

# ZEBRA WAFERS

In appreciation of the ZEBRA's unique stripe marks that function as thermal cooling, camouflage and predator motion dazzle.

## ZEBRA DASH Product Data Sheet

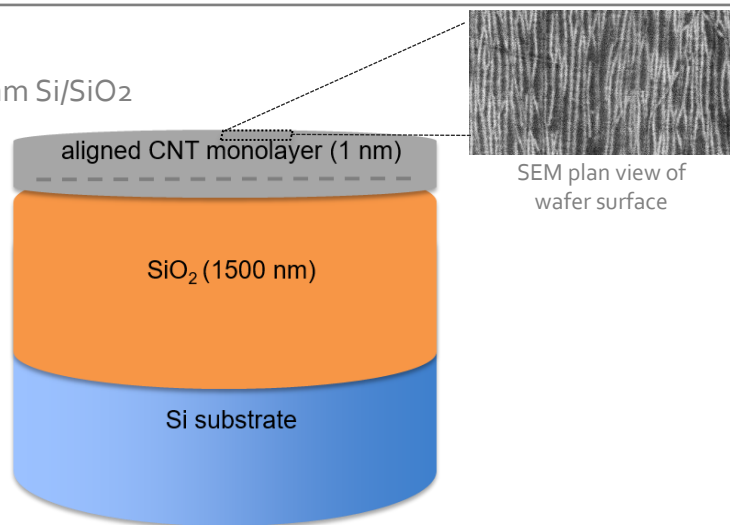
Materials:	monolayer aligned SWCNTs on 100 mm Si/SiO <sub>2</sub>
Purity:	>99.9% semiconducting CNTs
Density:	40 - 60 CNTs/ $\mu$ m
Type:	arc-discharge SWCNT
Diameter:	1.3 - 1.7 nm
CNT length:	400 nm (mean)

### Suggested Applications

Wireless Circuits (LNA, PA, Mixers)

Sensors & Detectors (Gas, Bio, IR)

DC Devices (Logic, Memory, Switch)



## Substrate Specifications

Wafer:	Silicon (CZ)
Diameter:	100 mm
Thickness:	525 +/- 25 $\mu$ m
Orientation:	<100>
Type:	undoped
Resistivity:	> 10,000 $\Omega$ -cm
Oxide:	1500 nm SiO <sub>2</sub> (thermal)
Frontside:	Polished
Backside:	Etched
Flats:	2 SEMI

## CNT Alignment Specifications

Coverage Area:	20 mm $\times$ 30 mm
Direction:	Perpendicular to major flat
Alignment:	In-plane of substrate

CNTs are deposited in the area outlined by the black dashed rectangle. The highest CNT density and best alignment are in the region along the red line close to the center of the wafer. The CNT long-axis is aligned preferentially parallel to the blue lines, perpendicular to the major flat. CNT density and alignment both lessen with increasing distance from the red line.

## Electrical Data References

$$I_d > 300 \text{ mA/mm}$$
$$I_{on}/I_{off} > 10^5 \text{ @ } V_{ds} = 0.1 \text{ V}$$

Cao, Yu, et al. "Radio Frequency Transistors Using Aligned Semiconducting Carbon Nanotubes with Current-Gain Cutoff Frequency and Maximum Oscillation Frequency Simultaneously Greater than 70 GHz." ACS Nano **10**, 6782 (2016).

Brady, G.J., et al. "Quasi-ballistic carbon nanotube array transistors with current density exceeding Si and GaAs." Science Advances **2**, e160124 (2016).

