IC Circuit Design & Technology Analysis of UCC1806 and UC1825A Pulse Width Modulators

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For full analysis information see report W0-05/C00-20 and report WO-05/C00-21

Specific Tasks Performed

- **Identify process technology.**
- **Reconstruct the IC designs.**
- **Correlate IC designs to manufacturers block diagram.**
- **Identify physical layout of the designs.**
- **Extract horizontal geometries (device sizes).**
- **Extract vertical geometries (cross-sectional data).**

Note: Ref documents DTE1339 & DTE1338 for comprehensive report concerning circuitry and technology information.

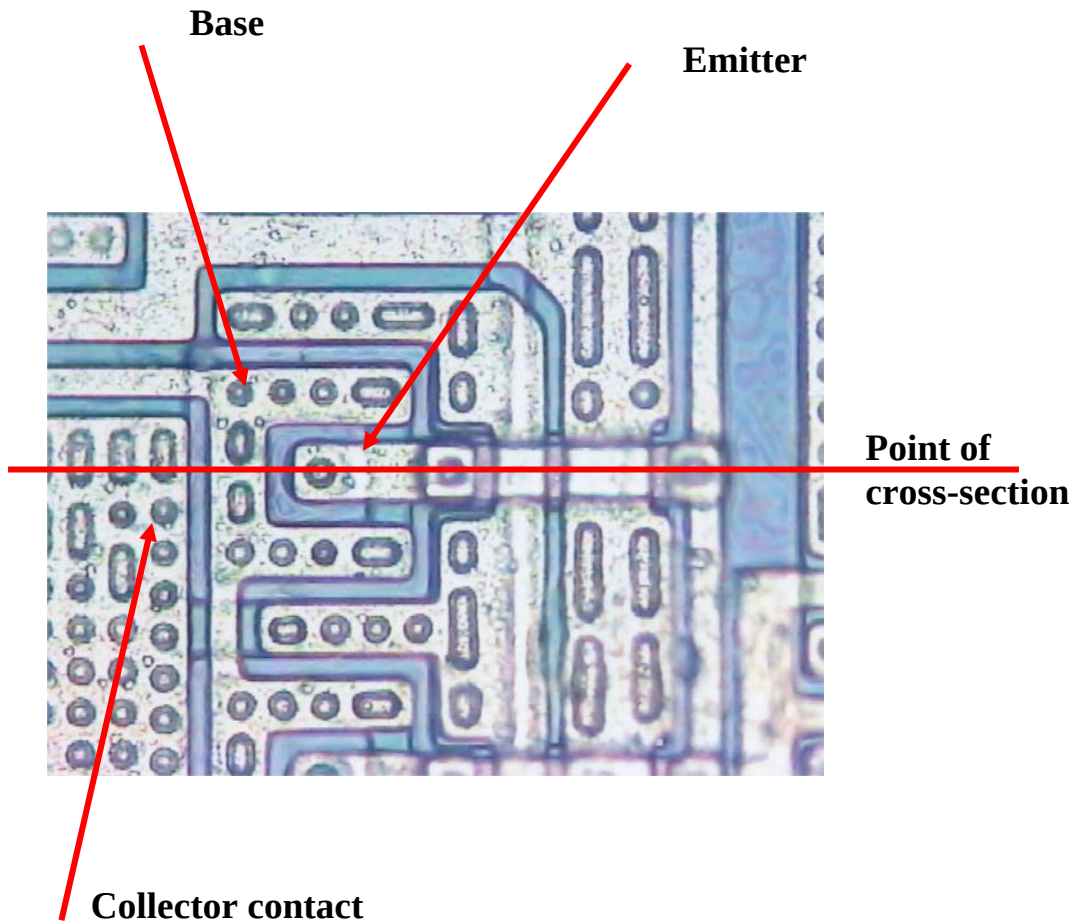
UCC-1806 primary process description

Package markings	UCC1806J/8838 5962-9457501MEA Q BA9845
Die size	2.48mm x 1.92mm
Die area	4.76mm^2
Die Thickness	390µm
Die markings	C1806 UICC (M) UICC 92
Process	BiCMOS
Metal	One level
Metal 1 width	5µm Metal 1 space = 3µm
Poly	One level
Poly 1 width	2µm Poly 1 space = 2µm
Other information	Diffused resistors used. No buried layer.

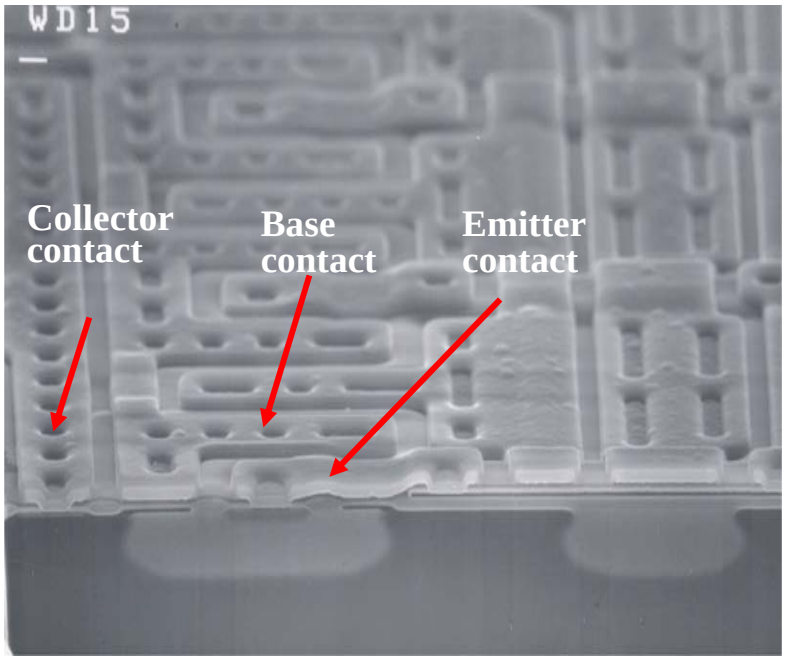
UC-1825A primary process description

Die size	3.32mm x 3.00mm
Die area	9.96mm^2
Die Thickness	380µm
Die markings	JJ 1825A
	(M) UICC 90
Process	Bipolar
Metal	One level
Metal 1 width	5µm
Metal 1 space	10µm
Poly	None
Other information	Thin film resistors used
	Diffused resistors used.
	Has buried layer.

UCC1806 sample Bipolar pnp cross section



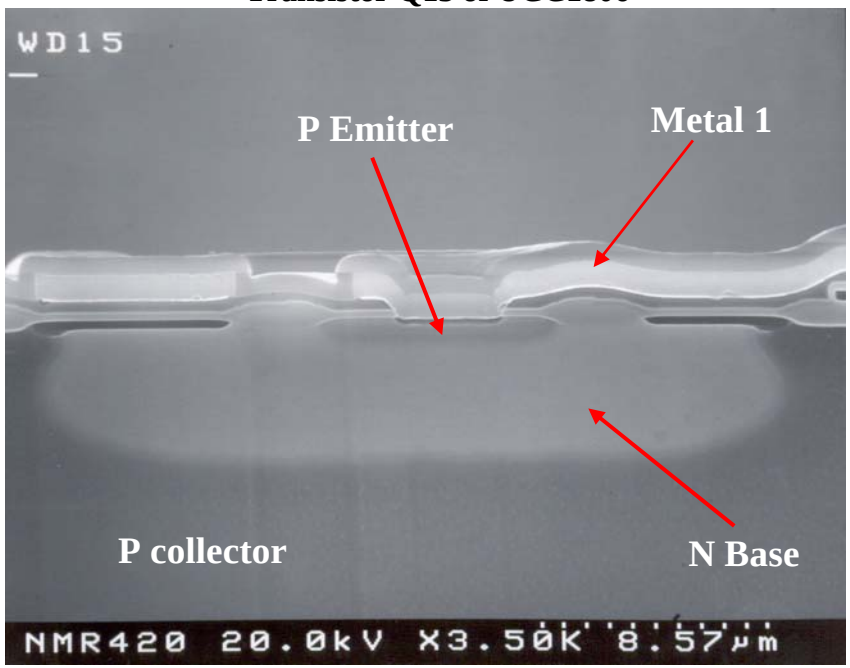
UCC1806 sample Bipolar pnp cross section



Plan and cross-section of the pnp BiPolar transistor (20deg tilt)

