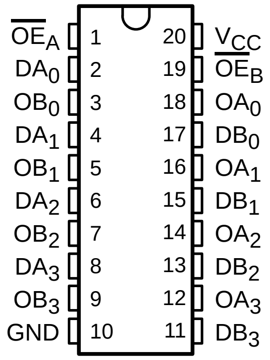
CY54FCT244T, CY74FCT244T
8-BIT BUFFERS/LINE DRIVERS
WITH 3-STATE OUTPUTS

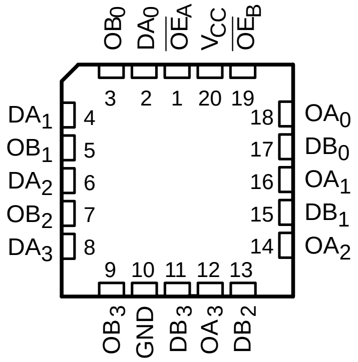
SCCS071 – OCTOBER 2001

- **Function, Pinout, and Drive Compatible With FCT and F Logic**
- **Reduced V_{OH} (Typically = 3.3 V) Versions of Equivalent FCT Functions**
- **Edge-Rate Control Circuitry for Significantly Improved Noise Characteristics**
- **I_{off} Supports Partial-Power-Down Mode Operation**
- **ESD Protection Exceeds JESD 22**
  - **– 2000-V Human-Body Model (A114-A)**
  - **– 200-V Machine Model (A115-A)**
  - **– 1000-V Charged-Device Model (C101)**
- **Matched Rise and Fall Times**
- **Fully Compatible With TTL Input and Output Logic Levels**
- **CY54FCT244T**
  - **– 48-mA Output Sink Current 12-mA Output Source Current**
- **CY74FCT244T**
  - **– 64-mA Output Sink Current 32-mA Output Source Current**
- **3-State Outputs**

CY54FCT244T . . . D PACKAGE
CY74FCT244T . . . P, Q, OR SO PACKAGE
(TOP VIEW)



CY54FCT244T . . . L PACKAGE
(TOP VIEW)



description

The ’FCT244T devices are octal buffers and line drivers designed to be employed as memory address drivers, clock drivers, and bus-oriented transmitters/receivers. These devices provide speed and drive capabilities equivalent to their fastest bipolar logic counterparts, while reducing power consumption. The input and output voltage levels allow direct interface with TTL, NMOS, and CMOS devices without external components.

These devices are fully specified for partial-power-down applications using I_{off}. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

TEXAS INSTRUMENTS

ORDERING INFORMATION

T_A	PACKAGE†		SPEED (ns)	ORDERABLE PART NUMBER	TOP-SIDE MARKING
0°C to 70°C	QSOP – Q	Tape and reel	3.6	CY74FCT244DTQCT	FCT244D
	SOIC – SO	Tube	3.6	CY74FCT244DTSOC	FCT244D
		Tape and reel	3.6	CY74FCT244DTSOCT	
–40°C to 85°C	SOIC – SO	Tube	4.1	CY74FCT244CTSOC	FCT244C
		Tape and reel	4.1	CY74FCT244CTSOCT	
	QSOP – Q	Tape and reel	4.1	CY74FCT244CTQCT	FCT244C
	DIP – P	Tube	4.6	CY74FCT244ATPC	CY74FCT244ATPC
	SOIC – SO	Tube	4.6	CY74FCT244ATSOC	FCT244A
		Tape and reel	4.6	CY74FCT244ATSOCT	
	QSOP – Q	Tape and reel	4.6	CY74FCT244ATQCT	FCT244A
	SOIC – SO	Tube	6.5	CY74FCT244TSOC	FCT244
		Tape and reel	6.5	CY74FCT244TSOCT	
	QSOP – Q	Tape and reel	6.5	CY74FCT244TQCT	FCT244
–55°C to 125°C	CDIP – D	Tube	4.6	CY54FCT244CTDMB	
	LCC – L	Tube	4.6	CY54FCT244CTLMB	
	CDIP – D	Tube	5.1	CY54FCT244ATDMB	
	LCC – L	Tube	5.1	CY54FCT244ATLMB	
	CDIP – D	Tube	7	CY54FCT244TDMB	
	LCC – L	Tube	7	CY54FCT244TLMB	

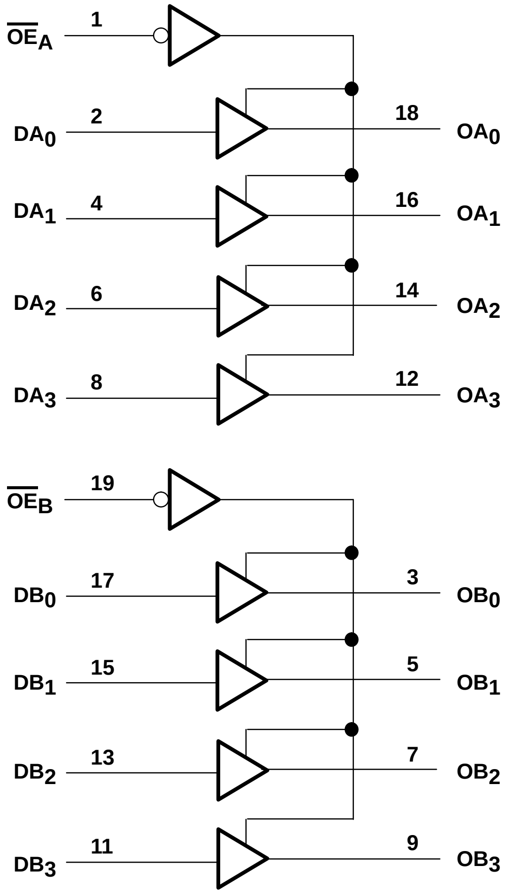
† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.

FUNCTION TABLE

INPUTS			OUTPUT O
$\overline{OE}_A$	$\overline{OE}_B$	D	
L	L	L	L
L	L	H	H
H	H	X	Z

H = High logic level, L = Low logic level,
X = Don’t care, Z = High-impedance state

logic diagram (positive logic)



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

Supply voltage range to ground potential		–0.5 V to 7 V
DC input voltage range		–0.5 V to 7 V
DC output voltage range		–0.5 V to 7 V
DC output current (maximum sink current/pin)		120 mA
Package thermal impedance, θ_{JA} (see Note 1):	P package	69°C/W
	Q package	68°C/W
	SO package	58°C/W
Ambient temperature range with power applied, T_A		–65°C to 135°C
Storage temperature range, T_{stg}		–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.

