

### Description

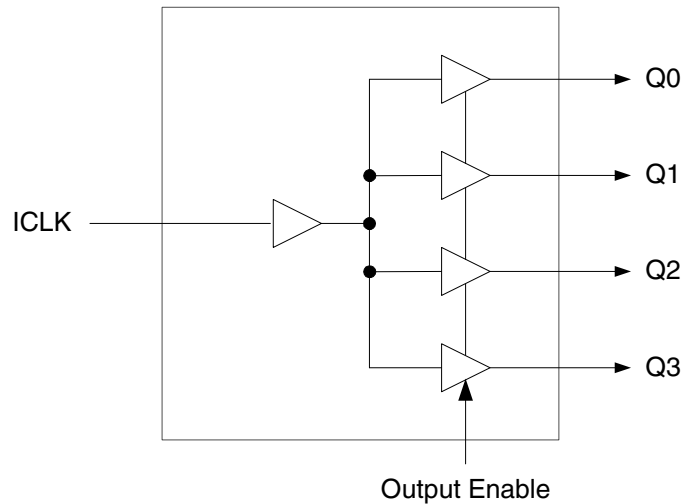
The 553S is a low skew, single input to four output, clock buffer. The 553S has best in class additive phase Jitter of sub 50 fsec.

IDT makes many non-PLL and PLL based low skew output devices as well as Zero Delay Buffers to synchronize clocks. Contact us for all of your clocking needs.

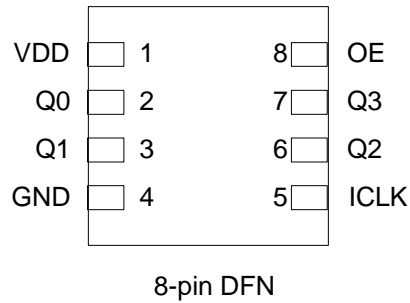
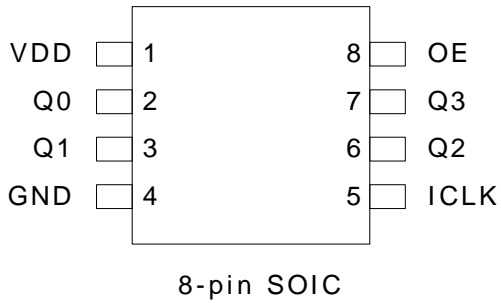
### Features

- Low additive phase jitter RMS: 50fs
- Extremely low skew outputs (50ps)
- Low cost clock buffer
- Packaged in 8-SOIC and small 8-DFN package, Pb-free
- Input/Output clock frequency up to 200MHz
- Ideal for networking clocks
- Operating voltages: 1.8V to 3.3V
- Output Enable mode tri-states outputs
- Advanced, low power CMOS process
- Extended temperature range (-40°C to +105°C)
- 3.3V tolerant input clock

### Block Diagram



## Pin Assignments



## Pin Descriptions

| Pin Number | Pin Name | Pin Type | Pin Description  |
|------------|----------|----------|--|
| 1          | VDD      | Power    | Connect to +1.8V, +2.5V, or +3.3V.   |
| 2          | Q0       | Output   | Clock output 0.  |
| 3          | Q1       | Output   | Clock output 1.  |
| 4          | GND      | Power    | Connect to ground.   |
| 5          | ICLK     | Input    | Clock input.   |
| 6          | Q2       | Output   | Clock output 2.  |
| 7          | Q3       | Output   | Clock output 3.  |
| 8          | OE       | Input    | Output Enable. Tri-states outputs when low. Connect to VDD for normal operation. |

## External Components

A minimum number of external components are required for proper operation. A decoupling capacitor of 0.01 $\mu$ F should be connected between VDD on pin 1 and GND on pin 4, as close to the device as possible. A 33 $\Omega$  series terminating resistor may be used on each clock output if the trace is longer than 1 inch.

To achieve the low output skew that the 553S is capable of, careful attention must be paid to board layout. Essentially, all four outputs must have identical terminations, identical loads and identical trace geometries. If they do not, the output skew will be degraded. For example, using a 30 $\Omega$  series termination on one output (with 33 $\Omega$  on the others) will cause at least 15ps of skew.

## Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the 553S. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

| Item                                     | Rating              |
|--|---------------------|
| Supply Voltage, VDD                      | 3.8V                |
| Output Enable and All Outputs            | -0.5 V to VDD+0.5 V |
| ICLK                                     | 3.465V              |
| Ambient Operating Temperature (extended) | -40 to +105°C       |
| Storage Temperature                      | -65 to +150°C       |
| Junction Temperature                     | 125°C               |
| Soldering Temperature                    | 260°C               |

## Recommended Operation Conditions

| Parameter   | Min.  | Typ. | Max.   | Units |
|---|-------|------|--------|-------|
| Ambient Operating Temperature (extended)          | -40   |      | +105   | °C    |
| Power Supply Voltage (measured in respect to GND) | +1.71 |      | +3.465 | V     |

## DC Electrical Characteristics

(VDD = 1.8V, 2.5V, 3.3V)

**VDD = 1.8V ±5%**, Ambient temperature -40° to +105°C, unless stated otherwise

| Parameter                | Symbol          | Conditions              | Min.    | Typ. | Max.    | Units |
|--------------------------|-----------------|-------------------------|---------|------|---------|-------|
| Operating Voltage        | VDD             |                         | 1.71    |      | 1.89    | V     |
| Input High Voltage, ICLK | V <sub>IH</sub> | Note 1                  | 0.7xVDD |      | 3.45    | V     |
| Input Low Voltage, ICLK  | V <sub>IL</sub> | Note 1                  |         |      | 0.3xVDD | V     |
| Input High Voltage, OE   | V <sub>IH</sub> |                         | 0.7xVDD |      | VDD     | V     |
| Input Low Voltage, OE    | V <sub>IL</sub> |                         |         |      | 0.3xVDD | V     |
| Output High Voltage      | V <sub>OH</sub> | I <sub>OH</sub> = -10mA | 1.3     |      |         | V     |
| Output Low Voltage       | V <sub>OL</sub> | I <sub>OL</sub> = 10mA  |         |      | 0.35    | V     |
| Operating Supply Current | IDD             | No load, 135MHz         |         | 15   |         | mA    |
| Nominal Output Impedance | Z <sub>O</sub>  |                         |         | 17   |         | Ω     |
| Input Capacitance        | C <sub>IN</sub> | ICLK, OE pin            |         | 5    |         | pF    |

Notes: 1. Nominal switching threshold is VDD/2.

**VDD = 2.5 V ±5%**, Ambient temperature -40° to +105°C, unless stated otherwise

| Parameter                | Symbol          | Conditions              | Min.    | Typ. | Max.    | Units |
|--------------------------|-----------------|-------------------------|---------|------|---------|-------|
| Operating Voltage        | VDD             |                         | 2.375   |      | 2.625   | V     |
| Input High Voltage, ICLK | V <sub>IH</sub> | Note 1                  | 0.7xVDD |      | 3.45    | V     |
| Input Low Voltage, ICLK  | V <sub>IL</sub> | Note 1                  |         |      | 0.3xVDD | V     |
| Input High Voltage, OE   | V <sub>IH</sub> |                         | 0.7xVDD |      | VDD     | V     |
| Input Low Voltage, OE    | V <sub>IL</sub> |                         |         |      | 0.3xVDD | V     |
| Output High Voltage      | V <sub>OH</sub> | I <sub>OH</sub> = -16mA | 1.8     |      |         | V     |
| Output Low Voltage       | V <sub>OL</sub> | I <sub>OL</sub> = 16mA  |         |      | 0.5     | V     |
| Operating Supply Current | IDD             | No load, 135MHz         |         | 18   |         | mA    |
| Nominal Output Impedance | Z <sub>O</sub>  |                         |         | 17   |         | Ω     |
| Input Capacitance        | C <sub>IN</sub> | ICLK, OE pin            |         | 5    |         | pF    |

