

# DCL54xx01A

|                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------|
| DCL540C01A/DCL540D01A/DCL541A01A/DCL541B01A/<br>DCL540L01A/DCL540H01A/DCL541L01A/DCL541H01A/DCL542L01A/DCL542H01A |
|-------------------------------------------------------------------------------------------------------------------|

## 1. Applications

- Industrial automation systems
- Motor control
- Inverter
- Switching power supply

## 2. Description

DCL540C01A/DCL540D01A/DCL541A01A/DCL541B01A/DCL540L01A/DCL540H01A/DCL541L01A/DCL541H01A/DCL542L01A/DCL542H01A are high-speed quad-channel digital isolators. Outstanding performance characteristics are achieved by Toshiba CMOS technology and the magnetic coupling structure. In addition, they comply with UL 1577 and has a 5000Vrms rating as an isolation voltage. These products can operate with a temperature range of -40 to 125 °C and a wide supply voltage of 2.25 to 5.5 V.

## 3. Features

|                              |                                                            |
|------------------------------|------------------------------------------------------------|
| Data rate                    | : Up to 150 Mbps                                           |
| Supply voltage               | : 2.25 V to 5.5 V                                          |
| Temperature Range            | : -40 °C to 125 °C                                         |
| Propagation Delay            | : 10.9 ns Typical (5.0 V operation)                        |
| Default Output               | : High and Low Options                                     |
| CMTI (Typ.)                  | : 100 kV/μs                                                |
| Withstand Voltage            | : 5 kVrms                                                  |
| Package                      | : 16pin SOIC Wide body                                     |
| Safety-Related Certification | :                                                          |
| UL                           | : UL 1577 (Planned)                                        |
| cUL                          | : CSA Component Acceptance Service Notice No. 5A (Planned) |
| VDE                          | : DIN EN IEC 60747-17 (VDE V 0884-17) (Planned) (Note 1)   |
| CQC                          | : (Planned)                                                |

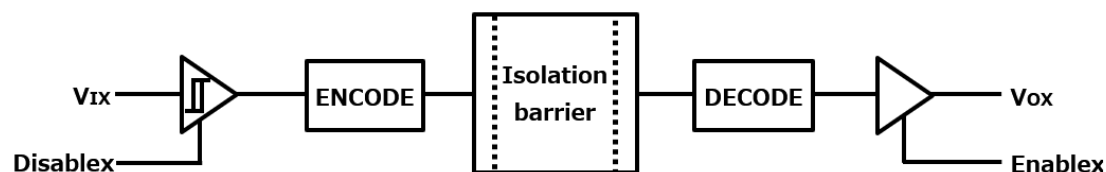
Note 1: When a VDE approved type is needed, please contact your Toshiba sales representative.

Start of commercial production  
2025-10

## Table of Contents

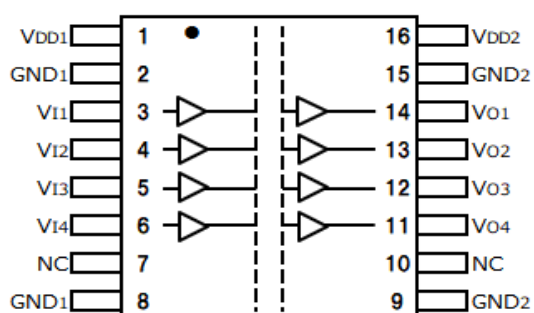
|                                                                         |    |
|-------------------------------------------------------------------------|----|
| 1. Applications.....                                                    | 1  |
| 2. Description.....                                                     | 1  |
| 3. Features.....                                                        | 1  |
| 4. Internal Circuit (Simplified Schematic).....                         | 3  |
| 5. Pin configuration and Functions.....                                 | 3  |
| 5.1. Pin Functions.....                                                 | 4  |
| 6. Functional Description .....                                         | 5  |
| 7. Absolute Maximum Ratings ( $T_a = 25\text{ }^{\circ}\text{C}$ )..... | 7  |
| 8. Recommended Operating Conditions (Note).....                         | 7  |
| 9. Electrical Characteristics .....                                     | 8  |
| 9.1. Electrical Characteristics – 5 V Supply.....                       | 8  |
| 9.2. Electrical Characteristics – 3.3 V Supply .....                    | 9  |
| 9.3. Electrical Characteristics – 2.5 V Supply .....                    | 10 |
| 9.4. Supply Current Characteristics – 5 V Supply .....                  | 11 |
| 9.5. Supply Current Characteristics – 3.3 V Supply .....                | 13 |
| 9.6. Supply Current Characteristics – 2.5 V Supply .....                | 15 |
| 10. Insulation Specifications .....                                     | 17 |
| 11. Safety Limiting Values.....                                         | 18 |
| 12. Test Circuit .....                                                  | 19 |
| 13. Characteristics Curves (Note) .....                                 | 34 |
| 14. Application Note .....                                              | 36 |
| 15. Package Information.....                                            | 37 |
| RESTRICTIONS ON PRODUCT USE.....                                        | 38 |

## 4. Internal Circuit (Simplified Schematic)

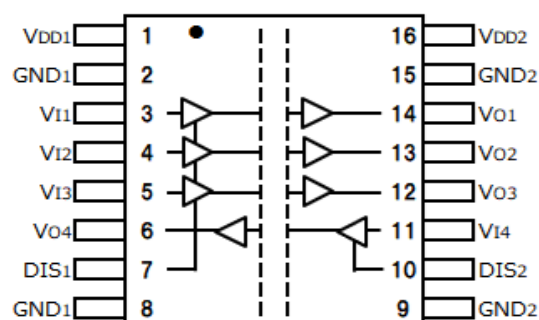


## 5. Pin configuration and Functions

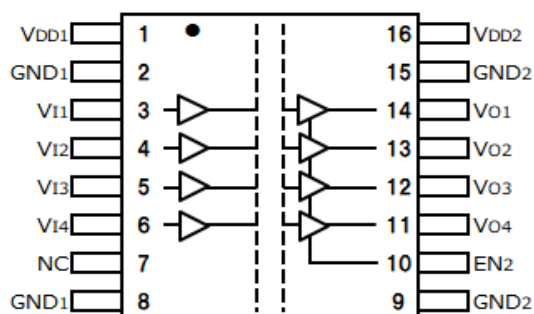
DCL540C01A / DCL540D01A



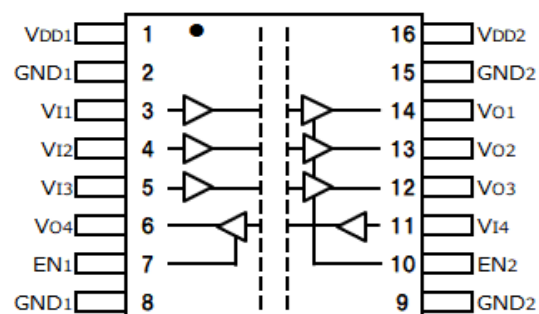
DCL541A01A / DCL541B01A



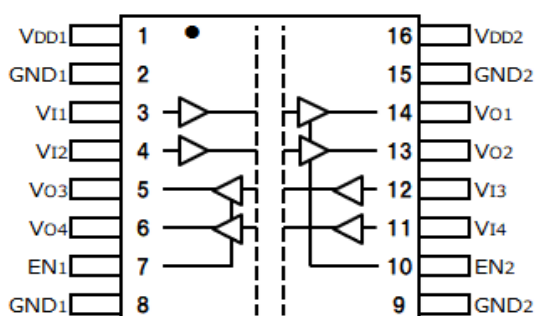
DCL540L01A / DCL540H01A



DCL541L01A / DCL541H01A



DCL542L01A / DCL542H01A



### 5.1. Pin Functions

| NAME             | PIN                    |                        |                        |                        |                        | I/O | DESCRIPTION                                                                                                                                     |
|------------------|------------------------|------------------------|------------------------|------------------------|------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------|
|                  | DCL540<br>C01A<br>D01A | DCL540<br>L01A<br>H01A | DCL541<br>A01A<br>B01A | DCL541<br>L01A<br>H01A | DCL542<br>L01A<br>H01A |     |                                                                                                                                                 |
| V <sub>DD1</sub> | 1                      | 1                      | 1                      | 1                      | 1                      | -   | Power Supply, side 1                                                                                                                            |
| GND <sub>1</sub> | 2,8                    | 2,8                    | 2,8                    | 2,8                    | 2,8                    | -   | GND connection for V <sub>DD1</sub> , side 1                                                                                                    |
| V <sub>I1</sub>  | 3                      | 3                      | 3                      | 3                      | 3                      | I   | Input, Channel1                                                                                                                                 |
| V <sub>I2</sub>  | 4                      | 4                      | 4                      | 4                      | 4                      | I   | Input, Channel2                                                                                                                                 |
| V <sub>I3</sub>  | 5                      | 5                      | 5                      | 5                      | 12                     | I   | Input, Channel3                                                                                                                                 |
| V <sub>I4</sub>  | 6                      | 11                     | 6                      | 11                     | 11                     | I   | Input, Channel4                                                                                                                                 |
| NC               | 7,10                   | -                      | 7                      | -                      | -                      | -   | Non connected                                                                                                                                   |
| DIS <sub>1</sub> | -                      | 7                      | -                      | -                      | -                      | I   | Input disable 1. Input pins on side 1 are disabled when DIS <sub>1</sub> is high, and in enabled state when DIS <sub>1</sub> is low or open.    |
| EN <sub>1</sub>  | -                      | -                      | -                      | 7                      | 7                      | I   | Input enable 1. Input pins on side 1 are enabled when EN <sub>2</sub> is high or open, and in high impedance state when EN <sub>2</sub> is low. |
| GND <sub>2</sub> | 9,15                   | 9,15                   | 9,15                   | 9,15                   | 9,15                   | -   | GND connection for V <sub>DD2</sub> , side 2                                                                                                    |
| DIS <sub>2</sub> | -                      | 10                     | -                      | -                      | -                      | I   | Input disable 2. Input pins on side 2 are disabled when DIS <sub>2</sub> is high, and in enabled state when DIS <sub>2</sub> is low or open.    |
| EN <sub>2</sub>  | -                      | -                      | 10                     | 10                     | 10                     | I   | Input enable 2. Input pins on side 2 are enabled when EN <sub>2</sub> is high or open, and in high impedance state when EN <sub>2</sub> is low. |
| V <sub>O4</sub>  | 11                     | 6                      | 11                     | 6                      | 6                      | O   | Output, Channel4                                                                                                                                |
| V <sub>O3</sub>  | 12                     | 12                     | 12                     | 12                     | 5                      | O   | Output, Channel3                                                                                                                                |
| V <sub>O2</sub>  | 13                     | 13                     | 13                     | 13                     | 13                     | O   | Output, Channel2                                                                                                                                |
| V <sub>O1</sub>  | 14                     | 14                     | 14                     | 14                     | 14                     | O   | Output, Channel1                                                                                                                                |
| V <sub>DD2</sub> | 16                     | 16                     | 16                     | 16                     | 16                     | -   | Power Supply, side 2                                                                                                                            |

## 6. Functional Description

### (1) DCL540C01A/ DCL540D01A

| V <sub>DD1</sub> | V <sub>DD2</sub> | INPUT (V <sub>ix</sub> ) | OUTPUT (V <sub>ox</sub> ) | COMMENTS                                                                            |
|------------------|------------------|--------------------------|---------------------------|-------------------------------------------------------------------------------------|
| PU               | PU               | L                        | L                         | Normal Operation                                                                    |
|                  |                  | H                        | H                         |                                                                                     |
|                  |                  | OPEN                     | Default                   | Default mode<br>DCL540C01A=L , DCL540D01A=H                                         |
| PD               |                  | L or OPEN                |                           |                                                                                     |
| PU               | PD               | X                        | Undetermined              | When V <sub>DD2</sub> is unpowered, a channel output is undetermined.               |
| PD               |                  | L or OPEN                |                           |                                                                                     |
| PD               | X                | H                        | -                         | Don't use, since a certain voltage will be output through the internal ESD circuit. |

PU= Powered up (V<sub>DD</sub>≥2.25 V), PD= Powered down (V<sub>DD</sub>≤1.7 V), H= High level, L= Low level, X= Don't care

### (2) DCL540L01A/ DCL540H01A/ DCL541L01A/ DCL541H01A/ DCL542L01A/ DCL542H01A

| V <sub>DD1</sub> | V <sub>DD2</sub> | OUTPUT ENABLE (EN <sub>2</sub> ) | INPUT (V <sub>ix</sub> ) | OUTPUT (V <sub>ox</sub> ) | COMMENTS                                                                            |
|------------------|------------------|----------------------------------|--------------------------|---------------------------|-------------------------------------------------------------------------------------|
| PU               | PU               | H or OPEN                        | L                        | L                         | Normal Operation                                                                    |
|                  |                  |                                  | H                        | H                         |                                                                                     |
|                  |                  |                                  | OPEN                     | Default                   | Default mode<br>DCL540L01A=L , DCL540H01A=H                                         |
|                  |                  | L                                | X                        | Z                         | Output Disable mode                                                                 |
| PD               | PU               | H or OPEN                        | L or OPEN                | Default                   | Default mode<br>DCL540L01A=L , DCL540H01A=H                                         |
|                  |                  | L                                |                          | Z                         | Output Disable mode                                                                 |
|                  | X                | X                                | H                        | -                         | Don't use, since a certain voltage will be output through the internal ESD circuit. |
| PU               | PD               | L or OPEN                        | X                        | Undetermined              | When V <sub>DD2</sub> is unpowered, a channel output is undetermined.               |
| PD               |                  |                                  | L or OPEN                |                           |                                                                                     |
| X                |                  | H                                | X                        | -                         | Don't use, since a certain voltage will be output through the internal ESD circuit. |

PU= Powered up (V<sub>DD</sub>≥2.25 V), PD= Powered down (V<sub>DD</sub>≤1.7 V), H= High level, L= Low level, X= Don't care

## (3) DCL541A01A/ DCL541B01A

| V <sub>DD1</sub> | V <sub>DD2</sub> | INPUT<br>DISABLE<br>(DIS <sub>x</sub> ) | INPUT<br>(V <sub>ix</sub> ) | OUTPUT<br>(V <sub>ox</sub> ) | COMMENTS                                                                            |
|------------------|------------------|-----------------------------------------|-----------------------------|------------------------------|-------------------------------------------------------------------------------------|
| PU               | PU               | L or OPEN                               | L                           | L                            | Normal Operation                                                                    |
|                  |                  |                                         | H                           | H                            |                                                                                     |
|                  |                  |                                         | OPEN                        | Default                      | Default mode<br>DCL541A01A=L , DCL541B01A=H                                         |
|                  |                  | H                                       | X                           |                              | Input Disable mode<br>DCL541A01A=L , DCL541B01A=H                                   |
|                  | PD               | X                                       | X                           | Undetermined                 | When V <sub>DD2</sub> is unpowered, a channel output is undetermined.               |
| PD               | X                | H                                       | X                           | Don't use                    | Don't use, since a certain voltage will be output through the internal ESD circuit. |
|                  |                  | X                                       | H                           |                              |                                                                                     |
|                  | PU               | L or OPEN                               | L or OPEN                   | Default                      | Default mode<br>DCL541A01A=L , DCL541B01A=H                                         |
|                  | PD               |                                         |                             | Undetermined                 | When V <sub>DD2</sub> is unpowered, a channel output is undetermined.               |

V<sub>DD1</sub>: Input V<sub>DDx</sub> , V<sub>DD0</sub>: Output V<sub>DDx</sub> , PU= Powered up (V<sub>DD</sub>≥2.25 V), PD=Powered down (V<sub>DD</sub>≤1.7 V),  
H=High Level, L=Low Level, X= Don't care

## 7. Absolute Maximum Ratings (T<sub>a</sub> = 25 °C)

| PARAMETER                                       | SYMBOL                              | MIN  | MAX                              | UNIT             |
|-------------------------------------------------|-------------------------------------|------|----------------------------------|------------------|
| Power supply voltage                            | V <sub>DD1</sub> , V <sub>DD2</sub> | -0.5 | 6.0                              | V                |
| Input Voltage                                   | V <sub>I</sub>                      | -0.5 | V <sub>DDX</sub> +0.5<br>(Note1) | V                |
| Output Voltage                                  | V <sub>O</sub>                      | -0.5 | V <sub>DDX</sub> +0.5<br>(Note1) | V                |
| Output Current                                  | I <sub>O</sub>                      | -15  | 15                               | mA               |
| Storage Temperature                             | T <sub>stg</sub>                    | -65  | 150                              | °C               |
| Operating Temperature                           | T <sub>opr</sub>                    | -40  | 125                              | °C               |
| Soldering Temperature (10 s)                    | T <sub>sol</sub>                    | -    | 260                              | °C               |
| Maximum Withstanding Isolation Voltage (1 min.) | BV <sub>S</sub>                     | -    | 5000                             | V <sub>rms</sub> |

Note 1: Maximum voltage must not exceed 6 V. X = 1 or 2.

