

## Features

- Single 5-V Supply
- 3-State Driver Output Circuitry
- TTL-Compatible Driver Inputs
- TTL-Compatible Receiver Output
- Differential Line Operation
- Receiver Output Strobe
- Designed for Party-Line (Data-Bus) Applications
- Independent Driver and Receiver
- Choice of Open-Collector or Totem-Pole Outputs on Both Driver and Receiver
- Dual Data Inputs on Driver
- Optional Line-Termination Resistor in Receiver
- $\pm 15$ -V Receiver Common-Mode Capability
- Receiver Frequency-Response Control

## description

This integrated circuit is designed for use in interfacing between TTL-type digital systems and differential data-transmission lines. It is especially useful for party-line (data-bus) applications. This circuit type combines in one package a 3-state differential line driver and a differential-input line receiver, both of which operate from a single 5-V power supply. The driver inputs and the receiver outputs are TTL compatible. The driver employed is similar to the SN55113 and SN75113 3-state line drivers and the receiver is similar to the SN55115 and SN75115 line receivers.

The SN55116 offers all the features of the SN55113 and SN75113 drivers and the SN55115 and SN75115 receivers combined. The driver performs the dual input AND and NAND functions when enabled or presents a high impedance to the load when in the disabled state. The driver output stages are similar to TTL totem-pole outputs, but have the current-sinking portion separated from the current-sourcing portion and both are brought out to adjacent package terminals. This feature allows the user the option of using the driver in the open-collector output configuration or, by connecting the adjacent source and sink terminals together, using the driver in the normal totem-pole output configuration.

The receiver portion of the SN55116 features a differential-input circuit having a common-mode voltage range of  $\pm 15$  V. An internal 130- $\Omega$  equivalent resistor also is provided, which optionally can be used to terminate the transmission line. A frequency-response control terminal allows the user to reduce the speed of the receiver or to improve differential noise immunity. The receiver of the SN55116 has an output strobe and a split totem-pole output. The receiver section of the circuit is independent of the driver section, except for the  $V_{CC}$  and ground terminals.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

**PRODUCTION DATA** information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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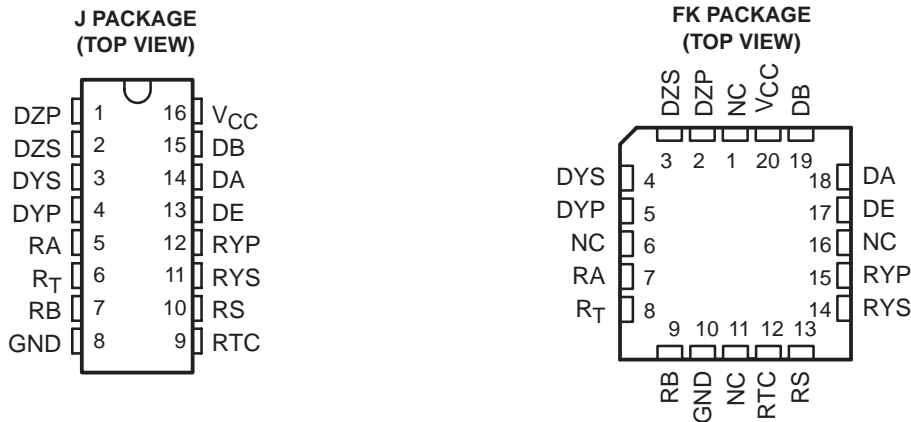
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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN55116 DIFFERENTIAL LINE TRANSCEIVERS

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## description (continued)

The SN55116 is characterized for operation over the full military temperature range of  $-55^{\circ}\text{C}$  to  $125^{\circ}\text{C}$ .



NC – No internal connection

### AVAILABLE OPTIONS

T <sub>A</sub>	CHIP CARRIER (FK)	CERAMIC DIP (J)
$-55^{\circ}\text{C}$ to $125^{\circ}\text{C}$	SN55116FK	SN55116J

### Function Tables

SN55116 DRIVER

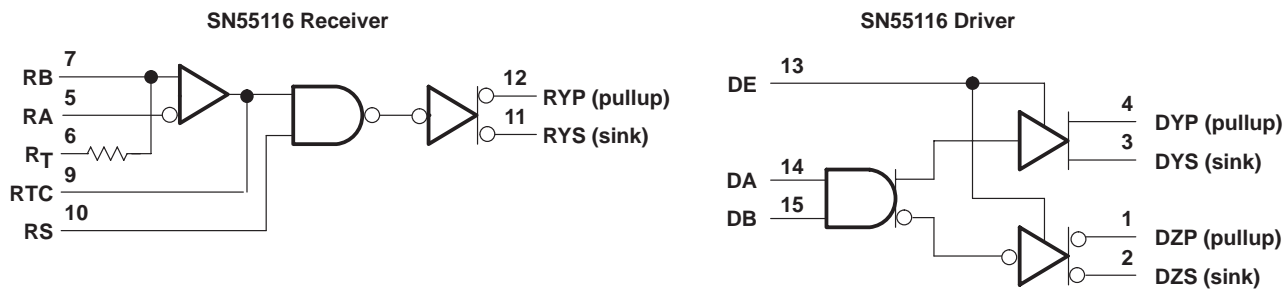
INPUTS			OUTPUTS	
DE	DA	DB	DY	DZ
L	X	X	Z	Z
H	L	X	L	H
H	X	L	L	H
H	H	H	H	L