**VDD = 3.3 V ±5%**, Ambient temperature -40° to +105°C, unless stated otherwise

| Parameter                | Symbol          | Conditions              | Min.    | Typ. | Max.    | Units |
|--------------------------|-----------------|-------------------------|---------|------|---------|-------|
| Operating Voltage        | VDD             |                         | 3.135   |      | 3.465   | V     |
| Input High Voltage, ICLK | V <sub>IH</sub> | Note 1                  | 0.7xVDD |      | VDD     | V     |
| Input Low Voltage, ICLK  | V <sub>IL</sub> | Note 1                  |         |      | 0.3xVDD | V     |
| Input High Voltage, OE   | V <sub>IH</sub> |                         | 0.7xVDD |      | VDD     | V     |
| Input Low Voltage, OE    | V <sub>IL</sub> |                         |         |      | 0.3xVDD | V     |
| Output High Voltage      | V <sub>OH</sub> | I <sub>OH</sub> = -25mA | 2.2     |      |         | V     |
| Output Low Voltage       | V <sub>OL</sub> | I <sub>OL</sub> = 25mA  |         |      | 0.7     | V     |
| Operating Supply Current | IDD             | No load, 135MHz         |         | 22   |         | mA    |
| Nominal Output Impedance | Z <sub>O</sub>  |                         |         | 17   |         | Ω     |
| Input Capacitance        | C <sub>IN</sub> | ICLK, OE pin            |         | 5    |         | pF    |

## AC Electrical Characteristics

(VDD = 1.8V, 2.5V, 3.3V)

**VDD = 1.8V ±5%**, Ambient Temperature -40° to +105°C, unless stated otherwise

| Parameter                         | Symbol                | Conditions   | Min. | Typ. | Max. | Units  |
|-----------------------------------|-----------------------|--|------|------|------|--------|
| Input Frequency                   |                       |  | 0    |      | 200  | MHz    |
| Output Rise Time                  | t <sub>OR</sub>       | 0.36 to 1.44V, C <sub>L</sub> =5pF                     |      | 0.6  | 1.0  | ns     |
| Output Fall Time                  | t <sub>OF</sub>       | 1.44 to 0.36V, C <sub>L</sub> =5pF                     |      | 0.6  | 1.0  | ns     |
| Propagation Delay                 | Note 1                |  | 2.5  | 3    | 3.5  | ns     |
| Buffer Additive Phase Jitter, RMS |                       | 125MHz, Integration Range: 12kHz-20MHz                 |      |      | 0.05 | ps     |
| Output to Output Skew             | Note 2                | Rising edges at VDD/2                                  |      | 50   | 65   | ps     |
| Device to Device Skew             |                       | Rising edges at VDD/2                                  |      |      | 200  | ps     |
| Start-up Time                     | t <sub>START-UP</sub> | Part start-up time for valid outputs after VDD ramp-up |      |      | 2    | ms     |
| Output Enable Time                | t <sub>EN</sub>       | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |
| Output Disable Time               | t <sub>DIS</sub>      | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |

**VDD = 2.5 V ±5%**, Ambient Temperature -40° to +105°C, unless stated otherwise

| Parameter                         | Symbol                | Conditions   | Min. | Typ. | Max. | Units  |
|-----------------------------------|-----------------------|--|------|------|------|--------|
| Input Frequency                   |                       |  | 0    |      | 200  | MHz    |
| Output Rise Time                  | t <sub>OR</sub>       | 0.5 to 2.0 V, C <sub>L</sub> =5pF                      |      | 0.6  | 1.0  | ns     |
| Output Fall Time                  | t <sub>OF</sub>       | 2.0 to 0.5 V, C <sub>L</sub> =5pF                      |      | 0.6  | 1.0  | ns     |
| Propagation Delay                 | Note 1                |  | 3    | 3.5  | 4    | ns     |
| Buffer Additive Phase Jitter, RMS |                       | 125MHz, Integration Range: 12kHz-20MHz                 |      |      | 0.05 | ps     |
| Output to Output Skew             | Note 2                | Rising edges at VDD/2                                  |      | 40   | 65   | ps     |
| Device to Device Skew             |                       | Rising edges at VDD/2                                  |      |      | 200  | ps     |
| Start-up Time                     | t <sub>START-UP</sub> | Part start-up time for valid outputs after VDD ramp-up |      |      | 2    | ms     |
| Output Enable Time                | t <sub>EN</sub>       | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |
| Output Disable Time               | t <sub>DIS</sub>      | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |

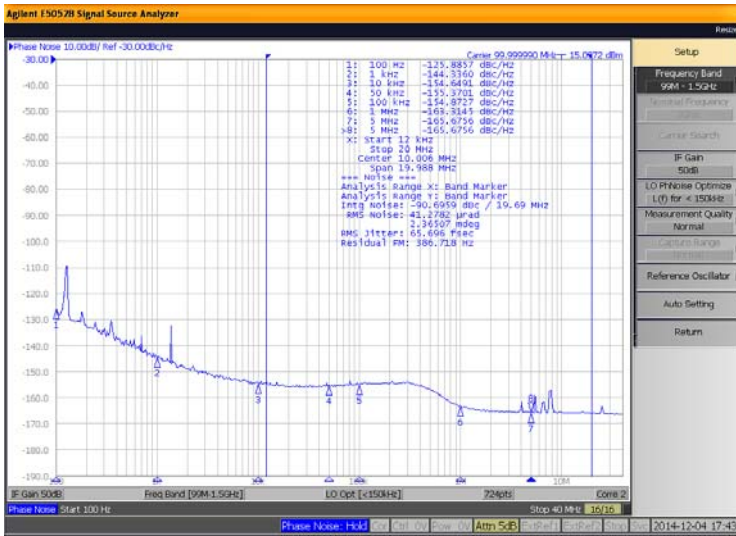
**VDD = 3.3 V ±5%**, Ambient Temperature -40° to +105°C, unless stated otherwise

| Parameter                         | Symbol                | Conditions   | Min. | Typ. | Max. | Units  |
|-----------------------------------|-----------------------|--|------|------|------|--------|
| Input Frequency                   |                       |  | 0    |      | 200  | MHz    |
| Output Rise Time                  | t <sub>OR</sub>       | 0.66 to 2.64 V, C <sub>L</sub> =5pF                    |      | 0.6  | 1.0  | ns     |
| Output Fall Time                  | t <sub>OF</sub>       | 2.64 to 0.66 V, C <sub>L</sub> =5pF                    |      | 0.6  | 1.0  | ns     |
| Propagation Delay                 | Note 1                |  | 2.5  | 3    | 3.5  | ns     |
| Buffer Additive Phase Jitter, RMS |                       | 125MHz, Integration Range: 12kHz-20MHz                 |      |      | 0.05 | ps     |
| Output to Output Skew             | Note 2                | Rising edges at VDD/2                                  |      | 25   | 65   | ps     |
| Device to Device Skew             |                       | Rising edges at VDD/2                                  |      |      | 200  | ps     |
| Start-up Time                     | t <sub>START-UP</sub> | Part start-up time for valid outputs after VDD ramp-up |      |      | 2    | ms     |
| Output Enable Time                | t <sub>EN</sub>       | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |
| Output Disable Time               | t <sub>DIS</sub>      | C <sub>L</sub> ≤ 5pF                                   |      |      | 3    | cycles |

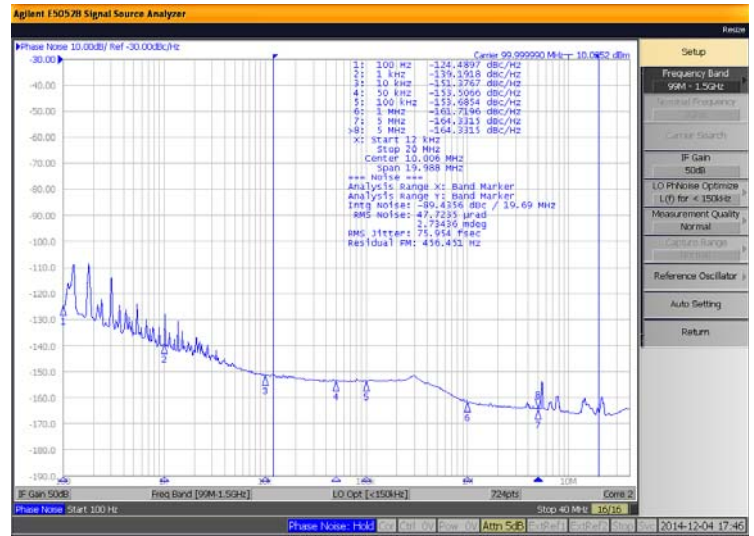
Notes:

1. With rail to rail input clock
2. Between any 2 outputs with equal loading.
3. Duty cycle on outputs will match incoming clock duty cycle. Consult IDT for tight duty cycle clock generators.