NOTE 1: The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 2)

		CY54FCT244T			CY74FCT244DT			CY74FCT244T			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
V_{CC}	Supply voltage	4.5	5	5.5	4.75	5	5.25	4.75	5	5.25	V
V_{IH}	High-level input voltage	2			2			2			V
V_{IL}	Low-level input voltage			0.8			0.8			0.8	V
I_{OH}	High-level output current			–12			–32			–32	mA
I_{OL}	Low-level output current			48			64			64	mA
T_A	Operating free-air temperature	–55		125	0		70	–40		85	°C

NOTE 2: All unused inputs of the device must be held at V_{CC} or GND to ensure proper device operation.

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

PARAMETER	TEST CONDITIONS		CY54FCT244T			CY74FCT244T			UNIT
			MIN	TYP[†]	MAX	MIN	TYP[†]	MAX	
V_{IK}	V_{CC} = 4.5 V,	I_{IN} = –18 mA		–0.7	–1.2				V
	V_{CC} = 4.75 V,	I_{IN} = –18 mA					–0.7	–1.2	
V_{OH}	V_{CC} = 4.5 V,	I_{OH} = –12 mA	2.4	3.3					V
	V_{CC} = 4.75 V	I_{OH} = –32 mA				2			
		I_{OH} = –15 mA				2.4	3.3		
V_{OL}	V_{CC} = 4.5 V,	I_{OL} = 48 mA		0.3	0.55				V
	V_{CC} = 4.75 V,	I_{OL} = 64 mA					0.3	0.55	
V_{hys}	All inputs			0.2			0.2		V
I_I	V_{CC} = 5.5 V,	V_{IN} = V_{CC}			5				µA
	V_{CC} = 5.25 V,	V_{IN} = V_{CC}						5	
I_{IH}	V_{CC} = 5.5 V,	V_{IN} = 2.7 V			±1				µA
	V_{CC} = 5.25 V,	V_{IN} = 2.7 V						±1	
I_{IL}	V_{CC} = 5.5 V,	V_{IN} = 0.5 V			±1				µA
	V_{CC} = 5.25 V,	V_{IN} = 0.5 V						±1	
I_{OZH}	V_{CC} = 5.5 V,	V_{OUT} = 2.7 V			10				µA
	V_{CC} = 5.25 V,	V_{OUT} = 2.7 V						10	
I_{OZL}	V_{CC} = 5.5 V,	V_{OUT} = 0.5 V			–10				µA
	V_{CC} = 5.25 V,	V_{OUT} = 0.5 V						–10	
I_{OS}[‡]	V_{CC} = 5.5 V,	V_{OUT} = 0 V	–60	–120	–225				mA
	V_{CC} = 5.25 V,	V_{OUT} = 0 V				–60	–120	–225	
I_{off}	V_{CC} = 0 V,	V_{OUT} = 4.5 V			±1			±1	µA
I_{CC}	V_{CC} = 5.5 V,	$V_{IN} \le 0.2$ V, $V_{IN} \ge V_{CC} - 0.2$ V		0.1	0.2				mA
	V_{CC} = 5.25 V,	$V_{IN} \le 0.2$ V, $V_{IN} \ge V_{CC} - 0.2$ V					0.1	0.2	
ΔI_{CC}	V_{CC} = 5.5 V, V_{IN} = 3.4 V[§], f_1 = 0, Outputs open			0.5	2				mA
	V_{CC} = 5.25 V, V_{IN} = 3.4 V[§], f_1 = 0, Outputs open						0.5	2	
I_{CCD}[¶]	V_{CC} = 5.5 V, One input switching at 50% duty cycle, Outputs open, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, $V_{IN} \le 0.2$ V or $V_{IN} \ge V_{CC} - 0.2$ V			0.06	0.12				mA/ MHz
	V_{CC} = 5.25 V, One input switching at 50% duty cycle, Outputs open, $\overline{OE}_A$ = $\overline{OE}_B$ = GND, $V_{IN} \le 0.2$ V or $V_{IN} \ge V_{CC} - 0.2$ V						0.06	0.12	

[†] Typical values are at V_{CC} = 5 V, T_A = 25°C.

[‡] Not more than one output should be shorted at a time. Duration of short should not exceed one second. The use of high-speed test apparatus and/or sample-and-hold techniques are preferable to minimize internal chip heating and more accurately reflect operational values. Otherwise, prolonged shorting of a high output can raise the chip temperature well above normal and cause invalid readings in other parametric tests. In any sequence of parameter tests, I_{OS} tests should be performed last.

[§] Per TTL-driven input (V_{IN} = 3.4 V); all other inputs at V_{CC} or GND

[¶] This parameter is derived for use in total power-supply calculations.

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

PARAMETER	TEST CONDITIONS			CY54FCT244T			CY74FCT244T			UNIT
				MIN	TYP[†]	MAX	MIN	TYP[†]	MAX	
I_C[#]	V_{CC} = 5.5 V, Outputs open, $\overline{OE}_A = \overline{OE}_B$ = GND	One bit switching at f_1 = 10 MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V		0.7	1.4				mA
			V_{IN} = 3.4 V or GND		1	2.4				
		Eight bits switching at f_1 = 2.5 MHz at 50% duty cycle	V_{IN} = 0.2 V or $V_{IN} \geq V_{CC} - 0.2$ V		1.3	2.6[‖]				
			V_{IN} = 3.4 V or GND		3.3	10.6[‖]				
	V_{CC} = 5.25 V, Outputs open, $\overline{OE}_A = \overline{OE}_B$ = GND	One bit switching at f_1 = 10 MHz at 50% duty cycle	$V_{IN} \leq 0.2$ V or $V_{IN} \geq V_{CC} - 0.2$ V					0.7	1.4	
			V_{IN} = 3.4 V or GND					1	2.4	
		Eight bits switching at f_1 = 2.5 MHz at 50% duty cycle	V_{IN} = 0.2 V or $V_{IN} \geq V_{CC} - 0.2$ V					1.3	2.6[‖]	
			V_{IN} = 3.4 V or GND					3.3	10.6[‖]	
C_i					5	10		5	10	pF
C_o					9	12		9	12	pF

[†] Typical values are at V_{CC} = 5 V, T_A = 25°C.