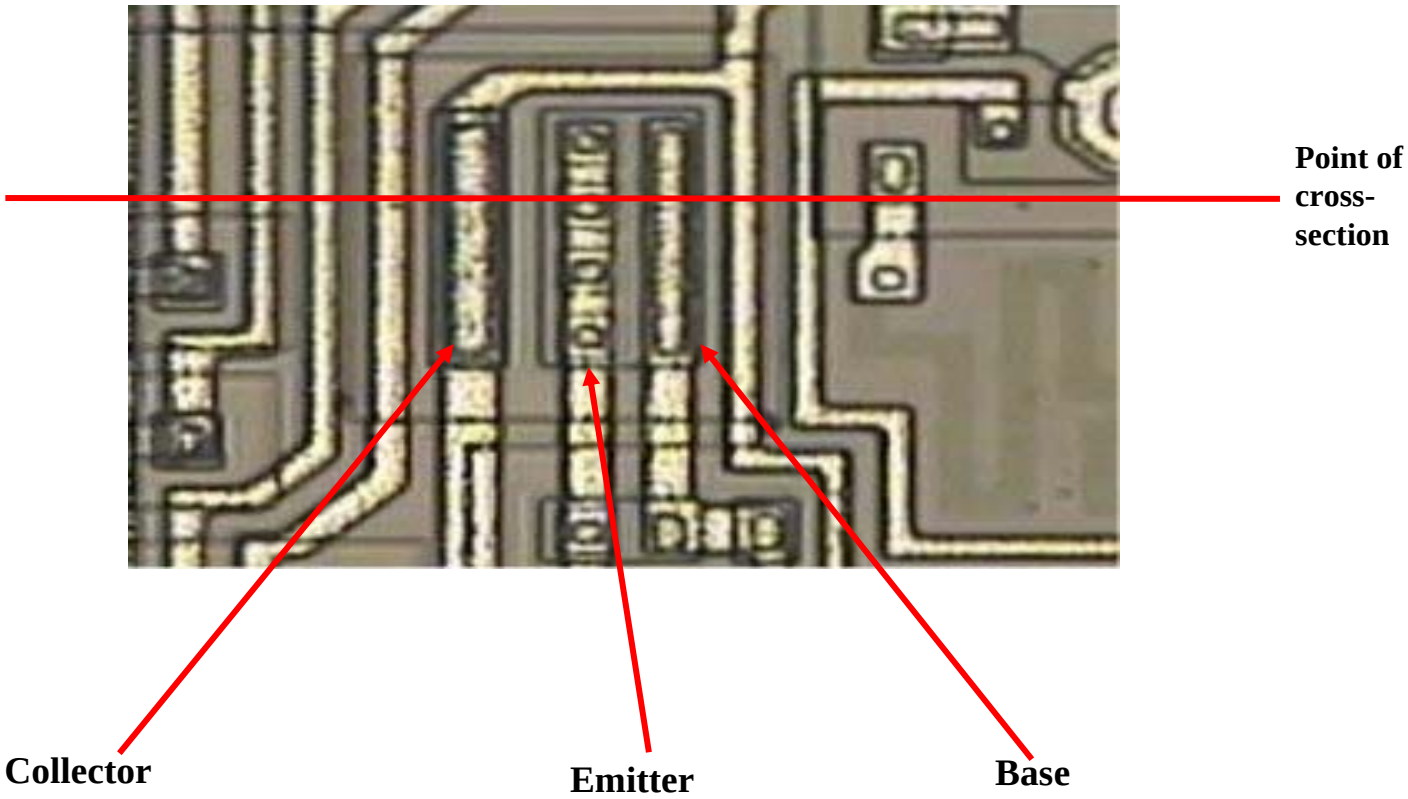
FIB cross sectioned, followed by a chemical etch to highlight diffusions

Transistor Q13 of UCC1806

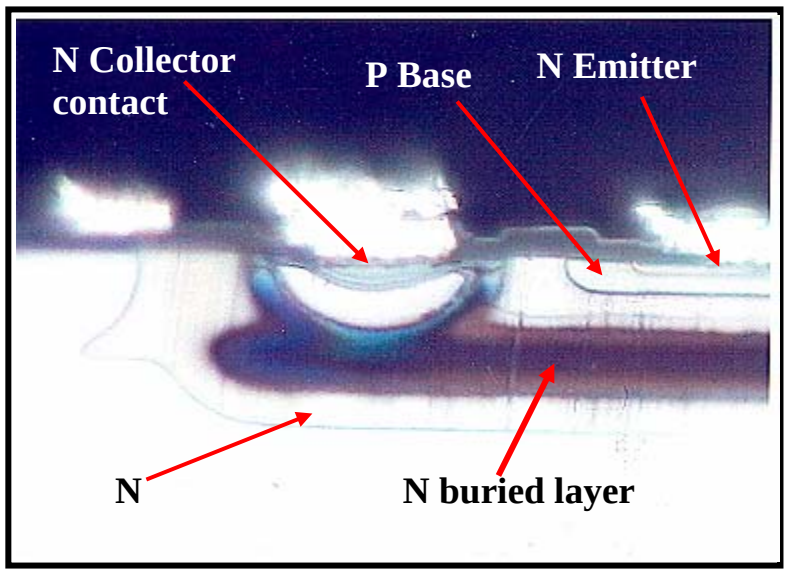


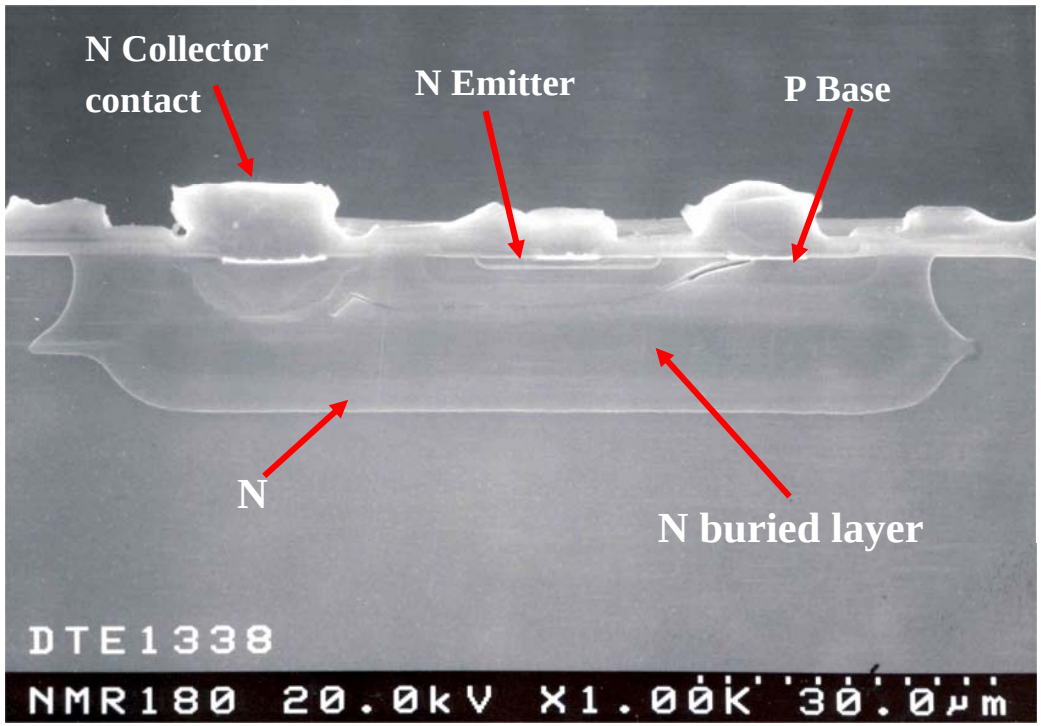
Note: UCC1806 has <u>no</u> buried layer

