CHIP ON BOARD (COB) MODULE

WITH 8-BIT MCU KEYBOARD CONTROLLER

FEATURES

Device	ROM (KB)	I/O Lines	Speed (MHz)
Z86K15	4	32	4-5
Z86C15	4	32	4-5
Z08615	4	32	4-5

- Low Power Consumption
- 0°C + 70°C Operating Temperature Range (0°C 55°C - Z08615)
- 4.5 - 5.5 Volt Operating Range
- Four Direct Connect LED Drive Ports
- Low System EMI Emission
- On-Chip RC Oscillator 4 MHz to 5 MHz

GENERAL DESCRIPTION

This Customer Procurement Specification describes the Chip-On-Board (COB) keyboard electronic module subassembly. This COB module is built and tested in accordance with design and manufacturing documentation. The module makes use of the Zilog Z8 Keyboard Controller (KCB) applied in chip configuration and mechanically mounted and electrically connected (bonded) as defined in the schematic.

The Z8 KBC is a member of the Z8 single-chip microcontroller family with 4 KB of ROM and is manufactured in NMOS/CMOS technology. The Z8 KBC microcontroller offers fast execution, efficient use of memory, sophisticated interrupt, input/output bit manipulation capabilities and easy hardware/software system expansion along with low cost and low power consumption.

The Z8 KBC architecture is characterized by a flexible I/O scheme, an efficient register, I/O and a number of ancillary features that are useful in many industrial and advanced scientific applications.

For application demanding powerful I/O capabilities, the KBC provides 32 pins dedicated to input and output. These lines are grouped into four ports, each port consists of 8 lines and are configurable under software control to provide timing, status signals and serial or parallel I/O ports. The KBC offers low EMI emission which is achieved by means of several modifications in the output drivers and clock circuitry of the device.

There are two basic address spaces available to support this wide range of configurations: Program Memory and 124 General-Purpose Registers.

The KBC offers on-chip counter/timers with a large number of user-selectable modes. This unburdens the program from coping with real-time problems such as counting/timing (Figure 1).

GENERAL DESCRIPTION (Continued)