## Phase Noise Plots



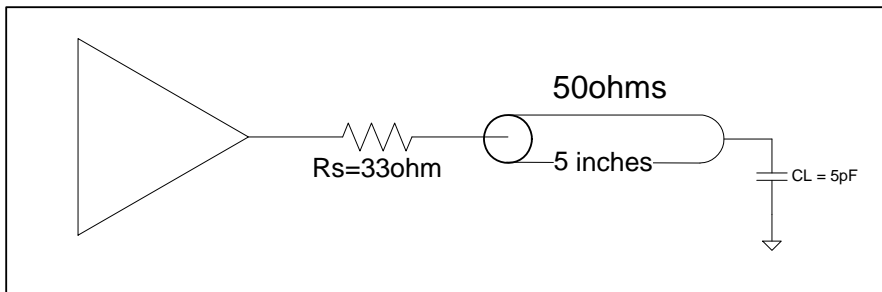
**Figure 1. 553S Reference Phase Noise 66fs (12kHz to 20MHz)**



**Figure 2. 553S Output Phase Noise 76fs (12kHz to 20MHz)**

The phase noise plots above show the low Additive Jitter of the 553S high-performance buffer. With an integration range of 12kHz to 20MHz, the reference input has about 66fs of RMS phase jitter while the output of 553S has about 76fs of RMS phase jitter. This results in a low Additive Phase Jitter of only 37fs.

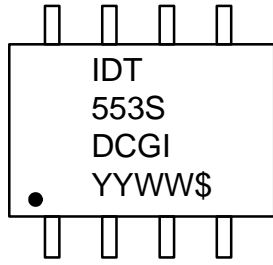
## Test Load and Circuit



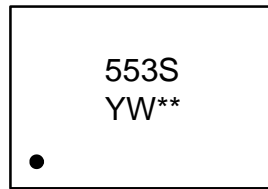
## Thermal Characteristics (8SOIC)

| Parameter                              | Symbol        | Conditions     | Min. | Typ. | Max. | Units |
|--|---------------|----------------|------|------|------|-------|
| Thermal Resistance Junction to Ambient | $\theta_{JA}$ | Still air      |      | 150  |      | °C/W  |
|  | $\theta_{JA}$ | 1 m/s air flow |      | 140  |      | °C/W  |
|  | $\theta_{JA}$ | 3 m/s air flow |      | 120  |      | °C/W  |
| Thermal Resistance Junction to Case    | $\theta_{JC}$ |                |      | 40   |      | °C/W  |

## Marking Diagrams



8-pin SOIC



8-pin DFN

### Notes:

1. “\*\*” is the lot number.
2. “YYWW” or “YW” are the last digits of the year and week that the part was assembled.
- 3 “G” denotes RoHS compliant package.
4. “\$” denotes mark code.
5. “I” denotes extended temperature range device.

## Package Outline Drawings

The package outline drawings are appended at the end of this document and are accessible from the link below. The package information is the most current data available.

[www.idt.com/document/psc/cmg8-package-outline-drawing-20-x-20-x-05-mm-body-05mm-pitch-dfn](http://www.idt.com/document/psc/cmg8-package-outline-drawing-20-x-20-x-05-mm-body-05mm-pitch-dfn)

[www.idt.com/document/psc/8-soic-package-outline-drawing-0150-body-width-0050-pitch-dcg8d1](http://www.idt.com/document/psc/8-soic-package-outline-drawing-0150-body-width-0050-pitch-dcg8d1)

## Ordering Information

| Part / Order Number | Shipping Packaging | Package    | Temperature     |
|---------------------|--------------------|------------|-----------------|
| 553SDCGI            | Tubes              | 8-pin SOIC | -40°C to +105°C |
| 553SDCGI8           | Tape and Reel      | 8-pin SOIC | -40°C to +105°C |
| 553SCMGI            | Cut Tape           | 8-pin DFN  | -40°C to +105°C |
| 553SCMGI8           | Tape and Reel      | 8-pin DFN  | -40°C to +105°C |

“G” after the two-letter package code denotes Pb-Free configuration, RoHS compliant.

