

REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
C	Redrawn with changes. Add device types 04 and 05. Add case outline H. Editorial changes throughout.	94-03-04	M.A. Frye
D	Add device types 06 and 07. Table I changes. Editorial changes throughout.	95-01-18	M.A. Frye
E	Changes in accordance with NOR 5962-R037-96.	96-01-11	M.A. Frye
F	Changes in accordance with NOR 5962-R072-96.	96-03-15	M.A. Frye
G	Update boiler plate and incorporate previous 2 NORs. Redrawn. Updated bulletin. -lgt	98-06-26	R. Monnin
H	Add figure 1 so that a change to symbol "A" dimension can be specified under case outline letter H. - ro	03-07-25	R. Monnin

THE ORIGINAL FIRST SHEET OF THIS DRAWING HAS BEEN REPLACED.

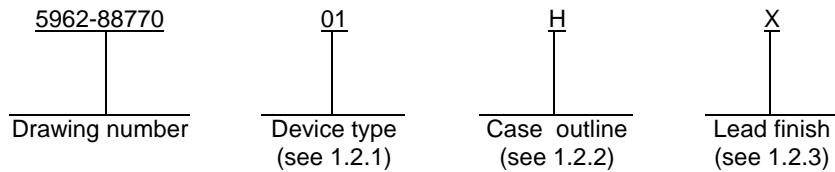
REV																				
SHEET																				
REV	H	H																		
SHEET	15	16																		
REV STATUS			REV	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	
OF SHEETS			SHEET	1	2	3	4	5	6	7	8	9	10	11	12	13	14			

PMIC N/A	PREPARED BY RICK OFFICER	DEFENSE SUPPLY CENTER COLUMBUS COLUMBUS, OHIO 43216 http://www.dsccl.dla.mil																		
STANDARD MICROCIRCUIT DRAWING THIS DRAWING IS AVAILABLE FOR USE BY ALL DEPARTMENTS AND AGENCIES OF THE DEPARTMENT OF DEFENSE AMSC N/A	CHECKED BY CHARLES E. BESORE																			
	APPROVED BY MICHAEL A. FRYE	MICROCIRCUIT, LINEAR, SINGLE POWER MOSFET DRIVER, MONOLITHIC SILICON																		
	DRAWING APPROVAL DATE 89-08-16																			
	REVISION LEVEL H		SIZE A	CAGE CODE 67268	5962-88770															
		SHEET	1 OF 16																	

1. SCOPE

1.1 Scope. This drawing describes device requirements for MIL-STD-883 compliant, non-JAN class level B microcircuits in accordance with MIL-PRF-38535, appendix A.

1.2 Part or Identifying Number (PIN). The complete PIN is as shown in the following example:



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

<u>Device type</u>	<u>Generic number</u>	<u>Circuit function</u>	<u>Output</u>
01	TSC429	Inverting power MOSFET driver	4.5 A dc
02	TSC4429	Inverting power MOSFET driver	4.5 A dc
03	TSC4420	Noninverting power MOSFET driver	4.5 A dc
04	MIC4451	Inverting hi speed, hi current MOSFET driver	12 A dc
05	MIC4452	Noninverting hi speed, hi current MOSFET driver	12 A dc
06	MIC44R21	Inverting, rad hardened MOSFET driver	9 A dc
07	MIC44R22	Noninverting, rad hardened MOSFET driver	9 A dc

1.2.2 Case outline(s). The case outline(s) are as designated in MIL-STD-1835 and as follows:

<u>Outline letter</u>	<u>Descriptive designator</u>	<u>Terminals</u>	<u>Package style</u>
H	See figure 1	10	Flat pack
P	GDIP1-T8 or CDIP2-T8	8	Dual-in-line
2	CQCC1-N20	20	Square leadless chip carrier

1.2.3 Lead finish. The lead finish is as specified in MIL-PRF-38535, appendix A.

1.3 Absolute maximum ratings.

Supply voltage (V _S).....	20 V dc
Input voltage range (V _{IN}) :	
Device 01	V _S + 0.3 V dc to GND - 0.3 V dc
Devices 02, 03, 04, 05	V _S + 0.3 V dc to GND - 5.0 V dc
Output current (per pin, capacitance load) :	
Devices 01 – 03	6.0 A dc
Devices 04 – 05	12.0 A dc
Devices 06 – 07	9.0 A dc
Peak supply current or GND current (per pin) :	
Devices 01 – 03	6.0 A dc
Devices 04 – 05	12.0 A dc
Devices 06 – 07	9.0 A dc
Storage temperature range	-55°C to +125°C

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1.3 Absolute maximum ratings - continued.

