

ICS RADIATION TECHNOLOGIES, INC.

8416 Florence Avenue, Suite 207
Downey, CA 90240-3949

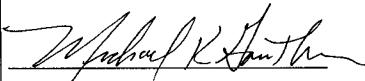
TEL: 562.923.1837 FAX: 562.923.3609

WEB: www.icsrad.com

CERTIFICATE OF CONFORMANCE

This document certifies that the task requirements of Line Item Number 1 of Purchase Order Number G0193570, dated 6/28/01 have been completed and meet the requirements of the above Purchase Order.

Our Quality Assurance procedures are in conformance to MIL-I-45208A and MIL-Q9858A. A government subcontractor has inspected our facilities.



Quality Assurance Officer

June 30, 2001

Date



(seal)



5335 PRICE AVENUE
BUILDING 258
McCLELLAN, CA 95652
PHONE: (916) 614-6200
FAX: (916) 614-6250
WEB: <http://www.ucdavis.edu/mnrc>

29 June 2001

MEMORANDUM FOR ICS, Inc.

FROM: UCD/MNRC

SUBJECT: Dosimetry for ¹³⁷Cs Irradiations 6/27/01-6/28/01

1. The following 1 MeV Equivalent Fluence (1 MeV neutrons/cm²) values were measured during the irradiations performed at the UCD/MNRC 4/2/01-4/4/01.

Date	1 MeV Equivalent Fluence (Exposure)	1 MeV Equivalent Fluence (Accumulated)
6/27/01	9.40E11	9.40E11
6/28/01	8.10E12	9.04E12

2. Attached please find additional data you may require. If you have any questions please call.

Daniel L. Newell
Nuclear Engineer, UCD/MNRC

IN COLLABORATION WITH
SCIENCE APPLICATIONS
INTERNATIONAL CORPORATION



I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)

=====

IGSSF VGS=20V nA

=====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11	3.08E+00	3.20E+00	3.13E+00
	12	3.06E+00	3.08E+00	3.12E+00
	13	3.06E+00	3.30E+00	3.13E+00
	14	3.06E+00	3.12E+00	3.06E+00
	15	3.04E+00	3.16E+00	3.08E+00
	16	3.06E+00	3.12E+00	3.04E+00
	17	3.05E+00	3.12E+00	3.11E+00
	18	3.06E+00	3.12E+00	3.13E+00
	19	3.09E+00	3.12E+00	3.06E+00
	20	3.05E+00	3.17E+00	3.09E+00
	MINIMUM	3.04E+00	3.08E+00	3.04E+00
	MEAN	3.06E+00	3.15E+00	3.09E+00
	MAXIMUM	3.09E+00	3.30E+00	3.13E+00
	+P 50/90	3.07E+00	3.17E+00	3.11E+00
	-P 50/90	3.05E+00	3.12E+00	3.08E+00
	+P 99/90	3.11E+00	3.37E+00	3.21E+00
	-P 99/90	3.01E+00	2.92E+00	2.97E+00
	SIGMA	1.41E-02	6.55E-02	3.44E-02

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IGSSF VGS=20V nA [DELTA]

=====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11		1.20E-01	5.00E-02
	12		2.00E-02	6.00E-02
	13		2.40E-01	7.00E-02
	14		6.00E-02	0.00E+00
	15		1.20E-01	4.00E-02
	16		6.00E-02	-2.00E-02
	17		7.00E-02	6.00E-02
	18		6.00E-02	7.00E-02
	19		3.00E-02	-3.00E-02
	20		1.20E-01	4.00E-02
	MINIMUM		2.00E-02	-3.00E-02
	MEAN		8.67E-02	3.22E-02
	MAXIMUM		2.40E-01	7.00E-02

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.
 . DEVICE TYPE IRH57260SE N-MOSFET (IRC) .
 . RADIATION SOURCE TRIGA Reactor (MNRC), 1.00MeV. .
 .
 . D/C CIRC 01 || PACKAGE TO-3 || LOT# ER13577 .
 . LOG# 971 || TEST DATE 06/26/01 || RTP# 385 .

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 I C S RADIATION TECHNOLOGIES, INC.

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PAGE 2 OF 6

I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IGSSR VGS=-20V nA
 =====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11	-3.34E+00	-3.20E+00	-3.17E+00
	12	-3.36E+00	-3.18E+00	-3.10E+00
	13	-3.38E+00	-3.20E+00	-3.16E+00
	14	-3.34E+00	-3.24E+00	-3.16E+00
	15	-3.38E+00	-3.29E+00	-3.12E+00
	16	-3.38E+00	-3.15E+00	-3.17E+00
	17	-3.38E+00	-3.11E+00	-3.13E+00
	18	-3.36E+00	-3.16E+00	-3.13E+00
	19	-3.38E+00	-3.17E+00	-3.17E+00
	20	-3.37E+00	-3.18E+00	-3.13E+00
	MINIMUM	-3.38E+00	-3.29E+00	-3.17E+00
	MEAN	-3.37E+00	-3.19E+00	-3.14E+00
	MAXIMUM	-3.34E+00	-3.11E+00	-3.10E+00
	+P 50/90	-3.36E+00	-3.16E+00	-3.13E+00
	-P 50/90	-3.38E+00	-3.21E+00	-3.15E+00
	+P 99/90	-3.32E+00	-3.00E+00	-3.05E+00
	-P 99/90	-3.42E+00	-3.37E+00	-3.23E+00
	SIGMA	1.46E-02	5.41E-02	2.55E-02

