

SN74BCT2414

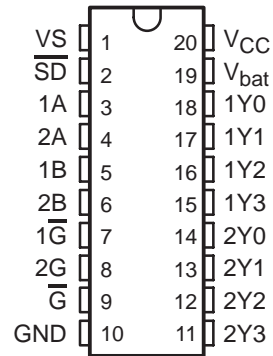
MEMORY DECODER

WITH ON-CHIP SUPPLY VOLTAGE MONITOR

SCBS059B – MARCH 1989 – REVISED NOVEMBER 1993

- BiCMOS Design Substantially Reduces Standby Current
- Two Independent 2-Line to 4-Line Decoders or One 3-Line to 8-Line Decoder
- Separate Enable Inputs for Easy Cascading
- Two Supply Voltage Terminals (V_{CC} and V_{bat})
- Built-In Supply-Voltage Monitor for V_{CC}
- Automatic Cut Off of Outputs During V_{CC} Fail
- Package Options Include Plastic Small-Outline (DW) Packages and Standard Plastic 300-mil DIPs (N)

DW OR N PACKAGE
(TOP VIEW)



description

The SN74BCT2414 is a decoder specially designed to be used in memory systems with battery backup during power failure. The two independent 2-line to 4-line decoders with separate and common control inputs may be externally cascaded to implement a 3-line to 8-line decoder.

The circuit has two supply voltage inputs: the voltage monitor (bandgap) is powered via the V_{CC} terminal; the internal logic of the circuit is powered via the V_{bat} terminal. In case V_{CC} drops below 3.65 V (nominal), the voltage monitor forces the voltage-control (VS) and decoder outputs (Y) to the high level. VS may be used to disconnect the supply voltage of the memories (V_{bat}) from the system supply. This output is switched off when the on-chip supply voltage monitor detects a power failure.

The SN74BCT2414 is characterized for operation from 0°C to 70°C.

