INCH-POUND

MIL-M-38510/62B
9 November 2005
SUPERSEDING
MIL-M-38510/62A
17 June 1985

MILITARY SPECIFICATION

MICROCIRCUITS, DIGITAL, ECL, AND/NAND GATES, MONOLITHIC SILICON

Inactive for new design after 8 July 1997.

This specification is approved for use by all Departments and Agencies of the Department of Defense.

The requirements for acquiring the product herein shall consist of this specification sheet and MIL-PRF 38535

1. SCOPE

1.1 Scope. This specification covers the detail requirements for monolithic, silicon, ECL, logic gating microcircuits. Two product assurance classes and a choice of case outlines and lead finishes are provided for each type and are reflected in the complete part number. For this product, the requirements of MIL-M-38510 have been superseded by MIL-PRF-38535, (see 6.4).

1.2 Part or Identifying Number (PIN). The PIN is in accordance with MIL-PRF-38535, and as specified herein.

1.2.1 Device types. The device types are as follows:

Device type	Circuit
01	Triple, and Single AND/NAND gate
02	Hex AND gate

1.2.2 Device class. The device class is the product assurance level as defined in MIL-PRF-38535.

1.2.3 Case outlines. The case outlines are as designated in MIL-STD-1835 and as follows:

Outline letter	Descriptive designator	Terminals	Package style
E	GDIP1-T16 or CDIP2-T16	16	Dual-in-line
F	GDFP2-F16 or CDFP3-F16	16	Flat-pack
2	CQCC1-N20	20	Square chip carrier

Comments, suggestions, or questions on this document should be addressed to: Commander, Defense Supply Center Columbus, ATTN: DSCC-VAS, P. O. Box 3990, Columbus, OH 43218-3990, or emailed to bipolar@dla.mil. Since contact information can change, you may want to verify the currency of this address information using the ASSIST Online database at http://assist.daps.dla.mil.

AMSC N/A FSC 5962

1.3 Absolute maximum ratings.

Supply voltage range	0 V dc minimum to -7.0 V dc maximum
Input voltage range	0 V dc to V_{EE} (most negative power supply voltage)
Storage temperature range	-65°C to +150°C
Maximum power dissipation per gate, (P_D) 1/	55 mW
Lead temperature (soldering 10 seconds)	+260°C
Thermal resistance, junction-to-case (θ_{JC})	(See MIL-STD-1835)
Junction temperature (T_J) 2/	165°C
Maximum output current	-50 mA

1.4 Recommended operating conditions.

Supply voltage (V_{CC})	-5.46 V dc minimum to -4.94 V dc maximum
Minimum high level input voltage (V_{IH})	-1.105 V at T_A =+25°C
(at 500 linear feet per minute)	-1.000 V at T_A =+125°C
(ft/min)	-1.255 V at T_A =-55°C
Maximum low level input voltage (V_{IL})	-1.475 V at T_A =+25°C
(at 500 linear ft/min)	-1.400 V at T_A =+125°C
	-1.510 V at T_A =-55°C
Normalized fanout (each output) 3/	10
Case operating temperature range (T_C) (at 500 linear ft/min)	-55°C to 125°C
Case operating temperature range (T_C) (at still air)	-55°C to 125°C

2.0 APPLICABLE DOCUMENTS

2.1 General. The documents listed in this section are specified in sections 3, 4, or 5 of this specification. This section does not include documents cited in other sections of this specification or recommended for additional information or as examples. While every effort has been made to ensure the completeness of this list, document users are cautioned that they must meet all specified requirements of documents cited in sections 3, 4, or 5 of this specification, whether or not they are listed.

2.2 Government documents.

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

DEPARTMENT OF DEFENSE SPECIFICATIONS

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

DEPARTMENT OF DEFENSE STANDARDS

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

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

1/ Must withstand the added P_D due to short circuit condition (e.g. I_{OS}).
2/ Maximum junction temperature should not be exceeded except in accordance with allowable short duration burn-in screening condition in accordance with MIL-PRF-38535.
3/ Device will fanout in both high and low levels to the specified number of data inputs on the same device type as that being tested.

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

3. REQUIREMENTS

3.1 Qualification. Microcircuits furnished under this specification shall be products that are manufactured by a manufacturer authorized by the qualifying activity for listing on the applicable qualified manufacturers list before contract award (see 4.3 and 6.3).

3.2 Item requirements. The individual item requirements 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.

3.3 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-PRF-38535 and herein.

3.3.1 Logic diagrams and terminal connections. The logic diagrams and terminal connections shall be as specified on figure 1.

3.3.2 Truth tables and logic equations. The truth table and logic equations shall be as specified on figure 2.

3.3.3 Schematic circuits. The schematic circuits shall be maintained by the manufacturer and made available to the qualifying activity and the preparing activity upon request.

3.3.4 Case outlines. Case outlines shall be as specified in 1.2.3.

3.4 Lead material and finish. Lead material and finish shall be in accordance with MIL-PRF-38535 (see 6.6).

3.5 Electrical performance characteristics. The electrical performance characteristics are as specified in table 1 and apply over the full recommended case operating temperature range, unless otherwise specified.

3.6 Electrical test requirements. The electrical test requirements for each device class shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table III.

3.7 Marking. Marking shall be in accordance with MIL-PRF-38535.

3.8 Microcircuit group assignment. The devices covered by this specification shall be in microcircuit group number 29 (see MIL-PRF-38535, appendix A).

TABLE I. Electrical performance characteristics.
(Limits are valid provided circuit is in a test socket and transverse air flow of 500 linear ft/min is maintained.)

Test	Symbol	Conditions 1/ $-55°C \le T_C \le 125°C$				Device type	Limits		Units
							Min	Max	
High-level output voltage	V_{OH}	V_{EE} = -5.2 V V_{CC} = 0 V Load = 100Ω to -2 V	T_C	V_{IH1}	V_{IL1}	All			V
			+25°C	-0.780 V	-1.850 V		-0.930	-0.780	
			+125°C	-0.630 V	-1.820 V		-0.825	-0.630	
			-55°C	-0.880 V	-1.920 V		-1.080	-0.880	
Low-level output voltage	V_{OL}	V_{EE} = -5.2 V V_{CC} = 0 V Load = 100 Ω to -2 V	T_C	V_{IH1}	V_{IL1}	All			V
			+25°C	-0.780 V	-1.850 V		-1.850	-1.620	
			+125°C	-0.630 V	-1.820 V		-1.820	-1.545	
			-55°C	-0.880 V	-1.920 V		-1.920	-1.655	
High-level threshold output voltage	V_{OTH}	V_{EE} = -5.2 V V_{CC} = 0 V Load = 100 Ω to -2 V	T_C	V_{ITH}	V_{ITL}	All			V
			+25°C	-1.105 V	-1.475 V		-0.950	- - -	
			+125°C	-1.000 V	-1.400 V		-0.845	- - -	
			-55°C	-1.255 V	-1.510 V		-1.100	- - -	
Low-level threshold output voltage	V_{OTL}	V_{EE} = -5.2 V V_{CC} = 0 V Load = 100 Ω to -2 V	T_C	V_{ITH}	V_{ITL}	All			V
			+25°C	-1.105 V	-1.475 V		- - -	1.600	
			+125°C	-1.000 V	-1.400 V		- - -	1.525	
			-55°C	-1.255 V	-1.510 V		- - -	1.635	
Power supply drain current	I_{EE}	V_{EE} = -5.2 V V_{CC} = 0 V				01	-39	- - -	mA
						02	-54	- - -	
High-level input current	I_{IH1}	V_{EE} = -5.2 V, V_{CC} = 0 V V_{IH1} = -0.780 V at +25°C, -0.630 V at +125°C, -0.880 V at -55°C.				All	- - -	450	µA
High-level input current	I_{IH2}	V_{EE} = -5.2 V, V_{CC} = 0 V V_{IH1} = -0.780 V at +25°C, -0.630 V at +125°C, -0.880 V at -55°C.				01 2/	- - -	375	µA
						02	- - -	495	

See footnotes at end of table.