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 IGSSR VGS=-20V nA [DELTA]

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11		1.40E-01	1.70E-01
	12		1.80E-01	2.60E-01
	13		1.80E-01	2.20E-01
	14		1.00E-01	1.80E-01
	15		9.00E-02	2.60E-01
	16		2.30E-01	2.10E-01
	17		2.70E-01	2.50E-01
	18		2.00E-01	2.30E-01
	19		2.10E-01	2.10E-01
	20		1.90E-01	2.40E-01
	MINIMUM		9.00E-02	1.80E-01
	MEAN		1.83E-01	2.29E-01
	MAXIMUM		2.70E-01	2.60E-01

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.         DEVICE TYPE      IRH57260SE N-MOSFET (IRC)      .
.         RADIATION SOURCE  TRIGA Reactor (MNRC), 1.00MeV.
.
.   D/C  CIRC 01 || PACKAGE   TO-3      || LOT#  ER13577  .
.   LOG# 971   || TEST DATE  06/26/01 || RTP#  385    .
.
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I C S RADIATION TECHNOLOGIES, INC.

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PAGE 3 OF 6

I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)
 =====

IDSS VDS=160V VGS=0V nA
 =====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11	1.31E+01	1.23E+01	1.53E+01
	12	1.32E+01	1.41E+02	1.18E+03
	13	1.29E+01	1.44E+02	1.29E+03
	14	1.33E+01	1.43E+02	1.28E+03
	15	1.54E+01	1.42E+02	1.18E+03
	16	1.54E+01	1.42E+02	1.26E+03
	17	1.27E+01	1.42E+02	1.22E+03
	18	1.30E+01	1.58E+02	1.18E+03
	19	1.28E+01	1.42E+02	1.19E+03
	20	1.29E+01	1.38E+02	1.18E+03
	MINIMUM	1.27E+01	1.38E+02	1.18E+03
	MEAN	1.35E+01	1.44E+02	1.22E+03
	MAXIMUM	1.54E+01	1.58E+02	1.29E+03
	+P 50/90	1.40E+01	1.46E+02	1.24E+03
	-P 50/90	1.30E+01	1.41E+02	1.20E+03
	+P 99/90	1.74E+01	1.64E+02	1.38E+03
	-P 99/90	9.66E+00	1.24E+02	1.06E+03
	SIGMA	1.12E+00	5.84E+00	4.71E+01

.....

IDSS VDS=160V VGS=0V nA [DELTA]
 =====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11		-8.00E-01	2.20E+00
	12		1.28E+02	1.17E+03
	13		1.31E+02	1.28E+03
	14		1.30E+02	1.26E+03
	15		1.27E+02	1.17E+03
	16		1.27E+02	1.24E+03
	17		1.29E+02	1.21E+03
	18		1.45E+02	1.17E+03
	19		1.29E+02	1.17E+03
	20		1.25E+02	1.17E+03

MINIMUM	1.25E+02	1.17E+03
MEAN	1.30E+02	1.20E+03
MAXIMUM	1.45E+02	1.28E+03

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.
.   DEVICE TYPE      IRH57260SE N-MOSFET (IRC)   .
.   RADIATION SOURCE TRIGA Reactor (MNRC), 1.00MeV.
.
.   D/C  CIRC 01 || PACKAGE   TO-3      || LOT#  ER13577  .
.   LOG# 971   || TEST DATE 06/26/01 || RTP#  385    .
.
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I C S RADIATION TECHNOLOGIES, INC.
    
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I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)
 =====

VGS(th) ID=1mA VDS=VGS V

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11	3.93E+00	3.96E+00	3.96E+00
	12	3.94E+00	3.96E+00	3.88E+00
	13	3.85E+00	3.66E+00	3.56E+00
	14	3.99E+00	3.99E+00	3.91E+00
	15	3.79E+00	3.82E+00	3.75E+00
	16	3.90E+00	3.91E+00	3.86E+00
	17	3.72E+00	3.72E+00	3.68E+00
	18	4.10E+00	4.13E+00	4.10E+00
	19	3.62E+00	3.67E+00	3.64E+00
	20	3.31E+00	3.50E+00	3.57E+00
	MINIMUM	3.31E+00	3.50E+00	3.56E+00
	MEAN	3.80E+00	3.82E+00	3.77E+00
	MAXIMUM	4.10E+00	4.13E+00	4.10E+00
	+P 50/90	3.91E+00	3.91E+00	3.85E+00
	-P 50/90	3.70E+00	3.73E+00	3.69E+00
	+P 99/90	4.63E+00	4.52E+00	4.41E+00
	-P 99/90	2.97E+00	3.12E+00	3.14E+00
	SIGMA	2.41E-01	2.04E-01	1.85E-01

VGS(th) ID=1mA VDS=VGS V [DELTA]

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11		3.00E-02	3.00E-02
	12		2.00E-02	-6.00E-02
	13		-1.90E-01	-2.90E-01
	14		0.00E+00	-8.00E-02
	15		3.00E-02	-4.00E-02
	16		1.00E-02	-4.00E-02

17	0.00E+00	-4.00E-02
18	3.00E-02	0.00E+00
19	5.00E-02	2.00E-02
20	1.90E-01	2.60E-01
MINIMUM	-1.90E-01	-2.90E-01
MEAN	1.56E-02	-3.00E-02
MAXIMUM	1.90E-01	2.60E-01

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.....
.
.      DEVICE TYPE      IRH57260SE N-MOSFET (IRC) .
.      RADIATION SOURCE  TRIGA Reactor (MNRC), 1.00MeV.
.
.      D/C  CIRC 01 || PACKAGE  TO-3      || LOT#  ER13577 .
.      LOG# 971  || TEST DATE 06/26/01 || RTP# 385 .
.
.....
I C S RADIATION TECHNOLOGIES, INC.