'SN55116 RECEIVER

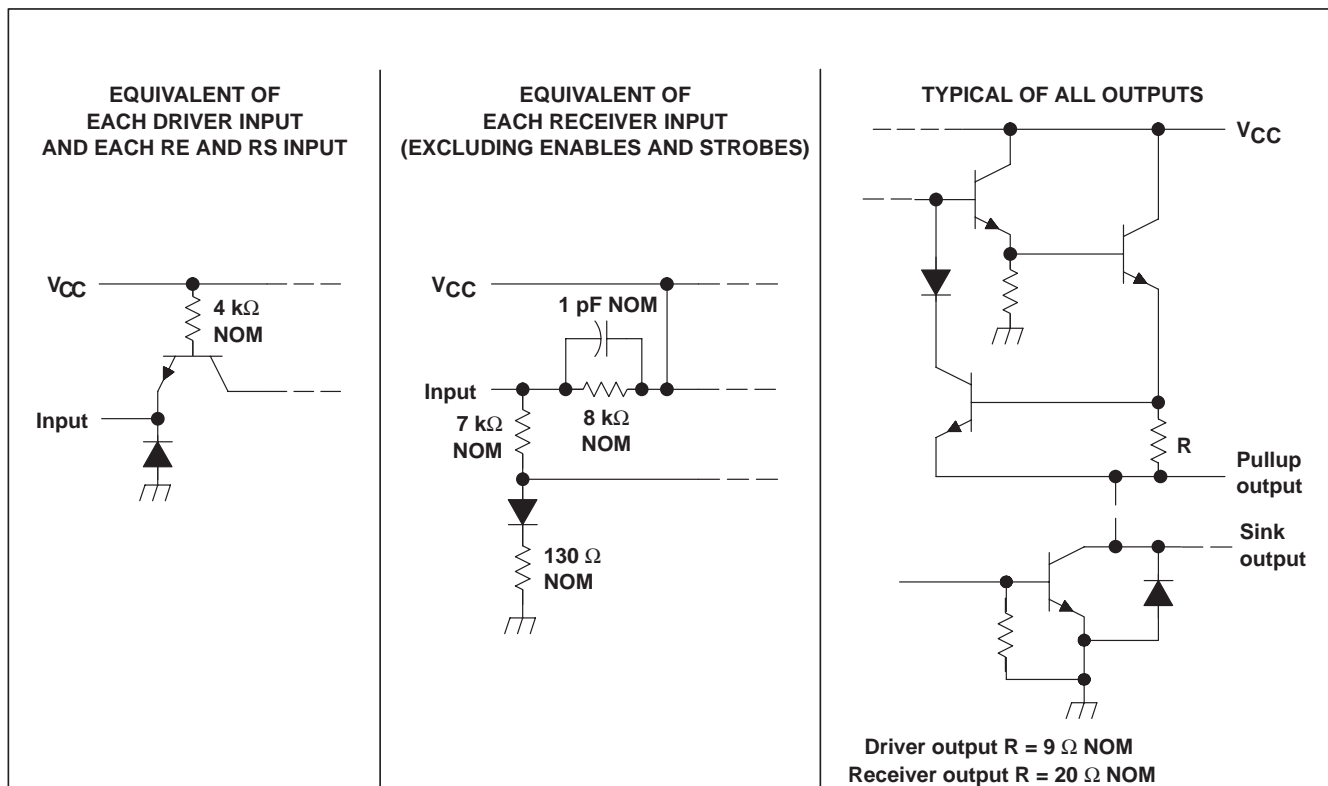
RS/RE	DIFF INPUT	OUTPUTS RY
L	X	H
H	L	H
H	H	L

H = high level ( $V_I \geq V_{IH}$  min or  $V_{ID}$  more positive than  $V_{TH}$  max), L = low level ( $V_I \leq V_{IL}$  max or  $V_{ID}$  more negative than  $V_{TL}$  max), X = irrelevant, Z = high impedance (off)

## logic diagram (positive logic)



## schematics of inputs and outputs



### absolute maximum ratings over operating free-air temperature (unless otherwise noted)<sup>†</sup>

Supply voltage, $V_{CC}$ (see Note 1 and Note 2)	7 V
Input voltage, $V_I$ : DA, DB, DE, DI, RE, and RS	5.5 V
RA, RB, $R_T$	$\pm 25$ V
Off-state voltage applied to open-collector outputs:	12 V
Continuous total power dissipation (see Note 2)	See Dissipation Rating Table
Case temperature for 60 seconds, $T_C$ : FK package	260°C
Lead temperature 1,6 mm (1/16 inch) from case for 60 seconds: J package	300°C
Storage temperature range, $T_{stg}$	-65°C to 150°C

<sup>†</sup> 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.

- NOTES: 1. All voltage values are with respect to the network ground terminal.  
2. In the FK and J packages, the SN55116 chip is alloy mounted.

**DISSIPATION RATING TABLE**

PACKAGE	$T_A \leq 25^\circ\text{C}$ POWER RATING	DERATING FACTOR ABOVE $T_A = 25^\circ\text{C}$	$T_A = 70^\circ\text{C}$ POWER RATING	$T_A = 125^\circ\text{C}$ POWER RATING
FK	1375 mW	11 mW/°C	880 mW	275 mW
J	1375 mW	11 mW/°C	880 mW	275 mW

# SN55116

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### recommended operating conditions

PARAMETER		MIN	NOM	MAX	UNIT
V <sub>CC</sub>	Supply voltage	4.5	5	5.5	V
V <sub>IH</sub>	High-level input voltage	All inputs except differential inputs		2	V
V <sub>IL</sub>	Low-level input voltage			0.8	V
I <sub>OH</sub>	High-level output current	Drivers		-40	mA
		Receivers		-5	
I <sub>OL</sub>	Low-level output current	Drivers		40	mA
		Receivers		15	
V <sub>I</sub>	Receiver input voltage			±15	V
V <sub>ICR</sub>	Common-mode receiver input voltage			±15	V
T <sub>A</sub>	Operating free-air temperature	-55		125	°C