Power dissipation (P_D) :

Case outline H	650 mW	<u>1/</u>
Case outline P	800 mW	<u>2/</u>
Case outline 2	1.8 W	<u>3/</u>
Lead temperature (soldering, 10 seconds)	+300°C	
Junction temperature range (T _J)	-55°C to +150°C	

1.4 Recommended operating conditions.

Supply voltage range	4.5 V dc ≤ V _S ≤ 18 V dc
Ambient operating temperature range (T _A)	-55°C to +125°C

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 listed in the issue of the Department of Defense Index of Specifications and Standards (DoDISS) and supplement thereto, cited in the solicitation.

SPECIFICATION

DEPARTMENT OF DEFENSE

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

STANDARDS

DEPARTMENT OF DEFENSE

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

HANDBOOKS

DEPARTMENT OF DEFENSE

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

(Unless otherwise indicated, copies of the specification, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094.)

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 takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

- 1/ Derate linearly at 6.5 mW/°C above T_A = +50°C.
2/ Derate linearly at 8 mW/°C above T_A = +50°C.
3/ Derate linearly at 18 mW/°C above T_A = +50°C.

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3. REQUIREMENTS

3.1 Item requirements. The individual item requirements shall be in accordance with MIL-PRF-38535, appendix A for non-JAN class level B devices and as specified herein. Product built to this drawing that is produced by a Qualified Manufacturer Listing (QML) certified and qualified manufacturer or a manufacturer who has been granted transitional certification to MIL-PRF-38535 may be processed as QML product in accordance with the manufacturers approved program plan and qualifying activity approval in accordance with MIL-PRF-38535. This QML flow as documented in the Quality Management (QM) plan may make modifications to the requirements herein. These modifications shall not affect form, fit, or function of the device. These modifications shall not affect the PIN as described herein. A "Q" or "QML" certification mark in accordance with MIL-PRF-38535 is required to identify when the QML flow option is used.

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

3.2.1 Case outlines. The case outlines shall be in accordance with 1.2.2 herein and figure 1.

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

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 ambient 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-PRF-38535, appendix A. 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 MIL-HDBK-103 (see 6.6 herein). 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.

3.5.1 Certification/compliance mark. A compliance indicator "C" shall be marked on all non-JAN devices built in compliance to MIL-PRF-38535, appendix A. The compliance indicator "C" shall be replaced with a "Q" or "QML" certification mark in accordance with MIL-PRF-38535 to identify when the QML flow option is used.

3.6 Certificate of compliance. 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 herein). The certificate of compliance submitted to DSCC-VA prior to listing as an approved source of supply shall affirm that the manufacturer's product meets the requirements of MIL-PRF-38535, appendix A and the requirements herein.

3.7 Certificate of conformance. A certificate of conformance as required in MIL-PRF-38535, appendix A shall be provided with each lot of microcircuits delivered to this drawing.

3.8 Notification of change. Notification of change to DSCC-VA shall be required in accordance with MIL-PRF-38535, appendix A.

