

Low Voltage, Dual DPDT in miniQFN-16 Analog Switch

DESCRIPTION

The DG2599 is a CMOS dual DPDT (Dual Double Pole Double Throw) analog switch that operates over a wide voltage range of 1.65 V to 5 V. It is optimized for portable applications switching audio, SIM card signals, and other low power signals.

The DG2599 features low on resistance of 2.8 Ω at 3 V power supply, fast switching speed, and low power consumption even when control logic signals are below V_{+} power supply voltage. The well matched dual DPDT switches conduct signals equally in both directions. The DG2599 is designed to guarantee break before make switching.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. DG2599 are offered in a miniQFN package. The miniQFN package has a nickel palladium- gold device termination and is represented by the lead (Pb)-free “-E4” suffix. The nickel-palladium-gold device terminations meet all JEDEC® standards for reflow and MSL ratings.

FEATURES

- Low voltage operation: 1.65 V to 5.5 V
- Low on-resistance: 2.8 Ω at $V_{+} = 3$ V
- Power off protection on COM1 and COM2 pins
- Latch up current great than 300 mA per JESD78
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912



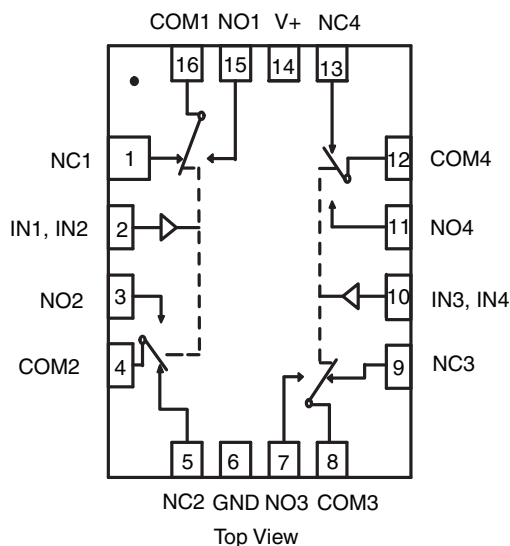
RoHS
COMPLIANT
HALOGEN
FREE

APPLICATIONS

- Cellular phones
- PMPs and PDAs
- Modems and peripherals
- Computers and ebooks
- Tablet devices
- Displays and gaming
- STB

ORDERING INFORMATION

| PART NUMBER | PACKAGE |
|-----------------|----------------------------|
| DG2599DN-T1-GE4 | miniQFN-16 1.8 mm x 2.6 mm |

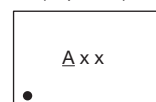


TRUTH TABLE (DG2599)

| LOGIC | NC1, 2, 3 AND 4 | NO 1, 2, 3 AND 4 |
|-------|-----------------|------------------|
| 0 | On | Off |
| 1 | Off | On |

Device Marking: A xx
xx = Date/Lot Traceability Code

(Top View)