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

#### driver section

PARAMETER		TEST CONDITION <sup>†</sup>		MIN	TYP <sup>‡</sup>	MAX	UNIT
V <sub>IK</sub>	Input clamp voltage	V <sub>CC</sub> = MIN,	I <sub>I</sub> = -12 mA	-0.9	-1.5		V
V <sub>OH</sub>	High-level output voltage	V <sub>CC</sub> = MIN, V <sub>IL</sub> = 0.8 V, I <sub>IH</sub> = 2 V	T <sub>A</sub> = 25°C	I <sub>OH</sub> = -10 mA	2.4	3.4	V
				I <sub>OH</sub> = -40 mA	2	3	
			T <sub>A</sub> = -55°C to 125°C	I <sub>OH</sub> = -10 mA	2		
				I <sub>OH</sub> = -40 mA	1.8		
V <sub>OL</sub>	Low-level output voltage	V <sub>CC</sub> = MIN,	V <sub>IH</sub> = 2 V, V <sub>IL</sub> = 0.8 V, I <sub>OL</sub> = 40 mA			0.4	V
V <sub>OK</sub>	Output clamp voltage	V <sub>CC</sub> = MAX,	I <sub>O</sub> = -40 mA, DE at 0.8 V			-1.5	V
I <sub>O(off)</sub>	Off-state open-collector output current	V <sub>CC</sub> = MAX, V <sub>O</sub> = 12 V	T <sub>A</sub> = 25°C		1	10	µA
			T <sub>A</sub> = MAX			200	
I <sub>OZ</sub>	Off-state (high-impedance state) output current	V <sub>CC</sub> = MAX, DE at 0.8 V, T <sub>A</sub> = MAX	V <sub>O</sub> = 0 to V <sub>CC</sub> , DE at 0.8 V, T <sub>A</sub> = 25°C			±10	µA
			V <sub>O</sub> = 0			-300	
			V <sub>O</sub> = 0.4 V to V <sub>CC</sub>			±150	
I <sub>I</sub>	Input current at maximum input voltage	Driver or enable input	V <sub>CC</sub> = MAX, V <sub>I</sub> = 5.5 V			1	mA
I <sub>IH</sub>	High-level input current		V <sub>CC</sub> = MAX, V <sub>I</sub> = 2.4 V			45	µA
I <sub>IL</sub>	Low-level input current		V <sub>CC</sub> = MAX, V <sub>I</sub> = 0.4 V			-1.6	mA
I <sub>OS</sub>	Short-circuit output current <sup>§</sup>	V <sub>CC</sub> = MAX,	V <sub>O</sub> = 0, T <sub>A</sub> = 25°C	-40		-120	mA
I <sub>CC</sub>	Supply current (driver and receiver combined)	V <sub>CC</sub> = MAX,	T <sub>A</sub> = 25°C		42	60	mA

<sup>†</sup> All parameters, with the exception of off-state open-collector output current, are measured with the active pullup connected to the sink output. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

<sup>‡</sup> All typical values are at V<sub>CC</sub> = 5 V and T<sub>A</sub> = 25°C.

<sup>§</sup> Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

### switching characteristics, V<sub>CC</sub> = 5 V, C<sub>L</sub> = 30 pF, T<sub>A</sub> = 25°C

#### driver section

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t <sub>PLH</sub>	Propagation-delay time, low-to-high level output	See Figure 13		14	30	ns
t <sub>PHL</sub>	Propagation-delay time, high-to-low level output			12	30	
t <sub>PZH</sub>	Output-enable time to high level	R <sub>L</sub> = 180 Ω, See Figure 14		8	20	ns
t <sub>PHZ</sub>	Output-disable time from high level	R <sub>L</sub> = 180 Ω, See Figure 14		16	30	ns



