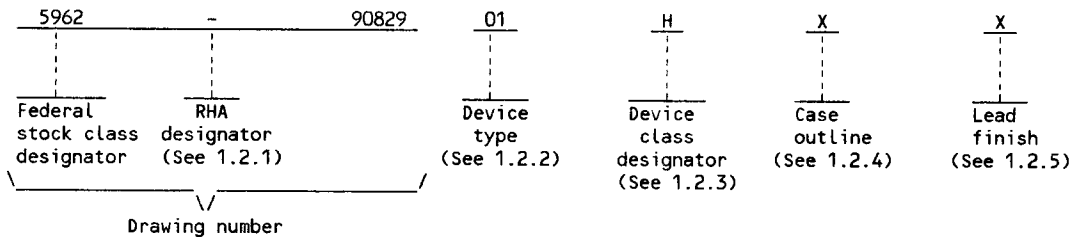


1. SCOPE

1.1 Scope. This drawing forms a part of a one part - one part number documentation system (see 6.6 herein). This drawing describes device requirements for hybrid microcircuits to be processed in accordance with MIL-H-38534. Two product assurance classes, military high reliability (device class H) and space application (device class K) and a choice of case outlines and lead finishes are available and are reflected in the Part or Identifying Number (PIN). When available, a choice of radiation hardness assurance levels are reflected in the PIN.

1.2 PIN. The PIN shall be as shown in the following example:



1.2.1 Radiation hardness assurance (RHA) designator. Device classes H and K RHA marked devices shall meet the MIL-H-38534 specified RHA levels and shall be marked with the appropriate RHA designator. A dash (-) indicates a non-RHA device.

1.2.2 Device type(s). The device type(s) shall identify the circuit function as follows:

Device type	Generic number	Circuit function	Coupling transformer turns ratio	
			Transformer	Direct
01	FC155371	Single channel, driver-receiver (receiver idle normally low)	1.66:1	1.2:1
02	FC155372	(receiver idle normally high)	1.66:1	1.2:1
03	ARX3420	(receiver idle normally low)	1.41:1	1:1
04	ARX3424	(receiver idle normally high)	1.41:1	1:1
05	NHI-1531	(receiver idle normally low)	1.77:1	1.25:1
06	NHI-1545	(receiver idle normally high)	1.77:1	1.25:1
07	CT1589M	(receiver idle normally low)	1.2:1	1:1
08	CT1589I	(receiver idle normally high)	1.2:1	1:1

1.2.3 Device class designator. This device class designator shall be a single letter identifying the product assurance level as follows:

Device class	Device requirements documentation
H or K	Certification and qualification to MIL-H-38534

1.2.4 Case outline(s). The case outline(s) shall be as designated in appendix C of MIL-M-38510, and as follows:

Outline letter	Case outline
X	See figure 1 (24-lead, 1.40" x .805" x .200") dual-in-line package
Y	See figure 1 (24-lead, 1.27" x .770" x .215") dual-in-line package (bathtub)
U	See figure 1 (24-lead, 1.26" x .620" x .200") dual-in-line package
T	See figure 1 (24-lead, 1.275" x .775" x .175") flat package

1.2.5 Lead finish. The lead finish shall be as specified in MIL-H-38534 for classes H and K. Finish letter "X" shall not be marked on the microcircuit or its packaging. The "X" designation is for use in specifications when lead finishes A, B, and C are considered acceptable and interchangeable without preference.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
2

1.3 Absolute maximum ratings.

Supply voltage:	
V _{CC} (device types 01, 02, 03, 04, 07, and 08)	-0.3 V dc to +18 V dc
V _{EE} (device types 01 and 02)	+0.3 V dc to -18 V dc
V _{CC1} (device types 03, 04, 07, and 08)	-0.3 V dc to +7 V dc
Logic input voltage	-0.3 V dc to V _{CC1}
Receiver differential voltage	40 Vp-p
Receiver common mode voltage	-10 V dc to +10 V dc
Driver peak output current:	
Device types 01, 02, 05, 06, 07, and 08	200 mA
Device types 03 and 04	350 mA
Power dissipation (P _D) at T _C = +125°C:	
Device types 01, 02, 07, and 08	3.816 W
Device types 03 and 04	1.591 W
Device types 05 and 06	0.70 W
Storage temperature range	-65°C to +150°C
Lead temperature (soldering, 10 seconds)	+300°C
Junction temperature (T _J):	
Device types 01, 02, 05, 06, 07, and 08	+160°C
Device types 03 and 04	+167°C ^{1/}
Thermal resistance, junction to case (θ _{JC}):	
Device types 01, 02, 05, and 06	18°C/W
Device types 03 and 04	88°C/W
Device types 07 and 08	60°C/W
Thermal resistance, junction to ambient (θ _{JA}):	
Device types 01, 02, 05, 06, 07, and 08	-35°C/W
Device types 03 and 04	118°C/W