Pin 1

Note: Pin 1 has long lead

**ABSOLUTE MAXIMUM RATINGS** ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

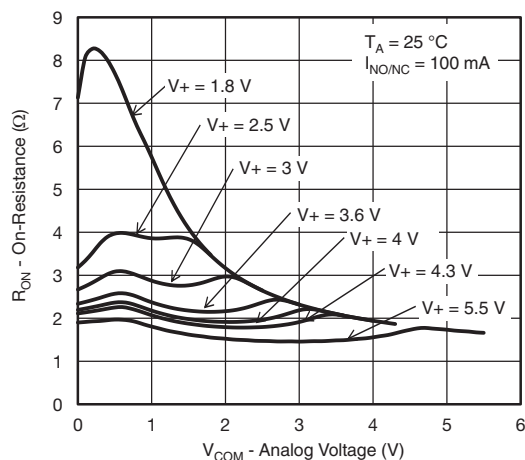
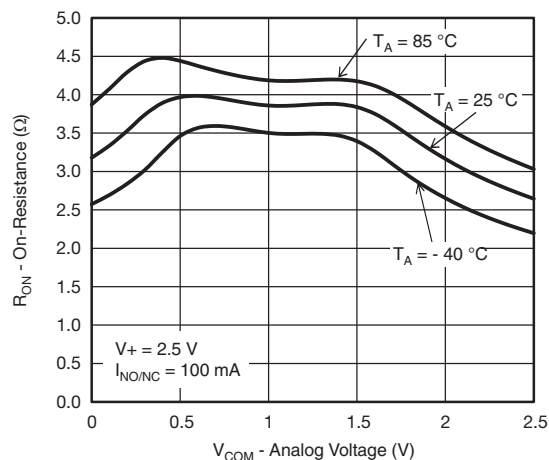
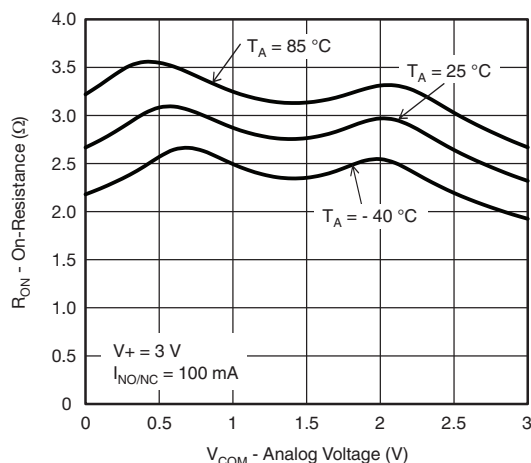
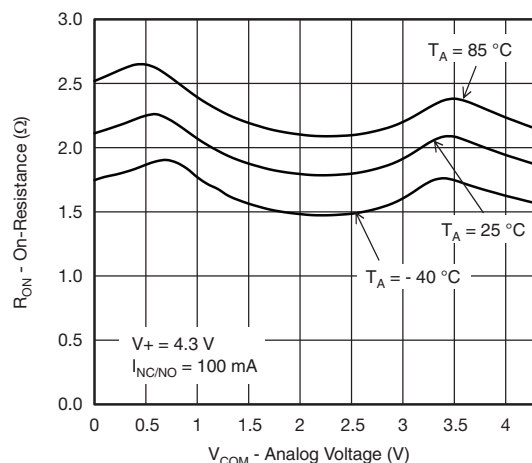
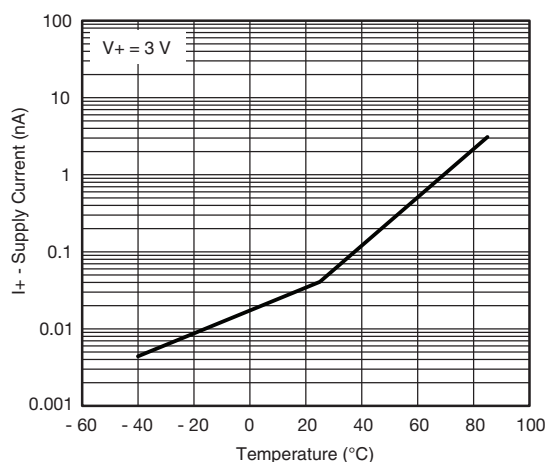
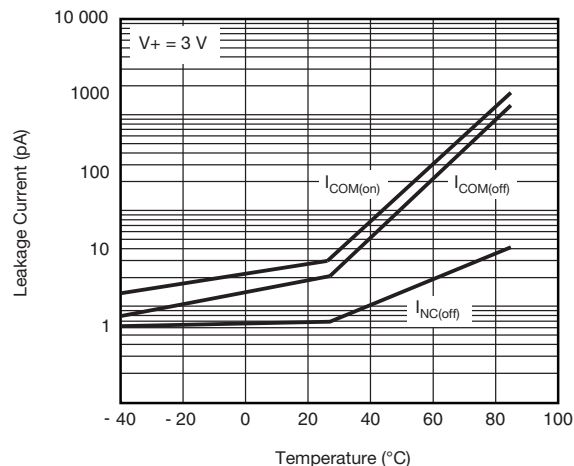
| PARAMETER | SYMBOL | LIMIT | UNIT |
|--|------------------------------|--------------------|--------------------|
| Reference to GND | V+ | -0.3 to +6 | V |
| | IN, COM, NC, NO ^a | -0.3 to (V+ + 0.3) | |
| Current (any terminal except NO, NC or COM) | | 30 | mA |
| Continuous current (NO, NC, or COM) | | ± 300 | |
| Peak current (pulsed at 1 ms, 10 % duty cycle) | | ± 500 | |
| Storage temperature (D suffix) | | -65 to +150 | $^{\circ}\text{C}$ |
| Package solder reflow conditions ^d | miniQFN-16 | 250 | |
| Power dissipation (packages) ^b | miniQFN-16 ^c | 525 | mW |

