

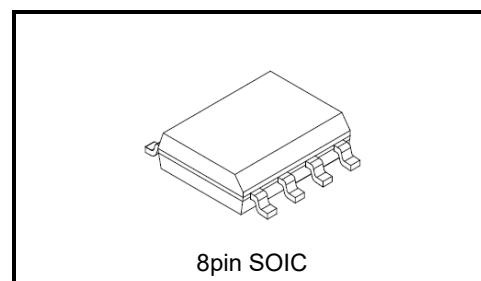
# DCM321D00

Dual - channel High speed Logic for Automotive equipment, Default High output

## 1. Description

The DCM321D00 is a 8-pin SOIC package default High-output, quad-channel high-speed digital isolator with the primary and secondary sides insulated and coupled by a magnetic coupling structure.

With a high isolation voltage of 3000 V<sub>rms</sub>, it is suitable for control applications such as in-vehicle communication line insulation.



8pin SOIC

Weight: 0.07 g (typ.)

## 2. Applications

- Battery Control in Automotive Equipment
- Fuel Battery Control in Automotive Equipment
- Application for Electrical Vehicle
- Date Converter Isolation

## 3. Features

- Data rate : 50 Mbps (Max)
- Default Output : High
- Number of channels : 2 channels (Forward 1 : Reverse 1)
- Suitable operating voltage : 3.3 V or 5 V
- Isolation voltage : 3000 V<sub>rms</sub>
- Common-Mode Transient Immunity : ±100 kV/μs (Typ)
- Safety standards
  - AEC-Q100 (Grade1 qualified)
  - UL : UL1577 , File No. E519997
  - cUL: CSA Component Acceptance Service Notice No. E519997

Note: Typical test conditions: V<sub>DD1</sub> = V<sub>DD2</sub> = 3.3V or 5V , T<sub>a</sub> = 25 °C; unless otherwise specified.

## 4. Mechanical Parameters

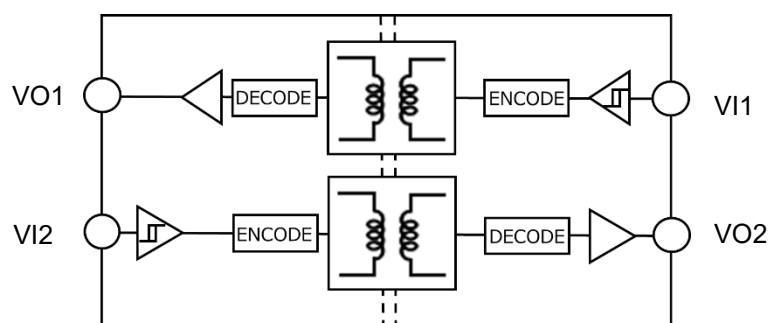
Table 4.1 Mechanical parameters

Characteristics	Symbol	unit	Unit
Creepage distances	CPG	3.8 (Min)	mm
Clearance distances	CLR	4 (Min)	mm
Distance Through the Insulation	DTI	17	μm

Start of commercial production  
2025-04

## 5. Block Diagram

DCM321D00



Note: Some of the functional blocks, circuits or constants labels in the block diagram may have been omitted or simplified for clarity.

**Figure 5.1 Block Diagram**

6. Pin Assignments

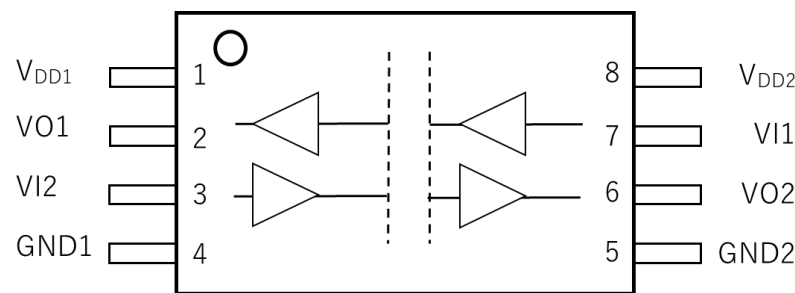


Figure 6.1 Pin Assignments (top view)

7. Pin Description

Table 7.1 Pin Description

Pin No	Pin name	I/O	Description
1	V <sub>DD1</sub>	—	Power Supply, side 1
2	VO1	OUT	Logic Output, Channel1
3	VI2	IN	Logic Input, Channel2
4	GND1	—	GND connection for VDD1, side 1
5	GND2	—	GND connection for VDD2, side 2
6	VO2	OUT	Logic Output, Channel2
7	VI1	IN	Logic Input, Channel1
8	V <sub>DD2</sub>	—	Power Supply, side 2