TABLE I. Electrical performance characteristics – Continued.
(Limits are valid provided circuit is in a test socket and transverse air flow of 500 linear ft/min is maintained.)

Test	Symbol	Conditions 1/ $-55°C \le T_C \le 125°C$	Device type	Limits		Units
				Min	Max	
Low-level input current	I_{IL}	V_{EE} = -5.2 V, V_{CC} = 0 V V_{IL1} = -1.850 V at +25°C, -1.820 V at +125°C, -1.920 V at -55°C.	All	0.3	---	µA
Transition time, low-to-high level	t_{TLH}	V_{EEL} = -3.2 V, V_{CC} = +2.0 V $\frac{RL}{2}$ = 50 Ω, $C_L \le 5$ pF (output under test) Load = 100 Ω to GND (outputs not under test)	01	1.0	4.1	ns
			02	1.0	5.3	
Transition time, high-to-low level	t_{THL}	V_{EEL} = -3.2 V, V_{CC} = +2.0 V $\frac{RL}{2}$ = 50 Ω, $C_L \le 5$ pF (output under test) Load = 100 Ω to GND (outputs not under test)	01	1.0	4.1	ns
			02	1.0	5.3	
Propagation delay time, low-to-high level	t_{PLH}	V_{EEL} = -3.2 V, V_{CC} = +2.0 V $\frac{RL}{2}$ = 50 Ω, $C_L \le 5$ pF (output under test) Load = 100 Ω to GND (outputs not under test)	All	1.0	4.7	ns
			02 3/	1.0	5.9	
Propagation delay time, high-to-low level	t_{PHL}	V_{EEL} = -3.2 V, V_{CC} = +2.0 V $\frac{RL}{2}$ = 50 Ω, $C_L \le 5$ pF (output under test) Load = 100 Ω to GND (outputs not under test)	All	1.0	4.7	ns
			02 3/	1.0	5.9	

1/ Complete terminal conditions shall be as specified in table III.
2/ Applicable to “B” inputs only.
3/ Applicable to “Common” input only.

TABLE II. Electrical test requirements.

MIL-PRF-38535 Test requirement	Subgroups (see table III)	
	Class S Devices	Class B Devices
Interim electrical parameters	1	1
Final electrical test parameters	1*, 2, 3, 9,	1*, 2, 3, 9
Group A test requirements	1, 2, 3, 9, 10, 11	1, 2, 3, 9, 10, 11
Group B electrical test parameters when using the method 5005 QCI option	1, 2, 3, 9, 10, 11	N/A
Groups C end point electrical parameters	1, 2, 3, 9, 10, 11	1, 2, 3
Group D end point electrical parameters	1, 2, 3	1, 2, 3

*PDA applies to subgroup 1.

4. VERIFICATION

4.1 Sampling and inspection. 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 effect the form, fit, or function as described herein.

4.2 Qualification inspection. Qualification inspection shall be in accordance with MIL-PRF-38535.

4.3 Screening. Screening shall be in accordance with MIL-PRF-38535 and shall be conducted on all devices prior to qualification and conformance inspection. The following additional criteria shall apply:

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 control by 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 test method 1015 of MIL-STD-883.

b. Interim and final electrical test parameters shall be as specified in table II, except interim electrical parameters test prior to burn-in is optional at the discretion of the manufacturer.

c. Additional screening for space level product shall be as specified in MIL-PRF-38535.

4.4 Technology Conformance Inspection (TCI). Technology conformance inspection shall be in accordance with MIL-PRF-38535 and herein for groups A, B, C, and D inspections (see 4.4.1 through 4.4.4).

4.4.1 Group A inspection. Group A inspection shall be in accordance with table III of MIL-PRF-38535 and as follows:

a. Tests shall be as specified in table II herein.

b. Subgroups 4, 5, 6, 7, and 8, shall be omitted.

4.4.2 Group B inspection. Group B inspection shall be in accordance with table II of MIL-PRF-38535.

4.4.3 Group C inspection. Group C inspection shall be in accordance with table IV of MIL-PRF-38535 and as follows:

a. End point electrical parameters shall be as specified in table II herein.

b. 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 burn-in test circuit shall be maintained under document control by 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 test method 1005 of MIL-STD-883.

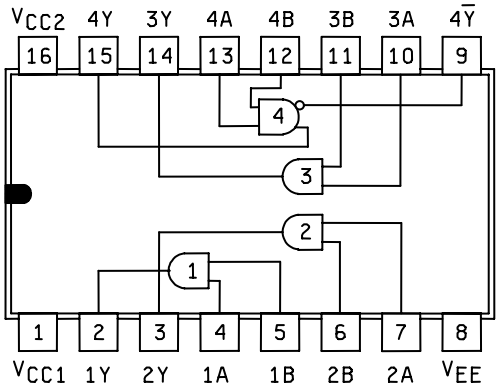
4.4.4 Group D inspection. Group D inspection shall be in accordance with table V of MIL-PRF-38535. End-point electrical parameters shall be as specified in table II herein.

4.5 Methods inspection. Methods of inspection shall be as specified in the appropriate tables and as follows:

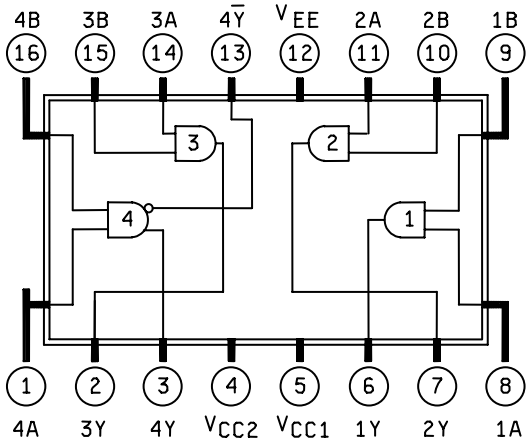
4.5.1 Voltage and current. All voltages given are referenced to the microcircuit ground terminal. Currents given are conventional current and positive when flowing into the referenced terminal.

