- **'LS377 and 'LS378 Contain Eight and Six Flip-Flops, Respectively, with Single-Rail Outputs**

- **'LS379 Contains Four Flip-Flops with Double-Rail Outputs**

- **Individual Data Input to Each Flip-Flop**

- **Applications Include:**
  Buffer/Storage Registers
  Shift Registers
  Pattern Generators

description

These monolithic, positive-edge-triggered flip-flops utilize TTL circuitry to implement D-type flip-flop logic with an enable input. The 'LS377, 'LS378, and 'LS379 devices are similar to 'LS273, 'LS174, and 'LS175, respectively, but feature a common enable instead of a common clear.
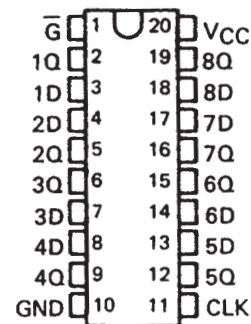
Information at the D inputs meeting the setup time requirements is transferred to the Q outputs on the positive-going edge of the clock pulse if the enable input $\overline{G}$ is low. Clock triggering occurs at a particular voltage level and is not directly related to the transition time of the positive-going pulse. When the clock input is at either the high or low level, the D input signal has no effect at the output. The circuits are designed to prevent false clocking by transitions at the $\overline{G}$ input.

These flip-flops are guaranteed to respond to clock frequencies ranging from 0 to 30 MHz while maximum clock frequency is typically 40 megahertz. Typical power dissipation is 10 milliwatts per flip-flop.
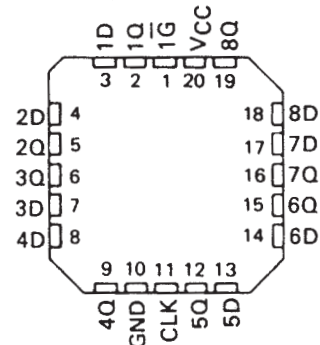
SN54LS377 . . . J PACKAGE
SN74LS377 . . . DW OR N PACKAGE
(TOP VIEW)

$\overline{G}$	1	20	V_{CC}
1Q	2	19	8Q
1D	3	18	8D
2D	4	17	7D
2Q	5	16	7Q
3Q	6	15	6Q
3D	7	14	6D
4D	8	13	5D
4Q	9	12	5Q
GND	10	11	CLK

SN54LS377 . . . FK PACKAGE
(TOP VIEW)

Pins (top): 1D 1Q 1G V_CC 8Q (3 2 1 20 19)

2D	4	18	8D
2Q	5	17	7D
3Q	6	16	7Q
3D	7	15	6Q
4D	8	14	6D

Pins (bottom): 4Q GND CLK 5Q 5D (9 10 11 12 13)

SN54LS378 . . . J OR W PACKAGE
SN74LS378 . . . D OR N PACKAGE
(TOP VIEW)

$\overline{G}$	1	16	V_{CC}
1Q	2	15	6Q
1D	3	14	6D
2D	4	13	5D
2Q	5	12	5Q
3D	6	11	4D
3Q	7	10	4Q
GND	8	9	CLK
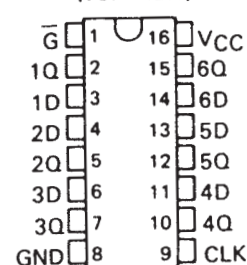
SN54LS378 . . . FK PACKAGE
(TOP VIEW)
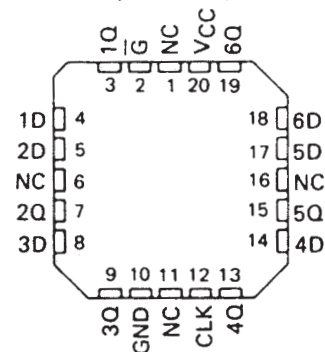
Pins (top): 1Q 1G NC V_CC 6Q (3 2 1 20 19)

1D	4	18	6D
2D	5	17	5D
NC	6	16	NC
2Q	7	15	5Q
3D	8	14	4D

Pins (bottom): 3Q GND NC CLK 4Q (9 10 11 12 13)

NC – No internal connection

FUNCTION TABLE
(EACH FLIP-FLOP)

INPUTS			OUTPUTS	
$\overline{G}$	CLOCK	DATA	Q	$\overline{Q}$
H	X	X	Q_0	$\overline{Q}_0$
L	↑	H	H	L
L	↑	L	L	H
X	L	X	Q_0	$\overline{Q}_0$

