Standard digital Isolators

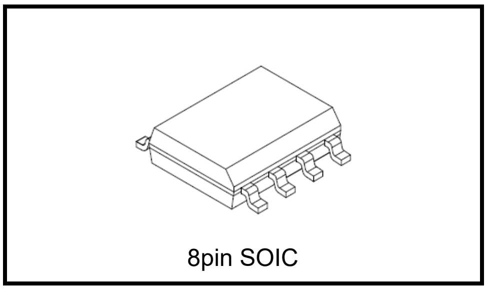
DCM321C00

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

1. Description

The DCM321C00 is a 8-pin SOIC package default Low-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_{rms}, 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	:	Low
Number of channels	:	2 channels (Forward 1: Reverse 1)
Suitable operating voltage	:	3.3 V or 5 V
Isolation voltage	:	3000 V_{rms}
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_{DD1} =V_{DD2} = 3.3V or 5V , T_a = 25 °C; unless otherwise specified.

4. Mechanical Parameters

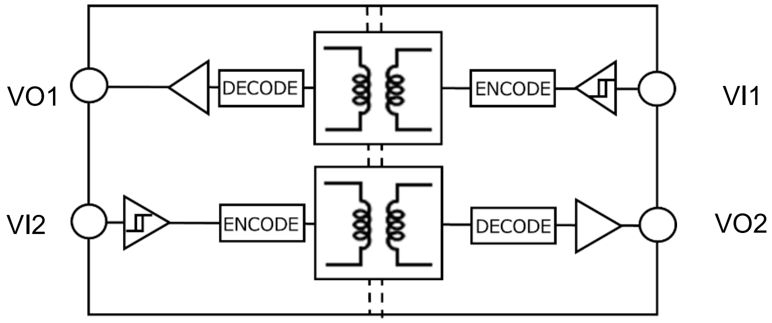
Table 4.1 Mechanical parameters

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
2025-03

5. Block Diagram

DCM321C00



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

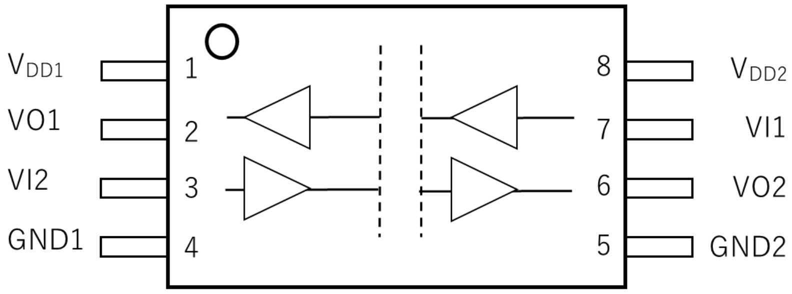


Figure 6.1 Pin Assignments (top view)

7. Pin Description

Table 7.1 Pin Description

Pin No	Pin name	I/O	Description
1	V_{DD1}	—	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_{DD2}	—	Power Supply, side 2

8. Functional Description

8.1. Specifications of External Components

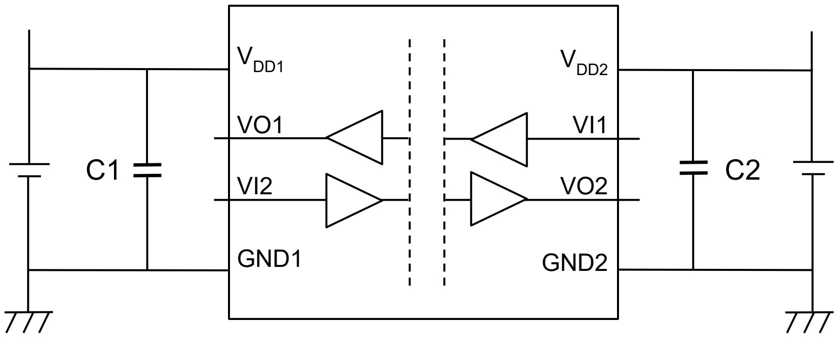


Figure 8.1 Pin Assignments (top view)

