

SEE Verification Test of Various Designs Using UCC1801/1805/1806 for ROSETTA.

by

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Abstract

Various PWM designs using UCC180X controllers were SEE assessed against Heavy ion Single Event Burnout. Soft start events, triggering of the internal over-current protection, were also characterised over the full LET range.



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Main Purpose of Test:

Knowing that Single Event Burnout can occur in these controllers output stage (MOSFET part) – Heavy ion SEE testing was carried out at the HIF, UCL, Belgium – assessing;

- UCC1801 devices in a TERMA design –
Using different de-coupling capacitors
- UCC1805 devices in a TERMA design –
Using different de-coupling capacitors
- UCC1806 devices in a TERMA design –
Using different supply impedance levels
- Each controller was tested in a test configuration representing
ROSETTA PCU designs
- Soft Start Events/Transient Events (over-current protection events)
were also characterised

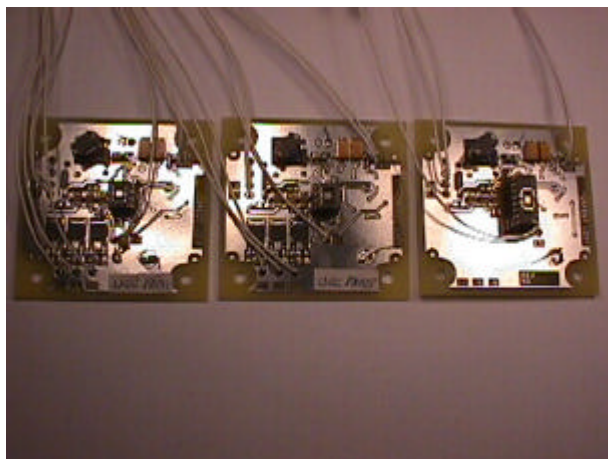


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UCC1801/1805/1806: PCB - Test Boards

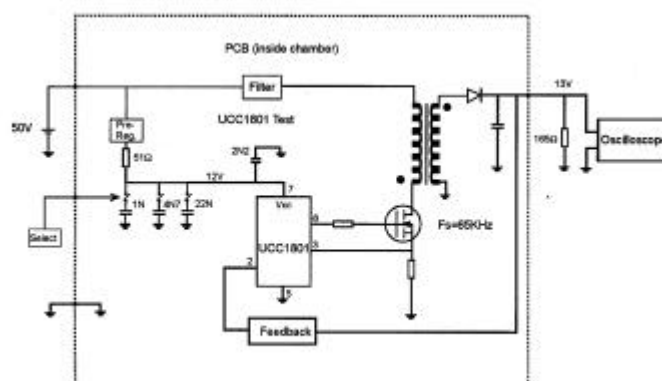


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UCC1801: Test Conditions

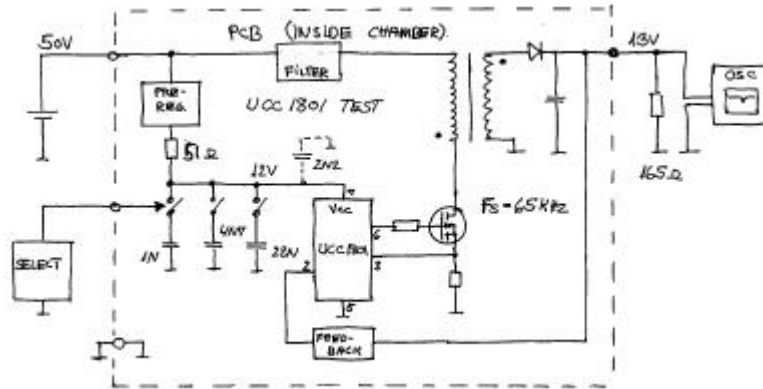


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UCC1801: Test Conditions



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UCC1801: Kr-ions having a LET = 34.0 MeV/(mg/cm²)

- With 4.7 nF - SEB and 14 Soft Start Events @ Fluence = 4.3E+5 p/cm²
- With 0.0 nF - No SEB/629 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 1.0 nF - No SEB/339 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 2.2 nF - No SEB/182 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 3.3 nF - No SEB/114 Soft Start Events @ Fluence = 2.0E+6 p/cm²