TEXAS INSTRUMENTS

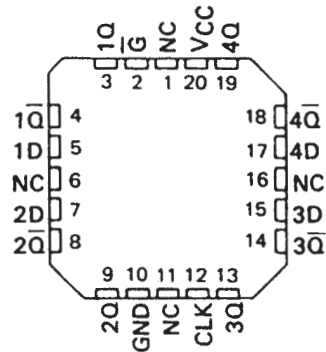POST OFFICE BOX 655303 ● DALLAS, TEXAS 75265

1

SN54LS377, SN54LS378, SN54LS379,
SN74LS377, SN74LS378, SN74LS379
OCTAL, HEX, AND QUAD D-TYPE FLIP-FLOPS WITH ENABLE

SDLS167 – OCTOBER 1976 – REVISED MARCH 1988

SN54LS379 . . . J OR W PACKAGE
SN74LS379 . . . D OR N PACKAGE
(TOP VIEW)

$\overline{G}$	1	16 V$_{CC}$
1Q	2	15 4Q
1$\overline{Q}$	3	14 4$\overline{Q}$
1D	4	13 4D
2D	5	12 3D
2$\overline{Q}$	6	11 3$\overline{Q}$
2Q	7	10 3Q
GND	8	9 CLK

SN54LS379 . . . FK PACKAGE
(TOP VIEW)

Top pins: 1Q (3), $\overline{G}$ (2), NC (1), V$_{CC}$ (20), 4Q (19)

Left pins: 1$\overline{Q}$ (4), 1D (5), NC (6), 2D (7), 2$\overline{Q}$ (8)

Right pins: 4$\overline{Q}$ (18), 4D (17), NC (16), 3D (15), 3$\overline{Q}$ (14)

Bottom pins: 2Q (9), GND (10), NC (11), CLK (12), 3Q (13)

NC – No internal connection

logic diagram (positive logic)

TO   7 ('LS377)
      5 ('LS378)
      3 ('LS379)
OTHER FLIP-FLOPS

$\overline{Q}$
('LS379
ONLY)

logic symbols[†]

'LS377

'LS378

'LS379

[†] These symbols are in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.
Pin numbers shown are for DW, J, and N packages.

2

schematics of inputs and outputs

EQUIVALENT OF DATA INPUT

V_{CC}

R_{eq}

INPUT

'LS379 : R_{eq} = 30 kΩ NOM

others : R_{eq} = 25 kΩ NOM

EQUIVALENT OF CLOCK INPUTS

V_{CC}

R_{eq}

INPUT

'LS379 : R_{eq} = 17 kΩ NOM

others : R_{eq} = 20 kΩ NOM

EQUIVALENT OF ENABLE INPUTS

V_{CC}

R_{eq}

INPUT

'LS379 : R_{eq} = 25 kΩ NOM

others : R_{eq} = 20 kΩ NOM

TYPICAL OF ALL OUTPUTS

V_{CC}

120 Ω NOM

OUTPUT

absolute maximum rating over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) . . . . 7 V

Input voltage . . . . 7 V

Operating free-air temperature range: SN54LS' . . . . −55°C to 125°C

SN74LS' . . . . 0°C to 70°C

Storage temperature range . . . . −65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

		SN54LS' MIN	SN54LS' NOM	SN54LS' MAX	SN74LS' MIN	SN74LS' NOM	SN74LS' MAX	UNIT
Supply voltage, V_{CC}		4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}				−400			−400	µA
Low-level output current, I_{OL}				4			8	mA
Clock frequency, f_{clock}		0		30	0		30	MHz
Width of clock pulse, t_w		20			20			ns
Setup time, t_{su}	Data input	20†			20†			ns
	Enable active-state	25†			25†			
	Enable inactive-state	10†			10†			
Hold time, t_h	Data and enable	5†			5†			ns
Operating free-air temperature, T_A		−55		125	0		70	°C

†The arrow indicates that the rising edge of the clock pulse is used for reference.

