

REVISIONS

LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
A	Add vendor CAGE F8859. Add case outline Y. Add device type 02. Add section 1.5, radiation features. Make changes to table III, delta limits. Update the boilerplate to add radiation hardness assurance requirements, to remove classes B and S criteria, and to reflect the changes in accordance with MIL-PRF-38535 requirements. Editorial changes throughout. – jak	04-05-24	Thomas M. Hess
B	Update radiation features in section 1.5. Add SEP test table IB and paragraph 4.4.4.2. – jak.	11-05-02	David J. Corbett

REV																				
SHEET																				
REV	B	B	B	B	B	B	B	B												
SHEET	15	16	17	18	19	20	21	22												
REV STATUS OF SHEETS	REV			B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B	B
	SHEET			1	2	3	4	5	6	7	8	9	10	11	12	13	14			
PMIC N/A	PREPARED BY Wanda L. Meadows								<p align="center">DLA LAND AND MARITIME COLUMBUS, OHIO 43218-3990 http://www.dsccl.dla.mil</p> <p>MICROCIRCUIT, DIGITAL, ADVANCED CMOS, 16-BIT BUS DRIVER WITH THREE- STATE OUTPUTS, TTL COMPATIBLE INPUTS, MONOLITHIC SILICON</p>											
<p align="center">STANDARD MICROCIRCUIT DRAWING</p> <p align="center">THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE</p> <p align="center">AMSC N/A</p>	CHECKED BY Thomas J. Ricciuti																			
	APPROVED BY Monica L. Poelking																			
	DRAWING APPROVAL DATE 93-02-23																			
	REVISION LEVEL B								SIZE A	CAGE CODE 67268	5962-92022									
												SHEET 1 OF 22								

1.3 Absolute maximum ratings. 1/ 2/

Supply voltage range (V_{CC})	-0.5 V dc to +7.0 V dc
Input voltage range (V_{IN})	-0.5 V dc to $V_{CC} + 0.5$ V dc
Output voltage range (V_{OUT})	-0.5 V dc to $V_{CC} + 0.5$ V dc
Input clamp current (I_{IK}) ($V_{IN} < 0$ V, $V_{IN} > V_{CC}$)	± 20 mA
DC output diode current (I_{OK}) ($V_{OUT} < 0$ V, $V_{OUT} > V_{CC}$)	± 50 mA
DC output current (I_{OUT}) ($V_{OUT} = 0$ to V_{CC}) (per output pin)	± 50 mA
DC V_{CC} or GND current (I_{CC} , I_{GND})	± 400 mA 3/
Storage temperature range (T_{STG})	-65°C to +150°C
Maximum power dissipation (P_D)	500 mW
Lead temperature (soldering, 10 seconds)	+260°C
Thermal resistance, junction-to-case (θ_{JC}):	
Case outline X	See MIL-STD-1835
Case outline Y	22°C/W
Junction temperature (T_J)	+175° C
Case operating temperature range (T_C)	-55°C to +125°C

1.4 Recommended operating conditions. 2/ 4/ 5/

Supply voltage range (V_{CC})	+4.5 V dc to +5.5 V dc
Input voltage range (V_{IN})	+0.0 V dc to V_{CC}
Output voltage range (V_{OUT})	+0.0 V dc to V_{CC}
Maximum low level input voltage (V_{IL})	0.8 V dc
Minimum high level input voltage (V_{IH})	2.0 V dc
Case operating temperature range (T_C)	-55°C to +125°C
Input rise and fall rate (t_r , t_f) maximum: (10% to 90% of V_{IN} , 90% to 10% of V_{IN})	10ns/V
Maximum high level output current (I_{OH})	-24 mA
Maximum low level output current (I_{OL})	+24 mA

1.5 Radiation features.

Device type 02:

Maximum total dose available (dose rate = 50 – 300 rads(Si)/s)	300 krad(Si)
Single event phenomenon (SEP):	
effective LET, no SEL (see 4.4.4.2)	≤ 93 MeV-cm ² /mg 6/
effective LET, no SEU (see 4.4.4.2)	≤ 93 MeV-cm ² /mg 6/

- 1/ Stresses above the absolute maximum rating may cause permanent damage to the device. Extended operation at the maximum levels may degrade performance and affect reliability. The maximum junction temperature may be exceeded for allowable short duration burn-in screening conditions in accordance with 5004 of MIL-STD-883.
- 2/ Unless otherwise noted, all voltages are referenced to GND.
- 3/ For packages with multiple V_{CC} and GND pins, this value represents the maximum total current flowing into or out of all V_{CC} and GND pins.
- 4/ Unless otherwise specified, the limits for parameters listed herein shall apply over the full V_{CC} and T_C recommended operating range.
- 5/ Unused or floating inputs should be held high or low.
- 6/ These limits were obtained during technology characterization and qualification, and are guaranteed by design or process, but not production tested unless specified by the customer through the purchase order or contract.

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2. APPLICABLE DOCUMENTS

2.1 Government specification, standards, and handbooks. The following specification, standards, and handbooks form a part of this drawing to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

DEPARTMENT OF DEFENSE SPECIFICATION

MIL-PRF-38535 - Integrated Circuits, Manufacturing, General Specification for.

DEPARTMENT OF DEFENSE STANDARDS

MIL-STD-883 - Test Method Standard Microcircuits.
 MIL-STD-1835 - Interface Standard Electronic Component Case Outlines.

DEPARTMENT OF DEFENSE HANDBOOKS

MIL-HDBK-103 - List of Standard Microcircuit Drawings.
 MIL-HDBK-780 - Standard Microcircuit Drawings.

(Copies of these documents are available online at <https://assist.daps.dla.mil/quicksearch/> or from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

2.2 Non-Government publications. The following document(s) form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those cited in the solicitation or contract.

JEDEC – SOLID STATE TECHNOLOGY ASSOCIATION (JEDEC)

JESD-20 - Standard for Description of 54/74ACXXXX and 54/74ACTXXXX Advanced High-Speed CMOS Devices.

(Copies of these documents are available online at <http://www.jedec.org> or from JEDEC – Solid State Technology Association, 3103 North 10th Street, Suite 240–S, Arlington, VA 22201.)

ASTM INTERNATIONAL (ASTM)

ASTM F1192 - Standard Guide for the Measurement of Single Event Phenomena (SEP) Induced by Heavy Ion Irradiation of Semiconductor Devices.

(Copies of this document is available online at <http://www.astm.org/> or from ASTM International, P. O. Box C700, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959).

(Non-Government standards and other publications are normally available from the organizations that prepare or distribute the documents. These documents may also be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this drawing and the references cited herein, the text of this drawing takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements for device classes Q and V shall be in accordance with MIL-PRF-38535 and as specified herein or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. The individual item requirements for device class M shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein.

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3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein for device classes Q and V or MIL-PRF-38535, appendix A and herein for device class M.