## 8. Recommended Operating Conditions (Note)

| PARAMETER            | SYMBOL                              | MIN  | MAX | UNIT |
|----------------------|-------------------------------------|------|-----|------|
| Power supply voltage | V <sub>DD1</sub> , V <sub>DD2</sub> | 2.25 | 5.5 | V    |
| Junction Temperature | T <sub>J</sub>                      | -40  | 150 | °C   |
| Ambient Temperature  | T <sub>a</sub>                      | -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.

Note: A ceramic capacitor (0.1 μF) should be connected between pin 1 (V<sub>DD1</sub>) and pin 2 (GND<sub>1</sub>) for V<sub>DD1</sub> and between pin 16 (V<sub>DD2</sub>) and pin 15 (GND<sub>2</sub>) for V<sub>DD2</sub>, and should be the layout on the IC as close as possible (less than 10 mm).

Otherwise, the IC may not switch properly.

### 9. Electrical Characteristics

#### 9.1. Electrical Characteristics – 5 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=5\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $4.5\text{ V}\leq V_{DD1}\leq 5.5\text{ V}$ ,  $4.5\text{ V}\leq V_{DD2}\leq 5.5\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted.

| PARAMETER                                      | TEST CONDITIONS                                                                                      | Fig. | SYMBOL                | MIN                      | TYP.                     | MAX                      | UNIT              |
|------------------------------------------------|------------------------------------------------------------------------------------------------------|------|-----------------------|--------------------------|--------------------------|--------------------------|-------------------|
| DC SPECIFICATIONS                              |                                                                                                      |      |                       |                          |                          |                          |                   |
| Under voltage Lockout                          | Threshold when supply voltage is rising                                                              | 12.1 | $V_{DDxUV+}$          | -                        | 2.1                      | 2.25                     | V                 |
|                                                | Threshold when supply voltage is falling                                                             |      | $V_{DDxUV-}$          | 1.7                      | 1.9                      | -                        |                   |
|                                                | Supply voltage hysteresis                                                                            |      | $V_{DDxUVH}$          | 0.1                      | 0.2                      | -                        |                   |
| Output Voltage Logic High                      | $V_{ix}=H$ , $I_{OH}=-20\text{ }\mu\text{A}$                                                         | 12.2 | $V_{OH}$              | $V_{DDO}-0.1$<br>(Note1) | $V_{DDO}$<br>(Note1)     | -                        | V                 |
|                                                | $V_{ix}=H$ , $I_{OH}=-4\text{ mA}$                                                                   |      |                       | $V_{DDO}-0.4$<br>(Note1) | $V_{DDO}-0.2$<br>(Note1) | -                        |                   |
| Output Voltage Logic Low                       | $V_{ix}=L$ , $I_{OL}=20\text{ }\mu\text{A}$                                                          | 12.2 | $V_{OL}$              | -                        | 0.0                      | 0.1                      | V                 |
|                                                | $V_{ix}=L$ , $I_{OL}=4\text{ mA}$                                                                    |      |                       | -                        | 0.2                      | 0.4                      |                   |
| Output impedance                               | -                                                                                                    | 12.2 | $Z_O$                 | -                        | 50                       | -                        | $\Omega$          |
| High-level input voltage                       | -                                                                                                    | 12.3 | $V_{IH}$              | $0.7*V_{DDI}$<br>(Note1) | -                        | -                        | V                 |
| Low-level input voltage                        | -                                                                                                    | 12.3 | $V_{IL}$              | -                        | -                        | $0.3*V_{DDI}$<br>(Note1) | V                 |
| Input Voltage Hysteresis                       | -                                                                                                    | 12.3 | $V_{HYS}$             | -                        | 0.37                     | -                        | V                 |
| Input Current                                  | $V_i=V_{DDI}$ or $0\text{ V}$ (Note1)                                                                | -    | $I_i$                 | -                        | -                        | $\pm 10$                 | $\mu\text{A}$     |
| SWITCHING SPECIFICATIONS                       |                                                                                                      |      |                       |                          |                          |                          |                   |
| Data Rate                                      | -                                                                                                    | -    | $t_{bps}$             | DC                       | -                        | 150                      | Mbps              |
| Pulse Width                                    | -                                                                                                    | -    | PW                    | 6.6                      | -                        | -                        | ns                |
| Propagation Delay                              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.4 | $t_{pHL}$ , $t_{pLH}$ | -                        | 10.9                     | 18.3                     | ns                |
| Pulse Width Distortion                         | $ t_{pHL} - t_{pLH} $                                                                                | 12.4 | PWD                   | -                        | 0.8                      | 2.8                      | ns                |
| Propagation Delay Skew (Between any two units) | (Note 2)                                                                                             | -    | $t_{PSK}$             | -                        | -                        | 10                       | ns                |
| Channel Matching                               | Same Direction                                                                                       | 12.4 | $t_{skCD}$            | -                        | -                        | 3.2                      | ns                |
|                                                | Opposing Direction                                                                                   | 12.4 | $t_{skOD}$            | -                        | -                        | 3.6                      |                   |
| Output Rise Time                               | 10 % - 90 %                                                                                          | 12.4 | $t_r$                 | -                        | 0.9                      | -                        | ns                |
| Output Fall Time                               | 90 % - 10 %                                                                                          | 12.4 | $t_f$                 | -                        | 0.9                      | -                        | ns                |
| Enable 3-state output enable time              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$<br>(Note 3)                            | 12.5 | $t_{pZL}$ , $t_{pZH}$ | -                        | -                        | 15.0                     | ns                |
| Enable 3-state output disable time             |                                                                                                      | 12.5 | $t_{pLZ}$ , $t_{pHZ}$ | -                        | -                        | 18.0                     | ns                |
| Disable output enable time                     | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.6 | $t_{p\_EN}$           | -                        | -                        | 23.0                     | ns                |
| Disable output disable time                    |                                                                                                      | 12.6 | $t_{p\_DIS}$          | -                        | -                        | 23.0                     | ns                |
| Common mode transient immunity                 | $V_i=V_{DDI}$ or $0\text{ V}$ , (Note1)<br>$V_{CM}=1500\text{ V}$ , $T_a=25\text{ }^{\circ}\text{C}$ | 12.7 | $ CMTI $              | -                        | 100                      | -                        | kV/ $\mu\text{s}$ |

Note 1:  $V_{DDI}$ =Input-side  $V_{DDx}$ ,  $V_{DDO}$ =Output-side  $V_{DDx}$

Note 2: Propagation delay difference (between parts) is applied under the same operating conditions (power supply voltage, input current, temperature conditions, etc.).

Note 3: When  $EN_2$  signal is changed from Low to High or OPEN, the output signal( $V_{Ox}$ ) is valid after the output enable time. The output signal( $V_{Ox}$ ) within the output enable time is undefined.

### 9.2. Electrical Characteristics – 3.3 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=3.3\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $3.0\text{ V}\leq V_{DD1}\leq 3.6\text{ V}$ ,  $3.0\text{ V}\leq V_{DD2}\leq 3.6\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted.

| PARAMETER                                      | TEST CONDITIONS                                                                                      | Fig. | SYMBOL                | MIN                           | TYP.                     | MAX                           | UNIT              |
|------------------------------------------------|------------------------------------------------------------------------------------------------------|------|-----------------------|-------------------------------|--------------------------|-------------------------------|-------------------|
| DC SPECIFICATIONS                              |                                                                                                      |      |                       |                               |                          |                               |                   |
| Under voltage Lockout                          | Threshold when supply voltage is rising                                                              | 12.1 | $V_{DDxUV+}$          | -                             | 2.1                      | 2.25                          | V                 |
|                                                | Threshold when supply voltage is falling                                                             |      | $V_{DDxUV-}$          | 1.7                           | 1.9                      | -                             |                   |
|                                                | Supply voltage hysteresis                                                                            |      | $V_{DDxUVH}$          | 0.1                           | 0.2                      | -                             |                   |
| Output Voltage Logic High                      | $V_{ix}=H$ , $I_{OH}=-20\text{ }\mu\text{A}$                                                         | 12.2 | $V_{OH}$              | $V_{DDO}-0.1$<br>(Note1)      | $V_{DDO}$<br>(Note1)     | -                             | V                 |
|                                                | $V_{ix}=H$ , $I_{OH}=-4\text{ mA}$                                                                   |      |                       | $V_{DDO}-0.4$<br>(Note1)      | $V_{DDO}-0.2$<br>(Note1) | -                             |                   |
| Output Voltage Logic Low                       | $V_{ix}=L$ , $I_{OL}=20\text{ }\mu\text{A}$                                                          | 12.2 | $V_{OL}$              | -                             | 0.0                      | 0.1                           | V                 |
|                                                | $V_{ix}=L$ , $I_{OL}=4\text{ mA}$                                                                    |      |                       | -                             | 0.2                      | 0.4                           |                   |
| Output impedance                               | -                                                                                                    | 12.2 | $Z_O$                 | -                             | 50                       | -                             | $\Omega$          |
| High-level input voltage                       | -                                                                                                    | 12.3 | $V_{IH}$              | $0.7\cdot V_{DDI}$<br>(Note1) | -                        | -                             | V                 |
| Low-level input voltage                        | -                                                                                                    | 12.3 | $V_{IL}$              | -                             | -                        | $0.3\cdot V_{DDI}$<br>(Note1) | V                 |
| Input Voltage Hysteresis                       | -                                                                                                    | 12.3 | $V_{HYS}$             | -                             | 0.32                     | -                             | V                 |
| Input Current                                  | $V_i=V_{DDI}$ or $0\text{ V}$ (Note1)                                                                | -    | $I_i$                 | -                             | -                        | $\pm 10$                      | $\mu\text{A}$     |
| SWITCHING SPECIFICATIONS                       |                                                                                                      |      |                       |                               |                          |                               |                   |
| Data Rate                                      | -                                                                                                    | -    | $t_{bps}$             | DC                            | -                        | 150                           | Mbps              |
| Pulse Width                                    | -                                                                                                    | -    | PW                    | 6.6                           | -                        | -                             | ns                |
| Propagation Delay                              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.4 | $t_{pHL}$ , $t_{pLH}$ | -                             | 11.6                     | 19.1                          | ns                |
| Pulse Width Distortion                         | $ t_{pHL} - t_{pLH} $                                                                                | 12.4 | PWD                   | -                             | 0.8                      | 2.8                           | ns                |
| Propagation Delay Skew (Between any two units) | (Note 2)                                                                                             | -    | $t_{PSK}$             | -                             | -                        | 10                            | ns                |
| Channel Matching                               | Same Direction                                                                                       | 12.4 | $t_{skCD}$            | -                             | -                        | 3.3                           | ns                |
|                                                | Opposing Direction                                                                                   | 12.4 | $t_{skOD}$            | -                             | -                        | 3.7                           |                   |
| Output Rise Time                               | 10 % - 90 %                                                                                          | 12.4 | $t_r$                 | -                             | 0.8                      | -                             | ns                |
| Output Fall Time                               | 90 % - 10 %                                                                                          | 12.4 | $t_f$                 | -                             | 0.8                      | -                             | ns                |
| Enable 3-state output enable time              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$<br>(Note 3)                            | 12.5 | $t_{pZL}$ , $t_{pZH}$ | -                             | -                        | 15.0                          | ns                |
| Enable 3-state output disable time             |                                                                                                      | 12.5 | $t_{pLZ}$ , $t_{pHZ}$ | -                             | -                        | 18.0                          | ns                |
| Disable output enable time                     | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.6 | $t_{p\_EN}$           | -                             | -                        | 23.0                          | ns                |
| Disable output disable time                    |                                                                                                      | 12.6 | $t_{p\_DIS}$          | -                             | -                        | 23.0                          | ns                |
| Common mode transient immunity                 | $V_i=V_{DDI}$ or $0\text{ V}$ , (Note1)<br>$V_{CM}=1500\text{ V}$ , $T_a=25\text{ }^{\circ}\text{C}$ | 12.7 | $ CMTI $              | -                             | 100                      | -                             | kV/ $\mu\text{s}$ |

Note 1:  $V_{DDI}$ =Input-side  $V_{DDx}$ ,  $V_{DDO}$ =Output-side  $V_{DDx}$

Note 2: Propagation delay difference (between parts) is applied under the same operating conditions (power supply voltage, input current, temperature conditions, etc.).

Note 3: When  $EN_2$  signal is changed from Low to High or OPEN, the output signal( $V_{Ox}$ ) is valid after the output enable time. The output signal( $V_{Ox}$ ) within the output enable time is undefined)

### 9.3. Electrical Characteristics – 2.5 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=2.5\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $2.25\text{ V}\leq V_{DD1}\leq 2.75\text{ V}$ ,  $2.25\text{ V}\leq V_{DD2}\leq 2.75\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted.

| PARAMETER                                      | TEST CONDITIONS                                                                                      | Fig. | SYMBOL                | MIN                           | TYP.                     | MAX                           | UNIT              |
|------------------------------------------------|------------------------------------------------------------------------------------------------------|------|-----------------------|-------------------------------|--------------------------|-------------------------------|-------------------|
| DC SPECIFICATIONS                              |                                                                                                      |      |                       |                               |                          |                               |                   |
| Under voltage Lockout                          | Threshold when supply voltage is rising                                                              | 12.1 | $V_{DDxUV+}$          | -                             | 2.1                      | 2.25                          | V                 |
|                                                | Threshold when supply voltage is falling                                                             |      | $V_{DDxUV-}$          | 1.7                           | 1.9                      | -                             |                   |
|                                                | Supply voltage hysteresis                                                                            |      | $V_{DDxUVH}$          | 0.1                           | 0.2                      | -                             |                   |
| Output Voltage Logic High                      | $V_{ix}=H$ , $I_{OH}=-20\text{ }\mu\text{A}$                                                         | 12.2 | $V_{OH}$              | $V_{DDO}-0.1$<br>(Note1)      | $V_{DDO}$<br>(Note1)     | -                             | V                 |
|                                                | $V_{ix}=H$ , $I_{OH}=-4\text{ mA}$                                                                   |      |                       | $V_{DDO}-0.4$<br>(Note1)      | $V_{DDO}-0.2$<br>(Note1) | -                             |                   |
| Output Voltage Logic Low                       | $V_{ix}=L$ , $I_{OL}=20\text{ }\mu\text{A}$                                                          | 12.2 | $V_{OL}$              | -                             | 0.0                      | 0.1                           | V                 |
|                                                | $V_{ix}=L$ , $I_{OL}=4\text{ mA}$                                                                    |      |                       | -                             | 0.2                      | 0.4                           |                   |
| Output impedance                               | -                                                                                                    | 12.2 | $Z_O$                 | -                             | 50                       | -                             | $\Omega$          |
| High-level input voltage                       | -                                                                                                    | 12.3 | $V_{IH}$              | $0.7\cdot V_{DDI}$<br>(Note1) | -                        | -                             | V                 |
| Low-level input voltage                        | -                                                                                                    | 12.3 | $V_{IL}$              | -                             | -                        | $0.3\cdot V_{DDI}$<br>(Note1) | V                 |
| Input Voltage Hysteresis                       | -                                                                                                    | 12.3 | $V_{HYS}$             | -                             | 0.32                     | -                             | V                 |
| Input Current                                  | $V_i=V_{DDI}$ or $0\text{ V}$ (Note1)                                                                | -    | $I_i$                 | -                             | -                        | $\pm 10$                      | $\mu\text{A}$     |
| SWITCHING SPECIFICATIONS                       |                                                                                                      |      |                       |                               |                          |                               |                   |
| Data Rate                                      | -                                                                                                    | -    | $t_{bps}$             | DC                            | -                        | 150                           | Mbps              |
| Pulse Width                                    | -                                                                                                    | -    | PW                    | 6.6                           | -                        | -                             | ns                |
| Propagation Delay                              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.4 | $t_{pHL}$ , $t_{pLH}$ | -                             | 12.6                     | 21.0                          | ns                |
| Pulse Width Distortion                         | $ t_{pHL} - t_{pLH} $                                                                                | 12.4 | PWD                   | -                             | 1.0                      | 3.0                           | ns                |
| Propagation Delay Skew (Between any two units) | (Note 2)                                                                                             | -    | $t_{PSK}$             | -                             | -                        | 10                            | ns                |
| Channel Matching                               | Same Direction                                                                                       | 12.4 | $t_{skCD}$            | -                             | -                        | 3.5                           | ns                |
|                                                | Opposing Direction                                                                                   | 12.4 | $t_{skOD}$            | -                             | -                        | 3.9                           |                   |
| Output Rise Time                               | 10 % - 90 %                                                                                          | 12.4 | $t_r$                 | -                             | 0.8                      | -                             | ns                |
| Output Fall Time                               | 90 % - 10 %                                                                                          | 12.4 | $t_f$                 | -                             | 0.8                      | -                             | ns                |
| Enable 3-state output enable time              | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$<br>(Note 3)                            | 12.5 | $t_{pZL}$ , $t_{pZH}$ | -                             | -                        | 15.0                          | ns                |
| Enable 3-state output disable time             |                                                                                                      | 12.5 | $t_{pLZ}$ , $t_{pHZ}$ | -                             | -                        | 18.0                          | ns                |
| Disable output enable time                     | 50 kHz, Duty=50 %, $t_r=t_f=2\text{ ns}$ , $C_L=15\text{ pF}$                                        | 12.6 | $t_{p\_EN}$           | -                             | -                        | 23.0                          | ns                |
| Disable output disable time                    |                                                                                                      | 12.6 | $t_{p\_DIS}$          | -                             | -                        | 23.0                          | ns                |
| Common mode transient immunity                 | $V_i=V_{DDI}$ or $0\text{ V}$ , (Note1)<br>$V_{CM}=1500\text{ V}$ , $T_a=25\text{ }^{\circ}\text{C}$ | 12.7 | CMTI                  | -                             | 100                      | -                             | kV/ $\mu\text{s}$ |

Note 1:  $V_{DDI}$ =Input-side  $V_{DDx}$ ,  $V_{DDO}$ =Output-side  $V_{DDx}$

Note 2: Propagation delay difference (between parts) is applied under the same operating conditions (power supply voltage, input current, temperature conditions, etc.).