DEVICE TYPE 01

CASE E

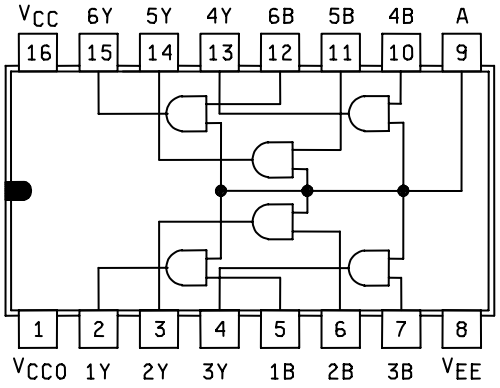


CASE F



DEVICE TYPE 02

CASE E



CASE F

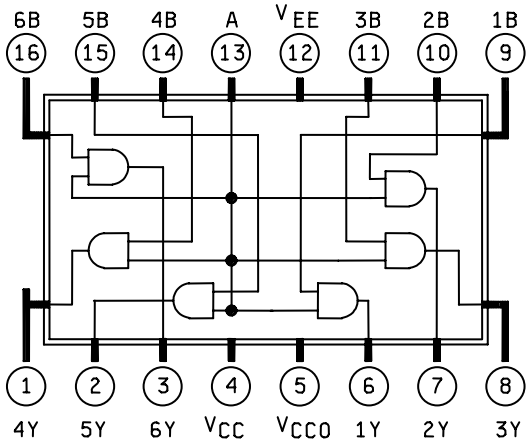
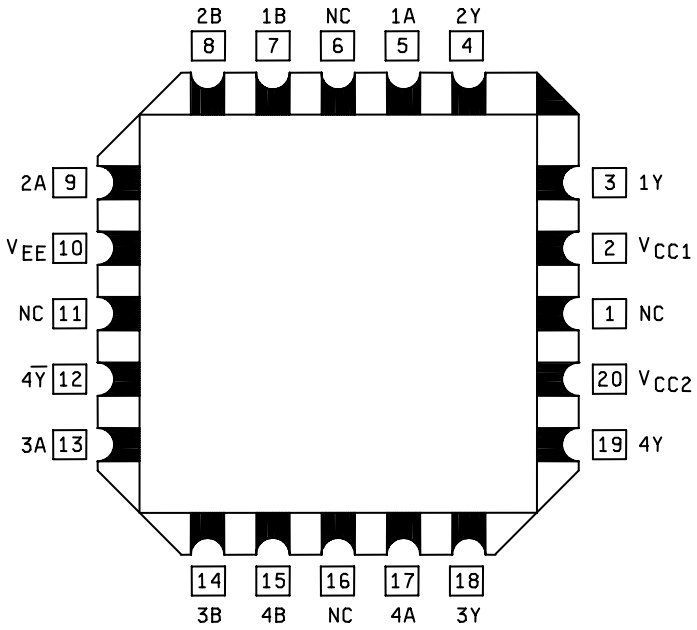


Figure 1. Logic diagram and terminal connections.

DEVICE TYPE 01



DEVICE TYPE 02

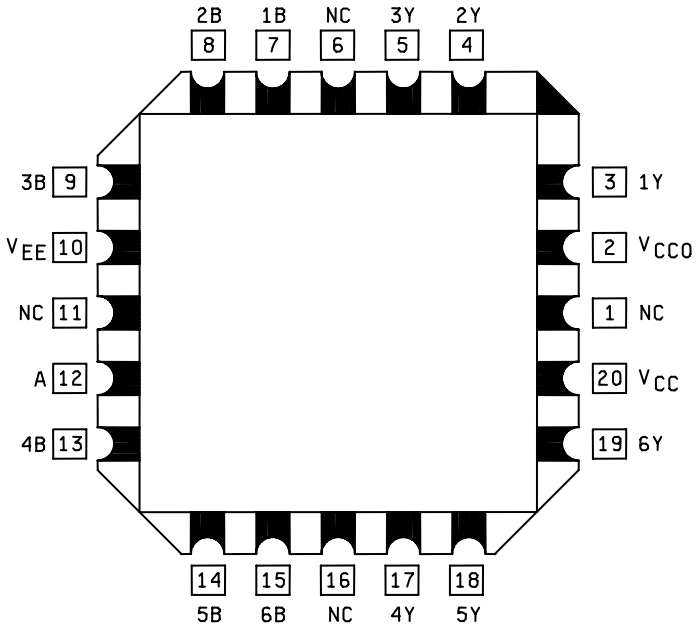


Figure 1. Logic diagram and terminal connections - Continued.

Device type 01

Each gate

Inputs		Outputs	
A	B	Y	$\overline{Y}$ *
L	L	L	H
H	L	L	H
L	H	L	H
H	H	H	L

* $\overline{Y}$ applies to gate 4 only.

Positive logic:

$Y = AB$

$\overline{Y} = \overline{AB}$

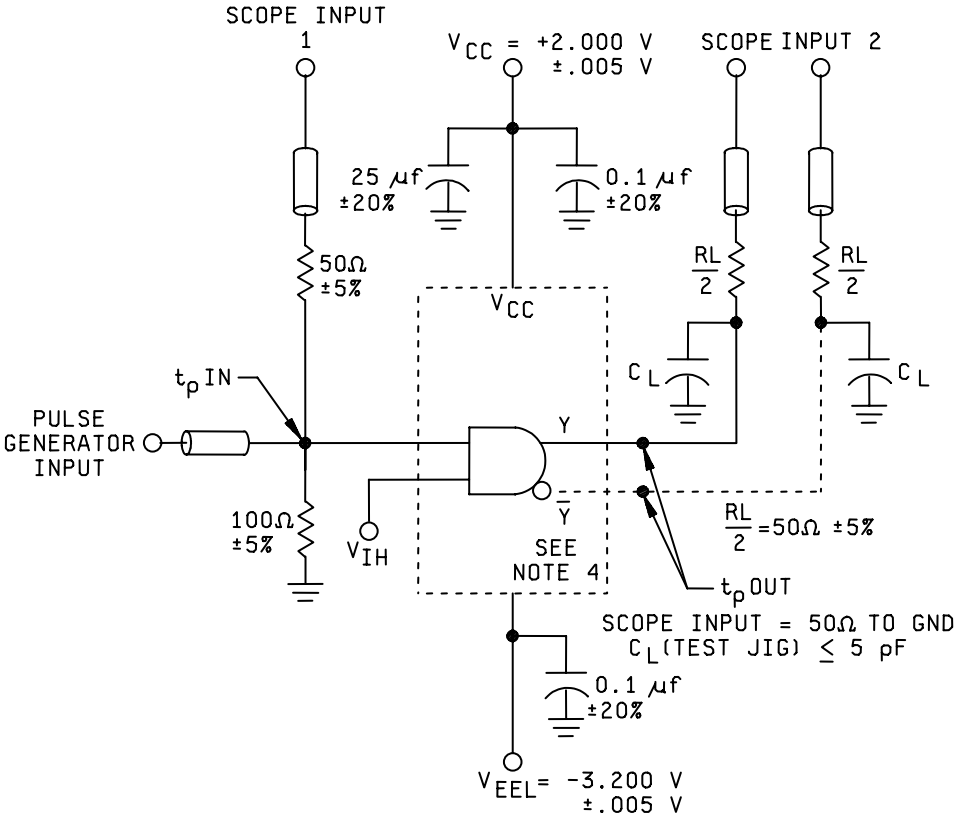
Device type 02

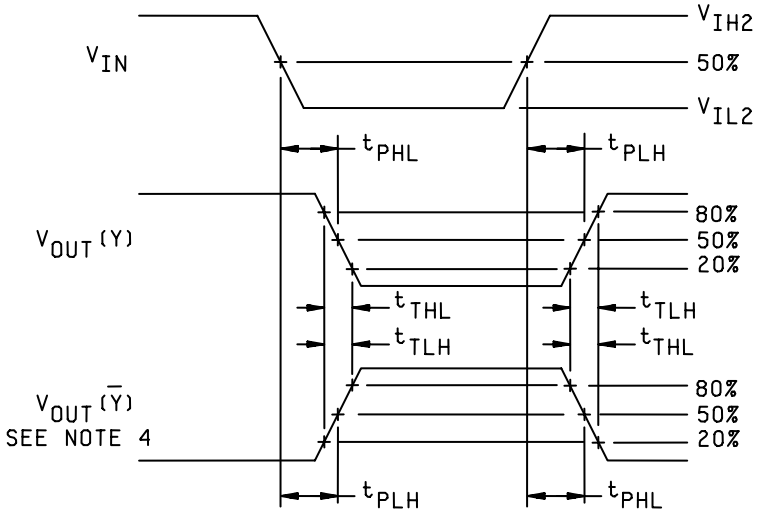
Each gate

Inputs		Output
A	B	Y
L	L	L
H	L	L
L	H	L
H	H	H

Positive logic: $Y = AB$

Figure 2. Truth table and logic equation.