3.2.1 Case outlines. The case outlines shall be in accordance with 1.2.4 herein and on figure 1.

3.2.2 Terminal connections. The terminal connections shall be as specified on figure 2.

3.2.3 Truth table. The truth table shall be as specified on figure 3.

3.2.4 Logic diagram. The logic diagram shall be as specified on figure 4.

3.2.5 Ground bounce waveforms and test circuit. The ground bounce waveforms and test circuit shall be as specified on figure 5.

3.2.6 Switching waveforms and test circuit. The switching waveforms and test circuit shall be as specified on figure 6.

3.2.7 Radiation exposure circuit. The radiation exposure circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request.

3.3 Electrical performance characteristics and postirradiation parameter limits. Unless otherwise specified herein, the electrical performance characteristics and postirradiation parameter limits are as specified in table IA and shall apply over the full case operating temperature range.

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table IIA. The electrical tests for each subgroup are defined in table IA.

3.5 Marking. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked. For packages where marking of the entire SMD PIN number is not feasible due to space limitations, the manufacturer has the option of not marking the "5962-" on the device. For RHA product using this option, the RHA designator shall still be marked. Marking for device classes Q and V shall be in accordance with MIL-PRF-38535. Marking for device class M shall be in accordance with MIL-PRF-38535, appendix A.

3.5.1 Certification/compliance mark. The certification mark for device classes Q and V shall be a "QML" or "Q" as required in MIL-PRF-38535. The compliance mark for device class M shall be a "C" as required in MIL-PRF-38535, appendix A.

3.6 Certificate of compliance. For device classes Q and V, a certificate of compliance shall be required from a QML-38535 listed manufacturer in order to supply to the requirements of this drawing (see 6.6.1 herein). For device class M, a certificate of compliance shall be required from a manufacturer in order to be listed as an approved source of supply in MIL-HDBK-103 (see 6.6.2 herein). The certificate of compliance submitted to DLA Land and Maritime-VA prior to listing as an approved source of supply for this drawing shall affirm that the manufacturer's product meets, for device classes Q and V, the requirements of MIL-PRF-38535 and herein or for device class M, the requirements of MIL-PRF-38535, appendix A and herein.

3.7 Certificate of conformance. A certificate of conformance as required for device classes Q and V in MIL-PRF-38535 or for device class M in MIL-PRF-38535, appendix A shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change for device class M. For device class M notification to DLA Land and Maritime -VA of change of product (see 6.2 herein) involving devices acquired to this drawing is required for any change that affects this drawing.

3.9 Verification and review for device class M. For device class M, DLA Land and Maritime, DLA Land and Maritime 's agent, and the acquiring activity retain the option to review the manufacturer's facility and applicable required documentation. Offshore documentation shall be made available onshore at the option of the reviewer.

3.10 Microcircuit group assignment for device class M. Device class M devices covered by this drawing shall be in microcircuit group number 37 (see MIL-PRF-38535, appendix A).

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TABLE IA. Electrical performance characteristics.

Test and MIL-STD-883 test method <u>1/</u>	Symbol	Test conditions <u>2/ 3/</u> -55°C ≤ T _C ≤ +125°C +4.5 V ≤ V _{CC} ≤ +5.5 V unless otherwise specified	Device type and <u>4/</u> device class	V _{CC}	Group A subgroups	Limits <u>5/</u>		Unit
						Min	Max	
Positive input clamp voltage 3022	V _{IC+}	For input under test, I _{IN} = 1.0 mA	All Q, V	GND	1	0.4	1.5	V
Negative input clamp voltage 3022	V _{IC-}	For input under test, I _{IN} = -1.0 mA	All Q, V	Open	1	-0.4	-1.5	V
High level output voltage 3006	V _{OH1}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OH} = -50 μA	All All	4.5 V	1, 2, 3	4.4		V
	V _{OH2}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OH} = -50 μA	All All	5.5 V	1, 2, 3	5.4		
	V _{OH3}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OH} = -24 mA	01 All	4.5 V	1	3.94		
					2, 3	3.7		
	V _{OH4}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OH} = -24 mA	02 All	5.5 V	1, 2, 3	3.7		
					1	4.94		
V _{OH5} <u>6/</u>	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OH} = -50 mA	01 All	5.5 V	2, 3	4.7			
				1, 2, 3	4.7			
Low level output voltage 3007	V _{OL1}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OL} = 50 μA	All All	4.5 V	1, 2, 3		0.1	V
	V _{OL2}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OL} = 50 μA	All All	5.5 V	1, 2, 3		0.1	

See footnotes at end of table.

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TABLE IA. Electrical performance characteristics - Continued.

Test and MIL-STD-883 test method <u>1/</u>	Symbol	Test conditions <u>2/ 3/</u> -55°C ≤ T _C ≤ +125°C +4.5 V ≤ V _{CC} ≤ +5.5 V unless otherwise specified	Device type and <u>4/</u> device class	V _{CC}	Group A subgroups	Limits <u>5/</u>		Unit	
						Min	Max		
Low level output voltage 3007	V _{OL3}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OL} = 24 mA	All Q, V	4.5 V	1, 3		0.36	V	
					2		0.50		
			All M		1		0.36		
					2, 3		0.50		
	V _{OL4}	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OL} = 24 mA	All Q, V	5.5 V	1, 3		0.36		
					2		0.50		
			All M		1		0.36		
					2, 3		0.50		
	V _{OL5} <u>6/</u>	For all inputs affecting output under test, V _{IN} = V _{IH} = 2.0 V or V _{IL} = 0.8 V For all other inputs, V _{IN} = V _{CC} or GND I _{OL} = 50 mA	All All	5.5 V	1, 2, 3		1.65		
Three-state output leakage current high 3021	I _{OZH}	mG = V _{IH} or V _{IL} V _{IH} = 2.0 V V _{IL} = 0.8 V For all other inputs V _{IN} = V _{CC} or GND V _{OUT} = 5.5 V	All Q, V	5.5 V	1		0.5	μA	
					2		10.0		
			All M		1		0.5		
					2, 3		10.0		
			M, D, P, L, R, F		02 Q, V	1			10.0
Three-state output leakage current low 3020	I _{OZL}	mG = V _{IH} or V _{IL} V _{IH} = 2.0 V V _{IL} = 0.8 V For all other inputs V _{IN} = V _{CC} or GND V _{OUT} = GND	All Q, V	5.5 V	1		-0.5	μA	
					2		-10.0		
			All M		1		-0.5		
					2, 3		-10.0		
			M, D, P, L, R, F		02 Q, V	1			-10.0
Input current high 3010	I _{IH}	For input under test V _{IN} = V _{CC} For all other inputs V _{IN} = V _{CC} or GND	All Q, V	5.5 V	1		0.1	μA	
					2		1.0		
			All M		1		0.1		
					2, 3		1.0		
Input current low 3009	I _{IL}	For input under test V _{IN} = GND For all other inputs V _{IN} = V _{CC} or GND	All Q, V	5.5 V	1		-0.1	μA	
					2		-1.0		
			All M		1		-0.1		
					2, 3		-1.0		
Input capacitance 3012	C _{IN}	See 4.4.1c T _C = +25°C	All All	GND	4		9.0	pF	
Output capacitance 3012	C _{OUT}	See 4.4.1c T _C = +25°C	All All	5.0 V	4		27.0	pF	
Power dissipation capacitance per buffer/driver	C _{PD} <u>7/</u>	See 4.4.1c, T _C = +25°C f = 1 MHz C _L = 50 pF Any one mA _n input switching	Outputs enabled	01 All	5.0 V	4		48.75	pF
			Outputs disabled	01 All	5.0 V	4		13.75	
				02 All	5.0 V	4		48.75	pF

See footnotes at end of table.