[#] $I_C = I_{CC} + \Delta I_{CC} \times D_H \times N_T + I_{CCD} (f_0/2 + f_1 \times N_1)$

Where:

I_C = Total supply current
I_{CC} = Power-supply current with CMOS input levels
ΔI_{CC} = Power-supply current for a TTL high input (V_{IN} = 3.4 V)
D_H = Duty cycle for TTL inputs high
N_T = Number of TTL inputs at D_H
I_{CCD} = Dynamic current caused by an input transition pair (HLH or LHL)
f_0 = Clock frequency for registered devices, otherwise zero
f_1 = Input signal frequency
N_1 = Number of inputs changing at f_1

All currents are in milliamperes and all frequencies are in megahertz.

[‖] Values for these conditions are examples of the I_{CC} formula.

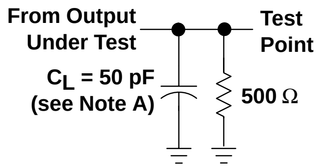
switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY54FCT244T		CY54FCT244AT		CY54FCT244CT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	D	O	1.5	7	1.5	5.1	1.5	4.6	ns
t_{PHL}			1.5	7	1.5	5.1	1.5	4.6	
t_{PZH}	$\overline{OE}$	O	1.5	8.5	1.5	6.5	1.5	6.5	ns
t_{PZL}			1.5	8.5	1.5	6.5	1.5	6.5	
t_{PHZ}	$\overline{OE}$	O	1.5	7.5	1.5	5.9	1.5	5.7	ns
t_{PLZ}			1.5	7.5	1.5	5.9	1.5	5.7	

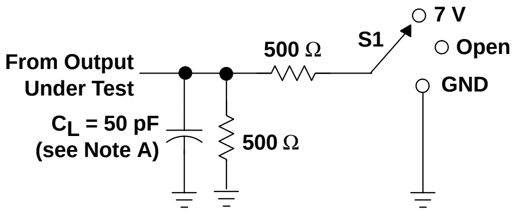
switching characteristics over operating free-air temperature range (see Figure 1)

PARAMETER	FROM (INPUT)	TO (OUTPUT)	CY74FCT244T		CY74FCT244AT		CY74FCT244CT		CY74FCT244DT		UNIT
			MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	
t_{PLH}	D	O	1.5	6.5	1.5	4.6	1.5	4.1	1.5	3.6	ns
t_{PHL}			1.5	6.5	1.5	4.6	1.5	4.1	1.5	3.6	
t_{PZH}	$\overline{OE}$	O	1.5	8	1.5	6.2	1.5	5.8	1.5	4.8	ns
t_{PZL}			1.5	8	1.5	6.2	1.5	5.8	1.5	4.8	
t_{PHZ}	$\overline{OE}$	O	1.5	7	1.5	5.6	1.5	5.2	1.5	4	ns
t_{PLZ}			1.5	7	1.5	5.6	1.5	5.2	1.5	4	

PARAMETER MEASUREMENT INFORMATION

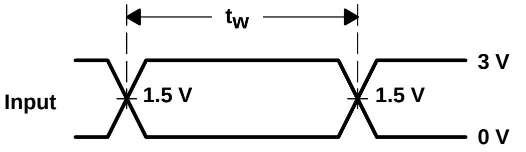


LOAD CIRCUIT FOR
TOTEM-POLE OUTPUTS

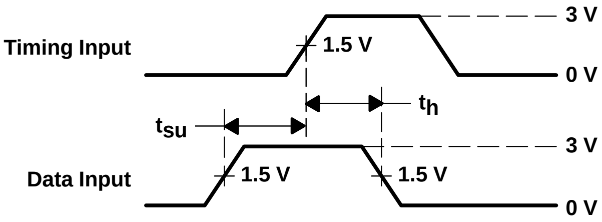


LOAD CIRCUIT FOR
3-STATE OUTPUTS

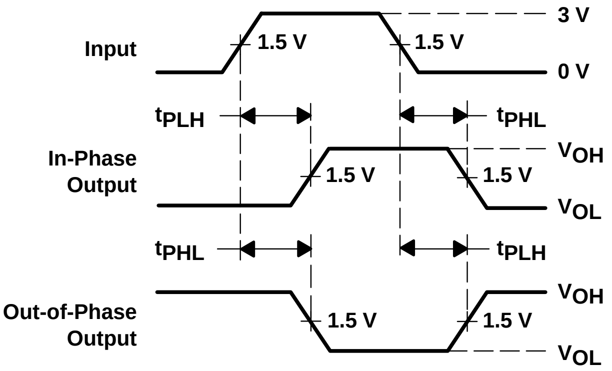
TEST	S1
t_{PLH}/t_{PHL}	Open
t_{PLZ}/t_{PZL}	7 V
t_{PHZ}/t_{PZH}	Open



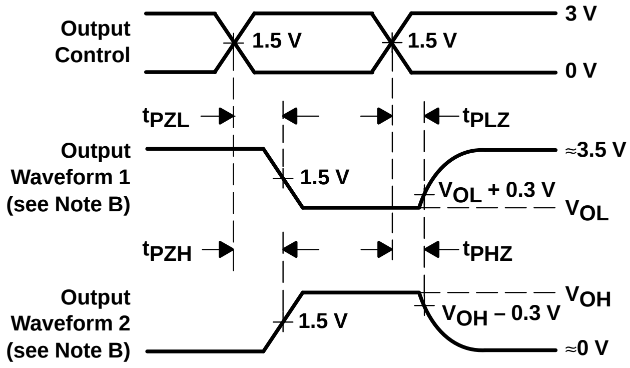
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