1.4 Recommended operating conditions.

Supply voltage:	
V _{CC} (device types 01, 02, 05, and 06)	+11.2 V dc to +12.6 V dc
V _{CC} (device types 03, 04, 07, and 08)	+11.4 V dc to +12.6 V dc
V _{EE} (device types 01 and 02)	-11.2 V dc to -12.6 V dc
V _{EE} (device types 03, 04, 07, and 08)	-11.4 V dc to -12.6 V dc
V _{CC1}	+4.5 V dc to +5.5 V dc
Logic input voltage	0 V dc to +5 V dc
Receiver differential voltage	30 Vp-p
Receiver common mode voltage	-10 V dc to +10 V dc
Driver peak output current:	
Device types 01, 02, 05, and 06	220 mA
Device types 03 and 04	350 mA
Serial data rate	1.0 MHz maximum
Junction temperature (T _J):	
Device types 01, 02, 05, 06, 07, and 08	+150°C
Device types 03 and 04	+167°C ^{1/}
Case operating temperature range (T _C)	-55°C to +125°C

^{1/} Maximum junction temperature rise above case temperature for the hottest die at 100 percent transmitting duty cycle shall be 42°C.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 3

2. APPLICABLE DOCUMENTS

2.1 Government specifications, standards, and handbook. Unless otherwise specified, the following specifications, standards, and handbook of the issue listed in that issue of the Department of Defense Index of Specifications and Standards specified in the solicitation, form a part of this drawing to the extent specified herein.

SPECIFICATIONS

MILITARY

- MIL-M-38510 - Microcircuits, General Specification for.
- MIL-H-38534 - Hybrid Microcircuits, General Specification for.

STANDARDS

MILITARY

- MIL-STD-480 - Configuration Control-Engineering Changes, Deviations and Waivers.
- MIL-STD-883 - Test Methods and Procedures for Microelectronics.

HANDBOOK

MILITARY

- MIL-HDBK-780 - Standardized Military Drawings.

(Copies of the specifications, standards, and handbook required by manufacturers in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.2 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 shall take precedence.

3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-H-38534 and as specified herein.

3.2 Design, construction, and physical dimensions. The design, construction, and physical dimensions shall be as specified in MIL-H-38534 and herein.

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

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

3.2.3 Timing waveforms. The timing waveforms shall be as specified on figure 3.

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

3.4 Electrical test requirements. The electrical test requirements shall be the subgroups specified in table II. The electrical tests for each subgroup are described in table I.

3.5 Marking. Marking shall be in accordance with MIL-H-38534. The part shall be marked with the PIN listed in 1.2 herein. In addition, the manufacturer's PIN may also be marked as listed in QML-38534.

3.6 Manufacturer eligibility. In addition to the general requirements of MIL-H-38534, the manufacturer of the part described herein shall submit for DESC-ECT review and approval electrical test data (variables format) on 22 devices from the initial quality conformance inspection group A lot sample, produced on the certified line, for each device type listed herein. The data should also include a summary of all parameters manually tested, and for those which, if any, are guaranteed.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 4

TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Receiver							
Input level	V _L	Differential input, pin 15 to pin 16	4,5,6	ALL	40		Vp-p
Input common mode voltage range	V _{ICM}	Independent of xfmr or in accordance with MIL-HDBK- 1553, section 5.1.2.2	4,5,6	01,02,05 06,07,08	-10	+10	V(pk)
				03,04	-5	+5	
Output low voltage	V _{OL}	I _{OL} = 8 mA	1,2,3	01,02,03 04,05,06		0.5	V
		I _{OL} = 4 mA		07,08		0.5	
Output high voltage	V _{OH}	I _{OH} = -0.4 mA		ALL	2.5		
Transmitter							
Input low voltage	V _{IL}		1,2,3	ALL		0.7	V
Input high voltage	V _{IH}				2		
Input low current	I _{IL}	V _{IL} = 0.4 V		01,02,05, 06,07,08		-1.6	mA
				03,04		-0.4	
Input high current	I _{IH}	V _{IH} = 2.7 V		ALL		0.04	
Output voltage	V _O	Across 35-ohm load		ALL	6	9	V(pk)
Output noise voltage	V _{ON}	Across 35-ohm load	4,5,6	ALL		10	mVp-p

See footnotes at end of table.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
5

