LM140QML Three Terminal Positive Regulators

Check for Samples: LM140QML

FEATURES

- **Complete Specifications at 1.0A and 0.5A Loads**
- **No External Components**
- **Internal Thermal Overload Protection**
- **Internal Short Circuit Current-Limiting**
- **Output Transistor Safe-Area Compensation**

DESCRIPTION

The monolithic 3-terminal positive voltage regulators employ internal current-limiting, thermal shutdown and safe-area compensation, making them essentially indestructible. If adequate heat sinking is provided, they can deliver over 0.5A output current. They are intended as fixed voltage regulators in a wide range of applications including local (on-card) regulation for elimination of noise and distribution problems associated with single-point regulation. In addition to use as fixed voltage regulators, these devices can be used with external components to obtain adjustable output voltages and currents.

Considerable effort was expended to make the entire series of regulators easy to use and minimize the number of external components. It is not necessary to bypass the output, although this does improve transient response. Input bypassing is needed only if the regulator is located far from the filter capacitor of the power supply.

Connection Diagram

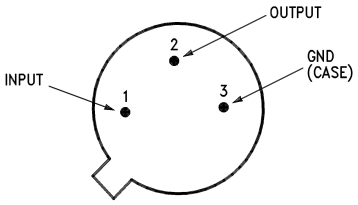


Figure 1. Steel Metal Can TO-39 Package (NDT)
Bottom View
See Package Number NDT0003A

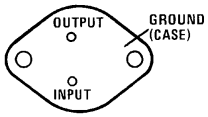


Figure 2. TO-3 Metal Can (K)
Bottom View
See Package Number K0002C

These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of the Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

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Absolute Maximum Ratings(1)

DC Input Voltage			35V
Internal Power Dissipation(2)			Internally Limited
Maximum Junction Temperature (T_{Jmax})			150°C
Storage Temperature Range			-65°C ≤ T_A ≤ +150°C
Operating Temperature Range			-55°C ≤ T_A ≤ +125°C
Lead Temperature (Soldering 10 seconds)			300°C
Thermal Resistance	θ_{JA}	T0−39 (Still Air)	232°C/W
		T0−39 (500 LF/Min Air Flow)	77°C/W
		T0−3 (Still Air)	35°C/W
		T0−3 (500 LF/Min Air Flow)	TBD
	θ_{JC}	T0−39	15°C/W
		T0−3	4°C/W
ESD Susceptibility(3)			2KV

(1) Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is functional, but do not specify specific performance limits. For ensured specifications and test conditions, see the Electrical Characteristics. The ensured specifications apply only for the test conditions listed. Some performance characteristics may degrade when the device is not operated under the listed test conditions.

(2) The maximum power dissipation must be derated at elevated temperatures and is dictated by T_{Jmax} (maximum junction temperature), θ_{JA} (package junction to ambient thermal resistance), and T_A (ambient temperature). The maximum allowable power dissipation at any temperature is $P_{Dmax} = (T_{Jmax} - T_A)/\theta_{JA}$ or the number given in the Absolute Maximum Ratings, whichever is lower.

(3) Human body model, 100pF discharged through 1.5KΩ

Quality Conformance Inspection

MIL-Std-883, Method 5005 - Group A

Subgroup	Description	Temp °C
1	Static tests at	+25
2	Static tests at	+125
3	Static tests at	-55
4	Dynamic tests at	+25
5	Dynamic tests at	+125
6	Dynamic tests at	-55
7	Functional tests at	+25
8A	Functional tests at	+125
8B	Functional tests at	-55
9	Switching tests at	+25
10	Switching tests at	+125
11	Switching tests at	-55
12	Settling time at	+25
13	Settling time at	+125
14	Settling time at	-55

