

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.

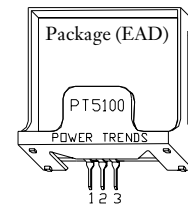
Ordering Information

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)

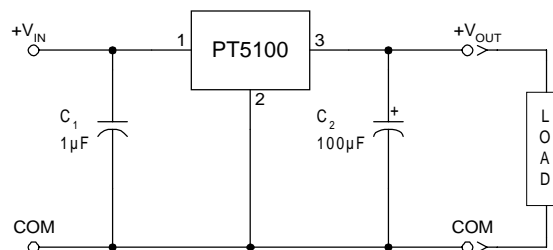
(Reference the applicable package code drawing for the dimensions and PC board layout)



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 $V_o = 5.0\text{V}$ 9 $V_o > 5.0\text{V}$ $V_o + 4$	—	26 38 38	VDC
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		$V_o = 15\text{V}$ — $V_o = 12\text{V}$ — $V_o = 10\text{V}$ — $V_o = 5.0\text{V}$ — $V_o = 3.3\text{V}$ —	95 — 94 — 92 — 90 — 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 $V_o \leq 3.3\text{V}$ 575	650 725	800 875	kHz
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)	$V_o = 3.3\text{V}$ — $V_o = 5.0\text{V}$ — $V_o \geq 12\text{V}$ —	45 — 50 — 60	— — — —	$^\circ\text{C}/\text{W}$
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 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_2 .

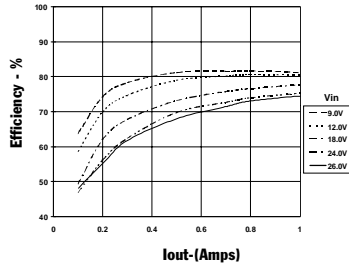
(3) See Thermal Derating curves.

(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.

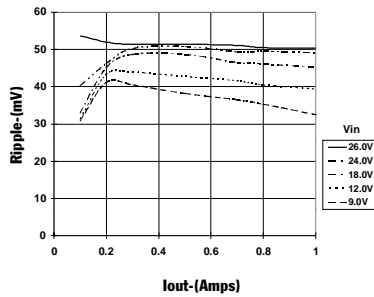
1-A Positive Step-down
Integrated Switching Regulator

PT5103, 3.3 VDC (See Note A)

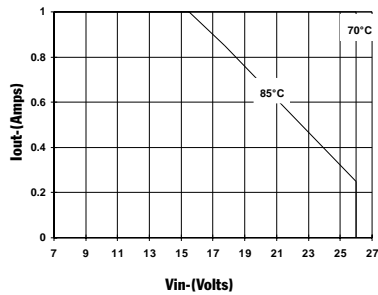
Efficiency vs Output Current



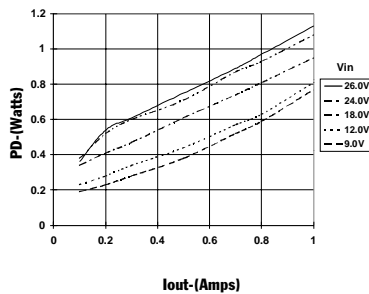
Ripple vs Output Current



Thermal Derating (T_A) (See Note B)

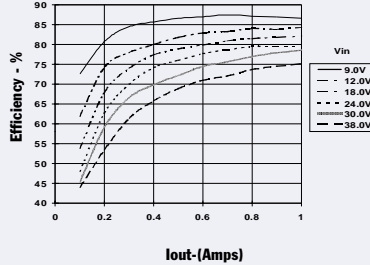


Power Dissipation vs Output Current

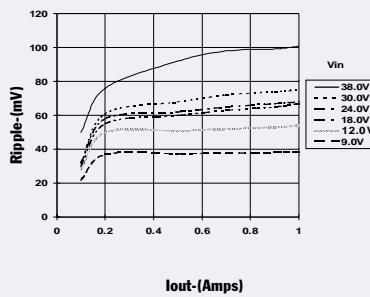


PT5101, 5.0 VDC (See Note A)

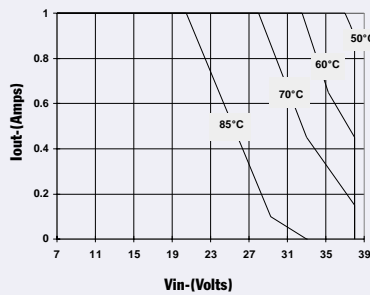
Efficiency vs Output Current



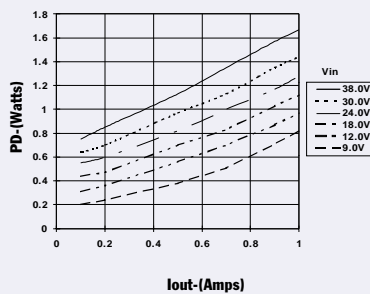
Ripple vs Output Current



Thermal Derating (T_A) (See Note B)

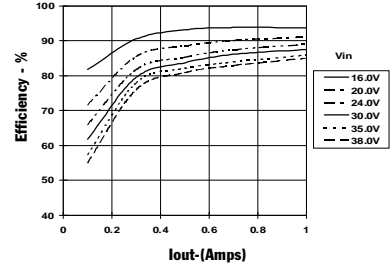


Power Dissipation vs Output Current

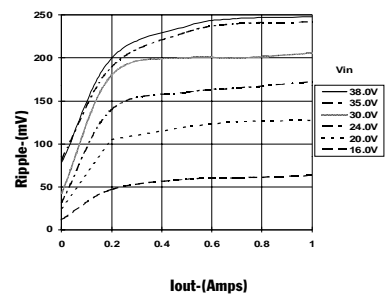


PT5102, 12.0 VDC (See Note A)