NOTES:
A. C_L includes probe and jig capacitance.
B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control.
Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
C. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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]
5962-9220301M2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9220301MRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9220301MSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
5962-9220302M2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9220302MRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9220302MSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
5962-9220303M2A	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
5962-9220303MRA	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
5962-9220303MSA	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
CY54FCT244ATDMB	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
CY54FCT244ATLMB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
CY54FCT244ATW	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
CY54FCT244CTDMB	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
CY54FCT244CTW	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
CY54FCT244TDMB	ACTIVE	CDIP	J	20	1	TBD	A42 SNPB	N / A for Pkg Type
CY54FCT244TLMB	ACTIVE	LCCC	FK	20	1	TBD	POST-PLATE	N / A for Pkg Type
CY54FCT244TW	ACTIVE	CFP	W	20	1	TBD	A42	N / A for Pkg Type
CY74FCT244ATPC	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CY74FCT244ATPCE4	ACTIVE	PDIP	N	20	20	Pb-Free (RoHS)	CU NIPDAU	N / A for Pkg Type
CY74FCT244ATQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244ATQCTE4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244ATQCTG4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244ATSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244ATSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244ATSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244ATSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244ATSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244ATSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244CTQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244CTQCTE4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244CTQCTG4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244CTSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS &	CU NIPDAU	Level-1-260C-UNLIM

Orderable Device	Status [1]	Package Type	Package Drawing	Pins	Package Qty	Eco Plan [2]	Lead/Ball Finish	MSL Peak Temp [3]
						no Sb/Br)		
CY74FCT244CTSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244CTSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244CTSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244CTSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244DTQCTE4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244DTQCTG4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244DTSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244DTSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TQCT	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244TQCTG4	ACTIVE	SSOP/ QSOP	DBQ	20	2500	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-2-260C-1 YEAR
CY74FCT244TSOC	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TSOCE4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TSOCG4	ACTIVE	SOIC	DW	20	25	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TSOCT	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TSOCTE4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM
CY74FCT244TSOCTG4	ACTIVE	SOIC	DW	20	2000	Green (RoHS & no Sb/Br)	CU NIPDAU	Level-1-260C-UNLIM

(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.

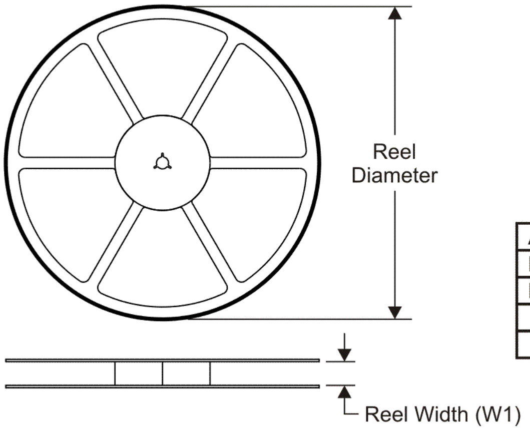
Important Information and Disclaimer: The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

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.

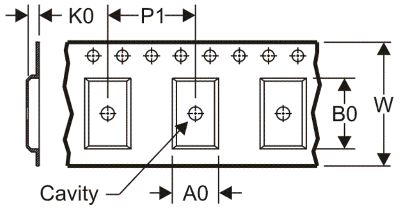
PACKAGE MATERIALS INFORMATION

TAPE AND REEL INFORMATION

REEL DIMENSIONS

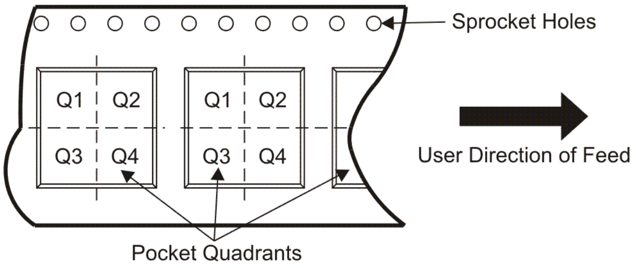


TAPE DIMENSIONS



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

QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE

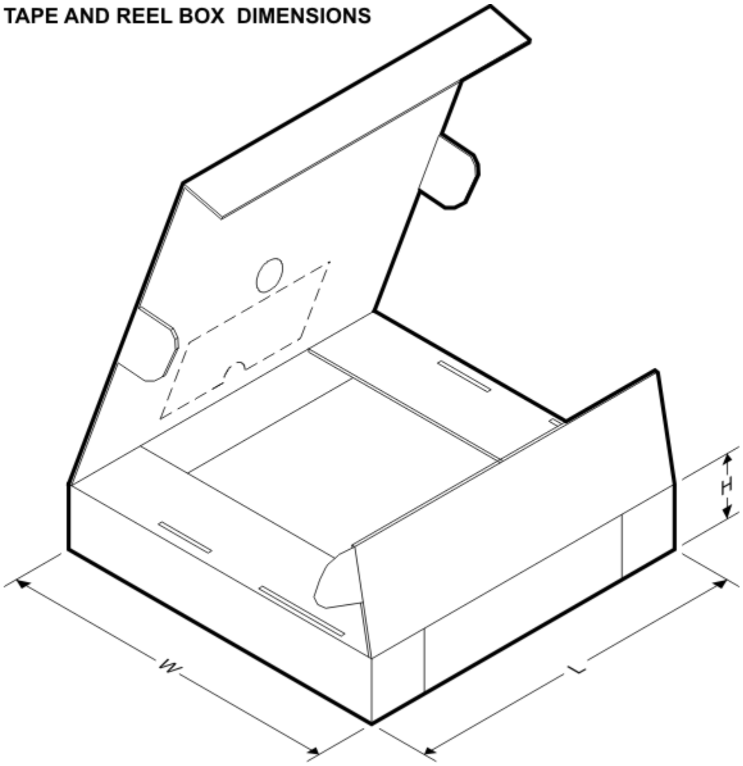


*All dimensions are nominal

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
CY74FCT244ATQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT244ATSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT244CTQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT244CTSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT244DTQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT244DTSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1
CY74FCT244TQCT	SSOP/ QSOP	DBQ	20	2500	330.0	16.4	6.5	9.0	2.1	8.0	16.0	Q1
CY74FCT244TSOCT	SOIC	DW	20	2000	330.0	24.4	10.8	13.0	2.7	12.0	24.0	Q1