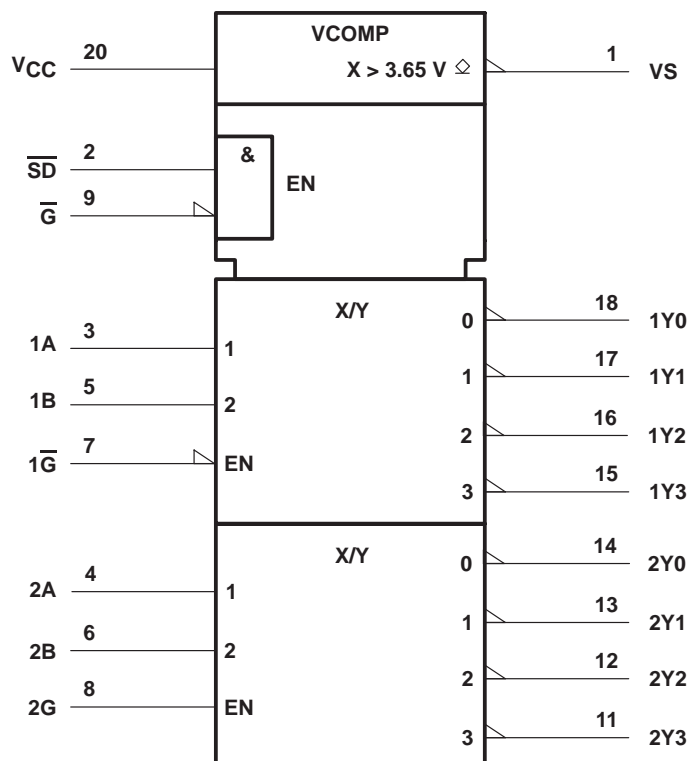
SN74BCT2414

MEMORY DECODER

WITH ON-CHIP SUPPLY VOLTAGE MONITOR

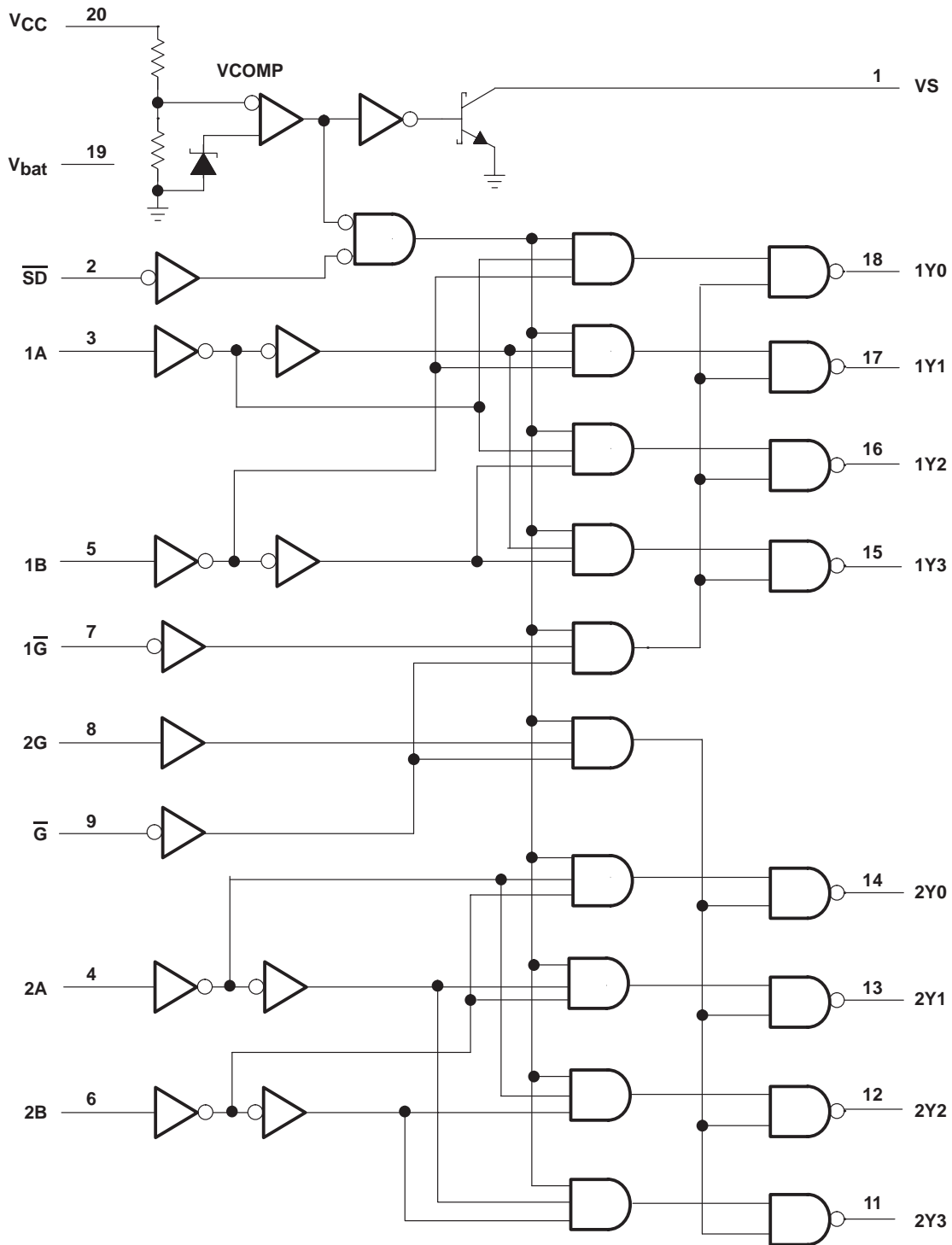
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logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

logic diagram (positive logic)