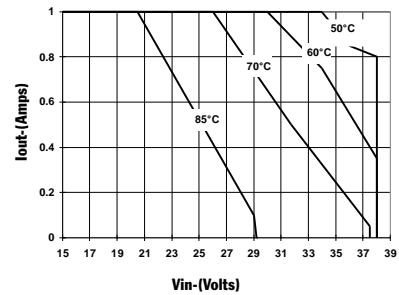
Efficiency vs Output Current



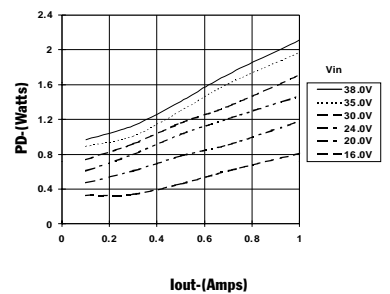
Ripple vs Output Current



Thermal Derating (T_A) (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.

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
PT5101A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5101CT	NRND	SIP MOD ULE	EAC	3	200	TBD	Call TI	Level-1-215C-UNLIM
PT5101G	NRND	SIP MOD ULE	EAG	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101H	NRND	SIP MOD ULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101J	NRND	SIP MOD ULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5101L	NRND	SIP MOD ULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5101M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101S	NRND	SIP MOD ULE	EAF	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5101U	NRND	SIP MOD ULE	EAU	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5102A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5102C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5102CT	NRND	SIP MOD ULE	EAC	3	200	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5102H	NRND	SIP MOD ULE	EAH	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5102M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5102N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5102S	NRND	SIP MOD ULE	EAF	3	16	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5103A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5103C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5103J	NRND	SIP MOD ULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5103L	NRND	SIP MOD ULE	EAL	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5103M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5103N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5105A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
PT5105C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5105N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5107A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5107C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5107J	NRND	SIP MOD ULE	EAJ	3	16	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5107M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5107N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5109A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5109C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5109M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5109N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5110A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5110C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5110N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5111A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5111M	NRND	SIP MOD ULE	EAM	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5111N	NRND	SIP MOD ULE	EAD	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5112A	NRND	SIP MOD ULE	EAA	3	35	Pb-Free (RoHS)	Call TI	N / A for Pkg Type
PT5112C	NRND	SIP MOD ULE	EAC	3	35	Pb-Free (RoHS)	Call TI	Level-1-215C-UNLIM
PT5112N	NRND	SIP MOD ULE	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)

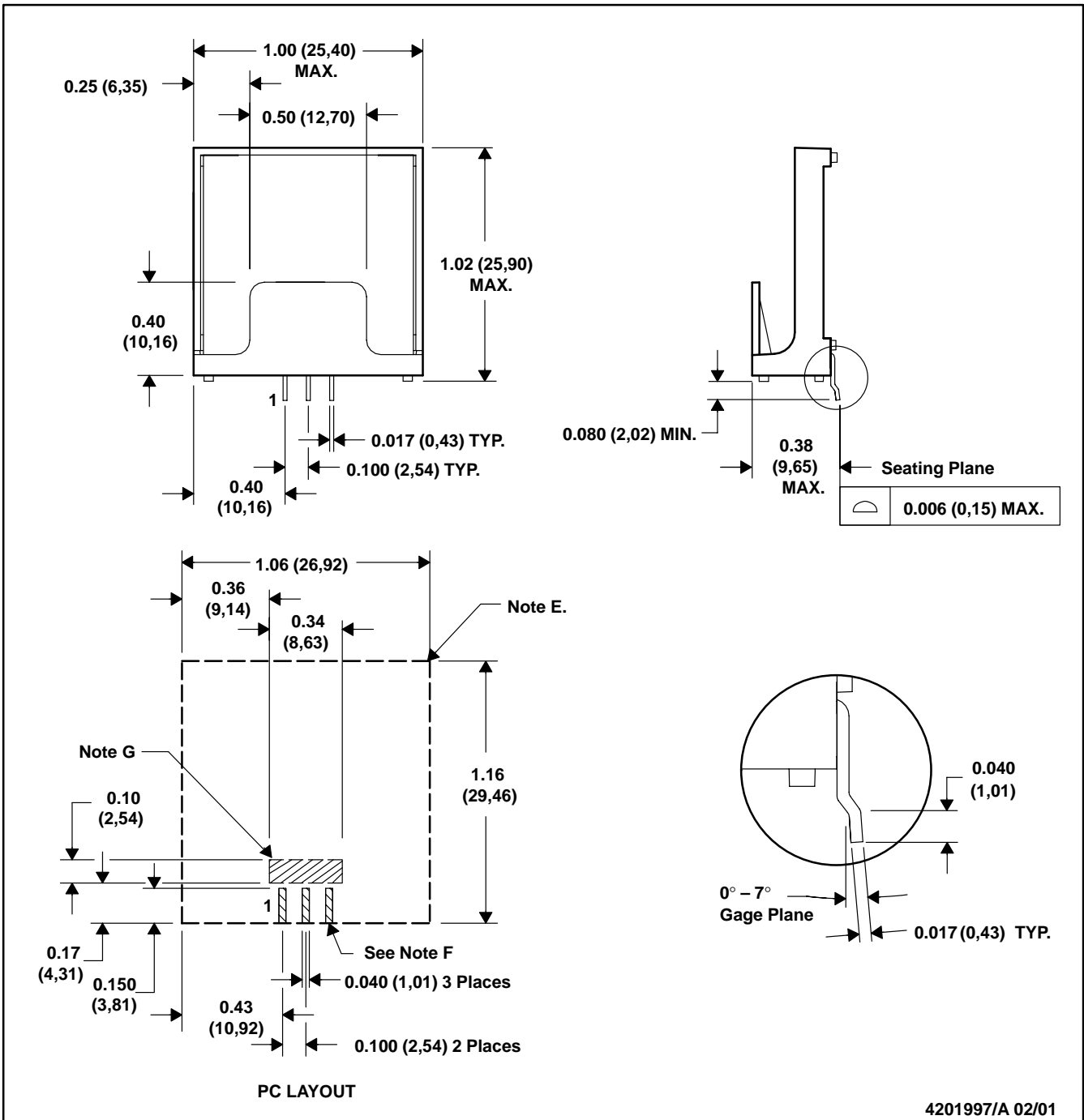
⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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EAC (R-PSIP-G3)