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

PARAMETER		TEST CONDITIONS†		SN54LS' MIN	SN54LS' TYP‡	SN54LS' MAX	SN74LS' MIN	SN74LS' TYP‡	SN74LS' MAX	UNIT
V_{IH}	High-level input voltage			2			2			V
V_{IL}	Low-level input voltage					0.7			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN,	I_I = −18 mA			−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, $V_{IL} = V_{IL}$ max, I_{OH} = −400 µA		2.5	3.5		2.7	3.5		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, $V_{IL} = V_{IL}$ max	I_{OL} = 4 mA		0.25	0.4		0.25	0.4	V
			I_{OL} = 8 mA					0.35	0.5	
I_I	Input current at maximum input voltage	V_{CC} = MAX,	V_I = 7 V			0.1			0.1	mA
I_{IH}	High-level input current	V_{CC} = MAX,	V_I = 2.7 V			20			20	µA
I_{IL}	Low-level input current	V_{CC} = MAX,	V_I = 0.4 V			−0.4			−0.4	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX		−20		−100	−20		−100	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2	'LS377		17	28		17	28	mA
			'LS378		13	22		13	22	mA
			'LS379		9	15		9	15	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Note more than one input should be shorted at a time, and duration of the short-circuit should not exceed one second.
NOTE 2: With all outputs open and ground applied to all data and enable inputs, I_{CC} is measured after a momentary ground, then 4.5 V, is applied to clock.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{max}	Maximum clock frequency	C_L = 15 pF,	30	40		MHz
t_{PLH}	Propagation delay time, low-to-high-level output from clock	R_L = 2 kΩ		17	27	ns
t_{PHL}	Propagation delay time, high-to-low-level output from clock	See Note 3		18	27	ns

NOTE 3: Load circuits and voltage waveforms are shown in Section 1.

PACKAGE OPTION ADDENDUM

PACKAGING INFORMATION

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
5962-8992501EA	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
5962-8992501FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
5962-8992501FA	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
JM38510/32504B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/32504B2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
JM38510/32504BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
JM38510/32504BRA	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
JM38510/32504BSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
JM38510/32504BSA	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SN54LS377J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SN54LS377J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SN54LS378J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN54LS378J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN54LS379J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN54LS379J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SN74LS377DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DW	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWR	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWRE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377DWRG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS377N	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS377N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74LS377N3	OBSOLETE	PDIP	N	20		TBD	Call TI	Call TI
SN74LS377NE4	ACTIVE	PDIP	N	20	20	Pb-Free	CU NIPDAU	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]
						(RoHS)		
SN74LS377NE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS377NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377NSR	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377NSRE4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS377NSRG4	ACTIVE	SO	NS	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378D	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DE4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DG4	ACTIVE	SOIC	D	16	40	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DR	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DRE4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378DRG4	ACTIVE	SOIC	D	16	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
SN74LS378N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS378N	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS378N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS378N3	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS378NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS378NE4	ACTIVE	PDIP	N	16	25	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
SN74LS379D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI
SN74LS379D	OBSOLETE	SOIC	D	16		TBD	Call TI	Call TI

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
SN74LS379J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74LS379J	OBSOLETE	CDIP	J	16		TBD	Call TI	Call TI
SN74LS379N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SN74LS379N	OBSOLETE	PDIP	N	16		TBD	Call TI	Call TI
SNJ54LS377FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS377FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS377J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SNJ54LS377J	ACTIVE	CDIP	J	20	1	TBD	A42	N / A for Pkg Type
SNJ54LS377W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54LS377W	ACTIVE	CFP	W	20	1	TBD	Call TI	N / A for Pkg Type
SNJ54LS378FK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
SNJ54LS378FK	OBSOLETE	LCCC	FK	20		TBD	Call TI	Call TI
SNJ54LS378J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS378J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS378W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS378W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS379FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS379FK	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
SNJ54LS379J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS379J	ACTIVE	CDIP	J	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS379W	ACTIVE	CFP	W	16	1	TBD	A42	N / A for Pkg Type
SNJ54LS379W	ACTIVE	CFP	W	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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![Texas Instruments logo] **PACKAGE MATERIALS INFORMATION**

TAPE AND REEL INFORMATION

REEL DIMENSIONS

Reel Diameter

Reel Width (W1)

TAPE DIMENSIONS

K0 — P1

B0 — W

Cavity — A0

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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

Sprocket Holes

Q1	Q2		Q1	Q2
Q3	Q4		Q3	Q4

User Direction of Feed

Pocket Quadrants

*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
SN74LS377DWR	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
SN74LS377NSR	SO	NS	20	2000	330.0	24.4	8.2	13.0	2.5	12.0	24.0	Q1
SN74LS378DR	SOIC	D	16	2500	330.0	16.4	6.5	10.3	2.1	8.0	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)
SN74LS377DWR	SOIC	DW	20	2000	346.0	346.0	41.0
SN74LS377NSR	SO	NS	20	2000	346.0	346.0	41.0
SN74LS378DR	SOIC	D	16	2500	333.2	345.9	28.6

CERAMIC DUAL IN−LINE PACKAGE

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)

B

14   8

C

1   7

0.065 (1,65)
0.045 (1,14)

0.005 (0,13) MIN

0.060 (1,52)
0.015 (0,38)

0.200 (5,08) MAX

Seating Plane

0.130 (3,30) MIN

0.026 (0,66)
0.014 (0,36)

0.100 (2,54)

A

0°−15°

0.014 (0,36)
0.008 (0,20)

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.