## 8. Functional Description

### 8.1. Specifications of External Components

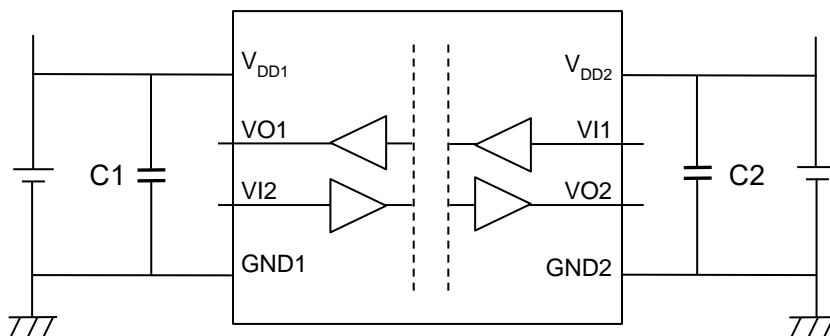


Figure 8.1 Pin Assignments (top view)

Table 8.1 External component specification (Note)

Component Name	Recommended Value	Pin	Description
C1	0.1μF	V <sub>DD1</sub>	—
C2	0.1μF	V <sub>DD2</sub>	—

Note: Use Ceramic capacitors (C1,C2) with good high frequency characteristics.

Note: Ceramic capacitors (C1,C2) should be connected between pin 1 (V<sub>DD1</sub>) and pin 2 (GND1) for V<sub>DD1</sub> and between pin 16 (V<sub>DD2</sub>) and pin 15 (GND2) for V<sub>DD2</sub>, and should be the layout on the IC as close as possible (less than 10mm). Otherwise, the IC may not switch properly.

## 8.2. IC Startup Procedure

### 8.2.1. Functional description

**Table 8.2 Pin Functional Description (Note)**

	V <sub>DDI</sub> Input side V <sub>DD</sub>	V <sub>DDO</sub> Output side V <sub>DD</sub>	Input ( V <sub>I1</sub> , V <sub>I2</sub> )	Output (V <sub>O1</sub> , V <sub>O2</sub> )	State Description
<b>1</b>	PU	PU	Low	Low	Normal Operation
<b>2</b>	PU	PU	High	High	Normal Operation
<b>3</b>	PU	PU	OPEN	High	Default mode
<b>4</b>	PD	PU	Low or OPEN	High	Default mode
<b>5</b>	PU	PD	Undetermined	Undetermined	When V <sub>DD2</sub> is unpowered, a channel output is undetermined
<b>6</b>	PD	PD	Low or OPEN		

Note: PU = Powered Up (V<sub>DD</sub> ≥ 2.25 V) , PD = Powered Down (V<sub>DD</sub> ≤ 1.7 V)

Note: V<sub>DDI</sub> = Input-side V<sub>DD</sub>, V<sub>DDO</sub> = Output-side V<sub>DD</sub>

## 9. Absolute Maximum Ratings (Note)

**Table 9.1 Absolute Maximum Ratings (Note)**

( $T_a = 25^\circ\text{C}$  unless otherwise specified)

Characteristics	Condition	Symbol	Rating	Unit
Junction temperature	—	$T_J$	-40 to 150	$^\circ\text{C}$
Storage temperature range	—	$T_{\text{stg}}$	-65 to 150	$^\circ\text{C}$
Operation temperature range	—	$T_{\text{opr}}$	-40 to 125	$^\circ\text{C}$
Soldering temperature	10s	$T_{\text{sol}}$	260	$^\circ\text{C}$
Supply voltage (DC)	—	$V_{\text{DD1}}, V_{\text{DD2}}$	-0.5 to 6.0	V
		$V_{\text{I1}}, V_{\text{I2}}$	-0.5 to $V_{\text{DDI}} + 0.5$ (Note 1)	V
		$V_{\text{O1}}, V_{\text{O2}}$	0.5 to $V_{\text{DDO}} + 0.5$ (Note 1)	V
		$\text{DIS1}, \text{DIS2}$	-0.5 to $V_{\text{DDEN}} + 0.5$ (Note 1)	V
Output Current	—	$I_O$	$\pm 15$	mA
Isolation voltage	1min	$BV_s$	3000	$V_{\text{rms}}$
Output current	$V_{\text{DD1}} = V_{\text{DD2}} = 5.5\text{ V}$ , $T_J = 150^\circ\text{C}$ , $T_a = 25^\circ\text{C}$	$I_{\text{S1}}$	255	mA
	$V_{\text{DD1}} = V_{\text{DD2}} = 3.6\text{ V}$ , $T_J = 150^\circ\text{C}$ , $T_a = 25^\circ\text{C}$	$I_{\text{S2}}$	390	mA
Power dissipation	$T_J = 150^\circ\text{C}$ , $T_a = 25^\circ\text{C}$	$P_{\text{d Max}}$	1403	mW