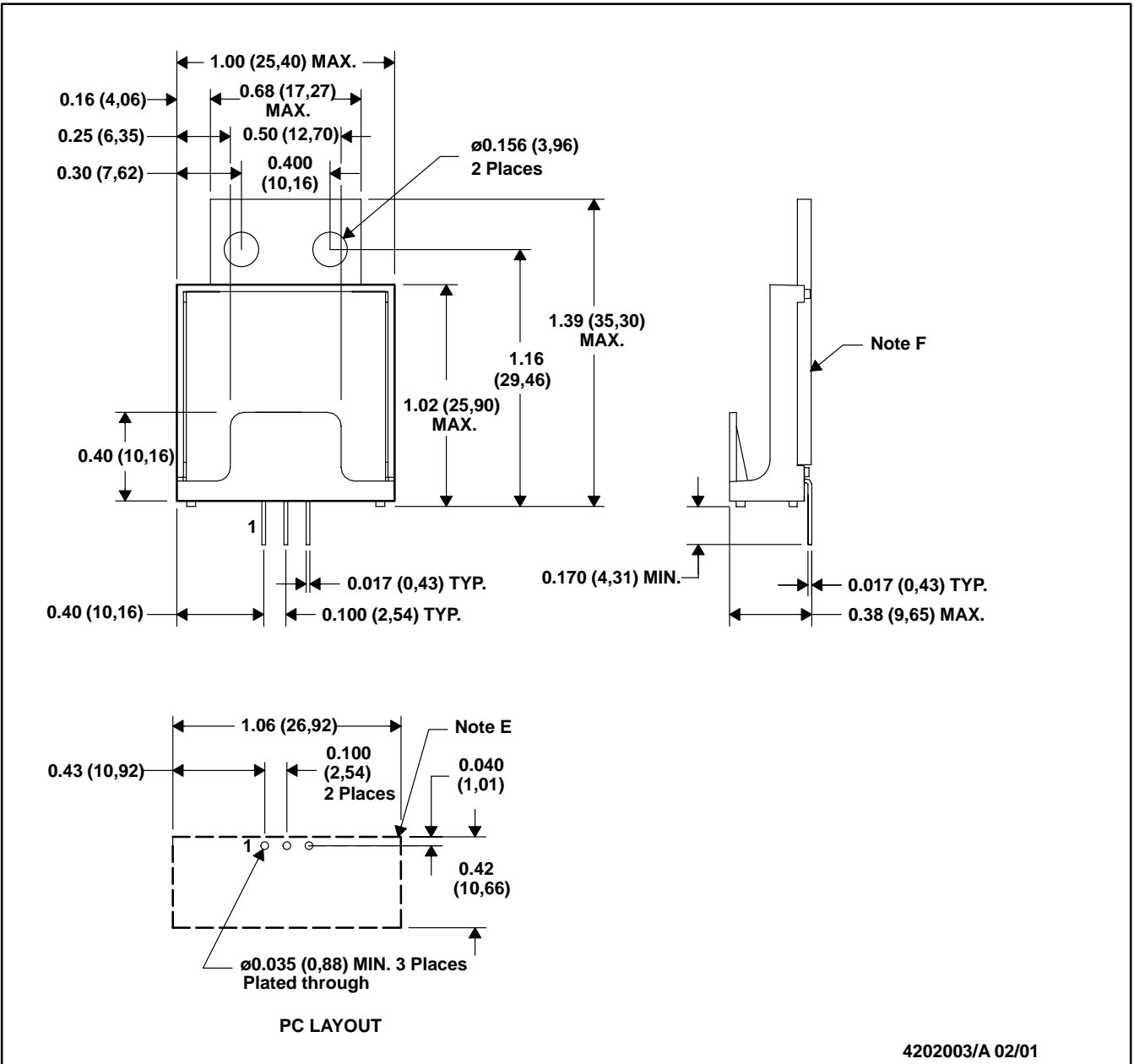
PLASTIC SINGLE-IN-LINE MODULE



- 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.