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

**receiver section**

PARAMETER		TEST CONDITIONST		MIN	TYP‡	MAX	UNIT	
V <sub>IT+</sub>	Positive-going threshold voltage §	V <sub>O</sub> = 0.4 V, I <sub>OL</sub> = 15 mA	V <sub>CC</sub> = MIN, V <sub>I</sub> CR = 0, See Note 3			0.5	V	
			V <sub>CC</sub> = 5 V, V <sub>I</sub> CR = MAX, See Note 4			1		
V <sub>IT-</sub>	Negative-going threshold voltage §	V <sub>O</sub> = 2.4 V, I <sub>OL</sub> = -5 mA	V <sub>CC</sub> = MIN, V <sub>I</sub> CR = 0, See Note 3			-0.5¶	V	
			V <sub>CC</sub> = 5 V, V <sub>I</sub> CR = MAX, See Note 4			-1¶		
V <sub>I</sub>	Input voltage range #	V <sub>CC</sub> = 5 V, V <sub>ID</sub> = -1 V or 1 V		15 to		-15	V	
V <sub>OH</sub>	High-level output voltage	I <sub>OH</sub> = -5 mA	V <sub>CC</sub> = MIN, V <sub>ID</sub> = -1 V, V <sub>ICR</sub> = 0, See Note 3	2.4			V	
			V <sub>CC</sub> = 5 V, V <sub>ID</sub> = -1 V, V <sub>ICR</sub> = MAX, See Note 5	2.4				
V <sub>OL</sub>	Low-level output voltage	I <sub>OL</sub> = 15 mA	V <sub>CC</sub> = MIN, V <sub>ID</sub> = 1 V, V <sub>ICR</sub> = 0, See Note 3	0.4			V	
			V <sub>CC</sub> = 5 V, V <sub>ID</sub> = 1 V, See Note 5	0.4				
I <sub>I(rec)</sub>	Receiver input current	V <sub>CC</sub> = MAX	V <sub>I</sub> = 0, Other input at 0 V	-0.5	-0.9		mA	
			V <sub>I</sub> = 0.4 V, Other input at 2.4 V	-0.4	-0.7			
			V <sub>I</sub> = 2.4 V, Other input at 0.4 V	0.1	0.3			
I <sub>I</sub>	Input current at maximum input voltage	Strobe	V <sub>CC</sub> = MIN, V <sub>ID</sub> = -0.5 V, V <sub>strobe</sub> = 4.5 V		5		µA	
I <sub>I</sub>	Low-level input current	Strobe	V <sub>CC</sub> = MAX, V <sub>strobe</sub> = 0.4 V,	V <sub>ID</sub> = 1 V, See Note 3	-2.4		mA	
I <sub>I(RTC)</sub>	Response-time-control current (RTC)		V <sub>CC</sub> = MAX, RC at 0 V,	V <sub>ID</sub> = 1 V, See Note 3	T <sub>A</sub> = 25°C	-1.2	mA	
I <sub>O(off)</sub>	Off-state open-collector output current		V <sub>CC</sub> = MAX, V <sub>O</sub> = 12 V, V <sub>ID</sub> = -1 V	T <sub>A</sub> = 25°C	1	10	µA	
				T <sub>A</sub> = MAX	200			
R <sub>T</sub>	Line-terminating resistance		V <sub>CC</sub> = 5 V	T <sub>A</sub> = 25°C	77	167	Ω	
I <sub>OS</sub>	Short-circuit output current§		V <sub>CC</sub> = MAX, V <sub>ID</sub> = -0.5 V,	V <sub>O</sub> = 0, See Note 3	T <sub>A</sub> = 25°C	-15	-80	mA
I <sub>CC</sub>	Short current (driver and receiver combined)		V <sub>CC</sub> = MAX, V <sub>ID</sub> = 0.5 V, See Note 3		T <sub>A</sub> = 25°C	42	60	mA

† Unless otherwise noted, V<sub>strobe</sub> = 2.4 V. All parameters, with the exception of off-state open-collector output current, are measured with the active pullup connected to the sink output. For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C, and V<sub>IC</sub> = 0.

§ Differential voltages are at the B input terminal with respect to the A input terminal.

¶ The algebraic convention, where the less positive (more negative) limit is designated as minimum, is used in this data sheet for threshold voltages only.

# Input voltage range is the voltage range that, if exceeded at either input, will cause the receiver to cease functioning properly.

NOTES: 3. This applies with the less-positive receiver input grounded.

4. This applies with the more-positive receiver input at 15 V or the more negative receiver input at -15 V.



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switching characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 30\text{ pF}$ ,  $T_A = 25^\circ\text{C}$

### receiver section

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$t_{PLH}$	Propagation-delay time, low to high-level output	$R_L = 400\ \Omega$ , See Figure 15		20	75	ns
$t_{PHL}$	Propagation-delay time, high to low-level output			17	75	ns
$t_{PZH}$	Output-enable time to high level	$R_L = 480\ \Omega$ , See Figure 14		9	20	ns
$t_{PHZ}$	Output-disable time from high level	$R_L = 480\ \Omega$ , See Figure 14		12	30	ns