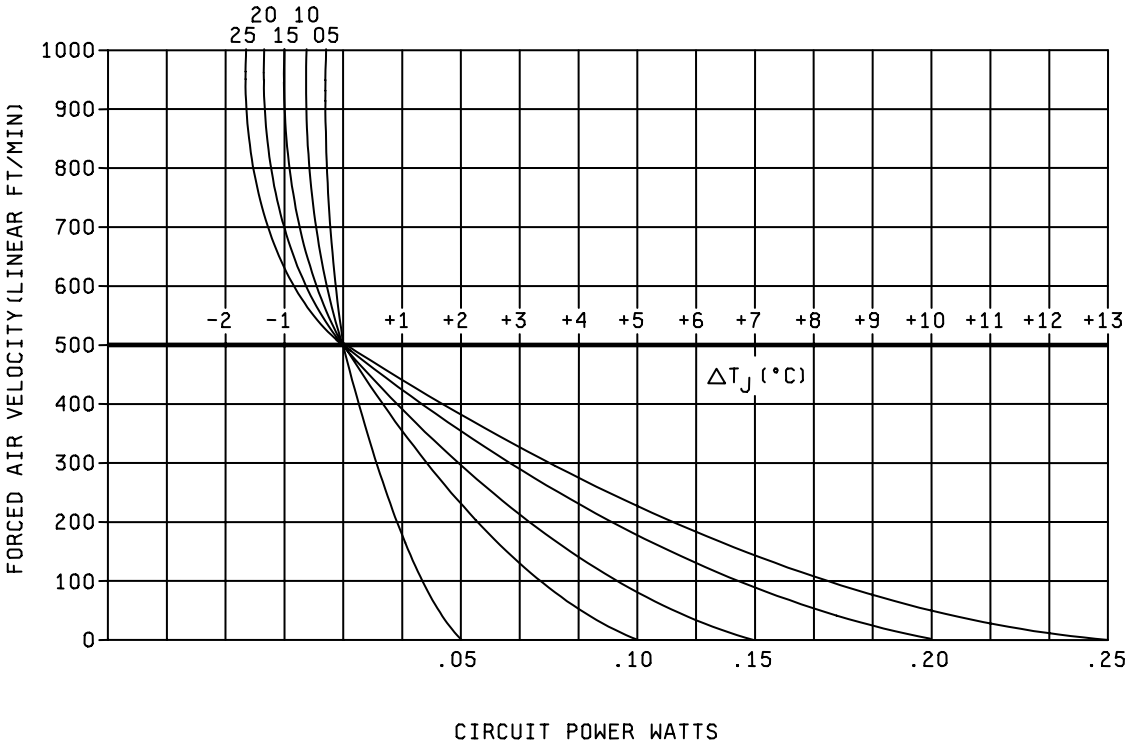
Generator characteristic:

T_A	V_{IH2} (±10 mV)	V_{IL2} (±10 mV)
25°C	+1.11 V	+0.31 V
125°C	+1.24 V	+0.36 V
-55°C	+1.01 V	+0.28 V

t_P = 40 ns ±1 ns
Z_{OUT} = 50 Ω
t_{THL} = 2.0 ns (20% - 80%) ±0.2 ns
t_{TLH} = 2.0 ns (20% - 80%) ±0.2 ns
RRR = 1.0 MHz ±.05 MHz

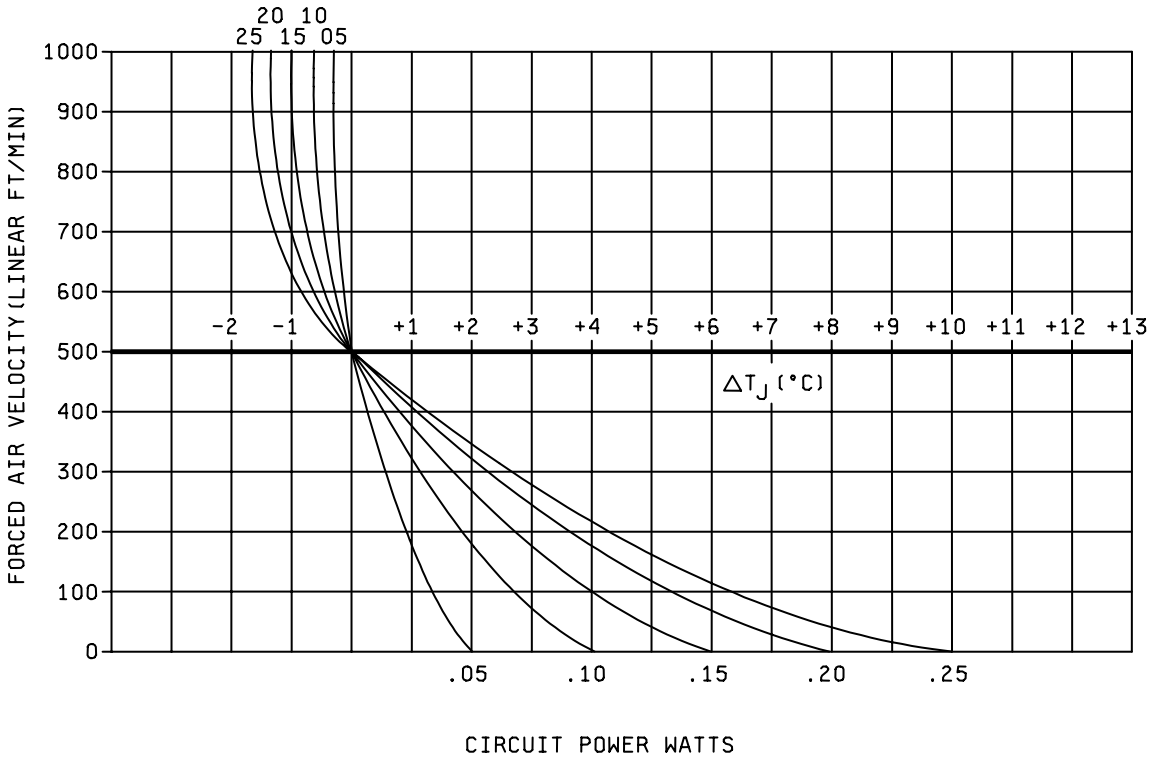
NOTES:
1/ Perform test in accordance with test table; each output is tested separately.
2/ All input and output cables to the scope are equal lengths of 50 Ω coaxial cables. Wire length should be ≤ 0.250 (6.35 mm) from t_{PIN} to input pin and t_{POUT} to output pin.
3/ Output not under test connected to a 100 Ω resistor to ground.
4/ Applies to gate 4 only.

FIGURE 3. Switching time test circuit and waveforms.



NOTE: Change in junction temperature versus forced air velocity, ref. to 500 linear ft./min circuit power as variable parameter 100 Ω load.

FIGURE 4. Junction temperature versus air velocity case E.