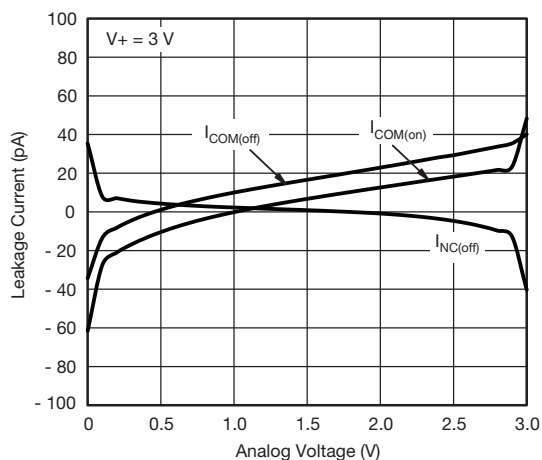
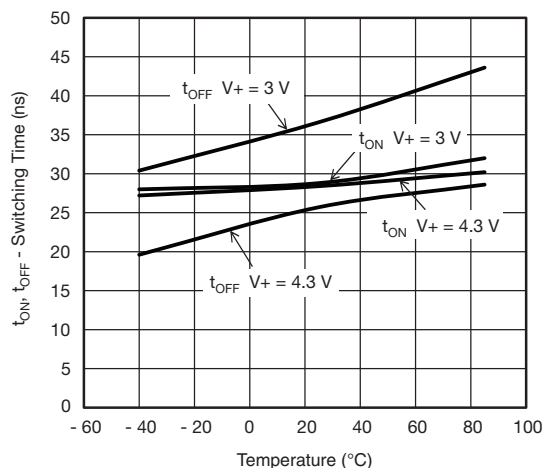
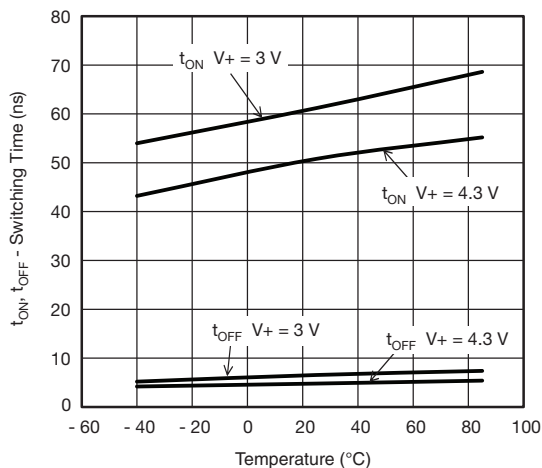
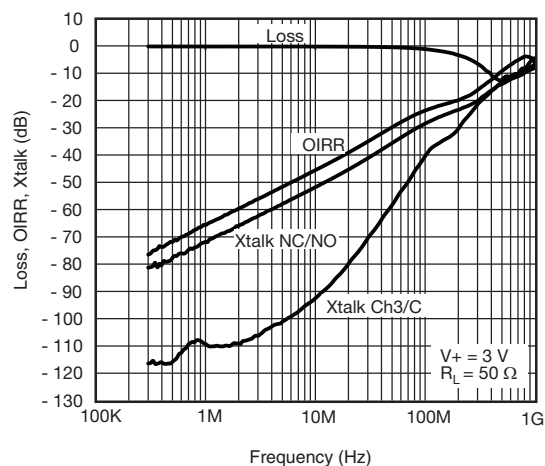
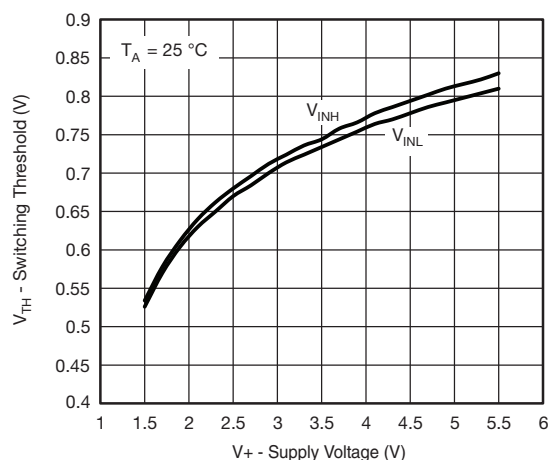
Note