UC1825A sample Bipolar npn cross-section



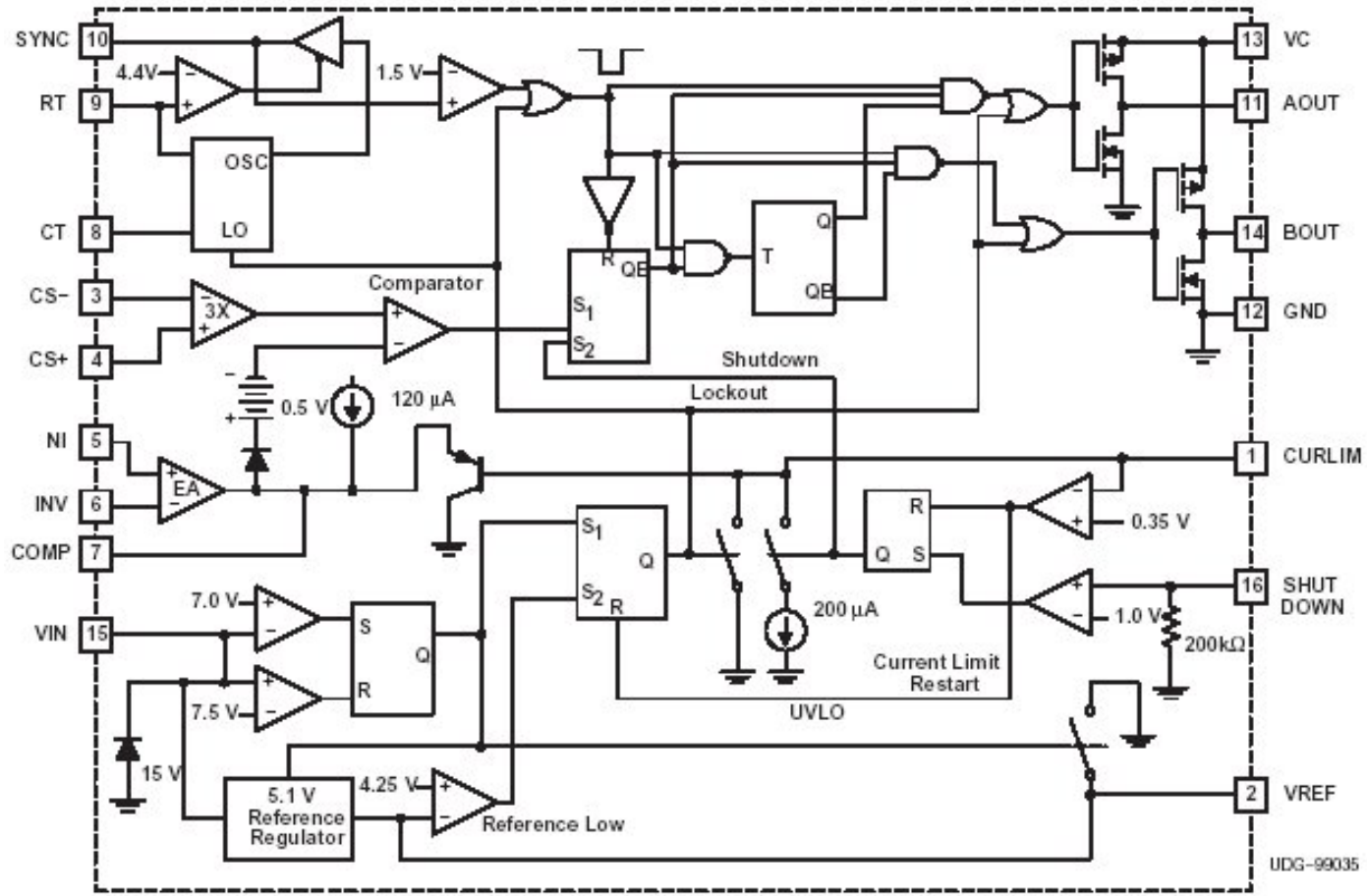
UC1825A sample Bipolar npn cross-section



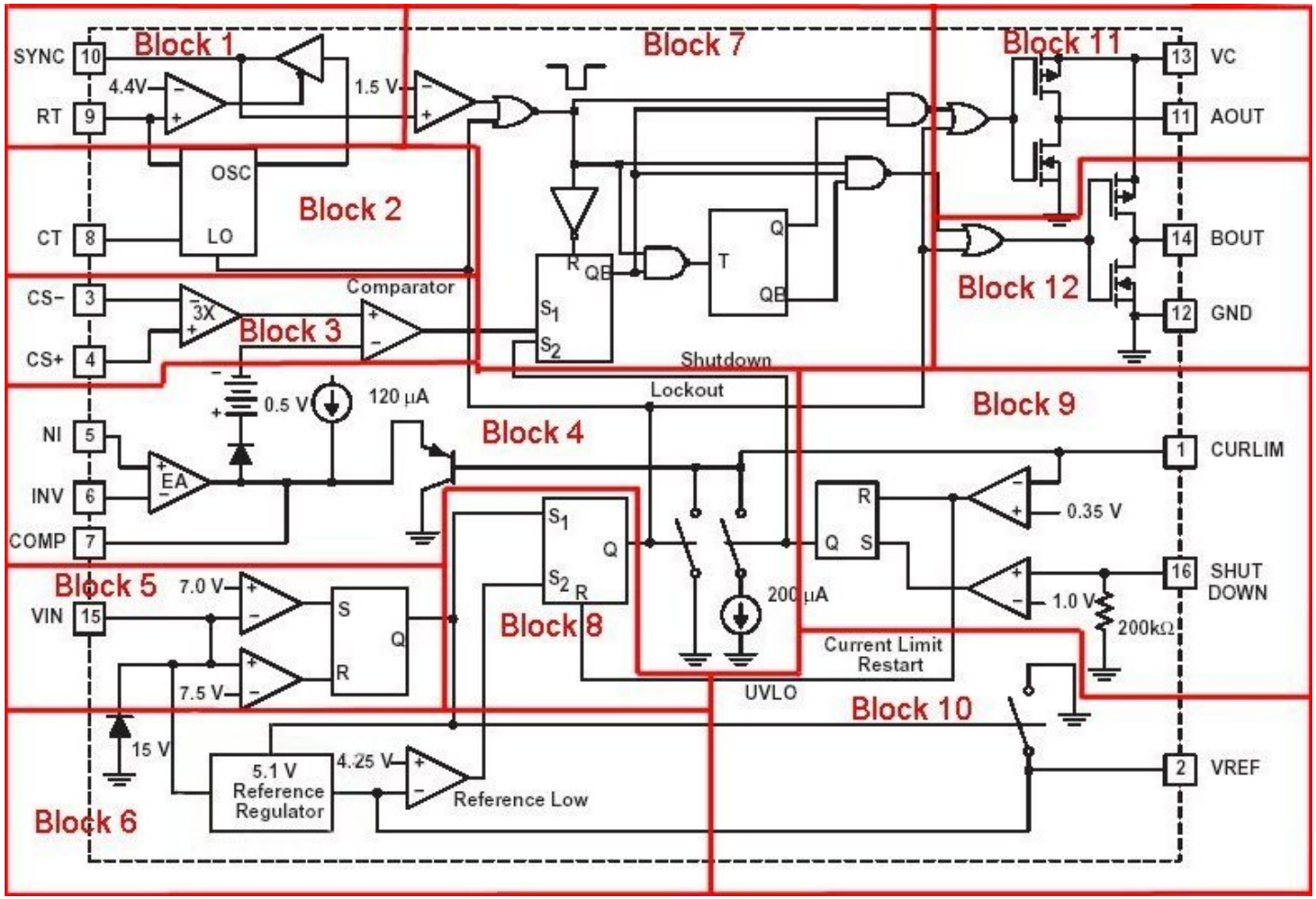


Mechanically cross sectioned, followed by a chemical etch to highlight diffusions