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LM140H–5.0 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 10V, I_L =350mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_O	Output Voltage	V_I = 35V, I_L = 5mA		4.75	5.75	V	1
				4.80	5.20	V	1
		V_I = 8V		4.70	5.30	V	1, 2, 3
		V_I = 8V, I_L = 5mA		4.70	5.30	V	1, 2, 3
		V_I = 20V, I_L = 5mA		4.70	5.30	V	1, 2, 3
		V_I = 20V		4.70	5.30	V	1, 2, 3
R_{Line}	Line Regulation	7V ≤ V_I ≤ 25V, I_L = 200mA		-50	50	mV	1
		8V ≤ V_I ≤ 25V, I_L = 200mA		-50	50	mV	2, 3
		8V ≤ V_I ≤ 20V, I_L = 200mA		-25	25	mV	1
				-40	40	mV	2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 500mA		-50	50	mV	1
				-100	100	mV	2, 3
		5mA ≤ I_L ≤ 200mA		-25	25	mV	1
				-50	50	mV	2, 3
I_Q	Quiescent Current				7.0	mA	1, 2, 3
ΔI_Q	Quiescent Current Change	8V ≤ V_I ≤ 25V, I_L = 200mA		-0.8	0.8	mA	1, 2, 3
		5mA ≤ I_L ≤ 350mA		-0.5	0.5	mA	1, 2, 3
I_{Pk}	Peak Current	V_I - V_O = 7V	See (1)	0.4	2.0	A	1, 2, 3
V_{DO}	Dropout Voltage		See (2)		2.5	V	1
I_{OS}	Short Circuit Current	V_I = 35V			1.0	A	1, 2, 3

(1) V_O is set to 90% V_{Ref}
(2) V_{DO} = V_I − V_O when V_O is 95% of V_{Ref}.

LM140H–5.0 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: V_I = 10V, I_L =350mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	I_L = 125mA, e_I = 1V_{RMS}, f = 2.4KHz, V_I = 10V		62		dB	4, 5, 6

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LM140H–12 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 19V, I_L =350mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_O	Output Voltage	V_I = 35V, I_L = 5mA		11.4	12.6	V	1
				11.5	12.5	V	1
		V_I = 15.5V		11.4	12.6	V	1, 2, 3
		V_I = 15.5V, I_L = 5mA		11.4	12.6	V	1, 2, 3
		V_I = 27V, I_L = 5mA		11.4	12.6	V	1, 2, 3
		V_I = 27V		11.4	12.6	V	1, 2, 3
R_{Line}	Line Regulation	14.5V ≤ V_I ≤ 30V, I_L = 200mA		-60	60	mV	1
		15.0V ≤ V_I ≤ 30V, I_L = 200mA		-120	120	mV	2, 3
		16V ≤ V_I ≤ 25V, I_L = 200mA		-30	30	mV	1
				-60	60	mV	2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 500mA		-120	120	mV	1
				-240	240	mV	2, 3
		5mA ≤ I_L ≤ 200mA		-60	60	mV	1
				-120	120	mV	2, 3
I_Q	Quiescent Current				7.0	mA	1, 2, 3
ΔI_Q	Quiescent Current Change	14.5V ≤ V_I ≤ 30V, I_L = 200mA		-0.8	0.8	mA	1, 2, 3
		5mA ≤ I_L ≤ 350mA		-0.5	0.5	mA	1, 2, 3
I_{Pk}	Peak Current	V_I - V_O = 7V	See (1)	0.4	2.0	A	1, 2, 3
V_{DO}	Dropout Voltage		See (2)		2.5	V	1
I_{OS}	Short Circuit Current	V_I = 35V			1.0	A	1, 2, 3

(1) V_O is set to 90% V_{Ref}
(2) $V_{DO} = V_I - V_O$ when V_O is 95% of V_{Ref}.

LM140H–12 Electrical Characteristics AC Parameters

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	V_I = 17V, I_L = 125mA, e_I = 1V_{RMS}, f = 2.4KHz		55		dB	4, 5, 6