Note 3: When  $EN_2$  signal is changed from Low to High or OPEN, the output signal( $V_{Ox}$ ) is valid after the output enable time. The output signal( $V_{Ox}$ ) within the output enable time is undefined)

### 9.4. Supply Current Characteristics – 5 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=5\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $4.5\text{ V}\leq V_{DD1}\leq 5.5\text{ V}$ ,  $4.5\text{ V}\leq V_{DD2}\leq 5.5\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted.

#### (1) DCL540x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL540C01A , DCL540L01A) ,<br>$V_I=1$ (DCL540D01A , DCL540H01A)       | $I_{DD1(Q)}$   | -   | 2.1  | 3.0  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 5.0  | 7.3  | mA   |
|                                 | $V_I=0$ (DCL540D01A , DCL540H01A) ,<br>$V_I=1$ (DCL540C01A , DCL540L01A)       | $I_{DD1(Q)}$   | -   | 19.6 | 28.1 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 5.3  | 7.6  | mA   |
| 1 Mbps                          | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(1)}$   | -   | 11.2 | 17.5 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 5.4  | 8.3  | mA   |
| 25 Mbps                         | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(25)}$  | -   | 11.0 | 17.1 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 9.8  | 14.7 | mA   |
| 100 Mbps                        | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(100)}$ | -   | 12.4 | 18.4 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 25.2 | 37.1 | mA   |

#### (2) DCL541x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL541A01A, DCL541L01A)<br>$V_I=1$ (DCL541B01A, DCL541H01A)           | $I_{DD1(Q)}$   | -   | 3.0  | 4.3  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 4.5  | 6.6  | mA   |
|                                 | $V_I=0$ (DCL541B01A, DCL541H01A)<br>$V_I=1$ (DCL541A01A, DCL541L01A)           | $I_{DD1(Q)}$   | -   | 16.6 | 22.5 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 10.2 | 14.1 | mA   |
| 1 Mbps                          | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(1)}$   | -   | 10.0 | 15.5 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 7.6  | 10.2 | mA   |
| 25 Mbps                         | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(25)}$  | -   | 12.1 | 18.2 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 10.6 | 15.4 | mA   |
| 100 Mbps                        | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(100)}$ | -   | 17.4 | 24.5 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 22.5 | 35.2 | mA   |

## (3) DCL542x01A

| PARAMETER                       | TEST CONDITIONS                                                                   | SYMBOL                | MIN | TYP. | MAX  | UNIT |
|---------------------------------|-----------------------------------------------------------------------------------|-----------------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | VI=0(DCL542L01A) ,<br>VI=1(DCL542H01A)                                            | I <sub>DD1(Q)</sub>   | -   | 3.8  | 5.5  | mA   |
|                                 |                                                                                   | I <sub>DD2(Q)</sub>   | -   | 3.8  | 5.5  | mA   |
|                                 | VI=0(DCL542H01A) ,<br>VI=1(DCL542L01A)                                            | I <sub>DD1(Q)</sub>   | -   | 13.4 | 18.3 | mA   |
|                                 |                                                                                   | I <sub>DD2(Q)</sub>   | -   | 13.4 | 18.3 | mA   |
| 1 Mbps                          | f <sub>CLK</sub> =500 kHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF  | I <sub>DD1(1)</sub>   | -   | 8.8  | 12.9 | mA   |
|                                 |                                                                                   | I <sub>DD2(1)</sub>   | -   | 8.8  | 12.9 | mA   |
| 25 Mbps                         | f <sub>CLK</sub> =12.5 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF | I <sub>DD1(25)</sub>  | -   | 11.4 | 16.8 | mA   |
|                                 |                                                                                   | I <sub>DD2(25)</sub>  | -   | 11.4 | 16.8 | mA   |
| 100 Mbps                        | f <sub>CLK</sub> =50 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF   | I <sub>DD1(100)</sub> | -   | 20.0 | 29.9 | mA   |
|                                 |                                                                                   | I <sub>DD2(100)</sub> | -   | 20.0 | 29.9 | mA   |

### 9.5. Supply Current Characteristics – 3.3 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=3.3\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $3.0\text{ V}\leq V_{DD1}\leq 3.6\text{ V}$ ,  $3.0\text{ V}\leq V_{DD2}\leq 3.6\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted.

#### (1) DCL540x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL540C01A , DCL540L01A) ,<br>$V_I=1$ (DCL540D01A , DCL540H01A)       | $I_{DD1(Q)}$   | -   | 2.0  | 2.9  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 4.9  | 7.1  | mA   |
|                                 | $V_I=0$ (DCL540D01A , DCL540H01A) ,<br>$V_I=1$ (DCL540C01A , DCL540L01A)       | $I_{DD1(Q)}$   | -   | 19.4 | 27.7 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 5.2  | 7.4  | mA   |
| 1 Mbps                          | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(1)}$   | -   | 11.0 | 16.7 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 5.2  | 7.8  | mA   |
| 25 Mbps                         | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(25)}$  | -   | 10.6 | 16.0 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 8.2  | 12.4 | mA   |
| 100 Mbps                        | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(100)}$ | -   | 11.6 | 16.6 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 16.5 | 29.3 | mA   |

#### (2) DCL541x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL541A01A, DCL541L01A)<br>$V_I=1$ (DCL541B01A, DCL541H01A)           | $I_{DD1(Q)}$   | -   | 2.9  | 4.1  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 4.4  | 6.5  | mA   |
|                                 | $V_I=0$ (DCL541B01A, DCL541H01A)<br>$V_I=1$ (DCL541A01A, DCL541L01A)           | $I_{DD1(Q)}$   | -   | 16.5 | 22.3 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 10.1 | 14.0 | mA   |
| 1 Mbps                          | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(1)}$   | -   | 9.9  | 14.9 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 7.5  | 9.5  | mA   |
| 25 Mbps                         | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(25)}$  | -   | 10.8 | 16.6 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 9.7  | 12.8 | mA   |
| 100 Mbps                        | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(100)}$ | -   | 14.5 | 19.9 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 16.6 | 26.0 | mA   |

## (3) DCL542x01A

| PARAMETER                       | TEST CONDITIONS                                                                   | SYMBOL                | MIN | TYP. | MAX  | UNIT |
|---------------------------------|-----------------------------------------------------------------------------------|-----------------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | V <sub>I</sub> =0 (DCL542L01A)                                                    | I <sub>DD1(Q)</sub>   | -   | 3.7  | 5.3  | mA   |
|                                 | V <sub>I</sub> =1 (DCL542H01A)                                                    | I <sub>DD2(Q)</sub>   | -   | 3.7  | 5.3  | mA   |
|                                 | V <sub>I</sub> =0 (DCL542H01A)                                                    | I <sub>DD1(Q)</sub>   | -   | 13.3 | 18.2 | mA   |
|                                 | V <sub>I</sub> =1 (DCL542L01A)                                                    | I <sub>DD2(Q)</sub>   | -   | 13.3 | 18.2 | mA   |
| 1 Mbps                          | f <sub>CLK</sub> =500 kHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF  | I <sub>DD1(1)</sub>   | -   | 8.7  | 12.2 | mA   |
|                                 |                                                                                   | I <sub>DD2(1)</sub>   | -   | 8.7  | 12.2 | mA   |
| 25 Mbps                         | f <sub>CLK</sub> =12.5 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF | I <sub>DD1(25)</sub>  | -   | 10.3 | 14.7 | mA   |
|                                 |                                                                                   | I <sub>DD2(25)</sub>  | -   | 10.3 | 14.7 | mA   |
| 100 Mbps                        | f <sub>CLK</sub> =50 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF   | I <sub>DD1(100)</sub> | -   | 15.6 | 23.0 | mA   |
|                                 |                                                                                   | I <sub>DD2(100)</sub> | -   | 15.6 | 23.0 | mA   |

### 9.6. Supply Current Characteristics – 2.5 V Supply

All typical specifications are at  $T_a=25\text{ }^{\circ}\text{C}$ ,  $V_{DD1}=V_{DD2}=2.5\text{ V}$ . Minimum/maximum specifications apply over the entire recommended operating range of  $2.25\text{ V}\leq V_{DD1}\leq 2.75\text{ V}$ ,  $2.25\text{ V}\leq V_{DD2}\leq 2.75\text{ V}$ , and  $-40\text{ }^{\circ}\text{C}\leq T_a\leq 125\text{ }^{\circ}\text{C}$ , unless otherwise noted

#### (1) DCL540x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL541A01A) ,<br>$V_I=1$ (DCL541B01A)                                 | $I_{DD1(Q)}$   | -   | 1.9  | 2.8  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 4.9  | 7.0  | mA   |
|                                 | $V_I=0$ (DCL541B01A) ,<br>$V_I=1$ (DCL541A01A)                                 | $I_{DD1(Q)}$   | -   | 19.3 | 27.6 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 5.2  | 7.3  | mA   |
| 1 Mbps                          | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(1)}$   | -   | 11.0 | 16.6 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 5.2  | 7.7  | mA   |
| 25 Mbps                         | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(25)}$  | -   | 10.4 | 15.8 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 7.5  | 11.6 | mA   |
| 100 Mbps                        | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(100)}$ | -   | 11.5 | 16.3 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 13.6 | 25.8 | mA   |

#### (2) DCL541x01A

| PARAMETER                       | TEST CONDITIONS                                                                | SYMBOL         | MIN | TYP. | MAX  | UNIT |
|---------------------------------|--------------------------------------------------------------------------------|----------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | $V_I=0$ (DCL541A01A, DCL541L01A)<br>$V_I=1$ (DCL541B01A, DCL541H01A)           | $I_{DD1(Q)}$   | -   | 2.9  | 4.1  | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 4.5  | 6.4  | mA   |
|                                 | $V_I=0$ (DCL541B01A, DCL541H01A)<br>$V_I=1$ (DCL541A01A, DCL541L01A)           | $I_{DD1(Q)}$   | -   | 16.4 | 22.2 | mA   |
|                                 |                                                                                | $I_{DD2(Q)}$   | -   | 10.0 | 13.9 | mA   |
| 1 Mbps                          | $f_{CLK}=500\text{ kHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$  | $I_{DD1(1)}$   | -   | 9.8  | 14.8 | mA   |
|                                 |                                                                                | $I_{DD2(1)}$   | -   | 7.4  | 9.5  | mA   |
| 25 Mbps                         | $f_{CLK}=12.5\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$ | $I_{DD1(25)}$  | -   | 10.4 | 16.1 | mA   |
|                                 |                                                                                | $I_{DD2(25)}$  | -   | 9.2  | 12.2 | mA   |
| 100 Mbps                        | $f_{CLK}=50\text{ MHz}$ , duty=50 % cycle square wave.<br>$C_L=15\text{ pF}$   | $I_{DD1(100)}$ | -   | 13.1 | 18.2 | mA   |
|                                 |                                                                                | $I_{DD2(100)}$ | -   | 14.3 | 24.1 | mA   |

## (3) DCL542x01A

| PARAMETER                       | TEST CONDITIONS                                                                   | SYMBOL                | MIN | TYP. | MAX  | UNIT |
|---------------------------------|-----------------------------------------------------------------------------------|-----------------------|-----|------|------|------|
| Supply Current<br>( DC Signal ) | V <sub>I</sub> =0 (DCL542L01A)<br>V <sub>I</sub> =1 (DCL541H01A)                  | I <sub>DD1(Q)</sub>   | -   | 3.7  | 5.3  | mA   |
|                                 |                                                                                   | I <sub>DD2(Q)</sub>   | -   | 3.7  | 5.3  | mA   |
|                                 | V <sub>I</sub> =0 (DCL542H01A)<br>V <sub>I</sub> =1 (DCL542L01A)                  | I <sub>DD1(Q)</sub>   | -   | 13.2 | 18.1 | mA   |
|                                 |                                                                                   | I <sub>DD2(Q)</sub>   | -   | 13.2 | 18.1 | mA   |
| 1 Mbps                          | f <sub>CLK</sub> =500 kHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF  | I <sub>DD1(1)</sub>   | -   | 8.6  | 12.2 | mA   |
|                                 |                                                                                   | I <sub>DD2(1)</sub>   | -   | 8.6  | 12.2 | mA   |
| 25 Mbps                         | f <sub>CLK</sub> =12.5 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF | I <sub>DD1(25)</sub>  | -   | 9.8  | 14.2 | mA   |
|                                 |                                                                                   | I <sub>DD2(25)</sub>  | -   | 9.8  | 14.2 | mA   |
| 100 Mbps                        | f <sub>CLK</sub> =50 MHz, duty=50 % cycle square wave.<br>C <sub>L</sub> =15 pF   | I <sub>DD1(100)</sub> | -   | 13.7 | 21.2 | mA   |
|                                 |                                                                                   | I <sub>DD2(100)</sub> | -   | 13.7 | 21.2 | mA   |

## 10. Insulation Specifications

| PARAMETER                                 | Symbol      | TEST CONDITIONS                                                                                                                                                                                                             | VALUE      | UNIT      |
|-------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----------|
| Minimum External Clearance                | CLR         | Shortest terminal-to-terminal distance through air                                                                                                                                                                          | 8          | mm        |
| Minimum External Creepage                 | CPG         | Shortest terminal-to-terminal distance across the package surface                                                                                                                                                           | 7.6        | mm        |
| Distance Through The Insulation           | DTI         | Minimum internal gap                                                                                                                                                                                                        | 17         | μm        |
| Comparative Tracking Index                | CTI         |                                                                                                                                                                                                                             | 400        | V         |
| Material Group                            | -           | According to IEC 60664-1                                                                                                                                                                                                    | II         | -         |
| Overvoltage Category Per IEC 60664-1      | -           | Related Mains Voltage $\leq 300 V_{rms}$                                                                                                                                                                                    | I-IV       | -         |
|                                           | -           | Related Mains Voltage $\leq 600 V_{rms}$                                                                                                                                                                                    | I-IV       | -         |
|                                           | -           | Related Mains Voltage $\leq 1000 V_{rms}$                                                                                                                                                                                   | I-III      | -         |
| <b>DIN EN IEC 60747-17; (VDE 0884-17)</b> |             |                                                                                                                                                                                                                             |            |           |
| Maximum Repetitive Peak Isolation Voltage | $V_{IORM}$  | AC voltage (bipolar)                                                                                                                                                                                                        | 1414       | $V_{PK}$  |
| Maximum Transient Isolation Voltage       | $V_{IOTM}$  | $V_{TEST} = V_{IOTM}$ , $t = 60$ s (qualification) ,<br>$V_{TEST} = 1.2 \times V_{IOTM}$ , $t = 1$ s (100 % production)                                                                                                     | 8000       | $V_{PK}$  |
| Maximum Impulse Voltage                   | $V_{IMP}$   | IEC 62368-1, 1.2/50 μs waveform                                                                                                                                                                                             | 8000       | $V_{PK}$  |
| Maximum surge isolation voltage           | $V_{IOSM}$  | Test method per IEC 62368-1, 1.2/50 μs waveform,<br>$V_{IOSM} \geq 1.3 \times V_{IMP}$ (qualification)                                                                                                                      | 12800      | $V_{PK}$  |
| Apparent charge measuring voltage         | $V_{pd(m)}$ | Method A, After Input/Output safety test subgroup2&3,<br>$V_{ini,a} = V_{IOTM}$ , $V_{pd(m)} = 1.2 \times V_{IORM}$<br>$t_{ini} = 60$ s, $t_m = 10$ s,<br>partial discharge $< 5$ pC                                        | 1697       | $V_{PK}$  |
|                                           |             | Method A, After environmental tests subgroup 1,<br>$V_{ini,a} = V_{IOTM}$ , $V_{pd(m)} = 1.6 \times V_{IORM}$<br>$t_{ini} = 60$ s, $t_m = 10$ s,<br>partial discharge $< 5$ pC                                              | 2263       |           |
|                                           |             | Method B1; At routine test (100 % production) and preconditioning (type test)<br>$V_{ini,b} \geq 1.2 \times V_{IOTM}$ , $V_{pd(m)} = 1.875 \times V_{IORM}$<br>$t_{ini,b} = 1$ s, $t_m = 1$ s<br>partial discharge $< 5$ pC | 2652       |           |
| Barrier capacitance, input to output      | $C_{IO}$    | $f = 1$ MHz                                                                                                                                                                                                                 | 1.5        | pF        |
| Input Capacitance                         | $C_i$       | $V_{IX}$                                                                                                                                                                                                                    | 1.8        | pF        |
| Isolation Resistance                      | $R_{IO}$    | $V_{IO} = 500$ V, $T_A = 25$ °C                                                                                                                                                                                             | $>10^{12}$ | $\Omega$  |
|                                           |             | $V_{IO} = 500$ V, $100$ °C $\leq T_A \leq 125$ °C                                                                                                                                                                           | $>10^{11}$ |           |
|                                           |             | $V_{IO} = 500$ V at $T_S = 150$ °C                                                                                                                                                                                          | $>10^9$    |           |
| Pollution Degree                          | -           | -                                                                                                                                                                                                                           | 2          | -         |
| Climaic Category                          | -           | -                                                                                                                                                                                                                           | 40/125/21  | -         |
| <b>UL 1577</b>                            |             |                                                                                                                                                                                                                             |            |           |
| Maximum Withstanding Isolation Voltage    | $V_{ISO}$   | $V_{TEST} = V_{ISO}$ , $t = 60$ s (qualification),<br>$V_{TEST} = 1.2 \times V_{ISO}$ , $t = 1$ s (100 % production)                                                                                                        | 5000       | $V_{rms}$ |