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MEMORY DECODER

WITH ON-CHIP SUPPLY VOLTAGE MONITOR

SCBS059B – MARCH 1989 – REVISED NOVEMBER 1993

FUNCTION TABLES

INPUTS					OUTPUTS			
CONTROL			SELECT					
\overline{G}	$1\overline{G}$	\overline{SD}	1B	1A	1Y0	1Y1	1Y2	1Y3
H	X	X	X	X	H	H	H	H
X	H	X	X	X	H	H	H	H
X	X	L	X	X	H	H	H	H
L	L	H	L	L	L	H	H	H
L	L	H	L	H	H	L	H	H
L	L	H	H	L	H	H	L	H
L	L	H	H	H	H	H	H	L

INPUTS					OUTPUTS			
CONTROL			SELECT					
\overline{G}	2G	\overline{SD}	2B	2A	2Y0	2Y1	2Y2	2Y3
H	X	X	X	X	H	H	H	H
X	H	X	X	X	H	H	H	H
X	X	L	X	X	H	H	H	H
L	H	H	L	L	L	H	H	H
L	H	H	L	H	H	L	H	H
L	H	H	H	L	H	H	L	H
L	H	H	H	H	H	H	H	L

NOTE: For a 3-line to 8-line decoder, the following pins must be shorted: $1\overline{G}$ to 2G, 1A to 2A and 1B to 2B.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)[†]

Supply voltage range, V_{bat}	–0.5 V to 7 V
Supply voltage range, V_{CC}	–0.5 V to 7 V
Supply voltage V_{CC} with respect to V_{bat}	–1.5 V
Input voltage range, V_I	–0.5 V to $V_{CC} + 0.5$ V
Off-state output voltage range at V_S	–0.5 V to 7 V
Voltage range applied to any Y output in the power-off state	–0.5 V to 7 V
Voltage applied to any Y output in the power-off state with respect to V_{bat}	0.5 V
Operating free-air temperature range	0°C to 70°C
Storage temperature range	–65°C to 150°C

[†] Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability



recommended operating conditions

		MIN	NOM	MAX	UNIT
V_{CC}	Supply voltage	4.5	5	5.5	V
V_{bat}	Supply voltage	4.5	5	5.5	V
V_{IH}	High-level input voltage	2			V
V_{IL}	Low-level input voltage			0.8	V
I_{IK}	Input clamp current			–18	mA
I_{OH}	High-level output current			–400	μ A
I_{OL}	Low-level output current	Y outputs		8	mA
		VS outputs		20	
t_t	Input transition time	0		10	ns/V
T_A	Operating free-air temperature	0		70	$^{\circ}$ C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS		MIN	TYP†	MAX	UNIT
V_{IK}		$V_{CC} = 4.5$ V,	$I_I = -18$ mA			–1.2	V
V_{OH}		$V_{bat} = V_{CC} = 4.5$ V	$I_{OH} = -20$ μ A	4.4			V
			$I_{OH} = -400$ μ A	3.5			
		$V_{bat} = 2$ V, $V_{CC} = 0$,	$I_{OH} = -50$ μ A	1.8			
V_{OL}	All except VS	$V_{bat} = V_{CC} = 4.5$ V	$I_{OL} = 4$ mA			0.4	V
			$I_{OL} = 8$ mA			0.5	
	VS	$V_{bat} = V_{CC} = 4.5$ V,	$I_{OL} = 20$ mA			1	
V_T^{\ddagger}					3.65		V
I_I		$V_{bat} = V_{CC} = 5.5$ V,	$V_I = 5.5$ V			100	μ A
I_{IH}		$V_{bat} = V_{CC} = 5.5$ V,	$V_I = 2.7$ V			± 20	μ A
I_{IL}		$V_{bat} = V_{CC} = 5.5$ V,	$V_I = 0.5$ V			± 20	μ A
I_{OH}	VS	$V_{bat} = 4.5$ V,	$V_{CC} = 0$			1	μ A
I_O^{\S}		$V_{bat} = V_{CC} = 5.5$ V,	$V_O = 2.25$ V	–30		–200	mA
I_{CC}		$V_{bat} = V_{CC} = 5.5$ V	Outputs high			3	mA
			Outputs low			3	
I_{bat}		$V_{bat} = 2.5$ V,	$V_{CC} = 0$		1	10	μ A
		$V_{bat} = V_{CC} = 5.5$ V	Outputs high			20	
			Outputs low			3	mA
C_i		$V_{bat} = V_{CC} = 5$ V,	$V_I = 0$ or 3 V		4		pF
C_o	Any Y	$V_{bat} = V_{CC} = 0$			6.5		pF
	VS				5		

† All typical values are at $V_{CC} = 5$ V, $T_A = 25^{\circ}$ C.