EAF (R-PSIP-T3)

PLASTIC SINGLE-IN-LINE MODULE

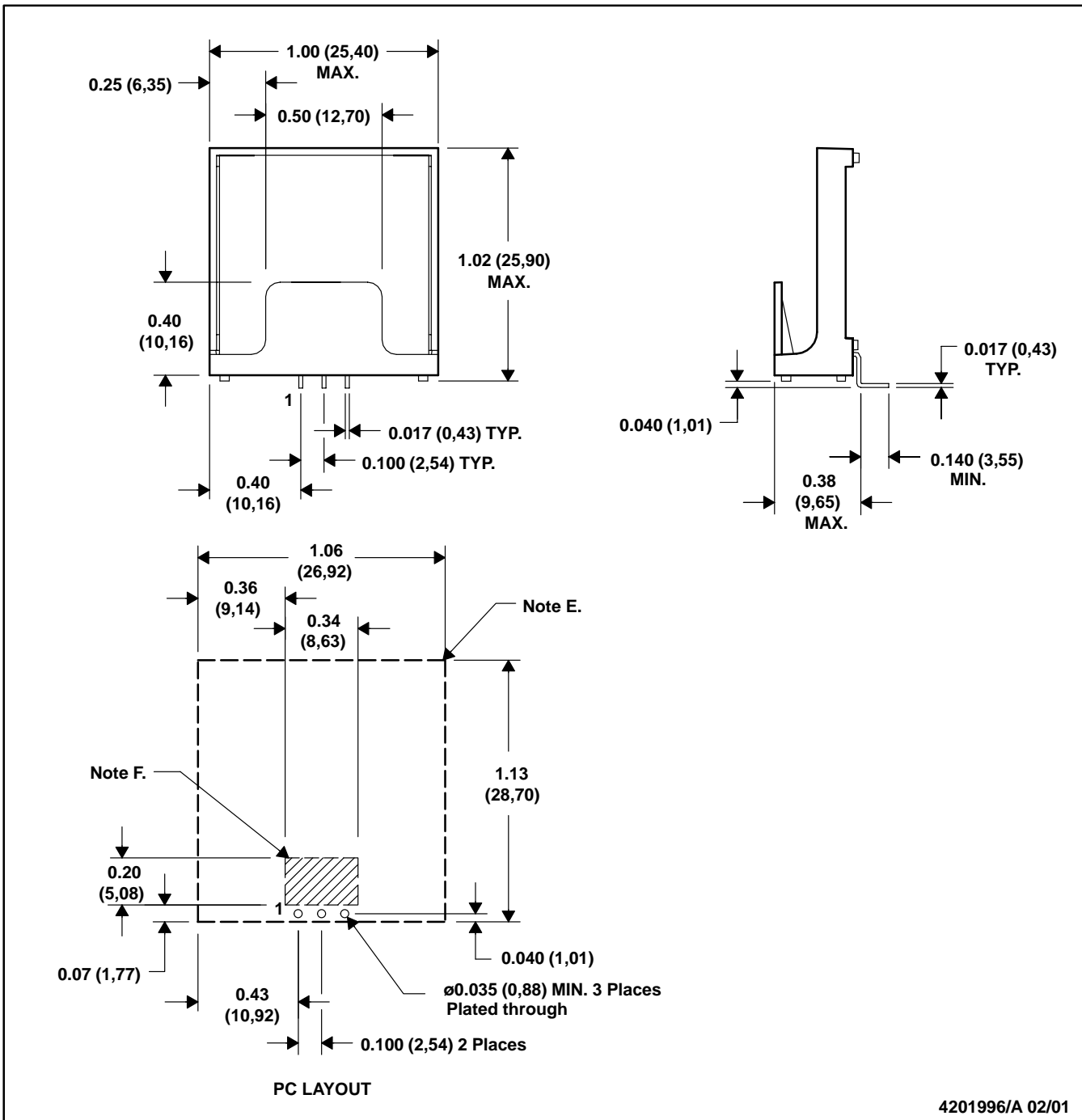


4202003/A 02/01

- 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.

EAA (R-PSIP-T3)

