

## SN54HC688、SN74HC688 8 ビット ID コンパレータ

### 1 特長

- 幅広い動作電圧範囲: 2V~6V
- 大電流出力は最大 10 個の LSTTL 負荷を駆動可能
- 低消費電力、 $I_{CC}$ : 80 $\mu$ A 以下
- $t_{pd} = 14$ ns (標準値)
- 5V で  $\pm 4$ mA の出力駆動能力
- 低い入力電流: 最大 1 $\mu$ A
- 2 つの 8 ビット・ワードを比較

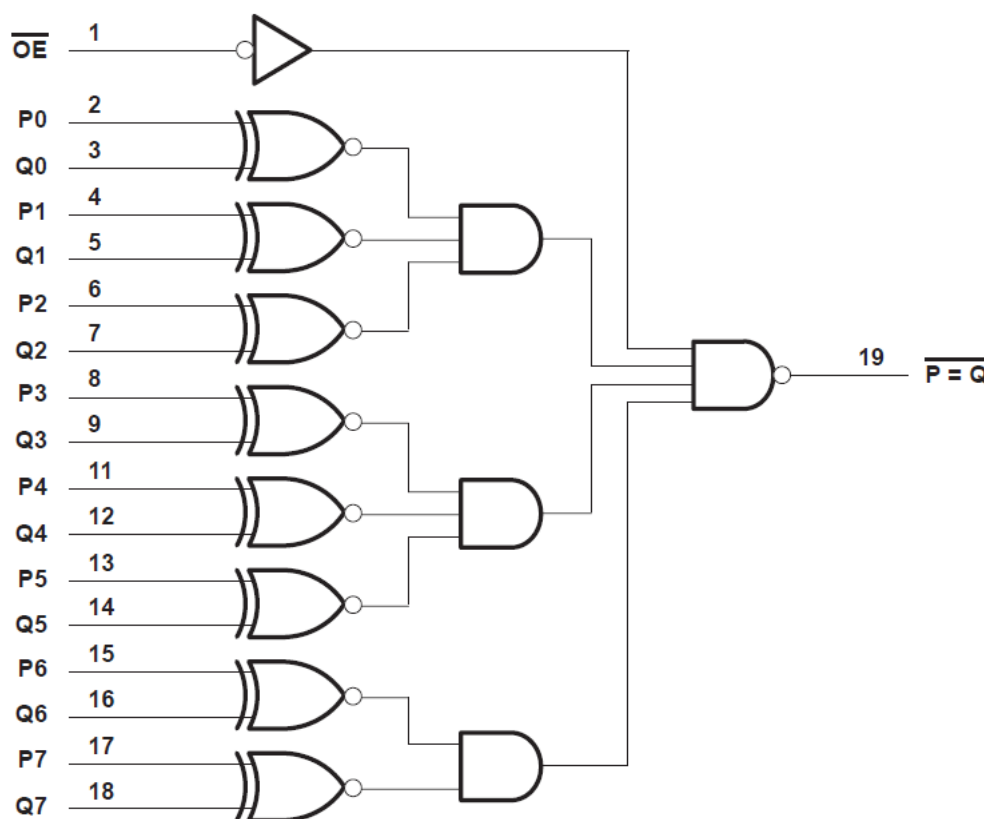
### 2 概要

これらの ID コンパレータは、2 つの 8 ビット・バイナリ・ワードまたは BCD ワードの比較を実行します。出力イネーブル ( $\overline{OE}$ ) 入力を使用すると、出力を強制的に High レベルにすることができます。

#### 製品情報

部品番号	パッケージ <sup>(1)</sup>	本体サイズ (公称)
SN74HC688DW	SOIC (20)	12.80mm × 7.50mm
SN74HC688N	PDIP (20)	25.40mm × 6.35mm
SN74HC688PWR	TSSOP (20)	6.50mm × 4.40mm
SN54HC688J	CDIP (20)	26.92mm × 6.92mm
SNJ54HC688FK	LCCC (20)	8.89mm × 8.45mm