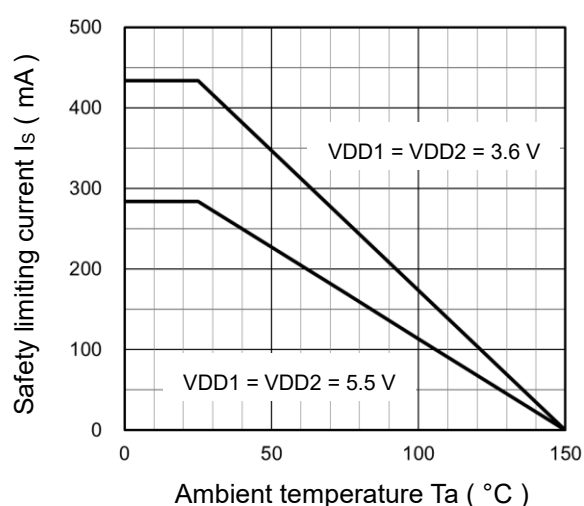
Note: The absolute maximum ratings of a semiconductor device are a set of specified parameter values, which must not be exceeded during operation, even for an instant.

If any of these rating would be exceeded during operation, the device electrical characteristics may be irreparably altered, and the reliability and lifetime of the device can no longer be guaranteed. Moreover, these operations with exceeded ratings may cause break down, damage, and/or degradation to any other equipment. Applications using the device should be designed such that each maximum rating will never be exceeded in any operating conditions.

Before using, creating, and/or producing designs, refer to and comply with the precautions and conditions set forth in this document.

Note 1: Maximum voltage must not exceed 6V.

## 9.1. Power Dissipation



**Figure 9.1** Thermal derating curve for safety limiting current -  $T_a$

## 10. Recommended operating conditions

**Table 10.1** Recommended Operating Ranges (Note)

Characteristics	Symbol	Min	Max	Unit
Operation voltage	$V_{DD1}, V_{DD2}$	3.0	5.5	V
Junction temperature	$T_J$	-40	150	°C
Operating temperature	$T_{opr}$	-40	125	°C

Note: The recommended operating conditions are given as a design guide necessary to obtain the intended performance of the device. Each parameter is an independent value. When creating a system design using this device, the electrical characteristics specified in this data sheet should also be considered.

## 11. Electrical Characteristics

### 11.1. DC characteristics – 5V Supply

**Table 11.1 DC characteristics – 5V Supply (Note)**

( $V_{DD1} = V_{DD2} = 4.5\text{ V to } 5.5\text{ V}$  over recommended operating conditions unless otherwise noted)

Characteristics	Symbol	Test condition	Min	Typ.	Max	Unit
<b><math>V_{DD}</math> Under Voltage Lockout threshold Voltage</b>	$V_{DDxUV+}$	Positive $V_{DDx}$ Threshold	—	2.10	2.25	V
	$V_{DDxUV-}$	Negative $V_{DDx}$ Threshold	1.7	1.9	—	
	$V_{DDxUVH}$	$V_{DDx}$ Hysteresis	0.1	0.2	—	
<b>Logic High-level output voltage</b>	$V_{OH}$	$V_{IX} = H$ , $I_{OH} = -20\text{ }\mu\text{A}$	$V_{DDO} - 0.1$	$V_{DDO}$	—	V
		$V_{IX} = H$ , $I_{OH} = -4\text{ mA}$	$V_{DDO} - 0.4$	$V_{DDO} - 0.2$	—	
<b>Logic Low-level output voltage</b>	$V_{OL}$	$V_{IX} = H$ , $I_{OL} = -20\text{ }\mu\text{A}$	—	0	0.1	V
		$V_{IX} = H$ , $I_{OL} = 4\text{ mA}$	—	0.2	0.4	
<b>Output Impedance</b>	$Z_O$	—	—	50	—	$\Omega$
<b>Logic High-level input Threshold voltage</b>	$V_{IH}$	—	$0.7 \times V_{DDI}$	—	—	V
<b>Logic Low-level input Threshold voltage</b>	$V_{IL}$	—	—	—	$0.3 \times V_{DDI}$	V
<b>Logic Input threshold voltage hysteresis</b>	$V_{HYS}$	—	—	0.37	—	V
<b>Input current</b>	$I_I$	$V_I = V_{DDI}$ or $0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$