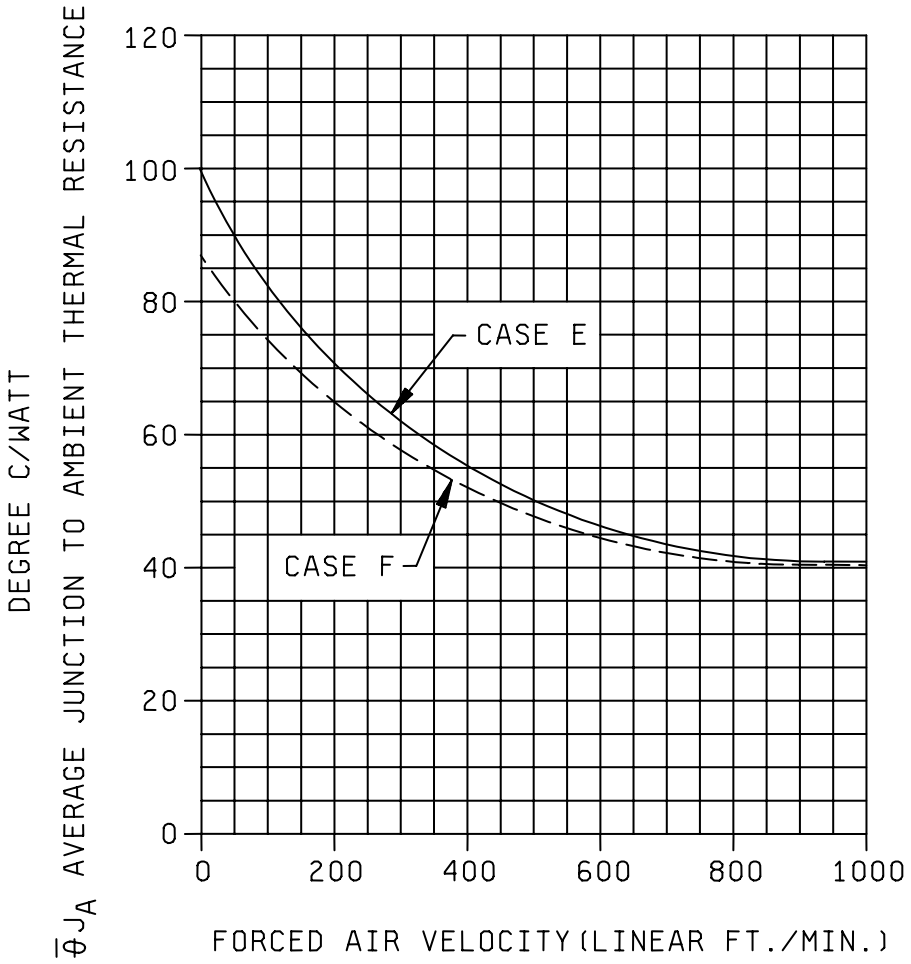


NOTE: Change in junction temperature versus forced air velocity, ref. to 500 linear ft./min circuit power as variable parameter 100 Ω load.

FIGURE 5. Junction temperature versus air velocity case F.

PARAMETER	-55°C (mV/°C)		+25°C (mV/°C)		+125°C (mV/°C)	
	$+\Delta T_J$	$-\Delta T_J$	$+\Delta T_J$	$-\Delta T_J$	$+\Delta T_J$	$-\Delta T_J$
V_{OH} max, V_{IH1}	1.25	1.25	1.50	1.25	1.50	1.50
V_{OH} min, V_{OTH}	1.88	1.88	1.05	1.88	1.05	1.05
V_{OL} max, V_{OTL}	0.44	0.44	0.75	0.44	0.75	0.75
V_{OL} min, V_{IL}	0.88	0.88	0.30	0.88	0.30	0.30
V_{ITH}	1.88	1.88	1.05	1.88	1.05	1.05
V_{ITL}	0.44	0.44	0.75	0.44	0.75	0.75

FIGURE 6. Adjustment coefficients for forcing function and test limit compensation.



NOTE: (θJ_A - vs - Forced Air Velocity) for case (E) and (F).
$T_J = T_C + \theta J_A \times P_D(max)$.

FIGURE 7. Air velocity versus thermal resistance.

TABLE III. Group A inspection for device type 01.

Symbol	MIL-STD-883 method	Cases E / F / 2 / Test no.	For terminal conditions see table IV																Measured terminal	Limits						Units
																				Subgroup 1 T_C = +25°C		Subgroup 2 T_C = +125°C		Subgroup 3 T_C = -55°C		
																				Min	Max	Min	Max	Min	Max	
V_{OH}	3006	1	GND	LD1	LD1	V_{IH1}	V_{IH1}			E1	LD1					LD1	LD1	GND	1Y	-.930	-.780	-.825	-.630	-1.08	-.88	V
	"	2	"	"	"			V_{IH1}	V_{IH1}	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	3	"	"	"					"	"	V_{IH1}	V_{IH1}			"	"	"	3Y	"	"	"	"	"	"	"
	"	4	"	"	"					"	"			V_{IH1}	V_{IH1}	"	"	"	4Y	"	"	"	"	"	"	"
	"	5	"	"	"					"	"			V_{IH1}		"	"	"	4Y	"	"	"	"	"	"	"
	"	6	"	"	"					"	"				V_{IH1}	"	"	"	4Y	"	"	"	"	"	"	"
	"	7	"	"	"					"	"			V_{IH1}	V_{IH1}	"	"	"	4Y	"	"	"	"	"	"	"
V_{OL}	3007	8	"	"	"	V_{IH1}				"	"					"	"	"	1Y	-1.85	-1.62	-1.82	-1.545	-1.92	-1.655	"
	"	9	"	"	"		V_{IH1}			"	"					"	"	"	1Y	"	"	"	"	"	"	"
	"	10	"	"	"			V_{IH1}		"	"					"	"	"	1Y	"	"	"	"	"	"	"
	"	11	"	"	"				V_{IH1}	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	12	"	"	"					"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	13	"	"	"					"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	14	"	"	"					"	"	V_{IH1}				"	"	"	3Y	"	"	"	"	"	"	"
	"	15	"	"	"					"	"		V_{IH1}			"	"	"	3Y	"	"	"	"	"	"	"
	"	16	"	"	"					"	"					"	"	"	3Y	"	"	"	"	"	"	"
	"	17	"	"	"					"	"			V_{IH1}		"	"	"	4Y	"	"	"	"	"	"	"
	"	18	"	"	"					"	"				V_{IH1}	"	"	"	4Y	"	"	"	"	"	"	"
	"	19	"	"	"					"	"					"	"	"	4Y	"	"	"	"	"	"	"
	"	20	"	"	"					"	"			V_{IH1}	V_{IH1}	"	"	"	4Y	"	"	"	"	"	"	"
V_{OTH}		21	"	"	"	V_{ITH}	V_{IH1}			"	"					"	"	"	1Y	-.95		-.845		-1.1		"
		22	"	"	"	V_{IH1}	V_{ITH}			"	"					"	"	"	1Y	"		"		"		"
		23	"	"	"			V_{ITH}	V_{IH1}	"	"					"	"	"	2Y	"		"		"		"
		24	"	"	"			V_{IH1}	V_{ITH}	"	"					"	"	"	2Y	"		"		"		"
		25	"	"	"					"	"	V_{ITH}	V_{IH1}			"	"	"	3Y	"		"		"		"
		26	"	"	"					"	"	V_{IH1}	V_{ITH}			"	"	"	3Y	"		"		"		"
		27	"	"	"					"	"			V_{ITH}	V_{IH1}	"	"	"	4Y	"		"		"		"
		28	"	"	"					"	"			V_{IH1}	V_{ITH}	"	"	"	4Y	"		"		"		"
		29	"	"	"					"	"			V_{ITL}	V_{IH1}	"	"	"	4Y	"		"		"		"
		30	"	"	"					"	"			V_{IH1}	V_{ITL}	"	"	"	4Y	"		"		"		"
V_{OTL}		31	"	"	"	V_{ITL}	V_{IH1}			"	"					"	"	"	1Y		-1.6		-1.525		-1.635	"
		32	"	"	"	V_{IH1}	V_{ITL}			"	"					"	"	"	1Y		"		"		"	"
		33	"	"	"			V_{ITL}	V_{IH1}	"	"					"	"	"	2Y		"		"		"	"
		34	"	"	"			V_{IH1}	V_{ITL}	"	"					"	"	"	2Y		"		"		"	"
		35	"	"	"					"	"	V_{ITL}	V_{IH1}			"	"	"	3Y		"		"		"	"
		36	"	"	"					"	"	V_{IH1}	V_{ITL}			"	"	"	3Y		"		"		"	"
		37	"	"	"					"	"			V_{ITL}	V_{IH1}	"	"	"	4Y		"		"		"	"
		38	"	"	"					"	"			V_{IH1}	V_{ITL}	"	"	"	4Y		"		"		"	"
		39	"	"	"					"	"			V_{ITH}	V_{IH1}	"	"	"	4Y		"		"		"	"
		40	"	"	"					"	"			V_{ITH}		"	"	"	4Y		"		"		"	"
I_{IH1}	3010	41	"			V_{IH1}				"								"	1A		265		450		450	µA
	"	42	"					V_{IH1}		"								"	2A		"		"		"	"
	"	43	"							"		V_{IH1}						"	3A		"		"		"	"
	"	44	"							"					V_{IH1}			"	4A		"		"		"	"
I_{IH2}	"	45	"				V_{IH1}			"								"	1B		220		375		375	"
	"	46	"					V_{IH1}		"								"	2B		"		"		"	"
	"	47	"							"			V_{IH1}					"	3B		"		"		"	"
	"	48	"							"				V_{IH1}				"	4B		"		"		"	"