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TABLE IA. Electrical performance characteristics - Continued.

Test and MIL-STD-883 test method <u>1/</u>	Symbol	Test conditions <u>2/ 3/</u> -55°C ≤ T _C ≤ +125°C +4.5 V ≤ V _{CC} ≤ +5.5 V unless otherwise specified	Device type and <u>4/</u> device class	V _{CC}	Group A subgroups	Limits <u>5/</u>		Unit	
						Min	Max		
Quiescent supply current delta, TTL input levels 3005	ΔI_{CC} <u>8/</u>	For input under test, V _{IN} = V _{CC} - 2.1 V For all other inputs, V _{IN} = V _{CC} or GND	01 Q, V	5.5 V	3		0.9	mA	
					1, 2		1.0		
			01 M		1		0.9		
						2, 3		1.0	
			02 All	5.5 V	1, 2, 3		1.6		
Quiescent supply current, output high 3005	I _{CCH}	mG = GND For all inputs, V _{IN} = V _{CC} or GND	01 Q, V	5.5 V	1		2.0	μA	
					2		40.0		
			02 Q, V	5.5 V	1		4.0	μA	
					2		160.0		
			All M		1		8.0		
					2, 3		160.0		
M, D, P, L, R, F <u>9/</u>	02 Q, V	1		50.0					
Quiescent supply current, output low 3005	I _{CCL}	mG = GND For all inputs, V _{IN} = V _{CC} or GND	01 Q, V	5.5 V	1		2.0	μA	
					2		40.0		
			02 Q, V	5.5 V	1		4.0	μA	
					2		160.0		
			All M		1		8.0		
					2, 3		160.0		
M, D, P, L, R, F <u>9/</u>	02 Q, V	1		50.0					
Quiescent supply current, output three-state 3005	I _{CCZ}	mG = V _{CC} For all inputs, V _{IN} = V _{CC} or GND	01 Q, V	5.5 V	1		2.0	μA	
					2		40.0		
			02 Q, V	5.5 V	1		4.0	μA	
					2		160.0		
			All M		1		8.0		
					2, 3		160.0		
M, D, P, L, R, F <u>9/</u>	02 Q, V	1		50.0					
Low level ground bounce noise	V _{GBL} <u>10/ 11/</u>	V _{LD} = 2.5 V I _{OL} = +24 mA See figure 5	01 Q, V	4.5 V	4		2000	mV	
			02 Q, V				1000		
High level ground bounce noise	V _{GBH} <u>10/ 11/</u>	V _{LD} = 2.5 V I _{OH} = -24 mA See figure 5	01 Q, V	4.5 V	4		2000	mV	
			02 Q, V				800		
Latch-up input/output over-voltage	I _{CC} (O/V1) <u>12/</u>	t _w ≥ 100 μs, t _{cool} ≥ t _w 5 μs ≤ t _r ≤ 5 ms 5 μs ≤ t _f ≤ 5 ms V _{test} = 6.0 V V _{CCQ} = 5.5 V, V _{over} = 10.5 V <u>999</u>	All Q, V	5.5 V	2		200	mA	
Latch-up input/output positive over-current	I _{CC} (O/I1+) <u>12/</u>	t _w ≥ 100 μs, t _{cool} ≥ t _w 5 μs ≤ t _r ≤ 5 ms 5 μs ≤ t _f ≤ 5 ms V _{test} = 6.0 V V _{CCQ} = 5.5 V, I _{trigger} = +120 mA	All Q, V	5.5 V	2		200	mA	

See footnotes at end of table.

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TABLE IA. Electrical performance characteristics - Continued.

Test and ML-STD-883 test method <u>1/</u>	Symbol	Test conditions <u>2/ 3/</u> -55°C ≤ T _C ≤ +125°C +4.5 V ≤ V _{CC} ≤ +5.5 V unless otherwise specified	Device type and <u>4/</u> device class	V _{CC}	Group A subgroups	Limits <u>5/</u>		Unit
						Min	Max	
Latch-up input/output negative over-current	I _{CC} (O/I1-) <u>12/</u>	t _w ≥ 100 μs, t _{cool} ≥ t _w 5 μs ≤ t _r ≤ 5 ms 5 μs ≤ t _f ≤ 5 ms V _{test} = 6.0 V V _{CCQ} = 5.5 V I _{trigger} = -120 mA	All Q, V	5.5 V	2		200	mA
Latch-up supply over-voltage	I _{CC} (O/V2) <u>12/</u>	t _w ≥ 100 μs, t _{cool} ≥ t _w 5 μs ≤ t _r ≤ 5 ms 5 μs ≤ t _f ≤ 5 ms V _{test} = 6.0 V V _{CCQ} = 5.5 V V _{over} = 9.0 V	All Q, V	5.5 V	2		100	mA
Functional tests 3014	<u>13/</u>	V _{IL} = 0.8 V, V _{IH} = 2.0 V Verify output V _{OUT} See 4.4.1d	All	4.5 V	7, 8	L	H	
			All M	5.5 V	7, 8	L	H	
Propagation delay time, mAn to mYn 3003	t _{PLH} <u>14/</u>	C _L = 50 pF minimum R _L = 500Ω See figure 6	01	4.5 V and 5.5 V	9	4.0	8.5	ns
			All		10, 11	3.0	10.3	
			02	4.5 V and 5.5 V <u>15/</u>	9	2.0	8.5	
			All		10, 11	2.0	10.3	
	t _{PHL} <u>14/</u>		01	4.5 V and 5.5 V	9	3.4	8.7	ns
			All		10, 11	3.4	10.1	
			02	4.5 V and 5.5 V <u>15/</u>	9	2.0	8.7	
			All		10, 11	2.0	10.1	
Propagation delay time, output enable, mG to mYn 3003	t _{PZH} <u>14/</u>	t _{PZH} <u>14/</u>	01	4.5 V and 5.5 V	9	3.0	8.1	ns
			All		10, 11	3.0	10.5	
			02	4.5 V and 5.5 V <u>15/</u>	9	2.0	8.1	
			All		10, 11	2.0	10.5	
	t _{PZL} <u>14/</u>		01	4.5 V and 5.5 V	9	3.7	9.3	ns
			All		10, 11	3.7	11.0	
			02	4.5 V and 5.5 V <u>15/</u>	9	2.0	9.3	
			All		10, 11	2.0	12.5	

See footnotes at the end of table.

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TABLE IA. Electrical performance characteristics - Continued.