‡ This value represents the V_{CC} monitor threshold voltage. Typical range is from 3.5 V to 3.8 V.

§ This output condition has been chosen to produce a current that closely approximates one half of the short-circuit output current, I_{OS} . Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

SN74BCT2414

MEMORY DECODER

WITH ON-CHIP SUPPLY VOLTAGE MONITOR

SCBS059B – MARCH 1989 – REVISED NOVEMBER 1993

switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = 25°C			V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = MIN to MAX†		UNIT
			MIN	TYP	MAX	MIN	MAX	
t _{PLH}	A or B	Any Y	1	5	10	1	12	ns
t _{PHL}			2	5.8	10	2	12	
t _{PLH}	Any \overline{G}	Any Y	1	4.5	9	1	10	ns
t _{PHL}			2	5.5	9	2	11	
t _{PLH}	\overline{SD}	Any Y	2	6.5	11	2	12	ns
t _{PHL}			2	6.5	11	2	12	

switching characteristics (see Note 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V _{CC} = 5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = 25°C			V _{CC} = 4.5 V to 5.5 V, C _L = 50 pF, R1 = 500 Ω, R2 = 500 Ω, T _A = MIN to MAX†		UNIT
			MIN	TYP	MAX	MIN	MAX	
t _{PLH}	V _{CC}	Any Y	10	25	50	10	250	ns
t _{PHL}			15	45	100	15	250	
t _{PLH}	V _{CC}	VS	10	28	50	10	250	ns
t _{PHL}			20	50	100	20	250	

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

NOTE 1: Load circuits and voltage waveforms are shown in Section 1.



APPLICATION INFORMATION

A typical application circuit for a battery-buffered memory in a microcomputer system is shown in Figure 1 which uses the SN74BCT2414. When power fails, the supply-voltage supervisor (TL7705) resets the microcomputer and disables the memory by switching the shutdown input \overline{SD} of the memory decoder to a logic zero. All memory decoder outputs are forced to a logic one. Abnormal write commands from the microprocessor, which may be issued during further voltage breakdown, no longer affect the contents of the memory. When the system supply voltage becomes lower than approximately 3.65 V, the voltage monitor inside the SN74BCT2414 memory decoder disconnects the input buffers of this circuit from the decoding logic internally and keeps all outputs at a logic one. The VS output is also switched off, disconnecting the system supply voltage from the memory circuits. During this low-voltage condition, the memory decoder and the memory circuits are supplied by the battery.



For further information on this device, please contact factory.

Figure 1. Memory System With Battery Backup

PACKAGING INFORMATION

Orderable Device	Status ⁽¹⁾	Package Type	Package Drawing	Pins	Package Qty	Eco Plan ⁽²⁾	Lead/Ball Finish	MSL Peak Temp ⁽³⁾
SN74BCT2414DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74BCT2414DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74BCT2414DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74BCT2414DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74BCT2414DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74BCT2414N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74BCT2414NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	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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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
SN74BCT2414DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
SN74BCT2414DWR	SOIC	DW	20	2000	367.0	367.0	45.0

N (R-PDIP-T**)

16 PINS SHOWN

PLASTIC DUAL-IN-LINE PACKAGE



PINS **	14	16	18	20
DIM				
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)
MS-001 VARIATION	AA	BB	AC	AD