11. Safety Limiting Values

| PARAMETER                              | Symbol | TEST CONDITIONS                                                                                        | Value | Unit               |
|----------------------------------------|--------|--------------------------------------------------------------------------------------------------------|-------|--------------------|
| Safety Input, Output Or Supply Current | $I_S$  | $V_{DD1}=V_{DD2}=5.5\text{ V}$ , $T_J=150\text{ }^{\circ}\text{C}$ , $T_a=25\text{ }^{\circ}\text{C}$  | 284   | mA                 |
|                                        |        | $V_{DD1}=V_{DD2}=3.6\text{ V}$ , $T_J=150\text{ }^{\circ}\text{C}$ , $T_a=25\text{ }^{\circ}\text{C}$  | 434   | mA                 |
|                                        |        | $V_{DD1}=V_{DD2}=2.75\text{ V}$ , $T_J=150\text{ }^{\circ}\text{C}$ , $T_a=25\text{ }^{\circ}\text{C}$ | 568   | mA                 |
| Safety Input, Output Or Total Power    | $P_S$  | $T_J=150\text{ }^{\circ}\text{C}$ , $T_a=25\text{ }^{\circ}\text{C}$                                   | 1562  | mW                 |
| Maximum Safety Temperature             | $T_S$  | -                                                                                                      | 150   | $^{\circ}\text{C}$ |

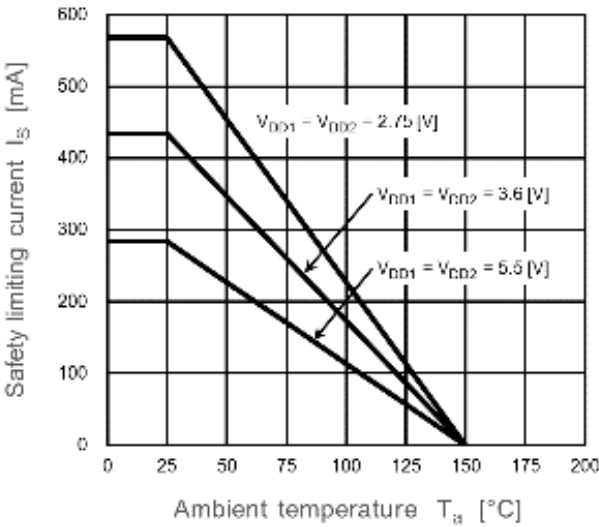
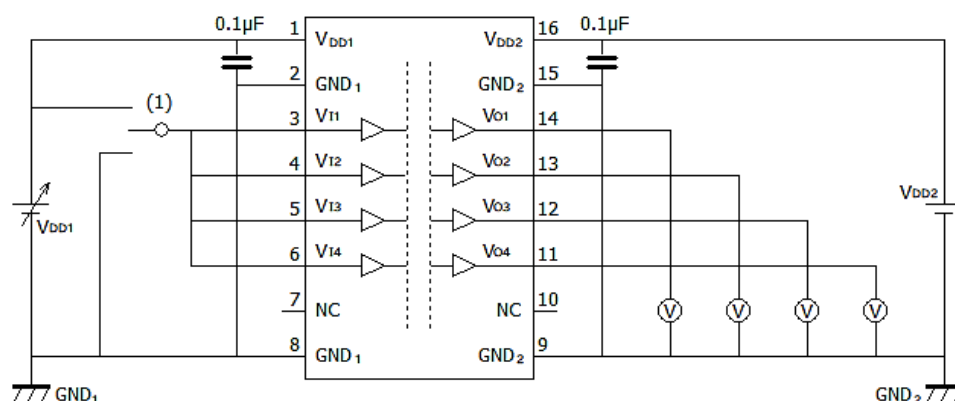


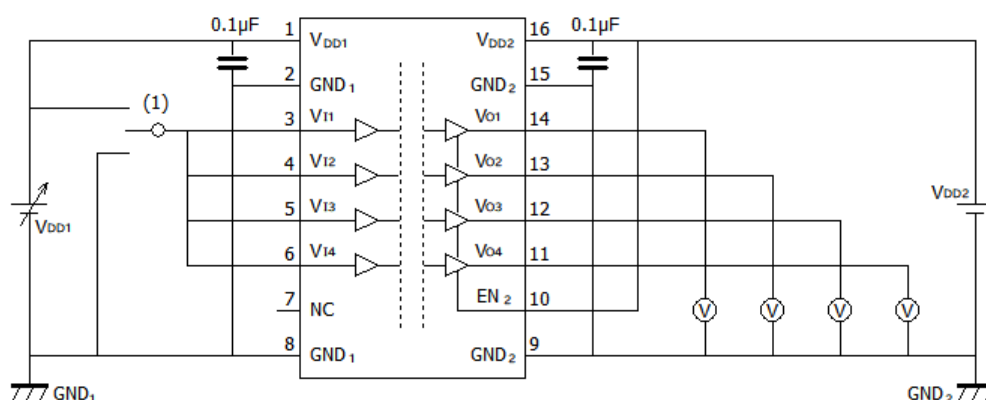
Fig. 11.1. Thermal Derating Curve for Safety Limiting Current -  $T_a$

## 12. Test Circuit



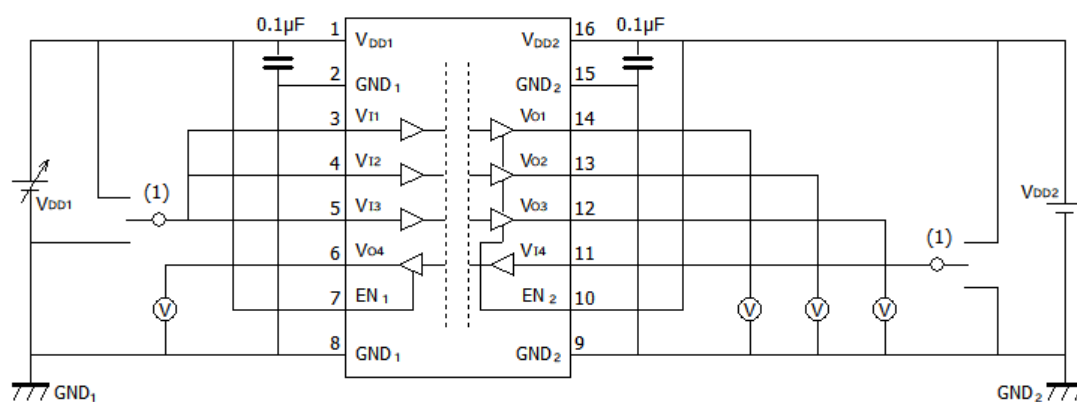
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.1. DCL540C01A/DCL540D01A  $V_{DD1UV+}$  /  $V_{DD1UV-}$  Test Circuit**



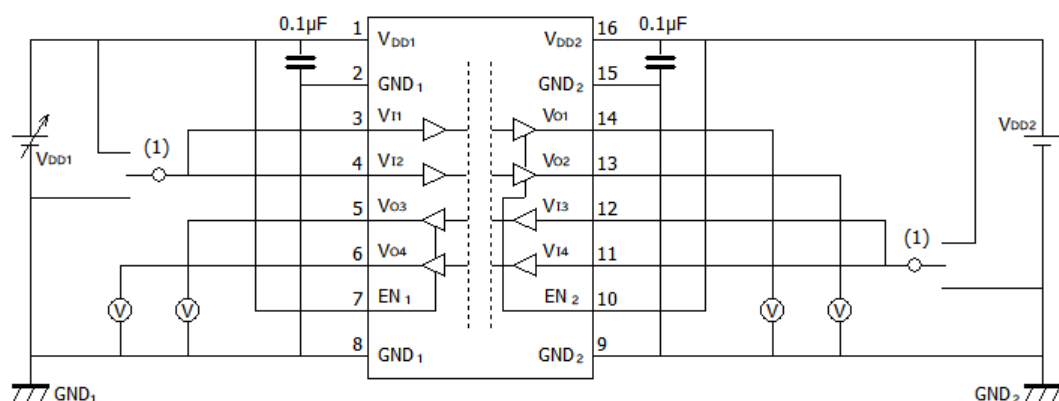
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.2. DCL540L01A/DCL540H01A  $V_{DD1UV+}$  /  $V_{DD1UV-}$  Test Circuit**



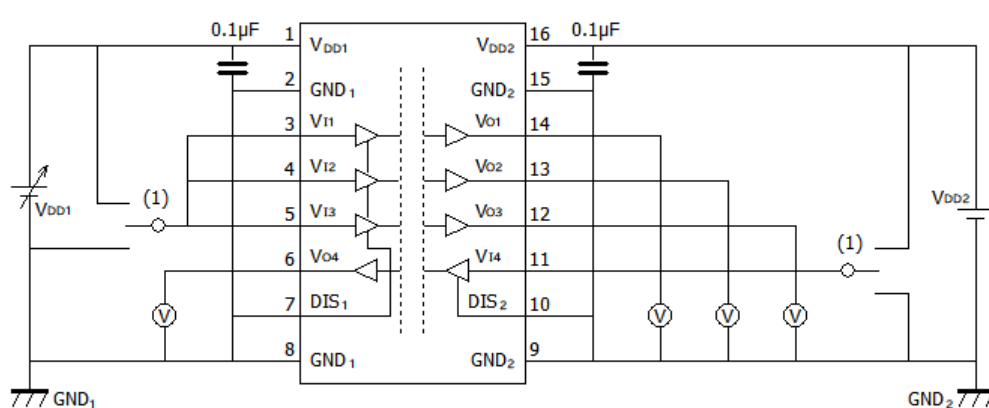
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.3. DCL541L01A/DCL541H01A  $V_{DD1UV+}$  /  $V_{DD1UV-}$  Test Circuit**



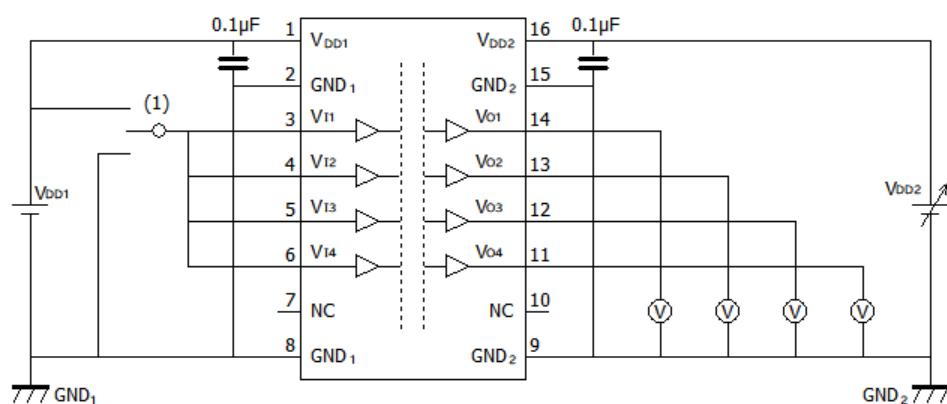
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.4. DCL542L01A/DCL542H01A  $V_{DD1UV+}$  /  $V_{DD1UV-}$ Test Circuit**



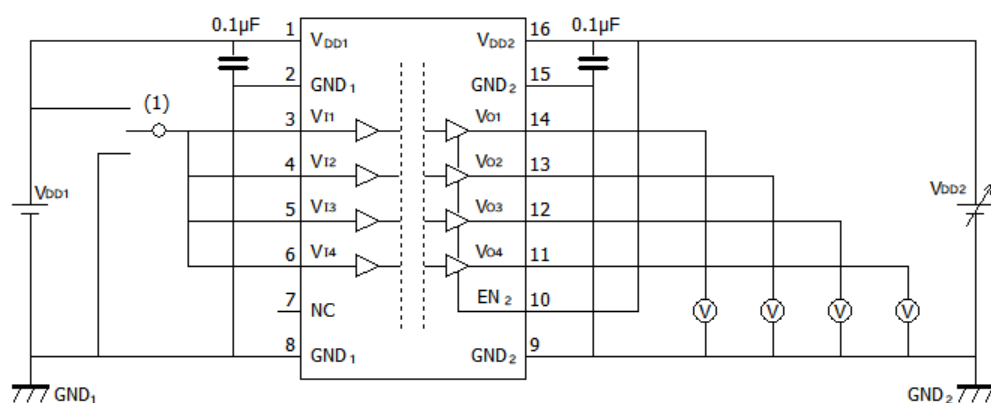
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.5. DCL541A01A/DCL541V01  $V_{DD1UV+}$  /  $V_{DD1UV-}$ Test Circuit**



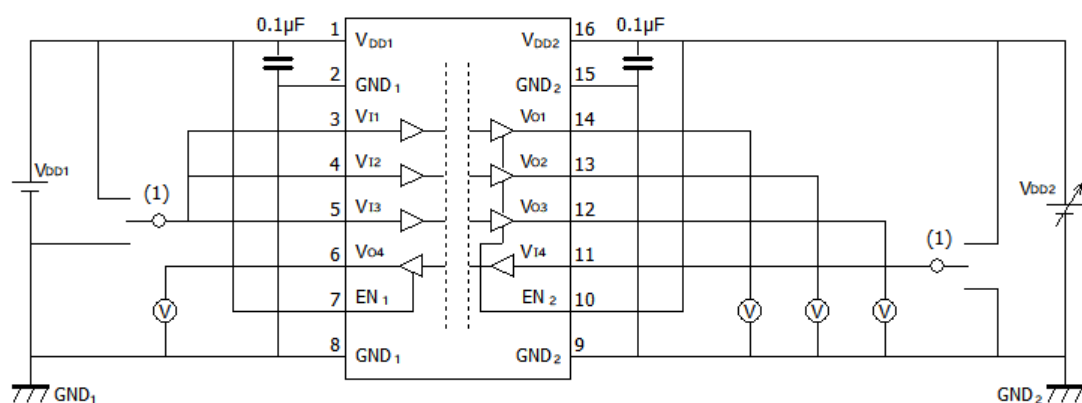
1: Default=L :  $V_{DD1}$  , Default=H :  $GND_1$