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LM140H–15 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 23V, I_L =350mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
V_O	Output Voltage	V_I = 35V, I_L = 5mA		14.25	15.75	V	1
				14.40	15.60	V	1
		V_I = 18.5V		14.25	15.75	V	1, 2, 3
		V_I = 18.5V, I_L = 5mA		14.25	15.75	V	1, 2, 3
		V_I = 30V, I_L = 5mA		14.25	15.75	V	1, 2, 3
		V_I = 30V		14.25	15.75	V	1, 2, 3
R_{Line}	Line Regulation	17.5V ≤ V_I ≤ 30V, I_L = 200mA		-60	60	mV	1
		18.5V ≤ V_I ≤ 30V, I_L = 200mA		-120	120	mV	2, 3
		20V ≤ V_I ≤ 30V, I_L = 200mA		-30	30	mV	1
				-60	60	mV	2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 500mA		-150	150	mV	1
				-300	300	mV	2, 3
		5mA ≤ I_L ≤ 200mA		-75	75	mV	1
				-150	150	mV	2, 3
I_Q	Quiescent Current				7.0	mA	1, 2, 3
ΔI_Q	Quiescent Current Change	17.5V ≤ V_I ≤ 30V, I_L = 200mA		-0.8	0.8	mA	1, 2, 3
		5mA ≤ I_L ≤ 350mA		-0.5	0.5	mA	1, 2, 3
I_{Pk}	Peak Current	V_I - V_O = 7V	See (1)	0.4	2.0	A	1, 2, 3
V_{DO}	Dropout Voltage		See (2)		2.5	V	1
I_{OS}	Short Circuit Current	V_I = 35V			1.0	A	1, 2, 3

(1) V_O is set to 90% V_{Ref}
(2) V_{DO} = V_I − V_O when V_O is 95% of V_{Ref}.

LM140H–15 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: V_I = 23V, I_L =350mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	V_I=20V, I_L=125mA, e_i=1V_{RMS}, f = 2.4KHz		54		dB	4, 5, 6

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LM140K–5.0 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 10V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
I_Q	Quiescent Current	I_L = 1A			6.0	mA	1
					7.0	mA	2, 3
ΔQ	Quiescent Current Change	I_L = 1A, 8V ≤ V_I ≤ 20mA		-0.8	0.8	mA	1
		I_L ≤ 500mA, 8V ≤ V_I ≤ 25V		-0.8	0.8	mA	1, 2, 3
		5mA, ≤ I_L ≤ 1.0A		-0.5	0.5	mA	1, 2, 3
V_O	Output Voltage			4.80	5.20	V	1
		V_I = 8V		4.75	5.25	V	1, 2, 3
		V_I = 8V, I_L = 1A		4.75	5.25	V	1, 2, 3
		V_I = 20V		4.75	5.25	V	1, 2, 3
		V_I = 20V, I_L = 1A		4.75	5.25	V	1, 2, 3
R_{Line}	Line Regulation	I_L = 500mA, 7V ≤ V_I ≤ 25V		-50	50	mV	1, 2, 3
		I_L = 1A, 7.3V ≤ V_I ≤ 20V		-50	50	mV	1
		I_L = 1A, 8.0V ≤ V_I ≤ 20V		-50	50	mV	2, 3
		I_L = 1A, 8V ≤ V_I ≤ 12V		-25	25	mV	1, 2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 1.5A		-50	50	mV	1
		5mA ≤ I_L ≤ 1.0A		-50	50	mV	2, 3
		250mA ≤ I_L ≤ 750mA		-25	25	mV	1
I_{OS}	Current Limit			-4.0	-0.02	A	1
		V_I = 35V		-2.0	-0.02	A	1

LM140K–5.0 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: V_I = 10V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	f = 120Hz, I_L = 350mA, e_I = $1V_{RMS}$		68		dB	4

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LM140K–12 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 19V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
I_Q	Quiescent Current	I_L = 1A			6.0	mA	1
					7.0	mA	2, 3
ΔI_Q	Quiescent Current Change	I_L = 1A, 15.5V ≤ V_I ≤ 27V		-0.8	0.8	mA	1
		I_L = 500mA 15V ≤ V_I ≤ 30V		-0.8	0.8	mA	1, 2, 3
		5mA ≤ I_L ≤ 1A		-0.5	0.5	mA	1, 2, 3
V_O	Output Voltage			11.5	12.5	V	1
		V_I = 15.5V		11.4	12.6	V	1, 2, 3
		V_I = 15.5V, I_L = 1A		11.4	12.6	V	1, 2, 3
		V_I = 27V		11.4	12.6	V	1, 2, 3
		V_I = 27V, I_L = 1A		11.4	12.6	V	1, 2, 3
R_{Line}	Line Regulation	I_L = 500mA, 14.5V ≤ V_I ≤ 25V		-120	120	mV	1, 2, 3
		I_L = 1A, 14.6V ≤ V_I ≤ 27V		-120	120	mV	1
		I_L = 1A, 15.0V ≤ V_I ≤ 27V		-120	120	mV	2, 3
		I_L = 1A, 16V ≤ V_I ≤ 22V		-60	60	mV	1, 2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 1.5A		-120	120	mV	1
		5mA ≤ I_L ≤ 1.0A		-120	120	mV	2, 3
		250mA ≤ I_L ≤ 750mA		-60	60	mV	1
I_{OS}	Current Limit	V_I = 17V		-3.5	-0.02	A	1
		V_I = 35V		-2.0	-0.02	A	1