PACKAGE MATERIALS INFORMATION

TAPE AND REEL BOX DIMENSIONS

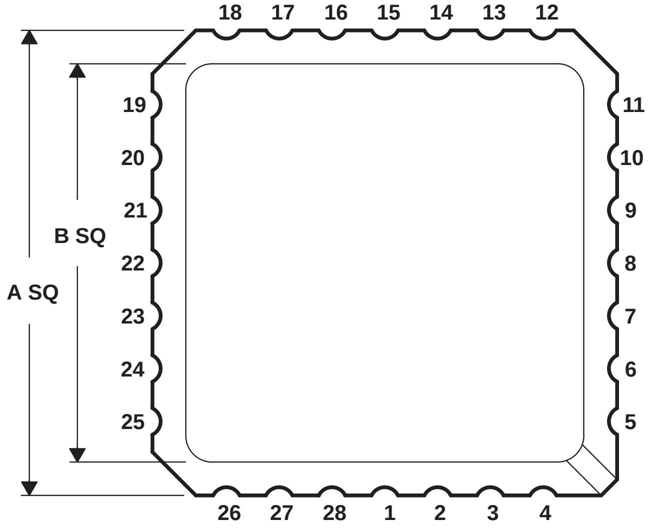


*All dimensions are nominal

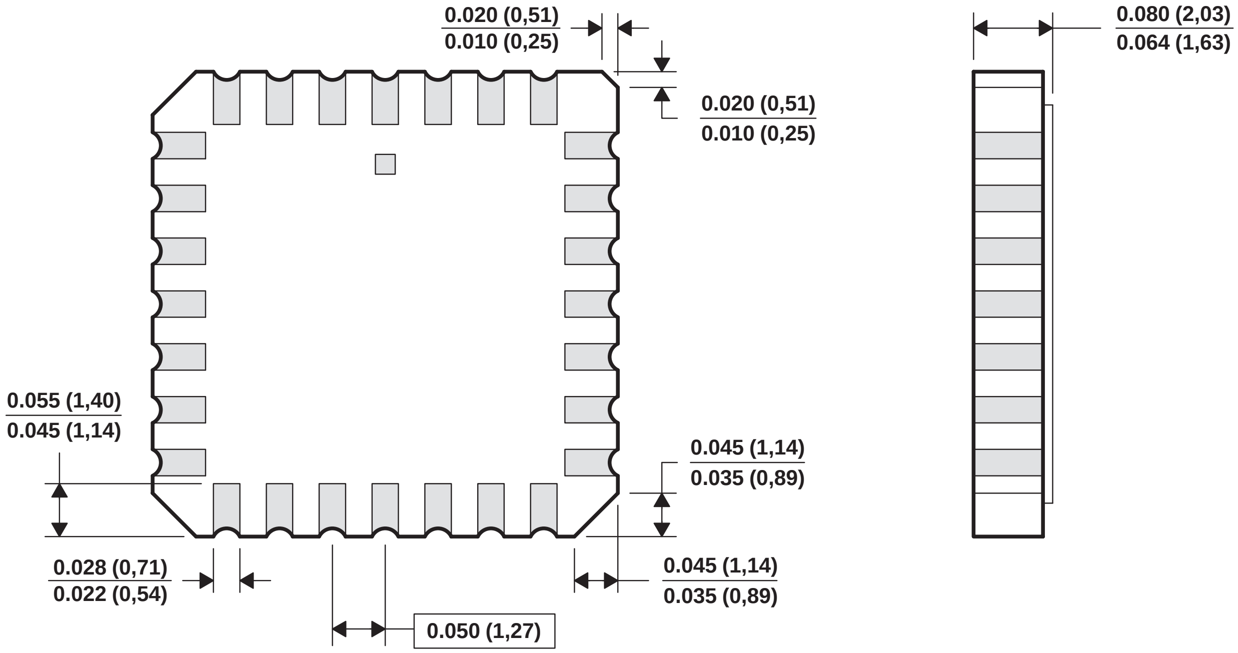
Device	Package Type	Package Drawing	Pins	SPQ	Length (mm)	Width (mm)	Height (mm)
CY74FCT244ATQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT244ATSOCT	SOIC	DW	20	2000	346.0	346.0	41.0
CY74FCT244CTQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT244CTSOCT	SOIC	DW	20	2000	346.0	346.0	41.0
CY74FCT244DTQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT244DTSOCT	SOIC	DW	20	2000	346.0	346.0	41.0
CY74FCT244TQCT	SSOP/QSOP	DBQ	20	2500	346.0	346.0	33.0
CY74FCT244TSOCT	SOIC	DW	20	2000	346.0	346.0	41.0

FK (S-CQCC-N**) LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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	0.739 (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)

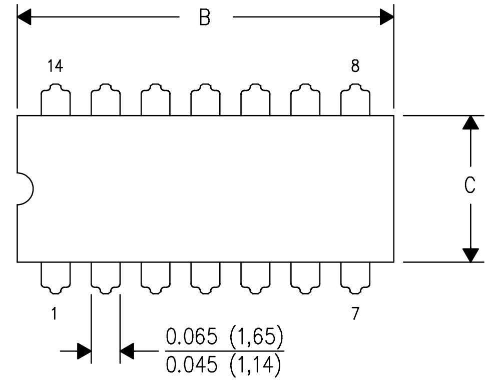


4040140 / D 10/96

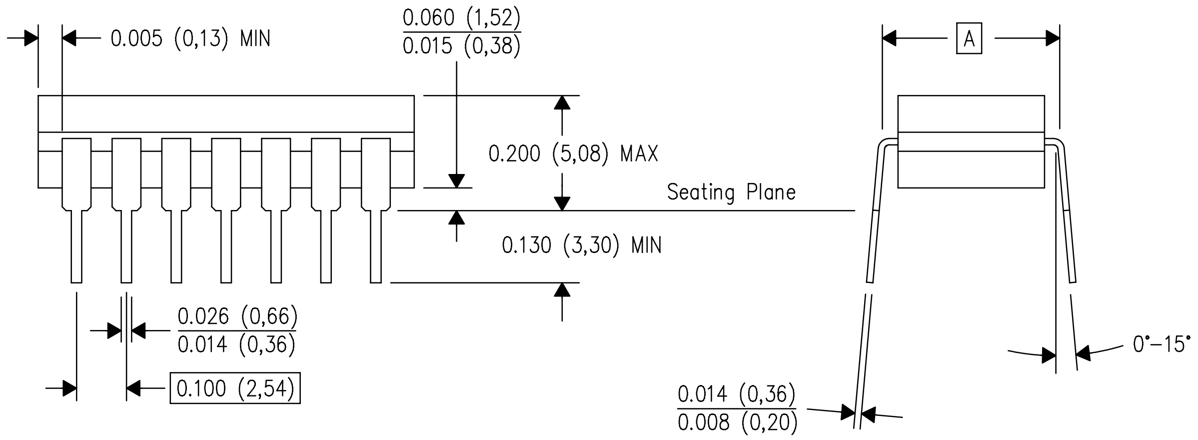
NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a metal lid.
- D. The terminals are gold plated.
- E. Falls within JEDEC MS-004

