Compound Semiconductor Solutions from RF to Lightwave

穩懋半導體

Leading HBT Technology for Cellular PA Application

Wen-Kai Wang

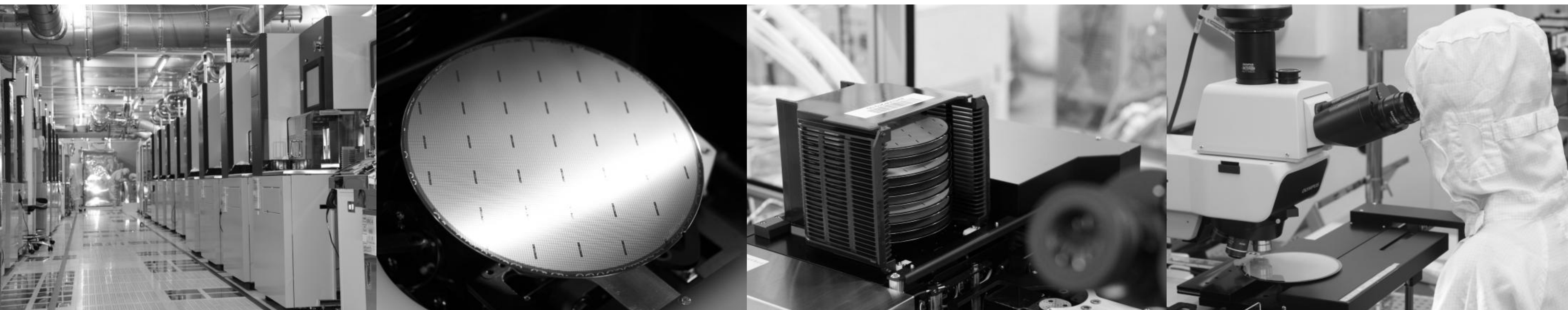
AVP of Customer Service and Engineering

WIN Semiconductors Corp.

WIN Semiconductors

win SEMICONDUCTORS

- **Founded**
  - Oct. 1999, Taipei, Taiwan
- **Employee**
  - ~3300 employees
- **Current Capacity**
  - GaAs: FAB-A: 10K WPM, FAB-B: 14K WPM, FAB-C: 19K WPM
  - GaN on SiC: FAB-B: 800 WPM 4-inch GaN on SiC wafers
  - Optical line (InP, GaAs): 3”, 4” & 6” in Fab-B & Fab-C



WIN Business Model

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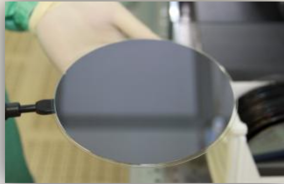
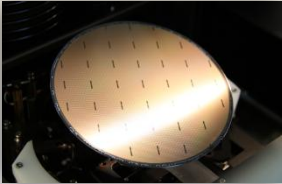
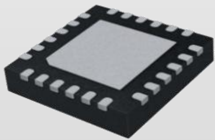
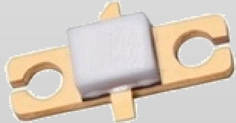
Substrates

Pure Play Foundry Service Provider


Epitaxial Growth


Wafer Manufacturing

Package

Applications

Technology Portfolio

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GaAs HBT
- 6 inch
- Cellular
- WiFi
- IOT

GaAs pHEMT
- 6 inch
- Infrastructure
- Aerospace
- Defense

GaN HEMT
- 4 inch
- Infrastructure
- Aerospace
- Defense

GaAs VCSEL
- 6 inch
- Sensing
- LiDAR
- Data

WIN HBT Process Generation

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HBT4 H02U-D4/F4

Legacy technology for 3G/4G PA

- Pure SiN crossover for robust moisture resistance
- Thermal bump available

HBT7 H01U-R7

HBT Cell Evolution

- Extremely HBT size reduction
- High frequency application up to FR3

HBT5 H02U-H5

Compact and Flexible Design

- Higher capacitor density (570pF/mm^2)
- Additional gold interconnection layer, MET3
- Compact design rules (eg: TWV)