LM140K–12 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: V_I = 19V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	f = 120Hz, I_L = 350mA, e_I = $1V_{RMS}$		61		dB	4

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LM140K–15 Electrical Characteristics DC Parameters

The following conditions apply, unless otherwise specified.
DC: V_I = 23V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
I_Q	Quiescent Current	I_L = 1A			6.0	mA	1
					7.0	mA	2, 3
ΔI_Q	Quiescent Current Change	I_L = 1A, 18.5V ≤ V_I ≤ 30V		-0.8	0.8	mA	1
		I_L = 500mA, 18.5V ≤ V_I ≤ 30V		-0.8	0.8	mA	2, 3
		5mA ≤ I_L ≤ 1A		-0.5	0.5	mA	1, 2, 3
V_O	Output Voltage			14.4	15.6	V	1
		V_I = 18.5V		14.25	15.75	V	1, 2, 3
		V_I = 18.5V, I_L = 1A		14.25	15.75	V	1, 2, 3
		V_I = 30V		14.25	15.75	V	1, 2, 3
		V_I = 30V, I_L = 1A		14.25	15.75	V	1, 2, 3
R_{Line}	Line Regulation	I_L = 500mA, 17.5V ≤ V_I ≤ 30V		-150	150	mV	1
		I_L = 500mA, 18.5V ≤ V_I ≤ 30V		-150	150	mV	2, 3
		I_L = 1A, 17.7V ≤ V_I ≤ 30V		-75	75	mV	1
		I_L = 1A, 20V ≤ V_I ≤ 26V		-75	75	mV	1, 2, 3
R_{Load}	Load Regulation	5mA ≤ I_L ≤ 1.5A		-150	150	mV	1
		5mA ≤ I_L ≤ 1.0A		-150	150	mV	2, 3
		250mA ≤ I_L ≤ 750mA		-75	75	mV	1
I_{OS}	Current Limit	V_I = 20V		-3.5	-0.02	A	1
		V_I =35V		-2.0	-0.02	A	1

LM140K–15 Electrical Characteristics AC Parameters

The following conditions apply, unless otherwise specified.
AC: V_I = 23V, I_L = 5mA

Symbol	Parameter	Conditions	Notes	Min	Max	Unit	Sub-groups
RR	Ripple Rejection	f = 120Hz, I_L = 350mA, e_I = $1V_{RMS}$		60		dB	4

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REVISION HISTORY SECTION

Released	Revision	Section	Originator	Changes
02/21/06	A	New Release, Corporate format	L. Lytle	6 MDS data sheets converted into one Corp. data sheet format. The drift tables were eliminated from the 883 section since it did not apply. MDS data sheets MNLM140-05H Rev 0B0, MNLM140-05-K Rev. 0C0, MNLM140-12H Rev 0A0, MNLM140-12K Rev 0B0, MNLM140-15H Rev 0A0, and MNLM140-15K Rev 0B0 will be archived.
05/02/13	B			Changed layout of National Data Sheet to TI format.