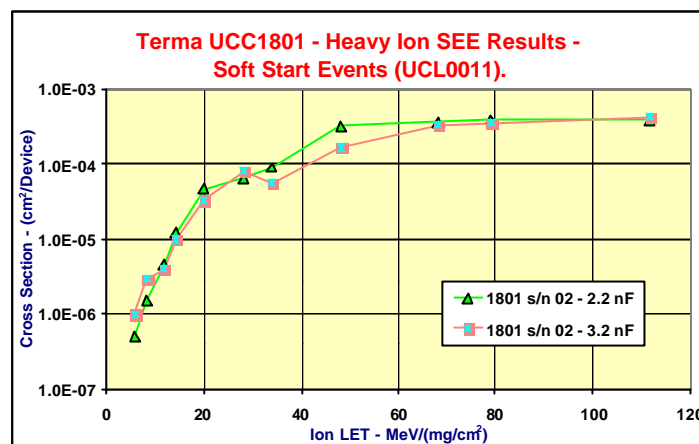


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UCC1801: SSE

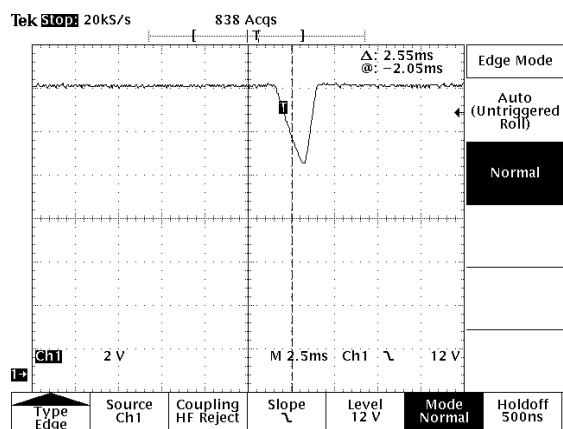


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UCC1801: Oscilloscope Slow Start Event (typical)

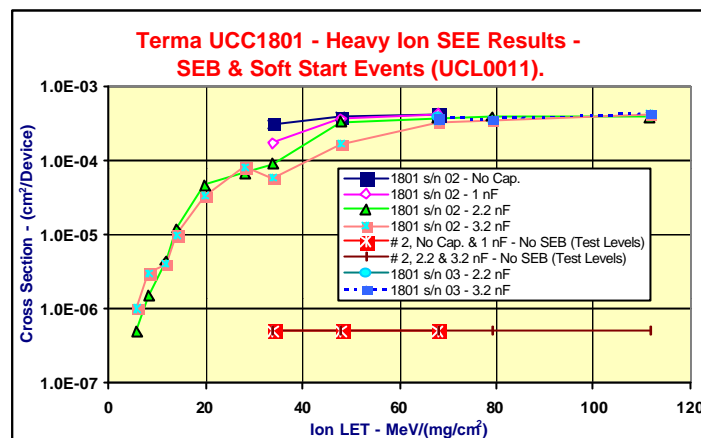


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UCC1801: SEB and SSE

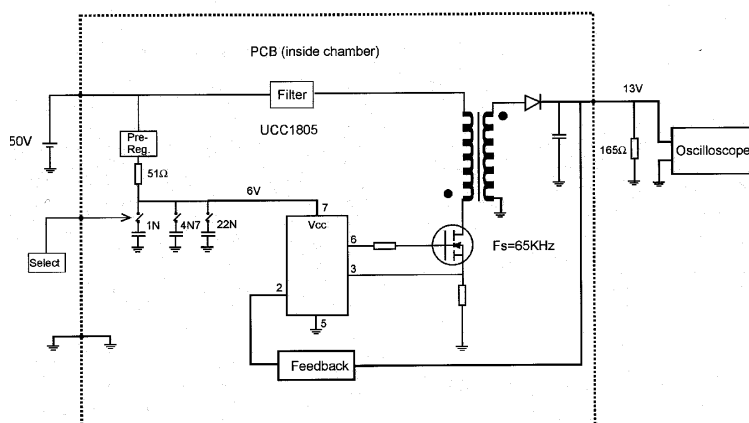


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UCC1805: Test Conditions



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UCC1805: Kr-ions having a LET = 34.0 MeV/(mg/cm²)