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## Revision History

| Date            | Description of Change  |
|-----------------|--|
| October 5, 2018 | <ul style="list-style-type: none"><li>• Added “3.3V tolerant input clock” bullet to Features section.</li><li>• Updated voltage ratings in DC Electrical Characteristics tables.</li><li>• Updated Package Outline Drawings section.</li><li>• Updated legal disclaimer.</li></ul> |
| March 18, 2015  | Initial release.   |



Corporate Headquarters  
6024 Silver Creek Valley Road  
San Jose, CA 95138 USA  
[www.IDT.com](http://www.IDT.com)

Sales  
1-800-345-7015 or 408-284-8200  
Fax: 408-284-2775  
[www.IDT.com/go/sales](http://www.IDT.com/go/sales)

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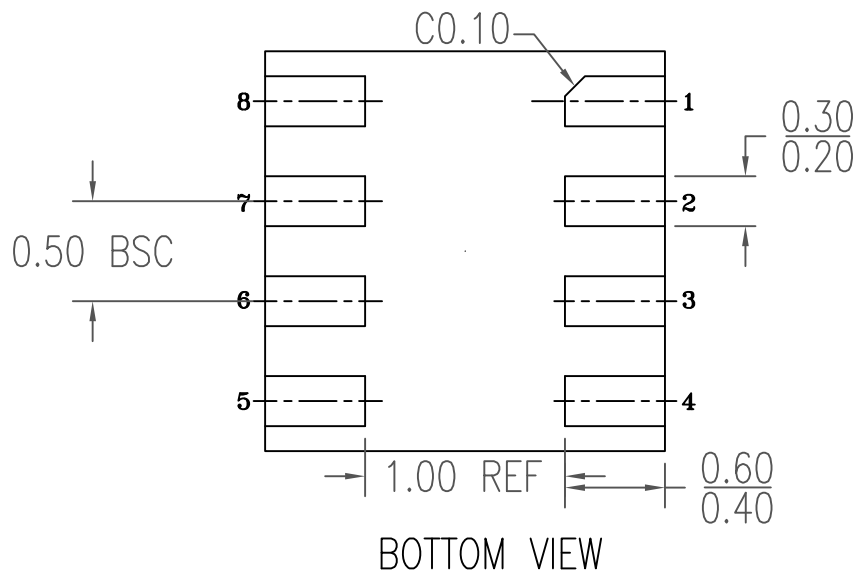
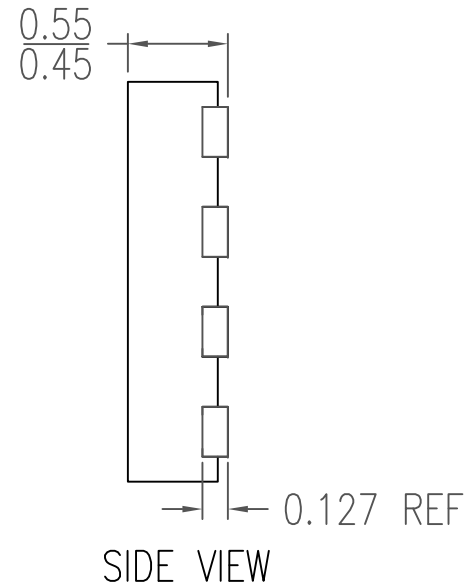
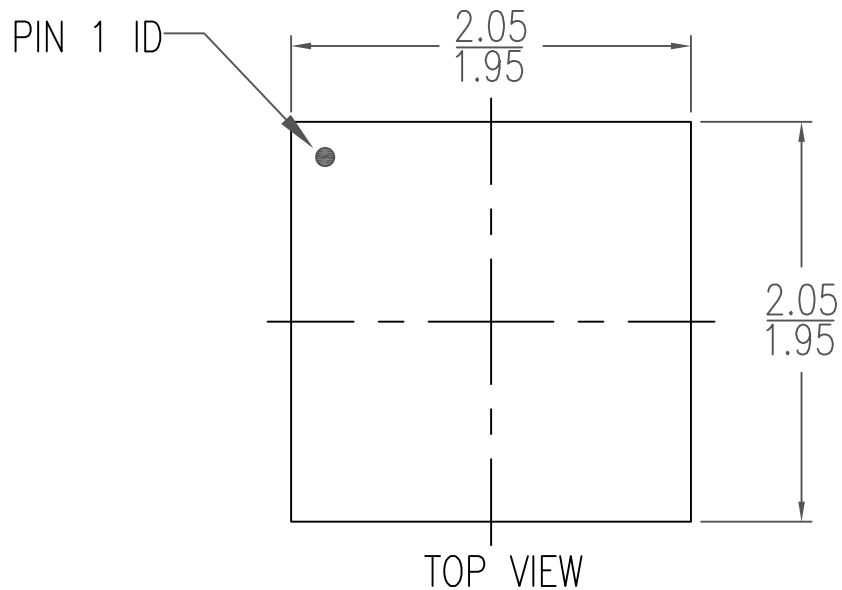
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| REVISIONS                                    |     |                     |        |
|--|-----|---------------------|--------|
| DATE CREATED                                 | REV | DESCRIPTION         | AUTHOR |
| 09/18/14                                     | 00  | INITIAL RELEASE     | J.HUA  |
| 4/5/18                                       | 01  | CHANGE VFQFN to DFN | R.C    |
| NOTE: REFER TO DCP FOR OFFICIAL RELEASE DATE |     |                     |        |