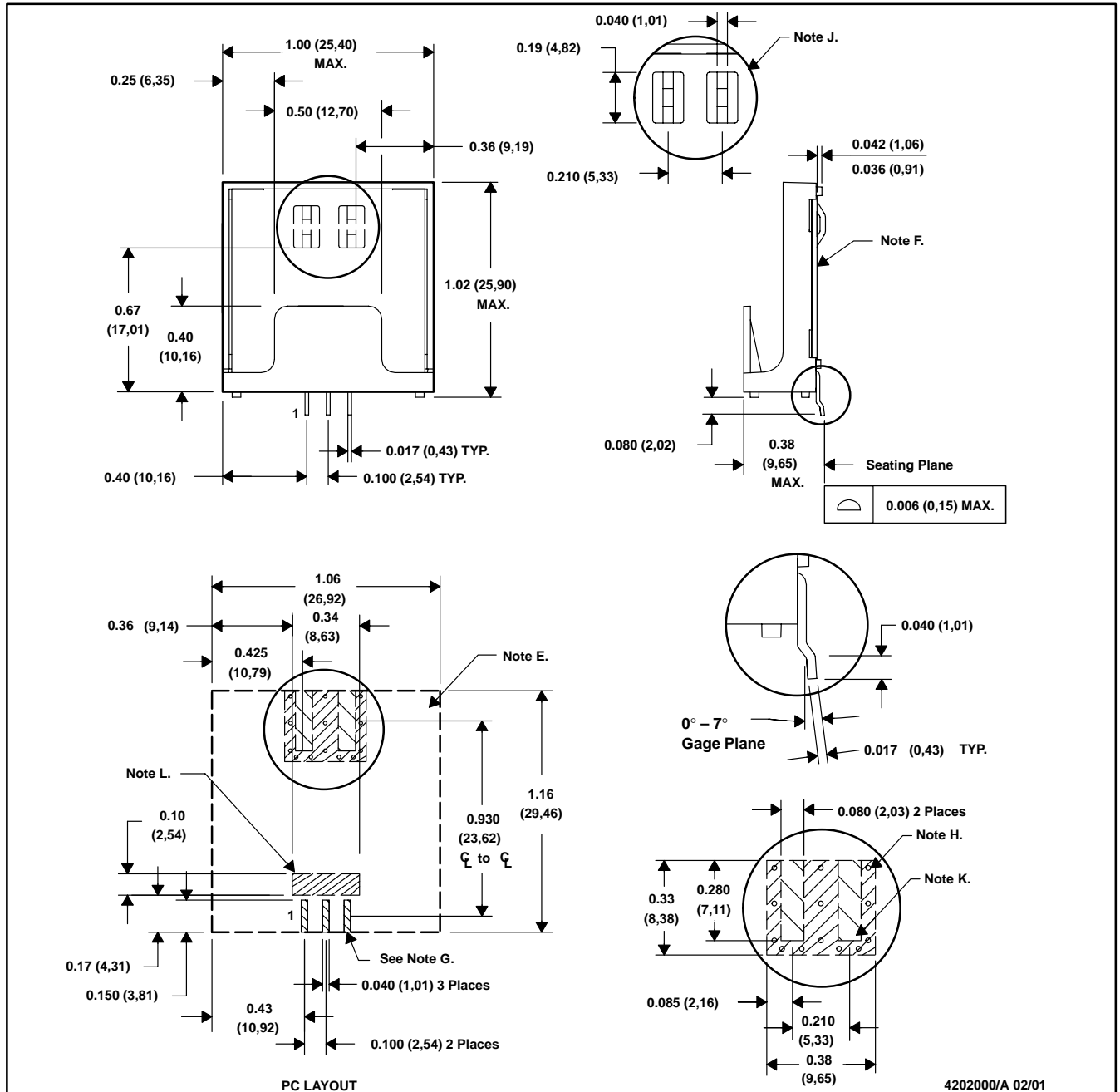
PLASTIC SINGLE-IN-LINE MODULE



- 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.

EAL (R-PSIP-G3)

PLASTIC SINGLE-IN-LINE MODULE

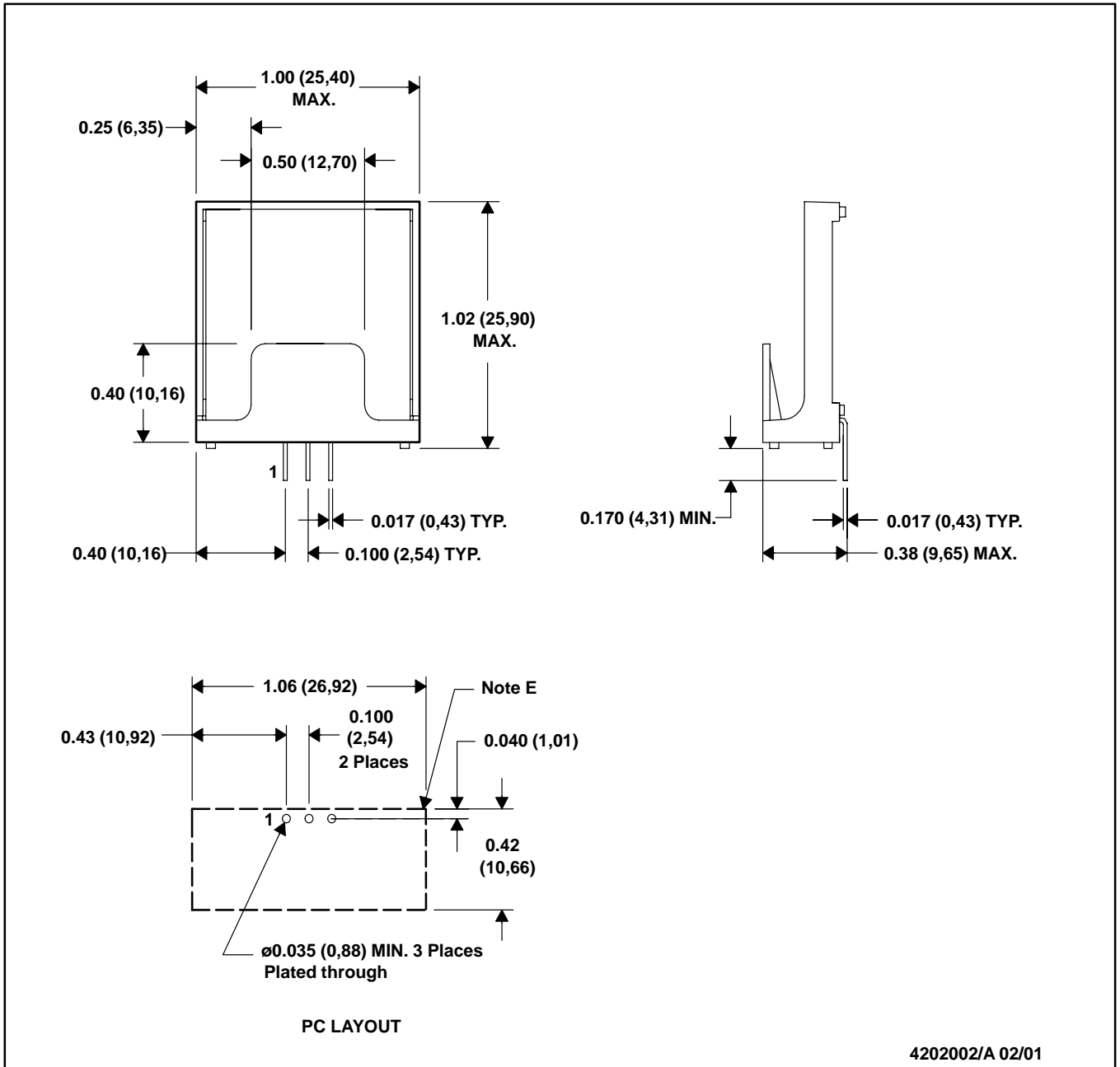


- NOTES:
- A. All linear dimensions are in inches (mm).
 - B. This drawing is subject to change without notice.
 - C. 2-place decimals are ± 0.030 ($\pm 0,76$ mm).
 - D. 3-place decimals are ± 0.010 ($\pm 0,25$ mm).
 - E. Recommended mechanical keep-out area.
 - F. The metal tab is isolated but electrically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

