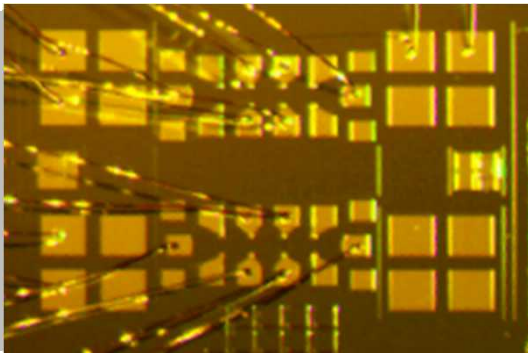
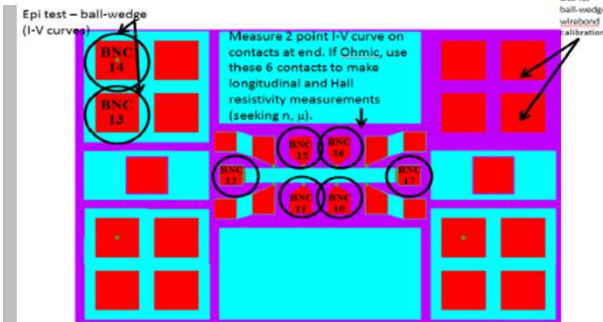


Exceptional service in the national interest



Pair of etch defined hall bars

Blue= remaining material
 Purple= etched to substrate
 Red = metal



Chip N3 from Zyvex (10/16/2015)

Device Parameters		Value						Units
Die Number	N3							
Device Number (if applicable)	Multiple Devices On Die	Yes	Device Number if Yes		2			
Runcard Number	2042							
Type	Delta-Doped							
Description	Zyvex Hall Bar with 450 C incorporation							
Purpose	Quantify the quality of the delta-doped layer							
Substrate								
Die Size Start	Length	8.0	Width	8.0	Thickness	0.675	mm	
Die Size End	Length	8.0	Width	8.0	Thickness	0.675	mm	
MBE/STM System								
MBE Epi-Silicon Thickness Measured by Profilometry	Minimum				Maximum			nm
Date of MBE/STM Growth	10/16/15							
Mask	Standard Optical Hall Bar							
Measurement Parameters		Value						Units
Date of Measurement(s) (Enter chronologically from left to right)	11/16/15							
Date of measurement for data in this table	11/16/15							
Au Ball Wirebonding Parameters	Power	300	Time	50	Force	Low		
Au Wedge Wirebonding Parameters	Power	600	Time	70	Force	Low		
Measurement System	CINT Janis Hall System							
Measurement	Temperature (K)							
Control Gate(s) to Epi-Silicon Leakage Limits and Range	V-		V+		ΔV		V	
Device Gate(s) to Epi-Silicon Leakage Limits and Range	V-		V+		ΔV		V	
R_c \equiv contact resistance(s) (increasing from left to right)	4.1	7.8	8.3				k Ω	
R_s \equiv sheet resistance	4.1		2635				Ω/\square	
R_{2T} \equiv two-terminal wire resistance								k Ω
R_{4T} \equiv four-terminal wire resistance								k Ω
n_{2D} \equiv 2D carrier density	4.1		3.99E+13				cm^{-2}	
μ \equiv carrier mobility	4.1		60				cm^2/Vs	
R_{00} \equiv STJ zero-bias resistance at $V_{gate} = 0$ (V)								M Ω
R_{0m} \equiv STJ zero-bias resistance at $V_{gate} = V+,-$								M Ω
ΔV_{gate} \equiv DTJ/SET Coulomb-Blockade average period								mV
δV_{gate} \equiv DTJ/SET CB resonance average width								mV
α \equiv DTJ/SET Gate Lever Arm								$\mu eV / mV$
Comments (200 characters maximum per line)								
<ul style="list-style-type: none"> • Zyvex provided the silicon starting material, therefore the Substrate entry above is blank. • The MBE growth was performed at Zyvex, therefore the MBE/STM System entry is blank. • Two Hall bars on this die were wirebonded, as shown in the image below. The two Hall bars are referred to as Device 1 and Device 2. This is the Summary sheet for Device 2. • Device 1 and Device 2 were measured in the same cooldown, as shown in the image below. • The contact resistances were calculated by taking the difference between the longitudinal two-terminal and longitudinal four-terminal measurements then dividing by two. • Two of the large pads in a corner of the pattern were wirebonded. The measured two-terminal I-V was linear with a resistance (slope) of 812 (Ohms). 								

Device Parameters		Value						Units
Die Number		N3						
Device Number (if applicable)		Multiple Devices On Die	Yes	Device Number if Yes	1			
Runcard Number		2042						
Type		Delta-Doped						
Description		Zyvex Hall Bar with 450 C incorporation						
Purpose		Quantify the quality of the delta-doped layer						
Substrate								
Die Size Start		Length	8.0	Width	8.0	Thickness	0.675	mm
Die Size End		Length	8.0	Width	8.0	Thickness	0.675	mm
MBE/STM System								
MBE Epi-Silicon Thickness Measured by Profilometry		Minimum		Maximum				nm
Date of MBE/STM Growth		10/16/15						
Mask		Standard Optical Hall Bar						
Measurement Parameters		Value						Units
Date of Measurement(s) (Enter chronologically from left to right)		11/16/15						
Date of measurement for data in this table		11/16/15						
Au Ball Wirebonding Parameters		Power	300	Time	50	Force	Low	
Au Wedge Wirebonding Parameters		Power	600	Time	70	Force	Low	
Measurement System		CINT Janis Hall System						
Measurement	Temperature (K)							
Control Gate(s) to Epi-Silicon Leakage Limits and Range		V-		V+		ΔV	V	
Device Gate(s) to Epi-Silicon Leakage Limits and Range		V-		V+		ΔV	V	
Rc \equiv contact resistance(s) (increasing from left to right)	4.1	6.9	7.0				k Ω	
R _s \equiv sheet resistance	4.1	1943					Ω/\square	
R _{2T} \equiv two-terminal wire resistance								k Ω
R _{4T} \equiv four-terminal wire resistance								k Ω
n _{2D} \equiv 2D carrier density	4.1	4.73E+13					cm ⁻²	
μ \equiv carrier mobility	4.1	69					cm ² /Vs	
R ₀₀ \equiv STJ zero-bias resistance at V _{gate} = 0 (V)								M Ω
R _{0m} \equiv STJ zero-bias resistance at V _{gate} = V+,-								M Ω
ΔV_{gate} \equiv DTJ/SET Coulomb-Blockade average period								mV
δV_{gate} \equiv DTJ/SET CB resonance average width								mV
α \equiv DTJ/SET Gate Lever Arm								ueV / mV
Comments (200 characters maximum per line)								
<ul style="list-style-type: none"> • Zyvex provided the silicon starting material, therefore the Substrate entry above is blank. • The MBE growth was performed at Zyvex, therefore the MBE/STM System entry is blank. • Two Hall bars on this die were wirebonded, as shown in the image below. The two Hall bars are referred to as Device 1 and Device 2. This is the Summary sheet for Device 1. • Device 1 and Device 2 were measured in the same cooldown, as shown in the image below. • The contact resistances were calculated by taking the difference between the longitudinal two-terminal and longitudinal four-terminal measurements then dividing by two. • Two of the large pads in a corner of the pattern were wirebonded. The measured two-terminal I-V was linear with a resistance (slope) of 706 (Ohms). 								