3.9 Verification and review. DSCC, DSCC'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.

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TABLE I. Electrical performance characteristics.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C 4.5 ≤ V _S ≤ 18 V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Logic "1" input voltage	V _{IH}		1, 2, 3	01-05	2.4		V
				06, 07	3.5		
Logic "0" input voltage	V _{IL}		1, 2, 3	01-05		0.8	V
				06, 07		2.0	
Input voltage range	V _{IN} (max)		1, 2, 3	01	0	V _S	V
			1, 2, 3	02, 03 04, 05	-5	V _S +0.3	
Input current	I _{IN}	0 V ≤ V _{IN} ≤ V _S	1	ALL		±1	μA
			2, 3			±10	
		-5 V ≤ V _{IN} ≤ 0 V	1, 2, 3	02, 03, 07		±10	mA
High output voltage	V _{OH}	R _L = ∞ 1/	1, 2, 3	ALL	V _S - 25 mV		V
Low output voltage	V _{OL}	R _L = ∞ 1/	1, 2, 3	ALL		25	mV
Output resistance	R _{O1}	V _S = 18 V, V _{IN} = 0.8 V, I _{OUT} = 10 mA	1	01, 03		2.5	Ω
			2, 3			5.0	
			1	02		2.8	
			2, 3			5.0	
			1	04, 05		1.5	
			2, 3			2.2	
			1	06, 07		2.5	
			2, 3			3.6	

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C 4.5 ≤ V _S ≤ 18 V unless otherwise specified	Group A subgroups	Device type	Limits		Unit			
					Min	Max				
Output resistance	R _{O2}	V _S = 18 V, V _{IN} = 2.4 V, I _{OUT} = 10 mA	1	01, 02		2.5	Ω			
			2, 3			5.0				
			1	03		2.8				
			2, 3			5.0				
			1	04, 05		1.5				
			2, 3			2.2				
			V _S = 18 V, V _{IN} = 3.5 V, I _{OUT} = 10 mA	1	06, 07			1.7		
				2, 3				2.7		
		Quiescent supply current	I _{S1}	V _{IN} = 3.0 V	1	01			5.0	mA
					2, 3				12	
1	02, 03 04, 05, 06, 07					1.5				
2, 3						3.0				
I _{S2}	V _{IN} = 0.0 V		1	01		0.5				
			2, 3			1.3				
			1	02, 03		0.15				
			2, 3			0.40				
			1	04, 05, 06, 07		0.15				
			2, 3			0.4				

See footnotes at end of table.

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TABLE I. Electrical performance characteristics - Continued.

Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C 4.5 ≤ V _S ≤ 18 V unless otherwise specified	Group A subgroups	Device type	Limits		Unit			
					Min	Max				
Rise time	t _R	V _S = 18 V, C _L = 2500 pF <u>2/</u> see figures 3 and 4	9	01		35	ns			
			10, 11			70				
			9	02, 03		35				
			10, 11			60				
			V _S = 18 V, C _L = 15,000 pF, <u>2/</u> see figures 3 and 4	9	04, 05			75		
				10, 11				100		
		V _S = 18 V, C _L = 10,000 pF, <u>2/</u> see figures 3 and 4	9	06, 07		75				
			10, 11			120				
		Fall time	t _F	V _S = 18 V, C _L = 2500 pF <u>2/</u> see figures 3 and 4	9	01			35	ns
					10, 11				70	
					9	02, 03			35	
					10, 11				60	
V _S = 18 V, C _L = 15,000 pF, <u>2/</u> see figures 3 and 4	9				04, 05		75			
	10, 11						100			
V _S = 18 V, C _L = 10,000 pF, <u>2/</u> see figures 3 and 4	9			06, 07		75				
	10, 11					120				

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TABLE I. Electrical performance characteristics - Continued.

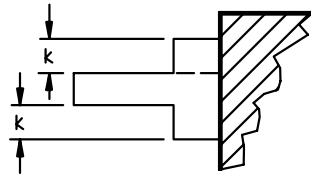
Test	Symbol	Conditions -55°C ≤ T _A ≤ +125°C 4.5 ≤ V _S ≤ 18 V unless otherwise specified	Group A subgroups	Device type	Limits		Unit
					Min	Max	
Delay time	t _{D1}	V _S = 18 V, <u>2/</u> see figures 3 and 4	9	01, 02 03		75	ns
			10, 11			100	
			9	04, 05, 06, 07		60	
			10, 11			80	
	t _{D2}		9	01		75	
			10, 11			120	
			9	02, 03		75	
			10, 11			100	
			9	04, 05, 06, 07		60	
			10, 11			80	

1/ Guaranteed by design.