**Fig.12.1.6. DCL540C01A/DCL540D01A  $V_{DD2UV+}$  /  $V_{DD2UV-}$ Test Circuit**



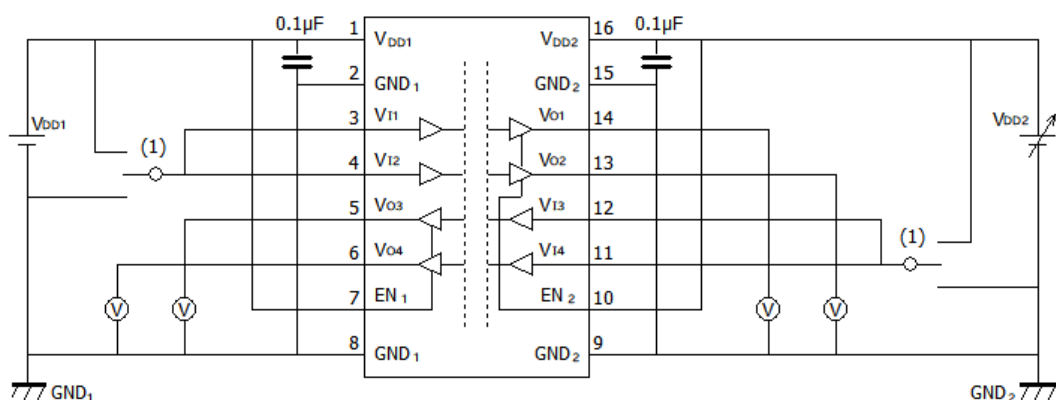
1: Default=L : VDD1 , Default=H : GND1

**Fig.12.1.7. DCL540L01A/DCL540H01A VDD2UV+ / VDD2UV-Test Circuit**



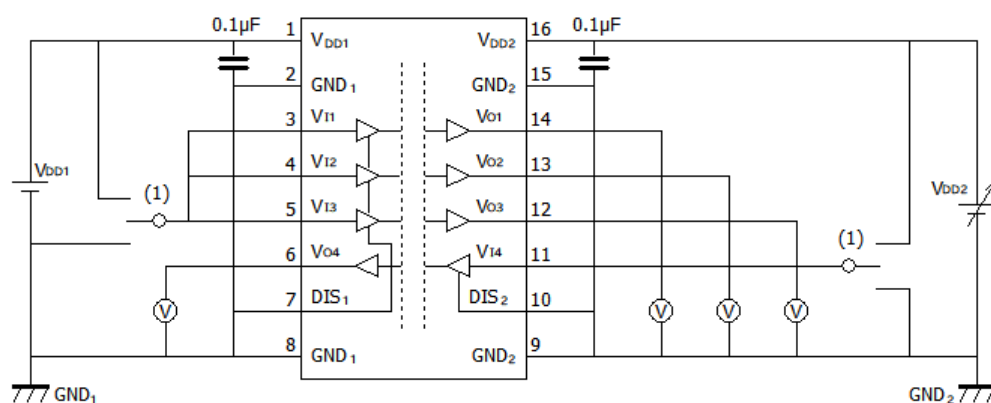
1: Default=L : VDDx , Default=H : GNDx

**Fig.12.1.8. DCL541L01A/DCL541H01A VDD2UV+ / VDD2UV-Test Circuit**



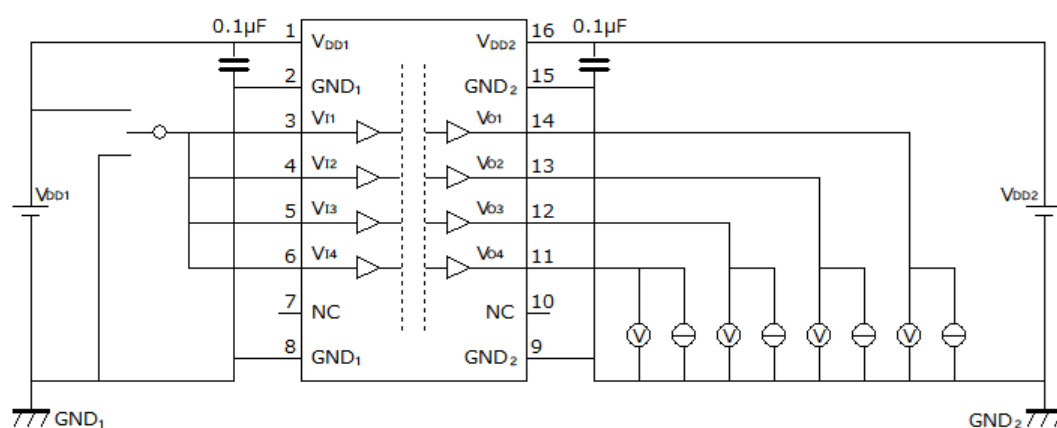
1: Default=L : VDDx , Default=H : GNDx

**Fig.12.1.9. DCL542L01A/DCL542H01A VDD2UV+ / VDD2UV-Test Circuit**

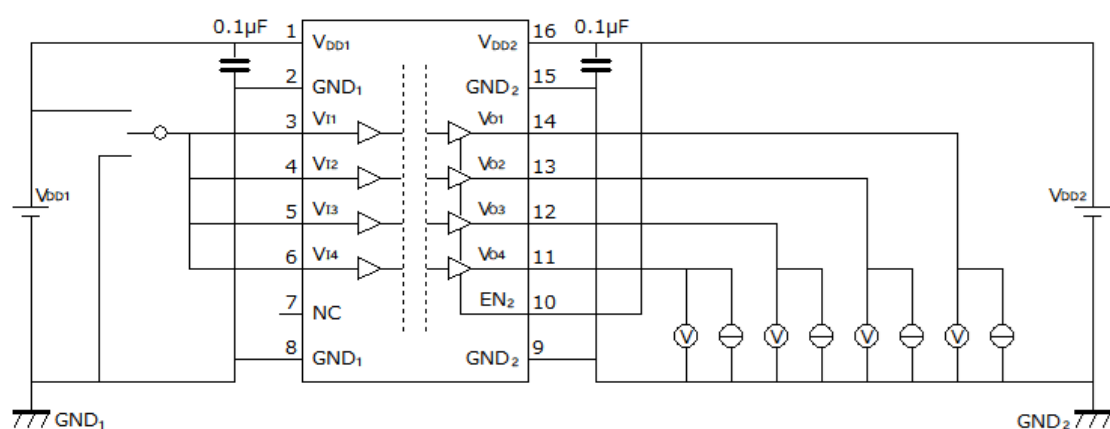


1: Default=L :  $V_{DDx}$  , Default=H :  $GNDx$

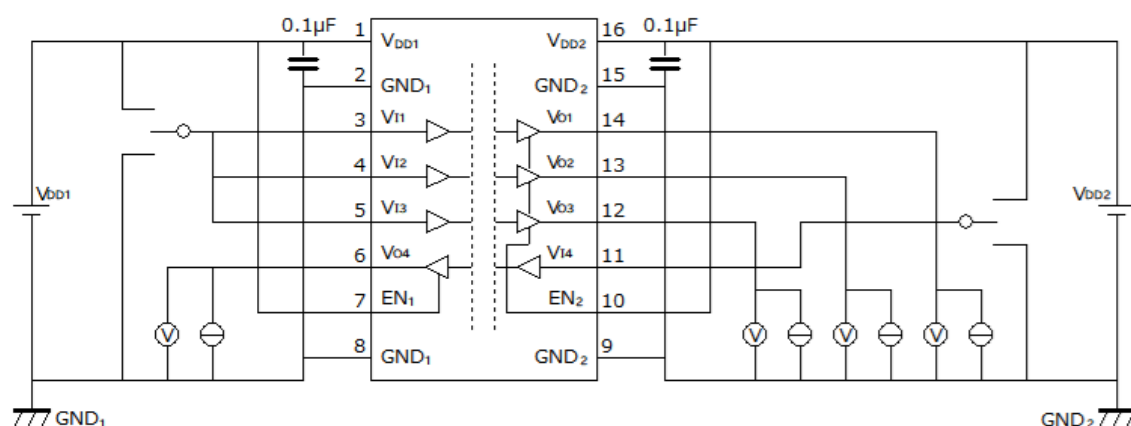
**Fig.12.1.10. DCL541A01A/DCL541B01A  $V_{DD2UV+}/V_{DD2UV-}$  Test Circuit**



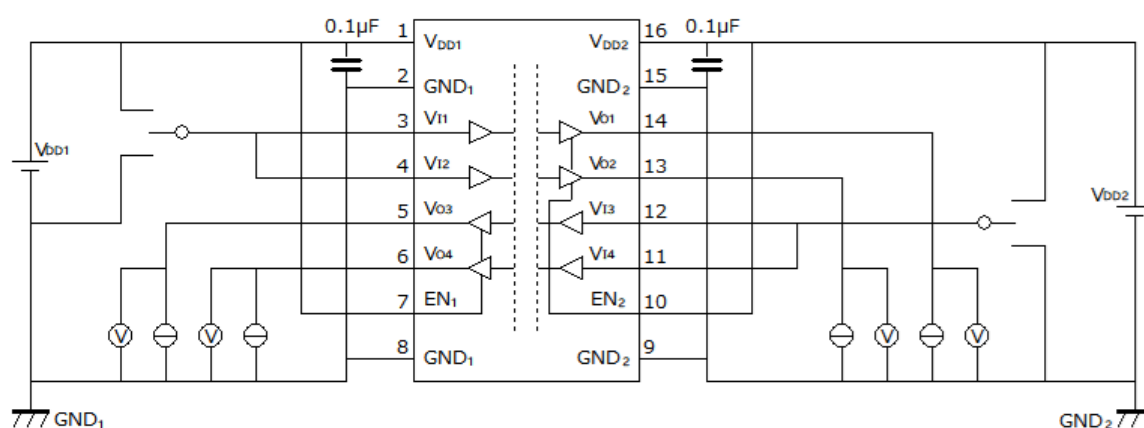
**Fig.12.2.1. DCL540C01A/DCL540D01A  $V_{OH}/V_{OL}$  Test Circuit**



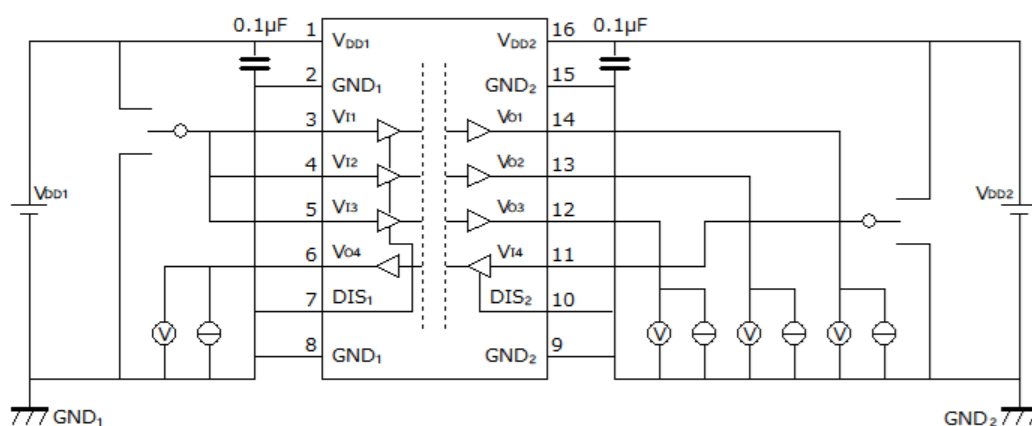
**Fig.12.2.2. DCL540L01A/DCL540H01A  $V_{OH}/V_{OL}$  Test Circuit**



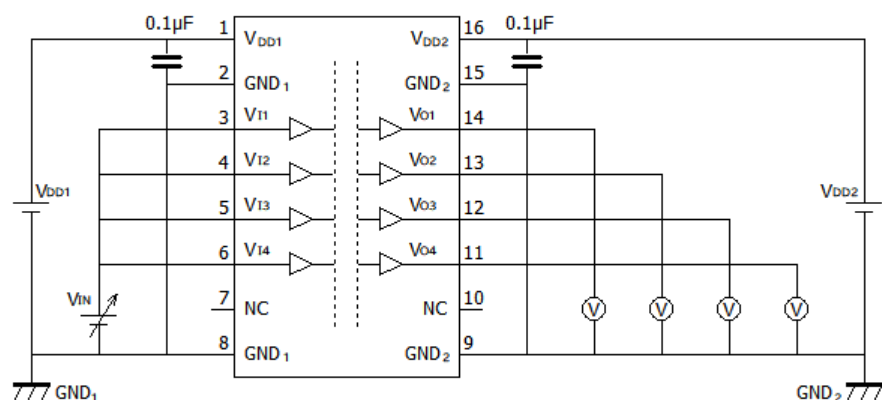
**Fig.12.2.3. DCL541L01A/DCL541H01A  $V_{OH}/V_{OL}$  Test Circuit**



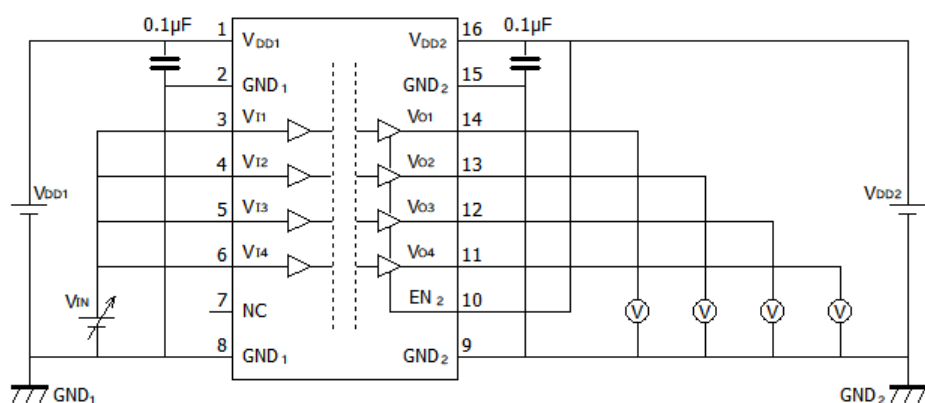
**Fig.12.2.4. DCL542L01A/DCL542H01A  $V_{OH}/V_{OL}$  Test Circuit**



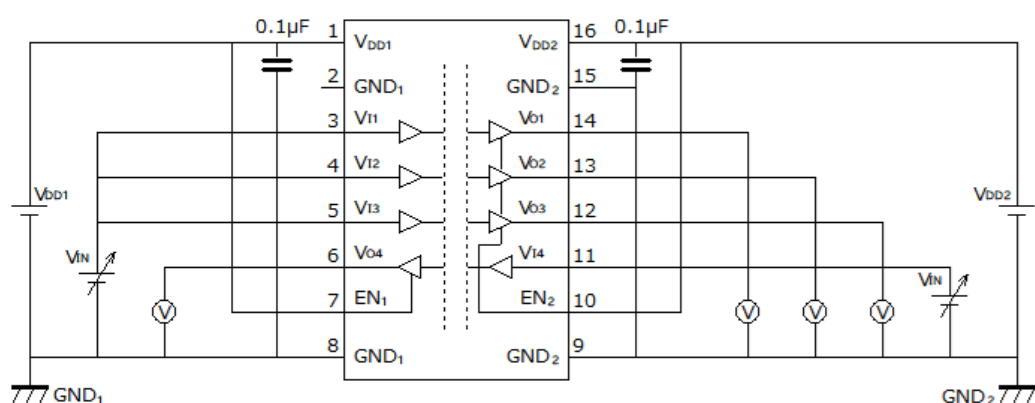
**Fig.12.2.5. DCL541A01A/DCL541B01A  $V_{OH}/V_{OL}$  Test Circuit**