UCC1806 manufacturers block diagram

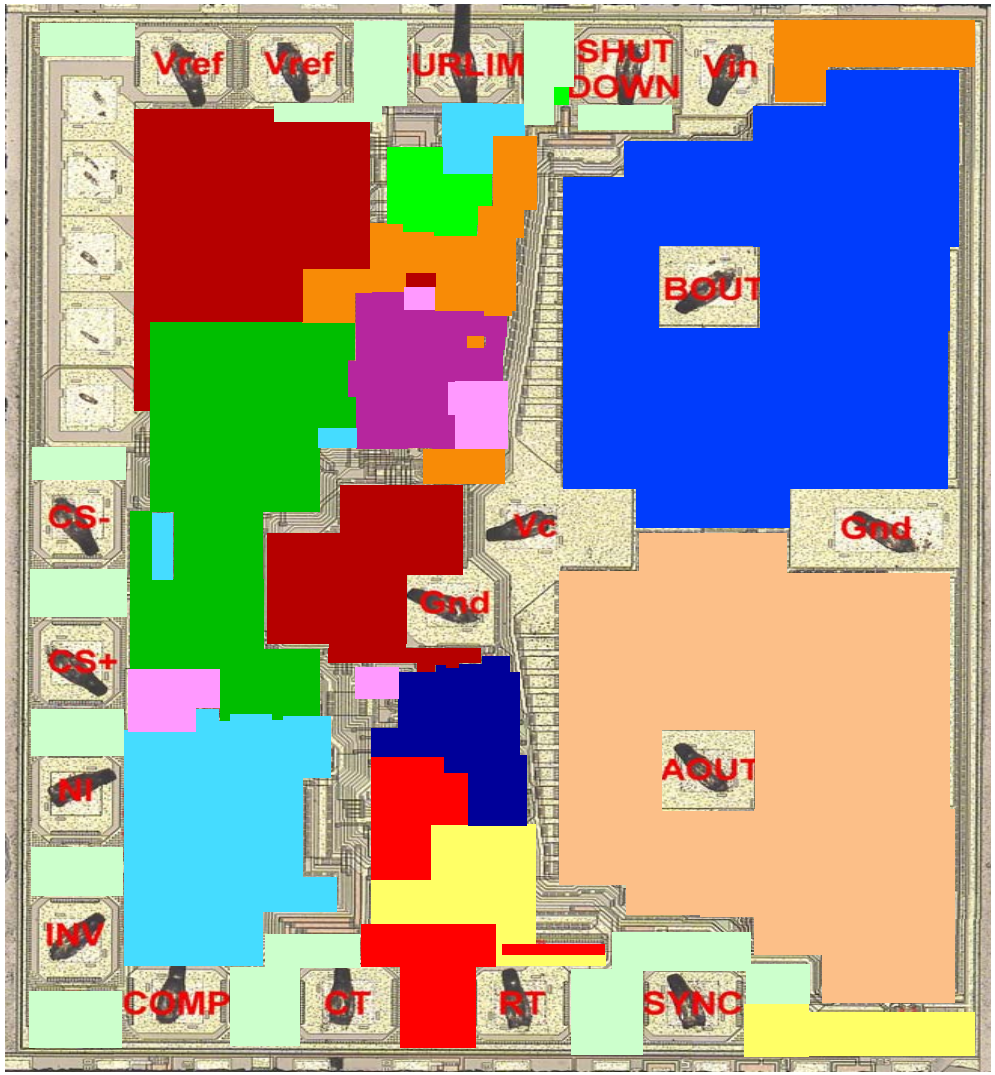


UCC1806 partitioned by extracted units



UCC1806 layout with arbitrary blocks extracted

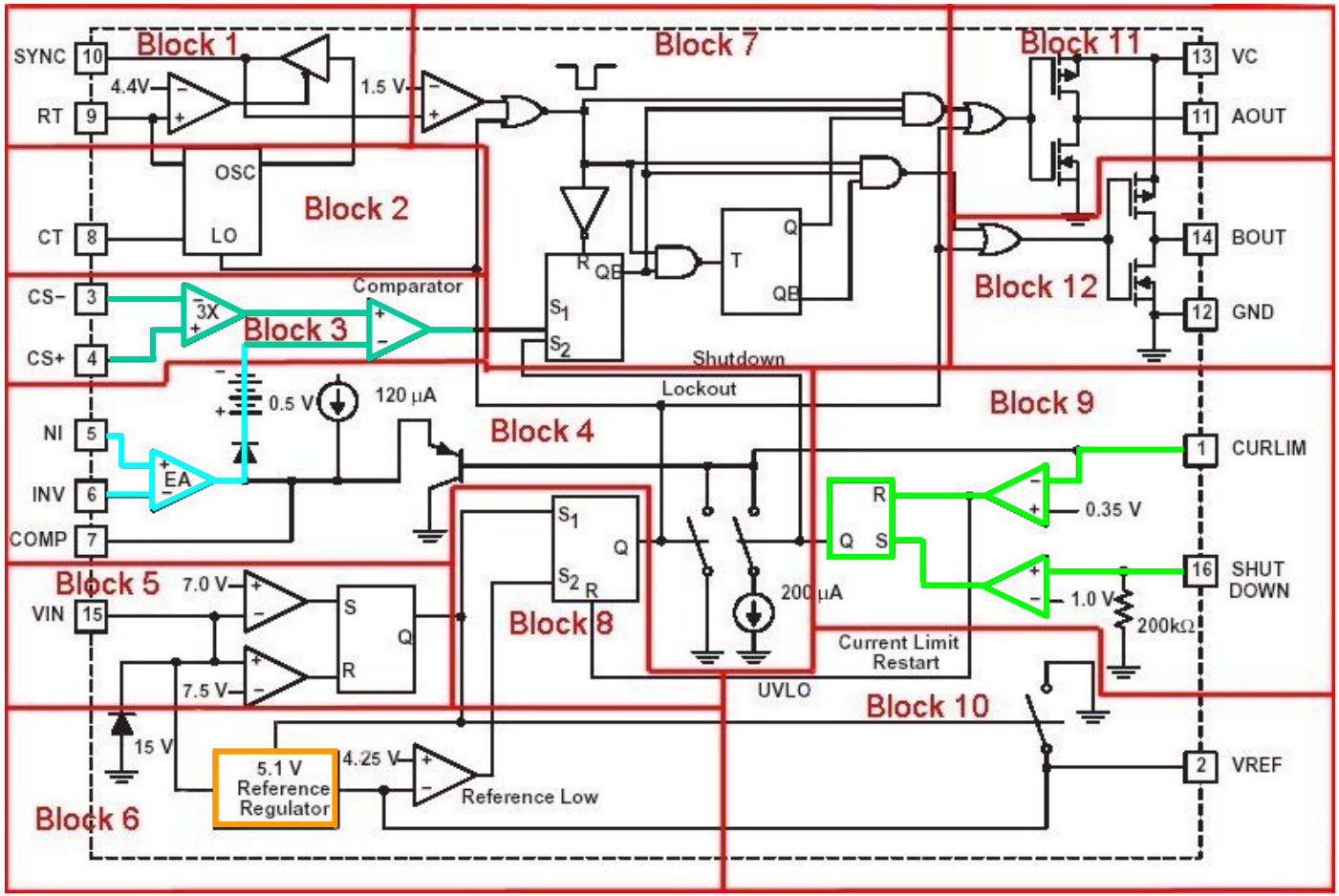
Block 1
Block 2
Block 3
Block 4
Block 5
Block 6
Block 7
Block 8
Block 9
Block 10
Block 11
Block 12
ESD Block



Some areas of special interest concerning the UCC1806

- Op-amp at pins 3,4 (CS-, CS+)
- Error-amp at pins 5,6 (NI, INV)
- Comparator
- Flip-flop connected to 1,16 (Curlim, Shut Down)
- 5.1V reference regulator
- Identify differences between
- DC9845(Unitrode)and DC0126 (TI)

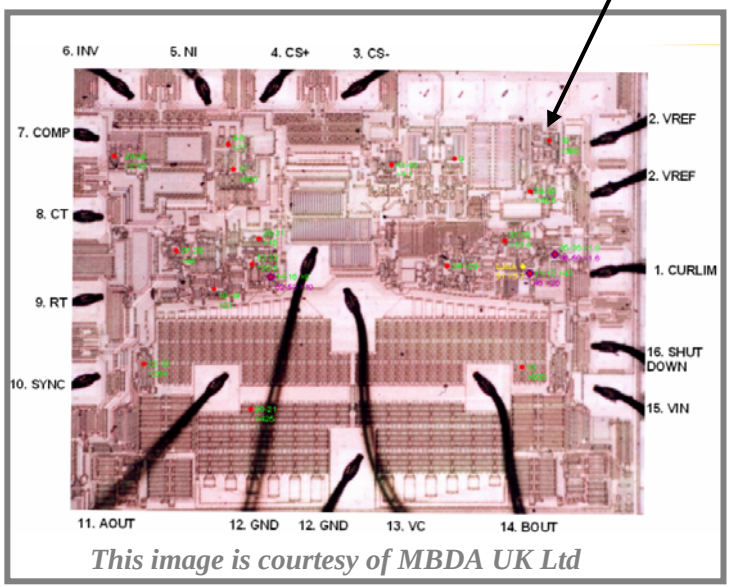
UCC1806 block diagram with some areas of special interest in green, blue & orange