TYPICAL CHARACTERISTICS†

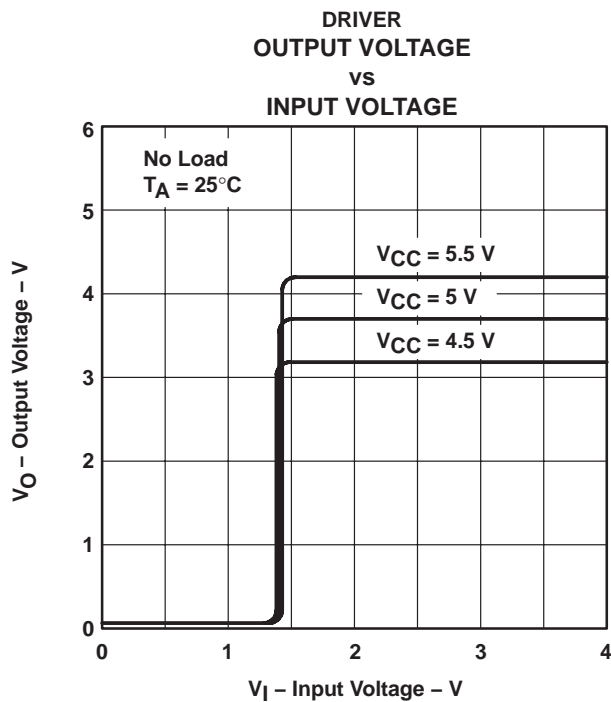


Figure 1

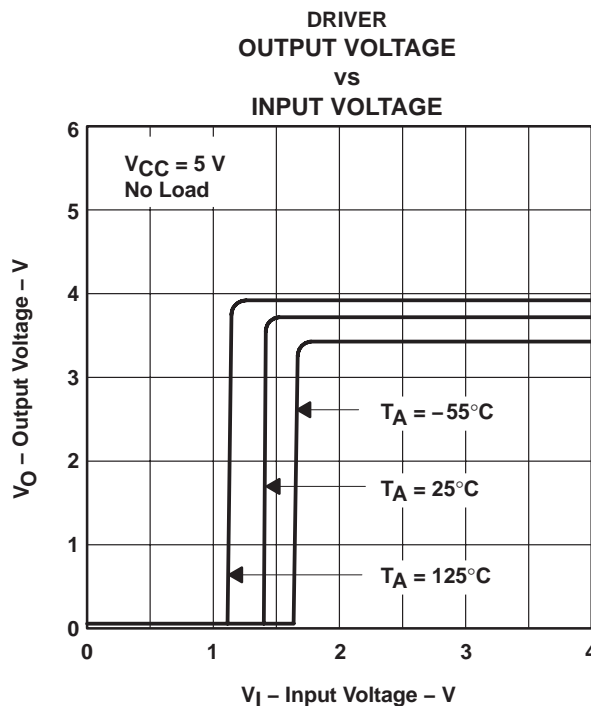


Figure 2

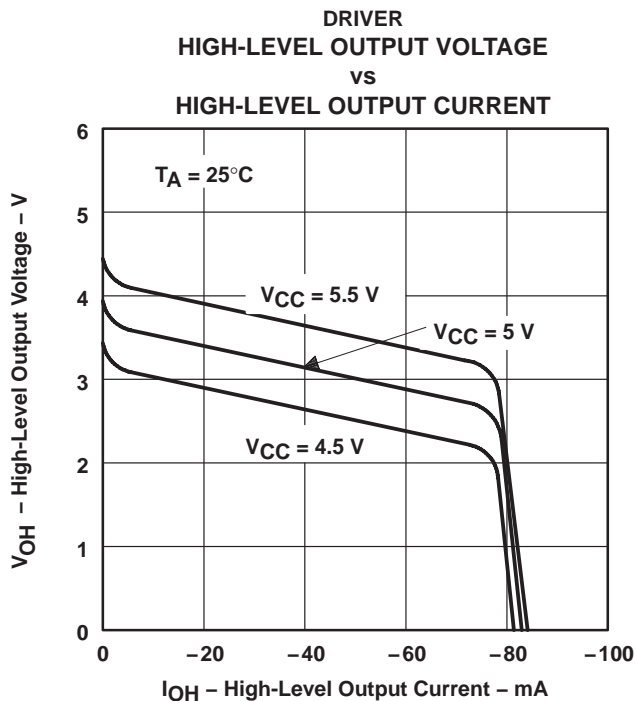


Figure 3

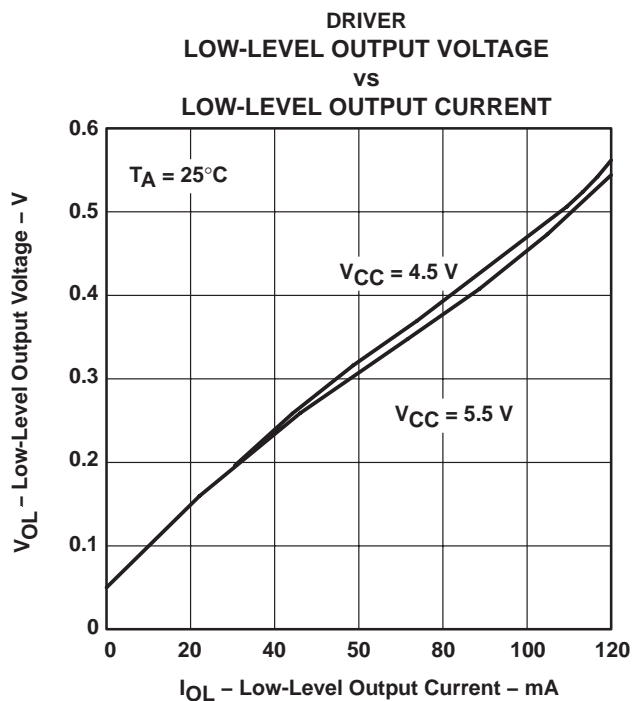
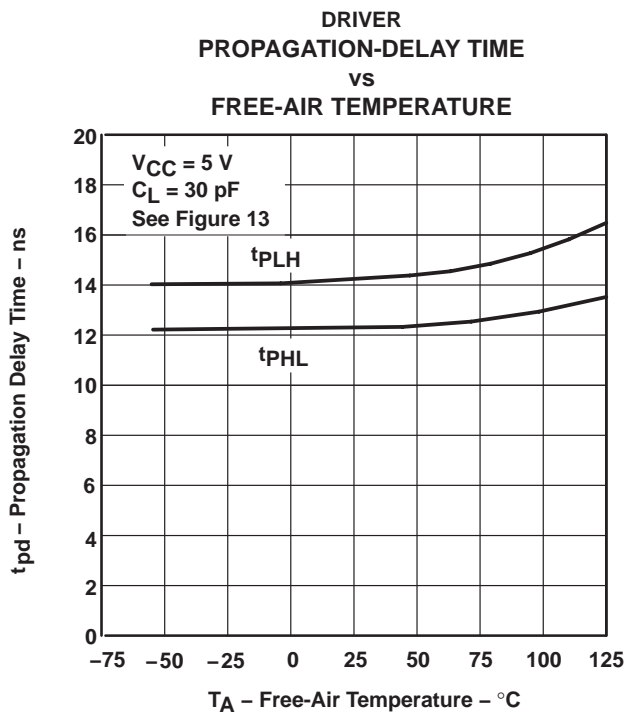