**Fig.12.3.1. DCL540C01A/DCL540D01A  $V_{IH}/V_{IL}$  Test Circuit**



**Fig.12.3.2. DCL540L01A/DCL540H01A  $V_{IH}/V_{IL}$  Test Circuit**



**Fig.12.3.3. DCL541L01A/DCL541H01A  $V_{IH}/V_{IL}$  Test Circuit**

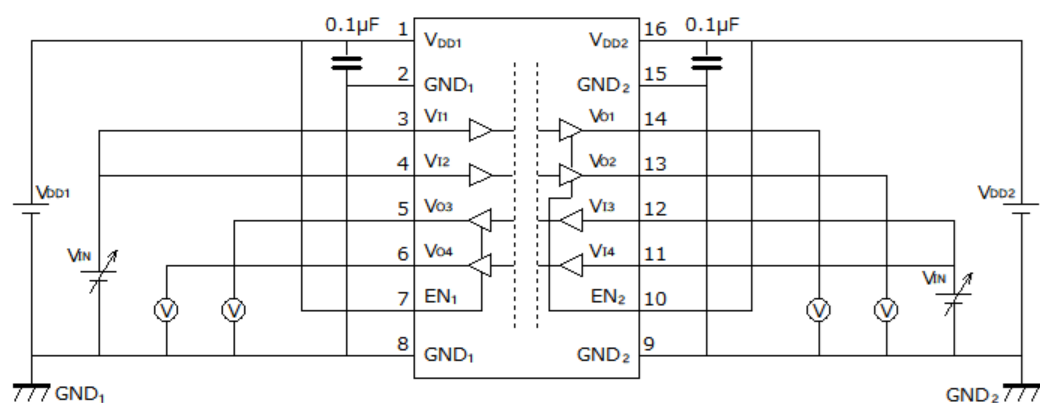


Fig.12.3.4. DCL542L01A/DCL541B01A  $V_{IH}/V_{IL}$  Test Circuit

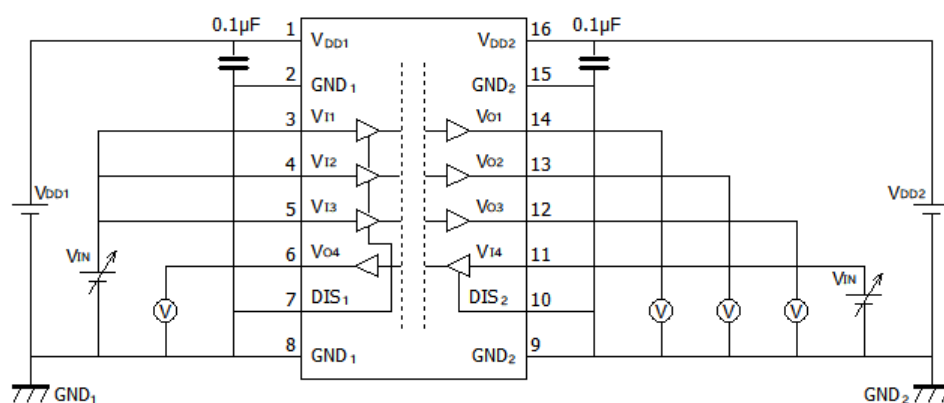
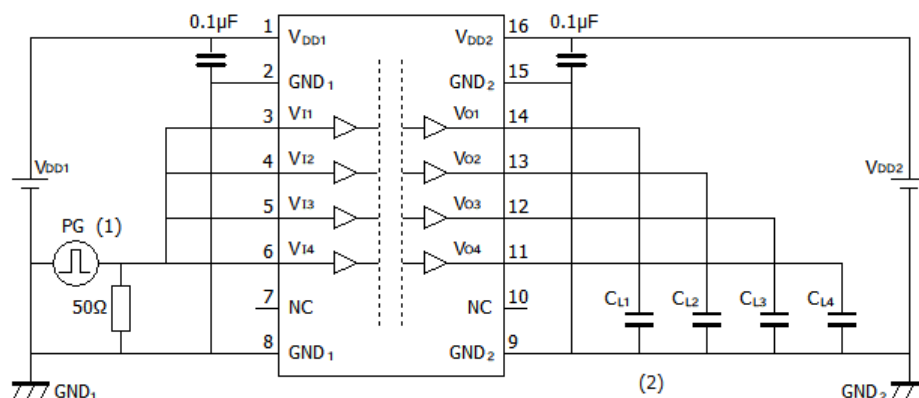
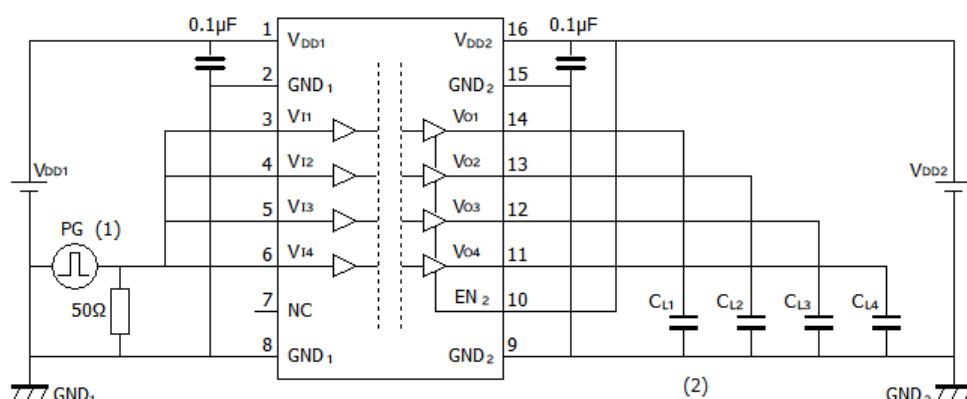


Fig.12.3.5. DCL541A01A/DCL541B01A  $V_{IH}/V_{IL}$  Test Circuit



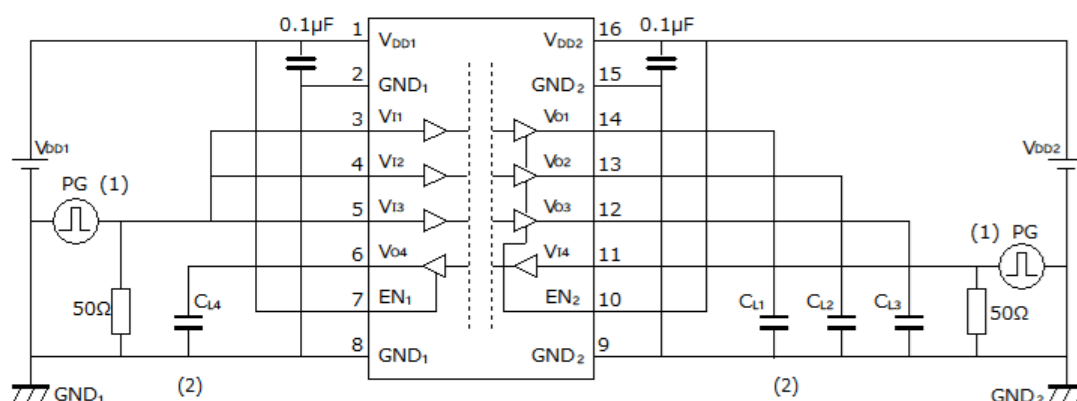
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.

**Fig.12.4.1. DCL540C01A/DCL540D01A Switching Test Circuit**



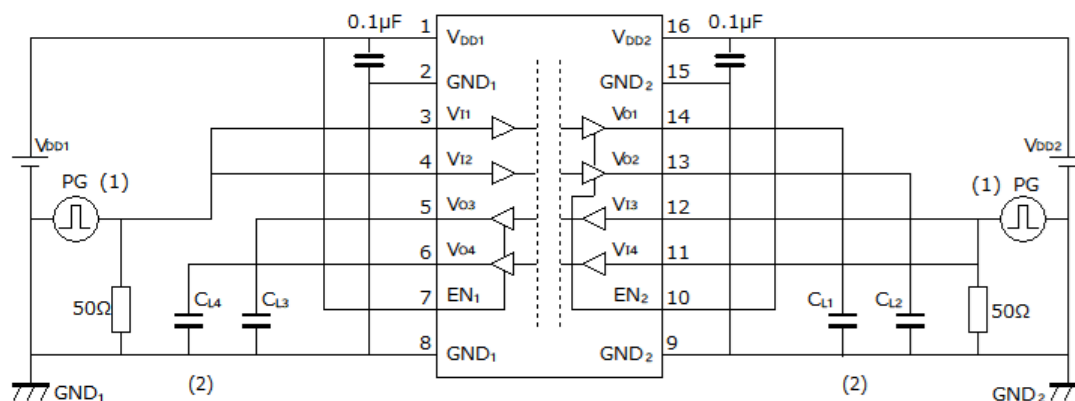
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.

**Fig.12.4.2. DCL540L01A/DCL540H01A Switching Test Circuit**



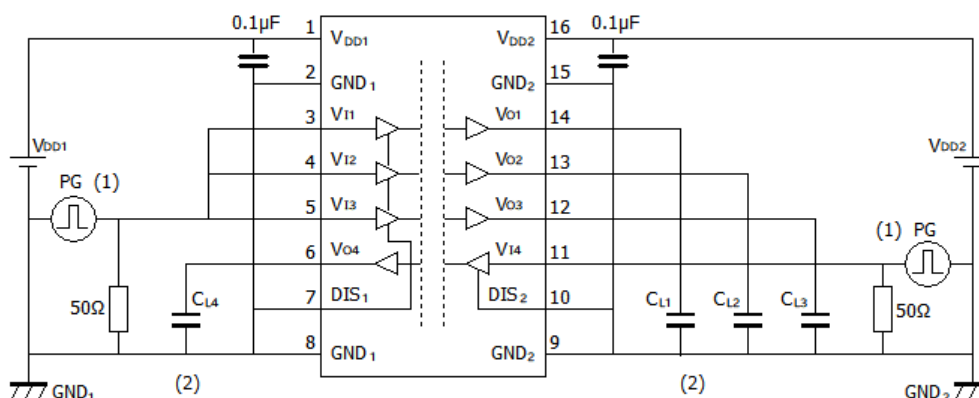
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.

**Fig.12.4.3. DCL541L01A/DCL541H01A Switching Test Circuit**



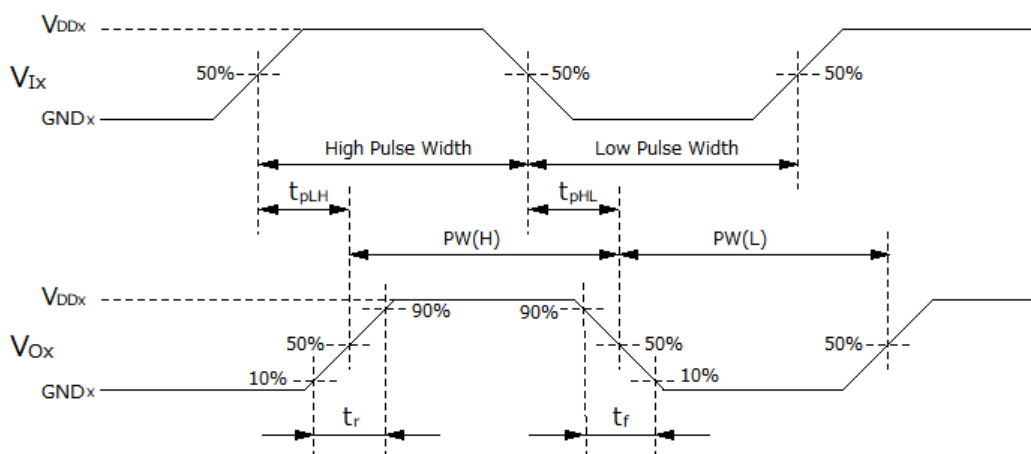
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_0 = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.

**Fig.12.4.4. DCL542L01A/DCL542H01A Switching Test Circuit**

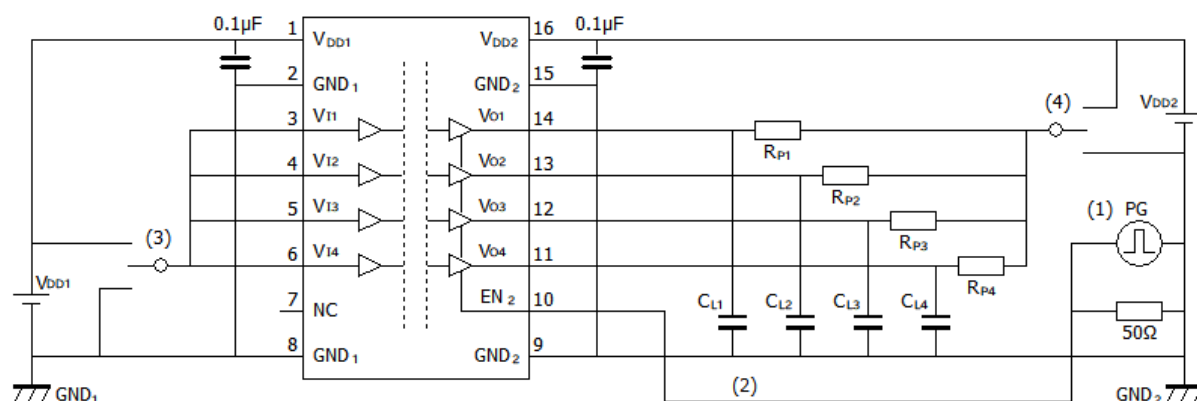


- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_0 = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.

**Fig.12.4.5. DCL541A01A/DCL541B01A Switching Test Circuit**

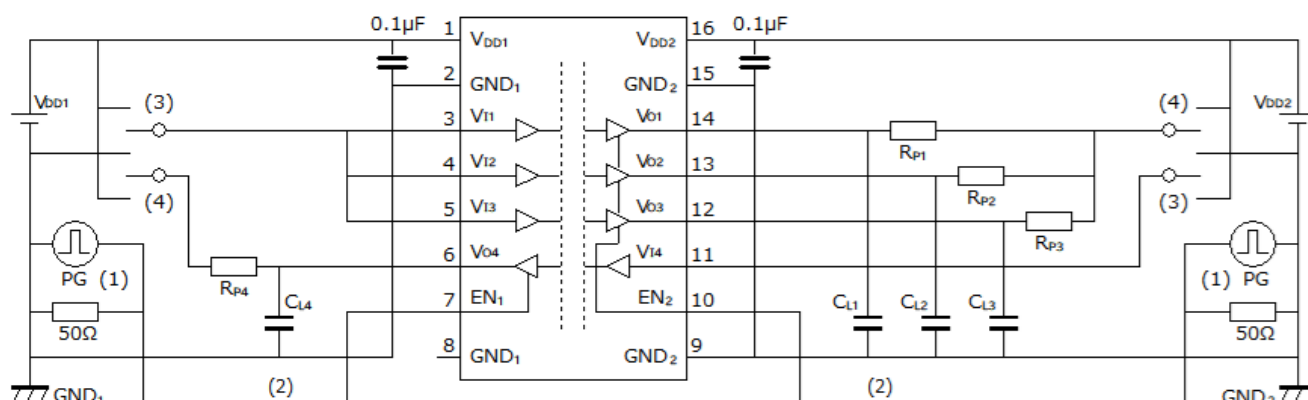


**Fig.12.4.6. DCL5xxA01A Switching characteristic waveform diagram**



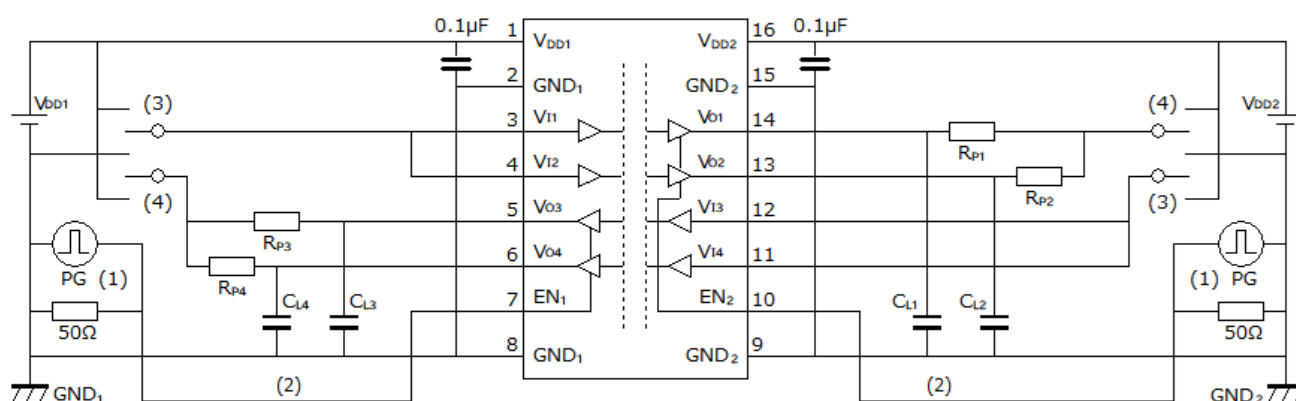
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.
- 3: GND for  $t_{pZL}$ ,  $t_{pLZ}$ ,  $V_{DD}$  for  $t_{pZH}$ ,  $t_{pHZ}$
- 4:  $V_{DD}$  for  $t_{pZL}$ ,  $t_{pLZ}$ , GND for  $t_{pZH}$ ,  $t_{pHZ}$ .

**Fig.12.5.1. DCL540L01A/ DCL540H01A Enable Propagation Delay Time Test Circuit**



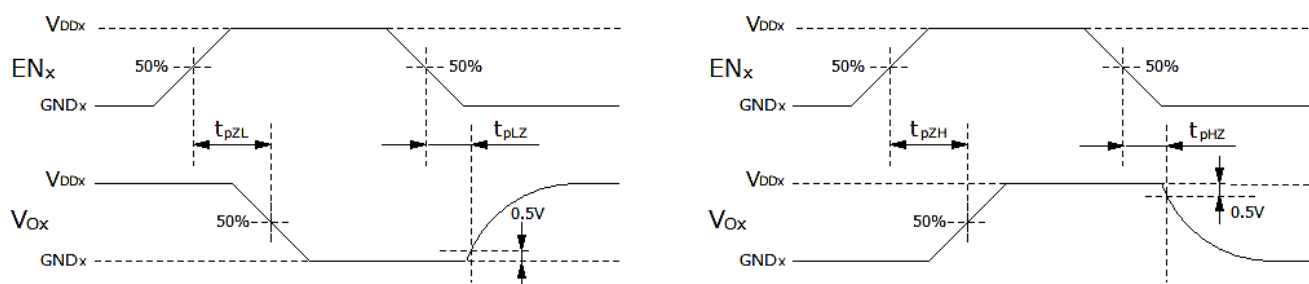
- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{LX} = 15$  pF includes instrumentation and fixture capacitance.
- 3: GND for  $t_{pZL}$ ,  $t_{pLZ}$ ,  $V_{DD}$  for  $t_{pZH}$ ,  $t_{pHZ}$
- 4:  $V_{DD}$  for  $t_{pZL}$ ,  $t_{pLZ}$ , GND for  $t_{pZH}$ ,  $t_{pHZ}$ .