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PACKAGING INFORMATION

Orderable part number	Status (1)	Material type (2)	Package | Pins	Package qty | Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
LM140H-12/883	Active	Production	TO (NDT) | 3	20 | JEDEC TRAY (5+1)	No	Call TI	Level-1-NA-UNLIM	-55 to 125	LM140H-12/883 Q ACO LM140H-12/883 Q >T
LM140H-15/883	Active	Production	TO (NDT) | 3	20 | JEDEC TRAY (5+1)	No	Call TI	Level-1-NA-UNLIM	-55 to 125	LM140H-15/883 Q ACO LM140H-15/883 Q >T
LM140H-5.0/883	Active	Production	TO (NDT) | 3	20 | JEDEC TRAY (5+1)	No	Call TI	Level-1-NA-UNLIM	-55 to 125	LM140H-5.0/883 Q ACO LM140H-5.0/883 Q >T
LM140K-12/883	Active	Production	TO (K) | 2	50 | TRAY NON-STD	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	(LM120H-15P+, LM140K-12) /883 Q ACO /883 Q >T
LM140KG-12 MD8	Active	Production	DIESALE (Y) | 0	221 | JEDEC TRAY (5+1)	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	
LM140KG-5 MD8	Active	Production	DIESALE (Y) | 0	221 | JEDEC TRAY (5+1)	Yes	Call TI	Level-1-NA-UNLIM	-55 to 125	

(1) **Status:** For more details on status, see our product life cycle.

(2) **Material type:** When designated, preproduction parts are prototypes/experimental devices, and are not yet approved or released for full production. Testing and final process, including without limitation quality assurance, reliability performance testing, and/or process qualification, may not yet be complete, and this item is subject to further changes or possible discontinuation. If available for ordering, purchases will be subject to an additional waiver at checkout, and are intended for early internal evaluation purposes only. These items are sold without warranties of any kind.

(3) **RoHS values:** Yes, No, RoHS Exempt. See the TI RoHS Statement for additional information and value definition.

(4) **Lead finish/Ball material:** Parts may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

(5) **MSL rating/Peak reflow:** The moisture sensitivity level ratings and peak solder (reflow) temperatures. In the event that a part has multiple moisture sensitivity ratings, only the lowest level per JEDEC standards is shown. Refer to the shipping label for the actual reflow temperature that will be used to mount the part to the printed circuit board.

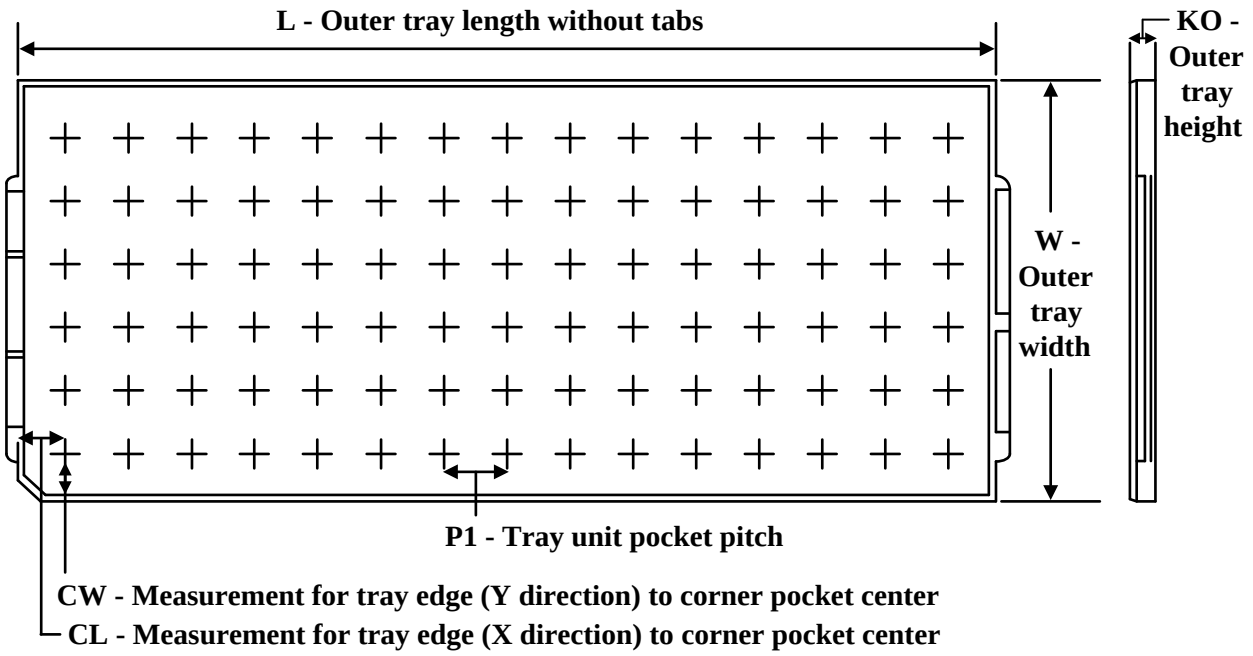
(6) **Part marking:** There may be an additional marking, which relates to the logo, the lot trace code information, or the environmental category of the part.