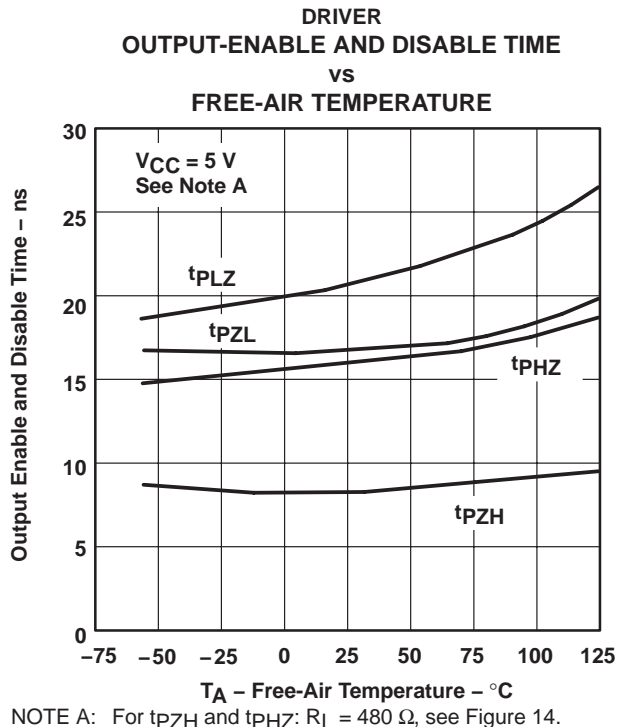
Figure 4

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

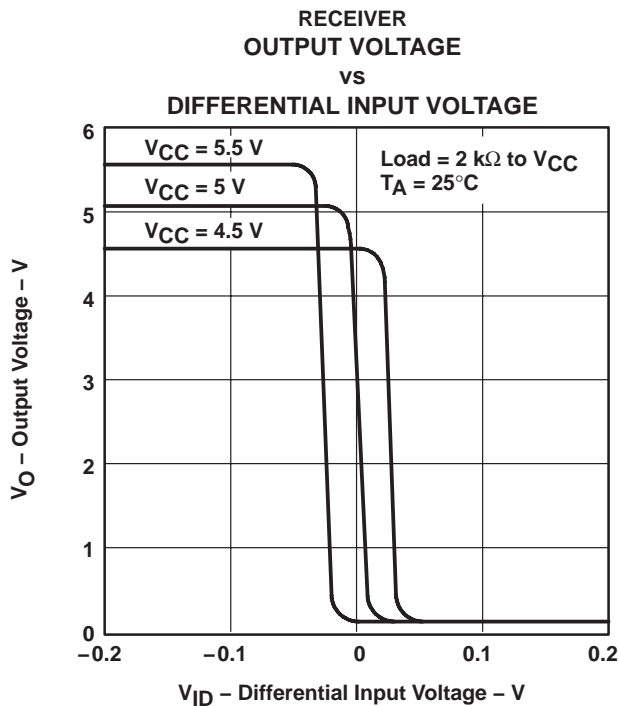
**TYPICAL CHARACTERISTICS†**



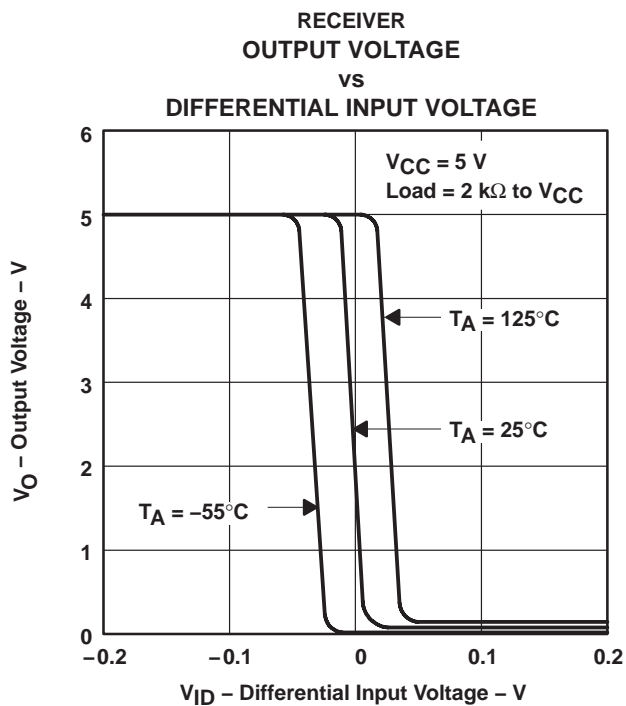
**Figure 5**



**Figure 6**



**Figure 7**



**Figure 8**

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.