Note:  $V_{DDI}$  = Input-side  $V_{DD}$ ,  $V_{DDO}$  = Output-side  $V_{DD}$



## 11.2. Switching Characteristics – 5 V Supply

**Table 11.2 Switching Characteristics – 5 V Supply**

(V<sub>DD1</sub> = V<sub>DD2</sub> = 4.5 V to 5.5 V over recommended operating conditions unless otherwise noted)

Characteristics		Symbol	Test condition	Min	Typ.	Max	Unit
Data Rate		t <sub>bps</sub>	—	DC	—	50	Mbps
Propagation Delay		t <sub>PHL</sub> , t <sub>PLH</sub>	50 kHz, Duty = 50 %, C <sub>L</sub> = 15 pF	—	10.9	18.3	ns
Pulse Width Distortion		PWD	t <sub>PHL</sub> – t <sub>PLH</sub>	—	0.8	5.1	ns
Propagation Delay Skew (Between any two units)		t <sub>PSK</sub>	(Note1)	—	—	13	ns
Channel Matching	Opposing Direction	t <sub>skOD</sub>	—	—	—	4.5	ns
Output signal rise time		t <sub>r</sub>	10% to 90%	—	0.9	—	ns
Output signal fall time		t <sub>f</sub>	90% to 10%	—	0.9	—	ns
Common-Mode Transient Immunity		CMTI	V <sub>I</sub> = V <sub>DDI</sub> or 0 V, V <sub>CM</sub> = 1500 V	—	100	—	kV/μs

Note1: The Propagation delay skew, t<sub>PSK</sub>, is equal to the magnitude of the difference in propagation delay that will be seen between units at the same given conditions (supply voltage, input current, temperature, etc.).

## 11.3. Supply Current Characteristics – 5 V Supply

**Table 11.3 Supply Current Characteristics – 5 V Supply**

(V<sub>DD1</sub> = V<sub>DD2</sub> = 4.5 V to 5.5 V over recommended operating conditions unless otherwise noted)

Characteristics		Symbol	Test condition	Min	Typ.	Max	Unit
DC Supply Current	Primary side	I <sub>DDQ1(0)5</sub>	V <sub>I</sub> = High	—	2.0	3.0	mA
		I <sub>DDQ1(1)5</sub>	V <sub>I</sub> = Low	—	7.2	10.4	
	Secondary side	I <sub>DDQ2(0)5</sub>	V <sub>I</sub> = High	—	2.0	3.0	mA
		I <sub>DDQ2(1)5</sub>	V <sub>I</sub> = Low	—	7.2	10.4	
Supply Current (AC signal)	t <sub>bps</sub> = 1 Mbps	Primary side	f <sub>CLK</sub> = 500 kHz, Duty = 50 % square wave, C <sub>L</sub> = 15 pF	—	4.6	6.8	mA
		Secondary side		—	4.6	6.8	
	t <sub>bps</sub> = 25 Mbps	Primary side	f <sub>CLK</sub> = 12.5 MHz, Duty = 50 % square wave, C <sub>L</sub> = 15 pF	—	6.1	8.5	mA
		Secondary side		—	6.1	8.5	
	t <sub>bps</sub> = 50 Mbps	Primary side	f <sub>CLK</sub> = 25 MHz, Duty = 50 % square wave, C <sub>L</sub> = 15 pF	—	7.1	9.9	mA
		Secondary side		—	7.1	9.9	

# 11.4. Supply Current Characteristics – 3.3 V Supply

**Table 11.4 Supply Current Characteristics – 3.3 V Supply (Note)**

( $V_{DD1} = V_{DD2} = 3.0\text{ V}$  to  $3.6\text{ V}$  over recommended operating conditions unless otherwise noted)

Characteristics	Symbol	Test condition	Min	Typ.	Max	Unit
<b><math>V_{DD}</math> Under Voltage Lockout threshold Voltage</b>	$V_{DDxUV+}$	Positive $V_{DDx}$ Threshold	—	2.1	2.25	V
	$V_{DDxUV-}$	Negative $V_{DDx}$ Threshold	1.7	1.9	—	
	$V_{DDxUVH}$	$V_{DDx}$ Hysteresis	0.1	0.2	—	
<b>Logic High-level output voltage</b>	$V_{OH}$	$V_{IX} = H$ , $I_{OH} = -20\text{ }\mu\text{A}$	$V_{DDO} - 0.1$	$V_{DDO}$	—	V
		$V_{IX} = H$ , $I_{OH} = -4\text{ mA}$	$V_{DDO} - 0.4$	$V_{DDO} - 0.2$	—	
<b>Logic Low-level output voltage</b>	$V_{OL}$	$V_{IX} = H$ , $I_{OL} = -20\text{ }\mu\text{A}$	—	0	0.1	V
		$V_{IX} = H$ , $I_{OL} = 4\text{ mA}$	—	0.2	0.4	
<b>Output Impedance</b>	$Z_O$	—	—	50	—	$\Omega$
<b>Logic High-level input Threshold voltage</b>	$V_{IH}$	—	$0.7 \times V_{DDI}$	—	—	V
<b>Logic Low-level input Threshold voltage</b>	$V_{IL}$	—	—	—	$0.3 \times V_{DDI}$	V
<b>Logic Input threshold voltage hysteresis</b>	$V_{HYS}$	—	—	0.32	—	V
<b>Input current</b>	$I_I$	$V_I = V_{DDI}$ or $0\text{ V}$	—	—	$\pm 10$	$\mu\text{A}$