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Receiver strobe							
Input low voltage	V _{SIL}		1,2,3	ALL		0.7	V
Input high voltage	V _{SIH}				2		
Input low current	I _{SIL}	V _{SIL} = 0.4 V		01,02,05 06,07,08		-1.6	mA
				03,04		-0.04	
Input high current	I _{SIH}	V _{SIH} = 2.7 V		ALL		0.04	
Transmitter inhibit							
Input low voltage	V _{IIL}		1,2,3	ALL		0.7	V
Input high voltage	V _{IIH}				2		
Input low current	I _{IIL}	V _{SIL} = 0.4 V		01,02,05, 06,07,08		-1.6	mA
				03,04		-0.04	
Input high current	I _{IIH}	V _{SIH} = 2.7 V		01,02,03 04,05,06	0.04		
				07,08	0.08		
Power supply							
Total current	I _{EE} -SB	(Standby mode)	1,2,3	01,02		30	mA
				03,04		16.5	
				07,08		35	

See footnotes at end of table.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET

6

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit			
					Min	Max				
Power supply										
Total current	I _{CC1} -SB	(Standby mode)	1,2,3	01,02,03, 04		30	mA			
				05,06		25				
				07,08		45				
	I _{CC} -SB			01,02		35				
				03,04		1				
				05,06		20				
				07,08		22				
				I _{EE} -25	(25% duty cycle into 35-ohm load)	4,5,6		01,02,07 08		30
								03,04		20.5
	I _{CC1} -25			01,02,03 04,07,08		30				
				05,06		25				
	I _{CC} -25			01,02,03 04,		80				
				05,06		75				
				07,08		95				
	I _{EE} -50	(50% duty cycle into 35-ohm load)		01,02		30				
				03,04		25				

See footnotes at end of table.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
7

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions $-55^{\circ}\text{C} \leq T_C \leq +125^{\circ}\text{C}$ unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	

Power supply

Total current	I_{CC1-50}	(50% duty cycle into 35-ohm load)	4,5,6	01,02,03, 04		30	mA
				05,06		25	
	I_{CC-50}			01,02		140	
				03,04		160	
				05,06		130	
	I_{EE-100}	(100% duty cycle into 35-ohm load)	1,2,3	01,02,03 04,07,08		30	
				01,02,03 04,07,08		30	
	$I_{CC1-100}$			05,06		25	
				01,02		250	
	I_{CC-100}			03,04		320	
				05,06		230	
				07,08		290	

Receiver

Input resistance	R_{IN}	1 MHz sine wave	4,5,6	ALL	8		$k\Omega$
Input capacitance	C_{IN}	1 MHz sine wave <u>2/</u>	4			7	pF
Threshold voltage	V_{TH}	<u>3/</u>	1,2,3	01,02,03 04,05,06	0.56	1.0	Vp-p
				07,08	0.8	1.0	

See footnotes at end of table.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 8

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	

Receiver

Threshold voltage	V _{TH}	Group C end-point electricals <u>3/</u>	1,2,3	01,02,03	0.56		Vp-p
				04,05,06	0.56	1.1	
				07,08	0.8	1.1	

Transmitter

Output resistance (transmitter off)	R _{OUT}	1 MHz sine wave <u>2/</u>	4,5,6	01,02,03 04,05,06	10		kΩ
				07,08	8		
Output capacitance (transmitter off)	C _{OUT}	1 MHz sine wave <u>2/</u>	4	ALL		5	pF
Output offset voltage	V _{OS}	<u>2/</u> <u>4/</u>	4,5,6	ALL	-90	+90	mV(pk)
Peak amplitude variation	A _V	<u>5/</u>			-15	+15	%

Receiver

Delay time, input to output	t _{dr}	Delay time from differential input zero crossing to DATA or DATA* (see figure 3) <u>2/</u>	9,10,11	01,02,05 06		300	ns
				03,04		400	
				07,08		450	
Strobe delay	t _{ds}	Delay time from strobe rising or falling edge to DATA or DATA* (see figure 3) <u>2/</u>		01,02,04, 05,06,07, 08		40	
				03		400	

See footnotes at end of table.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
9

TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _C ≤ +125°C unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Transmitter							
Rise time	t _r	Output load = 35-ohm (see figure 2)	9,10,11	All	100	300	ns
Fall time	t _f				100	300	
Delay time	t _{DT}	2/		01,02,05, 06,07,08		200	
				03,04		350	
Inhibit delay inhibiting	t _{di-h}	2/		01,02,05, 06		500	
				03,04		350	
				07,08		225	
Inhibit delay	t _{di-l}	2/		01,02,05, 06		100	
				03,04		350	
				07,08		150	

1/ $V_{CC} = 12\text{ V}$, $V_{EE} = -12\text{ V}$ for device types 01, 02, 03, 04, 07, and 08 only.

