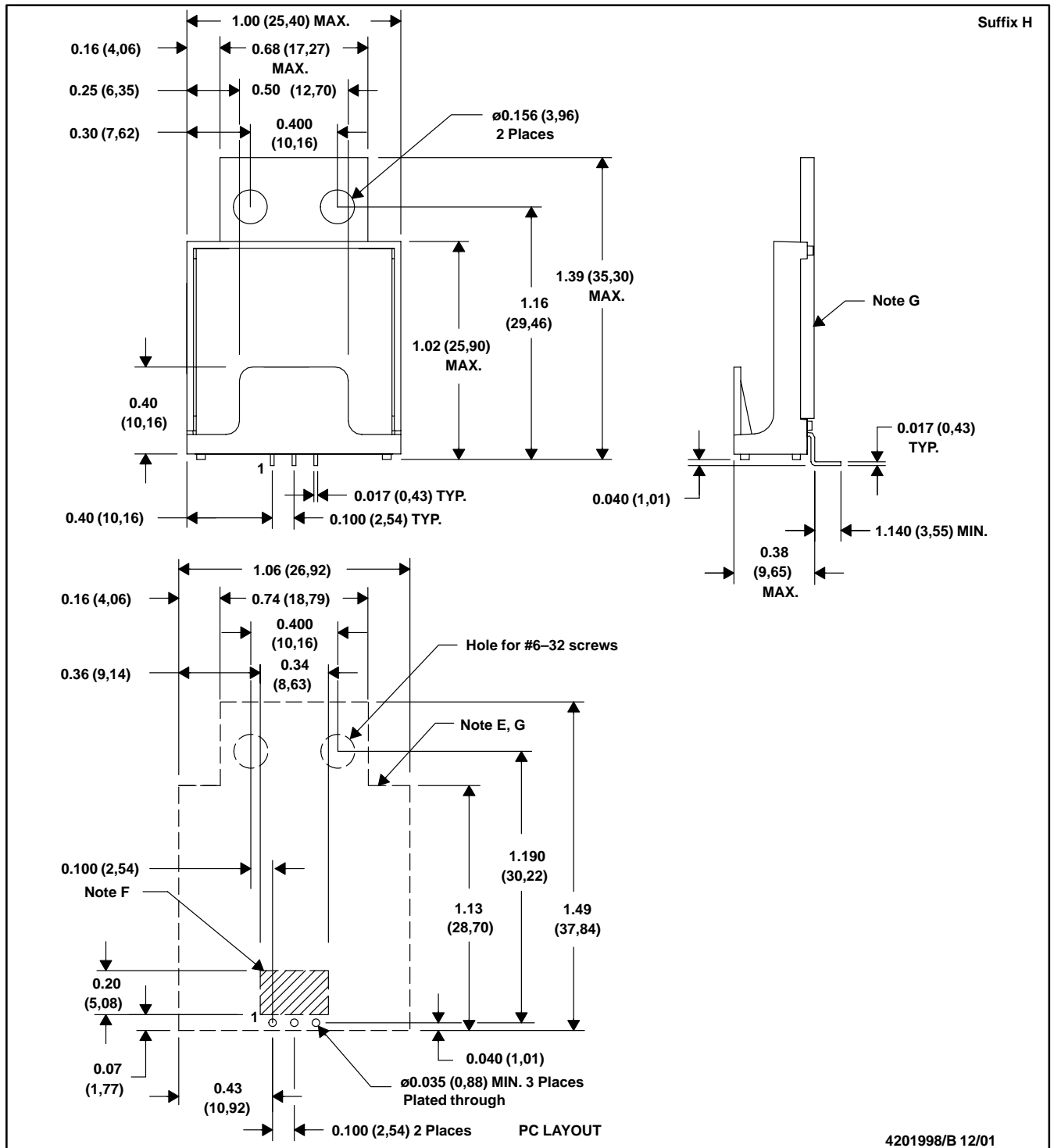
PLASTIC SINGLE-IN-LINE MODULE



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

EAH (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 ± 0.030 ($\pm 0,76$ mm).
 - D. 3-place decimals are ± 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.

IMPORTANT NOTICE

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