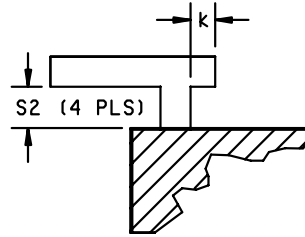
2/ Subgroups 10 and 11 are guaranteed if not tested to the limits as specified in table I herein.

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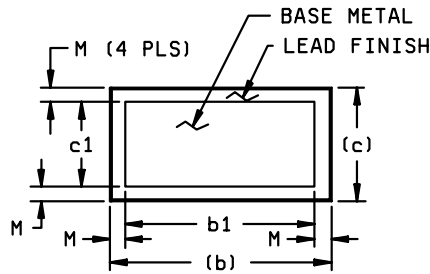
Case outline H



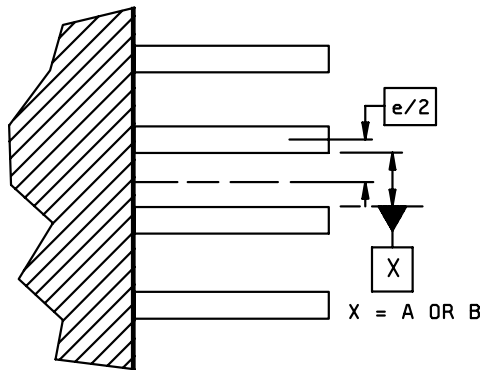
DETAIL A



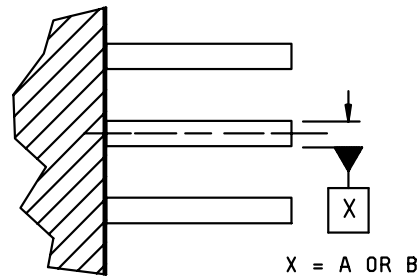
DETAIL B



SECTION A-A



EVEN NUMBER OF LEADS PER SIDE
DETAIL C



ODD NUMBER OF LEADS PER SIDE
DETAIL D

FIGURE 1. Case outline – Continued.

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1/ Symbol	Configuration A and B		
	Min	Max	Note
A	.045	.105	
b	.010	.022	
b1	.010	.019	2
c	.004	.009	
c1	.004	.006	2
D	---	.280	3
E	.240	.260	
E1	---	.300	3
E2	.125	---	
E3	.030	---	7
e	.050 BSC		
k	.008	.015	2
L	.250	.370	
Q	.026	.045	9
S1	.005	---	6
M	---	.0015	2
N	10		

NOTES:

1. Index area: A notch or a pin one identification mark shall be located adjacent to pin one and shall be located within the shaded area shown. The manufacturer's identification shall not be used as a pin one identification mark. Alternatively, a tab (dimension k) may be used to identify pin one. This tab may be located on either side of terminal one as shown in detail A, or it may be located on terminal one as shown in detail B.
2. If a pin one identification mark is used in addition to a tab, the limits of dimension k do not apply.
3. This dimension allows for off-center lid, meniscus, and glass overrun.
4. Dimensions b1 and c1 apply to lead base metal only. Dimension M applies to lead plating and finish thickness. The maximum limits of lead dimensions b and c or M shall be measured at the centroid of the finished lead surfaces, when solder dip or tin plate lead finish is applied.
5. N is the maximum number of terminal positions.
6. Measure dimension S1 at all four corners, see 5.2.5 of MIL-STD-1835. There is an alternative minimum limit to dimension S1, see 5.2.2 of MIL-STD-1835.
7. For bottom-brazed lead packages, no organic or polymeric materials shall be molded to the bottom of the package to cover the leads.
8. Optional, see note 1. If a pin one identification mark is used in addition to this tab, the minimum limit of dimension k does not apply.
9. Dimension Q shall be measured at the point of exit (beyond the meniscus) of the lead from the body. Dimension Q minimum shall be reduced by .0015 inch (0.038 mm) maximum when solder dip lead finish is applied.

FIGURE 1. Case outline – Continued.