- With 0.0 nF - No SEB/035 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 1.0 nF - No SEB/049 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 4.7 nF - No SEB/035 Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With 22 nF - No SEB/022 Soft Start Events @ Fluence = 2.0E+6 p/cm²

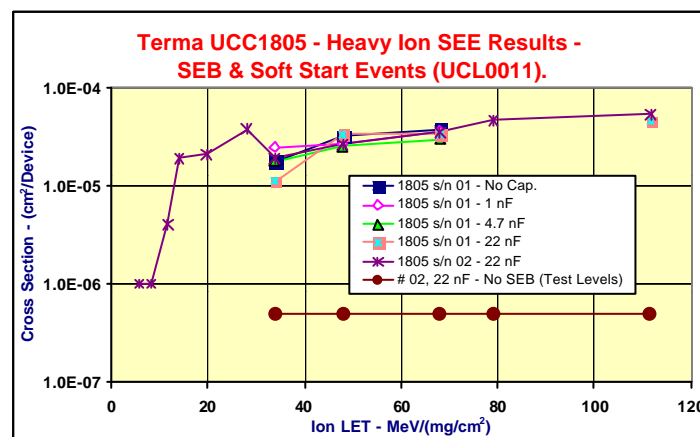


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UCC1805: SEB and SSE

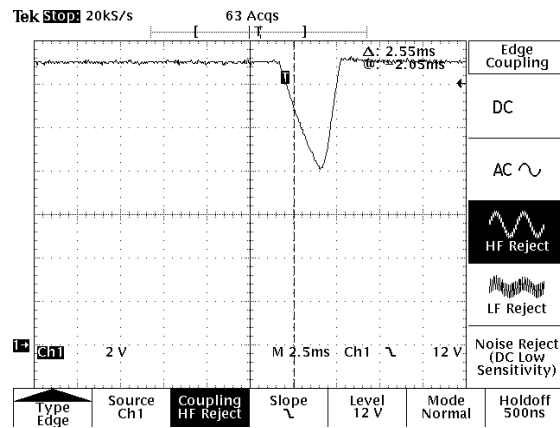


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UCC1805: Oscilloscope Slow Start Event (typical)

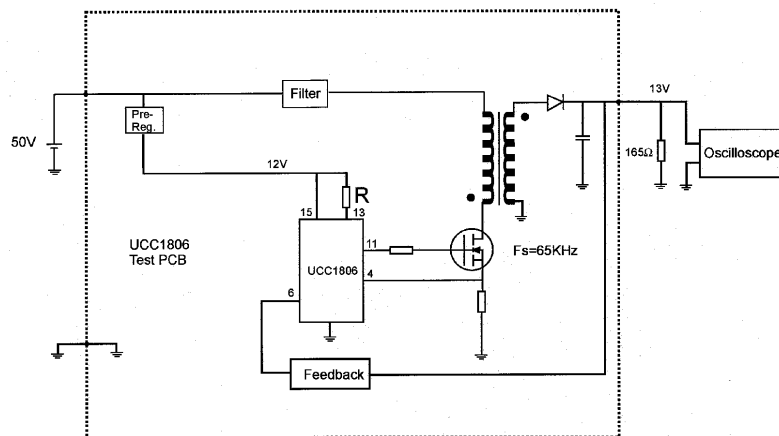


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UCC1806: Test Conditions



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UCC1806: Kr-ions having a LET = 34.0 MeV/(mg/cm²)

- With R = 50 Ω - No SEB/No Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With R = 15 Ω - No SEB/No Soft Start Events @ Fluence = 2.0E+6 p/cm²
- With R = 8.3 Ω - No SEB/No Soft Start Events @ Fluence = 2.0E+6 p/cm²