Table 8.1 External component specification (Note)

Component Name	Recommended Value	Pin	Description
C1	0.1 μF	V_{DD1}	―
C2	0.1 μF	V_{DD2}	―

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

Note: Ceramic capacitors (C1,C2) should be connected between pin 1 (V_{DD1}) and pin 2 (GND1) for V_{DD1} and between pin 16 (V_{DD2}) and pin 15 (GND2) for V_{DD2}, 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_{DDI} Input side V_{DD}	V_{DDO} Output side V_{DD}	Input (VI1 , VI2)	Output (VO1 , VO2)	State Description
1	PU	PU	Low	Low	Normal Operation
2	PU	PU	High	High	Normal Operation
3	PU	PU	OPEN	Low	Default mode
4	PD	PU	Low or OPEN	Low	Default mode
5	PU	PD	Undetermined	Undetermined	When V_{DD2} is unpowered, a channel output is undetermined
6	PD	PD	Low or OPEN		

Note: PU = Powered Up ($V_{DD} \geq 2.25$ V) , PD = Powered Down ($V_{DD} \leq 1.7$ V)
Note: V_{DDI} = Input-side V_{DD}, V_{DDO} = Output-side V_{DD}

9. Absolute Maximum Ratings (Note)

Table 9.1 Absolute Maximum Ratings (Note)

(T_a = 25°C unless otherwise specified)

Characteristics	Condition	Symbol	Rating	Unit
Junction temperature	—	T_J	-40 to 150	°C
Storage temperature range	—	T_{stg}	-65 to 150	°C
Operation temperature range	—	T_{opr}	-40 to 125	°C
Soldering temperature	10 s	T_{sol}	260	°C
Supply voltage (DC)	—	V_{DD1},V_{DD2}	-0.5 to 6.0	V
		VI1,VI2	-0.5 to V_{DDI} + 0.5 (Note 1)	V
		VO1,VO2	0.5 to V_{DDO} + 0.5 (Note 1)	V
Output Current	—	I_O	±15	mA
Isolation voltage	1min	BV_S	3000	Vrms
Output current	V_{DD1} = V_{DD2} = 5.5 V, Tj = 150 °C, Ta = 25 °C	I_{S1}	255	mA
	V_{DD1} = V_{DD2} = 3.6 V, Tj = 150 °C, Ta = 25 °C	I_{S2}	390	mA
Power dissipation	Tj = 150 °C, Ta = 25 °C	$P_{d\ Max}$	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

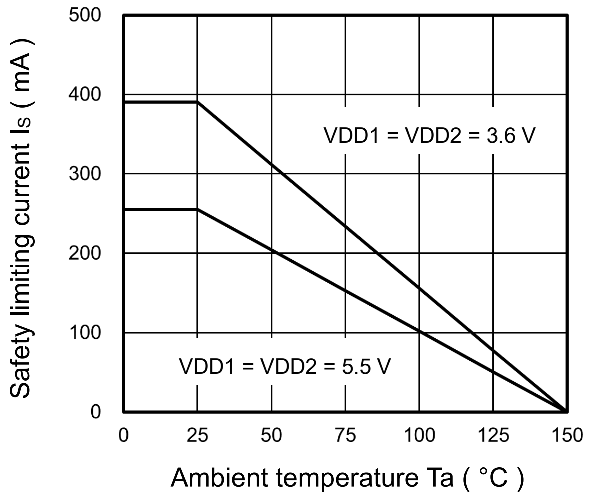


Figure 9.1 Thermal derating curve for safety limiting current - T_a

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 V to 5.5 V over recommended operating conditions unless otherwise noted)