TABLE III. Group A inspection for device type 01 – Continued.

Symbol	MIL-STD-883 method	Cases E	For terminal conditions see table IV																Meas-ured termi-nal	Limits						Units
		F																		Subgroup 1 T_C = +25°C		Subgroup 2 T_C = +125°C		Subgroup 3 T_C = -55°C		
		2																		Min	Max	Min	Max	Min	Max	
		Test no.	V_{CC1}	1Y	2Y	1A	1B	2B	2A	V_{EE}	$\overline{4Y}$	3A	3B	4B	4A	3Y	4Y	V_{CC2}								
I_{IL}	3009	49	GND			V_{IL1}												GND	1A	0.5		0.3		0.5		µA
	"	50	"				V_{IL1}											"	1B	"		"		"		"
	"	51	"					V_{IL1}										"	2B	"		"		"		"
	"	52	"						V_{IL1}									"	2A	"		"		"		"
	"	53	"									V_{IL1}						"	3A	"		"		"		"
	"	54	"										V_{IL1}					"	3B	"		"		"		"
	"	55	"											V_{IL1}				"	4B	"		"		"		"
	"	56	"												V_{IL1}			"	4A	"		"		"		"
I_{EE}		57	"								"							"	V_{EE}	-35		-39		-39		mA
																				Limits						
																				Subgroup 9 T_C = +25°C		Subgroup 10 T_C = +125°C		Subgroup 11 T_C = -55°C		
																				Min	Max	Min	Max	Min	Max	
t_{PLH}	3003	58	E3	OUT	LD2	IN	V_{IH2}			E2	LD2					LD2	LD2	E3	1Y	1.0	4.0	1.0	4.7	1.0	4.3	ns
	"	59	"	OUT	LD2	V_{IH2}	IN			"	"					"	"	"	1Y	"	"	"	"	"	"	"
	"	60	"	LD2	OUT			IN	V_{IH2}	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	61	"	"	OUT			V_{IH2}	IN	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	62	"	"	LD2					"	"	IN	V_{IH2}			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	63	"	"	"					"	"	V_{IH2}	IN			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	64	"	"	"					"	"			IN	V_{IH2}	LD2	OUT	"	4Y	"	"	"	"	"	"	"
	"	65	"	"	"					"	"			V_{IH2}	IN	"	OUT	"	4Y	"	"	"	"	"	"	"
	"	66	"	"	"					"	OUT			IN	V_{IH2}	"	LD2	"	4Y	"	"	"	"	"	"	"
	"	67	"	"	"					"	OUT			V_{IH2}	IN	"	"	"	4Y	"	"	"	"	"	"	"
t_{PHL}	"	68	"	OUT	"	IN	V_{IH2}			"	LD2					"	"	"	1Y	"	"	"	"	"	"	"
	"	69	"	OUT	"	V_{IH2}	IN			"	"					"	"	"	1Y	"	"	"	"	"	"	"
	"	70	"	LD2	OUT			IN	V_{IH2}	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	71	"	"	OUT			V_{IH2}	IN	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	72	"	"	LD2					"	"	IN	V_{IH2}			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	73	"	"	"					"	"	V_{IH2}	IN			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	74	"	"	"					"	"			IN	V_{IH2}	LD2	OUT	"	4Y	"	"	"	"	"	"	"
	"	75	"	"	"					"	"			V_{IH2}	IN	"	OUT	"	4Y	"	"	"	"	"	"	"
	"	76	"	"	"					"	OUT			IN	V_{IH2}	"	LD2	"	4Y	"	"	"	"	"	"	"
	"	77	"	"	"					"	OUT			V_{IH2}	IN	"	LD2	"	4Y	"	"	"	"	"	"	"
t_{TLH}	3004	78	"	OUT	LD2	IN	V_{IH2}			"	LD2					LD2	LD2	"	1Y	1.1	3.5	"	4.1	"	3.8	"
	"	79	"	LD2	OUT			IN	V_{IH2}	"	"					LD2	"	"	2Y	"	"	"	"	"	"	"
	"	80	"	"	LD2					"	"	IN	V_{IH2}			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	81	"	"	"					"	"			IN	V_{IH2}	LD2	OUT	"	4Y	"	"	"	"	"	"	"
	"	82	"	"	"					"	OUT			V_{IH2}	IN	"	LD2	"	4Y	"	"	"	"	"	"	"
t_{THL}	"	83	"	OUT	"	IN	V_{IH2}			"	LD2					"	"	"	1Y	"	"	"	"	"	"	"
	"	84	"	LD2	OUT			IN	V_{IH2}	"	"					"	"	"	2Y	"	"	"	"	"	"	"
	"	85	"	"	LD2					"	"	IN	V_{IH2}			OUT	"	"	3Y	"	"	"	"	"	"	"
	"	86	"	"	"					"	"			IN	V_{IH2}	LD2	OUT	"	4Y	"	"	"	"	"	"	"
	"	87	"	"	"					"	OUT			V_{IH2}	IN	"	LD2	"	4Y	"	"	"	"	"	"	"

TABLE III. Group A inspection for device type 02 – Continued.