W (R−GDFP−F16)   CERAMIC DUAL FLATPACK

Base and Seating Plane

$\dfrac{0.045\ (1,14)}{0.026\ (0,66)}$

$\dfrac{0.285\ (7,24)}{0.245\ (6,22)}$

$\dfrac{0.080\ (2,03)}{0.055\ (1,40)}$

$\dfrac{0.006\ (0,15)}{0.004\ (0,10)}$

0.305 (7,75) MAX

$\dfrac{0.019\ (0,48)}{0.015\ (0,38)}$

1   16

$\dfrac{0.430\ (10,92)}{0.370\ (9,40)}$

0.050 (1,27)

0.005 (0,13) MIN
4 Places

8   9

$\dfrac{0.360\ (9,14)}{0.250\ (6,35)}$ $\dfrac{0.360\ (9,14)}{0.250\ (6,35)}$

4040180−3/D 07/03
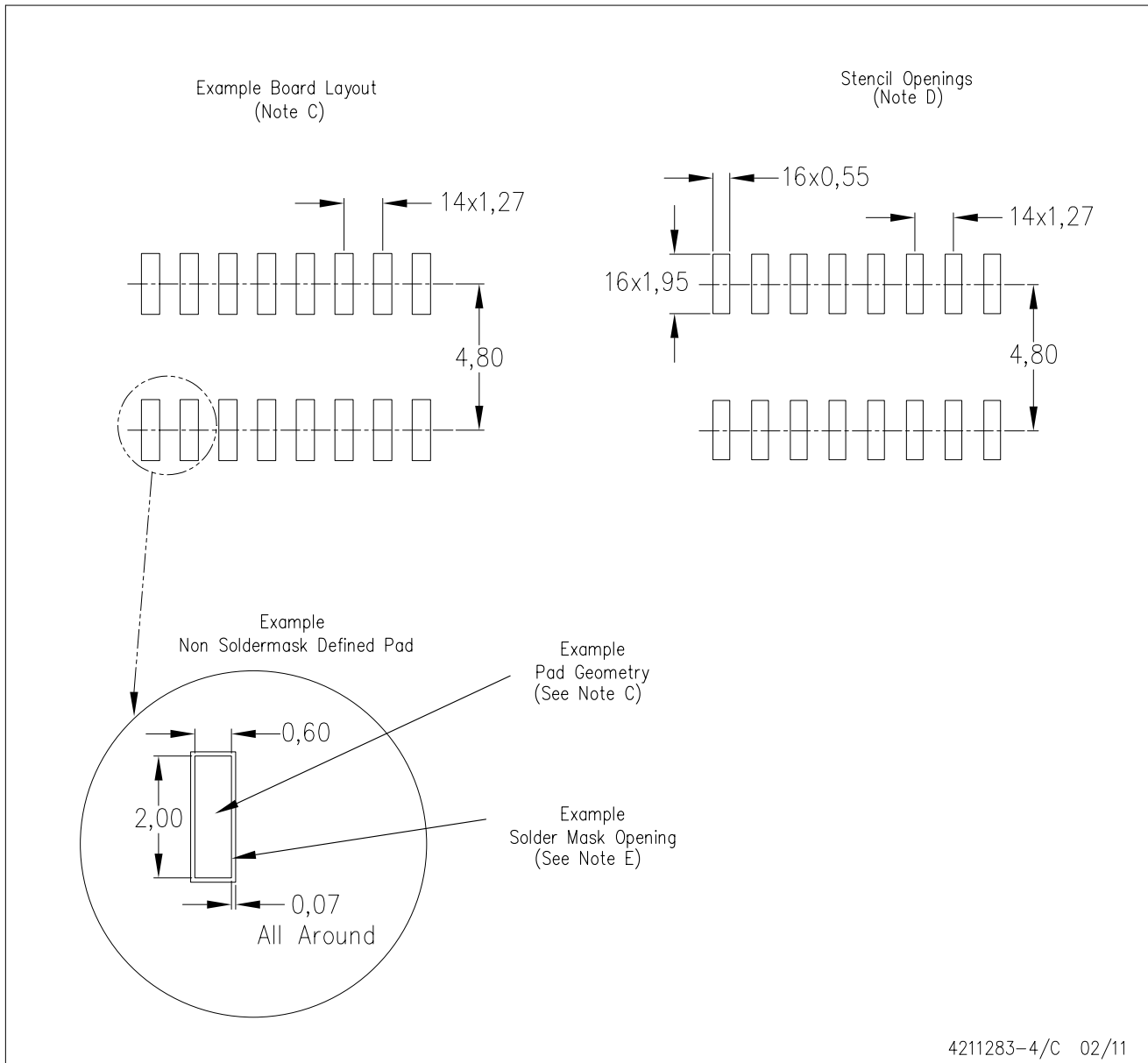
NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
         C.   This package can be hermetically sealed with a ceramic lid using glass frit.
         D.   Index point is provided on cap for terminal identification only.
         E.   Falls within MIL STD 1835 GDFP1−F16 and JEDEC MO−092AC

