TEXAS INSTRUMENTS
Data sheet acquired from Harris Semiconductor
SCHS028C – Revised October 2003

CD4018B Types

CMOS Presettable Divide-By-'N' Counter

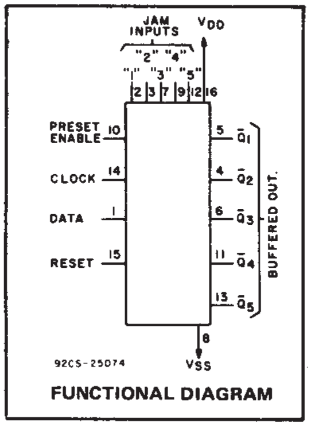
High-Voltage Types (20-Volt Rating)

■ CD4018B types consist of 5 Johnson-Counter stages, buffered Q outputs from each stage, and counter preset control gating. CLOCK, RESET, DATA, PRESET ENABLE, and 5 individual JAM inputs are provided. Divide by 10, 8, 6, 4, or 2 counter configurations can be implemented by feeding the $\overline{Q}5$, $\overline{Q}4$, $\overline{Q}3$, $\overline{Q}2$, $\overline{Q}1$ signals, respectively, back to the DATA input. Divide-by-9, 7, 5; or 3 counter configurations can be implemented by the use of a CD4011B to gate the feedback connection to the DATA input. Divide-by functions greater than 10 can be achieved by use of multiple CD4018B units. The counter is advanced one count at the positive clock-signal transition. Schmitt Trigger action on the clock line permits unlimited clock rise and fall times. A high RESET signal clears the counter to an all-zero condition. A high PRESET-ENABLE signal allows information on the JAM inputs to preset the counter. Anti-lock gating is provided to assure the proper counting sequence.

The CD4018B types are supplied in 16-lead hermetic dual-in-line ceramic packages (F3A suffix), 16-lead dual-in-line plastic packages (E suffix), 16-lead small-outline packages (M, M96, MT, and NSR suffixes), and 16-lead thin shrink small-outline packages (PW and PWR suffixes).

Features:

- Medium speed operation . . . . . . 10 MHz (typ.) at $V_{DD} - V_{SS} = 10$ V
- Fully static operation
- 100% tested for quiescent current at 20 V
- Standardized, symmetrical output characteristics
- 5-V, 10-V, and 15-V parametric ratings
- Maximum input current of 1 μA at 18 V over full package-temperature range; 100 nA at 18 V and 25°C
- Noise margin (full package-temperature range) = 1 V at V_{DD} = 5 V
  2 V at V_{DD} = 10 V
  2.5 V at V_{DD} = 15 V
- Meets all requirements of JEDEC Tentative Standard No. 13B, "Standard Specifications for Description of 'B' Series CMOS Devices"

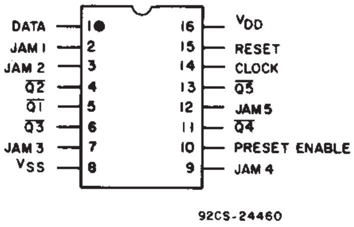


FUNCTIONAL DIAGRAM

Applications:

- Fixed and programmable divide-by-10, 9, 8, 7, 6, 5, 4, 3, 2 counters
- Fixed and programmable counters greater than 10
- Programmable decade counters
- Divide-by-"N" counters/frequency synthesizers
- Frequency division
- Counter control/timers

TERMINAL DIAGRAM
Top View



MAXIMUM RATINGS, *Absolute-Maximum Values:*

DC SUPPLY-VOLTAGE RANGE, (V_{DD})	
Voltages referenced to V_{SS} Terminal)	−0.5V to +20V
INPUT VOLTAGE RANGE, ALL INPUTS	−0.5V to V_{DD} +0.5V
DC INPUT CURRENT, ANY ONE INPUT	±10mA
POWER DISSIPATION PER PACKAGE (P_D):	
For T_A = −55°C to +100°C	500mW
For T_A = +100°C to +125°C	Derate Linearity at 12mW/°C to 200mW
DEVICE DISSIPATION PER OUTPUT TRANSISTOR	
FOR T_A = FULL PACKAGE-TEMPERATURE RANGE (All Package Types)	100mW
OPERATING-TEMPERATURE RANGE (T_A)	−55°C to +125°C
STORAGE TEMPERATURE RANGE (T_{stg})	−65°C to +150°C
LEAD TEMPERATURE (DURING SOLDERING):	
At distance 1/16 ± 1/32 inch (1.59 ± 0.79mm) from case for 10s max	+265°C

RECOMMENDED OPERATING CONDITIONS at T_A = 25°C, Unless Otherwise Specified

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges.

CHARACTERISTIC		V_{DD}	Min.	Max.	UNITS
Supply Voltage Range (at T_A = Full Package-Temperature Range)			3	18	V
Clock Input Frequency,	f_{CL}	5 10 15	– – –	3 7 8.5	MHz
Clock Pulse Width,	t_W	5 10 15	160 70 50	– – –	ns
Clock Rise & Fall Time,	t_rCL, t_fCL	5 10 15	Unlimited		μs
Data Input Set-Up Time,	t_S	5 10 15	40 12 16	– – –	ns
Data Input Hold Time,	t_H	5 10 15	140 80 60	– – –	ns
Preset or Reset Pulse Width,	t_W	5 10 15	160 70 50	 – –	ns
Preset or Reset Removal Time		5 10 15	160 60 40	– – –	ns

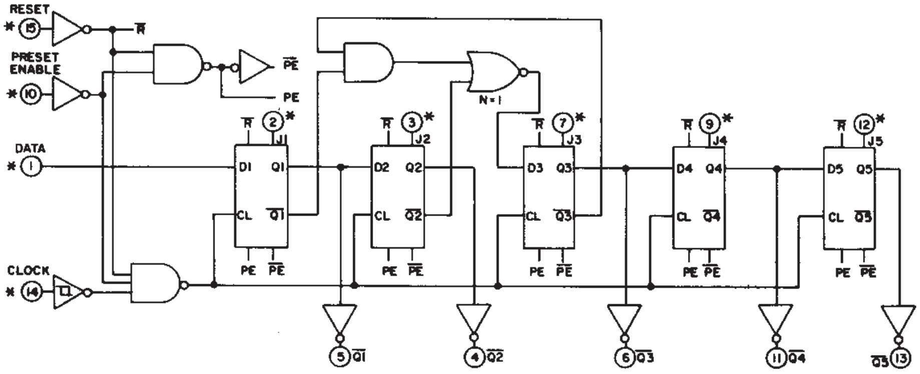


Fig. 1 – Logic diagram.