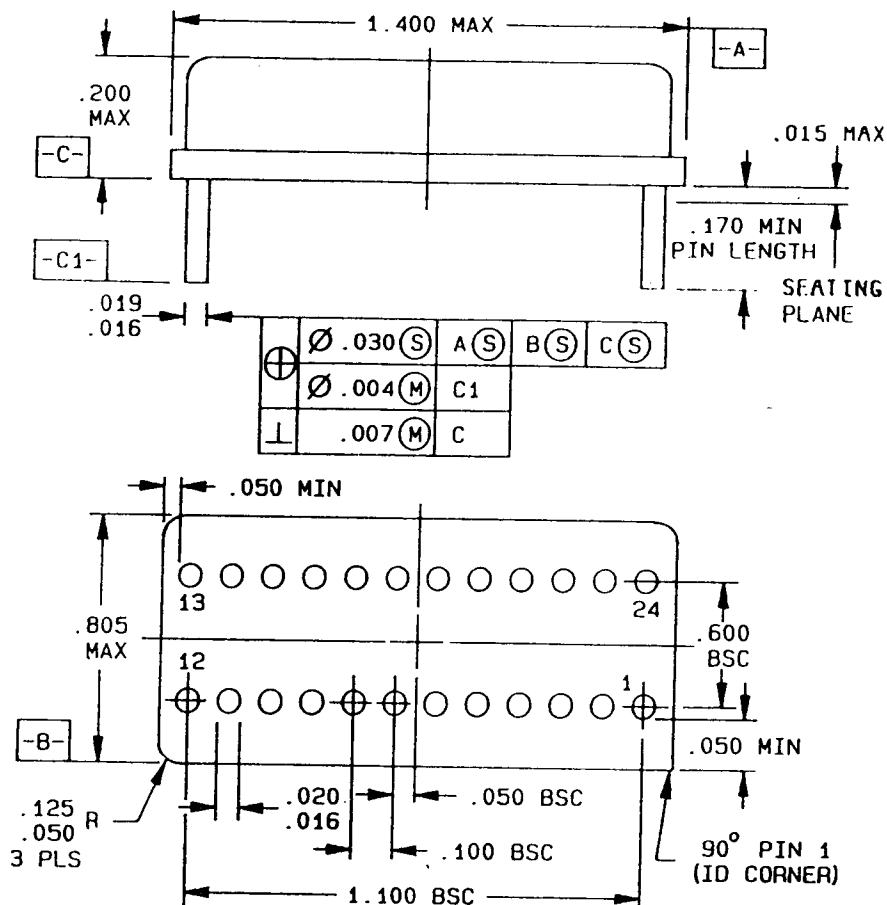
2/ This parameter is tested initially and after any process or design change which might affect this parameter.

3/ Threshold is measured in direct coupled mode including the transformer. Threshold is the maximum level on the BUS at which there are no pulses on either receiver output. Divide by 1.4 to obtain threshold in transformer coupled mode. For device types 01, 03, 05, and 07 add 0.14 V in direct coupled mode or 0.10 V in transformer coupled mode to obtain threshold at which no errors are observed when receiver is used with 15530 CMOS Manchester encoder-decoder.

4/ Measured across 35-ohm load, 2.5 μs after parity bit mid-bit zero crossing of a 660- μs message.

5/ Measured across 35-ohm load, variation of average peak amplitude.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 10



Inches	mm
.004	0.10
.007	0.18
.015	0.38
.016	0.41
.019	0.48
.020	0.50
.030	0.76
.050	1.27
.100	2.54
.125	3.18
.170	4.32
.200	5.08
.600	15.24
.805	20.45
1.100	27.94
1.400	35.56

FIGURE 1. Case outline.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

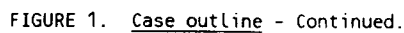
SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
11

Case Y



SHEET 12

Device types 03 and 04

Case U

Inches	mm
.002	0.05
.005	0.13
.010	0.25
.015	0.38
.017	0.43
.025	0.64
.100	2.54
.150	3.81
.200	5.08
.600	15.24
.630	15.24
1.100	27.94
1.250	31.75