Test and MIL-STD-883 test method <u>1/</u>	Symbol	Test conditions <u>2/ 3/</u> -55°C ≤ T _C ≤ +125°C +4.5 V ≤ V _{CC} ≤ +5.5 V unless otherwise specified	Device type and <u>4/</u> device class	V _{CC}	Group A subgroups	Limits <u>5/</u>		Unit
						Min	Max	
Propagation delay time, output disable, mG to mYn 3003	t _{PHZ} <u>14/</u>	C _L = 50 pF minimum R _L = 500Ω See figure 6	01 All	4.5 V and 5.5 V	9	5.4	11.5	ns
					10, 11	5.4	13.0	
	02 All		4.5 V and 5.5 V <u>15/</u>	9	2.0	11.5	ns	
				10, 11	2.0	13.0		
t _{PLZ} <u>14/</u>		01 All	4.5 V and 5.5 V	9	5.0	9.5	ns	
				10, 11	5.0	10.9		
	02 All	4.5 V and 5.5 V <u>15/</u>	9	2.0	9.5	ns		
			10, 11	2.0	10.9			

- 1/ For tests not listed in the referenced MIL-STD-883 (e.g. ΔI_{CC}), utilize the general test procedure under the conditions listed herein. All inputs and outputs shall be tested, as applicable, to the tests in table IA herein.
- 2/ Each input/output, as applicable, shall be tested at the specified temperature, for the specified limits. Output terminals not designated shall be high level logic, low level logic, or open, except as follows:
- V_{IC} (pos) tests, the GND terminal can be open. T_C = +25°C.
 - V_{IC} (neg) tests, the V_{CC} terminal shall be open. T_C = +25°C.
 - All I_{CC} and ΔI_{CC} tests, the output terminal shall be open. When performing these tests, the current meter shall be placed in the circuit such that all current flows through the meter.
- 3/ RHA parts for device type 02 meet all levels M, D, P, L, R, and F of irradiation. However, these parts are only tested at the "F" level. Pre and post irradiation values are identical unless otherwise specified in table IA. When performing post irradiation electrical measurements for any RHA level, T_A = 25°C.
- 4/ The word "All" in the device type and device class column, means limits for all device types and classes.
- 5/ For negative and positive voltage and current values, the sign designates the potential difference in reference to GND and the direction of current flow, respectively; and the absolute value of the magnitude, not the sign, is relative to the minimum and maximum limits, as applicable, listed herein.
- 6/ Transmission driving tests are performed at V_{CC} = 5.5 V with a 10 ms duration maximum. This test may be performed using V_{IN} = V_{CC} or GND. When V_{IN} = V_{CC} or GND is used, the test is guaranteed for V_{IN} = 2.0 V or 0.8 V. For device class M, values for subgroup 1 shall be guaranteed, if not tested, to the limits specified in table IA.
- 7/ Power dissipation capacitance (C_{PD}) determines the no load power consumption, P_D = (C_{PD} + C_L) (V_{CC} × V_{CC}) f + (I_{CC} × V_{CC}) + (n × d × ΔI_{CC} × V_{CC}) and the dynamic current consumption, I_S = (C_{PD} + C_L) V_{CC} f + I_{CC} + (n × d × ΔI_{CC}). For both P_D and I_S, n is the number of device inputs at TTL levels; f is the frequency of the input signal; and d is the duty cycle of the input signal.
- 8/ This is the increase in supply current for each input that is at one of the specified TTL voltage levels rather 0 V to V_{CC}. This test may be performed either one input at a time (preferred method) or with all input pins simultaneously at V_{IN} = V_{CC} - 2.1 V (alternate method). Classes Q and V shall use the preferred method. When the test is performed using the alternate method, the maximum limit is equal to the number of inputs at a high TTL input level times ΔI_{CC} max, and the preferred method and limits are guaranteed.
- 9/ The maximum limit for this parameter at 100 krad/s (Si) is 4 μA.

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TABLE IA. Electrical performance characteristics - Continued.

- 10/ This test is for qualification only. Ground bounce tests are performed on a nonswitching (quiescent) output and are used to measure the magnitude of induced noise caused by other simultaneously switching outputs. The test is performed on a low noise bench test fixture with all outputs fully dc loaded (I_{OL} maximum and I_{OH} maximum = ± 24 mA, for example) and 50 pF of load capacitance (see figure 5). The loads must be located as close as possible to the device output. Inputs are then conditioned with 1 MHz pulse ($t_r = t_f = 3.5 \pm 1.5$ ns) switching simultaneously and in phase such that one output is forced low and all others (possible) are switched. The low level ground bounce noise is measured at the quiet output using a F.E.T. oscilloscope probe with at least 1 M Ω impedance. Measurement is taken from the peak of the largest positive pulse with respect to the nominal low level output voltage (see figure 5). The device inputs are then conditioned such that the output under test is at a high nominal V_{OH} level. The high level ground bounce measurement is then measured from nominal V_{OH} level to the largest negative peak. This procedure is repeated such that all outputs are tested at a high and low level with a maximum number of outputs switching.
- 11/ When used in asynchronous TTL compatible systems, ground bounce (V_{GBL} and V_{GBH}) = 2000 mV can be a possible problem.
- 12/ See EIA/JEDEC STD. 78 for electrically induced latch-up test methods and procedures. The values listed for $I_{trigger}$ and V_{over} are to be accurate within ± 5 percent (see 4.4.1b).
- 13/ Tests shall be performed in sequence, attributes data only. Functional tests shall include the truth table and other logic patterns used for fault detection. Functional tests shall be performed in sequence as approved by the qualifying activity on qualified devices. Allowable tolerances in accordance with MIL-STD-883 for the input voltage levels may be incorporated. For outputs, $H \geq 2.5$ V, $L < 2.5$ V. For functional testing, the outputs shall have, at a minimum, the same loading conditions as the ac tests (see figure 6).
- 14/ For propagation delay tests, all paths must be tested.
- 15/ The AC parameter at $V_{CC} = 5.5$ V shall be guaranteed, if not tested, to the limits specified in table I.

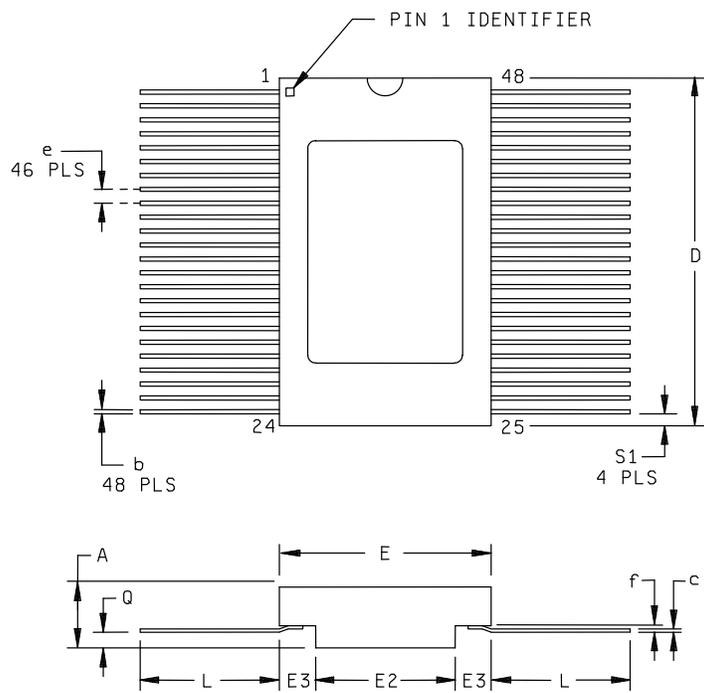
TABLE IB. SEP test limits. 1/ 2/

Device type	$V_{CC} = 4.5$ V <u>3/</u>	Bias for latch-up test $V_{CC} = 5.5$ V no latch-up LET = <u>4/</u> <u>5/</u> [MeV/(mg/cm ²)]
	Effective LET no upsets [MeV/(mg/cm ²)]	
01	LET \leq 93 <u>6/</u>	\leq 93