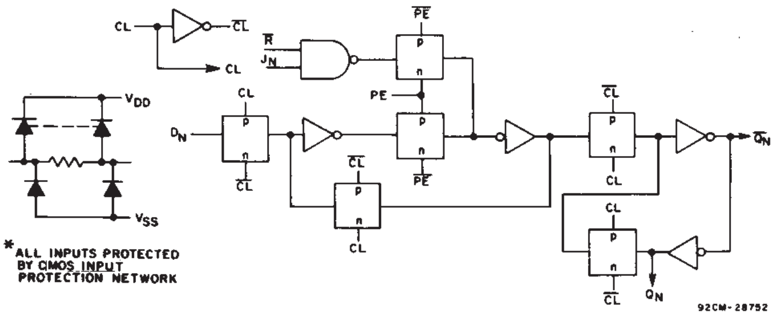


Fig. 2 – Detail of a typical stage.

STATIC ELECTRICAL CHARACTERISTICS

CHARACTERISTIC	CONDITIONS			LIMITS AT INDICATED TEMPERATURES (°C)							UNITS
	V_O (V)	V_{IN} (V)	V_{DD} (V)	−55	−40	+85	+125	+25 Min.	+25 Typ.	+25 Max.	
Quiescent Device Current, I_{DD} Max.	–	0,5	5	5	5	150	150	–	0.04	5	µA
	–	0,10	10	10	10	300	300	–	0.04	10	
	–	0,15	15	20	20	600	600	–	0.04	20	
	–	0,20	20	100	100	3000	3000	–	0.08	100	
Output Low (Sink) Current I_{OL} Min.	0.4	0,5	5	0.64	0.61	0.42	0.36	0.51	1	–	mA
	0.5	0,10	10	1.6	1.5	1.1	0.9	1.3	2.6	–	
	1.5	0,15	15	4.2	4	2.8	2.4	3.4	6.8	–	
Output High (Source) Current, I_{OH} Min.	4.6	0,5	5	−0.64	−0.61	−0.42	−0.36	−0.51	−1	–	
	2.5	0,5	5	−2	−1.8	−1.3	−1.15	−1.6	−3.2	–	
	9.5	0,10	10	−1.6	−1.5	−1.1	−0.9	−1.3	−2.6	–	
	13.5	0,15	15	−4.2	−4	−2.8	−2.4	−3.4	−6.8	–	
Output Voltage: Low-Level, V_{OL} Max.	–	0,5	5	0.05				–	0	0.05	V
	–	0,10	10	0.05				–	0	0.05	
	–	0,15	15	0.05				–	0	0.05	
Output Voltage: High-Level, V_{OH} Min.	–	0,5	5	4.95				4.95	5	–	
	–	0,10	10	9.95				9.95	10	–	
	–	0,15	15	14.95				14.95	15	–	
Input Low Voltage V_{IL} Max.	0.5,4.5	–	5	1.5				–	–	1.5	V
	1,9	–	10	3				–	–	3	
	1.5,13.5	–	15	4				–	–	4	
Input High Voltage, V_{IH} Min.	0.5,4.5	–	5	3.5				3.5	–	–	
	1,9	–	10	7				7	–	–	
	1.5,13.5	–	15	11				11	–	–	
Input Current I_{IN} Max.	–	0,18	18	±0.1	±0.1	±1	±1	–	$\pm 10^{-5}$	±0.1	µA

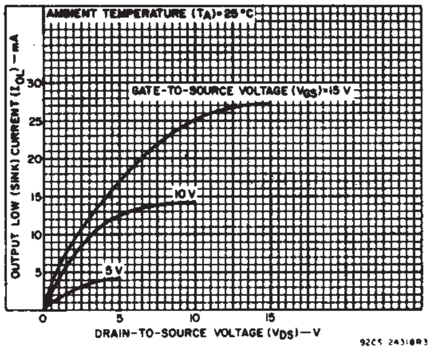


Fig. 3 – Typical output low (sink) current characteristics.

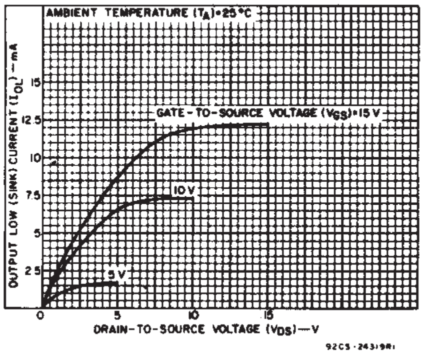


Fig. 4 – Minimum output low (sink) current characteristics.

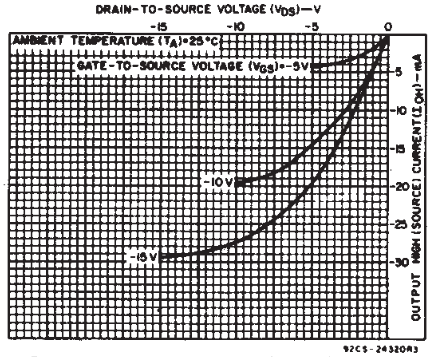


Fig. 5 – Typical output high (source) current characteristics.

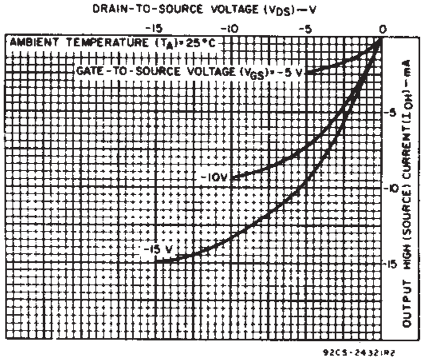


Fig. 6 – Minimum output high (source) current characteristics.

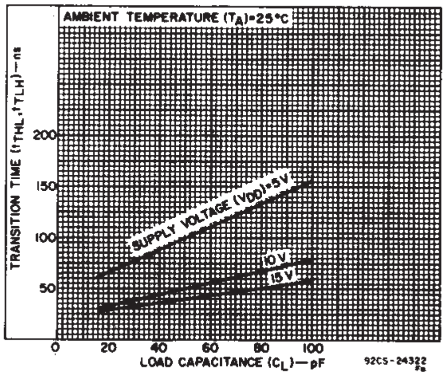


Fig. 7 – Typical transition time as a function of load capacitance.

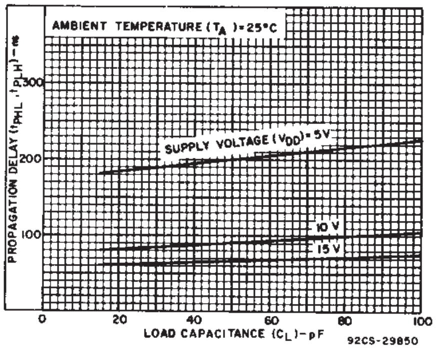


Fig. 8 – Typical propagation delay time as a function of load capacitance (CLOCK to Q).