Symbol	MIL-STD-883 method	Cases E	For terminal conditions see table IV																Meas-ured termi-nal	Limits						Units
		F	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16		Subgroup 1 T_C = +25°C		Subgroup 2 T_C = +125°C		Subgroup 3 T_C = -55°C		
		2	5	6	7	8	9	10	11	12	13	14	15	16	1	2	3	4								
		Test no.	2	3	4	5	7	8	9	10	12	13	14	15	17	18	19	20		Min	Max	Min	Max	Min	Max	
			V_{CC0}	1Y	2Y	3Y	1B	2B	3B	V_{EE}	A	4B	5B	6B	4Y	5Y	6Y	V_{CC}								
V_{OH}	3006	1	GND	LD1	LD1	LD1	V_{IH1}			E1	V_{IH1}				LD1	LD1	LD1	GND	1Y	-.930	-.780	-.825	-.630	-1.080	-1.880	V
	"	2	"	"	"	"		V_{IH1}		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	3	"	"	"	"			V_{IH1}	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	4	"	"	"	"				"	"	V_{IH1}			"	"	"	"	4Y	"	"	"	"	"	"	"
	"	5	"	"	"	"				"	"		V_{IH1}		"	"	"	"	5Y	"	"	"	"	"	"	"
	"	6	"	"	"	"				"	"			V_{IH1}	"	"	"	"	6Y	"	"	"	"	"	"	"
V_{OL}	3007	7	"	"	"	"				"					"	"	"	"	1Y	-1.85	-1.62	-1.82	-1.545	-1.92	-1.655	"
	"	8	"	"	"	"				"					"	"	"	"	2Y	"	"	"	"	"	"	"
	"	9	"	"	"	"				"					"	"	"	"	3Y	"	"	"	"	"	"	"
	"	10	"	"	"	"				"					"	"	"	"	4Y	"	"	"	"	"	"	"
	"	11	"	"	"	"				"					"	"	"	"	5Y	"	"	"	"	"	"	"
	"	12	"	"	"	"				"					"	"	"	"	6Y	"	"	"	"	"	"	"
V_{OTH}		13	"	"	"	"	V_{ITH}			"	V_{IH1}				"	"	"	"	1Y	-.95		-.845		-1.1		"
		14	"	"	"	"		V_{ITH}		"	"				"	"	"	"	2Y	"		"		"		"
		15	"	"	"	"			V_{ITH}	"	"				"	"	"	"	3Y	"		"		"		"
		16	"	"	"	"				"	"	V_{ITH}			"	"	"	"	4Y	"		"		"		"
		17	"	"	"	"				"	"		V_{ITH}		"	"	"	"	5Y	"		"		"		"
		18	"	"	"	"				"	"			V_{ITH}	"	"	"	"	6Y	"		"		"		"
		19	"	"	"	"	V_{IH1}	V_{IH1}	V_{IH1}	"	V_{IH1}	V_{IH1}	V_{IH1}	V_{IH1}	"	"	"	"	1Y	"		"		"		"
		20	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2Y	"		"		"		"
		21	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	3Y	"		"		"		"
		22	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	4Y	"		"		"		"
		23	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	5Y	"		"		"		"
		24	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	6Y	"		"		"		"
V_{OTL}		25	"	"	"	"	"	"	"	"	V_{ITL}	"	"	"	"	"	"	"	1Y		-1.6		-1.525		-1.635	"
		26	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	2Y		"		"		"	"
		27	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	3Y		"		"		"	"
		28	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	4Y		"		"		"	"
		29	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	5Y		"		"		"	"
		30	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	"	6Y		"		"		"	"
		31	"	"	"	"	V_{ITL}	"	"	"	V_{IH1}	"	"	"	"	"	"	"	1Y		"		"		"	"
		32	"	"	"	"		V_{ITL}	"	"	"	"	"	"	"	"	"	"	2Y		"		"		"	"
		33	"	"	"	"			V_{ITL}	"	"	"	"	"	"	"	"	"	3Y		"		"		"	"
		34	"	"	"	"				"	"	"	"	"	"	"	"	"	4Y		"		"		"	"
		35	"	"	"	"				"	"	"	"	"	"	"	"	"	5Y		"		"		"	"
		36	"	"	"	"				"	"	"	"	"	"	"	"	"	6Y		"		"		"	"
I_{IH1}	3010	37	"				V_{IH1}			"								"	1B		265		450		450	μA
	"	38	"					V_{IH1}		"								"	2B		"		"		"	"
	"	39	"						V_{IH1}	"								3B		"		"		"	"
	"	40	"							"		V_{IH1}						"	4B		"		"		"	"
	"	41	"							"			V_{IH1}					"	5B		"		"		"	"
	"	42	"							"				V_{IH1}				"	6B		"		"		"	"
I_{IH2}	"	43	"							"	V_{IH1}							"	A		290		495		495	"

TABLE III. Group A inspection for device type 02 – Continued.

Symbol	MIL-STD-883 method	Cases E	For terminal conditions see table IV																Measured terminal	Limits						Units
		F																		Subgroup 1 T_C = +25°C		Subgroup 2 T_C = +125°C		Subgroup 3 T_C = -55°C		
		2																								
		Test no.	V_{CC0}	1Y	2Y	3Y	1B	2B	3B	V_{EE}	A	4B	5B	6B	4Y	5Y	6Y	V_{CC}		Min	Max	Min	Max	Min	Max	
I_{IL}	3009	44	GND				V_{IL1}			E1								GND	1B	0.5		0.3		0.5		µA
	"	45	"					V_{IL1}		"								"	2B	"		"		"		"
	"	46	"						V_{IL1}	"								"	3B	"		"		"		"
	"	47	"							"		V_{IL1}						"	4B	"		"		"		"
	"	48	"							"			V_{IL1}					"	5B	"		"		"		"
	"	49	"							"				V_{IL1}				"	6B	"		"		"		"
	"	50	"							"	V_{IL1}							"	A	"		"		"		"
I_{EE}		51	"							"								"	V_{EE}	-49		-54		-54		mA

																				Limits						Units
																				Subgroup 9 T_C = +25°C		Subgroup 10 T_C = +125°C		Subgroup 11 T_C = -55°C		
																				Min	Max	Min	Max	Min	Max	
t_{PLH}	3003	52	E3	OUT	LD2	LD2	IN			E2	V_{IH2}				LD2	LD2	LD2	E3	1Y	1.1	4.0	1.0	4.7	1.0	4.3	ns
	"	53	"	LD2	OUT	LD2		IN		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	54	"	"	LD2	OUT			IN	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	55	"	"	"	LD2				"	"	IN			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	56	"	"	"	"				"	"		IN		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	57	"	"	"	"				"	"			IN	"	LD2	OUT	"	6Y	"	"	"	"	"	"	"
	"	58	"	OUT	"	"	V_{IH2}			"	IN				"	"	LD2	"	1Y	"	5.0	"	5.9	"	5.4	"
	"	59	"	LD2	OUT	"		V_{IH2}		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	60	"	"	LD2	OUT			V_{IH2}	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	61	"	"	"	LD2				"	"	V_{IH2}			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	62	"	"	"	"				"	"		V_{IH2}		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	63	"	"	"	"				"	"			V_{IH2}	"	LD2	OUT	"	6Y	"	"	"	"	"	"	"
t_{PHL}	"	64	"	OUT	"	"	IN			"	V_{IH2}				"	"	LD2	"	1Y	"	4.0	"	4.7	"	4.3	"
	"	65	"	LD2	OUT	"		IN		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	66	"	"	LD2	OUT			IN	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	67	"	"	"	LD2				"	"	IN			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	68	"	"	"	"				"	"		IN		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	69	"	"	"	"				"	"			IN	"	LD2	OUT	"	6Y	"	"	"	"	"	"	"
	"	70	"	OUT	"	"	V_{IH2}			"	IN				"	"	LD2	"	1Y	"	5.0	"	5.9	"	5.4	"
	"	71	"	LD2	OUT	"		V_{IH2}		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	72	"	"	LD2	OUT			V_{IH2}	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	73	"	"	"	LD2				"	"	V_{IH2}			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	74	"	"	"	"				"	"		V_{IH2}		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	75	"	"	"	"				"	"			V_{IH2}	"	LD2	OUT	"	6Y	"	"	"	"	"	"	"
t_{TLH}	3004	76	"	OUT	"	"	IN			"	V_{IH2}				"	"	LD2	"	1Y	"	4.5	"	5.3	"	4.9	"
	"	77	"	LD2	OUT	"		IN		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	78	"	"	LD2	OUT			IN	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	79	"	"	"	LD2				"	"	IN			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	80	"	"	"	"				"	"		IN		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	81	"	"	"	"				"	"			IN	LD2	LD2	OUT	"	6Y	"	"	"	"	"	"	"
t_{THL}	"	82	"	OUT	LD2	LD2	IN			"	"				"	"	LD2	"	1Y	"	"	"	"	"	"	"
	"	83	"	LD2	OUT	LD2		IN		"	"				"	"	"	"	2Y	"	"	"	"	"	"	"
	"	84	"	"	LD2	OUT			IN	"	"				"	"	"	"	3Y	"	"	"	"	"	"	"
	"	85	"	"	"	LD2				"	"	IN			OUT	"	"	"	4Y	"	"	"	"	"	"	"
	"	86	"	"	"	"				"	"		IN		LD2	OUT	"	"	5Y	"	"	"	"	"	"	"
	"	87	"	"	"	"				"	"			IN	LD2	LD2	OUT	"	6Y	"	"	"	"	"	"	"

TABLE IV. Test conditions for all devices, group A inspection.