- (1) 利用可能なパッケージについては、このデータシートの末尾にある注文情報を参照してください。



機能ブロック図



## Table of Contents

<b>1 特長</b> .....	1	7.2 Functional Block Diagram.....	7
<b>2 概要</b> .....	1	7.3 Device Functional Modes.....	7
<b>3 Revision History</b> .....	2	<b>8 Power Supply Recommendations</b> .....	8
<b>4 Pin Configuration and Functions</b> .....	3	<b>9 Layout</b> .....	8
<b>5 Specifications</b> .....	4	9.1 Layout Guidelines.....	8
5.1 Absolute Maximum Ratings .....	4	<b>10 Device and Documentation Support</b> .....	9
5.2 Recommended Operating Conditions <sup>(1)</sup> .....	4	10.1 Receiving Notification of Documentation Updates....	9
5.3 Thermal Information.....	4	10.2 サポート・リソース.....	9
5.4 Electrical Characteristics.....	5	10.3 Trademarks.....	9
5.5 Switching Characteristics .....	5	10.4 Electrostatic Discharge Caution.....	9
5.6 Operating Characteristics.....	5	10.5 Glossary.....	9
<b>6 Parameter Measurement Information</b> .....	6	<b>11 Mechanical, Packaging, and Orderable Information</b> .....	9
<b>7 Detailed Description</b> .....	7		
7.1 Overview.....	7		

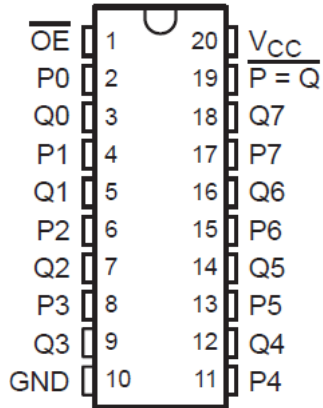
### 3 Revision History

資料番号末尾の英字は改訂を表しています。その改訂履歴は英語版に準じています。

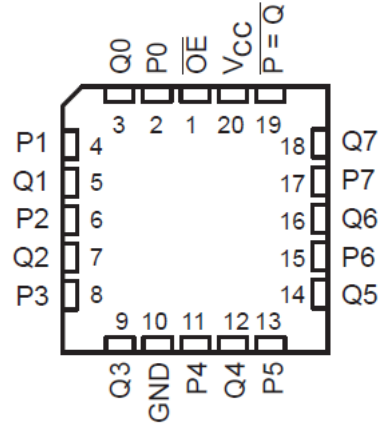
<b>Changes from Revision E (February 2022) to Revision F (May 2022)</b>	<b>Page</b>
• Junction-to-ambient thermal resistance values increased. DW was 58 is now 109.1, N was 69 is now 84.6, PW was 83 is now 131.8.....	4

<b>Changes from Revision D (August 2003) to Revision E (February 2022)</b>	<b>Page</b>
• 最新のデータシート規格を反映するように、文書全体の採番、書式設定、表、図、相互参照を更新.....	1

## 4 Pin Configuration and Functions



**J, DW, N or PW package**  
**20-Pin CDIP, SOIC, PDIP, TSSOP**  
**Top View**



**FK Package**  
**20-Pin LCCC**  
**Top View**

## 5 Specifications

### 5.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted)<sup>(1)</sup>

		MIN	MAX	UNIT
V <sub>CC</sub>	Supply voltage range	-0.5	7	V
I <sub>IK</sub>	Input clamp current <sup>(2)</sup>	V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub>	±20	mA
I <sub>OK</sub>	Output clamp current <sup>(2)</sup>	V <sub>O</sub> < 0 or V <sub>O</sub> > V <sub>CC</sub>	±20	mA
I <sub>O</sub>	Continuous output current	V <sub>O</sub> = 0 to V <sub>CC</sub>	±25	mA
	Continuous current through V <sub>CC</sub> or GND		±50	mA
T <sub>J</sub>	Junction temperature		150	°C
T <sub>stg</sub>	Storage temperature range	-65	150	°C

- (1) 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.
- (2) The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