DYNAMIC ELECTRICAL CHARATERISTICS at $T_A = 25°C$, Input $t_r, t_f = 20$ ns, $C_L = 50$ pF, $R_L = 200$ kΩ

CHARACTERISTIC	TEST CONDITIONS		LIMITS			UNITS
		V_{DD} (V)	Min.	Typ.	Max.	
CLOCKED OPERATION						
Propagation Delay Time; t_{PLH}, t_{PHL}		5	–	200	400	ns
		10	–	90	180	
		15	–	65	130	
Transition Time; t_{THL}, t_{TLH}		5	–	100	200	ns
		10	–	50	100	
		15	–	40	80	
Maximum Clock Input Frequency, f_{CL}		5	3	6	–	MHz
		10	7	14	–	
		15	8.5	17	–	
Minimum Clock Pulse Width, t_W		5	–	80	160	ns
		10	–	35	70	
		15	–	25	50	
Clock Rise & Fall Time; t_rCL, t_fCL		5	Unlimited			μs
		10				
		15				
Minimum Data Input Set-Up Time. t_S		5	–	20	40	ns
		10	–	6	12	
		15	–	3	6	
Minimum Data Input Hold Time, t_H		5	–	70	140	ns
		10	–	40	80	
		15	–	30	60	
Average Input Capacitance, C_I	Any Input		–	5	7.5	pF
PRESET* OR RESET OPERATION						
Propagation Delay Time; Preset or Reset to $\overline{Q}$ t_{PLH}, t_{PHL}		5	–	275	550	ns
		10	–	125	250	
		15	–	90	180	
Minimum Preset or Reset Pulse Width, t_W		5	–	80	160	ns
		10	–	35	70	
		15	–	25	50	
Minimum Preset or Reset Removal Time		5	–	80	160	ns
		10	–	30	60	
		15	–	20	40	

* At PRESET ENABLE or JAM Inputs.

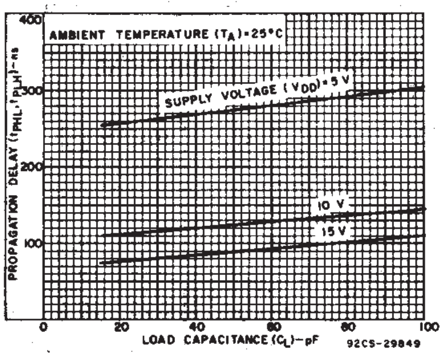


Fig. 9 – Typical propagation delay time as a function of load capacitance (RESET to Q).

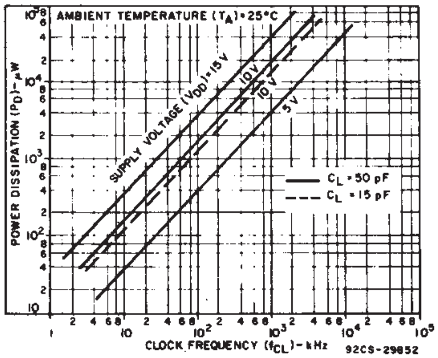


Fig. 10 – Typical dynamic power dissipation as a function of clock input frequency.

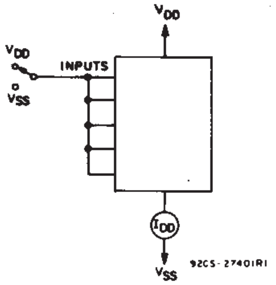


Fig. 11 – Quiescent device current test circuit.

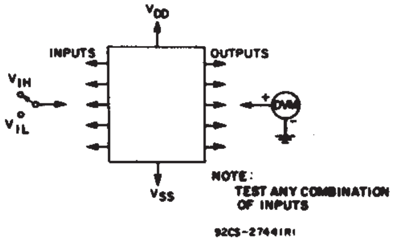


Fig. 12 – Input voltage test circuit.

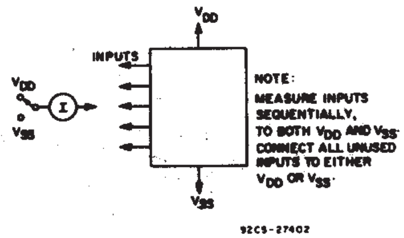


Fig. 13 – Input current test circuit.

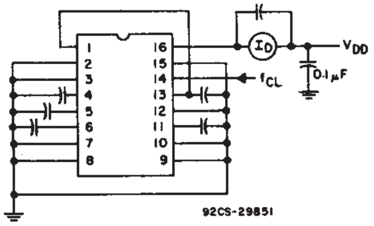


Fig. 14 – Dynamic power dissipation test circuit.

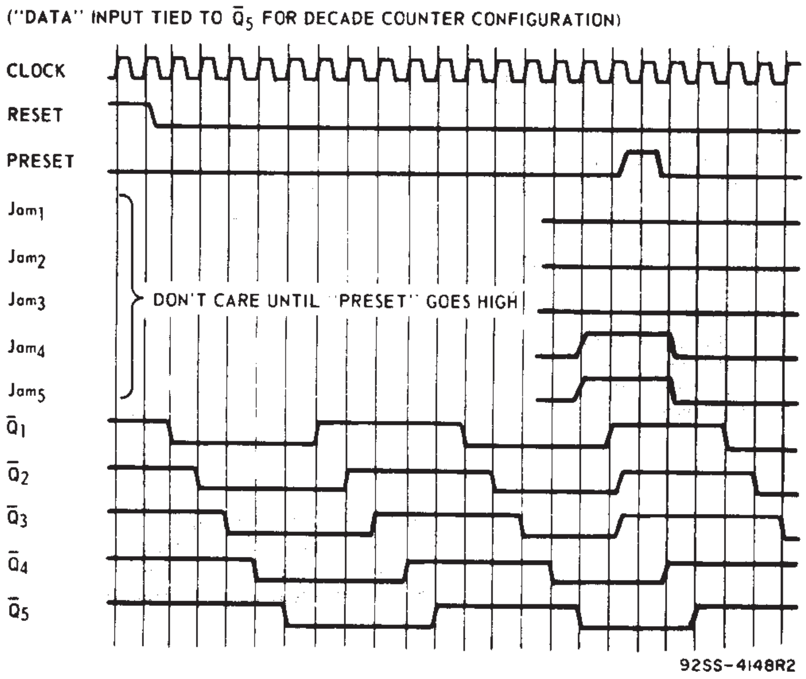


Fig. 15 – Timing diagram.