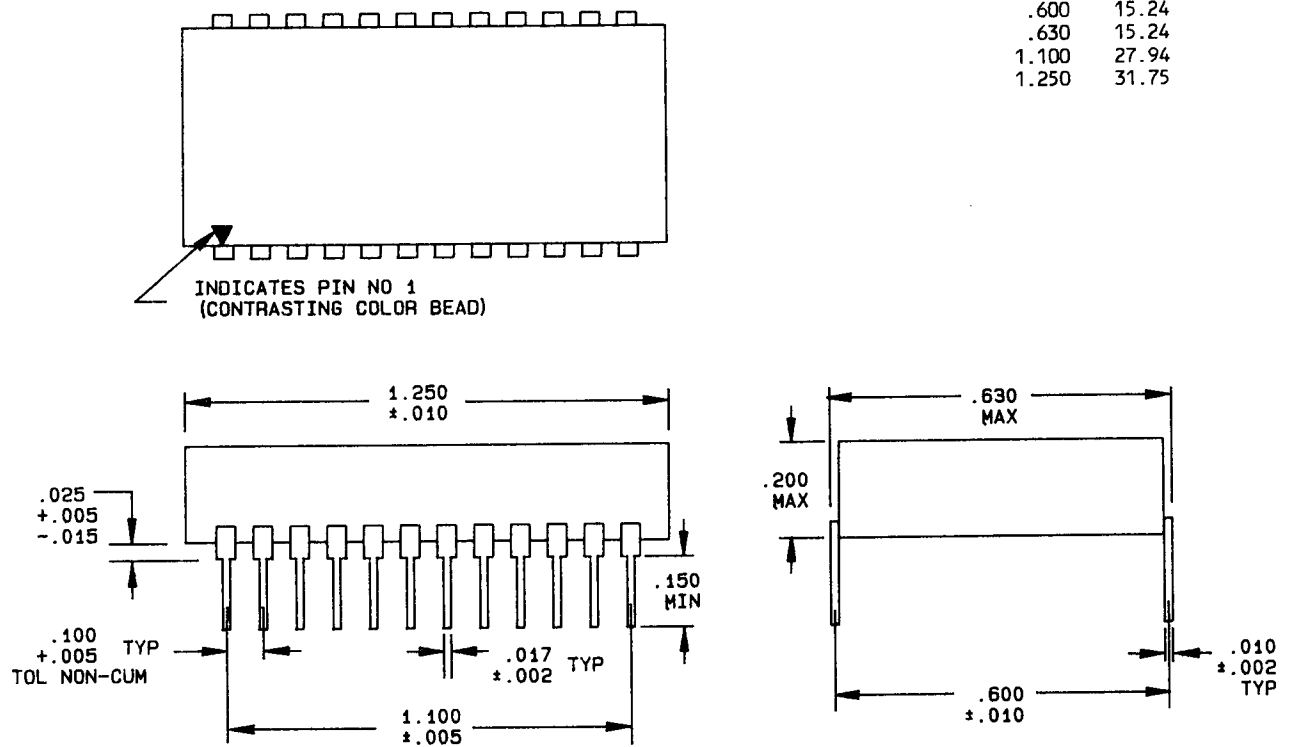
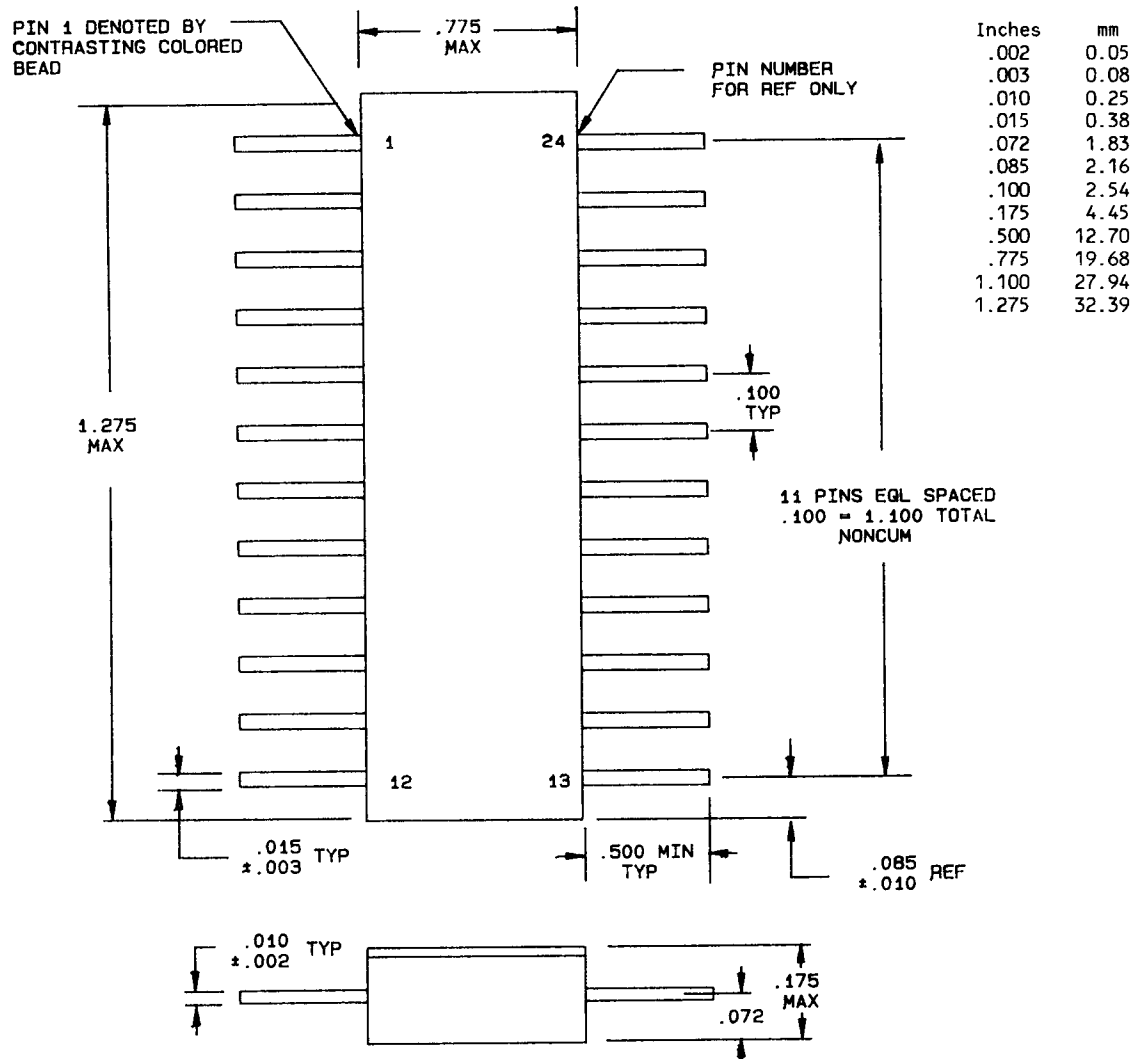