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W (R–GDFP–F20)   CERAMIC DUAL FLATPACK
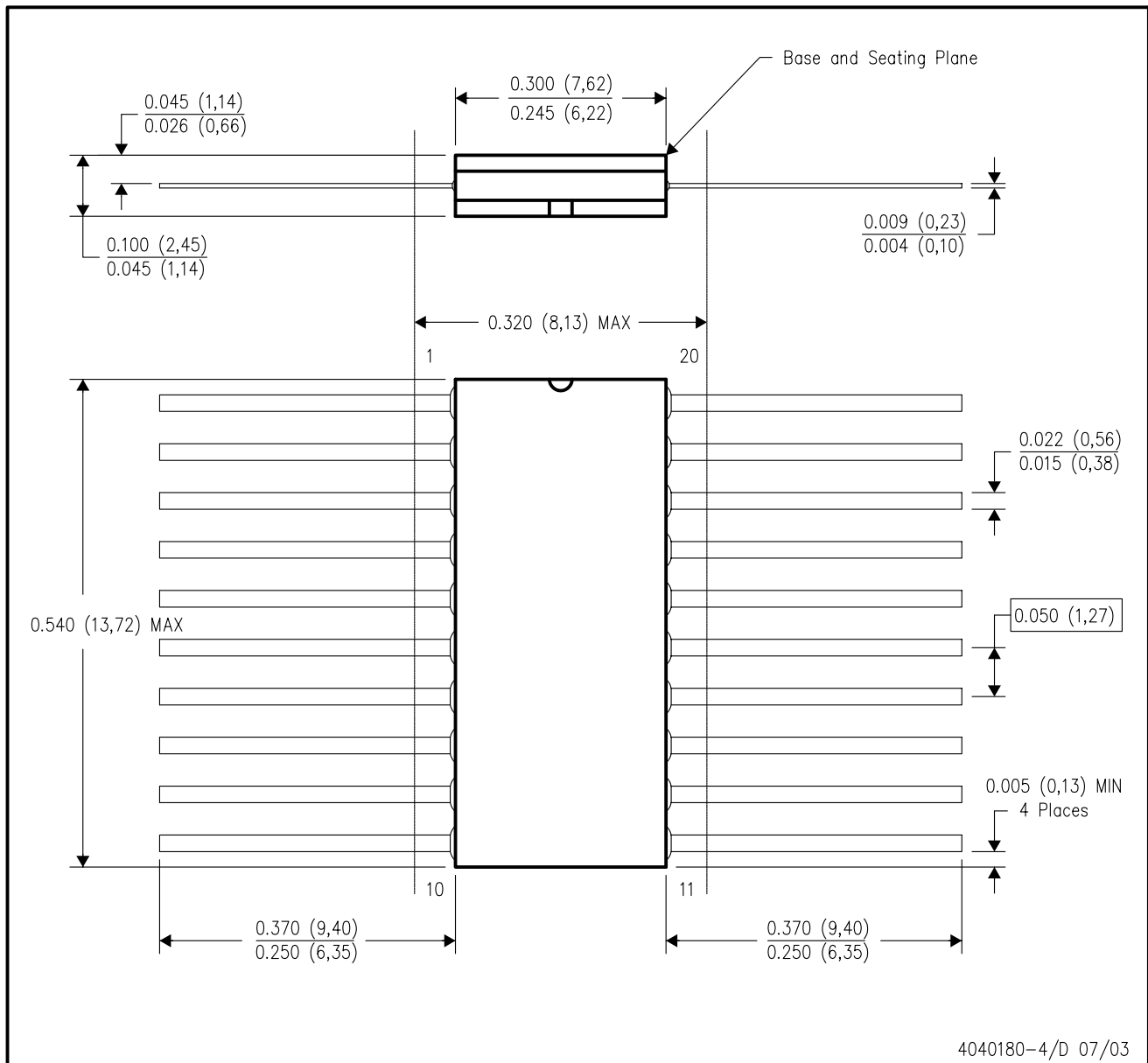
Base and Seating Plane