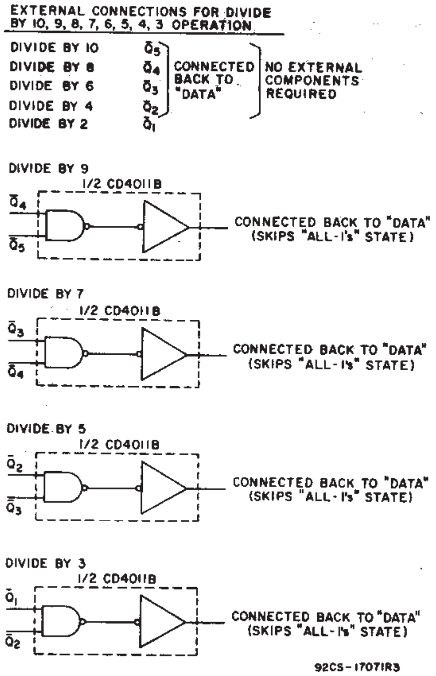
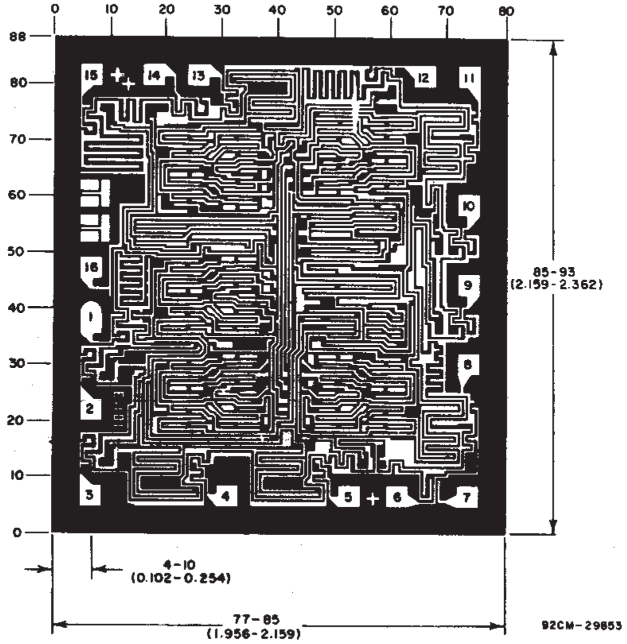


Fig. 16 – External connections for divide by 10, 9, 8, 7, 5, 4, 3, 2 operation.



Chip dimensions and pad layout for CD4018B

Dimensions in parentheses are in millimeters and are derived from the basic inch dimensions as indicated. Grid graduations are in mils (10^{-3} inch).

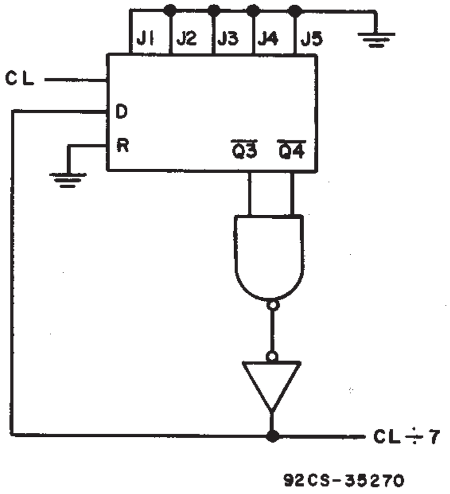


Fig. 17 — Example of divide by 7.

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)
CD4018BE	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
CD4018BEE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type	
CD4018BF	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
CD4018BF3A	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
CD4018BM	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BM96	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BM96E4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BM96G4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BME4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BMG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BMT	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BMTE4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BMTG4	ACTIVE	SOIC	D	16	250	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BNSR	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BNSRE4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BNSRG4	ACTIVE	SO	NS	16	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BPW	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
CD4018BPWE4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	

PACKAGE OPTION ADDENDUM

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/ Ball Finish	MSL Peak Temp [3]	Samples (Requires Login)
CD4018BPWG4	ACTIVE	TSSOP	PW	16	90	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM	
JM38510/05652BEA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type	
M38510/05652BEA	ACTIVE	CDIP	J	16	1	TBD	A42	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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OTHER QUALIFIED VERSIONS OF CD4018B, CD4018B-MIL :

- Catalog: CD4018B

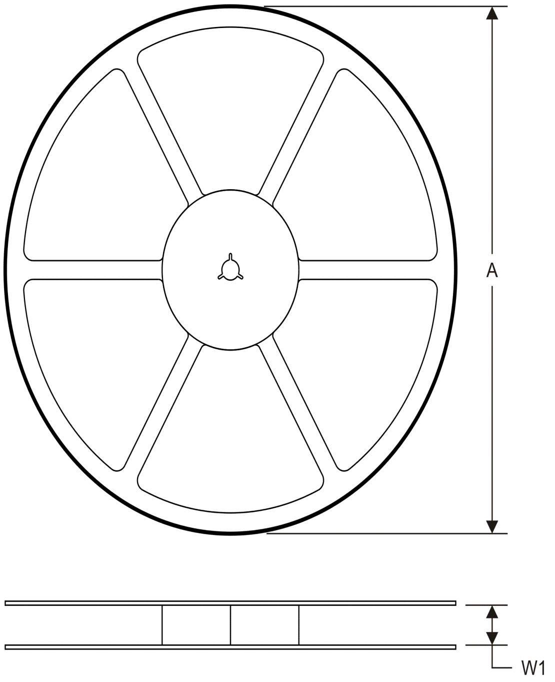
- Military: CD4018B-MIL

NOTE: Qualified Version Definitions:

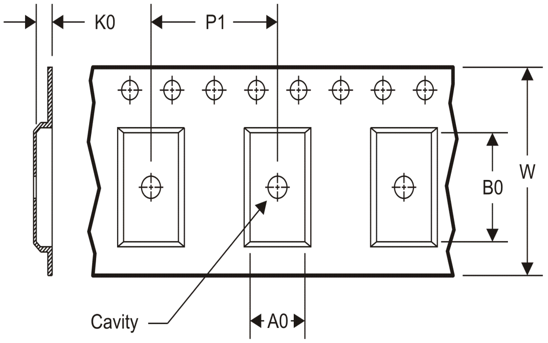
- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



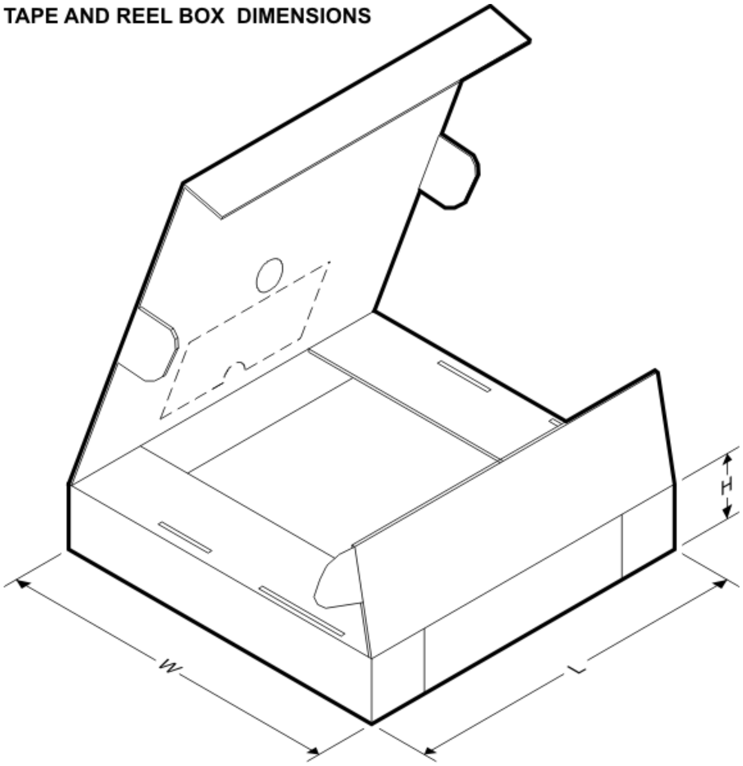
A0	Dimension designed to accommodate the component width
B0	Dimension designed to accommodate the component length
K0	Dimension designed to accommodate the component thickness
W	Overall width of the carrier tape
P1	Pitch between successive cavity centers