### 5.2 Recommended Operating Conditions<sup>(1)</sup>

		SN54HC688			SN74HC688			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	
V <sub>CC</sub>	Supply voltage	2	5	6	2	5	6	V
V <sub>IH</sub>	High-level input voltage	V <sub>CC</sub> = 2 V	1.5		1.5		V	
		V <sub>CC</sub> = 4.5 V	3.15		3.15			
		V <sub>CC</sub> = 6 V	4.2		4.2			
V <sub>IL</sub>	Low-level input voltage	V <sub>CC</sub> = 2 V	0.5		0.5		V	
		V <sub>CC</sub> = 4.5 V	1.35		1.35			
		V <sub>CC</sub> = 6 V	1.8		1.8			
V <sub>I</sub>	Input voltage	0	V <sub>CC</sub>		0	V <sub>CC</sub>		V
V <sub>O</sub>	Output voltage	0	V <sub>CC</sub>		0	V <sub>CC</sub>		V
t <sub>t</sub>	Input transition (rise and fall) time	V <sub>CC</sub> = 2 V	1000		1000		ns	
		V <sub>CC</sub> = 4.5 V	500		500			
		V <sub>CC</sub> = 6 V	400		400			
T <sub>A</sub>	Operating free-air temperature	-55	125		-40	85		°C

- (1) All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

### 5.3 Thermal Information

THERMAL METRIC		DW (SOIC)	N (PDIP)	PW (TSSOP)	UNIT
		20 PINS	20 PINS	20 PINS	
R <sub>θJA</sub>	Junction-to-ambient thermal resistance <sup>(1)</sup>	109.1	84.6	131.8	°C/W
R <sub>θJC(top)</sub>	Junction-to-case (top) thermal resistance	76	72.5	72.2	°C/W
R <sub>θJB</sub>	Junction-to-board thermal resistance	77.6	65.3	82.8	°C/W
ψ <sub>JT</sub>	Junction-to-top characterization parameter	51.5	55.3	21.5	°C/W
ψ <sub>JB</sub>	Junction-to-board characterization parameter	77.1	65.2	82.4	°C/W
R <sub>θJC(bot)</sub>	Junction-to-case (bottom) thermal resistance	N/A	N/A	N/A	°C/W

- (1) For more information about traditional and new thermal metrics, see the [Semiconductor and IC package thermal metrics](#) application report.

## 5.4 Electrical Characteristics

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

PARAMETER	TEST CONDITIONS		V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC688		SN74HC688		UNIT	
				MIN	TYP	MAX	MIN	MAX	MIN	MAX		
V <sub>OH</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -20 μA	2 V	1.9	1.998		1.9		1.9	V		
			4.5 V	4.4	4.499		4.4		4.4			
			6 V	5.9	5.999		5.9		5.9			
		I <sub>OH</sub> = -4 mA	4.5 V	3.98	4.3		3.7		3.84			
			6 V	5.48	5.8		5.2		5.34			
V <sub>OL</sub>	V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 20 μA	2 V		0.002	0.1		0.1		0.1	V	
			4.5 V		0.001	0.1		0.1		0.1		
			6 V		0.001	0.1		0.1		0.1		
		I <sub>OL</sub> = 4 mA	4.5 V		0.17	0.26		0.4		0.33		
			6 V		0.15	0.26		0.4		0.33		
I <sub>I</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0		6 V		±0.1	±100		±1000		±1000	nA	
I <sub>CC</sub>	V <sub>I</sub> = V <sub>CC</sub> or 0, I <sub>O</sub> = 0		6 V			8		160		80	μA	
C <sub>i</sub>			2 V to 6 V			3	10		10		10	pF

## 5.5 Switching Characteristics

over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see [Parameter Measurement Information](#))

PARAMETER	FROM (INPUT)	TO (OUTPUT)	V <sub>CC</sub>	T <sub>A</sub> = 25°C			SN54HC688		SN74HC688		UNIT
				MIN	TYP	MAX	MIN	MAX	MIN	MAX	
t <sub>pd</sub>	P or Q	P = Q	2 V		113	210		313		265	ns
			4.5 V		30	42		63		53	
			6 V		24	36		53		45	
	OE	P = Q	2 V		66	120		179		151	
			4.5 V		16	24		36		30	
			6 V		14	20		30		26	
t <sub>t</sub>		Any	2 V		38	75		110		95	ns
			4.5 V		8	15		22		19	
			6 V		6	13		19		16	

## 5.6 Operating Characteristics

T<sub>A</sub> = 25°C

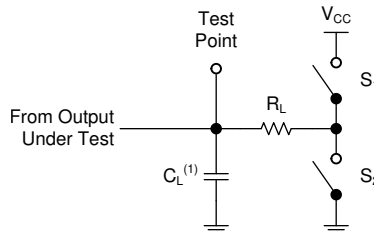
PARAMETER	TEST CONDITIONS	TYP	UNIT
C <sub>pd</sub>	Power dissipation capacitance	40	pF

## 6 Parameter Measurement Information

Phase relationships between waveforms were chosen arbitrarily. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_t < 6 \text{ ns}$ .