Note:  $V_{DDI}$  = Input-side  $V_{DD}$ ,  $V_{DDO}$  = Output-side  $V_{DD}$

## 11.5. Switching Characteristics – 3.3 V Supply

**Table 11.5 Switching Characteristics – 3.3 V Supply**

( $V_{DD1} = V_{DD2} = 3.0 \text{ V}$  to  $3.6 \text{ V}$  over recommended operating conditions unless otherwise noted)

Characteristics		Symbol	Test condition	Min	Typ.	Max	Unit
Data Rate		$t_{bps}$	—	DC	—	50	Mbps
Propagation Delay		$t_{PHL}$ , $t_{PLH}$	50 kHz, Duty = 50 %, $C_L = 15 \text{ pF}$	—	11.6	19.1	ns
Pulse Width Distortion		PWD	$ t_{PHL} - t_{PLH} $	—	0.8	5.1	ns
Propagation Delay Skew (Between any two units)		$t_{PSK}$	(Note1)	—	—	13	ns
Channel Matching	Opposing Direction	$t_{skOD}$	—	—	—	4.5	ns
Output signal rise time		$t_r$	10% to 90%	—	0.8	—	ns
Output signal fall time		$t_f$	90% to 10%	—	0.8	—	ns
Common-Mode Transient Immunity		CMTI	$V_I = V_{DDI}$ or $0 \text{ V}$ , $V_{CM} = 1500 \text{ V}$	—	100	—	kV/ $\mu\text{s}$

Note1: The Propagation delay skew,  $t_{PSK}$ , is equal to the magnitude of the difference in propagation delay.

That will be seen between units at the same given conditions (supply voltage, input current, temperature, etc.).

## 11.6. Supply Current Characteristics – 3.3 V Supply

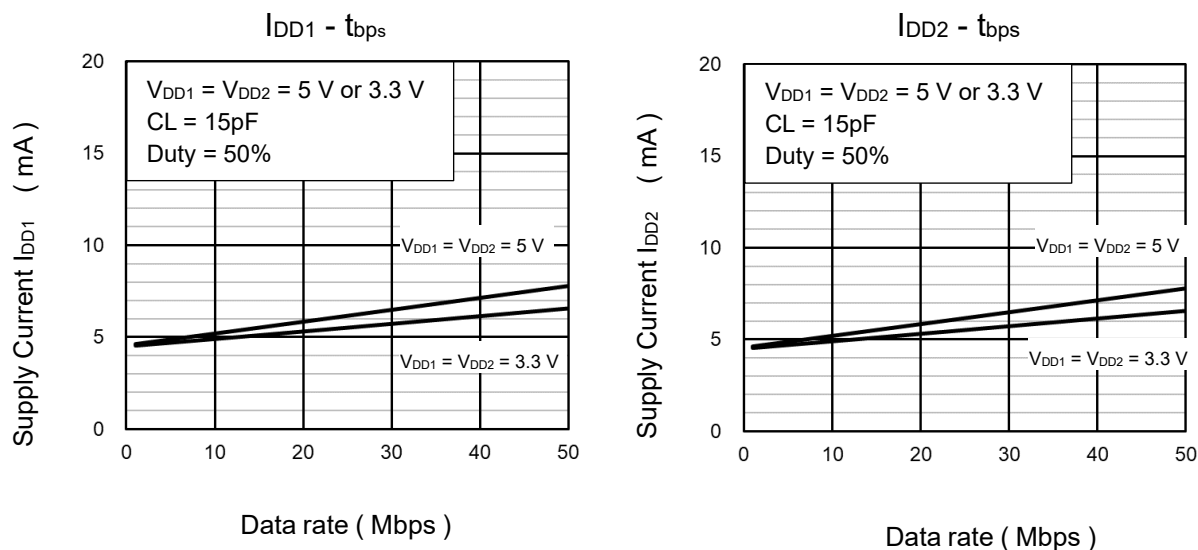
**Table 11.6 Supply Current Characteristics – 3.3 V Supply**