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Device types	01, 02, 03, 04, 05, 06, 07	01, 02, 03, 04, 05, 06, 07	01, 02, 03
Case outlines	H	P	2
Terminal number	Terminal symbol		
1	V _S	V _S	NC
2	INPUT	INPUT	NC
3	NC	NC	V _S
4	GND	GND	NC
5	NC	GND	NC
6	NC	OUTPUT	INPUT
7	GND	OUTPUT	NC
8	OUTPUT	V _S	NC
9	OUTPUT	---	GND
10	V _S	---	NC
11	---	---	NC
12	---	---	NC
13	---	---	GND
14	---	---	NC
15	---	---	OUTPUT
16	---	---	OUTPUT
17	---	---	NC
18	---	---	NC
19	---	---	V _S
20	---	---	NC

FIGURE 2. Terminal connections.

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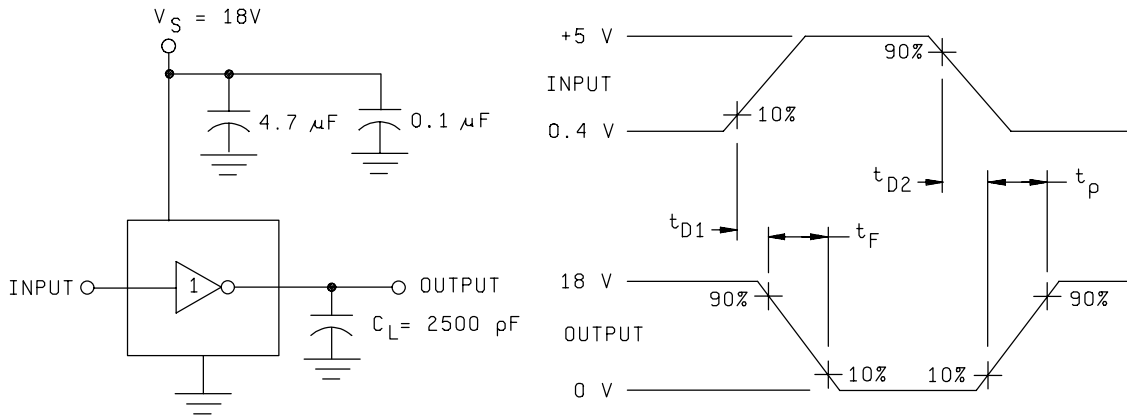


FIGURE 3. Inverting driver switching time.

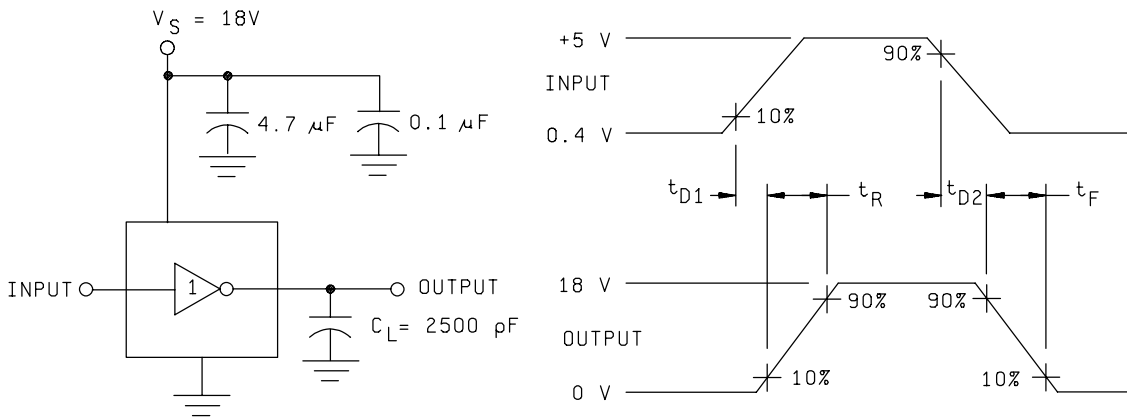


FIGURE 4. Noninverting driver switching time.

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4. QUALITY ASSURANCE PROVISIONS

4.1 Sampling and inspection. Sampling and inspection procedures shall be in accordance with MIL-PRF-38535, appendix A.

4.2 Screening. Screening shall be in accordance with method 5004 of MIL-STD-883, and shall be conducted on all devices prior to quality conformance inspection. The following additional criteria shall apply:

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 test 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 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 method 5005 of MIL-STD-883 including groups A, B, C, and D inspections. The following additional criteria shall apply.