WIN HBT Epitaxial Development

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D4/F4-HBT4

Epi optimization for APT and ET

- Epi D : Average Power Tracking (APT)
- Epi F : Envelop tracking (ET)

R7-HBT7

Leading performance in ET

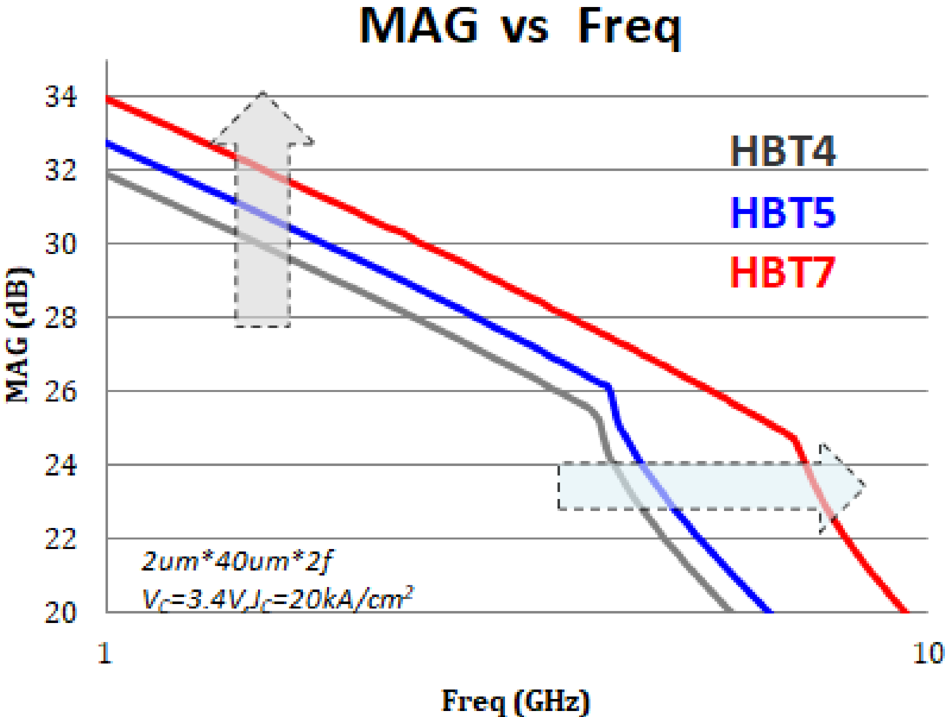
- Epi R: ET Enhancement.
- Higher Max PAE and superior ruggedness than Epi “F”.

H5-HBT5

Leading performance in APT

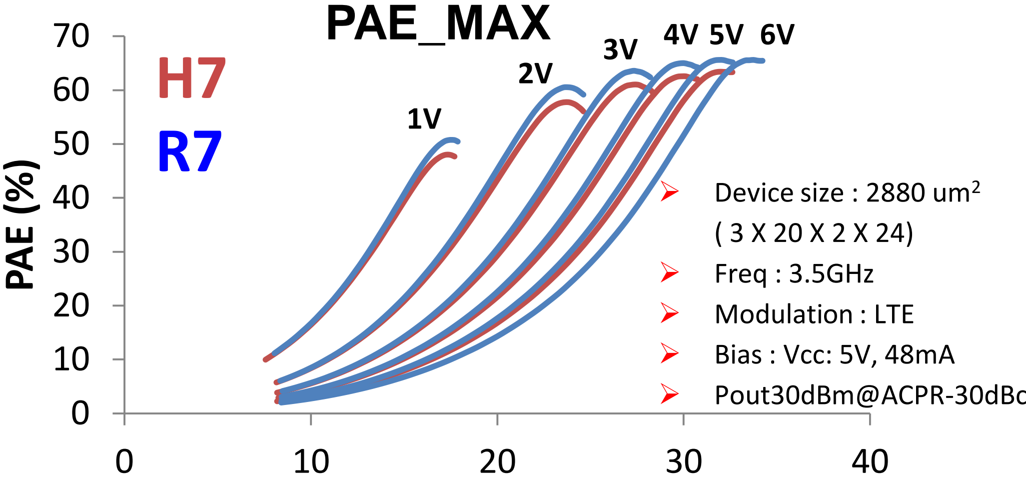
- Epi H : APT Enhancement.
- Higher gain, PAE and linearity than Epi “D”.