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PAGE 5 OF 6

I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)
 =====

BVDSS ID=1mA VGS=0V V

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=====
FLUENCE  neutrons/cm2  INITIAL          9.40E+11  8.10E+12
-----  S/N  -----
CONTROL  11          2.73E+02    2.73E+02    2.73E+02
        12          2.73E+02    2.73E+02    2.74E+02
        13          2.68E+02    2.68E+02    2.69E+02
        14          2.66E+02    2.66E+02    2.67E+02
        15          2.77E+02    2.76E+02    2.77E+02
        16          2.73E+02    2.73E+02    2.75E+02
        17          2.75E+02    2.75E+02    2.76E+02
        18          2.73E+02    2.72E+02    2.73E+02
        19          2.73E+02    2.73E+02    2.73E+02
        20          2.73E+02    2.72E+02    2.74E+02
        MINIMUM    2.66E+02    2.66E+02    2.67E+02
        MEAN      2.72E+02    2.72E+02    2.73E+02
        MAXIMUM    2.77E+02    2.76E+02    2.77E+02
        +P 50/90    2.74E+02    2.73E+02    2.75E+02
        -P 50/90    2.71E+02    2.71E+02    2.72E+02
        +P 99/90    2.84E+02    2.83E+02    2.85E+02
        -P 99/90    2.60E+02    2.61E+02    2.62E+02
        SIGMA     3.46E+00    3.26E+00    3.32E+00

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BVDSS ID=1mA VGS=0V V [DELTA]

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=====
FLUENCE  neutrons/cm2  INITIAL          9.40E+11  8.10E+12
-----  S/N  -----
CONTROL  11          0.00E+00    0.00E+00

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12	0.00E+00	1.00E+00
13	0.00E+00	1.00E+00
14	0.00E+00	1.00E+00
15	-1.00E+00	0.00E+00
16	0.00E+00	2.00E+00
17	0.00E+00	1.00E+00
18	-1.00E+00	0.00E+00
19	0.00E+00	0.00E+00
20	-1.00E+00	1.00E+00
MINIMUM	-1.00E+00	0.00E+00
MEAN	-3.33E-01	7.78E-01
MAXIMUM	0.00E+00	2.00E+00

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.....
.
.      DEVICE TYPE      IRH57260SE N-MOSFET (IRC)      .
.      RADIATION SOURCE  TRIGA Reactor (MNRC), 1.00MeV.  .
.
.      D/C  CIRC 01 || PACKAGE  TO-3      || LOT#  ER13577  .
.      LOG# 971   || TEST DATE 06/26/01 || RTP#  385    .
.
.....
I C S RADIATION TECHNOLOGIES, INC.

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06-29-01

PAGE 6 OF 6

I C S Radiation Test Results
 IRH57260SE N-CHANNEL POWER MOSFET (IRC)
 =====

RDS(on) VGS=12V ID=16A OHMS
 =====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
----- S/N -----				
CONTROL	11	3.40E-02	3.60E-02	3.60E-02
	12	3.40E-02	3.70E-02	3.70E-02
	13	3.40E-02	3.40E-02	3.60E-02
	14	3.40E-02	3.40E-02	3.60E-02
	15	3.40E-02	3.40E-02	3.80E-02
	16	3.30E-02	3.30E-02	3.70E-02
	17	3.40E-02	3.40E-02	3.80E-02
	18	3.40E-02	3.40E-02	3.70E-02
	19	3.40E-02	3.40E-02	3.70E-02
	20	3.40E-02	3.40E-02	3.70E-02
MINIMUM		3.30E-02	3.30E-02	3.60E-02
MEAN		3.39E-02	3.42E-02	3.70E-02
MAXIMUM		3.40E-02	3.70E-02	3.80E-02
+P 50/90		3.40E-02	3.47E-02	3.73E-02
-P 50/90		3.37E-02	3.37E-02	3.67E-02
+P 99/90		3.51E-02	3.81E-02	3.95E-02
-P 99/90		3.27E-02	3.04E-02	3.45E-02
SIGMA		3.44E-04	1.13E-03	7.30E-04

RDS(on) VGS=12V ID=16A OHMS [DELTA]
 =====

FLUENCE	neutrons/cm2	INITIAL	9.40E+11	8.10E+12
S/N		-----		
CONTROL	11		2.00E-03	2.00E-03
	12		3.00E-03	3.00E-03
	13		0.00E+00	2.00E-03
	14		0.00E+00	2.00E-03
	15		0.00E+00	4.00E-03
	16		0.00E+00	4.00E-03
	17		0.00E+00	4.00E-03
	18		0.00E+00	3.00E-03
	19		0.00E+00	3.00E-03
	20		0.00E+00	3.00E-03
	MINIMUM		0.00E+00	2.00E-03
	MEAN		3.33E-04	3.11E-03
	MAXIMUM		3.00E-03	4.00E-03