TYPICAL CHARACTERISTICS†

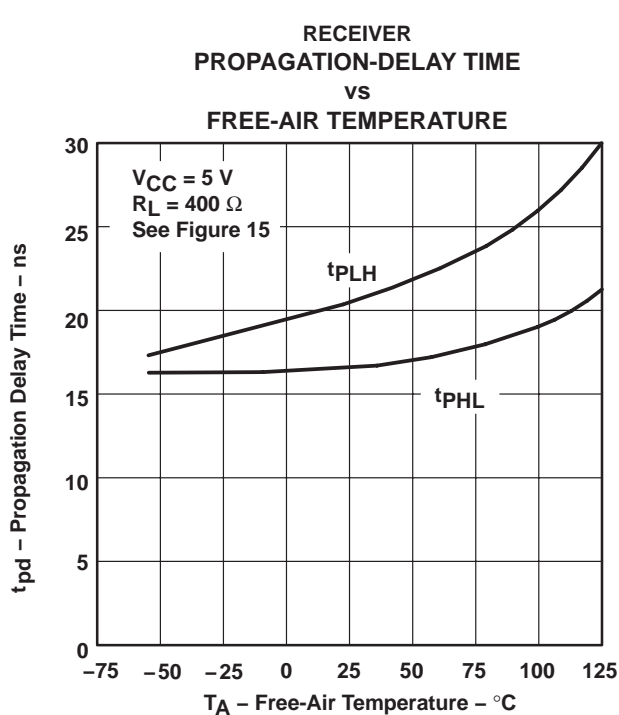


Figure 9

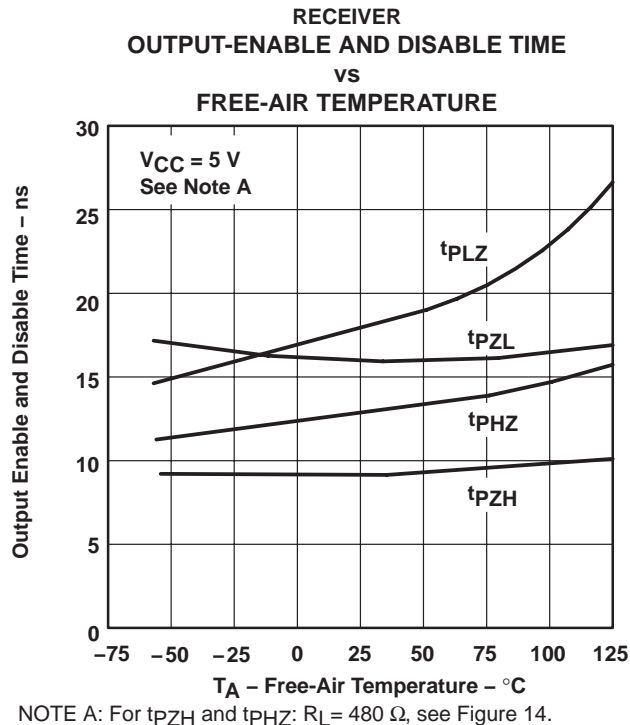


Figure 10

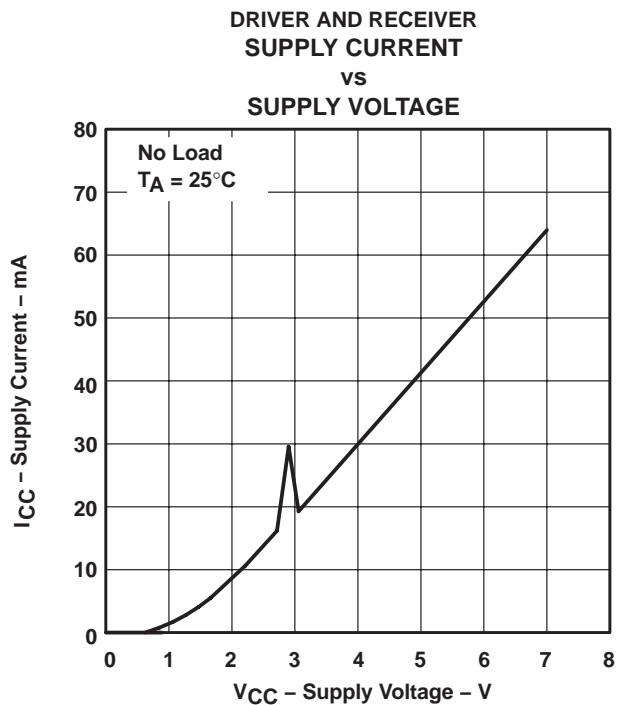


Figure 11

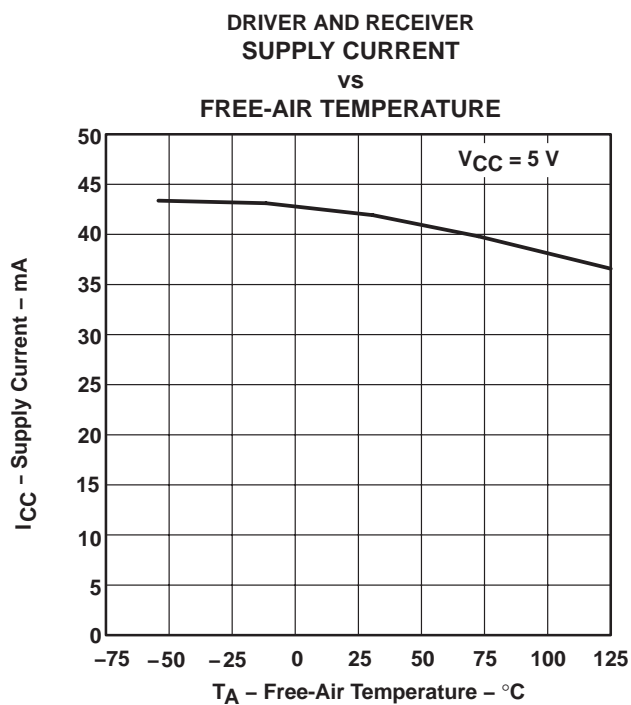


Figure 12

† Operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied.