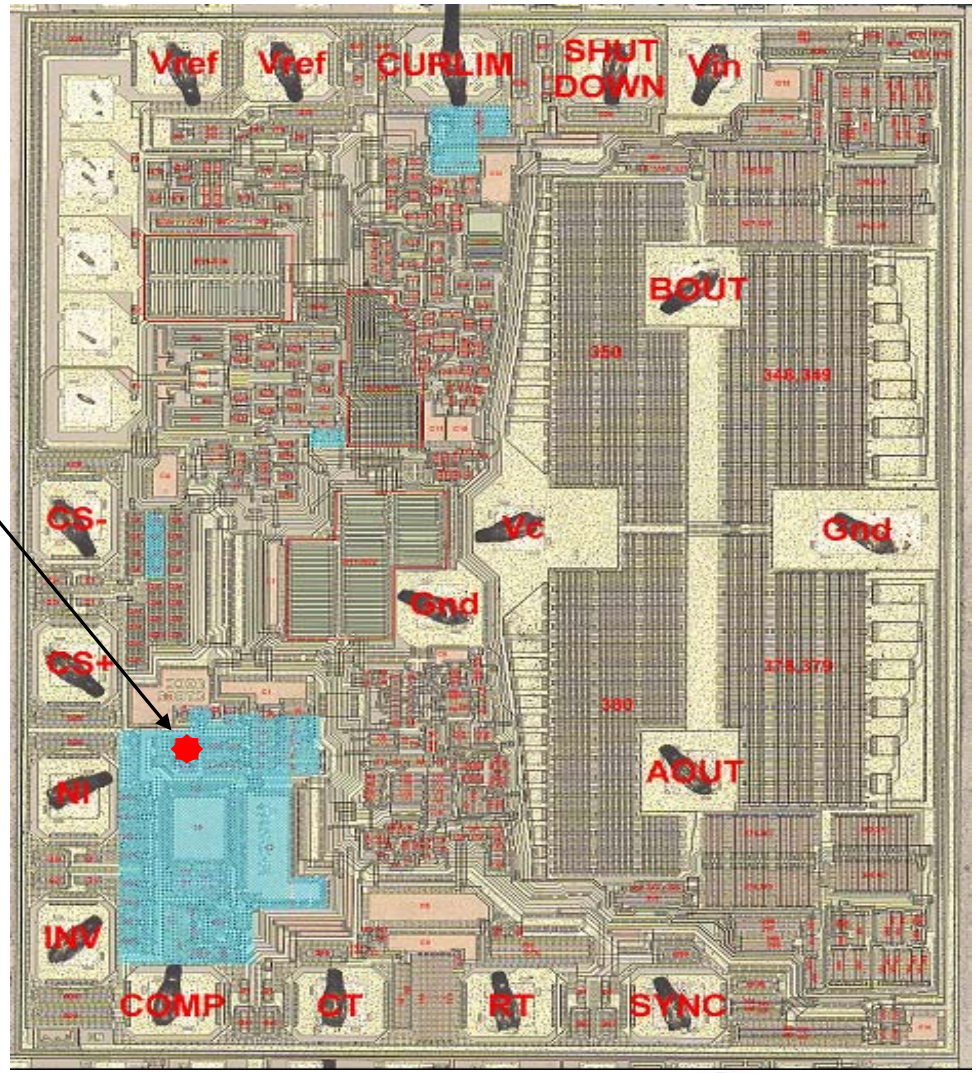
UCC1806 with the ‘error amp’ circuitry highlighted