J (R–GDIP–T∗∗) CERAMIC DUAL IN–LINE PACKAGE

14 LEADS SHOWN



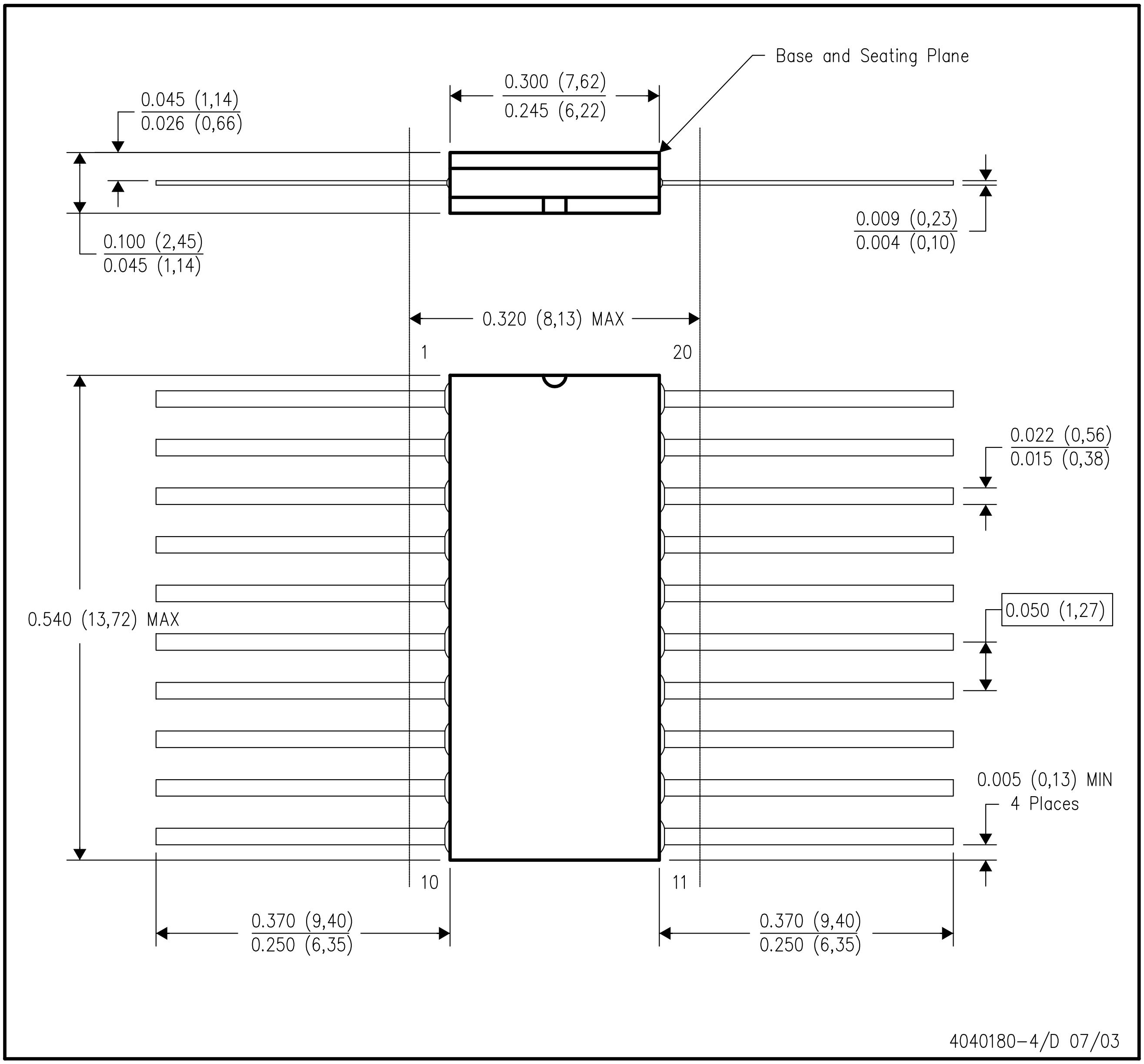
PINS ∗∗ / DIM	14	16	18	20
$\boxed{A}$	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC	0.300 (7,62) BSC
B MAX	0.785 (19,94)	.840 (21,34)	0.960 (24,38)	1.060 (26,92)
B MIN	——	——	——	——
C MAX	0.300 (7,62)	0.300 (7,62)	0.310 (7,87)	0.300 (7,62)
C MIN	0.245 (6,22)	0.245 (6,22)	0.220 (5,59)	0.245 (6,22)