TAPE AND REEL INFORMATION

*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Reel Diameter (mm)	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P1 (mm)	W (mm)	Pin1 Quadrant
CD4018BM96	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	16.0	Q1
CD4018BNSR	SO	NS	16	2000	330.0	16.4	8.2	10.5	2.5	12.0	16.0	Q1

TAPE AND REEL BOX DIMENSIONS

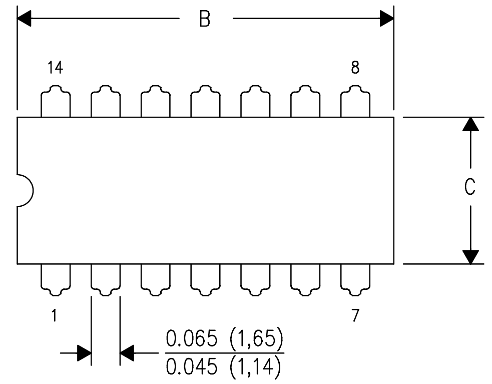


*All dimensions are nominal

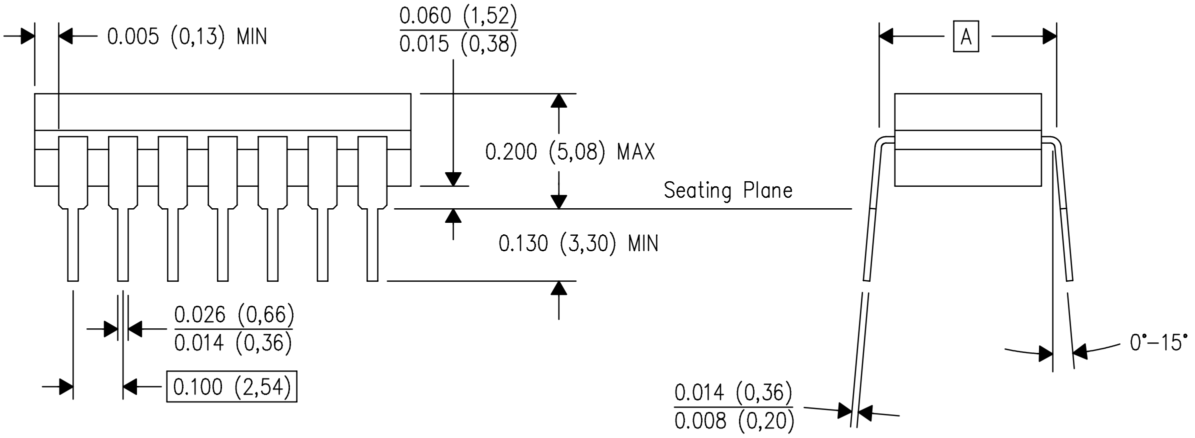
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CD4018BM96	SOIC	D	16	2500	333.2	345.9	28.6
CD4018BNSR	SO	NS	16	2000	367.0	367.0	38.0

J (R-GDIP-T**) CERAMIC DUAL IN-LINE PACKAGE

14 LEADS SHOWN



DIM \ PINS **	14	16	18	20
A	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	——	——	——	——
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)

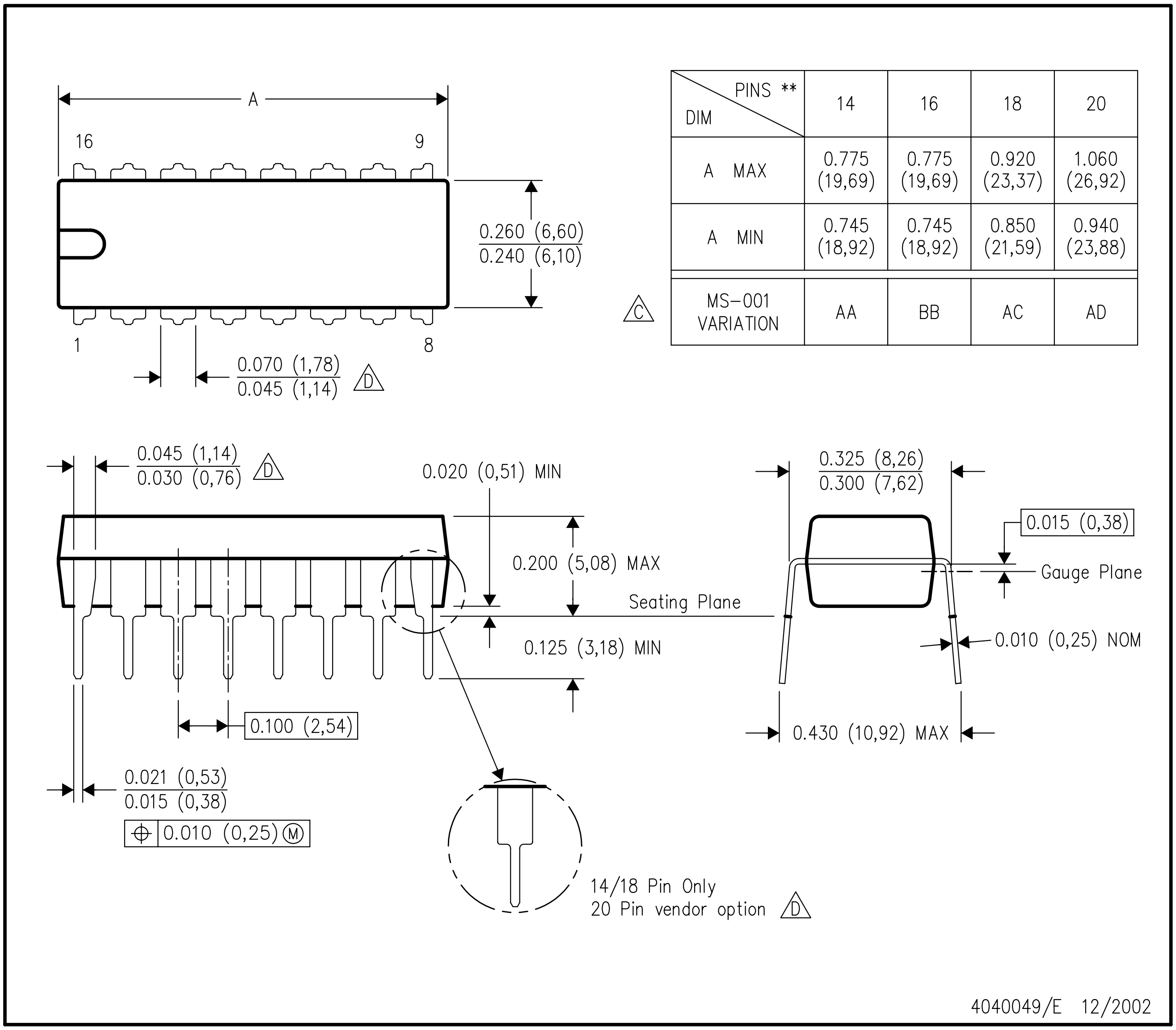


4040083/F 03/03

NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
- E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