Characteristics	Symbol	Test condition	Min	Typ.	Max	Unit
V_{DD} Under Voltage Lockout threshold Voltage	VDD_{xUV+}	Positive VDDx Threshold	—	2.1	2.25	V
	VDD_{xUV-}	Negative VDDx Threshold	1.7	1.9	—	
	VDD_{xUVH}	VDDx Hysteresis	0.1	0.2	—	
Logic High-level output voltage	V_{OH}	V_{Ix} = H , I_{OH} = -20 μA	V_{DDO} - 0.1	V_{DDO}	—	V
		V_{Ix} = H , I_{OH} = -4 mA	V_{DDO} - 0.4	V_{DDO} - 0.2	—	
Logic Low-level output voltage	V_{OL}	V_{Ix} = H , I_{OL} = 20 μA	—	0	0.1	V
		V_{Ix} = H , I_{OL} = 4 mA	—	0.2	0.4	
Output Impedance	Z_O	—	—	50	—	Ω
Logic High-level input Threshold voltage	V_{IH}	—	0.7 x V_{DDI}	—	—	V
Logic Low-level input Threshold voltage	V_{IL}	—	—	—	0.3 x V_{DDI}	V
Logic Input threshold voltage hysteresis	V_{HYS}	—	—	0.37	—	V
Input current	I_I	V_I = V_{DDI} or 0 V	—	—	±10	μA

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_{DD1} = V_{DD2} =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_{bps}	—	DC	—	50	Mbps
Propagation Delay		t_{PHL} , t_{PLH}	50 kHz, Duty = 50 %, C_L = 15 pF	—	10.9	18.3	ns
Pulse Width Distortion		PWD	$\lvert t_{PHL} - t_{PLH} \rvert$	—	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%	—	0.9	—	ns
Output signal fall time		t_f	90% to 10%	—	0.9	—	ns
Common-Mode Transient Immunity		CMTI	V_I = V_{DDI} or 0 V , V_{CM} = 1500 V	—	100	—	kV/μs

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.).

11.3. Supply Current Characteristics – 5 V Supply

Table 11.3 Supply Current Characteristics – 5 V Supply

(V_{DD1} = V_{DD2} =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	$I_{DDQ1(0)5}$	V_I = Low	—	2.0	3.0	mA
			$I_{DDQ1(1)5}$	V_I = High	—	7.2	10.4	
		Secondary side	$I_{DDQ2(0)5}$	V_I = Low	—	2.0	3.0	mA
			$I_{DDQ2(1)5}$	V_I = High	—	7.2	10.4	
Supply Current (AC signal)	t_{bps} = 1 Mbps	Primary side	$I_{DD1(1)5}$	f_{CLK} = 500 kHz, Duty = 50 % square wave, C_L = 15 pF	—	4.6	6.8	mA
		Secondary side	$I_{DD2(1)5}$		—	4.6	6.8	
	t_{bps} = 25 Mbps	Primary side	$I_{DD1(25)5}$	f_{CLK} = 12.5 MHz, Duty = 50 % square wave, C_L = 15 pF	—	6.1	8.5	mA
		Secondary side	$I_{DD2(25)5}$		—	6.1	8.5	
	t_{bps} = 50 Mbps	Primary side	$I_{DD1(50)5}$	f_{CLK} = 25 MHz, Duty = 50 % square wave, C_L = 15 pF	—	7.1	9.9	mA
		Secondary side	$I_{DD2(50)5}$		—	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 V to 3.6 V over recommended operating conditions unless otherwise noted)