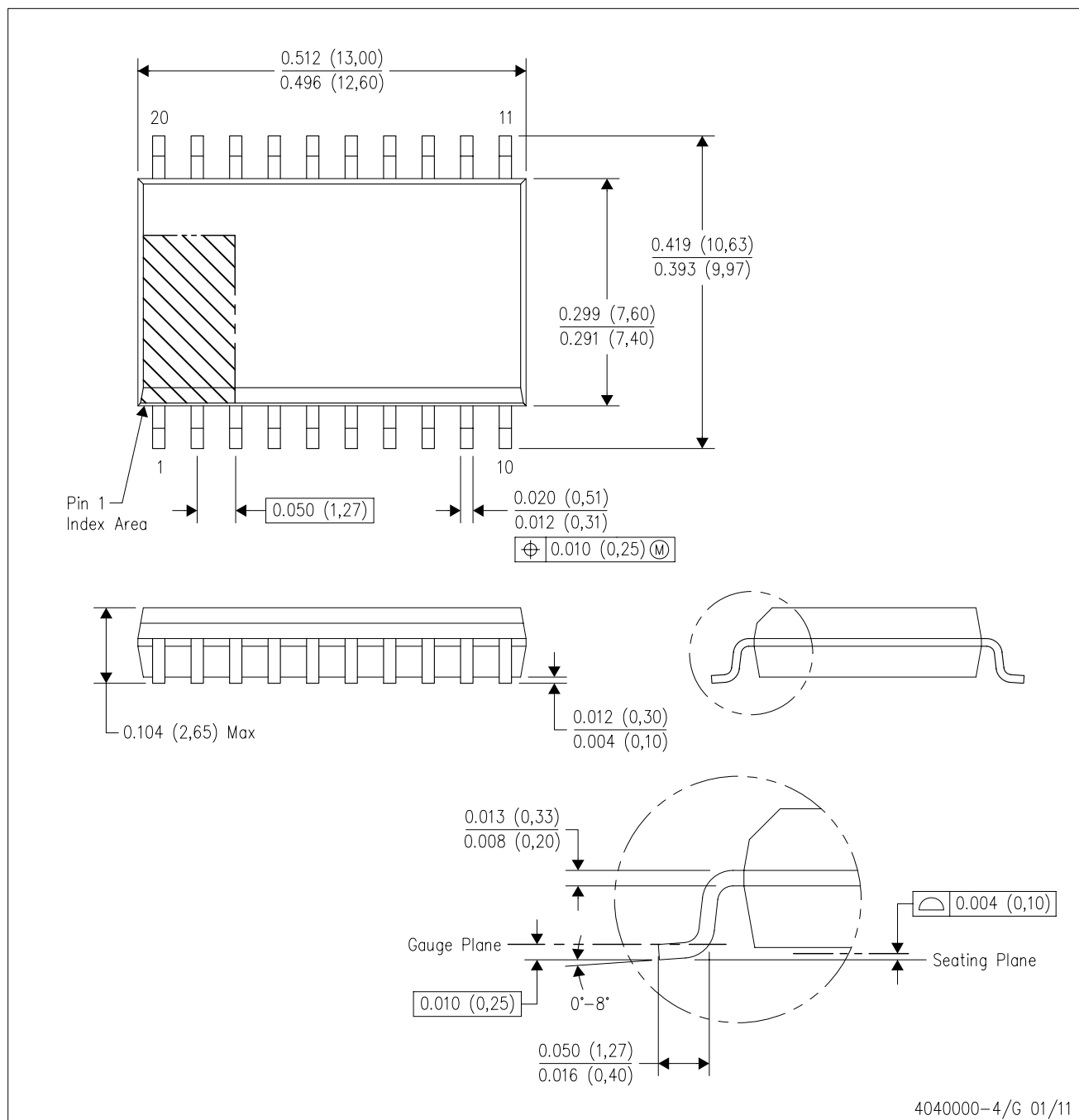
14/18 Pin Only
20 Pin vendor option

4040049/E 12/2002

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

DW (R-PDSO-G20)