Multiple part markings will be inside parentheses. Only one part marking contained in parentheses and separated by a "~" will appear on a part. If a line is indented then it is a continuation of the previous line and the two combined represent the entire part marking for that device.

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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.

TRAY

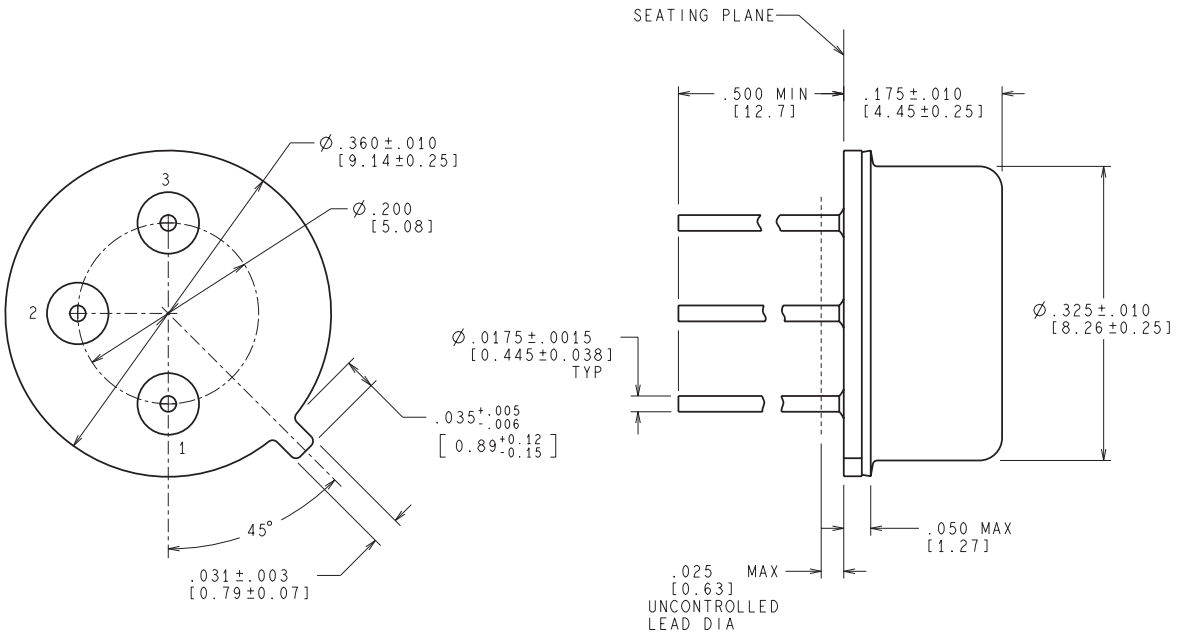


Chamfer on Tray corner indicates Pin 1 orientation of packed units.

*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	Unit array matrix	Max temperature (°C)	L (mm)	W (mm)	K0 (µm)	P1 (mm)	CL (mm)	CW (mm)
LM140H-12/883	NDT	TO-CAN	3	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54
LM140H-15/883	NDT	TO-CAN	3	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54
LM140H-5.0/883	NDT	TO-CAN	3	20	2 X 10	150	126.49	61.98	8890	11.18	12.95	18.54
LM140K-12/883	K	TO-CAN	2	50	9 X 6	NA	292.1	215.9	25654	3.87	22.3	25.4

NDT0003A



CONTROLLING DIMENSION IS INCH
VALUES IN [ ] ARE MILLIMETERS

MIL-PRF-38535
CONFIGURATION CONTROL

H03A (Rev D)