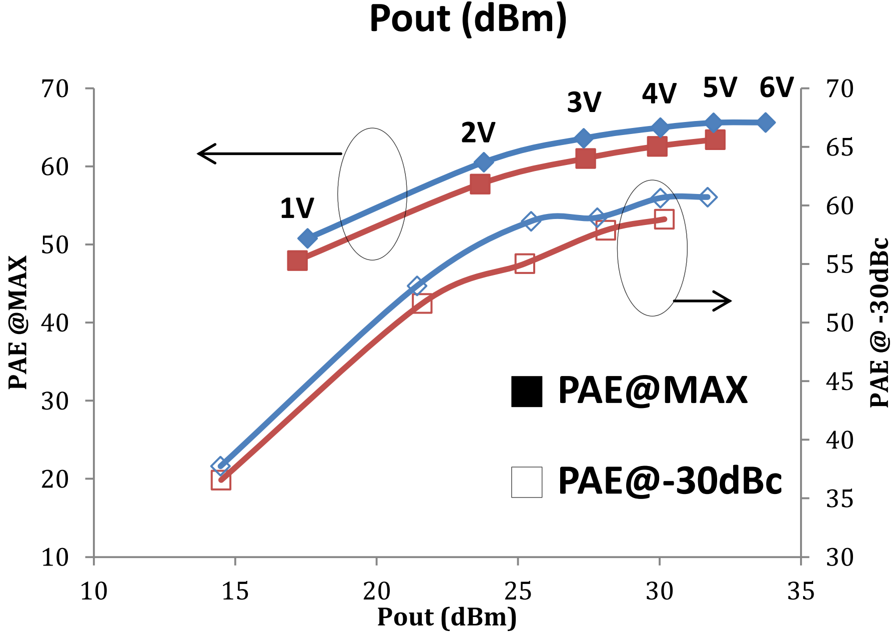
Leading Performance of HBT7



	HBT4	HBT5	HBT7
Junction Capacitor	Ref.	85%	65%
MAG	Ref.	+1dB	+2dB
Breakpoint@ K>1	Ref.	Ref.	+2GHz

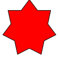
HBT7: PAE, Linearity, and Ruggedness





H7_Ruggedness (6.5V)

Increase Vcc _ Ruggedness test					
Device : 4320um², Q36_R1E403BR150_B_C0P8_5_M2S_C22P5 Mod : LTE ,VSWR 10:1 , VCC =3.5V , Po() = 28 dBm					
VCC	3.5v	5.5v	6v	**6.5v**	7v
Po_3.5v(Before-Rug)	28.00	28.08	28.09	28.09	28.08
Po_3.5v(After-Rug)	28.03	28.09	28.09	28.08	8.13



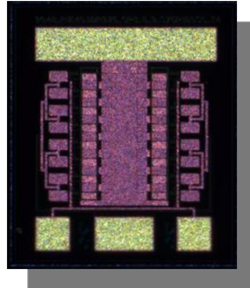
R7_Ruggedness (10.5V)