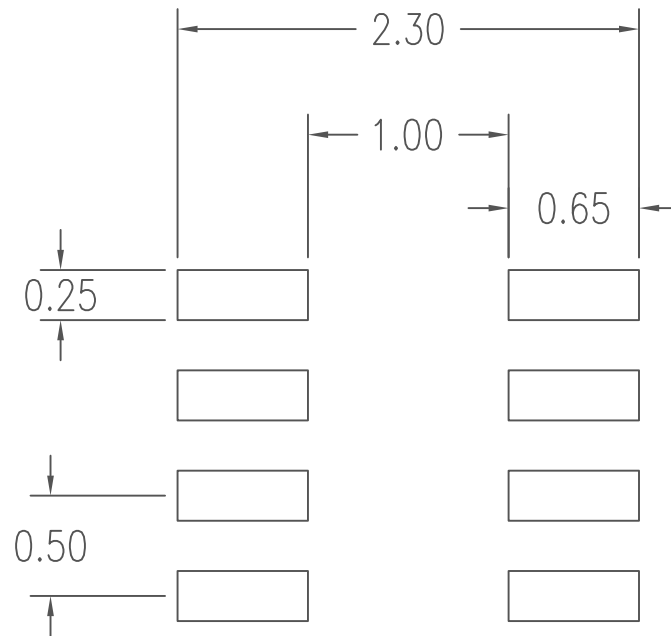


NOTES:

1. ALL DIMENSIONING AND TOLERANCING CONFORM TO ANSI Y14.5M-1982
2. ALL DIMENSIONS ARE IN MILLIMETERS

|   |  |              |
|---|--|--------------|
| TOLERANCES<br>UNLESS SPECIFIED<br>DECIMAL ANGULAR<br>XX± ±<br>XXX± ±<br>XXXX± ± | <b>IDT</b> 6024 SILVER CREEK VALLEY ROAD<br>San Jose, CA 95138<br>PHONE: (408) 284-8200<br>FAX: (408) 492-8674<br><small>www.IDT.com</small> |              |
|   | TITLE CMC8 Package Outline Drawing<br>2.0 x 2.0 x 0.5 mm Body<br>0.5mm Pitch DFN   |              |
| SIZE<br>C   | DRAWING No.<br>PSC-4490  | REV<br>01    |
| DO NOT SCALE DRAWING  |  | SHEET 1 OF 2 |