Characteristics	Symbol	Test condition	Min	Typ.	Max	Unit
V_{DD} Under Voltage Lockout threshold Voltage	VDD_{xUV+}	Positive VDDx Threshold	—	2.1	2.25	V
	VDD_{xUV-}	Negative VDDx Threshold	1.7	1.9	—	
	VDD_{xUVH}	VDDx Hysteresis	0.1	0.2	—	
Logic High-level output voltage	V_{OH}	V_{Ix} = H , I_{OH} = - 20 μA	V_{DDO} - 0.1	V_{DDO}	—	V
		V_{Ix} = H , I_{OH} = - 4 mA	V_{DDO} - 0.4	V_{DDO}-0.2	—	
Logic Low-level output voltage	V_{OL}	V_{Ix} = H , I_{OL} = 20 μA	—	0	0.1	V
		V_{Ix} = H , I_{OL} = 4 mA	—	0.2	0.4	
Output Impedance	Z_O	—	—	50	—	Ω
Logic High-level input Threshold voltage	V_{IH}	—	0.7 x V_{DDI}	—	—	V
Logic Low-level input Threshold voltage	V_{IL}	—	—	—	0.3 x V_{DDI}	V
Logic Input threshold voltage hysteresis	V_{HYS}	—	—	0.32	—	V
Input current	I_I	V_I = V_{DDI} or 0 V	—	—	±10	μA

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 V to 3.6 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 pF	—	11.6	19.1	ns
Pulse Width Distortion	PWD	$\lvert t_{PHL} - t_{PLH}\rvert$	—	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 V , V_{CM} = 1500 V	—	100	—	kV/μs

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 V to 3.6 V over recommended operating conditions unless otherwise noted)

Characteristics			Symbol	Test condition	Min	Typ.	Max	Unit
DC Supply Current		Primary side	$I_{DDQ1(0)3}$	V_I = Low	—	2.0	2.8	mA
			$I_{DDQ1(1)3}$	V_I = High	—	7.1	10.2	
		Secondary side	$I_{DDQ2(0)3}$	V_I = Low	—	2.0	2.8	mA
			$I_{DDQ2(1)3}$	V_I = High	—	7.1	10.2	
Supply Current (AC signal)	t_{bps} = 1 Mbps	Primary side	$I_{DD1(1)3}$	f_{CLK} = 500 kHz, Duty = 50 % square wave, C_L = 15 pF	—	4.5	6.6	mA
		Secondary side	$I_{DD2(1)3}$		—	4.5	6.6	
	t_{bps} = 25 Mbps	Primary side	$I_{DD1(25)3}$	f_{CLK} = 12.5 MHz, Duty = 50 % square wave, C_L = 15 pF	—	5.5	7.6	mA
		Secondary side	$I_{DD2(25)3}$		—	5.5	7.6	
	t_{bps} = 50 Mbps	Primary side	$I_{DD1(50)3}$	f_{CLK} = 25 MHz, Duty = 50 % square wave, C_L = 15 pF	—	6.1	8.5	mA
		Secondary side	$I_{DD2(50)3}$		—	6.1	8.5	