EAD (R-PSIP-T3)

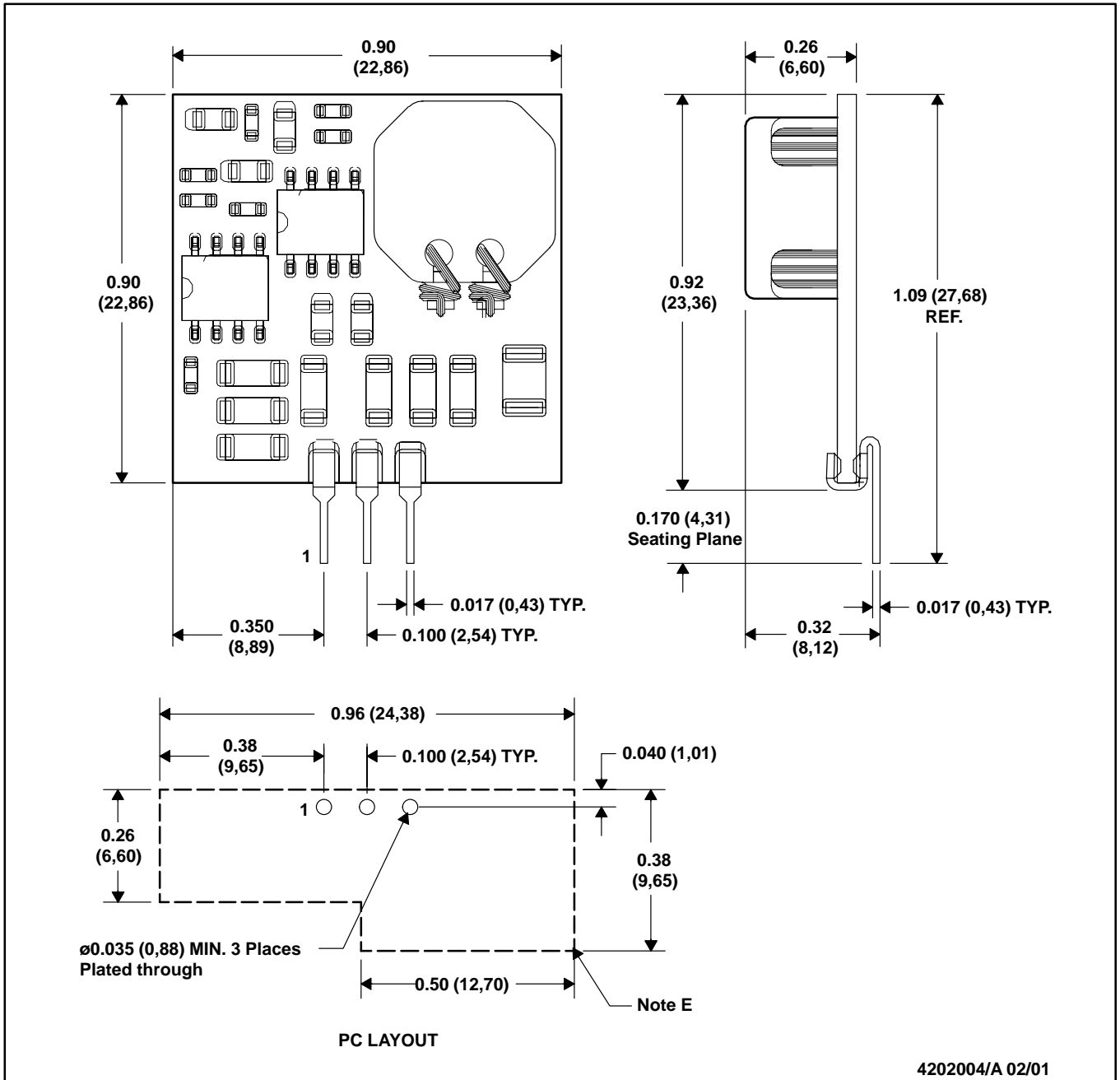
PLASTIC SINGLE-IN-LINE MODULE



- 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.

EAU (S-PSIP-T3)