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## PARAMETER MEASUREMENT INFORMATION

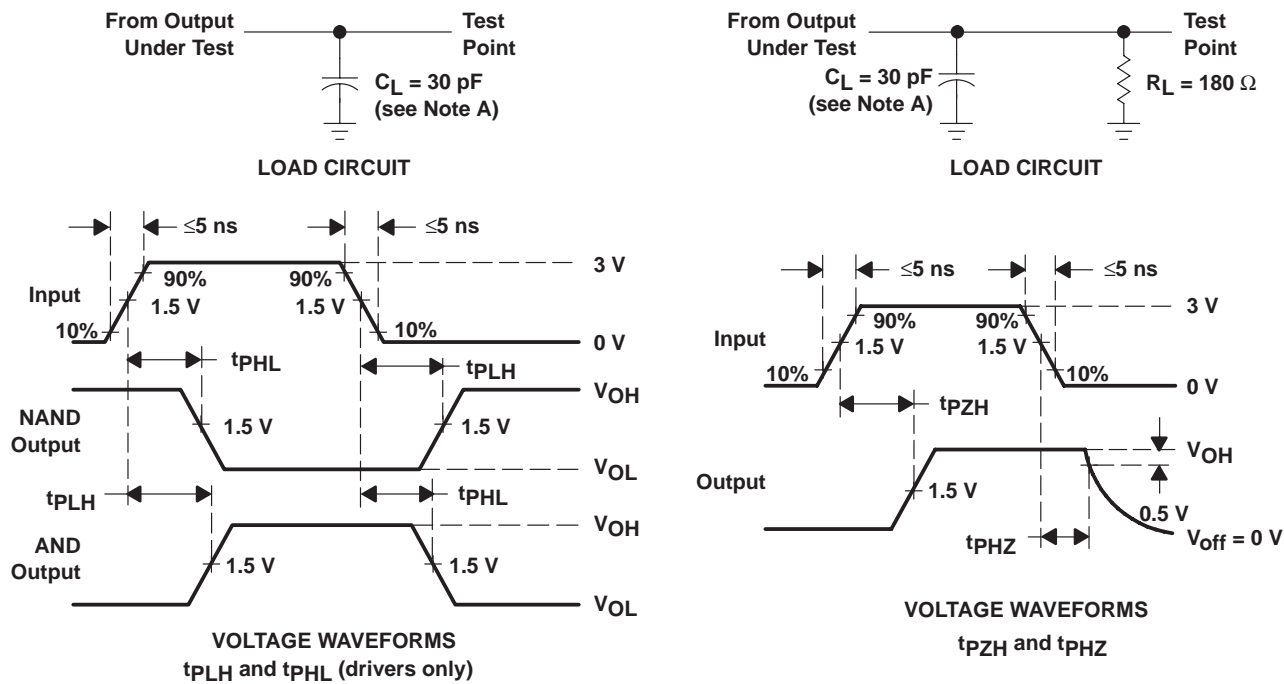


Figure 13

Figure 14

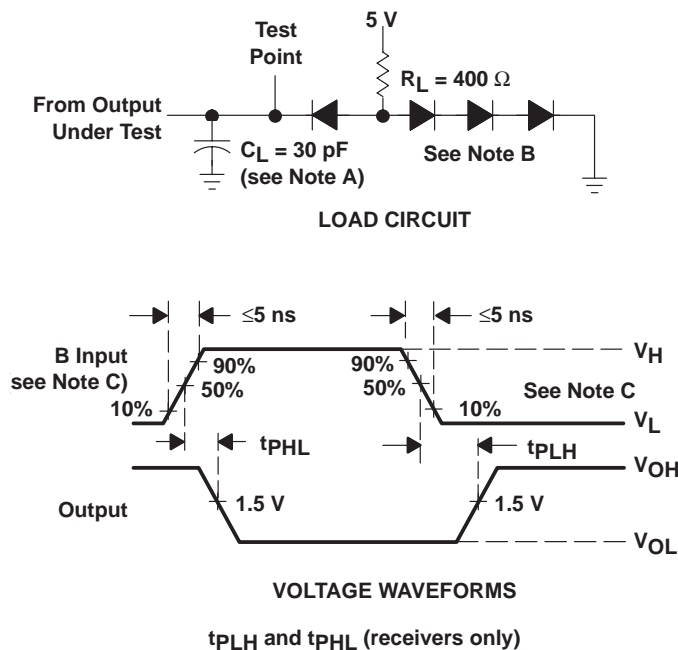


Figure 15

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. All diodes are 1N3064 or equivalent.  
 C.  $V_H = 3\text{ V}$ ,  $V_L = -3\text{ V}$ , the A input is at 0 V.  
 D. When testing the receiver sections, the response-time control and the termination-resistor pins are left open.



**PACKAGING INFORMATION**

Orderable Device	Status (1)	Package Type	Package Drawing	Pins	Package Qty	Eco Plan (2)	Lead finish/ Ball material (6)	MSL Peak Temp (3)	Op Temp (°C)	Device Marking (4/5)	Samples
5962-88511012A	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 88511012A SNJ55 116FK	<a href="#">Samples</a>
5962-8851101EA	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8851101EA SNJ55116J	<a href="#">Samples</a>
SNJ55116FK	ACTIVE	LCCC	FK	20	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962- 88511012A SNJ55 116FK	<a href="#">Samples</a>
SNJ55116J	ACTIVE	CDIP	J	16	1	Non-RoHS & Green	SNPB	N / A for Pkg Type	-55 to 125	5962-8851101EA SNJ55116J	<a href="#">Samples</a>

(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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

(4) There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices 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.

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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 SN55116 :**

- Catalog : [SN75116](#)

NOTE: Qualified Version Definitions:

- Catalog - TI's standard catalog product

**TUBE**


\*All dimensions are nominal

Device	Package Name	Package Type	Pins	SPQ	L (mm)	W (mm)	T (μm)	B (mm)
5962-88511012A	FK	LCCC	20	1	506.98	12.06	2030	NA
SNJ55116FK	FK	LCCC	20	1	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\

J (R-GDIP-T\*\*)

14 LEADS SHOWN

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)



4040083/F 03/03

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

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