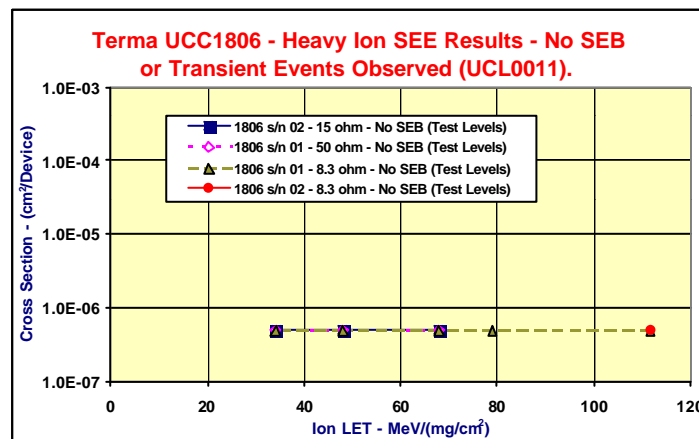


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UCC1806: SEB

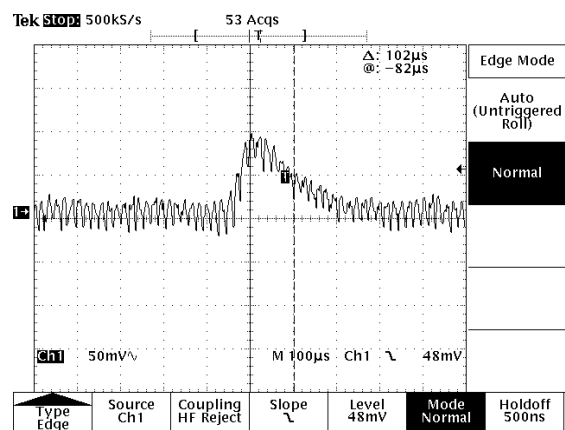


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Ref.: D/TOS-QCA/UCC180X

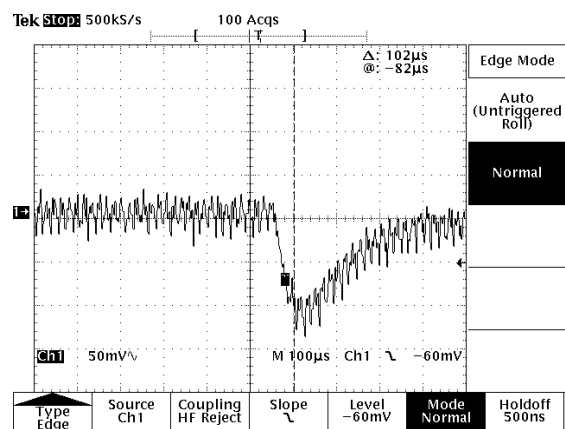
UCC1806: Oscilloscope Slow Start Event (typical)



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Ref. : D/TOS-QCA/UCC180X

UCC1806: Oscilloscope Slow Start Event (typical)



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Conclusions:

Within the 16 hours of beam time allocated at the Heavy-ion Irradiation Facility at UCL, Belgium – various ROSETTA PCU designs using PWM controllers were fully SEE characterized over the full LET range;

- UCC1801 devices in a TERMA design using $C = 2.2 \text{ \& } 3.2 \text{ nF}$
SEB – No events to a $\text{LET} = 111.8 \text{ MeV}/(\text{mg}/\text{cm}^2)$
Soft Start Events – Threshold around a $\text{LET} = 5.0 \text{ MeV}/(\text{mg}/\text{cm}^2)$
- UCC1805 devices in a TERMA design using $C = 22.0 \text{ nF}$
SEB – No events to a $\text{LET} = 111.8 \text{ MeV}/(\text{mg}/\text{cm}^2)$
Soft Start Events – Threshold around a $\text{LET} = 5.0 \text{ MeV}/(\text{mg}/\text{cm}^2)$
- UCC1806 devices in a TERMA design using $R = 8.3 \text{ \& } W$
SEB – No events to a $\text{LET} = 111.8 \text{ MeV}/(\text{mg}/\text{cm}^2)$
Transient Events – No events to a $\text{LET} = 111.8 \text{ MeV}/(\text{mg}/\text{cm}^2)$



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