**Fig.12.5.2. DCL541L01A/ DCL541H01A Enable Propagation Delay Time Test Circuit**

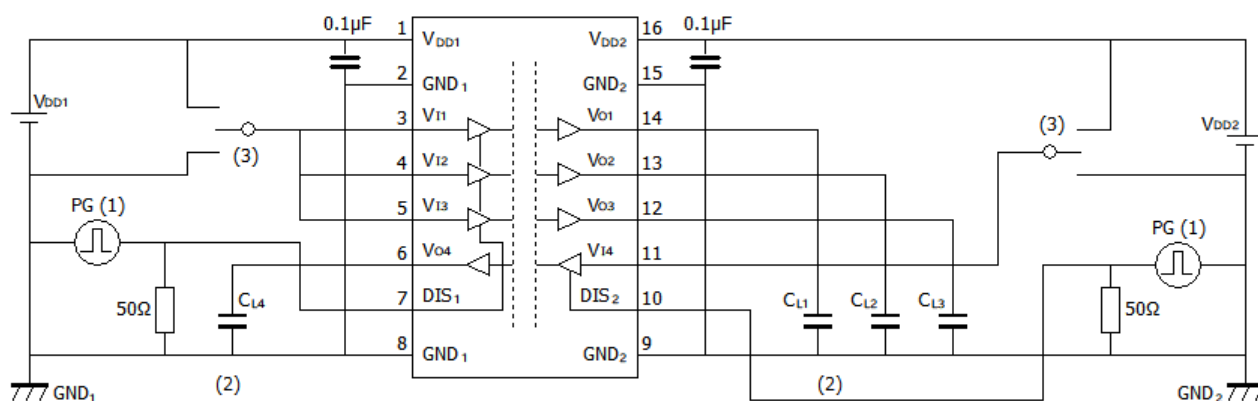


- 1: The input pulse is supplied by a generator having the following characteristics:  $\text{PRR} \leq 50 \text{ kHz}$ , 50 % duty cycle,  $t_{\text{r}} \leq 2 \text{ ns}$ ,  $t_{\text{f}} \leq 2 \text{ ns}$ ,  $Z_0 = 50 \text{ } \Omega$ . At the input,  $50 \text{ } \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{\text{LX}} = 15 \text{ pF}$  includes instrumentation and fixture capacitance.
- 3: GND for  $t_{\text{pZL}}$ ,  $t_{\text{pLZ}}$ ,  $V_{\text{DD}}$  for  $t_{\text{pZH}}$ ,  $t_{\text{pHZ}}$
- 4:  $V_{\text{DD}}$  for  $t_{\text{pZL}}$ ,  $t_{\text{pLZ}}$ , GND for  $t_{\text{pZH}}$ ,  $t_{\text{pHZ}}$ .

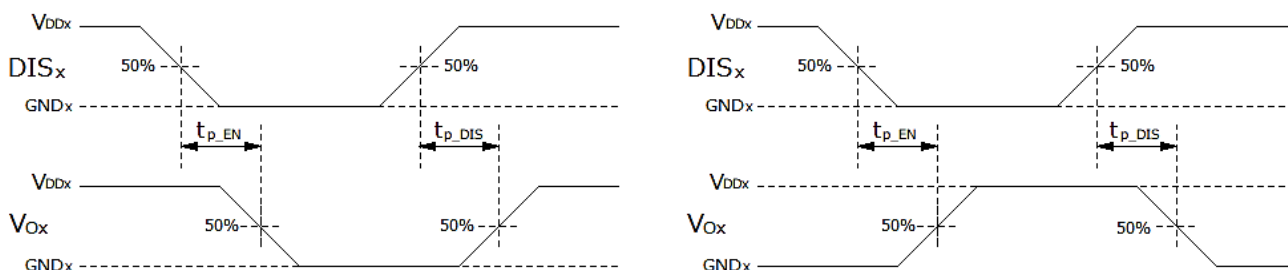
**Fig.12.5.3. DCL542L01A/ DCL542H01A Enable Propagation Delay Time Test Circuit**



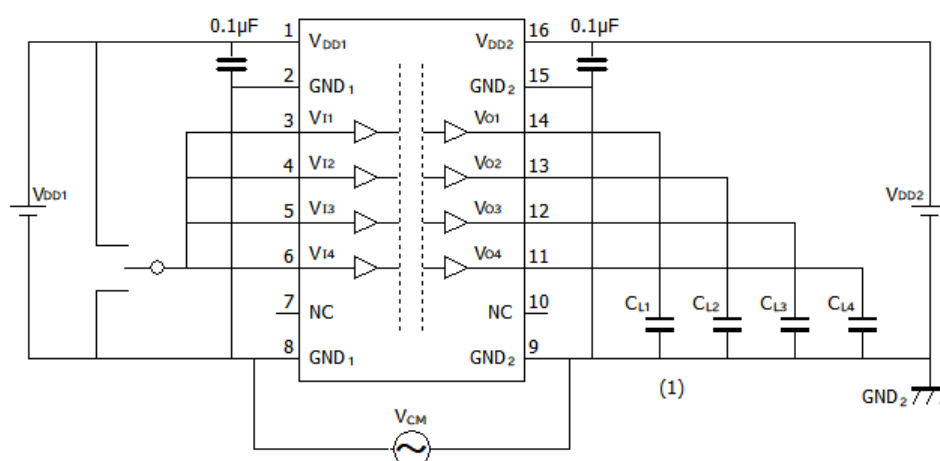
**Fig.12.5.4. DCL54xL01A/ DCL54xH01A Enable propagation delay time waveform**



- 1: The input pulse is supplied by a generator having the following characteristics:  $PRR \leq 50$  kHz, 50 % duty cycle,  $t_r \leq 2$  ns,  $t_f \leq 2$  ns,  $Z_o = 50 \Omega$ . At the input,  $50 \Omega$  resistor is required to terminate input generator signal. It is needed not in actual application.
- 2:  $C_{Lx} = 15$  pF includes instrumentation and fixture capacitance.
- 3: GND for DCL541B01A,  $V_{DD}$  for DCL541A01A

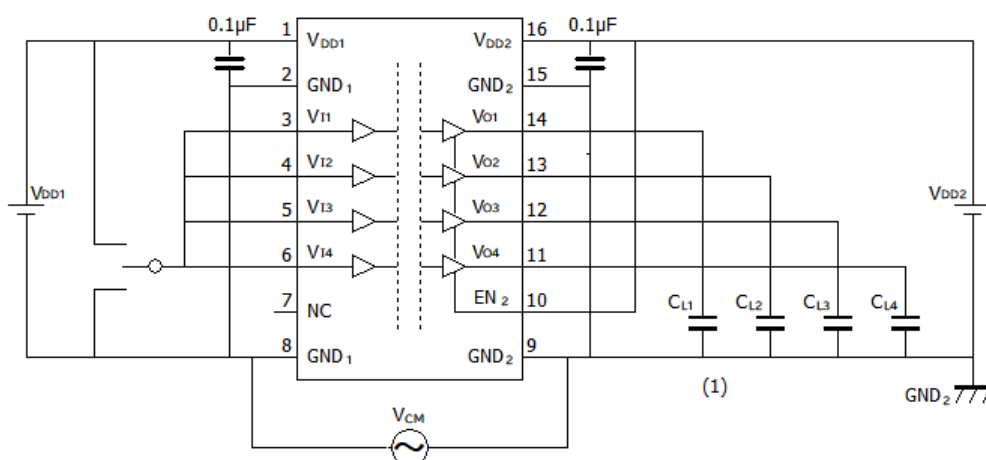


**Fig.12.6. DCL541A01A/DCL541B01A Disable Propagation Delay Time Test Circuit and Waveforms**



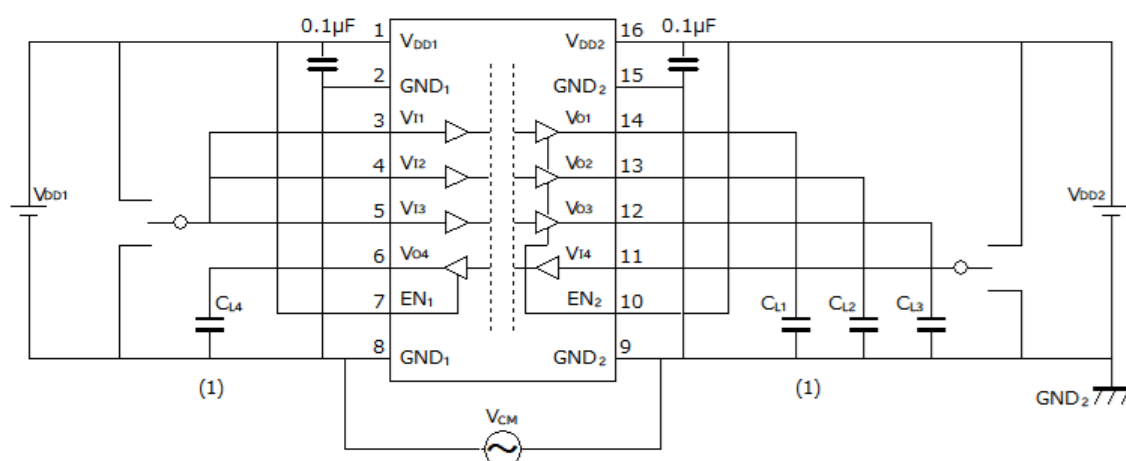
- 1:  $C_{LX}=15$  pF includes instrumentation and fixture capacitance.
- 2: Apply  $V_{CM}$  with reference to the GND terminal on the output terminal side of the IC. The GND on the IC input terminal side is isolated from the output terminal side. Depending on which channel is being measured,  $V_{CM}$  may be applied with reference to GND<sub>1</sub> or with reference to GND<sub>2</sub>.

**Fig.12.7.1. DCL540C01A/DCL540D01A Common-Mode Transient Immunity Test Circuit**



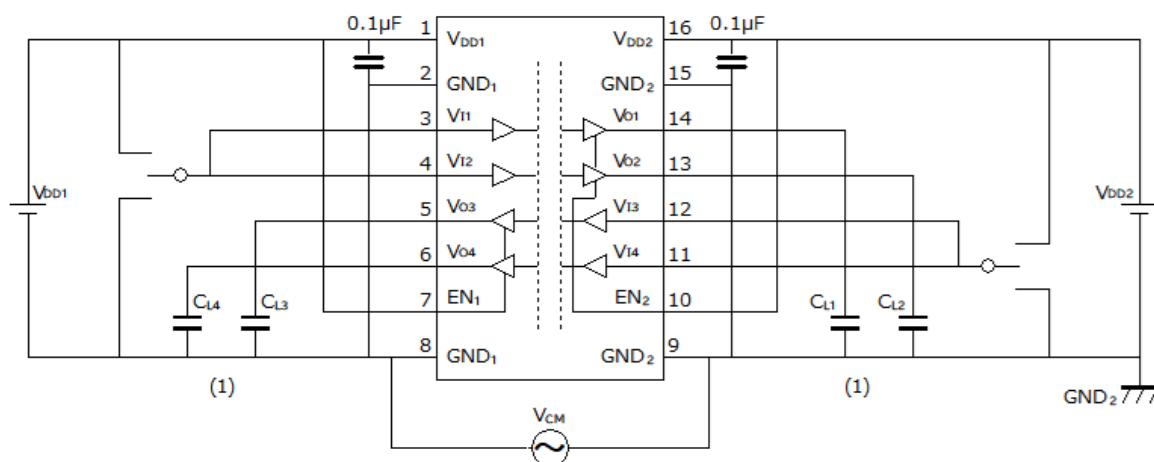
- 1:  $C_{LX}=15$  pF includes instrumentation and fixture capacitance.
- 2: Apply  $V_{CM}$  with reference to the GND terminal on the output terminal side of the IC. The GND on the IC input terminal side is isolated from the output terminal side. Depending on which channel is being measured,  $V_{CM}$  may be applied with reference to GND<sub>1</sub> or with reference to GND<sub>2</sub>.

**Fig.12.7.2. DCL540L01A/DCL540H01A Common-Mode Transient Immunity Test Circuit**



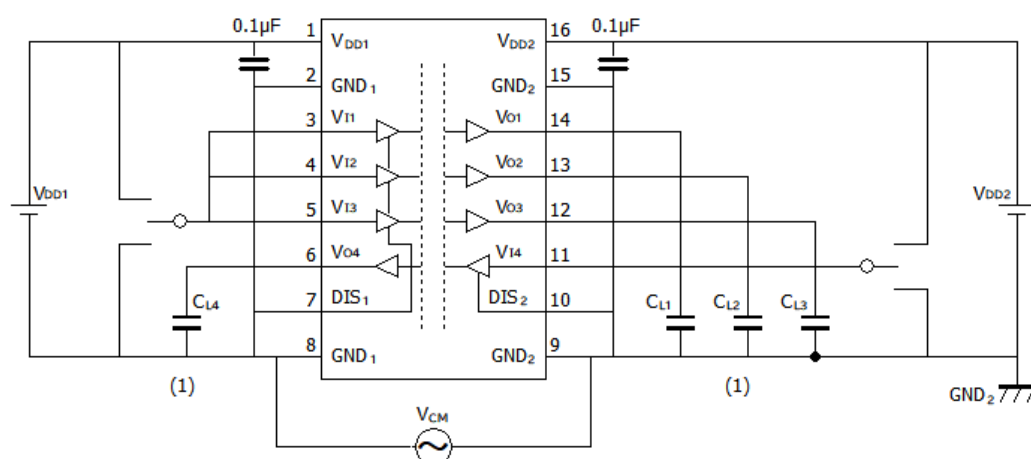
- 1:  $C_{LX}=15$  pF includes instrumentation and fixture capacitance.
- 2: Apply  $V_{CM}$  with reference to the GND terminal on the output terminal side of the IC. The GND on the IC input terminal side is isolated from the output terminal side. Depending on which channel is being measured,  $V_{CM}$  may be applied with reference to GND<sub>1</sub> or with reference to GND<sub>2</sub>.

**Fig.12.7.3. DCL541L01A/DCL541H01A Common-Mode Transient Immunity Test Circuit**



- 1:  $C_{LX}=15$  pF includes instrumentation and fixture capacitance.
- 2: Apply  $V_{CM}$  with reference to the GND terminal on the output terminal side of the IC. The GND on the IC input terminal side is isolated from the output terminal side. Depending on which channel is being measured,  $V_{CM}$  may be applied with reference to GND<sub>1</sub> or with reference to GND<sub>2</sub>.

**Fig.12.7.4. DCL542L01A/DCL542H01A Common-Mode Transient Immunity Test Circuit**



- 1:  $C_{LX}=15\text{ pF}$  includes instrumentation and fixture capacitance.
- 2: Apply  $V_{CM}$  with reference to the GND terminal on the output terminal side of the IC. The GND on the IC input terminal side is isolated from the output terminal side. Depending on which channel is being measured,  $V_{CM}$  may be applied with reference to GND<sub>1</sub> or with reference to GND<sub>2</sub>.