- a. Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings
- b. All leads welded or soldered to PC board
- c. Derate 6.6 mW/ $^{\circ}\text{C}$ above 70 $^{\circ}\text{C}$
- d. Manual soldering with iron is not recommended for leadless components. The miniQFN-16 is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection

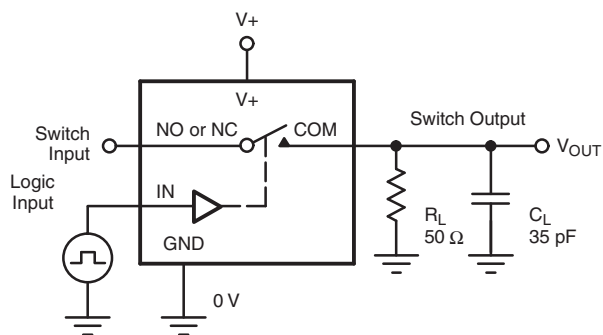
ELECTRICAL CHARACTERISTICS ($V_+ = 3\text{ V}$)

| PARAMETER | TEST CONDITIONS | TEMP. | MIN. | TYP. | MAX. | UNIT |
|----------------------------------|---|-------|------|-------|------|------|
| Power Supply and Signal | | | | | | |
| V+ supply voltage | | Full | 1.65 | - | 5.5 | V |
| V+ supply current | V _{IN} = 0 or V+ | Full | - | 0.001 | 2 | μA |
| Analog signal range | | Full | 0 | - | V+ | V |
| Switch On-Resistance and Leakage | | | | | | |
| Drain-source on-resistance | V+ = 3 V, I _{NO/NC} = 100 mA, V _{COM} = 0.9 V, 2.3 V | Room | - | 2.8 | 3.3 | Ω |
| | | Full | - | - | 3.6 | |
| On-resistance flatness | V+ = 3 V, I _{NO/NC} = 100 mA, V _{COM} = 0 to V+ | Room | - | 0.24 | 1.1 | Ω |
| | | Full | - | - | 1.3 | |
| Switch off leakage current | V+ = 4.3 V, V _{NO/NC} = 0.3 V/4 V, V _{COM} = 4 V / 0.3 V | Room | -10 | 0.1 | 10 | nA |
| | | Full | -100 | - | 100 | |
| Channel on-leakage current | V+ = 4.3 V, V _{NO/NC} and V _{COM} = 0.3 V / 4 V | Room | -10 | 0.1 | 10 | nA |
| | | Full | -100 | - | 100 | |
| Digital Control | | | | | | |
| Input, high voltage | V+ = 4.3 V | Full | 1.6 | - | - | V |
| | V+ = 3 V | | 1.3 | - | - | |
| Input, low voltage | V+ = 4.3 V | Full | - | - | 0.6 | V |
| | V+ = 3 V | | - | - | 0.5 | |
| Input, bias current | V _{IN} = V+ | Full | -1 | 0.01 | 1 | μA |
| Dynamic Characteristics | | | | | | |
| Turn on-time | V _{COM} or V _{NO/NC} = 3 V, R _L = 50 Ω, C _L = 35 pF | Room | - | - | 90 | ns |
| | | Full | - | - | 115 | |
| Turn off-time | V _{COM} or V _{NO/NC} = 3 V, R _L = 50 Ω, C _L = 35 pF | Room | - | - | 70 | |
| | | Full | - | - | 85 | |
| Break before make time | V _{COM} or V _{NO/NC} = 3 V, R _L = 50 Ω, C _L = 35 pF | Room | 2 | - | - | pC |
| | | Full | 2 | - | - | |
| Charge injection | C _L = 1 nF, R _{GEN} = 0 Ω | Room | - | ± 10 | - | pC |
| Off isolation | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz | | - | -66 | - | dB |
| Crosstalk | R _L = 50 Ω, C _L = 5 pF, f = 1 MHz, non-adjacent channels | | - | -110 | - | |
| 3 dB bandwidth | C _L = 5 pF, R _L = 50 Ω | | - | 186 | - | MHz |
| Source off capacitance | V _{IN} = 0 or V+, f = 1 MHz | | - | 9 | - | pF |
| Channel on capacitance | V _{IN} = 0 or V+, f = 1 MHz | | - | 26 | - | |

TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

 R_{ON} vs. V_{COM} and Single Supply Voltage

 R_{ON} vs. Analog Voltage and Temperature

 R_{ON} vs. Analog Voltage and Temperature

 R_{ON} vs. Analog Voltage and Temperature

Supply Current vs. Temperature

Leakage Current vs. Temperature

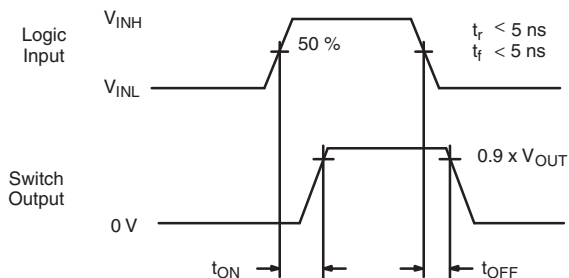
TYPICAL CHARACTERISTICS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Leakage vs. Analog Voltage

(NO) Switching Time vs. Temperature

(NC) Switching Time vs. Temperature

Insertion Loss, Off Isolation and Crosstalk

Switching Threshold vs. Supply Voltage

TEST CIRCUITS



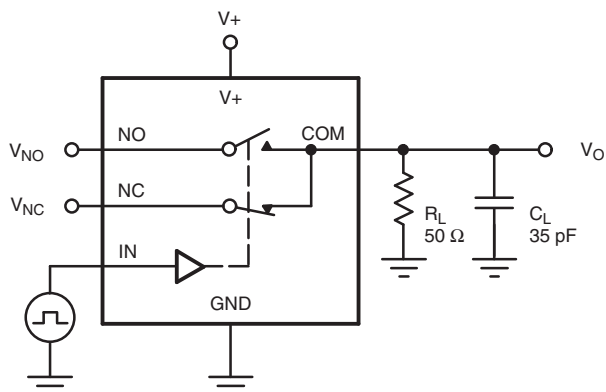
C_L (includes fixture and stray capacitance)

$$V_{OUT} = V_{COM} \left(\frac{R_L}{R_L + R_{ON}} \right)$$

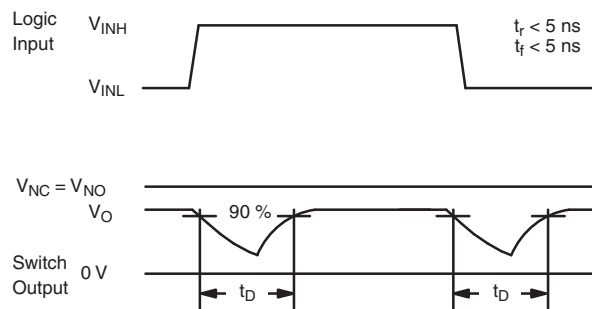


Logic "1" = Switch On
Logic input waveforms inverted for switches that have the opposite logic sense.

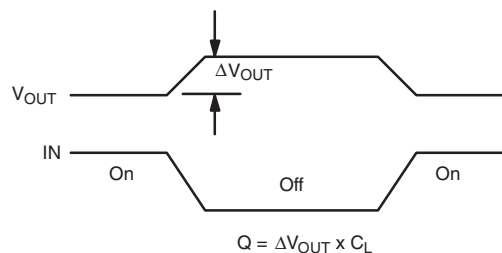
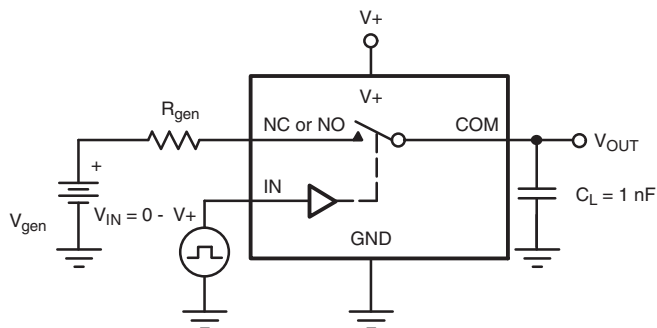
Switching Time