‘error-amp’ related circuitry in blue.
Block 4

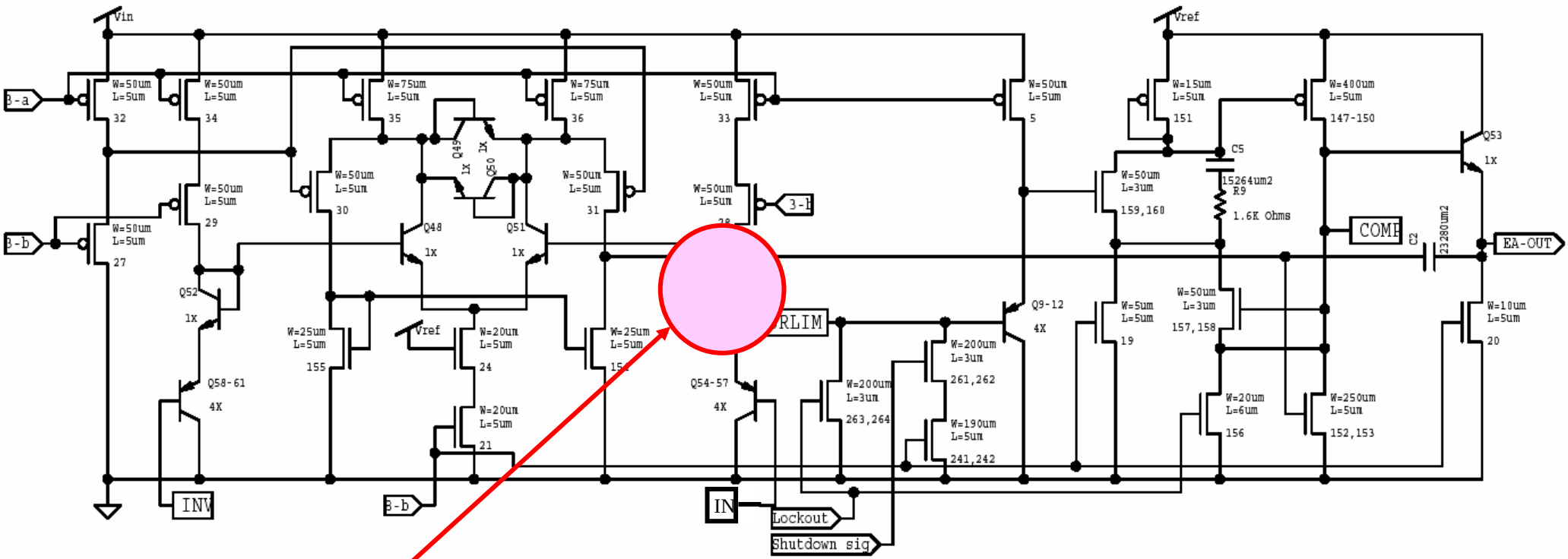
laser / heavy ion
scan failure site

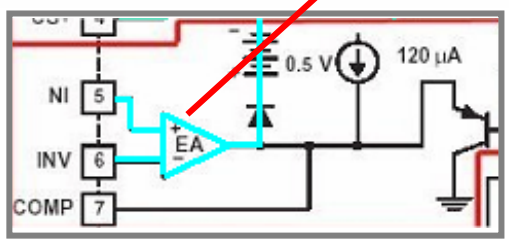


This image is courtesy of MBDA UK Ltd

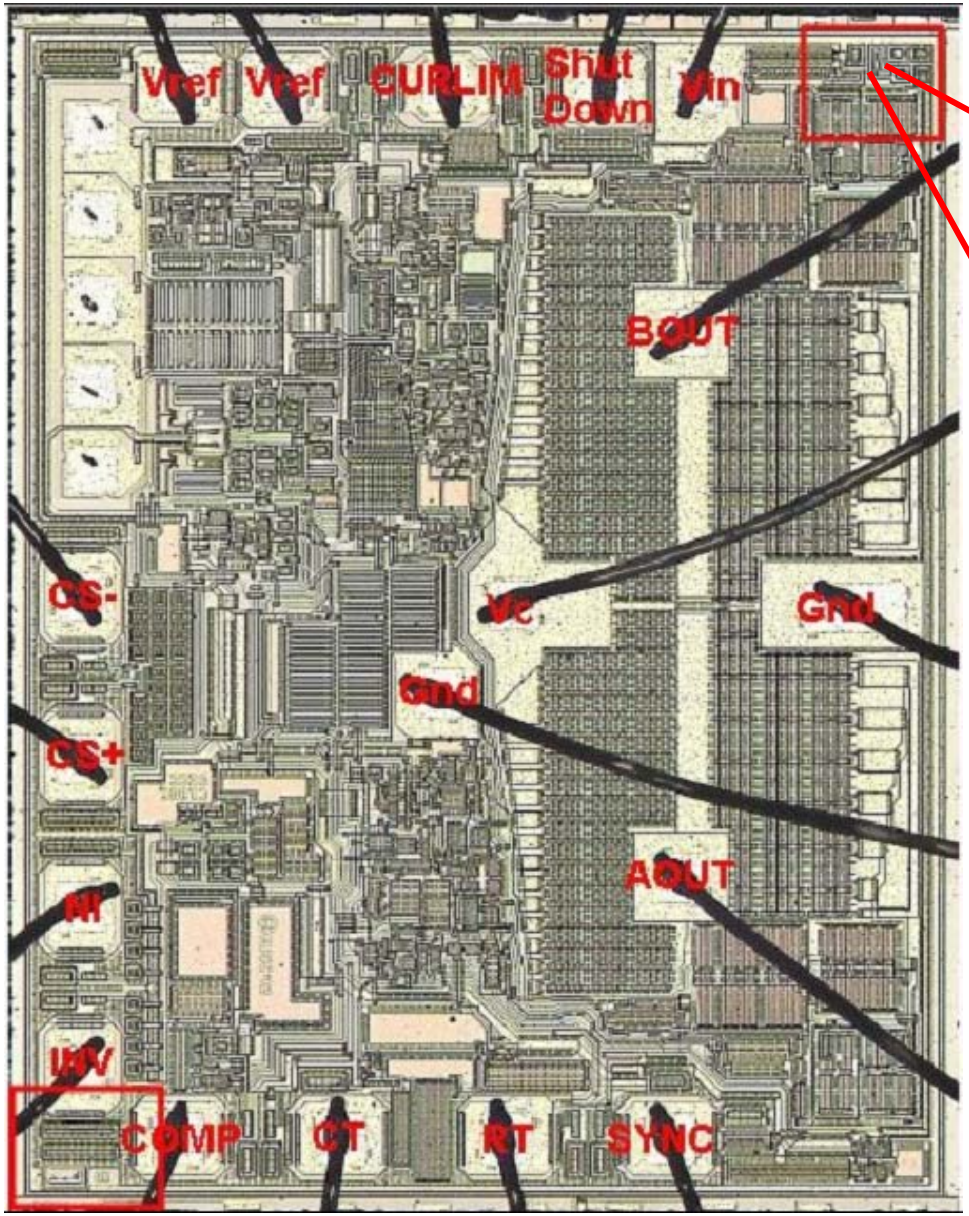


UCC1806 circuitry for the the ‘error-amp’ section

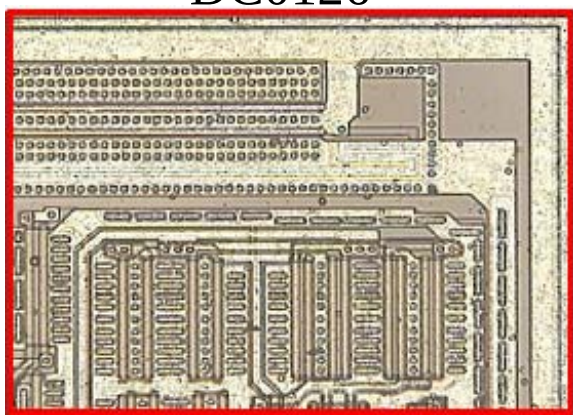




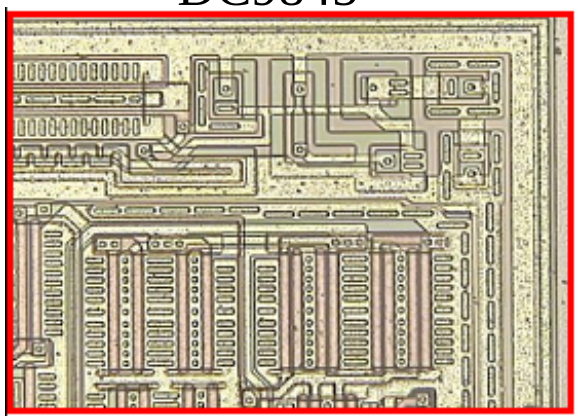
Difference between version DC9845 and DC0126 of the UCC1806



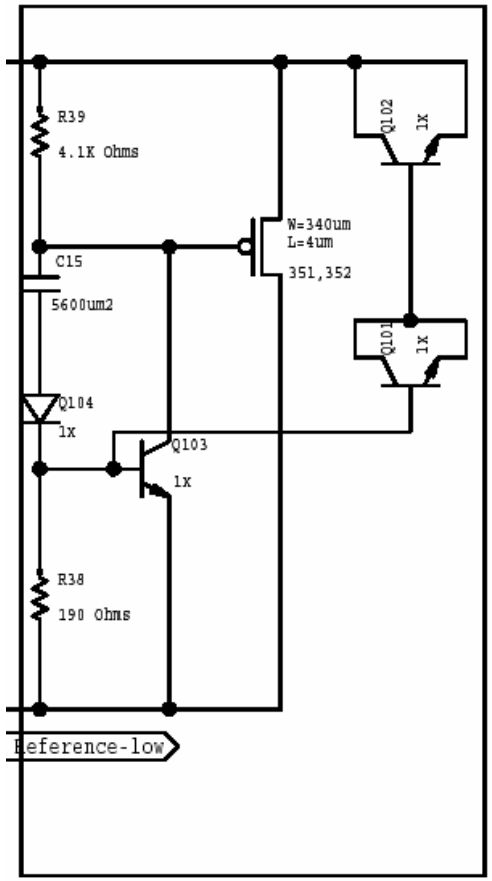
DC0126



DC9845



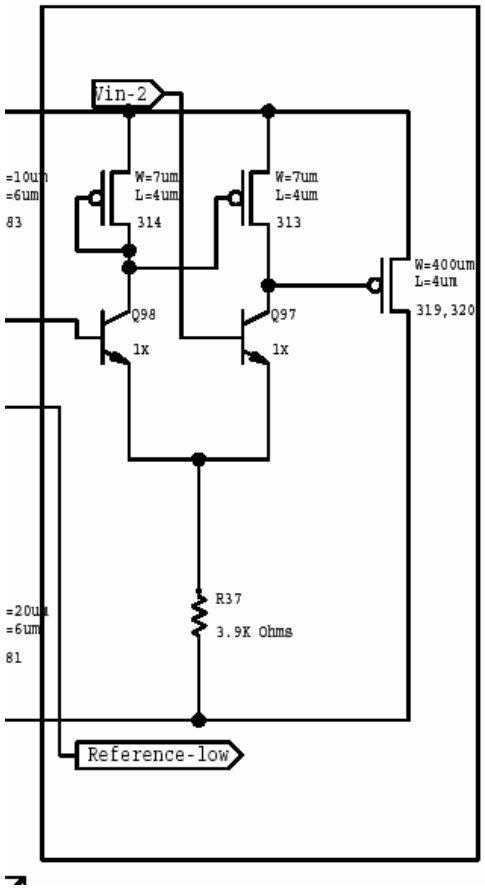
UCC1806 circuitry differences between the Unitrode DC9845 and Texas Instruments DC0126