12. Characteristic Chart (Note)

12.1. Supply Current vs Data rate

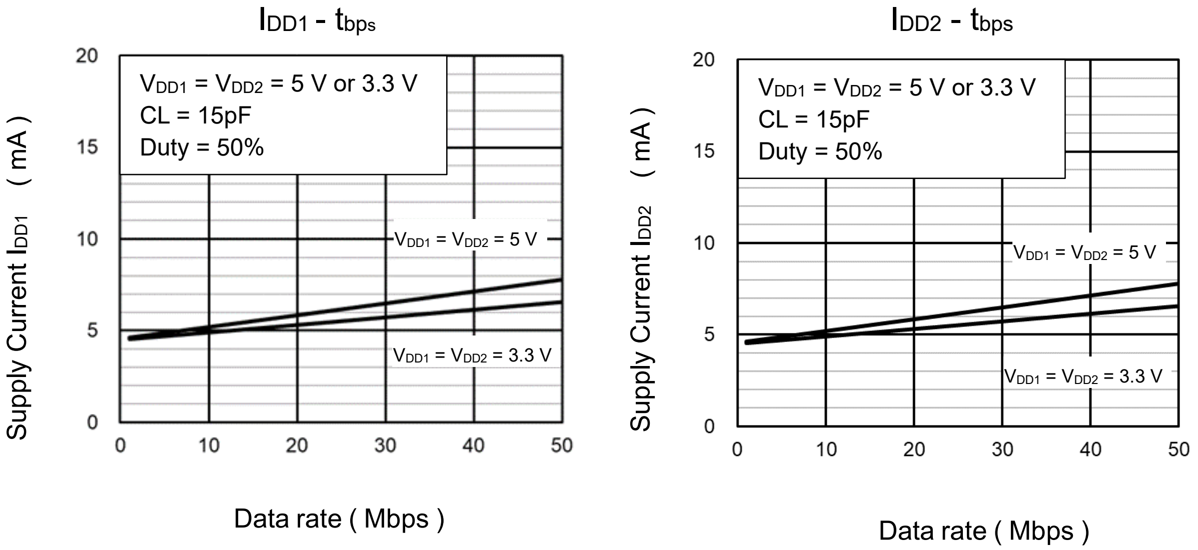


Figure12.1 Supply Current – Data rate

12.2. Output Voltage vs Output Current

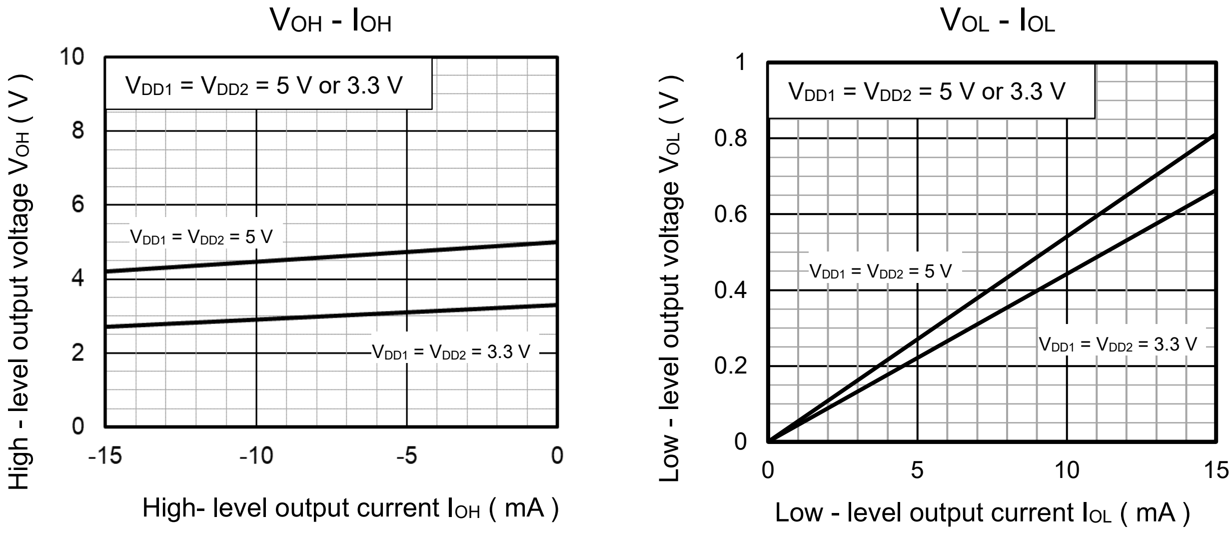


Figure12.2 Output Voltage – Output Current

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