N (R–PDIP–T**) PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

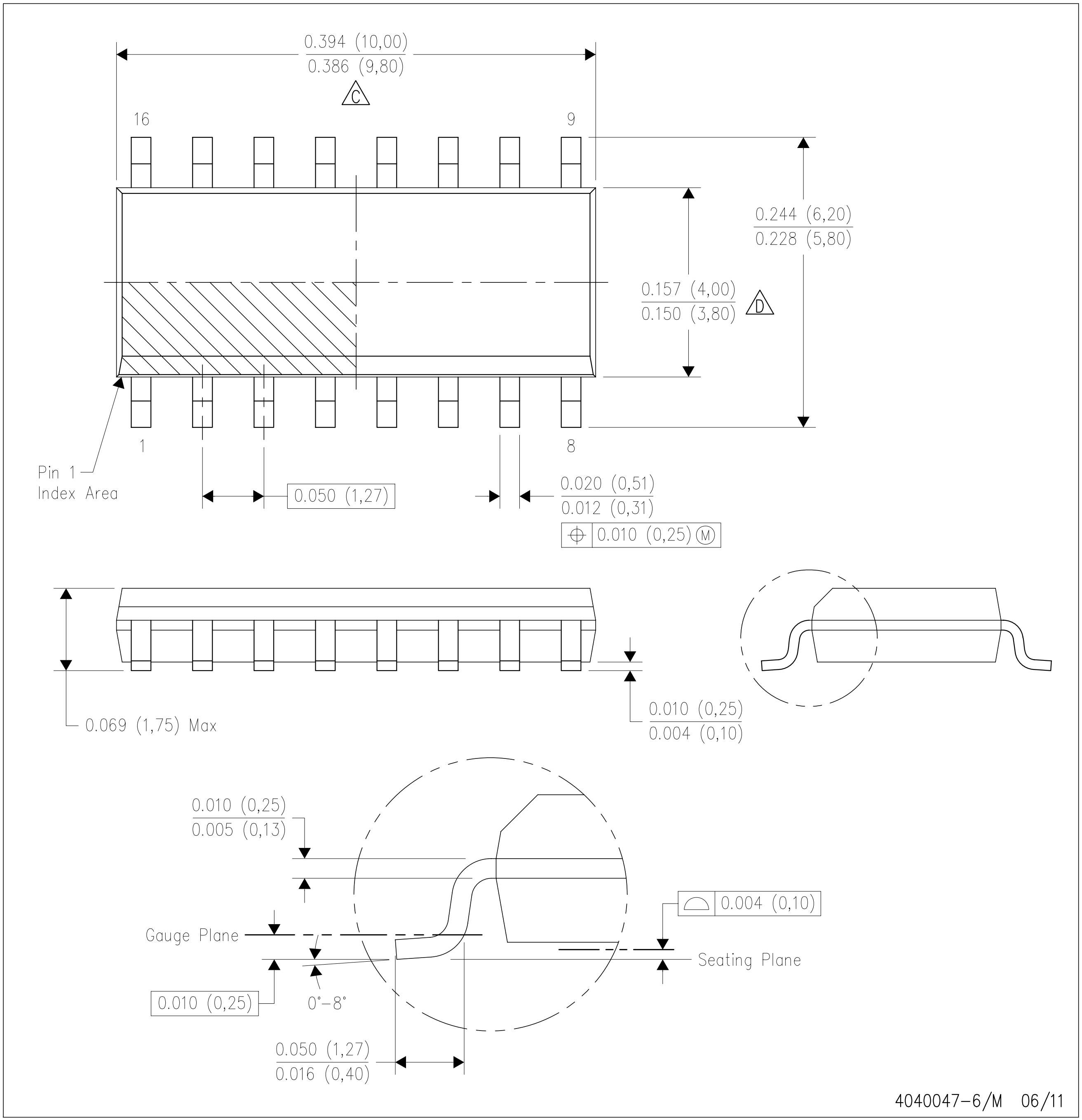


PINS ** DIM	14	16	18	20
A MAX	0.775 (19,69)	0.775 (19,69)	0.920 (23,37)	1.060 (26,92)
A MIN	0.745 (18,92)	0.745 (18,92)	0.850 (21,59)	0.940 (23,88)
△C MS–001 VARIATION	AA	BB	AC	AD

4040049/E 12/2002

NOTES:
A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
△C Falls within JEDEC MS–001, except 18 and 20 pin minimum body length (Dim A).
△D The 20 pin end lead shoulder width is a vendor option, either half or full width.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:

A. All linear dimensions are in inches (millimeters).

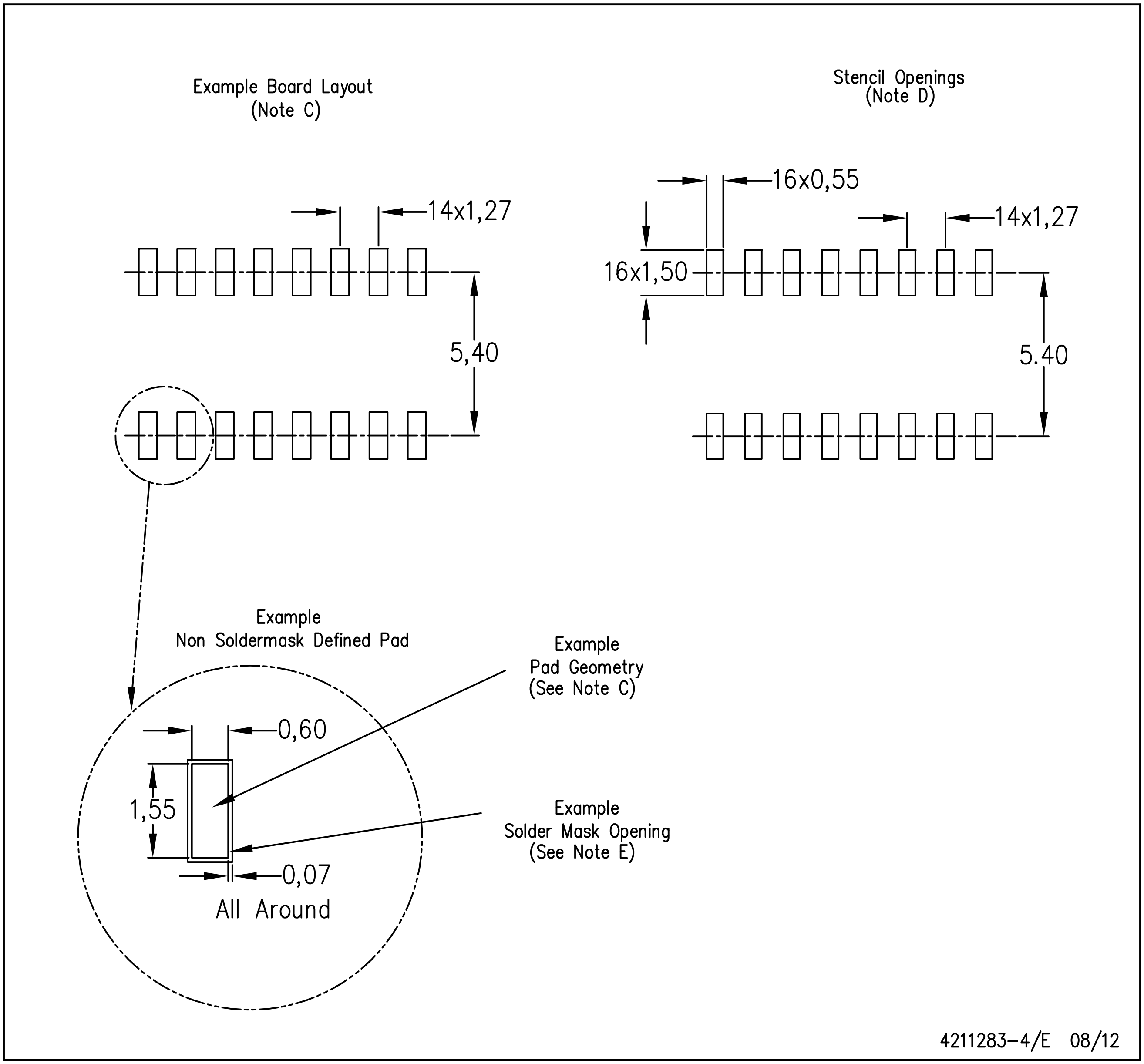
B. This drawing is subject to change without notice.

C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.006 (0,15) each side.

D. Body width does not include interlead flash. Interlead flash shall not exceed 0.017 (0,43) each side.

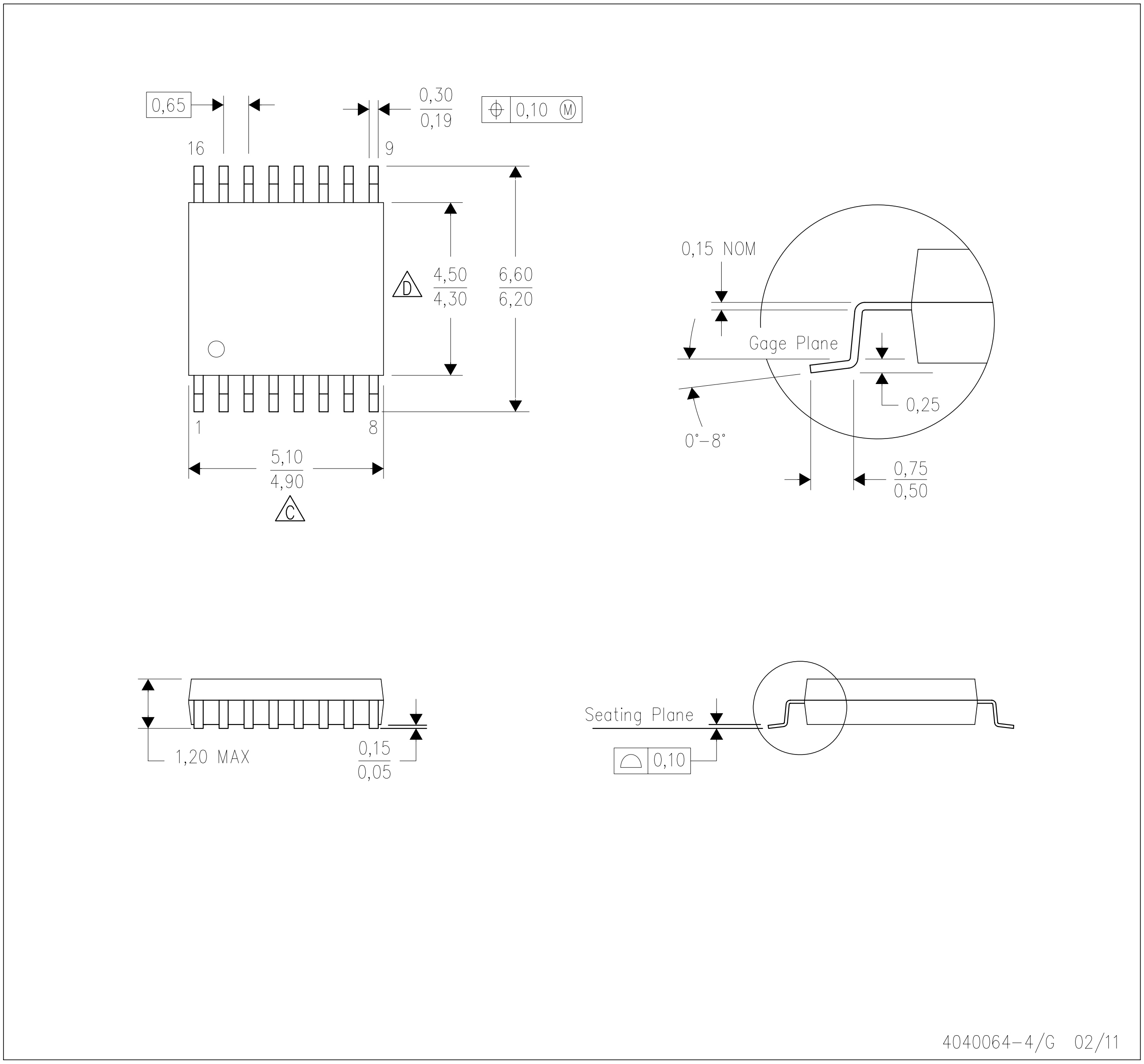
E. Reference JEDEC MS-012 variation AC.