| REVISIONS                                    |     |                    |        |
|--|-----|--------------------|--------|
| DATE CREATED                                 | REV | DESCRIPTION        | AUTHOR |
| 09/18/14                                     | 00  | INITIAL RELEASE    | J.HUA  |
| 4/5/18                                       | 01  | CHANGE VQFN to DFN | R.C    |
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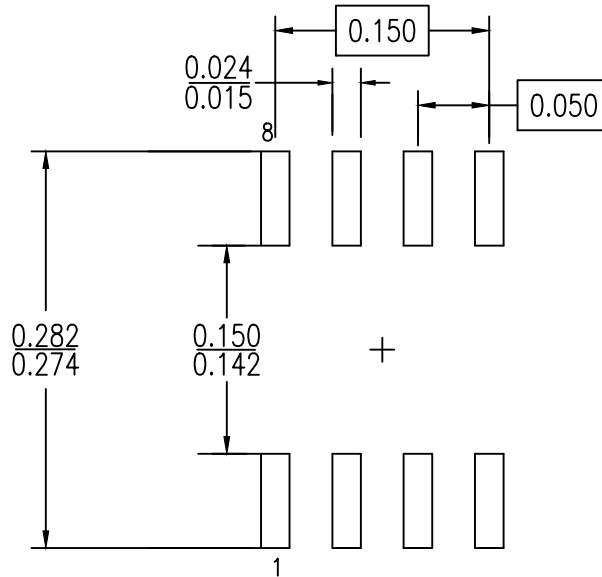
RECOMMENDED LAND PATTERN DIMENSION

NOTES:

1. ALL DIMENSION ARE IN MM. ANGLES IN DEGREES.
2. TOP DOWN VIEW. AS VIEWED.
3. LAND PATTERN RECOMMENDATION PER IPC-7351B GENERIC REQUIREMENT FOR MOUNT DESIGN AND LAND PATTERN.

|                                |             |  |
|--------------------------------|-------------|--|
| TOLERANCES<br>UNLESS SPECIFIED |             |  <b>IDT</b> 6024 SILVER CREEK VALLEY ROAD<br>San Jose, CA 95138<br>PHONE: (408) 284-8200<br>FAX: (408) 492-8674 |
| DECIMAL                        | ANGULAR     |  |
| XX±                            | ±           |  |
| XXX±                           |             |  |
| XXXX±                          |             |  |
| TITLE                          |             | CMG8 Package Outline Drawing<br>2.0 x 2.0 x 0.5 mm Body<br>0.5mm Pitch DFN   |
| SIZE                           | DRAWING No. | REV  |
| C                              | PSC-4490    | 01   |
| DO NOT SCALE DRAWING           |             | SHEET 2 OF 2   |





RECOMMENDED LAND PATTERN DIMENSION

NOTES:

1. ALL DIMENSIONING AND TOLERANCING CONFORM TO ANSI Y14.5M-1982
2. ALL DIMENSIONS ARE IN INCHES

| Package Revision History |         |                               |
|--------------------------|---------|-------------------------------|
| Date Created             | Rev No. | Description                   |
| July 27, 2018            | Rev 01  | Dedicate to Package DCG8 Only |
| Feb 24, 2016             | Rev 00  | Initial Release               |

## Данный компонент на территории Российской Федерации

### Вы можете приобрести в компании MosChip.

Для оперативного оформления запроса Вам необходимо перейти по данной ссылке:

<http://moschip.ru/get-element>

Вы можете разместить у нас заказ для любого Вашего проекта, будь то серийное производство или разработка единичного прибора.

В нашем ассортименте представлены ведущие мировые производители активных и пассивных электронных компонентов.

Нашей специализацией является поставка электронной компонентной базы двойного назначения, продукции таких производителей как XILINX, Intel (ex.ALTERA), Vicor, Microchip, Texas Instruments, Analog Devices, Mini-Circuits, Amphenol, Glenair.

Сотрудничество с глобальными дистрибьюторами электронных компонентов, предоставляет возможность заказывать и получать с международных складов практически любой перечень компонентов в оптимальные для Вас сроки.

На всех этапах разработки и производства наши партнеры могут получить квалифицированную поддержку опытных инженеров.

Система менеджмента качества компании отвечает требованиям в соответствии с ГОСТ Р ИСО 9001, ГОСТ РВ 0015-002 и ЭС РД 009

### Офис по работе с юридическими лицами:

105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: [info@moschip.ru](mailto:info@moschip.ru)

Skype отдела продаж:

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