FIGURE 1. Case outline - Continued.

<p>STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444</p>	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 13

Device types 05, 06, 07, and 08

Case T



NOTES:

1. Dimensions are in inches.
2. Metric equivalents are given for general information only.
3. Lead identification numbers are for reference only.
4. Lead spacing dimensions apply only at seating plane.
5. The total number of terminals is 24.
6. For case outline U, the case is non-conductive and the lid is conductive.

FIGURE 1. Case outline - Continued.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 14

Device types	ALL		
Case outlines	X, Y, U, and T		
Terminal number	Terminal symbol	Terminal number	Terminal symbol
1	TX DATA OUT	13	V _{CC}
2	TX DATA OUT	14	No connection
3	GND <u>1/</u>	15	RX DATA IN
4	No connection	16	RX DATA IN
5	No connection	17	No connection
6	No connection	18	GND <u>1/</u>
7	RX DATA OUT	19	V _{EE} <u>2/</u>
8	STROBE	20	V _{CC1}
9	GND	21	TX INHIBIT
10	RX DATA OUT	22	TX DATA IN
11	No connection	23	TX DATA IN
12	No connection	24	No connection

1/ GND pins should all be connected externally.

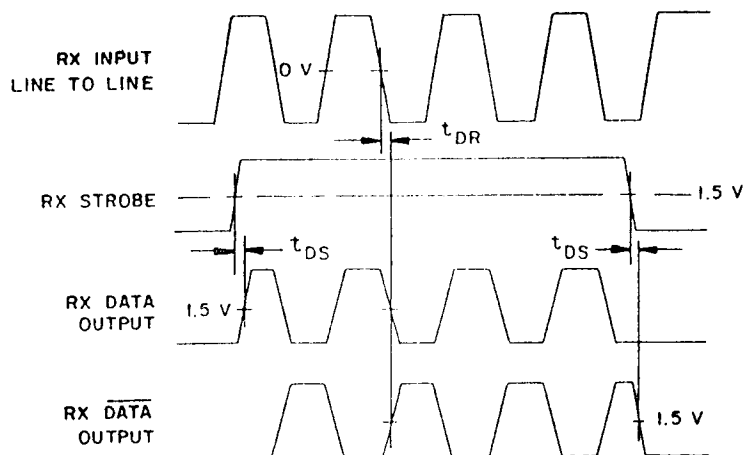
2/ Pin 19 no connect (NC), for device types 05 and 06 only.

FIGURE 2. Terminal connections.