C_L (includes fixture and stray capacitance)



Break-Before-Make Interval

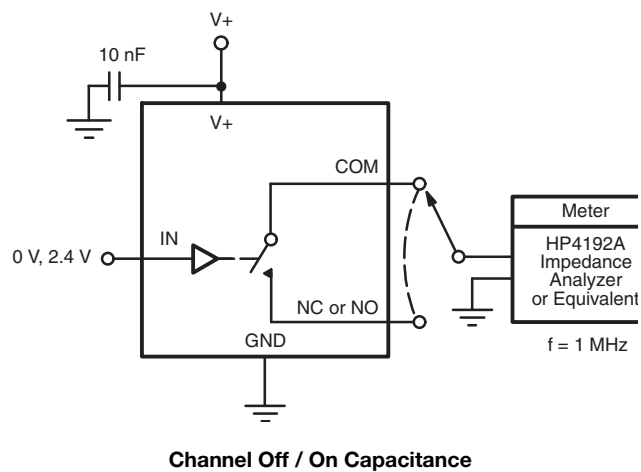
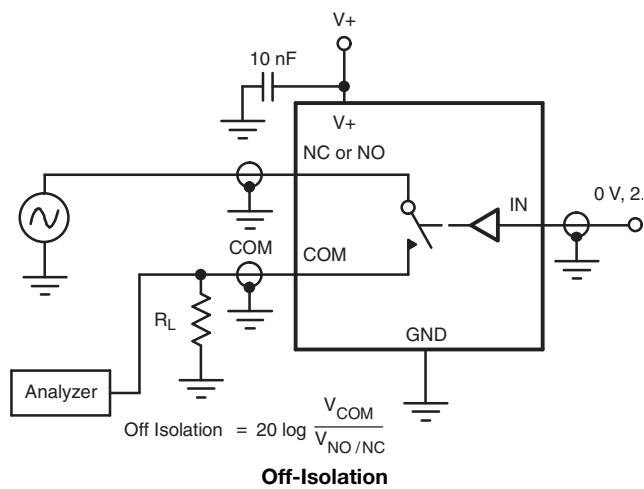


IN depends on switch configuration: input polarity determined by sense of switch.