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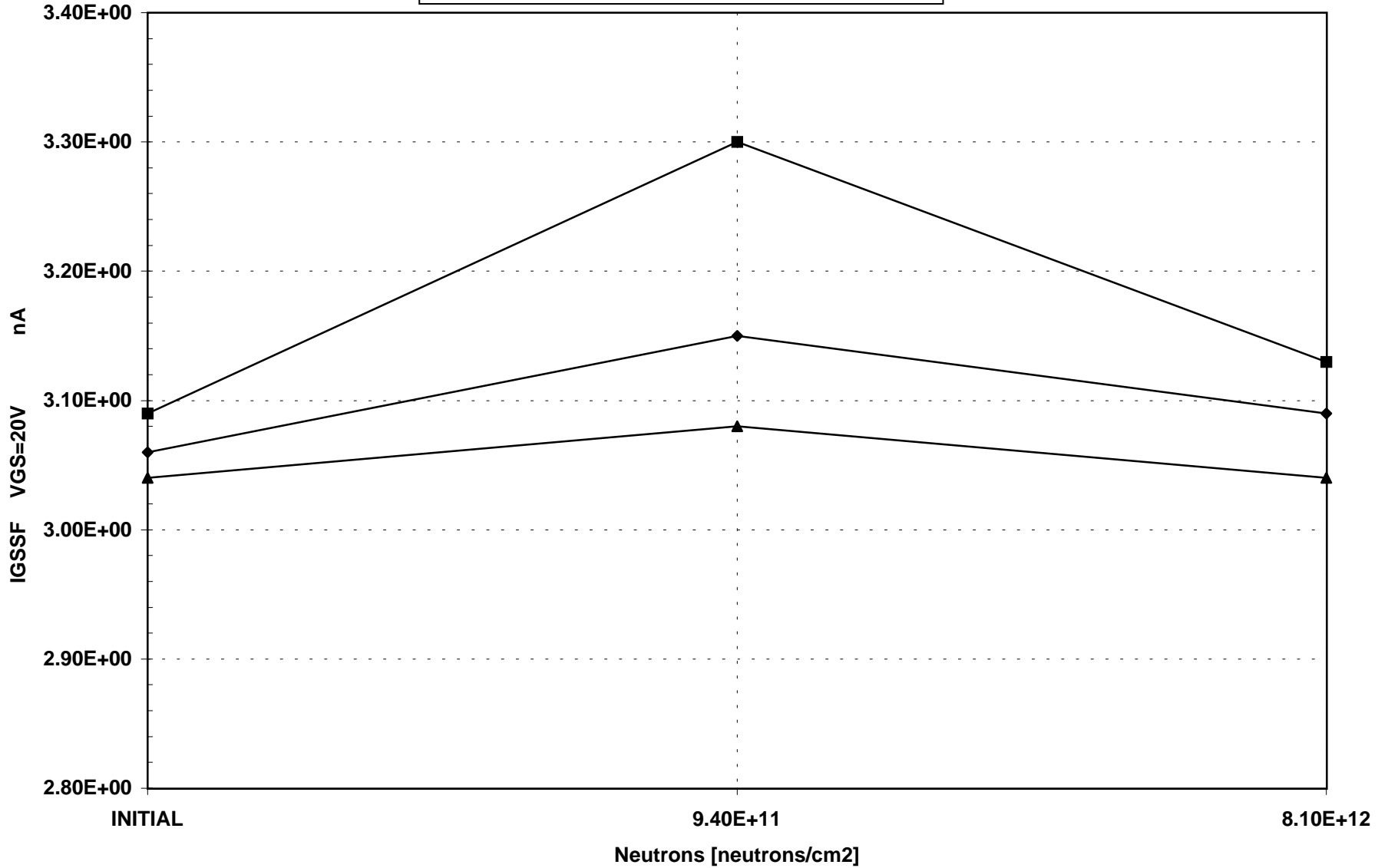
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.   DEVICE TYPE      IRH57260SE N-MOSFET (IRC)   .
.   RADIATION SOURCE TRIGA Reactor (MNRC), 1.00MeV.
.
.   D/C  CIRC 01 || PACKAGE  TO-3      || LOT#  ER13577  .
.   LOG# 971   || TEST DATE 06/26/01 || RTP#  385    .
.
.....
I C S RADIATION TECHNOLOGIES, INC.

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IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IC S Radiation Test Results Log # 971 06/26/01