4040083/F 03/03

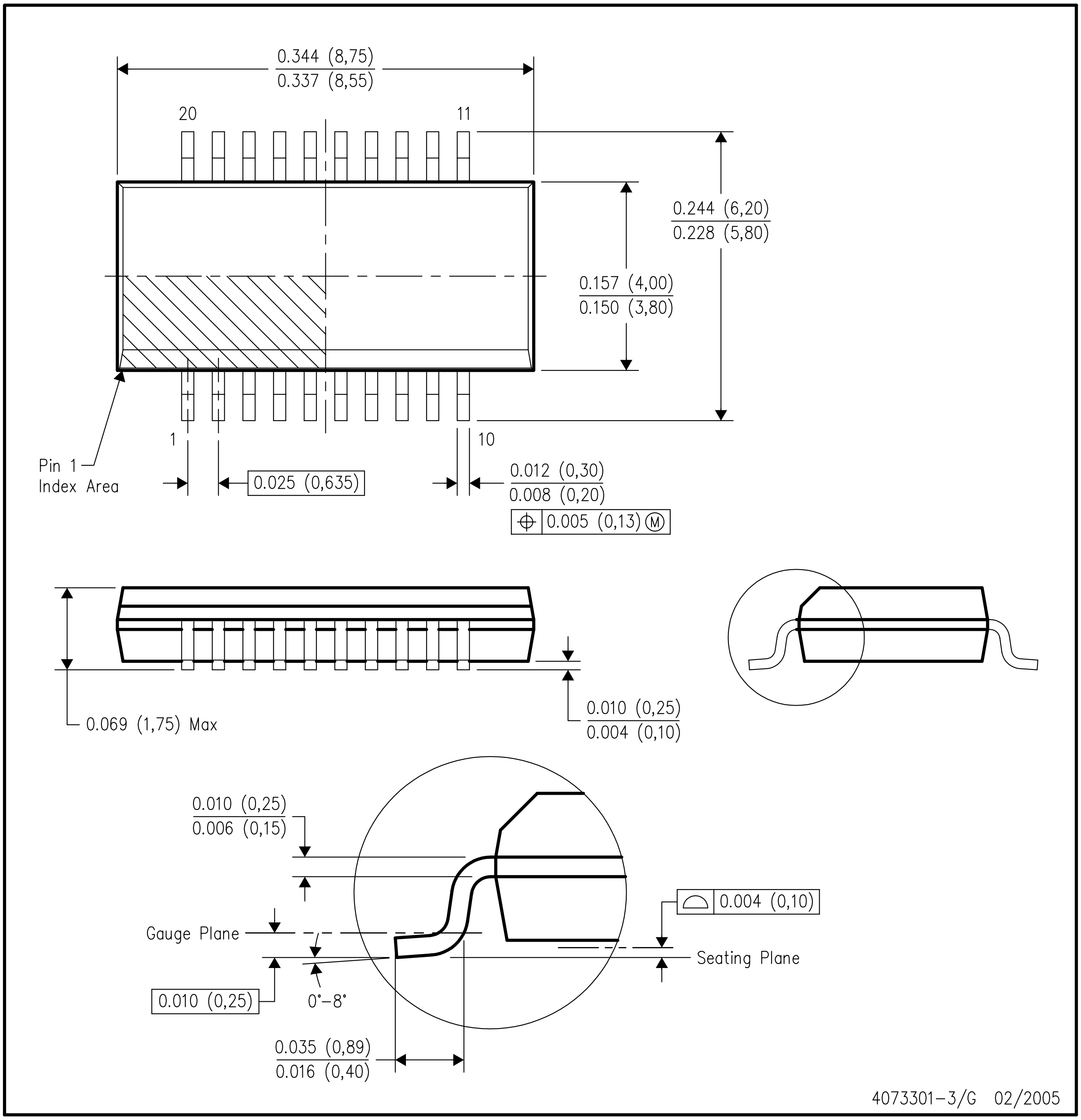
NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package is hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.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

W (R–GDFP–F20) CERAMIC DUAL FLATPACK



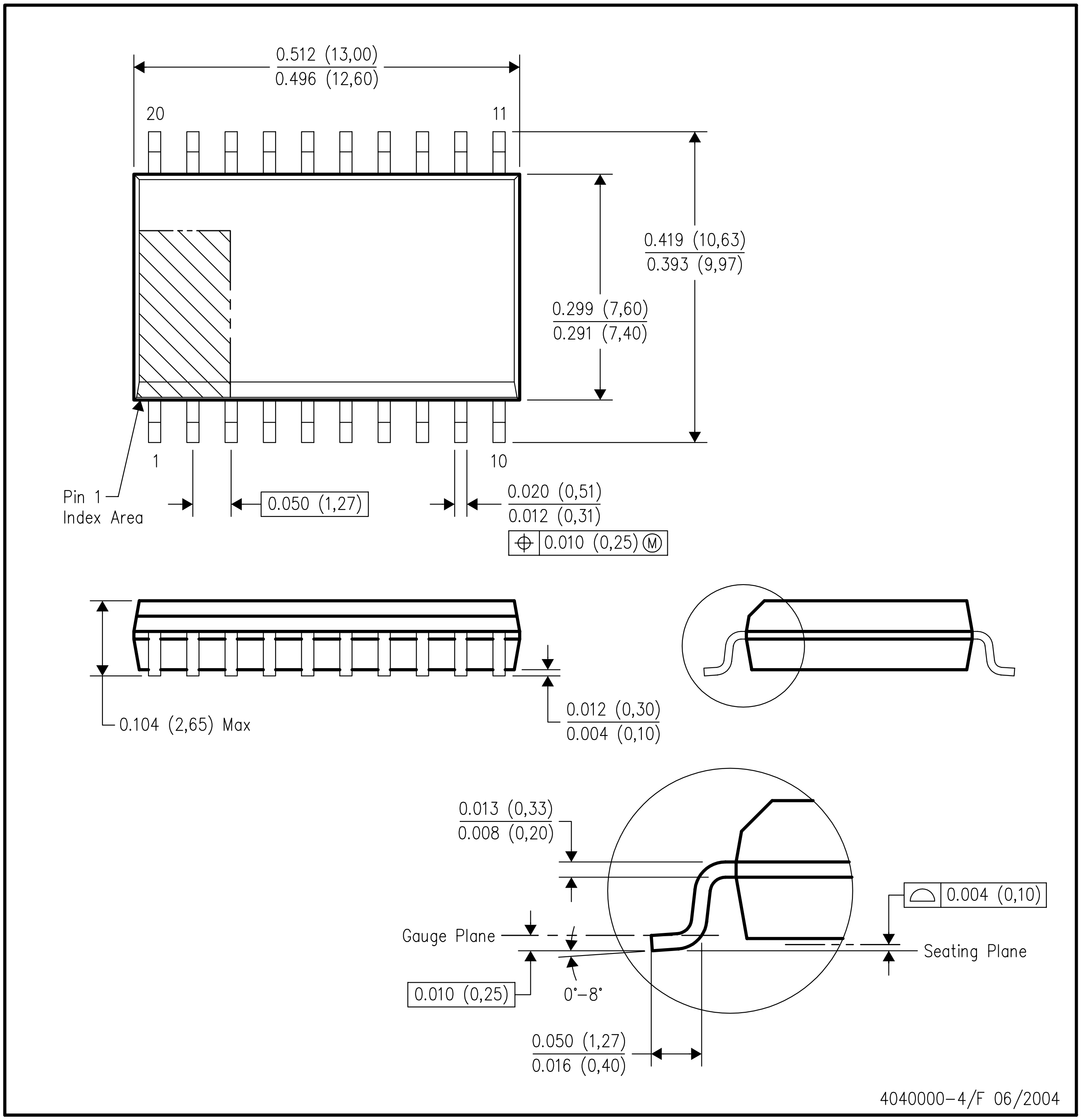
NOTES:
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. This package can be hermetically sealed with a ceramic lid using glass frit.
- D. Index point is provided on cap for terminal identification only.
- E. Falls within Mil–Std 1835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

DBQ (R–PDSO–G20) PLASTIC SMALL–OUTLINE PACKAGE



NOTES:
- A. All linear dimensions are in inches (millimeters).
- 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) per side.
- D. Falls within JEDEC MO–137 variation AD.