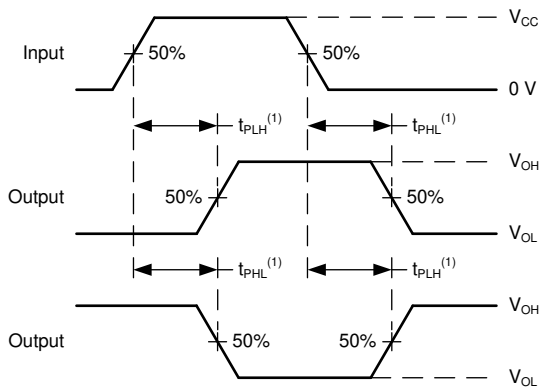
For clock inputs,  $f_{max}$  is measured when the input duty cycle is 50%.

The outputs are measured one at a time with one input transition per measurement.



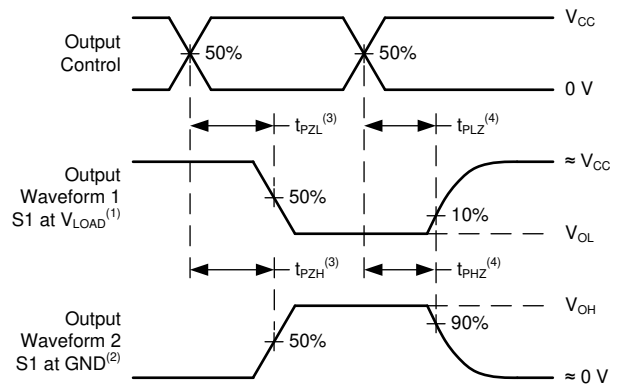
(1)  $C_L$  includes probe and test-fixture capacitance.

**6-1. Load Circuit for 3-State Outputs**



(1) The greater between  $t_{PLH}$  and  $t_{PHL}$  is the same as  $t_{pd}$ .

**6-2. Voltage Waveforms, Propagation Delays for Standard CMOS Inputs**



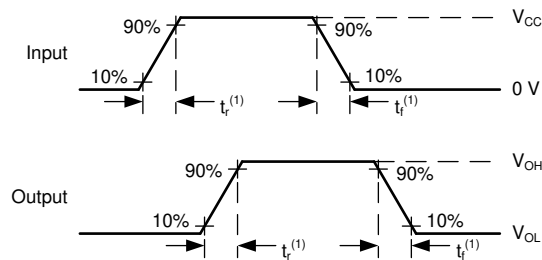
(1) S1 = CLOSED; S2 = OPEN.

(2) S1 = OPEN; S2 = CLOSED.

(3)  $t_{PZL}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .

(4)  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .

**6-3. Voltage Waveforms, Standard CMOS Inputs Propagation Delays**



(1) The greater between  $t_r$  and  $t_f$  is the same as  $t_t$ .