0.300 (7,62)
―――――――――
0.245 (6,22)

0.045 (1,14)
―――――――――
0.026 (0,66)

0.009 (0,23)
―――――――――
0.004 (0,10)

0.100 (2,45)
―――――――――
0.045 (1,14)

0.320 (8,13) MAX

1   20

0.022 (0,56)
―――――――――
0.015 (0,38)

0.540 (13,72) MAX

0.050 (1,27)

0.005 (0,13) MIN
4 Places

10   11

0.370 (9,40)
―――――――――
0.250 (6,35)

0.370 (9,40)
―――――――――
0.250 (6,35)

4040180–4/D 07/03

NOTES: A.   All linear dimensions are in inches (millimeters).
         B.   This drawing is subject to change without notice.
         C.   This package can be hermetically sealed with a ceramic lid using glass frit.
         D.   Index point is provided on cap for terminal identification only.
         E.   Falls within Mil–Std 1835 GDFP2–F20

FK (S−CQCC−N**)
28 TERMINAL SHOWN

LEADLESS CERAMIC CHIP CARRIER

NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.442 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.740 (18,78)	0.761 (19,32)	0.495 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

$\frac{0.020\ (0,51)}{0.010\ (0,25)}$

$\frac{0.020\ (0,51)}{0.010\ (0,25)}$

$\frac{0.080\ (2,03)}{0.064\ (1,63)}$

$\frac{0.055\ (1,40)}{0.045\ (1,14)}$

$\frac{0.045\ (1,14)}{0.035\ (0,89)}$

$\frac{0.028\ (0,71)}{0.022\ (0,54)}$

0.050 (1,27)

$\frac{0.045\ (1,14)}{0.035\ (0,89)}$

4040140/D 01/11

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. Falls within JEDEC MS−004

N (R–PDIP–T**)

PLASTIC DUAL–IN–LINE PACKAGE

16 PINS SHOWN

	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

16 9

$\dfrac{0.260\ (6,60)}{0.240\ (6,10)}$

1 8

$\dfrac{0.070\ (1,78)}{0.045\ (1,14)}$ △D

$\dfrac{0.045\ (1,14)}{0.030\ (0,76)}$ △D

0.020 (0,51) MIN

0.200 (5,08) MAX

Seating Plane

0.125 (3,18) MIN

0.100 (2,54)

$\dfrac{0.021\ (0,53)}{0.015\ (0,38)}$

⊕ 0.010 (0,25) Ⓜ

14/18 Pin Only
20 Pin vendor option △D

$\dfrac{0.325\ (8,26)}{0.300\ (7,62)}$

0.015 (0,38)

Gauge Plane

0.010 (0,25) NOM

0.430 (10,92) MAX

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.

DW (R−PDSO−G20)   PLASTIC SMALL OUTLINE

$\frac{0.512 \ (13,00)}{0.496 \ (12,60)}$

20   11

$\frac{0.419 \ (10,63)}{0.393 \ (9,97)}$

$\frac{0.299 \ (7,60)}{0.291 \ (7,40)}$

1   10

Pin 1
Index Area

0.050 (1,27)

$\frac{0.020 \ (0,51)}{0.012 \ (0,31)}$

⊕ 0.010 (0,25) Ⓜ

0.104 (2,65) Max

$\frac{0.012 \ (0,30)}{0.004 \ (0,10)}$

$\frac{0.013 \ (0,33)}{0.008 \ (0,20)}$

◁ 0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)

0°−8°

$\frac{0.050 \ (1,27)}{0.016 \ (0,40)}$

4040000−4/G 01/11

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.

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DW (R−PDSO−G20)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

20x0,5   18x1,27

20x0,5   18x1,27

20x2,2

9,2

9,2

Non Solder Mask Define Pad

0,5

Solder Mask Opening
(Note E)

2,2

Pad Geometry
(Note C)