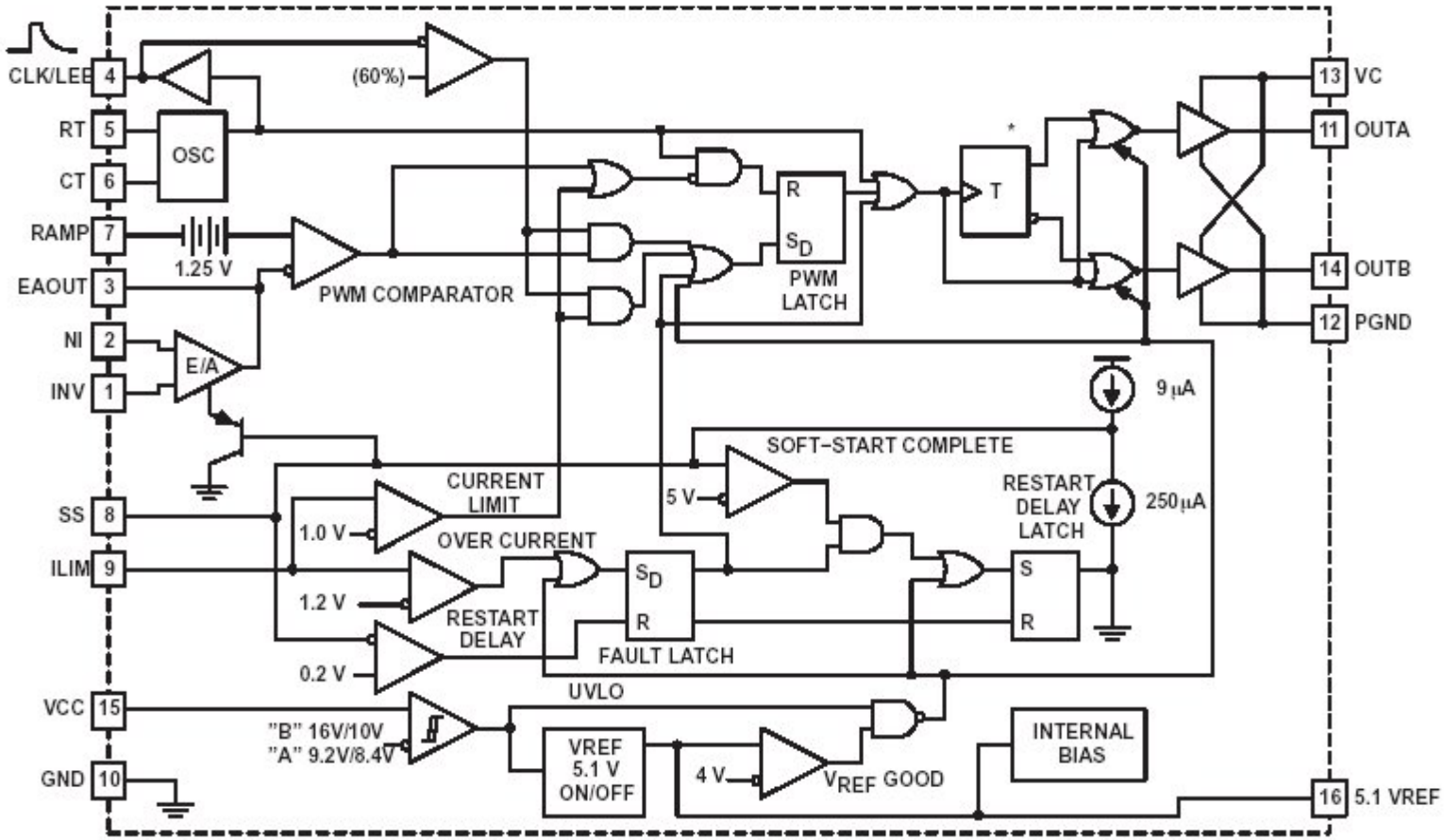
DC9845

DC0126

Taken from Block 6 in circuit extraction



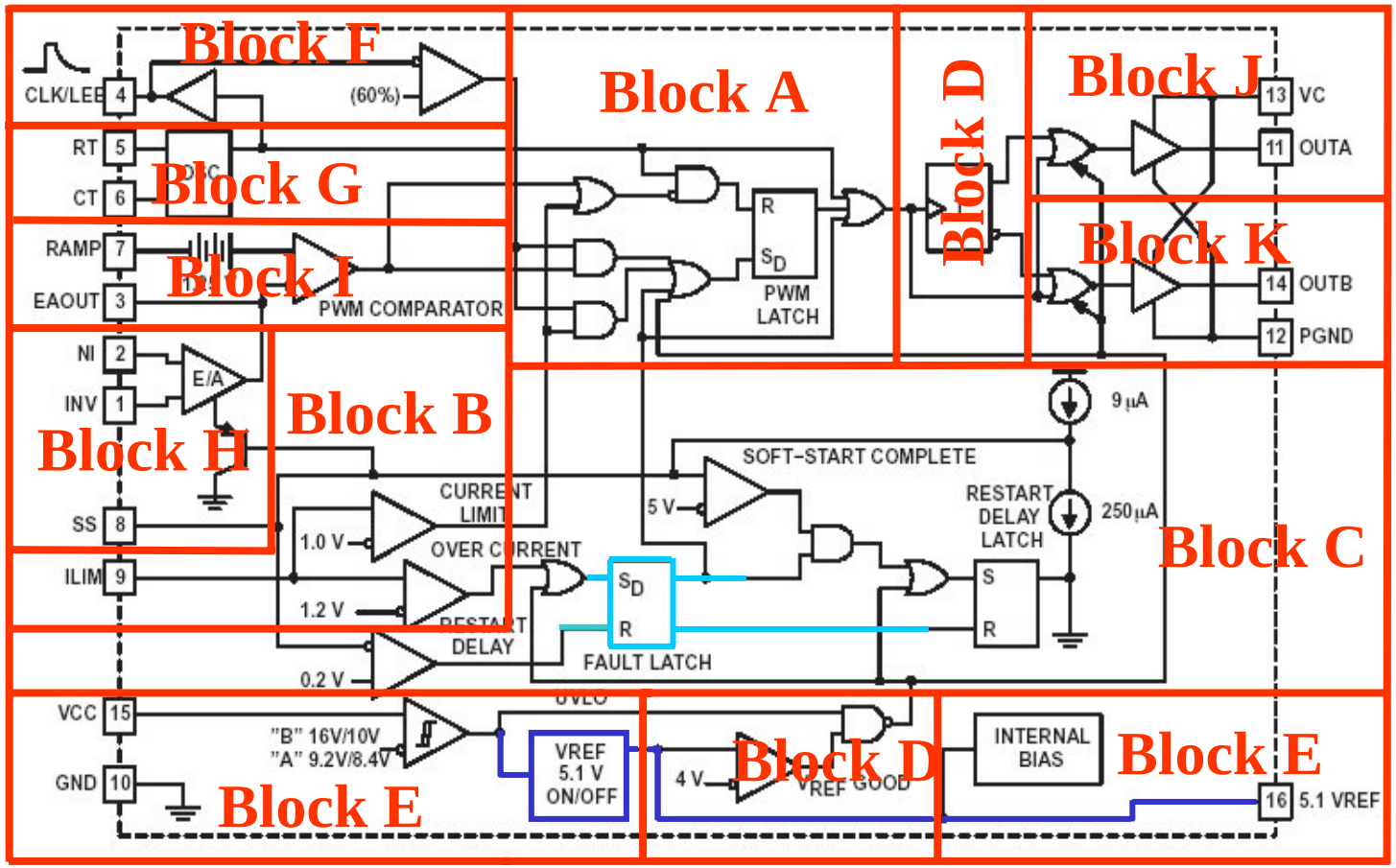
UC1825A manufacturers block diagram



Some areas of special interest concerning the UC1825A

- **Fault Latch**
- **Voltage Reference**

UC1825A block diagram partitioned by extracted units, and showing two areas of special interest in blue