- 1/ For SEP test conditions, see 4.4.4.2 herein.
- 2/ Technology characterization and model verification supplemented by in-line data may be used in lieu of end-of-line testing. Test plan must be approved by TRB and qualifying activity.
- 3/ Tested for upsets at operating temperature, $T_A = +25^\circ\text{C} \pm 10^\circ\text{C}$.
- 4/ Tested at operating temperature, $T_A = +125^\circ\text{C} \pm 10^\circ\text{C}$ for latch-up.
- 5/ Tested to a LET of ≤ 93 MeV/(mg/cm²) with no latch-up (SEL).
- 6/ Tested to a LET of ≤ 93 MeV/(mg/cm²) with no single event upsets (SEU).

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Case outline Y



Dimensions				
Symbol	Inches		Millimeters	
	Min	Max	Min	Max
A	.086	.107	2.18	2.72
b	.008	.012	0.20	0.30
c	.005	.007	0.12	0.18
D	.613	.627	15.57	15.92
E	.375	.385	9.52	9.78
E2	.245	.255	6.22	6.48
E3	.060	.070	1.52	1.78
f	.008 BSC		0.20 BSC	
e	.025 BSC		0.635 BSC	
L	.270	.370	6.85	9.40
Q	.026	.036	0.66	0.92
S1	.010	.024	0.25	0.61
N	48		48	

FIGURE 1. Case outline.

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Device types	01, 02		
Case outlines	X, Y		
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	$\overline{1G}$	25	$\overline{3G}$
2	1Y1	26	4A4
3	1Y2	27	4A3
4	GND	28	GND
5	1Y3	29	4A2
6	1Y4	30	4A1
7	V _{CC}	31	V _{CC}
8	2Y1	32	3A4
9	2Y2	33	3A3
10	GND	34	GND
11	2Y3	35	3A2
12	2Y4	36	3A1
13	3Y1	37	2A4
14	3Y2	38	2A3
15	GND	39	GND
16	3Y3	40	2A2
17	3Y4	41	2A1
18	V _{CC}	42	V _{CC}
19	4Y1	43	1A4
20	4Y2	44	1A3
21	GND	45	GND
22	4Y3	46	1A2
23	$\overline{4Y4}$	47	$\overline{1A1}$
24	4G	48	2G

Terminal symbol description	
Terminal Symbol	Description
mAn (m = 1 to 4, n = 1 to 4)	Data inputs
\overline{mG} (m = 1 to 4)	Output enable control inputs
mYn (m = 1 to 4, n = 1 to 4)	Outputs (non-inverting)

FIGURE 2. Terminal connections.

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Inputs		Output
\overline{mG}	mAn	mYn
L	H	H
L	L	L
H	X	Z

H = High voltage level
L = Low voltage level
X = Irrelevant
Z = High impedance

FIGURE 3. Truth table.

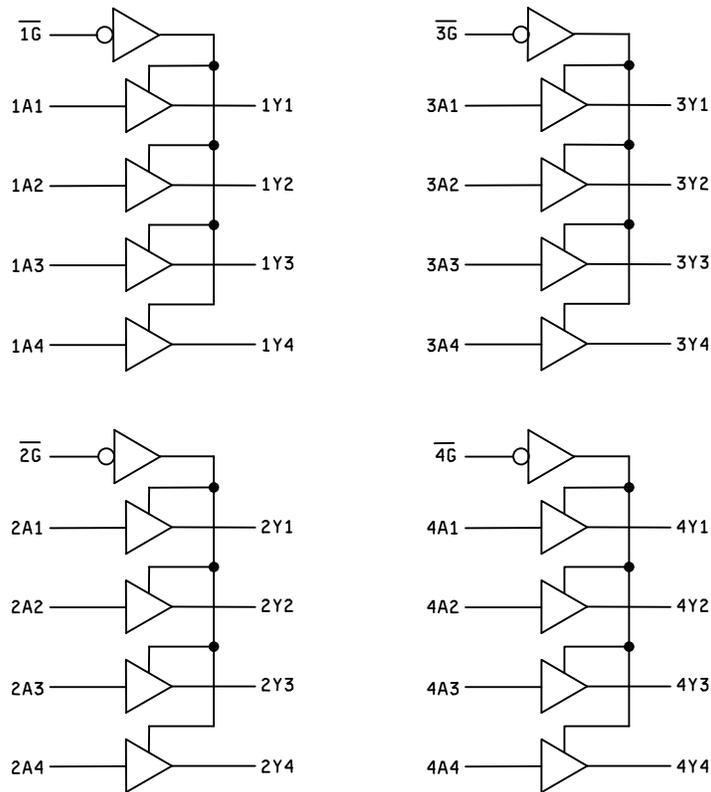


FIGURE 4. Logic diagram.

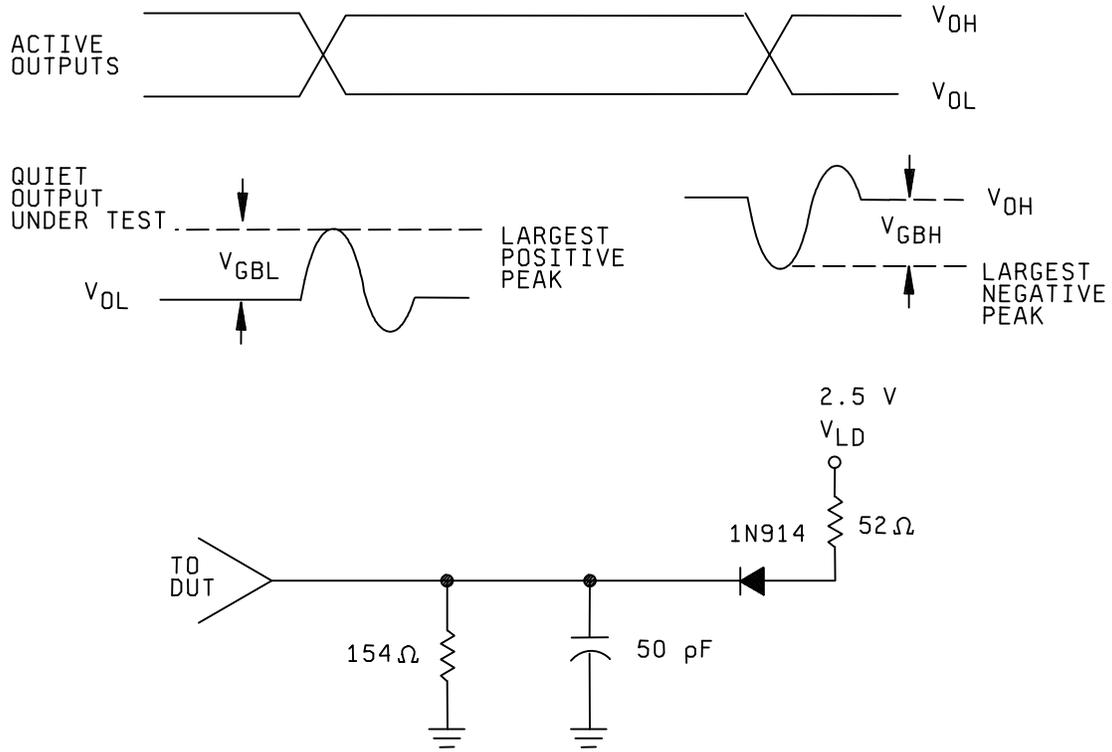
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NOTE: Resistor and capacitor tolerances = $\pm 10\%$.