0,07
All Around
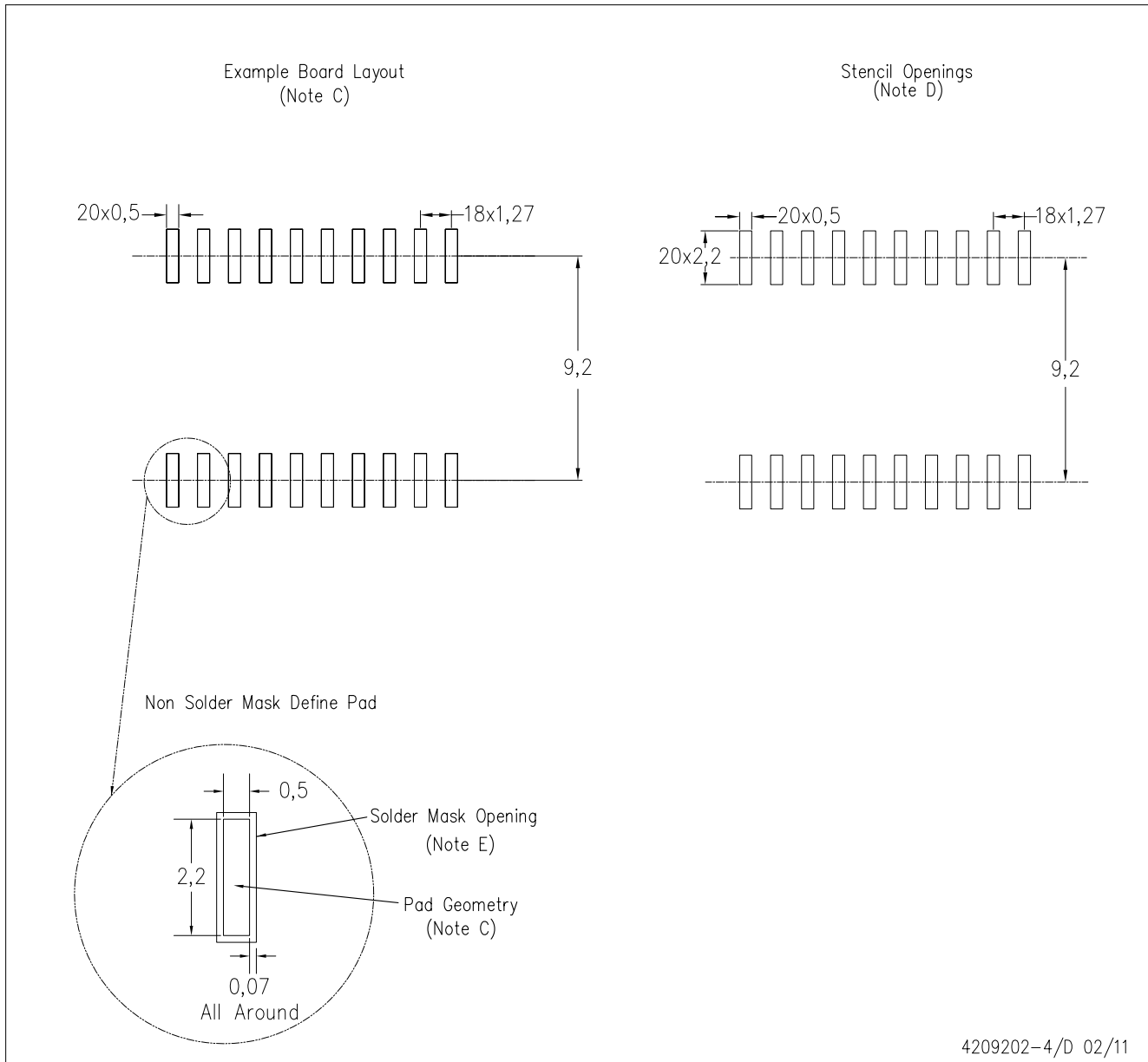
4209202−4/D 02/11

NOTES: A. All linear dimensions are in millimeters.
         B. This drawing is subject to change without notice.
         C. Customers should place a note on the circuit board fabrication drawing not to alter the center solder mask defined pad.
         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.

D (R−PDSO−G16)   PLASTIC SMALL OUTLINE

0.394 (10,00)
0.386 (9,80)
Ⓒ

16   9

0.244 (6,20)
0.228 (5,80)

0.157 (4,00)
0.150 (3,80) Ⓓ

1   8

Pin 1
Index Area

0.050 (1,27)

0.020 (0,51)
0.012 (0,31)

⊕ 0.010 (0,25) Ⓜ

0.069 (1,75) Max

0.010 (0,25)
0.004 (0,10)

0.010 (0,25)
0.005 (0,13)

0.004 (0,10)