IGSSF VGS=20V nA

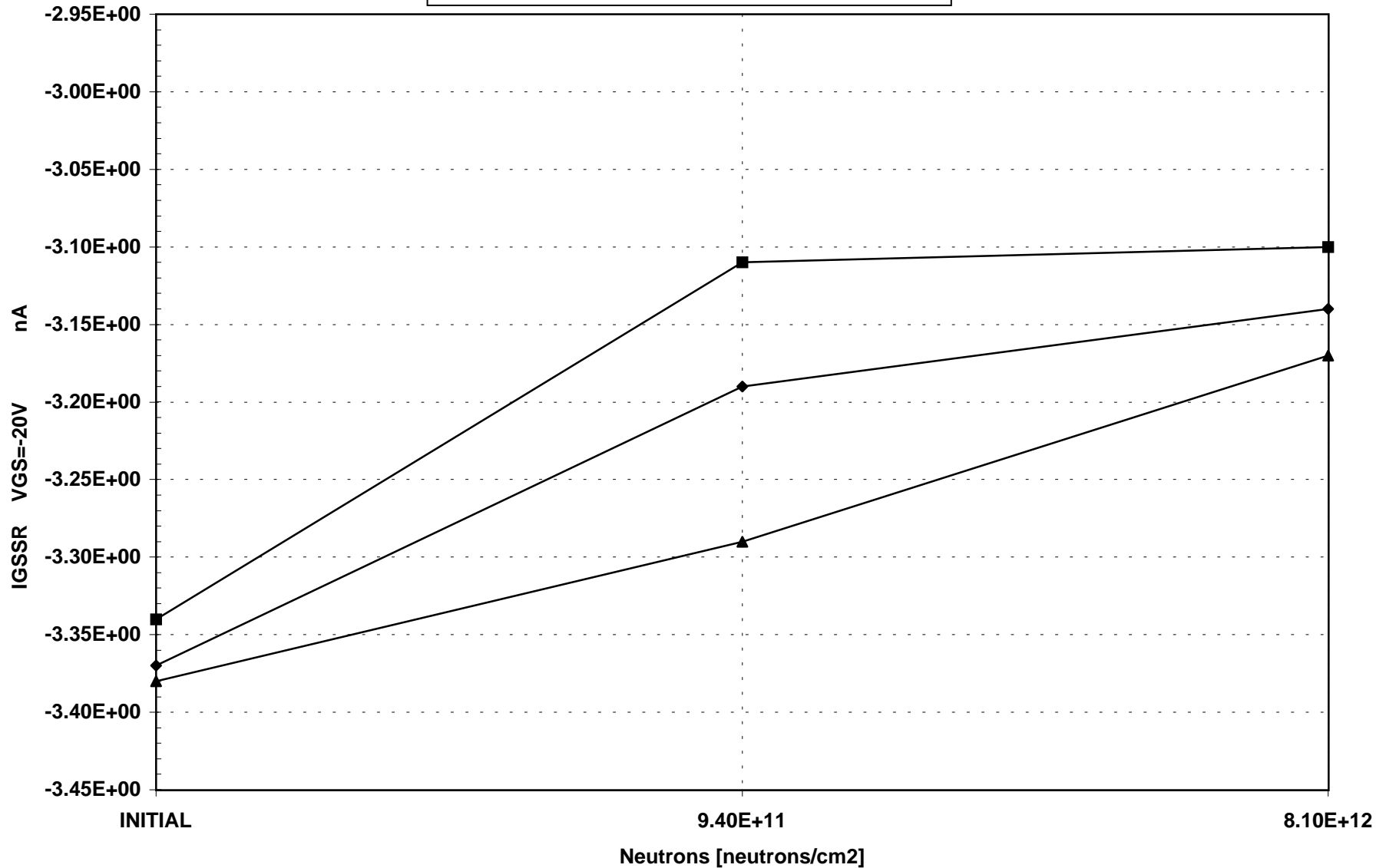


▲ MINIMUM ◆ MEAN ■ MAXIMUM

IRH57260SE N-CHANNEL POWER MOSFET (IRC)