FIGURE 5. Ground bounce waveforms and test circuit.

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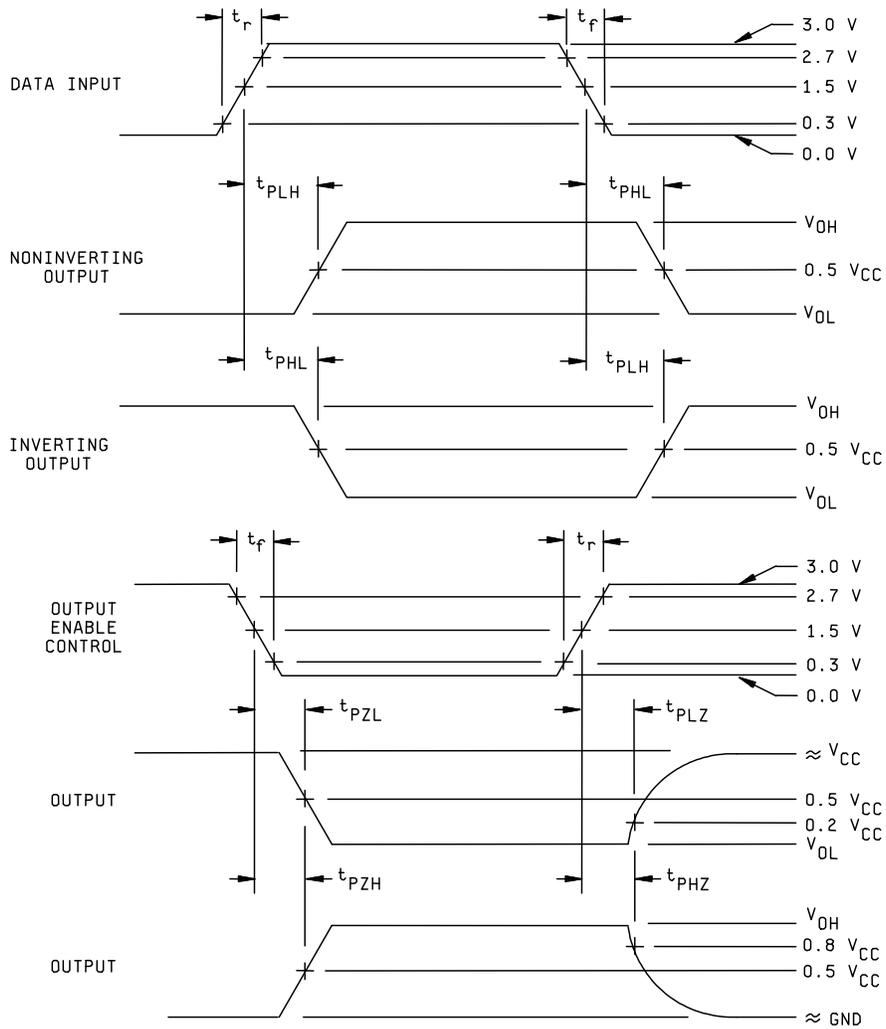


FIGURE 6. Switching waveforms and test circuit .

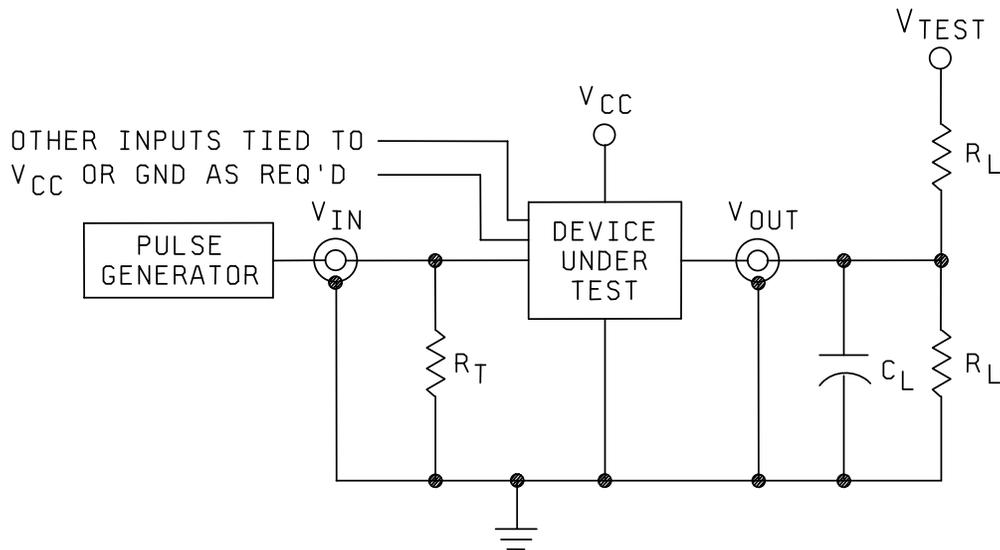
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NOTES:

1. When measuring t_{PHZ} and t_{PZH} : $V_{TEST} = GND$.
2. When measuring t_{PLZ} and t_{PZL} : $V_{TEST} = 2 \times V_{CC}$.
3. When measuring t_{PLH} and t_{PHL} : $V_{TEST} = \text{open}$.
4. The t_{PZL} and t_{PLZ} reference waveform is for the output under test with internal conditions such that the output is low at V_{OL} except when disabled by the output enable control. The t_{PZH} and t_{PHZ} reference waveform is for the output under test with internal conditions such that the output is high at V_{OH} except when disabled by the output enable control.
5. $C_L = 50 \text{ pF}$ minimum or equivalent (includes test jig and probe capacitance).
6. $R_T = 50\Omega$ or equivalent. $R_L = 500\Omega$ or equivalent.
7. Input signal from pulse generator: $V_{IN} = 0.0 \text{ V}$ to 3.0 V ; $PRR \leq 10 \text{ MHz}$; $t_r \leq 3 \text{ ns}$; $t_f \leq 3 \text{ ns}$; duty cycle = 50 percent.
8. Timing parameters shall be tested at a minimum input frequency of 1 MHz.
9. Outputs are measured one at a time with one output per measurement.