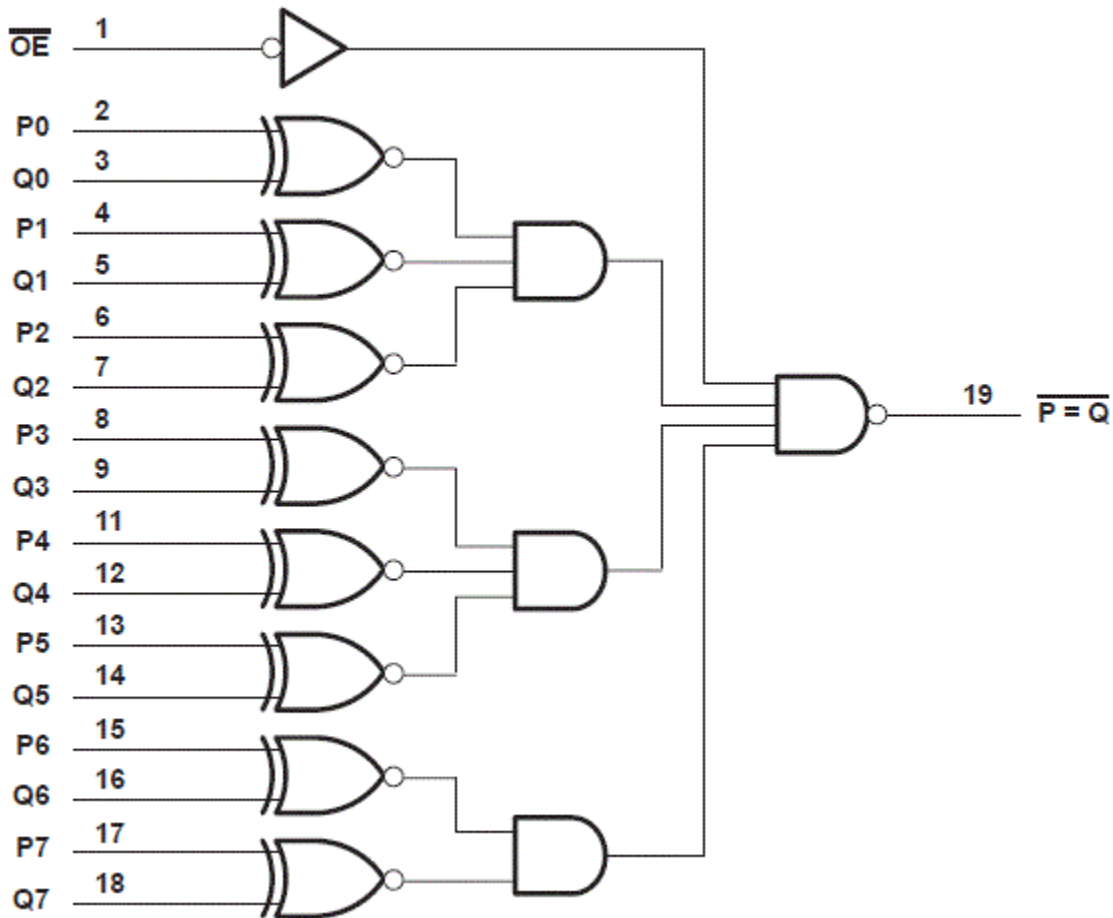
**6-4. Voltage Waveforms, Input and Output Transition Times for Standard CMOS Inputs**

## 7 Detailed Description

### 7.1 Overview

These identity comparators perform comparisons of two 8-bit binary or BCD words. An output-enable ( $\overline{OE}$ ) input may be used to force the output to the high level.

### 7.2 Functional Block Diagram



### 7.3 Device Functional Modes

表 7-1. Function Table

INPUTS		OUTPUT $P = Q$
DATA P, Q	OE	
$P = Q$	L	L
$P > Q$	X	H
$P < Q$	X	H
X	H	H

## 8 Power Supply Recommendations

The power supply can be any voltage between the minimum and maximum supply voltage rating located in the *Recommended Operating Conditions*. Each  $V_{CC}$  terminal should have a good bypass capacitor to prevent power disturbance. A 0.1- $\mu\text{F}$  capacitor is recommended for this device. It is acceptable to parallel multiple bypass caps to reject different frequencies of noise. The 0.1- $\mu\text{F}$  and 1- $\mu\text{F}$  capacitors are commonly used in parallel. The bypass capacitor should be installed as close to the power terminal as possible for best results.

## 9 Layout

### 9.1 Layout Guidelines

When using multiple-input and multiple-channel logic devices inputs must not ever be left floating. In many cases, functions or parts of functions of digital logic devices are unused; for example, when only two inputs of a triple-input AND gate are used or only 3 of the 4 buffer gates are used. Such unused input pins must not be left unconnected because the undefined voltages at the outside connections result in undefined operational states. All unused inputs of digital logic devices must be connected to a logic high or logic low voltage, as defined by the input voltage specifications, to prevent them from floating. The logic level that must be applied to any particular unused input depends on the function of the device. Generally, the inputs are tied to GND or  $V_{CC}$ , whichever makes more sense for the logic function or is more convenient.



## 10 Device and Documentation Support

TI offers an extensive line of development tools. Tools and software to evaluate the performance of the device, generate code, and develop solutions are listed below.

### 10.1 Receiving Notification of Documentation Updates

To receive notification of documentation updates, navigate to the device product folder on [ti.com](https://www.ti.com). Click on *Subscribe to updates* to register and receive a weekly digest of any product information that has changed. For change details, review the revision history included in any revised document.