Gauge Plane

Seating Plane

0.010 (0,25)   0°–8°

0.050 (1,27)
0.016 (0,40)
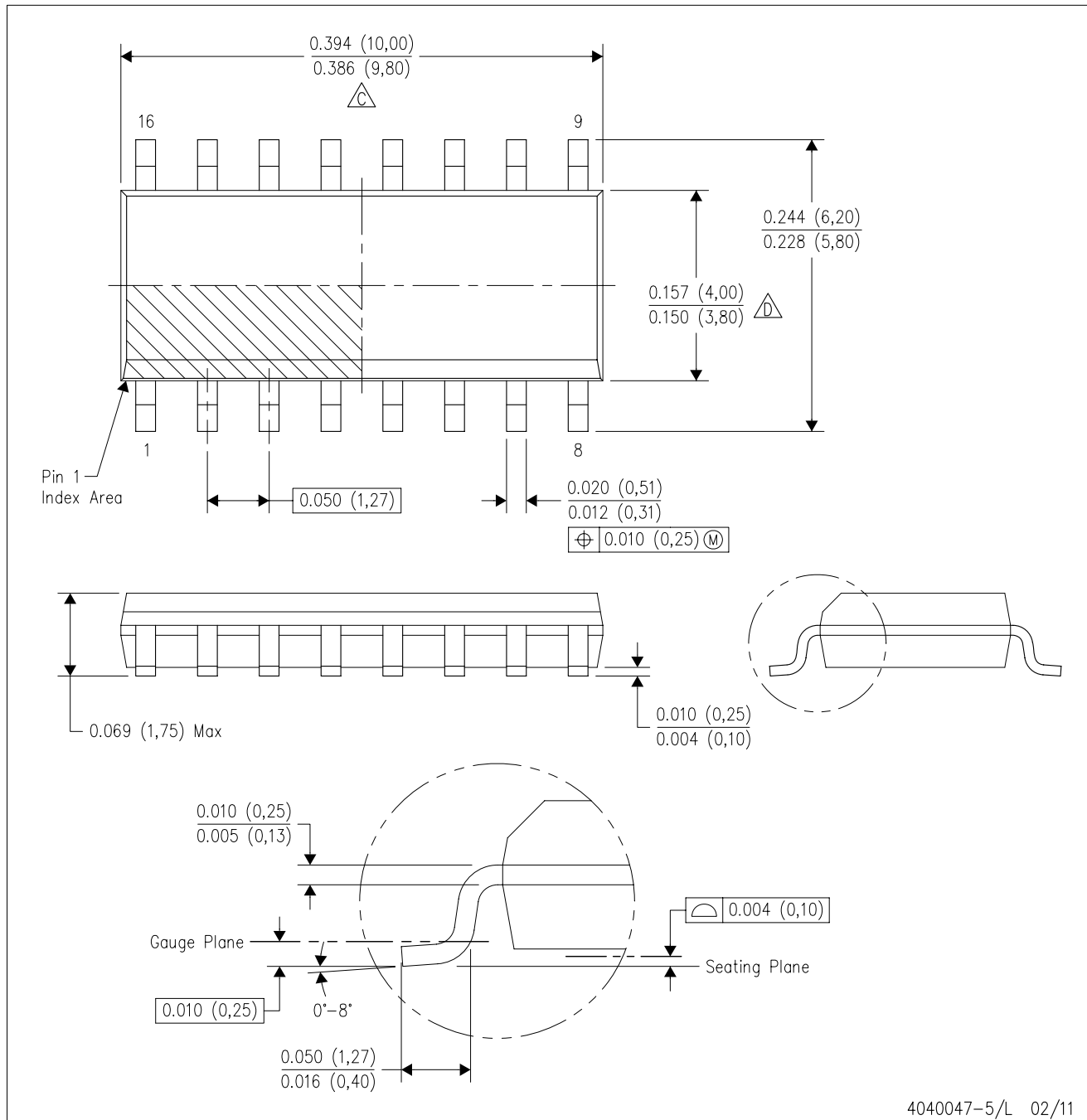
4040047−5/L 02/11

NOTES: A. All linear dimensions are in inches (millimeters).
        B. This drawing is subject to change without notice.
        Ⓒ 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.
        Ⓓ 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.

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D (R−PDSO−G16)   PLASTIC SMALL OUTLINE

Example Board Layout
(Note C)

Stencil Openings
(Note D)

14x1,27

16x0,55

14x1,27

16x1,95

4,80

4,80

Example
Non Soldermask Defined Pad

Example
Pad Geometry
(See Note C)

0,60

2,00

Example
Solder Mask Opening
(See Note E)

0,07
All Around

4211283−4/C 02/11

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.

MECHANICAL DATA

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN

DIM ╲ PINS **	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.

IMPORTANT NOTICE