FIGURE 6. Switching waveforms and test circuit - Continued.

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4. VERIFICATION

4.1 Sampling and inspection. For device classes Q and V, sampling and inspection procedures shall be in accordance with MIL-PRF-38535 or as modified in the device manufacturer's Quality Management (QM) plan. The modification in the QM plan shall not affect the form, fit, or function as described herein. For device class M, sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 Screening. For device classes Q and V, screening shall be in accordance with MIL-PRF-38535, and shall be conducted on all devices prior to qualification and technology conformance inspection. For device class M, screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection.

4.2.1 Additional criteria for device class M.

- a. Burn-in test, method 1015 of MIL-STD-883.
 - (1) Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.
 - (2) $T_A = +125^{\circ}\text{C}$, minimum.
- b. Interim and final electrical test parameters shall be as specified in table IIA herein.

4.2.2 Additional criteria for device classes Q and V.

- a. The burn-in test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The burn-in test circuit shall be maintained under document revision level control of the device manufacturer's Technology Review Board (TRB) in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1015 of MIL-STD-883.
- b. Interim and final electrical test parameters shall be as specified in table IIA herein.
- c. Additional screening for device class V beyond the requirements of device class Q shall be as specified in MIL-PRF-38535, appendix B.

4.3 Qualification inspection for device classes Q and V. Qualification inspection for device classes Q and V shall be in accordance with MIL-PRF-38535. Inspections to be performed shall be those specified in MIL-PRF-38535 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

4.4 Conformance inspection. Technology conformance inspection for classes Q and V shall be in accordance with MIL-PRF-38535 including groups A, B, C, D, and E inspections and as specified herein. Quality conformance inspection for device class M shall be in accordance with MIL-PRF-38535, appendix A and as specified herein. Inspections to be performed for device class M shall be those specified in method 5005 of MIL-STD-883 and herein for groups A, B, C, D, and E inspections (see 4.4.1 through 4.4.4).

4.4.1 Group A inspection.

- a. Tests shall be as specified in table IIA herein.
- b. Latch-up and ground bounce tests are required for device classes Q and V. These tests shall be performed only for initial qualification and after process or design changes which may affect the performance of the device. Latch-up tests shall be considered destructive. For latch-up and ground-bounce tests, test all applicable pins on five devices with zero failures.
- c. C_{IN} , C_{OUT} , and C_{PD} shall be measured only for initial qualification and after process or design changes which may affect capacitance. C_{IN} and C_{OUT} shall be measured between the designated terminal and GND at a frequency of 1 MHz. C_{PD} shall be tested in accordance with the latest revision of JESD-20 and table IA herein. For C_{IN} , C_{OUT} , and C_{PD} , test all applicable pins on five devices with zero failures.

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- d. For device class M, subgroups 7 and 8 tests shall be sufficient to verify the truth table in figure 3 herein. The test vectors used to verify the truth table shall, at a minimum, test all functions of each input and output. All possible input to output logic patterns per function shall be guaranteed, if not tested, to the truth table in figure 3, herein. For device classes Q and V, subgroups 7 and 8 shall include verifying the functionality of the device.

TABLE IIA. Electrical test requirements.

Test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table IA)	Subgroups (in accordance with MIL-PRF-38535, table IIB)	
	Device class M	Device class Q	Device class V
Interim electrical parameters (see 4.2)	---	---	1
Final electrical parameters (see 4.2)	<u>1/</u> 1, 2, 3, 7, 8, 9, 10, 11	<u>1/</u> 1, 2, 3, 7, 8, 9, 10, 11	<u>2/ 3/</u> 1, 2, 3, 7, 8, 9, 10, 11
Group A test requirements (see 4.4)	1, 2, 3, 4, 7, 8, 9, 10, 11	1, 2, 3, 4, 7, 8, 9, 10, 11	1, 2, 3, 4, 7, 8, 9, 10, 11
Group C end-point electrical parameters (see 4.4)	1, 2, 3	1, 2, 3	<u>3/</u> 1, 2, 3, 7, 8, 9, 10, 11
Group D end-point electrical parameters (see 4.4)	1, 2, 3	1, 2, 3	1, 2, 3, 7, 9
Group E end-point electrical parameters (see 4.4)	1, 7, 9	1, 7, 9	1, 7, 9

1/ PDA applies to subgroup 1.

2/ PDA applies to subgroups 1, 7, and deltas.

3/ Delta limits, as specified in table IIB, shall be required, and the delta limits shall be completed with reference to the zero hour electrical parameters.

TABLE IIB. Burn-in and operating life test, delta parameters (+25°C).

Parameter <u>1/</u>	Symbol	Device types	Delta limits
Supply current	$I_{CCH}, I_{CCL}, I_{CCZ}$	01	± 100 nA <u>2/</u>
		02	± 300 nA
Supply current delta	ΔI_{CC}	02	± 0.4 mA
Input current low level	I_{IL}	02	± 20 nA
Input current high level	I_{IH}	02	± 20 nA
Output voltage low level ($V_{CC} = 5.5$ V, $I_{OL} = 24$ mA)	V_{OL}	02	± 0.04 V
Output voltage high level ($V_{CC} = 5.5$ V, $I_{OH} = -24$ mA)	V_{OH}	02	± 0.20 V

1/ These parameters shall be recorded before and after the required burn-in and life tests to determine delta limits.

2/ This limit may not be production tested.

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4.4.2 Group C inspection. The group C inspection end-point electrical parameters shall be as specified in table IIA herein.

4.4.2.1 Additional criteria for device class M. Steady-state life test conditions, method 1005 of MIL-STD-883:

- a. Test condition A, B, C, or D. The test circuit shall be maintained by the manufacturer under document revision level control and shall be made available to the preparing or acquiring activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.
- b. $T_A = +125^{\circ}\text{C}$, minimum.
- c. Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.4.2.2 Additional criteria for device classes Q and V. The steady-state life test duration, test condition and test temperature, or approved alternatives shall be as specified in the device manufacturer's QM plan in accordance with MIL-PRF-38535. The test circuit shall be maintained under document revision level control by the device manufacturer's TRB in accordance with MIL-PRF-38535 and shall be made available to the acquiring or preparing activity upon request. The test circuit shall specify the inputs, outputs, biases, and power dissipation, as applicable, in accordance with the intent specified in method 1005 of MIL-STD-883.

4.4.3 Group D inspection. The group D inspection end-point electrical parameters shall be as specified in table IIA herein.

4.4.4 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein).