### 10.2 サポート・リソース

[TI E2E™ サポート・フォーラム](#)は、エンジニアが検証済みの回答と設計に関するヒントをエキスパートから迅速かつ直接得ることができる場所です。既存の回答を検索したり、独自の質問をしたりすることで、設計に必要な支援を迅速に得ることができます。

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### 10.3 Trademarks

TI E2E™ is a trademark of Texas Instruments.

すべての商標は、それぞれの所有者に帰属します。

### 10.4 Electrostatic Discharge Caution



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

### 10.5 Glossary

[TI Glossary](#) This glossary lists and explains terms, acronyms, and definitions.

## 11 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

Orderable part number	Status (1)	Material type (2)	Package   Pins	Package qty   Carrier	RoHS (3)	Lead finish/ Ball material (4)	MSL rating/ Peak reflow (5)	Op temp (°C)	Part marking (6)
<a href="#">5962-86818012A</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 86818012A SNJ54HC 688FK
<a href="#">5962-8681801RA</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8681801RA SNJ54HC688J
<a href="#">SN54HC688J</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	SN54HC688J
<a href="#">SN74HC688DW</a>	Obsolete	Production	SOIC (DW)   20	-	-	Call TI	Call TI	-40 to 85	HC688
<a href="#">SN74HC688DWR</a>	Active	Production	SOIC (DW)   20	2000   LARGE T&R	Yes	NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC688
<a href="#">SN74HC688N</a>	Active	Production	PDIP (N)   20	20   TUBE	Yes	NIPDAU	N/A for Pkg Type	-40 to 85	SN74HC688N
<a href="#">SN74HC688PWR</a>	Active	Production	TSSOP (PW)   20	2000   LARGE T&R	Yes	NIPDAU   NIPDAU	Level-1-260C-UNLIM	-40 to 85	HC688
<a href="#">SN74HC688PWT</a>	Obsolete	Production	TSSOP (PW)   20	-	-	Call TI	Call TI	-40 to 85	HC688
<a href="#">SNJ54HC688FK</a>	Active	Production	LCCC (FK)   20	55   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962- 86818012A SNJ54HC 688FK
<a href="#">SNJ54HC688J</a>	Active	Production	CDIP (J)   20	20   TUBE	No	SNPB	N/A for Pkg Type	-55 to 125	5962-8681801RA SNJ54HC688J

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

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

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

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

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

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

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

**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.

**OTHER QUALIFIED VERSIONS OF SN54HC688, SN74HC688 :**

- Catalog : [SN74HC688](#)
- Military : [SN54HC688](#)

NOTE: Qualified Version Definitions:

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

## TAPE AND REEL INFORMATION



### 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
SN74HC688DWR	SOIC	DW	20	2000	330.0	24.4	10.9	13.3	2.7	12.0	24.0	Q1
SN74HC688DWR	SOIC	DW	20	2000	330.0	24.4	10.9	13.3	2.7	12.0	24.0	Q1
SN74HC688PWR	TSSOP	PW	20	2000	330.0	16.4	6.95	7.0	1.4	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)
SN74HC688DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC688DWR	SOIC	DW	20	2000	367.0	367.0	45.0
SN74HC688PWR	TSSOP	PW	20	2000	356.0	356.0	35.0

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-86818012A	FK	LCCC	20	55	506.98	12.06	2030	NA
SN74HC688N	N	PDIP	20	20	506	13.97	11230	4.32
SNJ54HC688FK	FK	LCCC	20	55	506.98	12.06	2030	NA



## GENERIC PACKAGE VIEW

**FK 20**

**LCCC - 2.03 mm max height**

8.89 x 8.89, 1.27 mm pitch

LEADLESS CERAMIC CHIP CARRIER

This image is a representation of the package family, actual package may vary.  
Refer to the product data sheet for package details.



4229370VA\



N (R-PDIP-T\*\*)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- 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.



# EXAMPLE BOARD LAYOUT

DW0020A

SOIC - 2.65 mm max height

SOIC



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

4220724/A 05/2016

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DW0020A

SOIC - 2.65 mm max height

SOIC



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

4220724/A 05/2016

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

PW0020A



**PACKAGE OUTLINE**  
**TSSOP - 1.2 mm max height**

SMALL OUTLINE PACKAGE



4220206/A 02/2017

NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220206/A 02/2017

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

PW0020A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE: 10X

4220206/A 02/2017

NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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