( $V_{DD1} = V_{DD2} = 3.0 \text{ V}$  to  $3.6 \text{ V}$  over recommended operating conditions unless otherwise noted)

Characteristics		Symbol	Test condition	Min	Typ.	Max	Unit
DC Supply Current	Primary side	$I_{DDQ1(0)5}$	$V_I = \text{High}$	—	2.0	2.8	mA
		$I_{DDQ1(1)5}$	$V_I = \text{Low}$	—	7.1	10.2	
	Secondary side	$I_{DDQ2(0)5}$	$V_I = \text{High}$	—	2.0	2.8	mA
		$I_{DDQ2(1)5}$	$V_I = \text{Low}$	—	7.1	10.2	
Supply Current (AC signal)	$t_{bps} = 1 \text{ Mbps}$	Primary side	$f_{CLK} = 500 \text{ kHz}$ , Duty = 50 % square wave, $C_L = 15 \text{ pF}$	—	4.5	6.6	mA
		Secondary side		—	4.5	6.6	
	$t_{bps} = 25 \text{ Mbps}$	Primary side	$f_{CLK} = 12.5 \text{ MHz}$ , Duty = 50 % square wave, $C_L = 15 \text{ pF}$	—	5.5	7.6	mA
		Secondary side		—	5.5	7.6	
	$t_{bps} = 50 \text{ Mbps}$	Primary side	$f_{CLK} = 25 \text{ MHz}$ , Duty = 50 % square wave, $C_L = 15 \text{ pF}$	—	6.1	8.5	mA
		Secondary side		—	6.1	8.5	

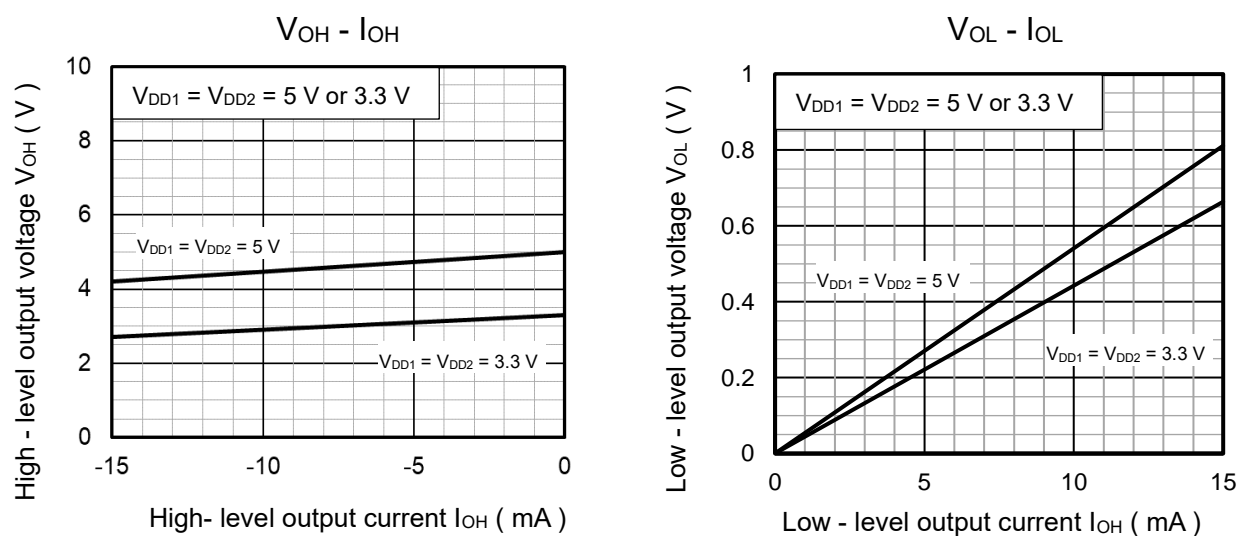
## 12. Characteristic Chart (Note)