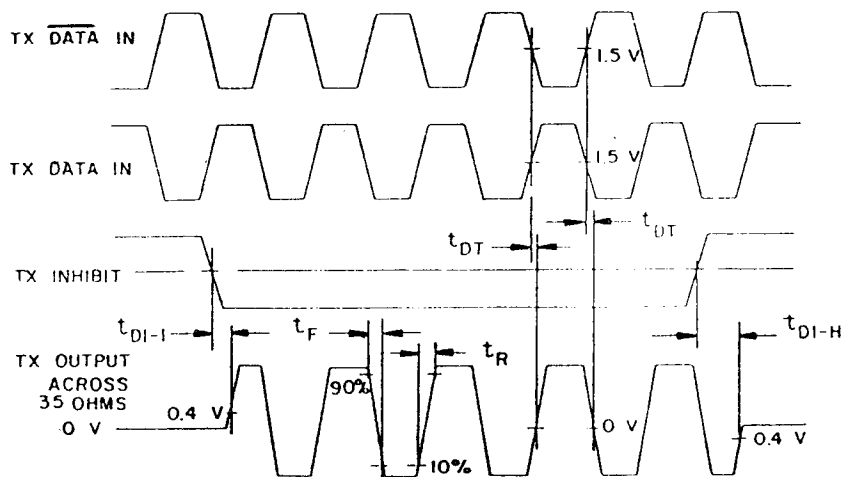
STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 15

Device types 01, 03, 05, and 07

RECEIVER TIMING



TRANSMITTER TIMING



NOTE: Both inputs "TX DATA IN" and "TX DATA IN" must be in the same logic state during off times.

FIGURE 3. Timing waveforms.

STANDARDIZED
MILITARY DRAWING
DEFENSE ELECTRONICS SUPPLY CENTER
DAYTON, OHIO 45444

SIZE
A

5962-90829

REVISION LEVEL
A

SHEET
16

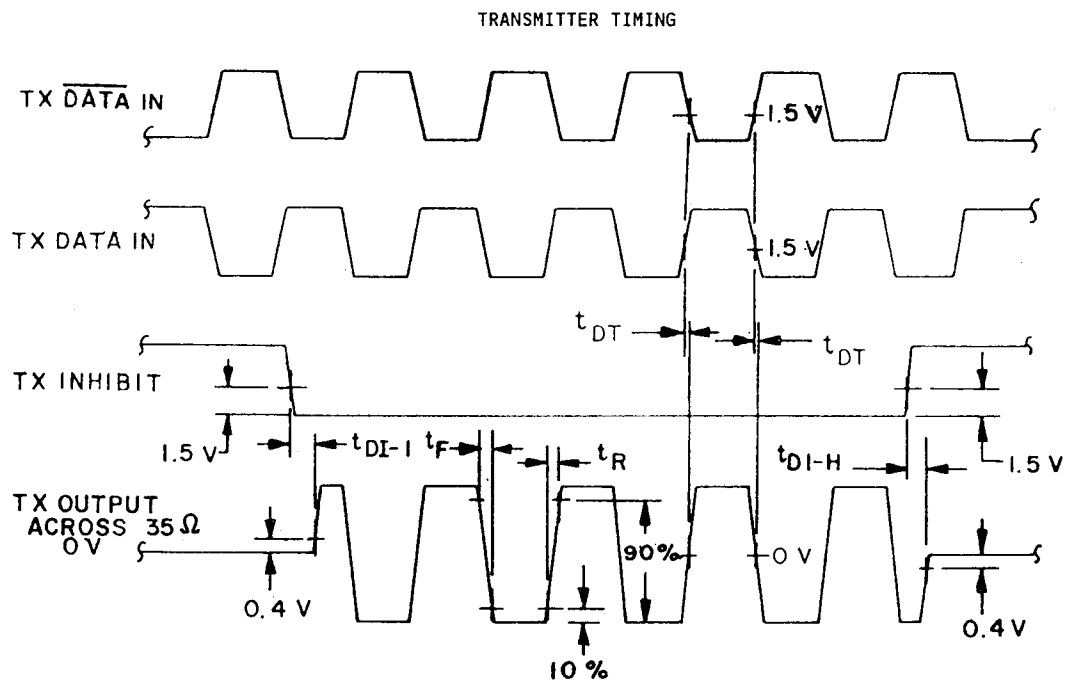


FIGURE 3. Timing waveforms - Continued.

SHEET 17

TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (per method 5008 group A test table)
Interim electrical parameters	
Final electrical test parameters	1*,2,3,4,5,6,9,10,11
Group A test requirements	1*,2,3,4,5,6,9,10,11
Group C end-point electrical parameters	1,2,3
Group E end-point electrical parameters for RHA devices	Subgroups ** (per method 5005, group A test table)

*PDA applies to subgroup 1.

**When applicable to this standardized military drawing,
the subgroups shall be defined.

3.7 Certificate of compliance. A certificate of compliance shall be required from a manufacturer in order to supply to this drawing. The certificate of compliance submitted to DESC-ECT shall affirm that the manufacturer's product meets the requirements of MIL-H-38534 and the requirements herein.

3.8 Certificate of conformance. A certificate of conformance as required in MIL-H-38534 shall be provided with each lot of microcircuits delivered to this drawing.

4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-H-38534.