D (R–PDSO–G16) PLASTIC SMALL OUTLINE



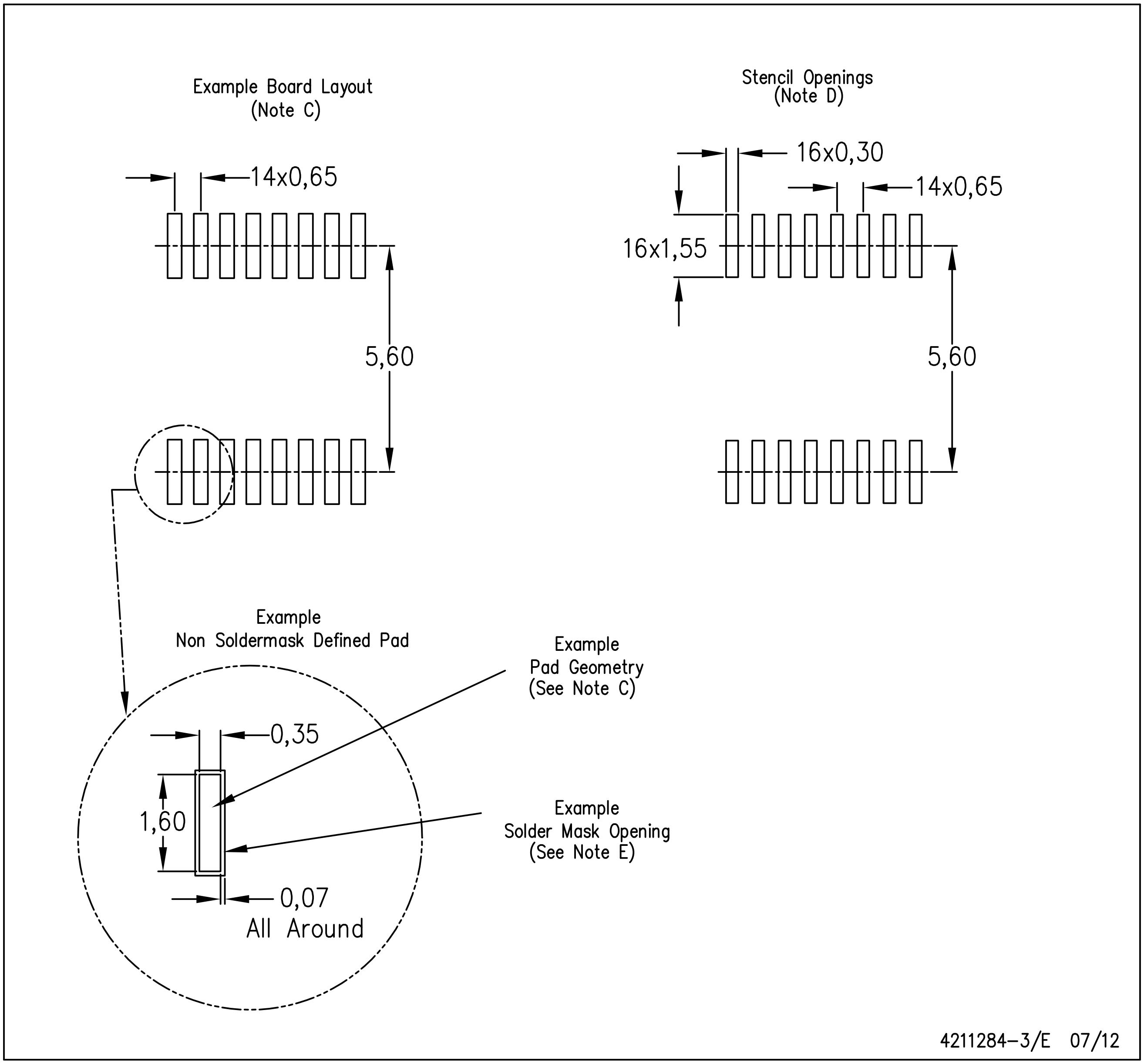
NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Publication IPC–7351 is recommended for alternate designs.
- D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.
- E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

PW (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M–1994.
- B. This drawing is subject to change without notice.
- C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0,15 each side.
- D. Body width does not include interlead flash. Interlead flash shall not exceed 0,25 each side.
- E. Falls within JEDEC MO–153

PW (R–PDSO–G16) PLASTIC SMALL OUTLINE



NOTES:

A. All linear dimensions are in millimeters.

B. This drawing is subject to change without notice.

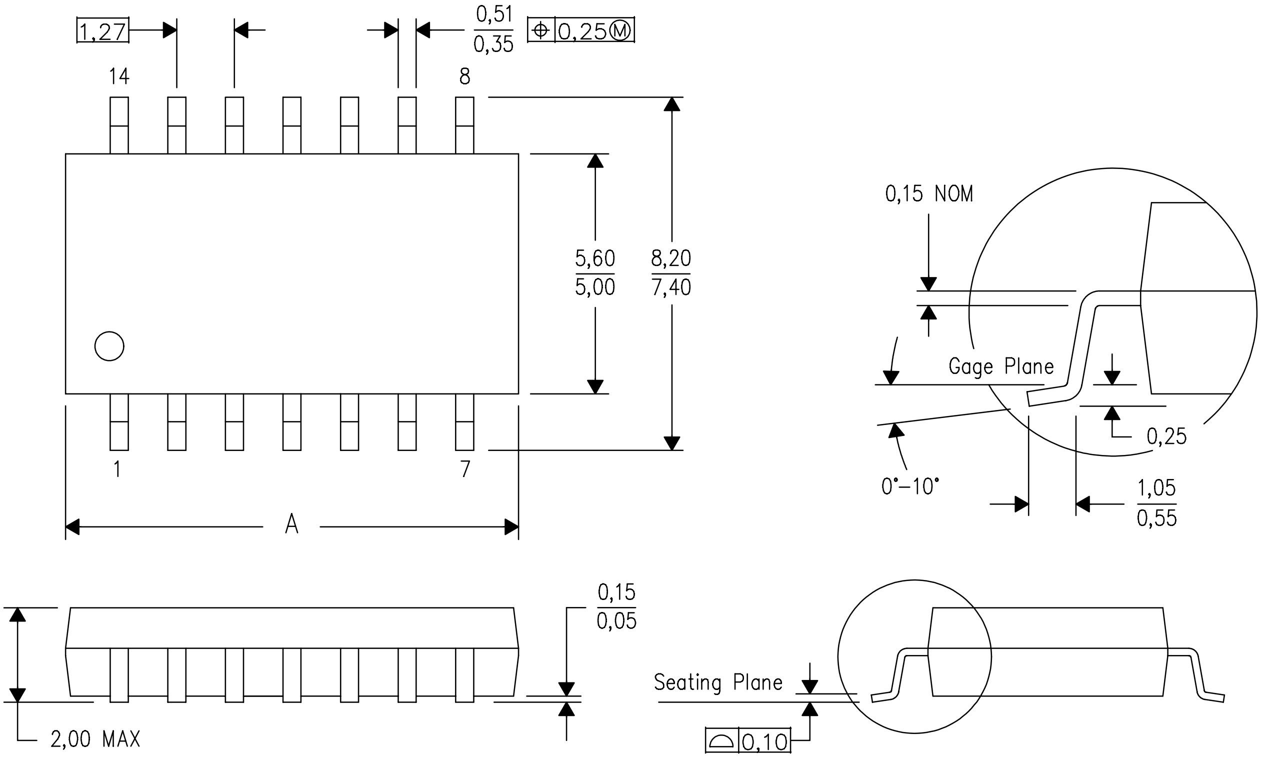
C. Publication IPC–7351 is recommended for alternate designs.

D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC–7525 for other stencil recommendations.

E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

NS (R-PDSO-G**) PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



PINS ** / DIM	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

4040062/C 03/03

NOTES:
- A. All linear dimensions are in millimeters.
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

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