Symbol	V_{IH1} (V)	V_{IL1} (V)	V_{IH2} (V)	V_{ITL} (V)	V_{ITH} (V)	E1 (V)	E2 (V)	E3 (V)	LD1	LD2
T_C = +25°C	-0.780	-1.850	+1.11	-1.475	-1.105	-5.2	-3.2	+2.0	100 Ω to -2 V	100 Ω to GND
T_C = +125°C	-0.630	-1.820	+1.24	-1.400	-1.000	-5.2	-3.2	+2.0	100 Ω to -2 V	100 Ω to GND
T_C = -55°C	-0.880	-1.920	+1.01	-1.510	-1.255	-5.2	-3.2	+2.0	100 Ω to -2 V	100 Ω to GND

5. PACKAGING

5.1 Packaging requirements. For acquisition purposes, the packaging requirements shall be as specified in the contract or order (see 6.2). When packaging of materiel is to be performed by DoD or in-house contractor personnel, these personnel need to contact the responsible packaging activity to ascertain packaging requirements. Packaging requirements are maintained by the Inventory Control Point's packaging activity within the Military Service or Defense Agency, or within the military service's system command. Packaging data retrieval is available from the managing Military Department's or Defense Agency's automated packaging files, CD-ROM products, or by contacting the responsible packaging activity.

6. NOTES

(This section contains information of a general or explanatory nature that may be helpful, but it is not mandatory)

6.1 Intended use. Microcircuits conforming to this specification are intended for logistic support of existing equipment.

6.2 Acquisition requirements. Acquisition documents should specify the following:

a. Title, number, and date of the specification.
b. PIN and compliance identifier, if applicable (see 1.2).
c. Requirements for delivery of one copy of the conformance inspection data pertinent to the device inspection lot to be supplied with each shipment by the device manufacturer, if applicable.
d. Requirement for certificate of compliance, if applicable.
e. Requirements for notification of change of product or process to acquiring activity in addition to notification to the qualifying activity, if applicable.
f. Requirements for failure analysis (including required test condition of method 5003), corrective action and reporting of results, if applicable.
g. Requirements for product assurance options.
h. Requirements for carriers, special lead lengths or lead forming, if applicable. These requirements shall not affect the part number. Unless otherwise specified, these requirements will not apply to direct purchase by or direct shipment to the Government.
i. Requirements for "JAN" marking.
j. Packaging requirements (see 5.1).

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are, at the time of award of contract, qualified for inclusion in Qualified Manufacturers List QML-38535 whether or not such products have actually been so listed by that date. The attention of the contractors is called to these requirements, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or purchase orders for the products covered by this specification. Information pertaining to qualification of products may be obtained from DSCC-VQ, 3990 E. Broad Street, Columbus, Ohio 43123-1199.

6.4 Superseding information. The requirements of MIL-M-38510 have been superseded to take advantage of the available Qualified Manufacturer Listing (QML) system provided by MIL-PRF-38535. Previous references to MIL-M-38510 in this document have been replaced by appropriate references to MIL-PRF-38535. All technical requirements now consist of this specification and MIL-PRF-38535. The MIL-M-38510 specification sheet number and PIN have been retained to avoid adversely impacting existing government logistics systems and contractor's parts lists.

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

GND ..... Ground zero voltage potential.
V_{OTH} ..... High level threshold output voltage.
V_{OTL} ..... Low level threshold output voltage.
V_{ITH} ..... High level threshold input voltage.
V_{ITL} ..... Low level threshold input voltage.
V_{EEL} ..... Shifted power supply voltage for the purpose of ac testing.
T_J ..... Circuit junction temperature.
T_C ..... Case operating temperature range.
P_D ..... Circuit power dissipation.
θ_{JA} ..... Junction to ambient thermal resistance in °C per watt.
θ_{JC} ..... Junction to case thermal resistance in °C per watt.

6.6 Logistic support. Lead materials and finishes (see 3.3) are interchangeable. Unless otherwise specified, microcircuits acquired for Government logistic support will be acquired to device class B (see 1.2.2), lead material and finish A (see 3.4). Longer lead lengths and lead forming should not affect the part number.

6.7 Substitutability. The cross-reference information below is presented for the convenience of users. Microcircuits covered by this specification will functionally replace the listed generic-industry type. Generic-industry microcircuit types may not have equivalent operational performance characteristics across military temperature ranges or reliability factors equivalent to MIL-M-35810 device types and may have slight physical variations in relation to case size. The presence of this information should not be deemed as permitting substitution of generic-industry types for MIL-M-38510 types or as a waiver of any of the provisions of MIL-PRF-38535.

6.8 Test limit compensation examples.

a. A device which has a power dissipation of 100 mW in case F is to be tested under a zero air flow condition. On figure 5 ΔT_J between 500 ft/min and zero air flow is +4°C. In order to adjust the various parameter limits use figure 7 which defines the limit adjustment coefficients for ΔT_J. To adjust V_{OH}(max) at -55°C, use the $+\Delta T_J$ column of the -55°C portion of figure 7 and locate the coefficient corresponding to V_{OH}(max). This value is 1.25 mV/°C. Multiply the ΔT_J by the coefficient and algebraically add it to the -55°C V_{OH}(max) limit from table III.

V_{OH}(max) (adjusted limits) = (+4°C x 1.25 mV/°C) + (-880 mV)
= 5 mV -880 mV = -875 mV
Use -875 mV

Follow the same procedure to adjust the remaining parameters at -55°C as well as all parameters at +25°C and +125°C.

b. A device which has a power dissipation of 150 mW in case E is to be tested at an air flow of 200 linear ft/min and the 25°C testing is to be accomplished at a case temperature of 20°C. On figure 4 ΔT_J due to air flow is +3°C. The ΔT_J due to case temperature change is -5°C (25-20). Therefore the total ΔT_J = -5°C +3°C = -2°C. Using figure 6, find the +25°C, -ΔT_J column. To adjust V_{OL}(max) locate the limit coefficient corresponding to V_{OL}(max) for a negative ΔT_J, this value is 0.44 mV°C. Multiply the ΔT_J by the coefficient and algebraically add it to the +25°C V_{OL}(max) limit from table III.

V_{OL}(max) (adjusted limits) = (-2°C) x (0.44 mV/°C) + (-1620 mV)
= -.88 mV -1620 mV = -1620.88 mV
Use -1621 mV

Follow the same procedure to adjust the remaining parameters at +25°C.

6.9 Changes from previous issue. Marginal notations are not used in this revision to identify changes with respect to the previous issue due to the extensiveness of the changes.

Custodians:
Army - CR
Navy - EC
Air Force - 11
DLA - CC

Preparing activity:
DLA - CC

(Project 5962-2005-044)

Review activities:
Army - MI, SM
Navy - AS, CG, MC, SH, TD
Air Force - 03, 19, 99

NOTE: The activities listed above were interested in this document as of the date of this document. Since organizations and responsibilities can change, you should verify the currency of the information above using the ASSIST Online database at http://assist.daps.dla.mil.