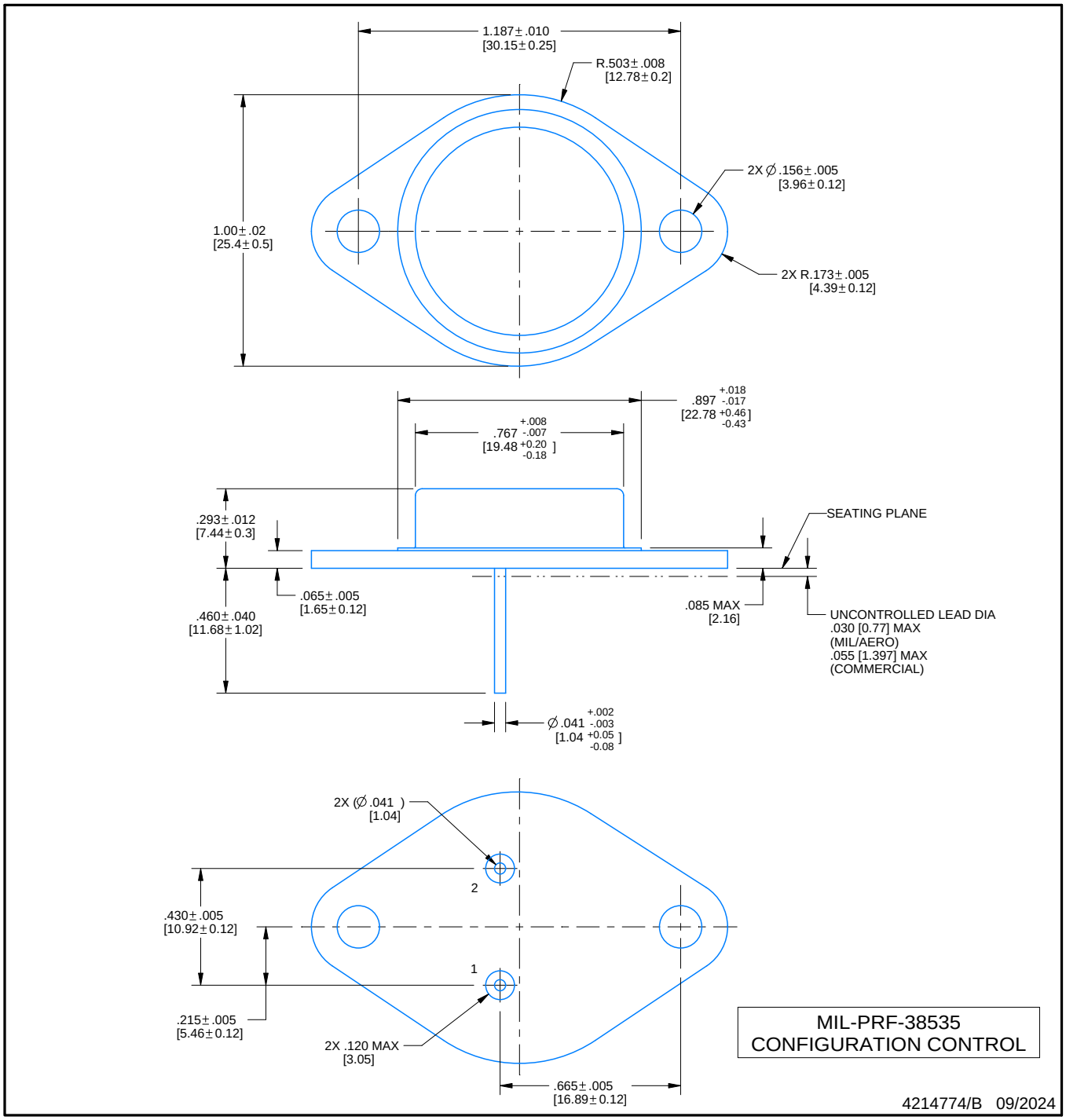
K0002A



PACKAGE OUTLINE

TO-CAN - 7.747 mm max height

TRANSISTOR OUTLINE



NOTES:

1. Linear dimensions are in inches [millimeters]. Dimensions in parenthesis are for reference only. Controlling dimensions are in inches. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. Leads not to be bent greater than 15°.

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