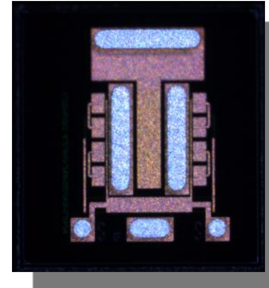
Increase Vcc _ Ruggedness test					
Device : 4320um², Q36_R1E403BR150_B_C0P8_5_M2S_C22P5 Mod : LTE ,VSWR 10:1 , VCC =3.5V, Pi() =14.27 dBm , Po() = 28 dBm					
VCC	3.5v	9.5v	10v	**10.5V**	11V
Po_3.5v(Before-Rug)	28.00	27.74	27.60	27.49	27.35
Po_3.5v(After-Rug)	27.95	27.60	27.49	27.35	27.00

- ***For ET application, R7 demonstrates superior PAE.***
- ***R7 successfully survived VSWR 10:1 ruggedness @ 10.5V***

Thermal Management: MET3 & Bump

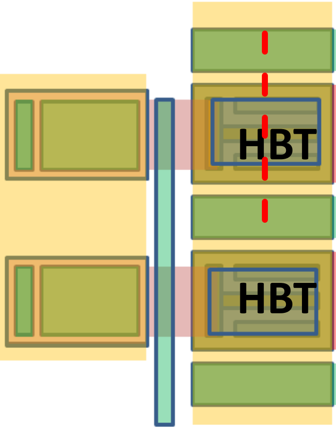
Wire Bonding | **Flip-chip**

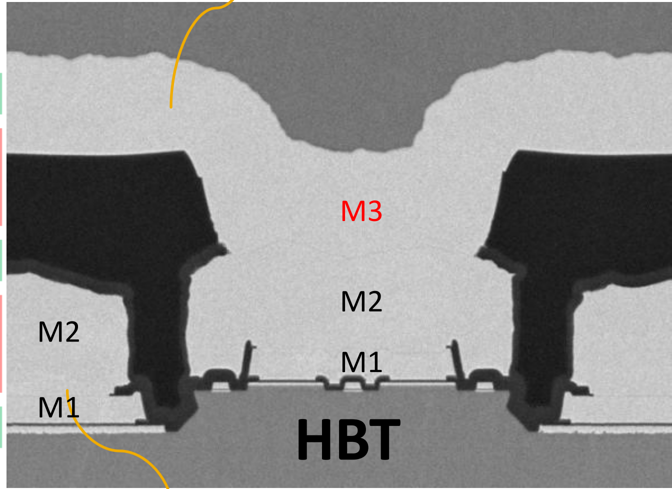




Thick metal shunt for better heat dissipation
Capable for Cu pillar thermal bar

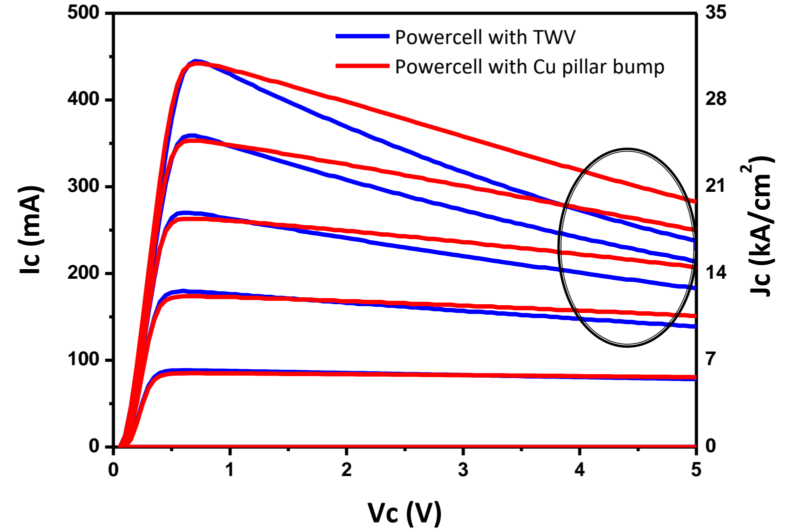
An Example of HBT power cell



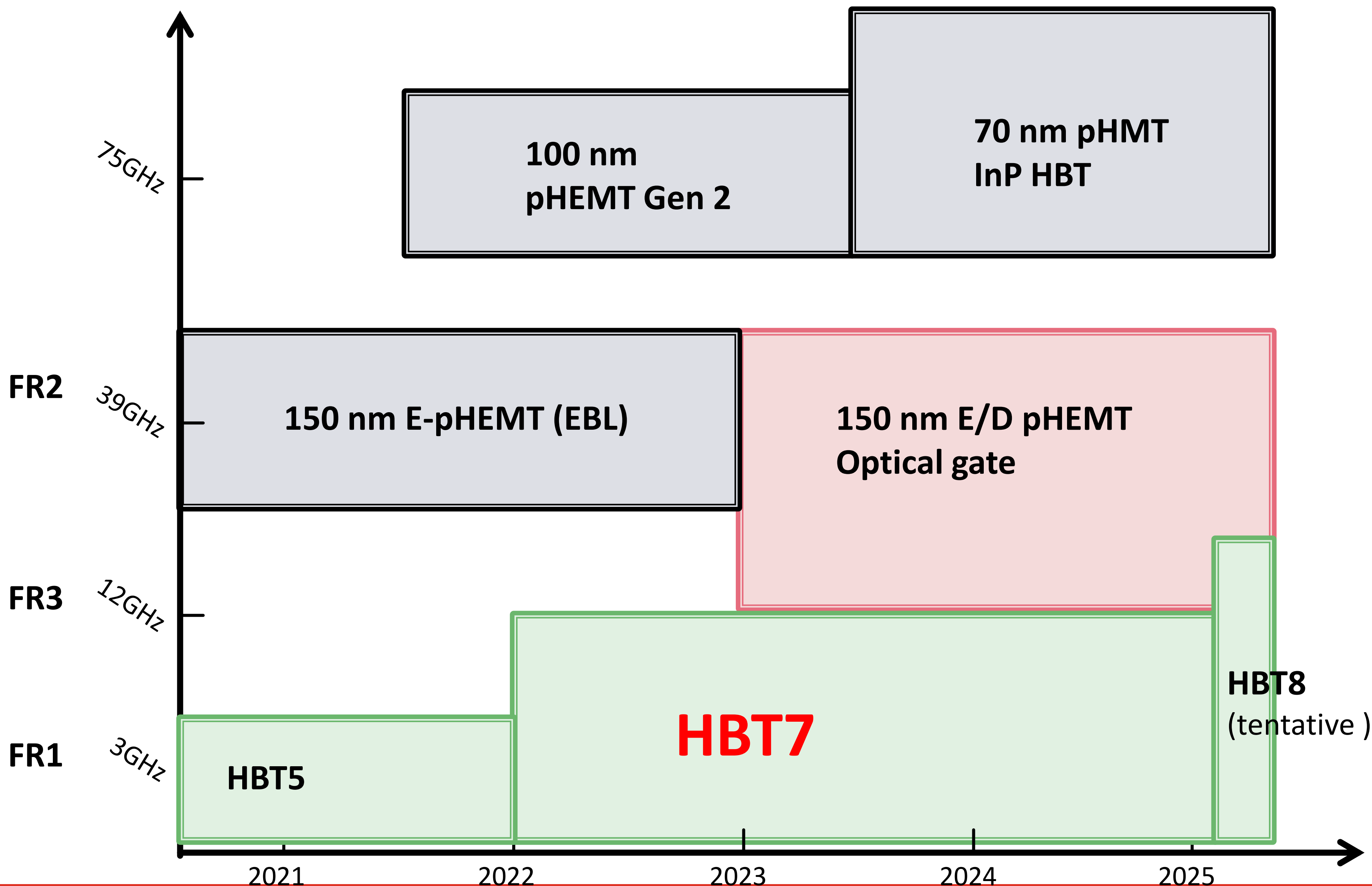


Thick collector metal for
Higher collector current handling,

w/ Thermal BAR
w/o Thermal BAR



Technology Roadmap



THANK YOU