**Fig.12.7.5. DCL541A01A/DCL541B01A Common-Mode Transient Immunity Test Circuit**

## 13.Characteristics Curves (Note)

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

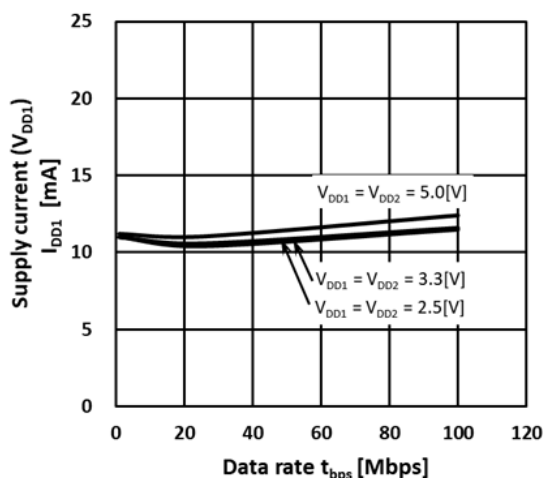


Fig.13.1. DCL540x01A  $I_{DD1}$  Supply Current - Data rate

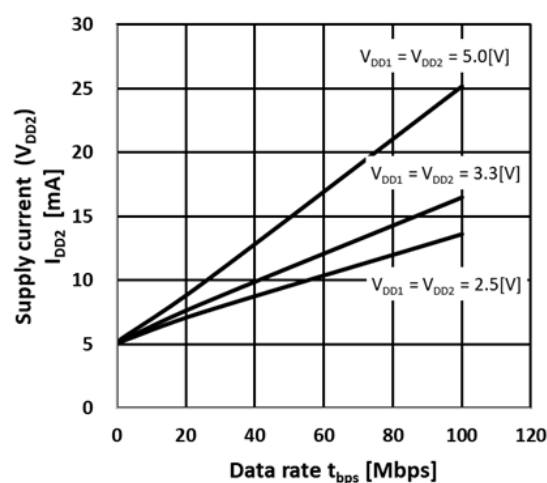


Fig.13.2. DCL540x01A  $I_{DD2}$  Supply Current - Data rate

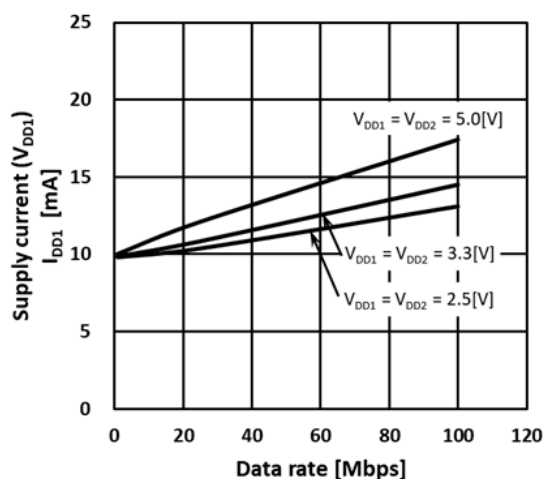


Fig.13.3. DCL541x01A  $I_{DD1}$  Supply Current - Data rate

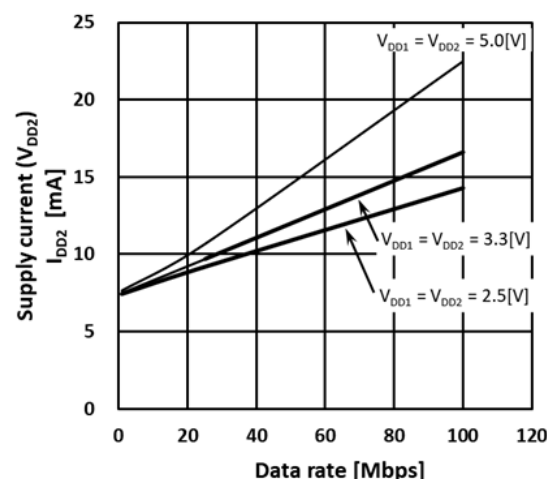


Fig.13.4. DCL5401x01A  $I_{DD2}$  Supply Current - Data rate

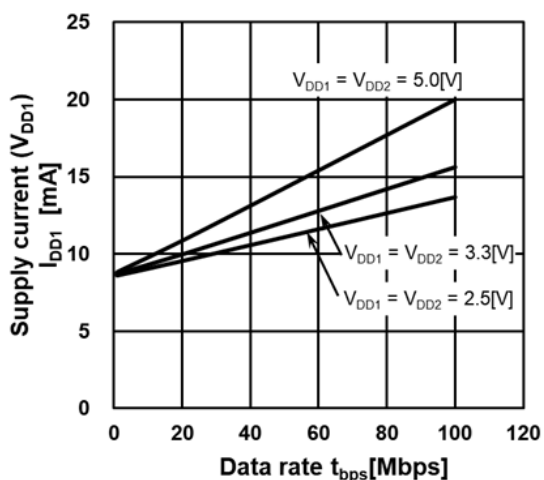


Fig.13.5. DCL542x01A  $I_{DD1}$  Supply Current - Data rate

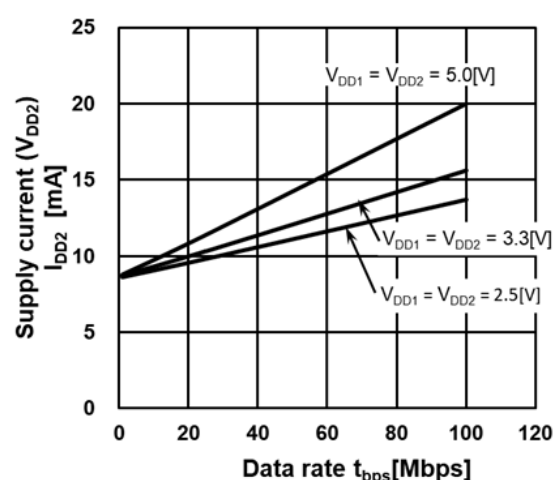


Fig.13.6. DCL542x01A  $I_{DD2}$  Supply Current - Data rate

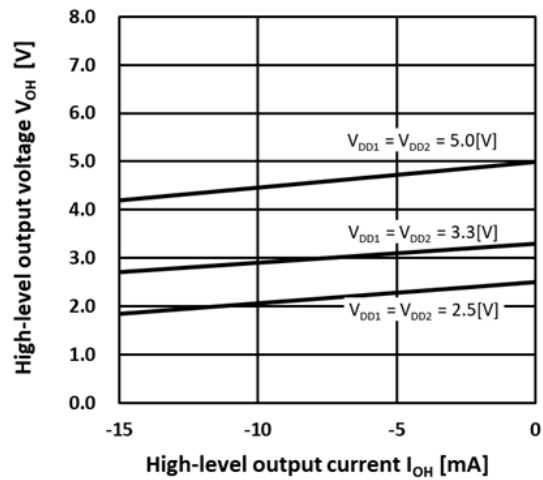


Fig.13.5.  $V_{OH} - I_{OH}$

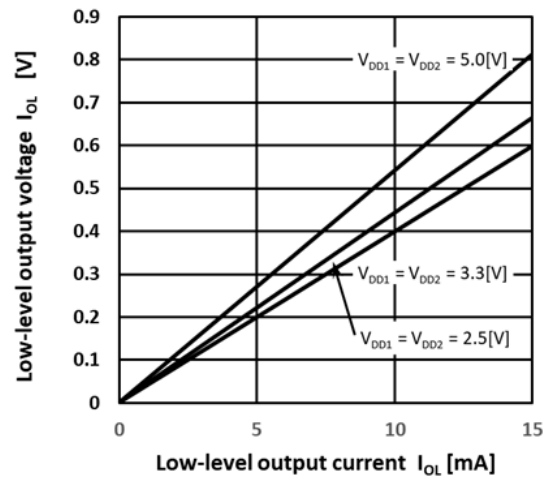


Fig.13.6.  $V_{OL} - I_{OL}$

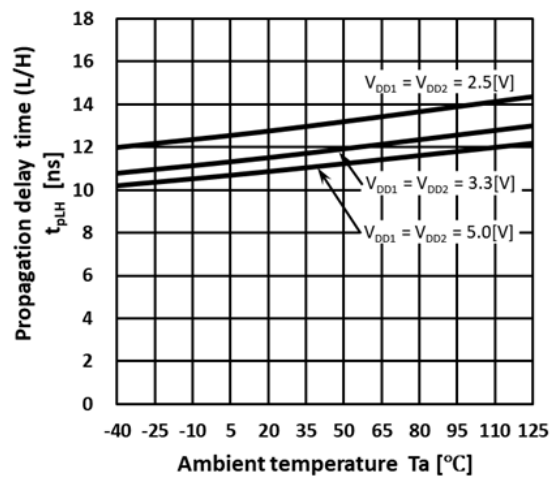


Fig.13.7. Propagation Delay Time  $t_{pLH} - T_a$

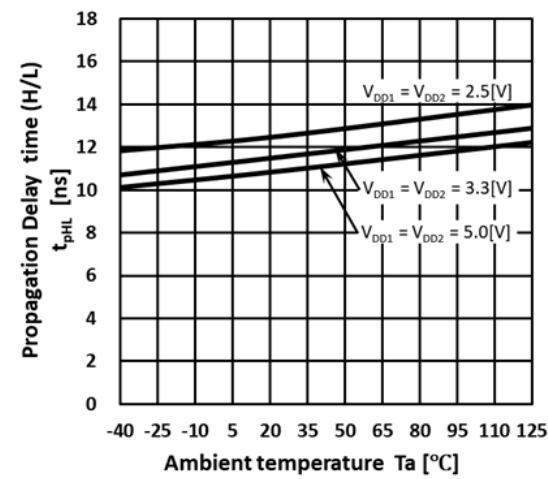


Fig.13.8. Propagation Delay Time  $t_{pLH} - T_a$

## 14. Application Note

### 14.1. Eye diagram

The following figure shows typical eye diagrams of DCL541x01A at the maximum data rate of 150Mbps with pseudorandom bit sequences (PRBS), supply voltage 3.3 V for reference only.

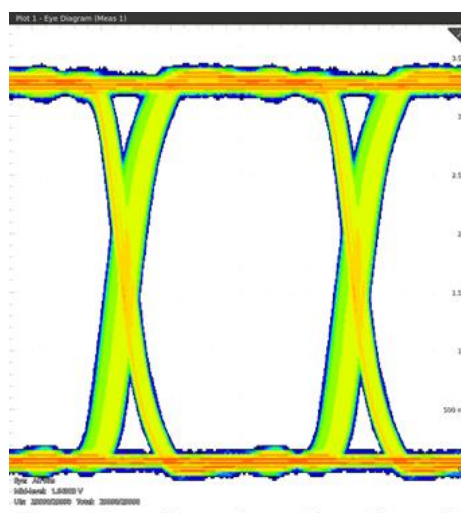


Fig.14.1 DCL541A01A Eye diagram at 150Mbps

### 14.2. PCB layout

A ceramic capacitor (0.1  $\mu$ F) should be connected between pin 1 ( $V_{DD1}$ ) and pin 2 ( $GND_1$ ) for  $V_{DD1}$  and between pin 16 ( $V_{DD2}$ ) and pin 15 ( $GND_2$ ) for  $V_{DD2}$ , and it should be the layout on the IC as close as possible (less than 10mm). Otherwise, the IC may not operate properly.

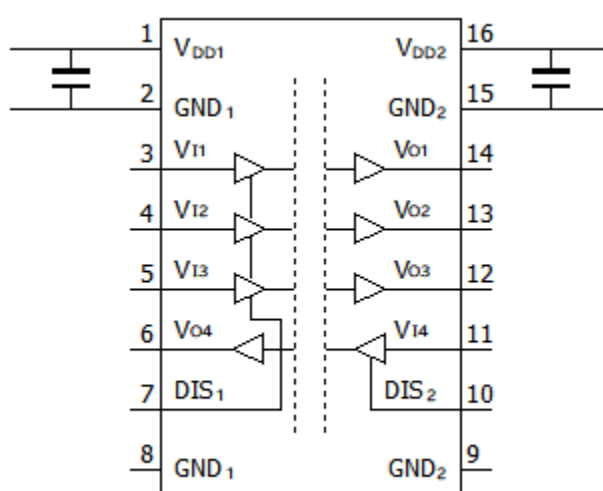


Fig.14.2 Recommended Printed Circuit Board Layout

15. Package Information

|                                                            |                                                                                                                                                                                     |
|------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Implementation category                                    | Surface Mount                                                                                                                                                                       |
| Pin Number                                                 | 16                                                                                                                                                                                  |
| Weight (g)                                                 | 0.426 (Typical)                                                                                                                                                                     |
| Package Dimension<br>Width × Length × Height<br>(mm)       | 10.3 × 10.3 × 2.65 (Max)                                                                                                                                                            |
| Package Dimension(mm)<br>/<br>Land Pattern Example<br>(mm) | <div>Package Dimension</div> <div>Land Pattern Dimensions (for reference only)</div> <div><div><p>Normal</p></div><div><p>Option<br/>(Primary-Secondary Gap: Large)</p></div></div> |

## RESTRICTIONS ON PRODUCT USE

Toshiba Corporation and its subsidiaries and affiliates are collectively referred to as "TOSHIBA". Hardware, software and systems described in this document are collectively referred to as "Product".

- TOSHIBA reserves the right to make changes to the information in this document and related Product without notice.
- This document and any information herein may not be reproduced without prior written permission from TOSHIBA. Even with TOSHIBA's written permission, reproduction is permissible only if reproduction is without alteration/omission.
- Though TOSHIBA works continually to improve Product's quality and reliability, Product can malfunction or fail. Customers are responsible for complying with safety standards and for providing adequate designs and safeguards for their hardware, software and systems which minimize risk and avoid situations in which a malfunction or failure of Product could cause loss of human life, bodily injury or damage to property, including data loss or corruption. Before customers use the Product, create designs including the Product, or incorporate the Product into their own applications, customers must also refer to and comply with (a) the latest versions of all relevant TOSHIBA information, including without limitation, this document, the specifications, the data sheets and application notes for Product and the precautions and conditions set forth in the "TOSHIBA Semiconductor Reliability Handbook" and (b) the instructions for the application with which the Product will be used with or for. Customers are solely responsible for all aspects of their own product design or applications, including but not limited to (a) determining the appropriateness of the use of this Product in such design or applications; (b) evaluating and determining the applicability of any information contained in this document, or in charts, diagrams, programs, algorithms, sample application circuits, or any other referenced documents; and (c) validating all operating parameters for such designs and applications. **TOSHIBA ASSUMES NO LIABILITY FOR CUSTOMERS' PRODUCT DESIGN OR APPLICATIONS.**
- **PRODUCT IS NEITHER INTENDED NOR WARRANTED FOR USE IN EQUIPMENTS OR SYSTEMS THAT REQUIRE EXTRAORDINARILY HIGH LEVELS OF QUALITY AND/OR RELIABILITY, AND/OR A MALFUNCTION OR FAILURE OF WHICH MAY CAUSE LOSS OF HUMAN LIFE, BODILY INJURY, SERIOUS PROPERTY DAMAGE AND/OR SERIOUS PUBLIC IMPACT ("UNINTENDED USE").** Except for specific applications as expressly stated in this document, Unintended Use includes, without limitation, equipment used in nuclear facilities, equipment used in the aerospace industry, lifesaving and/or life supporting medical equipment, equipment used for automobiles, trains, ships and other transportation, traffic signaling equipment, equipment used to control combustions or explosions, safety devices, elevators and escalators, and devices related to power plant. **IF YOU USE PRODUCT FOR UNINTENDED USE, TOSHIBA ASSUMES NO LIABILITY FOR PRODUCT.** For details, please contact your TOSHIBA sales representative or contact us via our website.
- Do not disassemble, analyze, reverse-engineer, alter, modify, translate or copy Product, whether in whole or in part.
- Product shall not be used for or incorporated into any products or systems whose manufacture, use, or sale is prohibited under any applicable laws or regulations.
- The information contained herein is presented only as guidance for Product use. No responsibility is assumed by TOSHIBA for any infringement of patents or any other intellectual property rights of third parties that may result from the use of Product. No license to any intellectual property right is granted by this document, whether express or implied, by estoppel or otherwise.
- **ABSENT A WRITTEN SIGNED AGREEMENT, EXCEPT AS PROVIDED IN THE RELEVANT TERMS AND CONDITIONS OF SALE FOR PRODUCT, AND TO THE MAXIMUM EXTENT ALLOWABLE BY LAW, TOSHIBA (1) ASSUMES NO LIABILITY WHATSOEVER, INCLUDING WITHOUT LIMITATION, INDIRECT, CONSEQUENTIAL, SPECIAL, OR INCIDENTAL DAMAGES OR LOSS, INCLUDING WITHOUT LIMITATION, LOSS OF PROFITS, LOSS OF OPPORTUNITIES, BUSINESS INTERRUPTION AND LOSS OF DATA, AND (2) DISCLAIMS ANY AND ALL EXPRESS OR IMPLIED WARRANTIES AND CONDITIONS RELATED TO SALE, USE OF PRODUCT, OR INFORMATION, INCLUDING WARRANTIES OR CONDITIONS OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, ACCURACY OF INFORMATION, OR NONINFRINGEMENT.**
- Do not use or otherwise make available Product or related software or technology for any military purposes, including without limitation, for the design, development, use, stockpiling or manufacturing of nuclear, chemical, or biological weapons or missile technology products (mass destruction weapons). Product and related software and technology may be controlled under the applicable export laws and regulations including, without limitation, the Japanese Foreign Exchange and Foreign Trade Law and the U.S. Export Administration Regulations. Export and re-export of Product or related software or technology are strictly prohibited except in compliance with all applicable export laws and regulations.
- Please contact your TOSHIBA sales representative for details as to environmental matters such as the RoHS compatibility of Product. Please use Product in compliance with all applicable laws and regulations that regulate the inclusion or use of controlled substances, including without limitation, the EU RoHS Directive. **TOSHIBA ASSUMES NO LIABILITY FOR DAMAGES OR LOSSES OCCURRING AS A RESULT OF NONCOMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS.**

Toshiba Electronic Devices & Storage Corporation

<https://toshiba.semicon-storage.com/>