### 12.1. Supply Current vs Data rate



**Figure12.1 Supply Current – Data rate**

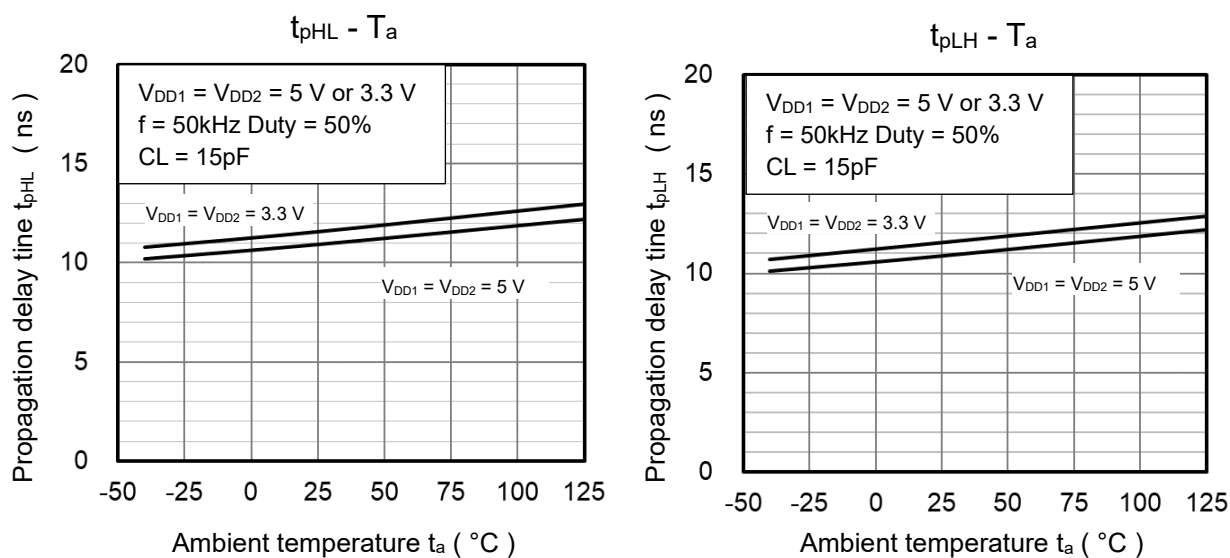
### 12.2. Output Voltage vs Output Current



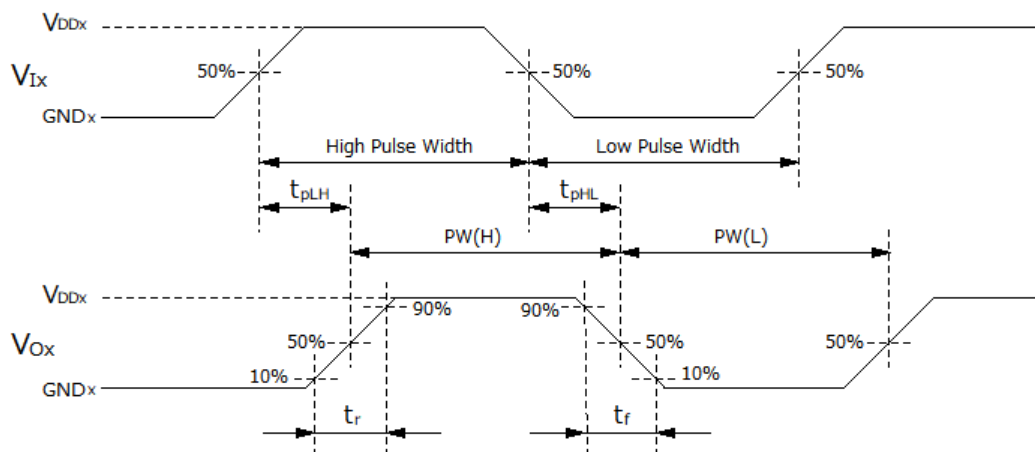
**Figure12.2 Output Voltage – Output Current**

Note: The following characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### 12.3. Propagation Delay Time vs Ambient Temperature



**Figure12.3 Propagation Delay Time vs Ambient Temperature**



**Figure12.4 Switching Waveforms**

Note: The following characteristics curves are presented for reference only and not guaranteed by production test, unless otherwise noted.

### 13. Package Information

**Table 13.1 Insulation Related Specifications (Note)**

Parameters	Symbol	DCM321D00	Unit
Minimum clearance	CLR	4.0	mm
Minimum creepage distance	CPG	3.8	mm
Minimum insulation thickness	DTI	17	μm
Comparative tracking index	CTI	550	V

Note: If a printed circuit is incorporated, the creepage distance and clearance may be reduced below this value. (e.g., at a standard distance between soldering eye centers of 3.8 mm). If this is not permissible, the user shall take suitable measures.