4.2 Screening. Screening shall be in accordance with MIL-H-38534. The following additional criteria shall apply:

a. Burn-in test, method 1015 of MIL-STD-883.

(1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).

(2) T_A as specified in accordance with table I of method 1015 of MIL-STD-883.

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

4.3 Quality conformance inspection. Quality conformance inspection shall be in accordance with MIL-H-38534 and as specified herein.

4.3.1 Group A inspection. Group A inspection shall be in accordance with MIL-H-38534 and as follows:

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

b. Subgroups 7 and 8 shall be omitted.

4.3.2 Group B inspection. Group B inspection shall be in accordance with MIL-H-38534.

STANDARDIZED MILITARY DRAWING DEFENSE ELECTRONICS SUPPLY CENTER DAYTON, OHIO 45444	SIZE A		5962-90829
		REVISION LEVEL A	SHEET 18

4.3.3 Group C inspection. Group C inspection shall be in accordance with MIL-H-38534 and as follows:

- a. End-point electrical parameters shall be as specified in table II herein.
- b. Steady-state life test conditions, method 1005 of MIL-STD-883.
 - (1) Test condition A, B, C, or D using the circuit submitted with the certificate of compliance (see 3.7 herein).
 - (2) T_A as specified in accordance with table I of method 1005 of MIL-STD-883.
 - (3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

4.3.4 Group D inspection. Group D inspection shall be in accordance with MIL-H-38534.

4.3.5 Group E inspection. Group E inspection is required only for parts intended to be marked as radiation hardness assured (see 3.5 herein). RHA levels for device classes H and K shall be M, D, R, and H. RHA quality conformance inspection sample tests shall be performed at the RHA level specified in the acquisition document.

- a. RHA tests for device classes H and K for levels M, D, R, and H 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.
- b. End-point electrical parameters shall be as specified in table II herein.
- c. Prior to total dose 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 II herein.
- d. For device classes H and K, the devices shall be subjected to radiation hardness assured tests as specified in MIL-H-38534 for RHA level being tested, and meet the postirradiation end-point electrical parameter limits as defined in table I at $T_A = +25^{\circ}\text{C} \pm 5$ percent, after exposure.
- e. Prior to and during total dose irradiation testing, the devices shall be biased to establish a worst case condition as specified in the radiation exposure circuit.
- f. For device classes H and K, subgroups 1 and 2 in table V, method 5005 of MIL-STD-883 shall be tested as appropriate for device construction.
- g. When specified in the purchase order or contract, a copy of the RHA delta limits shall be supplied.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-H-38534.

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.

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

6.3 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 in accordance with MIL-STD-481 using DD Form 1693, Engineering Change Proposal (Short Form).

6.4 Record of users. Military and industrial users shall inform Defense Electronics Supply Center when a system application requires configuration control and the applicable SMD. DESC 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 DESC-ECT, telephone (513) 296-6047.

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		REVISION LEVEL A	SHEET 19

6.5 Comments. Comments on this drawing should be directed to DESC-ECT, Dayton, Ohio 45444, or telephone (513) 296-5374.

6.6 One part - one part number system. The one part - one part number system described below has been developed to allow for transitions between identical generic devices covered by the four major microcircuit requirements documents (MIL-M-38510, MIL-H-38534, MIL-I-38535, and 1.2.1 of MIL-STD-883) without the necessity for the generation of unique PIN's. The four military requirements documents represent different class levels, and previously when a device manufacturer upgraded military product from one class level to another, the benefits of the upgraded product were unavailable to the Original Equipment Manufacturer (OEM), that was contractually locked into the original unique PIN. By establishing a one part number system covering all four documents, the OEM can acquire to the highest class level available for a given generic device to meet system needs without modifying the original contract parts selection criteria.

<u>Military documentation format</u>	<u>Example PIN under new system</u>	<u>Manufacturing source listing</u>	<u>Document listing</u>
New MIL-M-38510 Military Detail Specifications (in the SMD format)	5962-XXXXXZZ(B or S)YY	QPL-38510 (Part 1 or 2)	MIL-BUL-103
New MIL-H-38534 Standardized Military Drawings	5962-XXXXXZZ(H or K)YY	QML-38534	MIL-BUL-103
New MIL-I-38535 Standardized Military Drawings	5962-XXXXXZZ(Q or V)YY	QML-38535	MIL-BUL-103
New 1.2.1 of MIL-STD-883 Standardized Military Drawings	5962-XXXXXZZ(M)YY	MIL-BUL-103	MIL-BUL-103

6.7 Sources of supply for device classes H and K. Sources of supply for device classes H and K are listed in QML-38534. The vendors listed in QML-38534 have submitted a certificate of compliance (see 3.7 herein) to DESC-ECT and have agreed to this drawing.

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		REVISION LEVEL A	SHEET 20

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