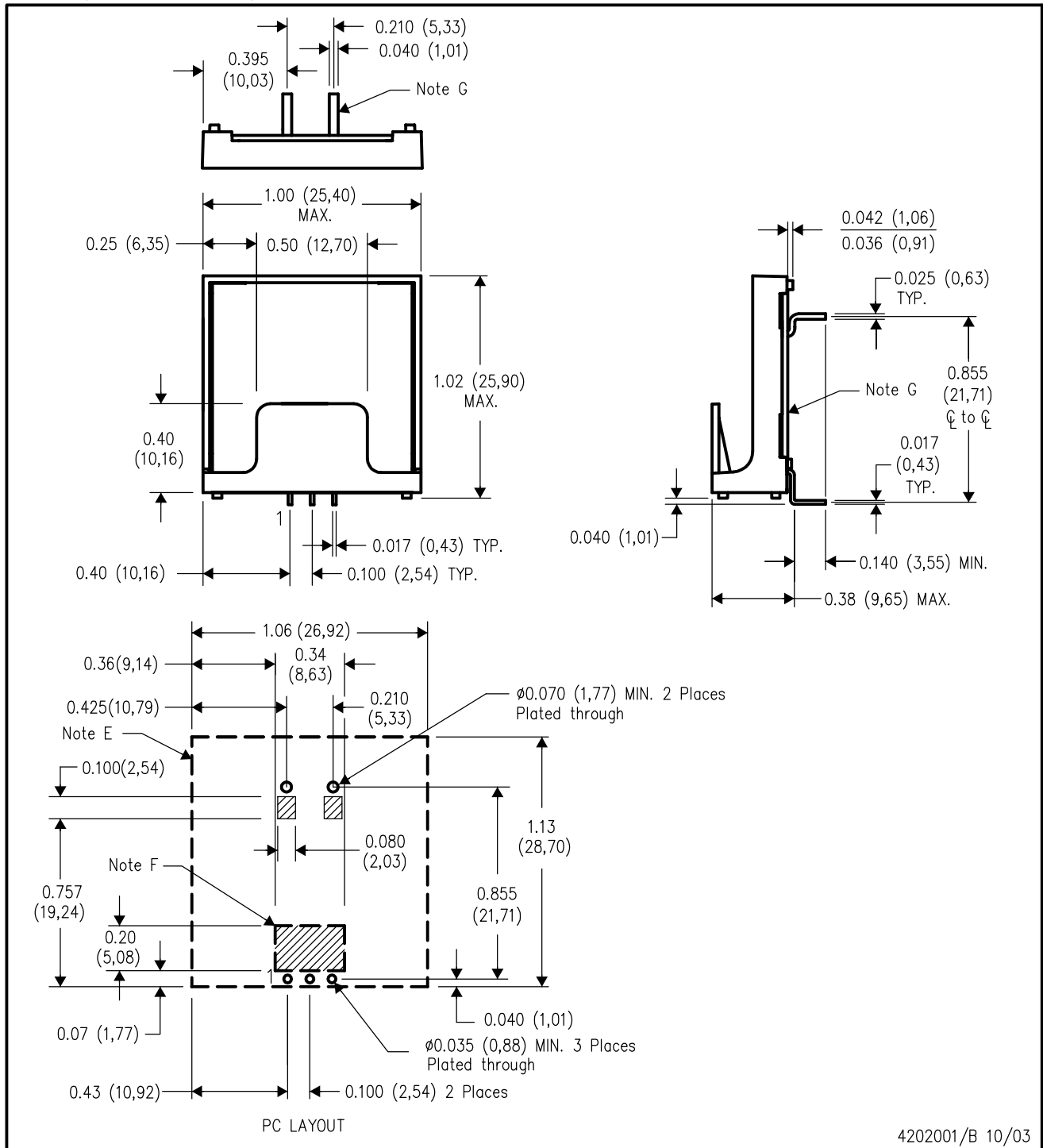
PLASTIC SINGLE-IN-LINE MODULE



- 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.

EAM (R-PSIP-T3)