4.3.1 Group A inspection.

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

b. Subgroups 4, 5, 6, 7, and 8 in table I, method 5005 of MIL-STD-883 shall be omitted.

4.3.2 Groups C and D inspections.

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. 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 test method 1005 of MIL-STD-883.

(2) $T_A = +125^{\circ}\text{C}$, minimum.

(3) Test duration: 1,000 hours, except as permitted by method 1005 of MIL-STD-883.

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TABLE II. Electrical test requirements.

MIL-STD-883 test requirements	Subgroups (in accordance with MIL-STD-883, method 5005, table I)
Interim electrical parameters (method 5004)	---
Final electrical test parameters (method 5004)	1*,2,3
Group A test requirements (method 5005)	1,2,3,9,10,**,11**
Groups C and D end-point electrical parameters (method 5005)	1

* PDA applies to subgroup 1.

** Subgroups 10 and 11, if not tested, shall be guaranteed to the specified limits in table I.

5. PACKAGING

5.1 Packaging requirements. The requirements for packaging shall be in accordance with MIL-PRF-38535, appendix A.

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 using DD Form 1692, Engineering Change Proposal.

6.4 Record of users. Military and industrial users shall inform Defense Supply Center Columbus when a system application requires configuration control and the applicable SMD. DSCC 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 microelectronics devices (FSC 5962) should contact DSCC-VA, telephone (614) 692-0544.

6.5 Comments. Comments on this drawing should be directed to DSCC-VA, Columbus, Ohio 43216-5000, or telephone (614) 692-0547.

6.6 Approved sources of supply. Approved sources of supply 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 DSCC-VA.

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STANDARD MICROCIRCUIT DRAWING BULLETIN

DATE: 03-07-25

Approved sources of supply for SMD 5962-88770 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 DSCC-VA. This bulletin is superseded by the next dated revision of MIL-HDBK-103 and QML-38535.

Standard microcircuit drawing PIN <u>1</u> /	Vendor CAGE number	Vendor similar PIN <u>2</u> /
5962-8877001HA	<u>3</u> /	MIC429AWBQ
5962-8877001PA	<u>3</u> /	MIC429AJBQ
5962-88770012A	<u>3</u> /	TSC429MNP/883
5962-8877002HA	<u>3</u> /	MIC4429AWBQ
5962-8877002PA	1ES66	MAX4429MJA/883B
5962-88770022C	1ES66	MAX4429MLP/883B
5962-8877003HA	<u>3</u> /	MIC4420AWBQ
5962-8877003PA	60496	MIC4420AJBQ
	1ES66	MAX4420MJA/883B
5962-88770032C	1ES66	MAX4420MLP/883B
5962-8877004HA	<u>3</u> /	MIC4451AWBQ
5962-8877004PA	<u>3</u> /	MIC4451AJBQ
5962-8877005HA	<u>3</u> /	MIC4452AWBQ
5962-8877005PA	<u>3</u> /	MIC4452AJBQ

See footnotes at end of table.

STANDARD MICROCIRCUIT DRAWING SOURCE APPROVAL BULLETIN - Continued

Standard microcircuit drawing PIN <u>1/</u>	Vendor CAGE number	Vendor similar PIN <u>2/</u>
5962-8877006HA	<u>3/</u>	MIC44R21AWBQ
5962-8877006PA	<u>3/</u>	MIC44R21AJBQ
5962-8877007HA	<u>3/</u>	MIC44R22AWBQ
5962-8877007HC	69210	OM9422SFM
5962-8877007PA	<u>3/</u>	MIC44R22AJBQ

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

60496

Micrel Inc.
1849 Fortune Drive
San Jose, CA 95131-1724

69210

Omnirel Corporation
205 Crawford Street
Leominster, MA 01453-2353

1ES66

Maxim Integrated Products Inc.
120 San Gabriel Drive
Sunnyvale, CA 94086-5125

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