Charge Injection



TEST CIRCUITS

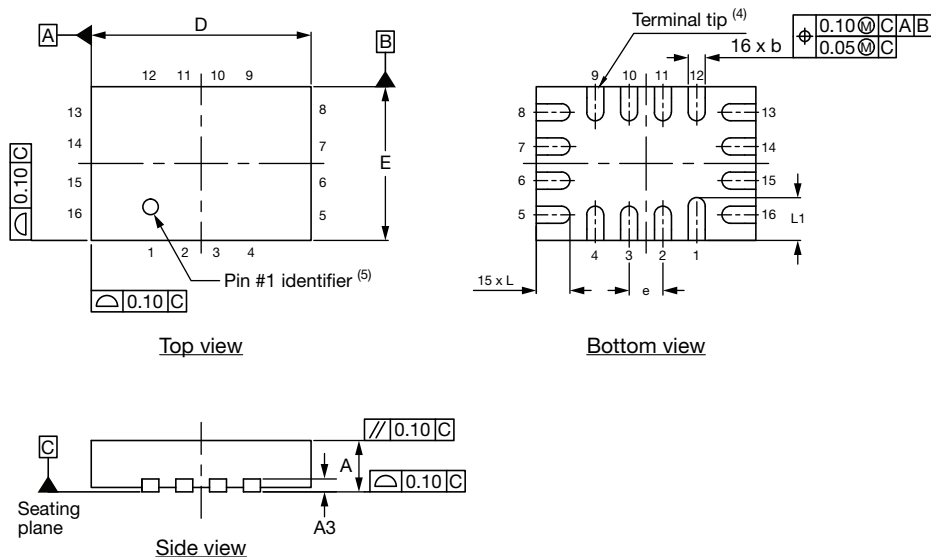




| PRODUCT SUMMARY | |
|-----------------------------------|--|
| Part number | DG2599 |
| Status code | 2 |
| Configuration | DPDT x 2 |
| Single supply min. (V) | 1.65 |
| Single supply max. (V) | 5 |
| Dual supply min. (V) | - |
| Dual supply max. (V) | - |
| On-resistance (Ω) | 2.8 |
| Charge injection (pC) | 10 |
| Source on capacitance (pF) | 26 |
| Source off capacitance (pF) | 9 |
| Leakage switch on typ. (nA) | 0.1 |
| Leakage switch off max. (nA) | 10 |
| -3 dB bandwidth (MHz) | 186 |
| Package | miniQFN-16 (0.55 mm) |
| Functional circuit / applications | Multi purpose, instrumentation, medical and healthcare, portable |
| Interface | Parallel |
| Single supply operation | Yes |
| Dual supply operation | - |
| Turn on time max. (ns) | 90 |
| Crosstalk and off isolation | -110 |

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Thin miniQFN16 Case Outline



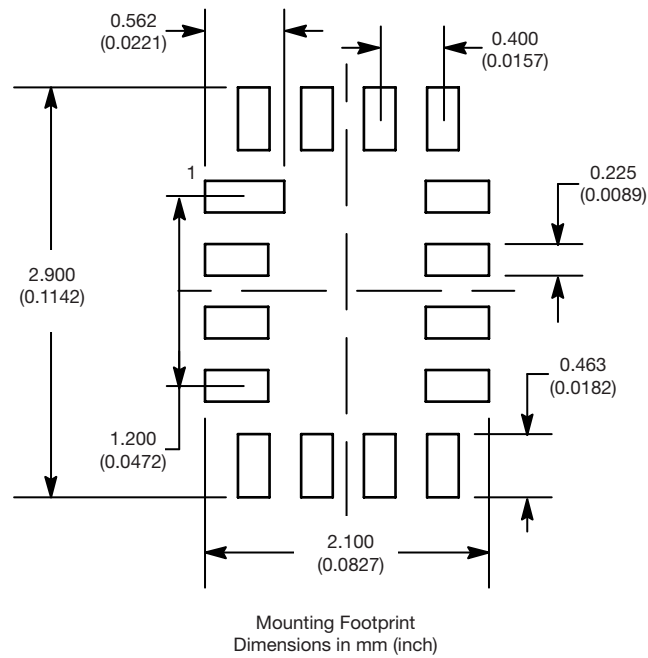
| DIMENSIONS | MILLIMETERS ⁽¹⁾ | | | INCHES | | |
|-------------------|----------------------------|------|------|------------|-------|-------|
| | MIN. | NOM. | MAX. | MIN. | NOM. | MAX. |
| A | 0.50 | 0.55 | 0.60 | 0.020 | 0.022 | 0.024 |
| A1 | 0 | - | 0.05 | 0 | - | 0.002 |
| A3 | 0.15 ref. | | | 0.006 ref. | | |
| b | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 2.50 | 2.60 | 2.70 | 0.098 | 0.102 | 0.106 |
| e | 0.40 BSC | | | 0.016 BSC | | |
| E | 1.70 | 1.80 | 1.90 | 0.067 | 0.071 | 0.075 |
| L | 0.35 | 0.40 | 0.45 | 0.014 | 0.016 | 0.018 |
| L1 | 0.45 | 0.50 | 0.55 | 0.018 | 0.020 | 0.022 |
| N ⁽³⁾ | 16 | | | 16 | | |
| Nd ⁽³⁾ | 4 | | | 4 | | |
| Ne ⁽³⁾ | 4 | | | 4 | | |

Notes

- (1) Use millimeters as the primary measurement.
- (2) Dimensioning and tolerances conform to ASME Y14.5M. - 1994.
- (3) N is the number of terminals. Nd and Ne is the number of terminals in each D and E site respectively.
- (4) Dimensions b applies to plated terminal and is measured between 0.15 mm and 0.30 mm from terminal tip.
- (5) The pin 1 identifier must be existed on the top surface of the package by using identification mark or other feature of package body.
- (6) Package warpage max. 0.05 mm.

ECN: T16-0226-Rev. B, 09-May-16
DWG: 6023

RECOMMENDED MINIMUM PADS FOR MINI QFN 16L





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