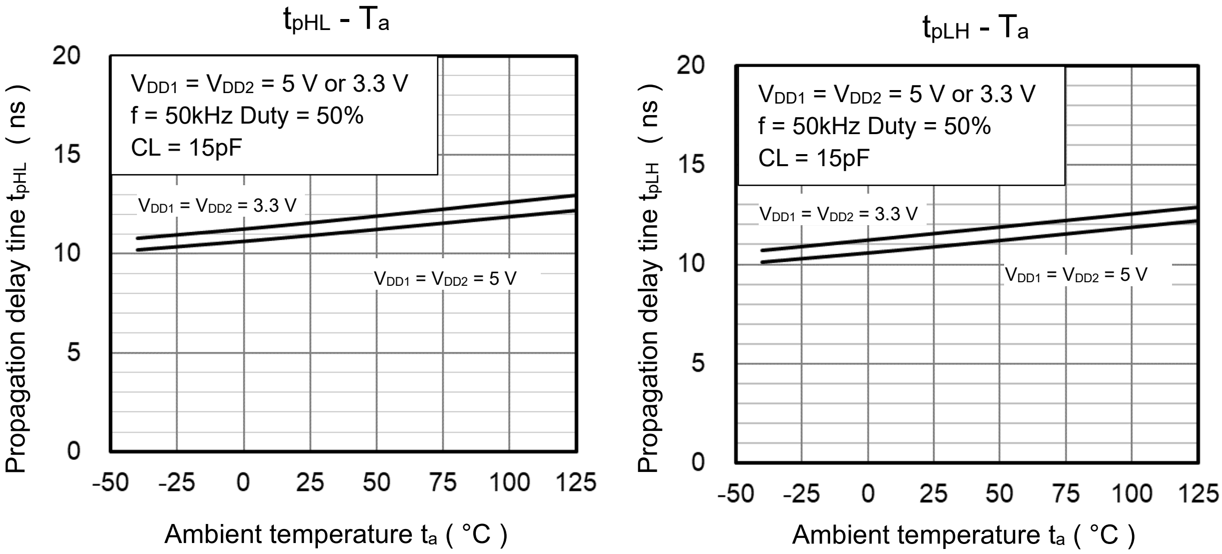


Figure12.3 Propagation Delay Time vs Ambient Temperature

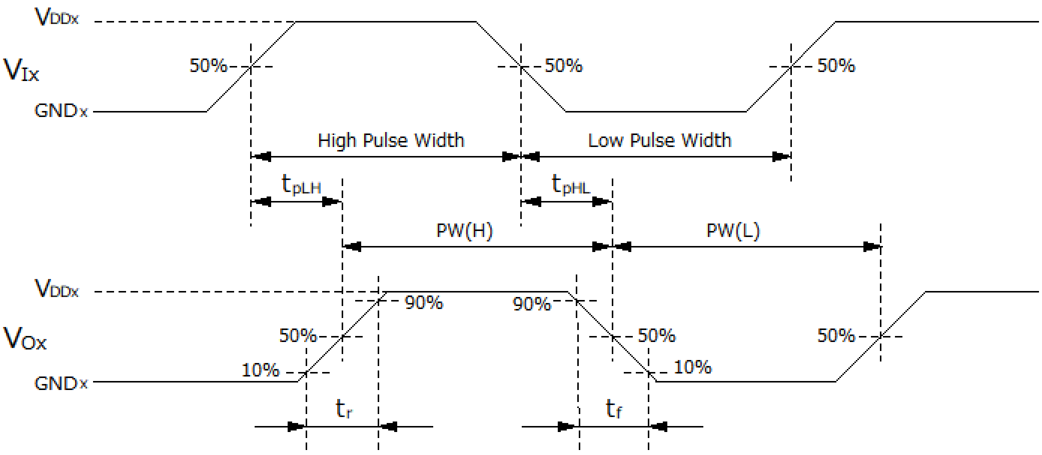


Figure12.4 Switching Waveforms

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	DCM321C00	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.