I C S Radiation Test Results Log # 971 06/26/01

IGSSR VGS=-20V nA

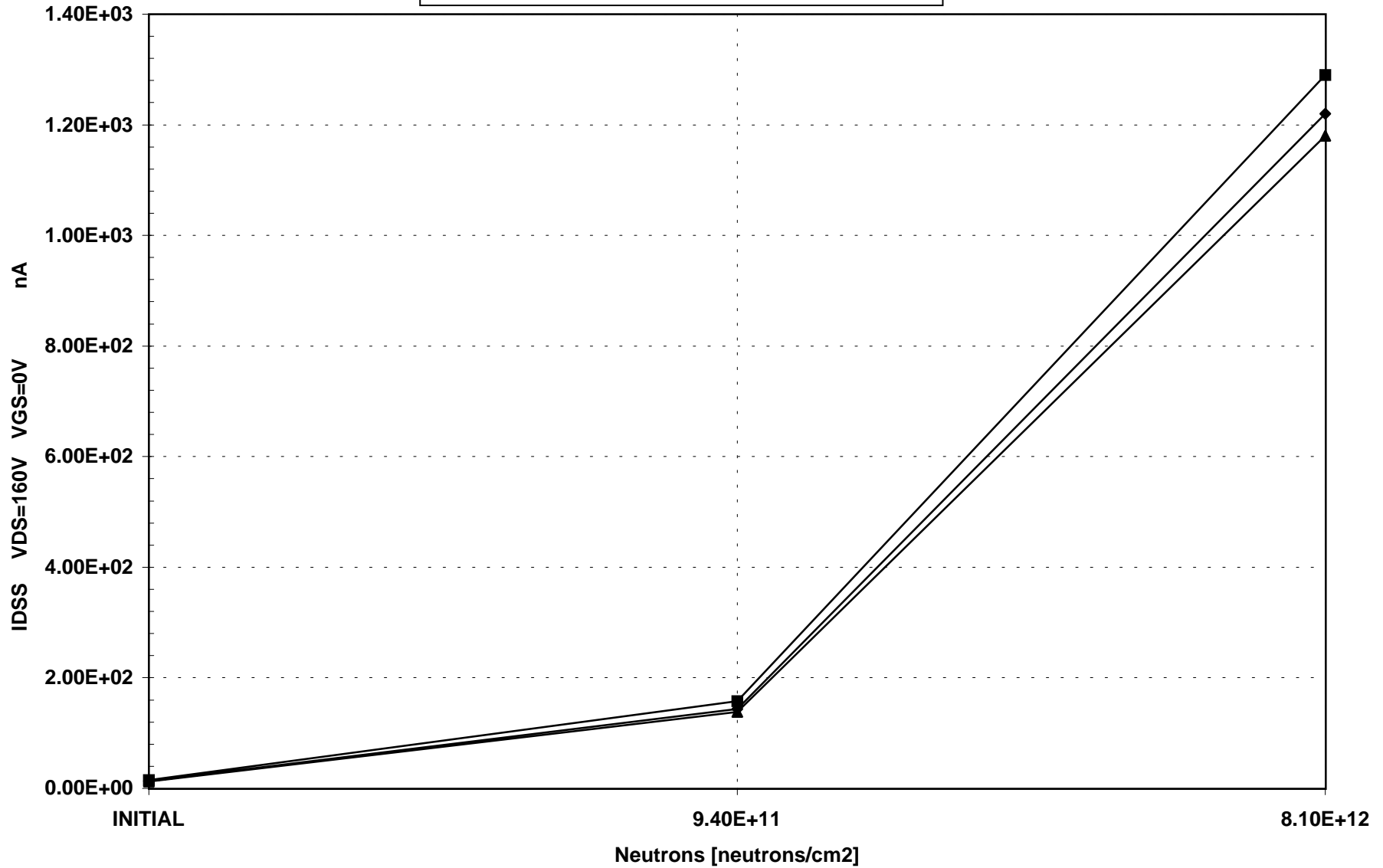


▲ MINIMUM ◆ MEAN ■ MAXIMUM

IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IC S Radiation Test Results Log # 971 06/26/01

IDSS VDS=160V VGS=0V nA

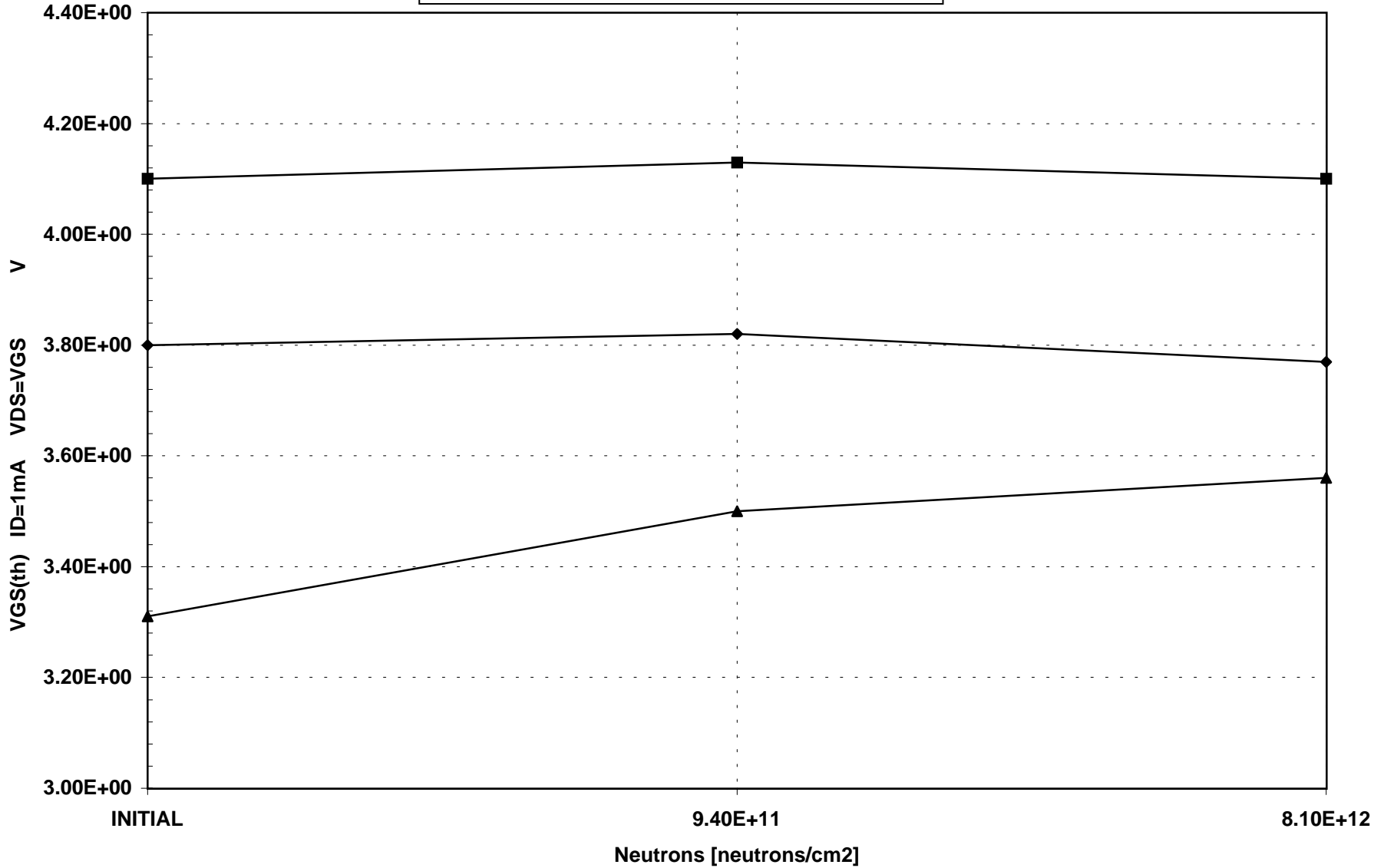


▲ MINIMUM ◆ MEAN ■ MAXIMUM

IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IC S Radiation Test Results Log # 971 06/26/01