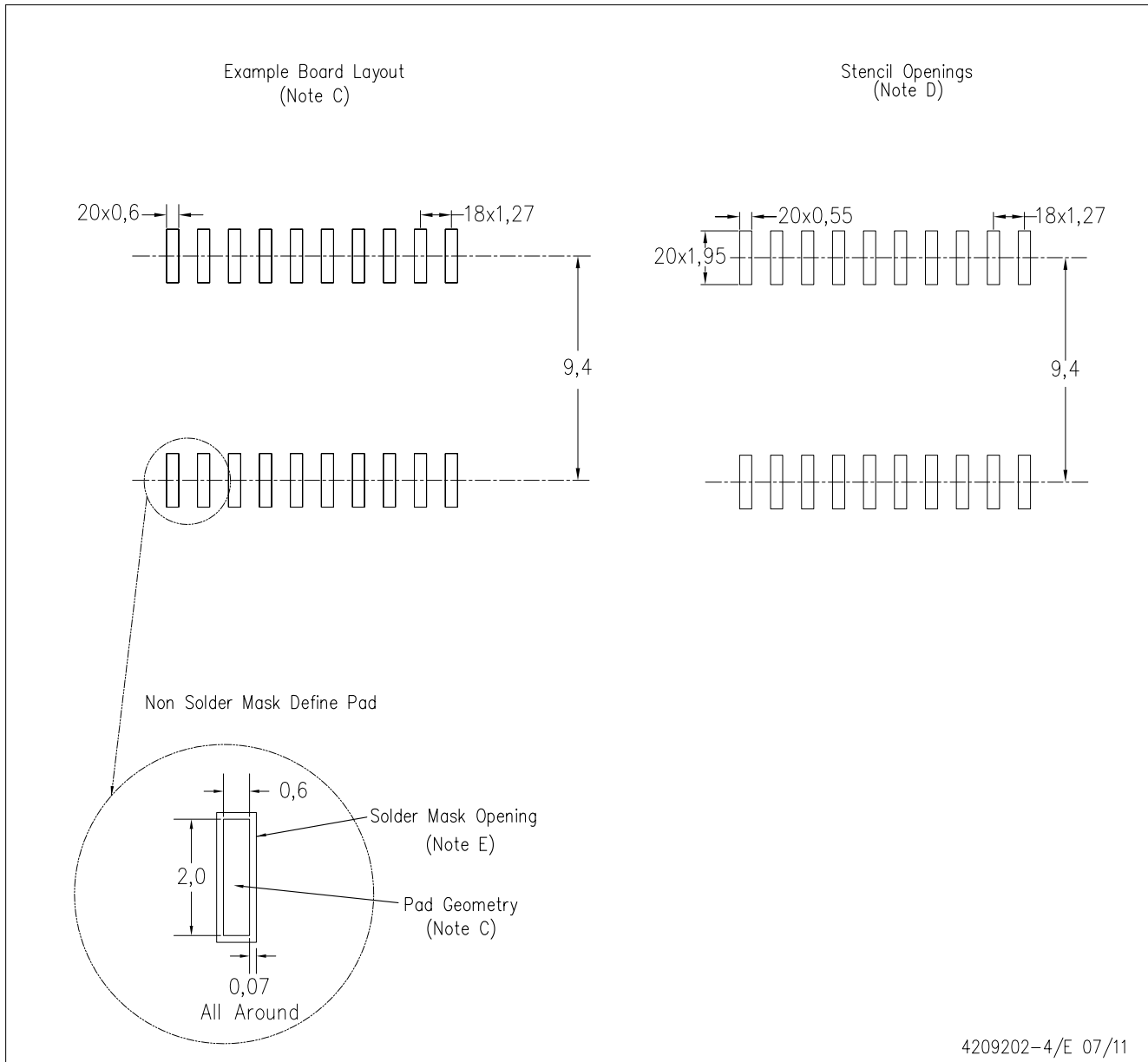
PLASTIC SMALL OUTLINE



- NOTES: A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013 variation AC.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Refer to IPC7351 for alternate board design.
 - 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
 - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

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