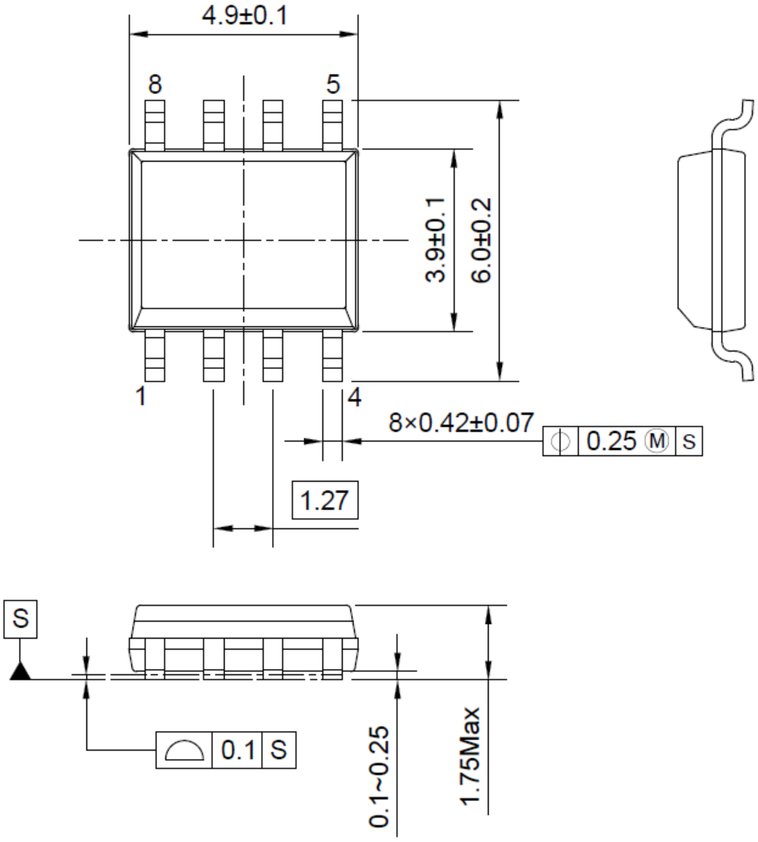
Note: This photocoupler is suitable for safe electrical isolation only within the safety limit data. Maintenance of the safety data shall be ensured by means of protective circuits.

14. Package Information

14.1. Package Dimensions

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

UNIT: mm



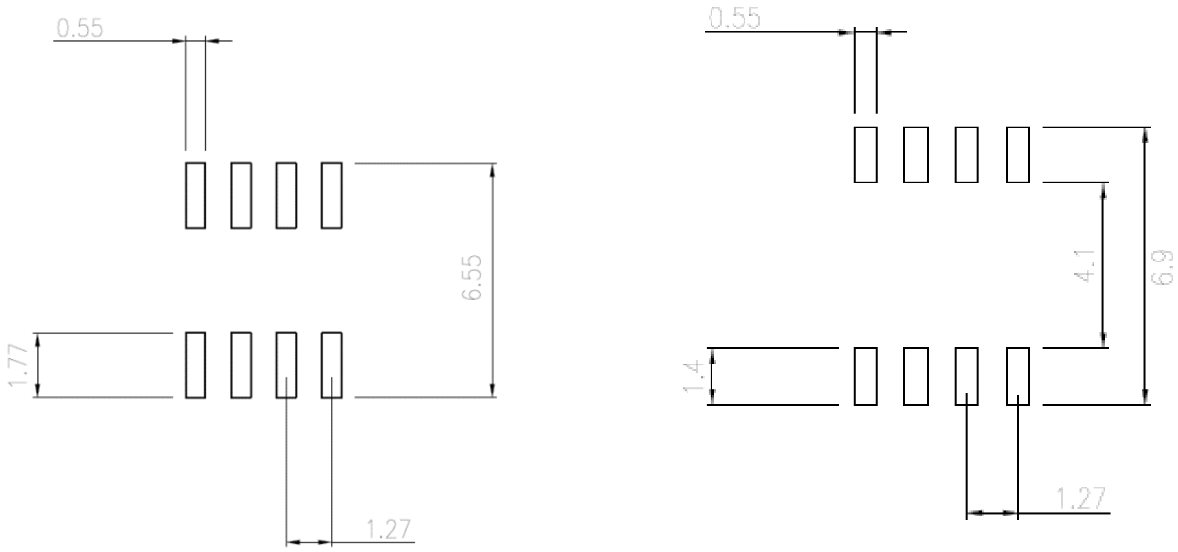
Weight: 0.07 g (typ.)

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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