DW (R-PDSO-G20) PLASTIC SMALL-OUTLINE PACKAGE

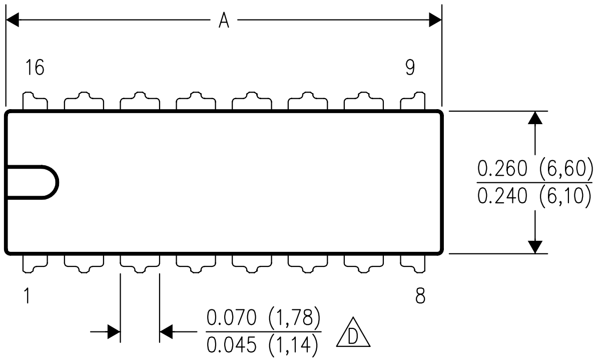


NOTES:

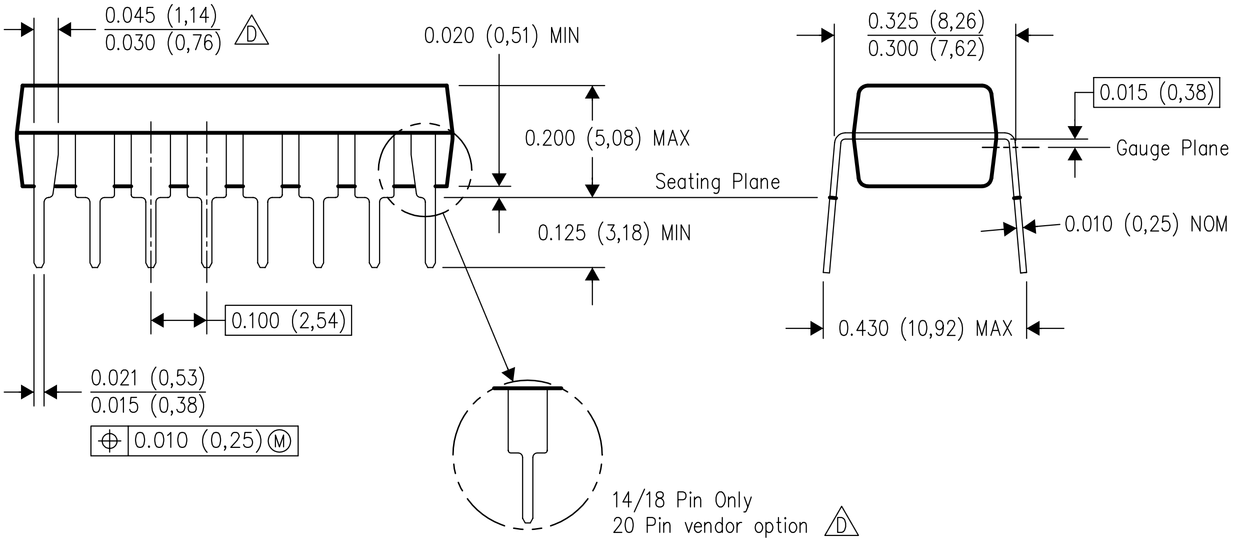
- A. All linear dimensions are in inches (millimeters).
- B. This drawing is subject to change without notice.
- C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
- D. Falls within JEDEC MS-013 variation AC.

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



14/18 Pin Only
20 Pin vendor option △D

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.

IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of TI information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation. Information of third parties may be subject to additional restrictions.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

TI products are not authorized for use in safety-critical applications (such as life support) where a failure of the TI product would reasonably be expected to cause severe personal injury or death, unless officers of the parties have executed an agreement specifically governing such use. Buyers represent that they have all necessary expertise in the safety and regulatory ramifications of their applications, and acknowledge and agree that they are solely responsible for all legal, regulatory and safety-related requirements concerning their products and any use of TI products in such safety-critical applications, notwithstanding any applications-related information or support that may be provided by TI. Further, Buyers must fully indemnify TI and its representatives against any damages arising out of the use of TI products in such safety-critical applications.

TI products are neither designed nor intended for use in military/aerospace applications or environments unless the TI products are specifically designated by TI as military-grade or "enhanced plastic." Only products designated by TI as military-grade meet military specifications. Buyers acknowledge and agree that any such use of TI products which TI has not designated as military-grade is solely at the Buyer's risk, and that they are solely responsible for compliance with all legal and regulatory requirements in connection with such use.

TI products are neither designed nor intended for use in automotive applications or environments unless the specific TI products are designated by TI as compliant with ISO/TS 16949 requirements. Buyers acknowledge and agree that, if they use any non-designated products in automotive applications, TI will not be responsible for any failure to meet such requirements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

Products	
Amplifiers	amplifier.ti.com
Data Converters	dataconverter.ti.com
DSP	dsp.ti.com
Clocks and Timers	www.ti.com/clocks
Interface	interface.ti.com
Logic	logic.ti.com
Power Mgmt	power.ti.com
Microcontrollers	microcontroller.ti.com
RFID	www.ti-rfid.com
RF/IF and ZigBee® Solutions	www.ti.com/lprf

Applications	
Audio	www.ti.com/audio
Automotive	www.ti.com/automotive
Broadband	www.ti.com/broadband
Digital Control	www.ti.com/digitalcontrol
Medical	www.ti.com/medical
Military	www.ti.com/military
Optical Networking	www.ti.com/opticalnetwork
Security	www.ti.com/security
Telephony	www.ti.com/telephony
Video & Imaging	www.ti.com/video
Wireless	www.ti.com/wireless

Mailing Address: Texas Instruments, Post Office Box 655303, Dallas, Texas 75265