PLASTIC SINGLE-IN-LINE MODULE

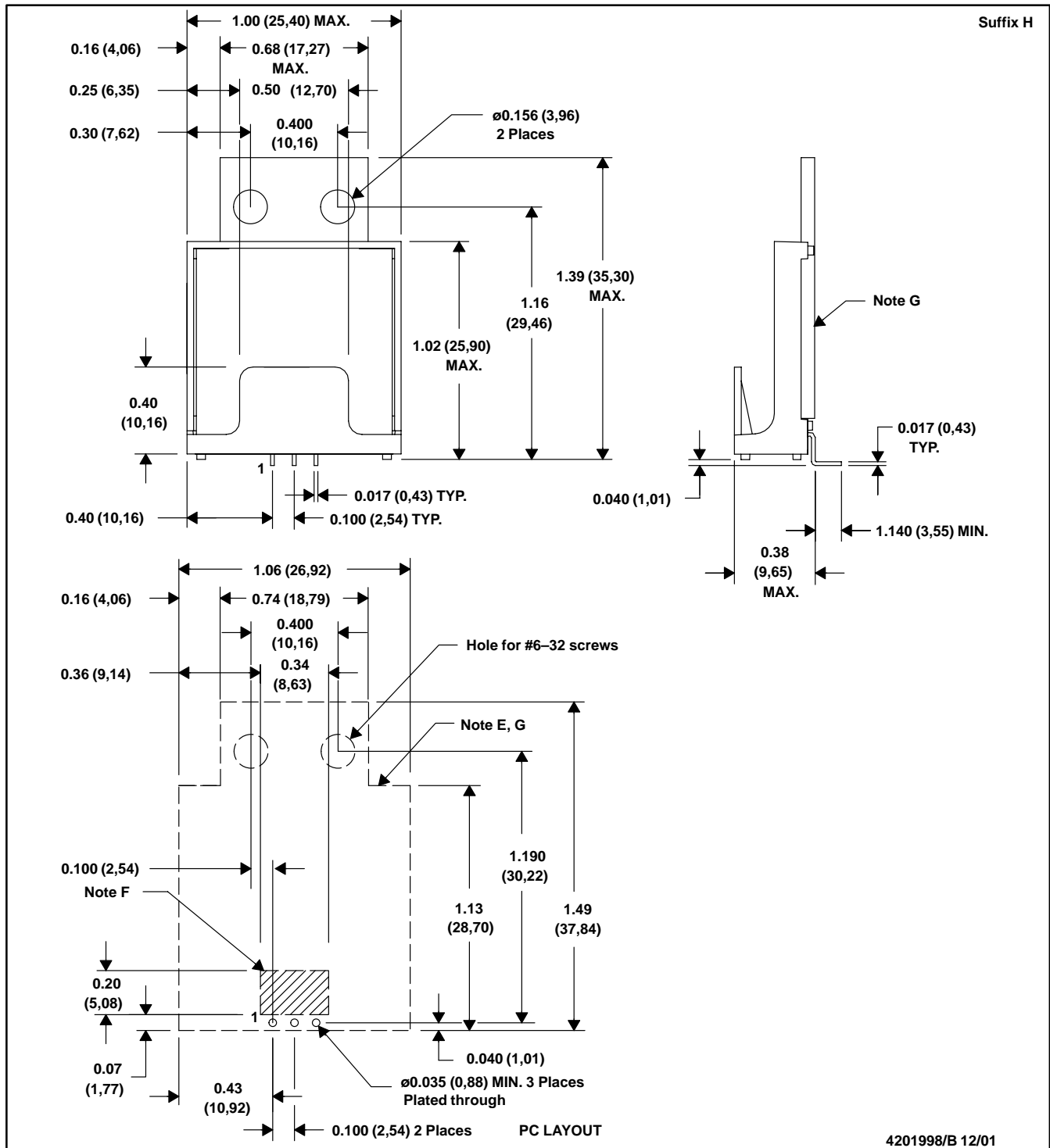


4202001/B 10/03

- 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.

EAH (R-PSIP-T3)

PLASTIC SINGLE-IN-LINE MODULE



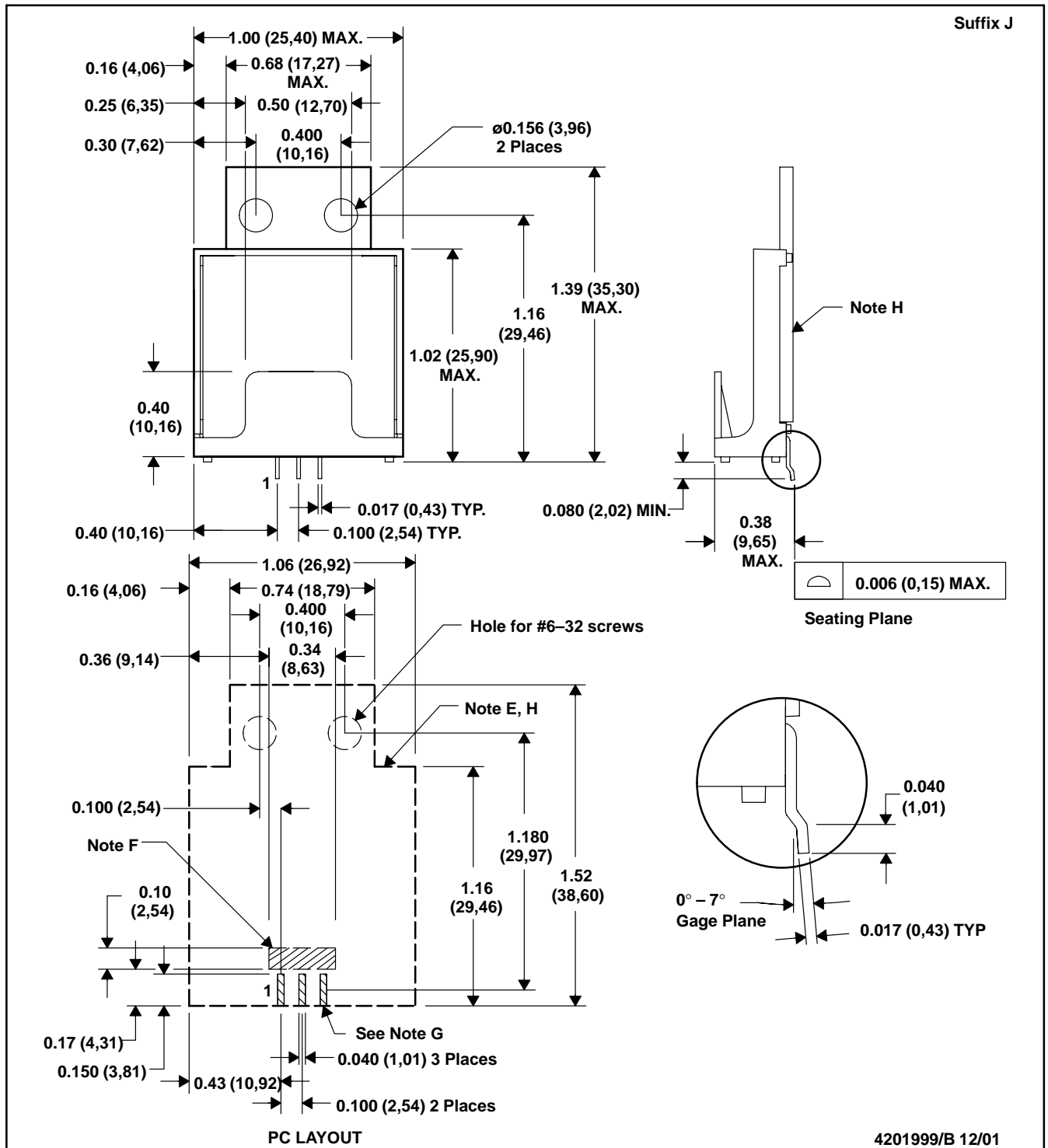
- NOTES:
- A. All linear dimensions are in inches (mm).
 - B. This drawing is subject to change without notice.
 - C. 2-place decimals are ± 0.030 ($\pm 0,76$ mm).
 - D. 3-place decimals are ± 0.010 ($\pm 0,25$ mm).
 - E. Recommended mechanical keep-out area.
 - F. No copper, power or signal traces in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

4201998/B 12/01



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.

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