VGS(th) ID=1mA VDS=VGS V

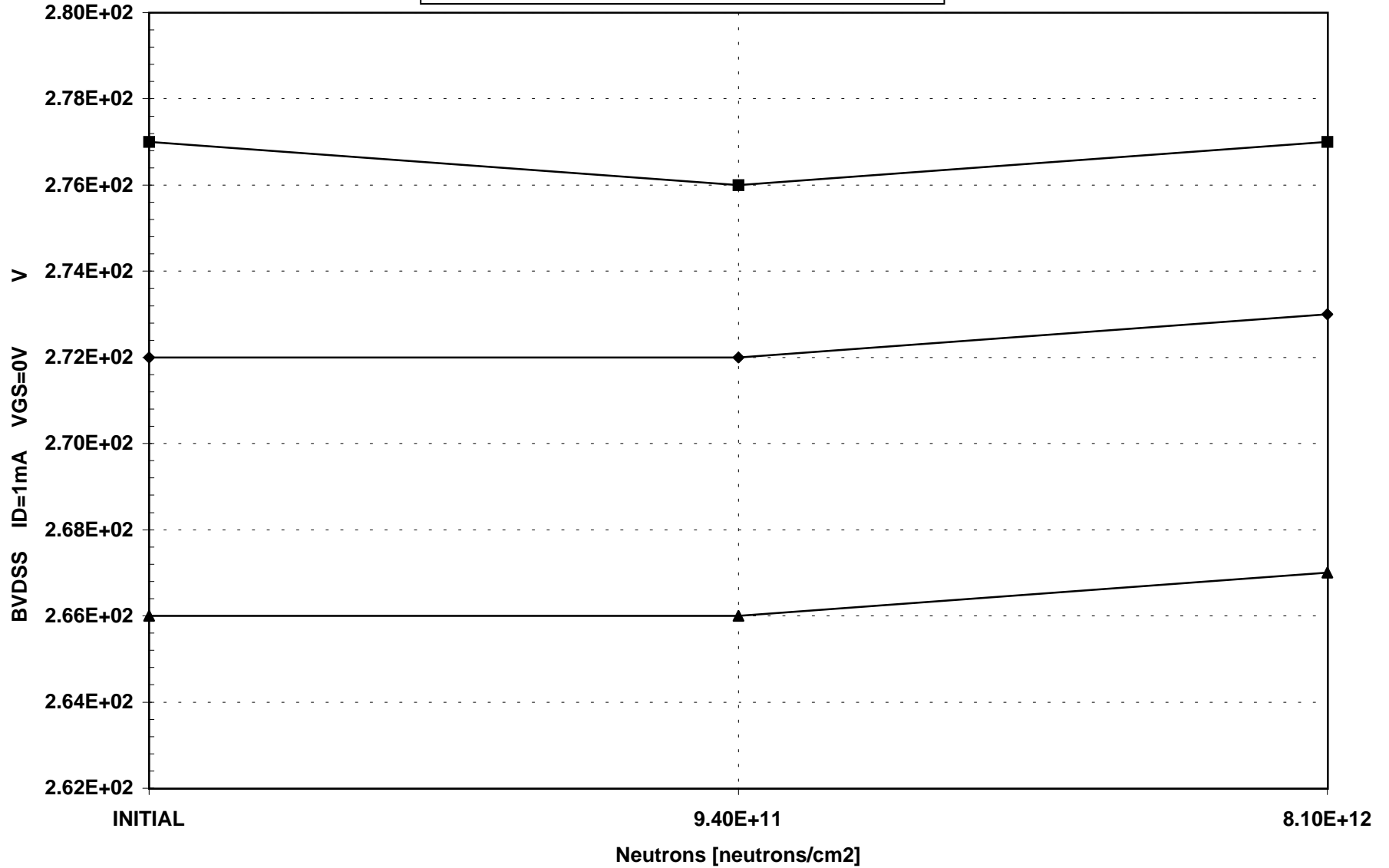


▲ MINIMUM ◆ MEAN ■ MAXIMUM

IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IC S Radiation Test Results Log # 971 06/26/01