UC1825A layout with arbitrary blocks extracted

Block A

Block B

Block C

Block D

Block E

Block F

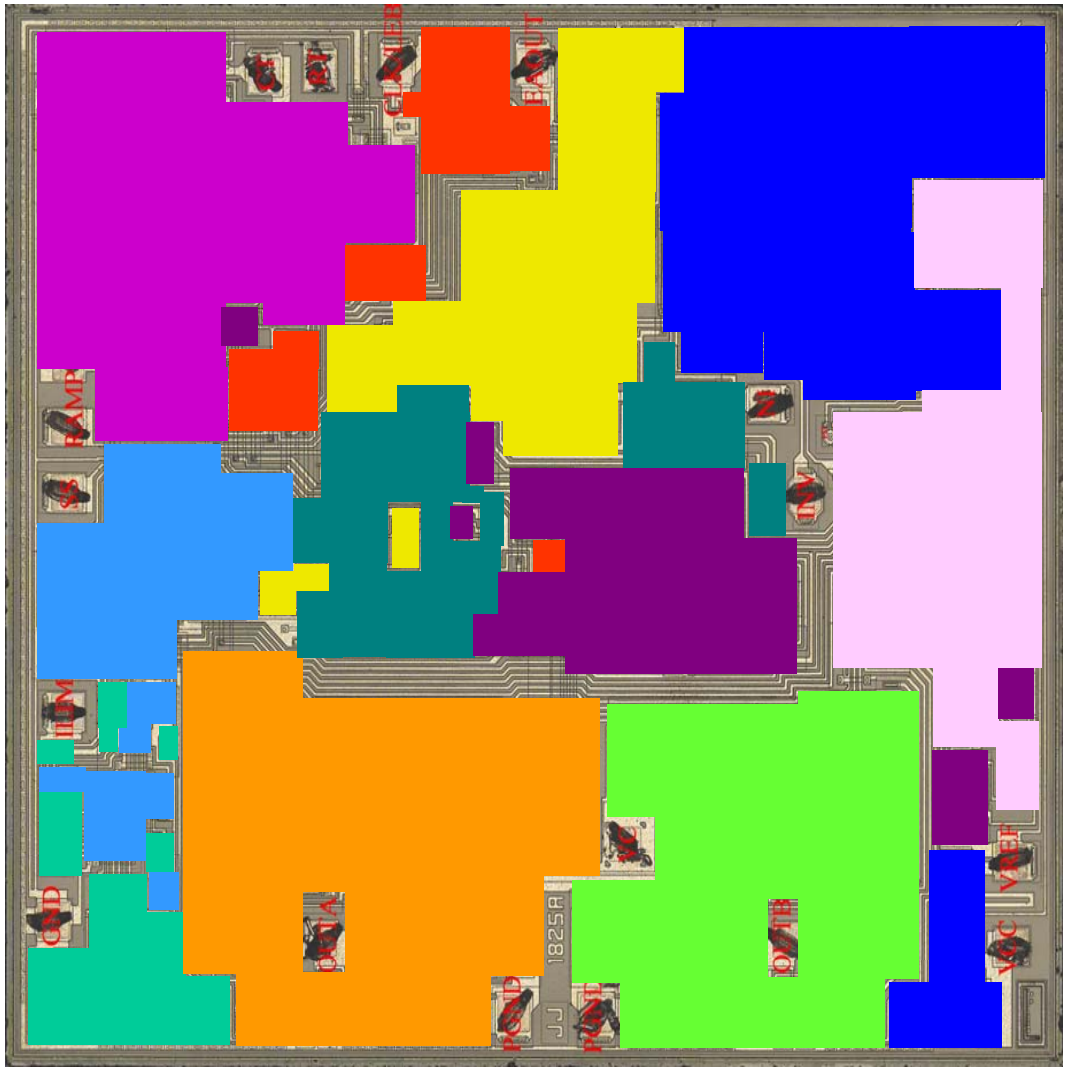
Block G

Block H

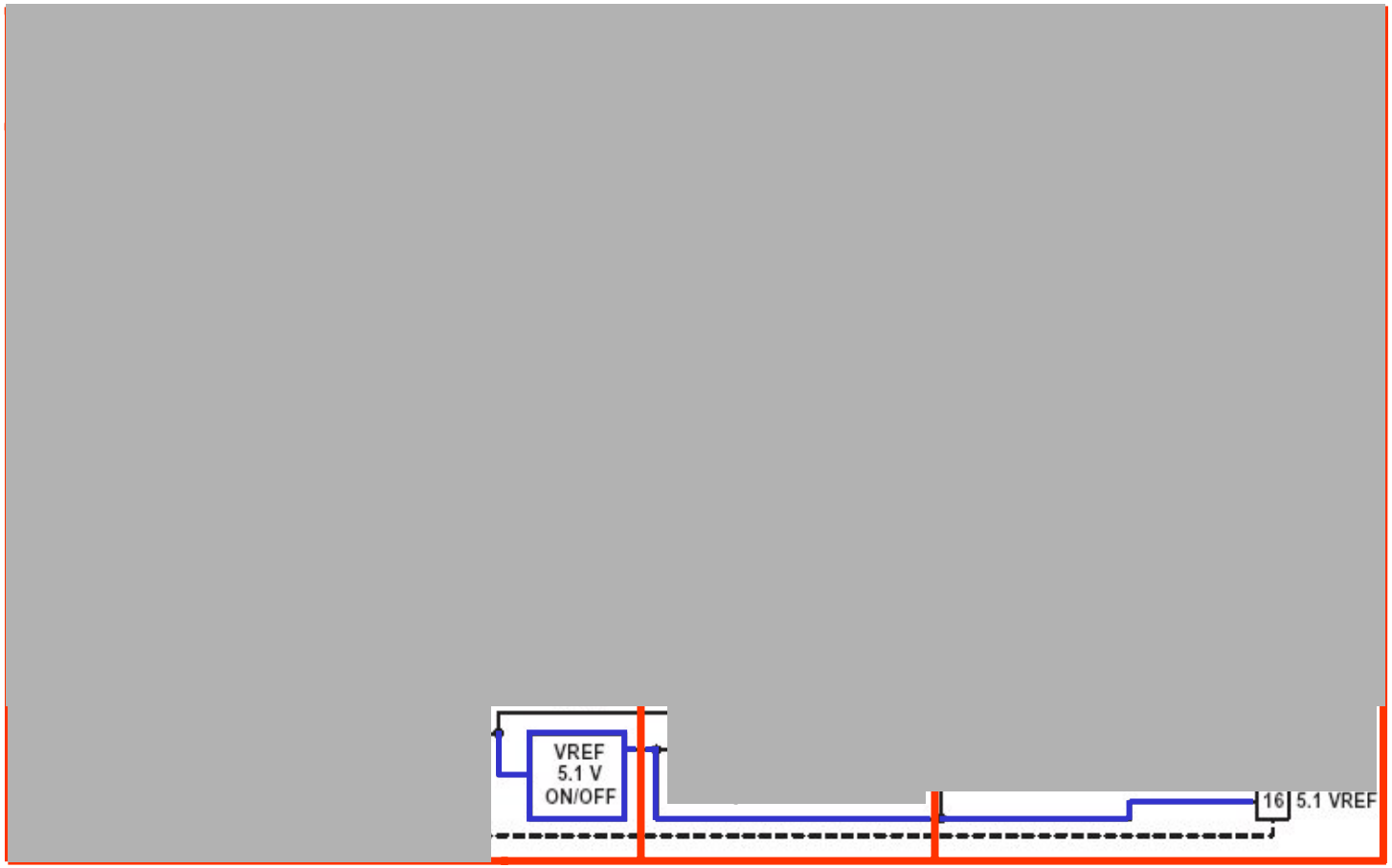
Block I

Block J

Block K

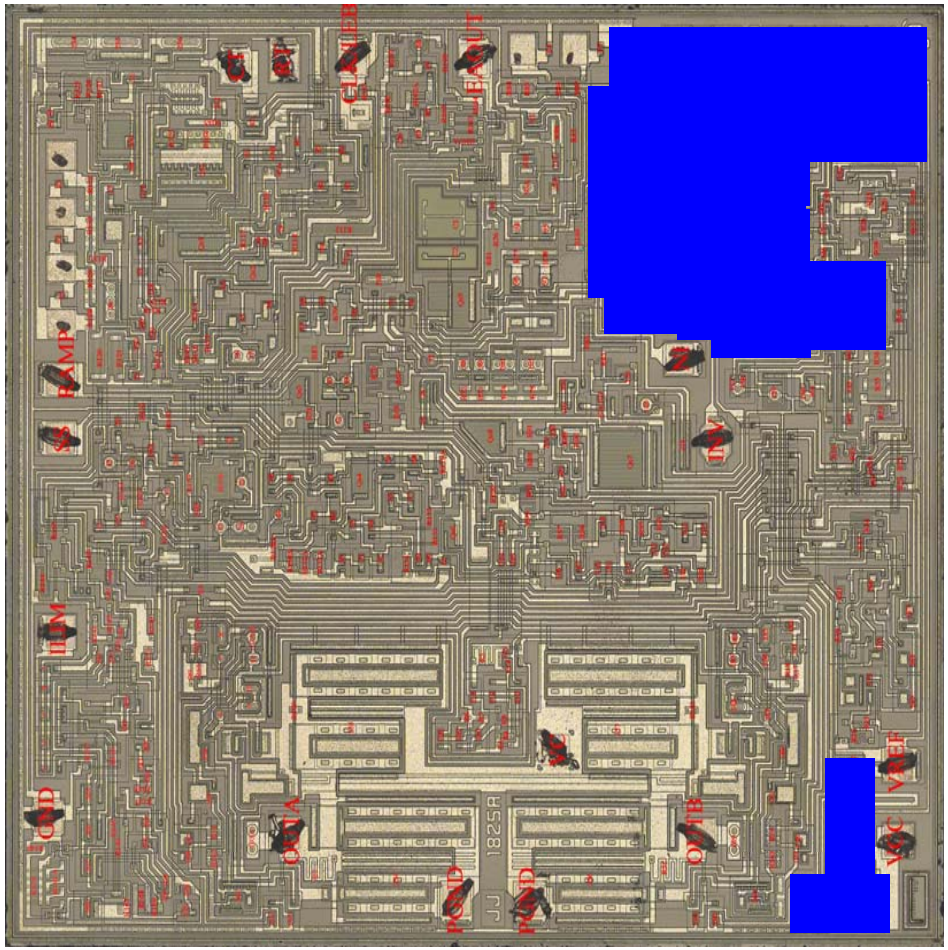


UC1825A: A closer look at the voltage reference.

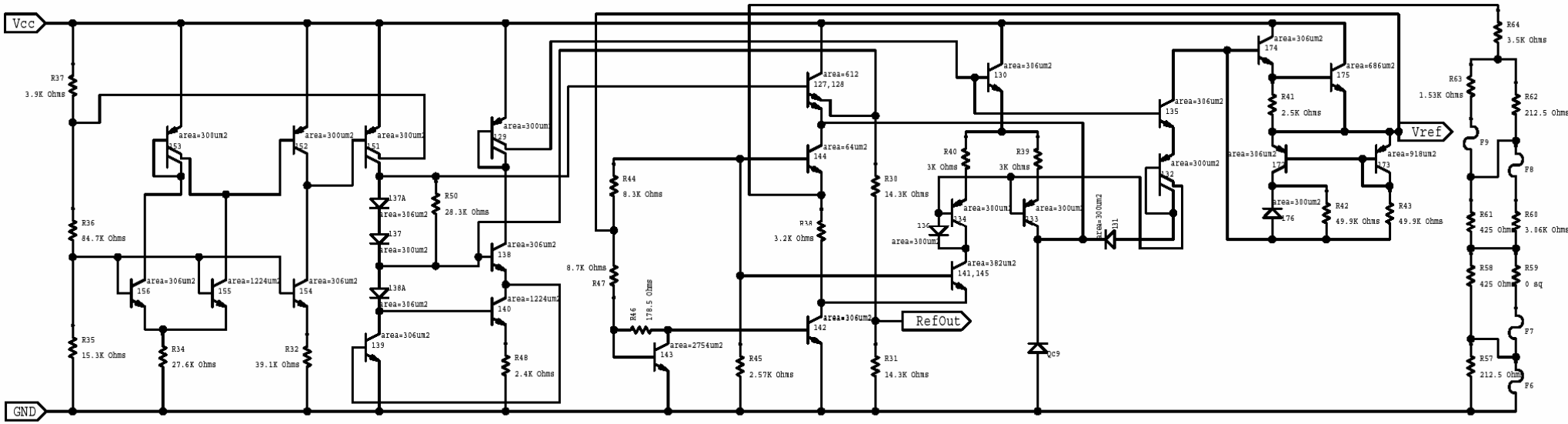


UC1825A: Voltage reference circuitry in blue.

Voltage-ref
Block E



UC1825A: Full circuitry of the Voltage reference.



Conclusion

- **We fully extracted the circuitry of both the UCC1806 and UC1825A Pulse Width Modulators.**
- **We compiled both functional block diagram descriptions and transistor level schematics of the IC's, facilitating precise correlation of failure locations with circuitry.**
- **We also provided the primary process technology information.**

Thank you for you attention