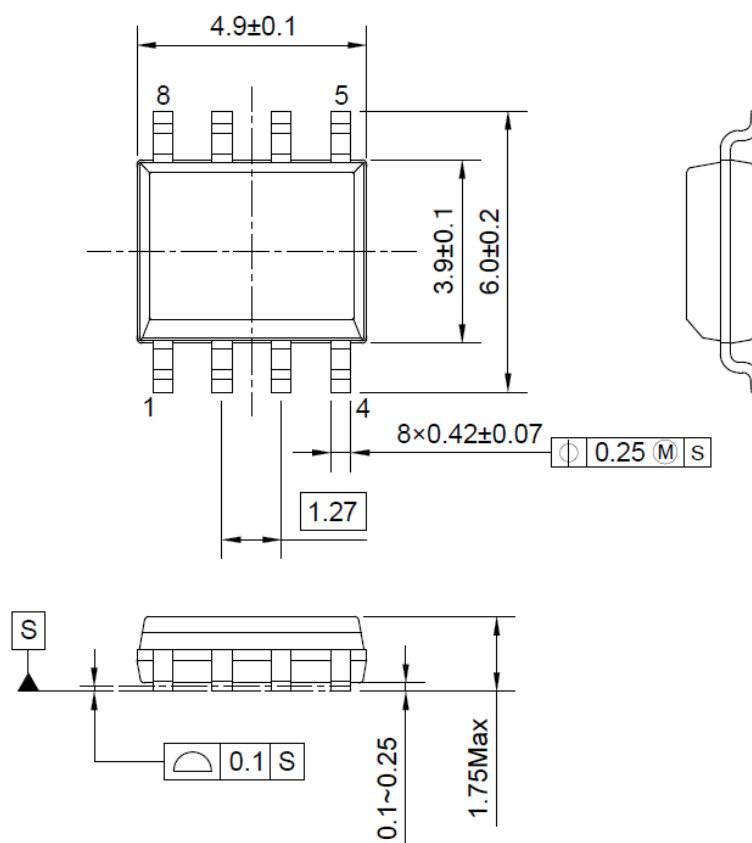
Note: This photocoupler is suitable for safe electrical isolation only within the safety limit data. Maintenance of the safety data shall be ensured by means of protective circuits.

## 14. Package Information

### 14.1. Package Dimensions

8pin SOIC  
( P-SOP8-0405-1.27-002 )

UNIT: mm



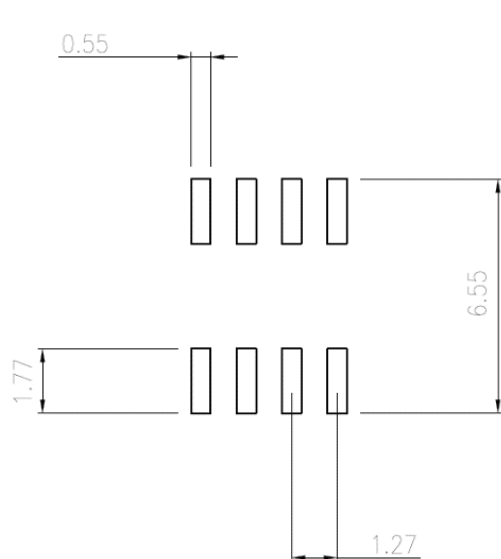
Weight: 0.07 g (typ.)

Figure 14.1 Package Dimensions

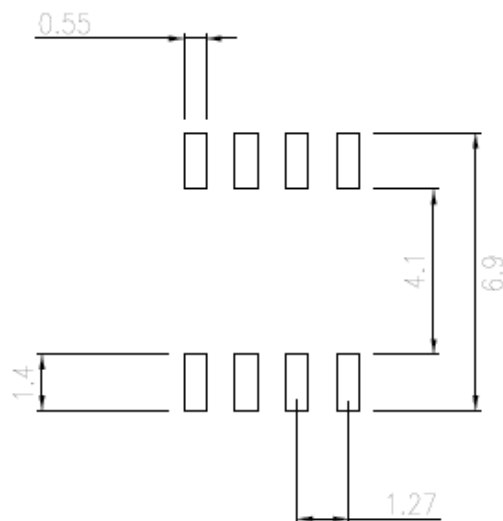
## 14.2. Land Pattern Dimensions for Reference only

8pin SOIC  
( P-SOP8-0405-1.27-002 )

Unit: mm



Complies with JEITA ET-7501 Level 3 Normal



Isolation option

**Figure 14.2 Land Pattern Dimensions for Reference only**

### Notes.

- Unless otherwise indicated, dimensions are given in millimeters.
- This document is a reference drawing in accordance with JEITA ET-7501 Level 3. The Company does not guarantee the accuracy or completeness of the diagrams and information.
- The customer should fully evaluate the various conditions (soldering conditions, etc.) and adjust at their own risk.
- The diagrams in this document do not accurately show the actual shape and dimensions. Do not use the dimensions of the actual product as a basis for designing the product.
- When designing and using the product, check the latest information on the product and the operating instructions of the equipment in which the product is to be used, and follow these instructions.



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