BVDSS	ID=1mA	VGS=0V	V
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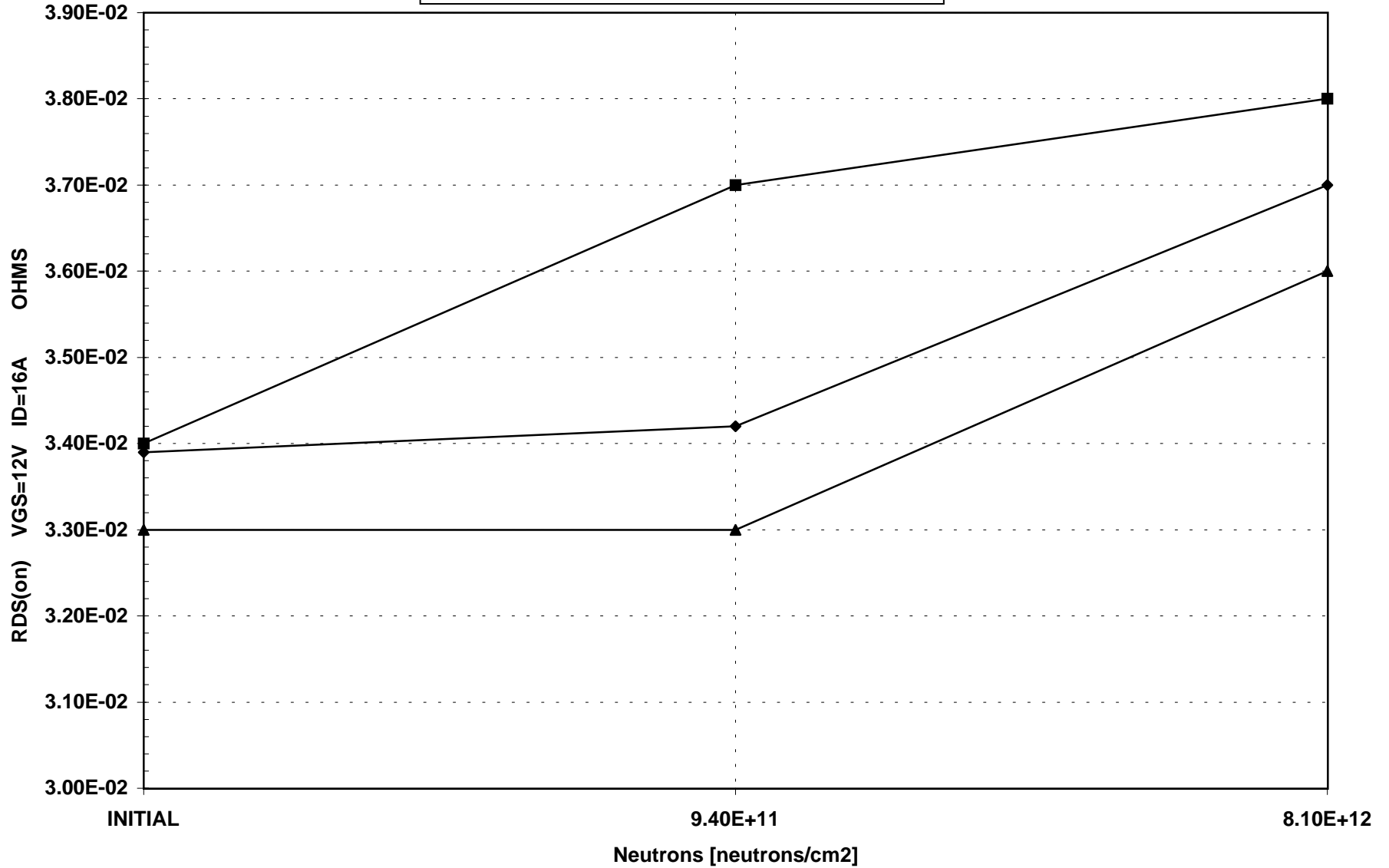


▲ MINIMUM	◆ MEAN	■ MAXIMUM
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IRH57260SE N-CHANNEL POWER MOSFET (IRC)

IC S Radiation Test Results Log # 971 06/26/01

RDS(on) VGS=12V ID=16A OHMS



▲ MINIMUM ◆ MEAN ■ MAXIMUM

June 22, 2001

RADIATION TEST PROCEDURE

No. 385

Device Type: IRH 57260SE N-Channel Power MOSFET
 Manufacturer: International Rectifier Corp.
 Lot No: ER13577 Date Code: Circ. 2001
 Package Type: TO-3 Can
 No. of Devices Supplied: 10
 No. of Devices to be tested: 9 + 1 Control

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RADIATION CONDITIONS: MIL STD 750D, Test Method 1017

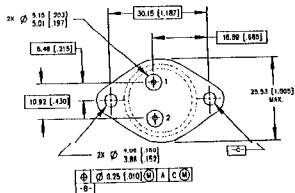
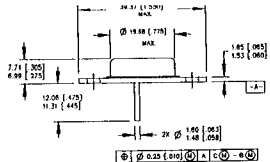
Facility: TRIGA Reactor Energy: 1 MeV Equivalent

Neutrons/cm ²	1E12	1E13
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BIAS CONDITIONS DURING IRRADIATION: All leads grounded.

Pin No. Name

- 1 SOURCE
- 2 GATE
- 3 DRAIN (Case)



RADIATION TEST PROCEDURE

No. 385

Device Type: IRH 57260SE N-Channel Power MOSFET

Electrical Parameter Measurement Conditions*

TEST NUMBER	TEST NAME	TEST CONDITIONS	LIMIT/UNITS
1	IGSSF	VGS=20 V	100 nA
2	IGSSR	VGS=-20 V	-100 nA
3	IDSS	VDS=160 V VGS=0 V	10 μ A
4	VGSTH	ID=1mA VDS=VGS	2.5 to 4.5 V
5	BVDSS	ID=1 mA	200 V
6	RDSON	VGS=12 V ID=20 A*	0.044 Ω

*Pulsed: Pulse width \leq 300 μ s; Duty Cycle \leq 2%.

*Measurements shall be made using a Tektronix 370 Curve Tracer at room ambient temperature.