- a. End-point electrical parameters shall be as specified in table IIA herein.
- b. For device classes Q and V, the devices or test vehicle shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535 for the RHA level being tested. For device class M, the devices shall be subjected to radiation hardness assured tests as specified in MIL-PRF-38535, appendix A for the RHA level being tested. All device classes must meet the postirradiation end-point electrical parameter limits as defined in table IA at $T_A = +25^{\circ}\text{C} \pm 5^{\circ}\text{C}$, after exposure, to the subgroups specified in table IIA herein.
- c. RHA tests for device classes M, Q, and V for levels M, D, P, L, R, and F shall be performed through each level to determine at what levels the devices meet the RHA requirements. These RHA tests shall be performed for initial qualification and after design or process changes which may affect the RHA performance of the device.
- d. Prior to irradiation, each selected sample shall be assembled in its qualified package. It shall pass the specified group A electrical parameters in table I for subgroups specified in table IIA herein.

4.4.4.1 Total dose irradiation testing. Total dose irradiation testing shall be performed in accordance with MIL-STD-883, method 1019, condition A, and as specified herein. Prior to and during total dose irradiation characterization and testing, the devices for characterization shall be biased so that 50 percent are at inputs high and 50 percent are at inputs low, and the devices for testing shall be biased to the worst case condition established during characterization. Devices shall be biased as follows:

- a. Inputs tested high, $V_{CC} = 5.5 \text{ V dc} \pm 5\%$, $V_{IN} = 5.0 \text{ V dc} + 10\%$, $R_{IN} = 1 \text{ k}\Omega \pm 20\%$, and all outputs are open.
- b. Inputs tested low, $V_{CC} = 5.5 \text{ V dc} \pm 5\%$, $V_{IN} = 0.0 \text{ V dc}$, $R_{IN} = 1 \text{ k}\Omega \pm 20\%$, and all outputs are open.

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4.4.4.1.1 Accelerated annealing test. Accelerated annealing tests shall be performed on all devices requiring a RHA level greater than 5k rads (Si). The post-anneal end-point electrical parameter limits shall be as specified in table IA herein and shall be the pre-irradiation end-point electrical parameter limit at +25°C ±5°C. Testing shall be performed at initial qualification and after any design or process changes which may affect the RHA response of the device.

4.4.4.2 Single event phenomena (SEP). When specified in the purchase order or contract, SEP testing shall be performed on class V devices. SEP testing shall be performed on the Standard Evaluation Circuit (SEC) or alternate SEP test vehicle as approved by the qualifying activity at initial qualification and after any design or process changes which may affect the upset or latchup characteristics. Test 4 devices with zero failures. ASTM F1192 may be used as a guideline when performing SEP testing. The recommended test conditions for SEP are as follows:

- a. The ion beam angle of incidence shall be between normal to the die surface and 60° to the normal, inclusive (i.e. 0° ≤ angle ≤ 60°). No shadowing of the ion beam due to fixturing or package related effects is allowed.
- b. The fluence shall be ≥ 100 errors or ≥ 10⁷ ions/cm².
- c. The flux shall be between 10² and 10⁵ ions/cm²/s. The cross-section shall be verified to be flux independent by measuring the cross-section at two flux rates that differ by at least an order of magnitude.
- d. The particle range shall be ≥ 20 microns in silicon.
- e. The test temperature shall be +25°C and the maximum rated operating temperature ±10°C.
- f. Bias conditions shall be defined by the manufacturer for the latchup measurements.
- g. Test four devices with zero failures.

4.5 Methods of inspection. Methods of inspection shall be specified as follows:

4.5.1 Voltage and current. Unless otherwise specified, all voltages given are referenced to the microcircuit GND terminal. Currents given are conventional current and positive when flowing into the referenced terminal.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535 for device classes Q and V or MIL-PRF-38535, appendix A for device class M.

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6. NOTES

6.1 Intended use. Microcircuits conforming to this drawing are intended for use for Government microcircuit applications (original equipment), design applications, and logistics purposes.

6.1.1 Replaceability. Microcircuits covered by this drawing will replace the same generic device covered by a contractor-prepared specification or drawing.

6.1.2 Substitutability. Device class Q devices will replace device class M devices.

6.2 Configuration control of SMD's. All proposed changes to existing SMD's will be coordinated with the users of record for the individual documents. This coordination will be accomplished using DD Form 1692, Engineering Change Proposal.

6.3 Record of users. Military and industrial users should inform DLA Land and Maritime when a system application requires configuration control and which SMD's are applicable to that system. DLA Land and Maritime will maintain a record of users and this list will be used for coordination and distribution of changes to the drawings. Users of drawings covering microelectronic devices (FSC 5962) should contact DLA Land and Maritime -VA, telephone (614) 692-0544.

6.4 Comments. Comments on this drawing should be directed to DLA Land and Maritime -VA , Columbus, Ohio 43218-3990, or telephone (614) 692-0547.

6.5 Abbreviations, symbols, and definitions. The abbreviations, symbols, and definitions used herein are defined in MIL-PRF-38535 and MIL-HDBK-1331.

6.6 Sources of supply.

6.6.1 Sources of supply for device classes Q and V. Sources of supply for device classes Q and V are listed in QML-38535. The vendors listed in QML-38535 have submitted a certificate of compliance (see 3.6 herein) to DLA Land and Maritime -VA and have agreed to this drawing.

6.6.2 Approved sources of supply for device class M. Approved sources of supply for class M are listed in MIL-HDBK-103. The vendors listed in MIL-HDBK-103 have agreed to this drawing and a certificate of compliance (see 3.6 herein) has been submitted to and accepted by DLA Land and Maritime -VA.

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STANDARD MICROCIRCUIT DRAWING SOURCE

DATE: 11-05-02

Approved sources of supply for SMD 5962-92022 are listed below for immediate acquisition information only and shall be added to MIL-HDBK-103 and QML-38535 during the next revision. MIL-HDBK-103 and QML-38535 will be revised to include the addition or deletion of sources. The vendors listed below have agreed to this drawing and a certificate of compliance has been submitted to and accepted by DLA Land and Maritime -VA. This information bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535. DLA LAND AND MARITIME maintains an online database of all current sources of supply at <http://www.dscc.dla.mil/Programs/Smcr/>.

Standard microcircuit drawing PIN <u>1/</u>	Vendor CAGE number	Vendor similar PIN <u>2/</u>
5962-9202201MXA	01295	SNJ54ACT16244WD
5962-9202202QYA	<u>3/</u>	54ACT16244K02Q
5962-9202202VYA	<u>3/</u>	54ACT16244K02V
5962F9202202QYC	F8859	RHFACT16244K01Q
5962F9202202QYA	F8859	RHFACT16244K02Q
5962F9202202VYC	F8859	RHFACT16244K01V
5962F9202202VYA	F8859	RHFACT16244K02V

1/ The lead finish shown for each PIN representing a hermetic package is the most readily available from the manufacturer listed for that part. If the desired lead finish is not listed contact the Vendor to determine its availability.

2/ Caution. Do not use this number for item acquisition. Items acquired to this number may not satisfy the performance requirements of this drawing.

3/ Not available from an approved source of supply.

Vendor CAGE number

Vendor name and address

01295

Texas Instruments, Inc.
Semiconductor Group
8505 Forest Ln.
P.O. Box 660199
Dallas, TX 75243
Point of contact: U.S. Highway 75 South
P.O. Box 84 M/S 853
Sherman, TX 75090-9493

F8859

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