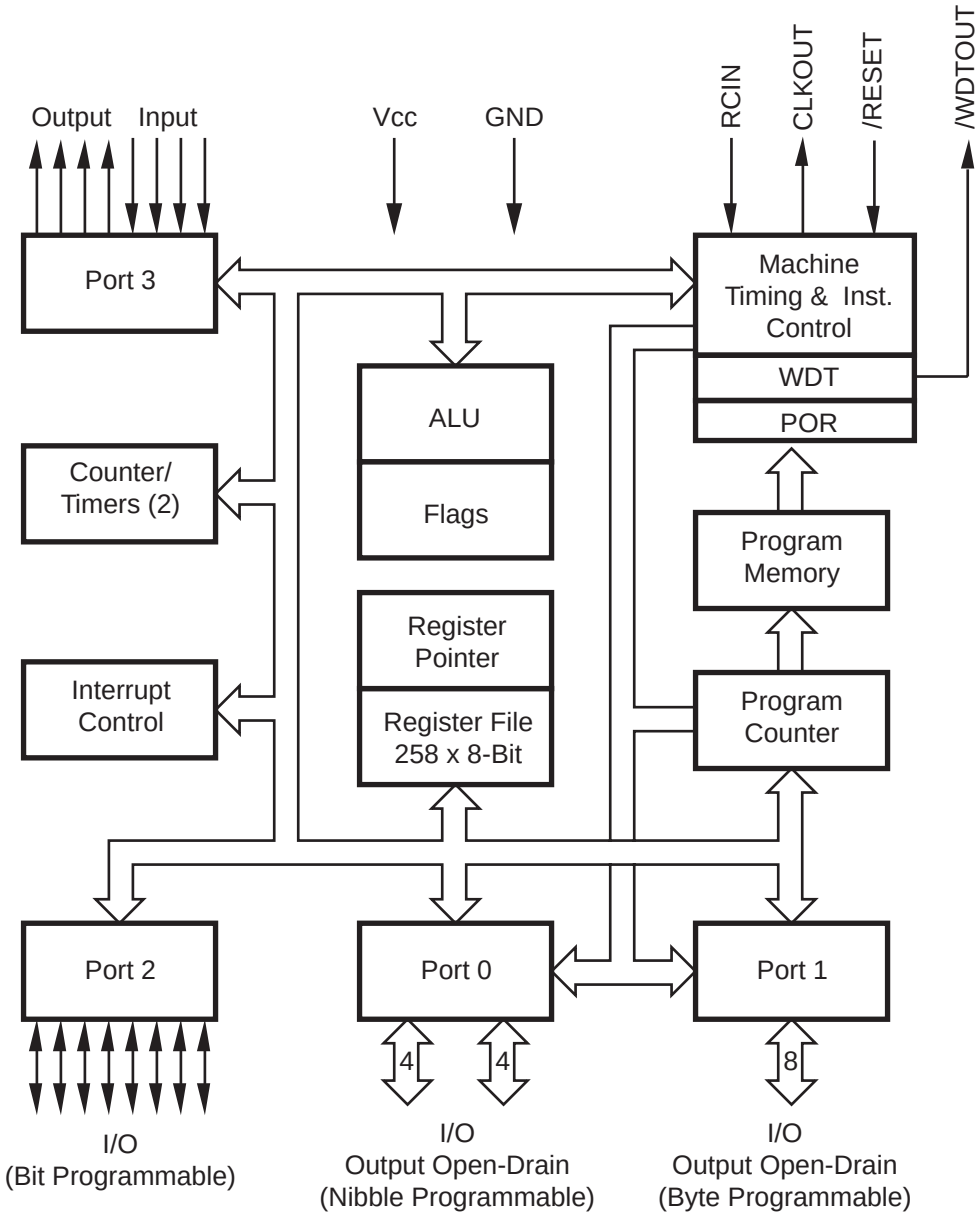


Figure 1. Functional Block Diagram

DC CHARACTERISTICS

Z86K15

(V_{CC} = 5.0V ± 5% @ 0°C to +70°C)

Sym	Parameter	Min	Max	Unit	Condition	Notes
V_{CH}	Clock Input High Voltage	0.7 V_{cc}	V_{cc} +0.3 V	V	Driven by External Clock Generator	
V_{CL}	Clock Input Low Voltage	GND -0.3	0.2 V_{cc}	V	Driven by External Clock Generator	
V_{IH}	Input High Voltage	0.7 V_{cc}	V_{cc} +0.3	V		
V_{IL}	Input Low Voltage	GND -0.3	0.2 V_{cc}	V		
V_{OH}	Output High Voltage	V_{cc} -0.4		V	I_{OH} = -2.0 mA	
V_{OH}	Output High Voltage	V_{cc} -0.6		V	I_{OH} = -2.0 mA	1
V_{OL}	Output Low Voltage		.4	V	I_{OH} = 4 mA	
V_{OL}	Output Low Voltage		.8	V	I_{OH} = 4 mA	1
I_{OL}	Output Low	10	20	mA	V_{OL} = V_{CC} -2.2 V	1
I_{IL}	Input Leakage	-1	1	µA	V_{IN} = 0V, 5.25 V	2
I_{OL}	Output Leakage	-1	1	µA	V_{IN} = 0V, 5.25 V	
I_{CC}	V_{CC} Supply Current		12	mA	@ 5.0 MHz	
I_{CC1}	HALT Mode Current			mA	@ 5.0 MHz	
I_{CC2}	STOP Mode Current		10	µA		
R_P	Pull Up Resistor	6.76	14.04	Kohm		
R_P	Pull Up Resistor (P26-P27)	1.8	3	Kohm		

Notes:
1. Ports P37-P34. These may be used for LEDs or as general-purpose outputs requiring high sink current.
2. Input pin without pull-up resistor.

ABSOLUTE MAXIMUM RATINGS

Sym	Description	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7.0	V
T_{STG}	Storage Temp	-65	+150	°C
T_A	Oper Ambient Temp	0	+105	°C

Note:
*Voltage on all pins with respect to GND.

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

Z86C15

(V_{CC} = 5.0V ± 10% @ 0°C to +70°C)

Sym	Parameter	Min	Max	Unit	Condition	Note
V_{CH}	Clock Input High Voltage	0.7 V_{CC}	V_{CC} to +0.3V	V	Driven by External Clock Generator	
V_{CL}	Clock Input Low Voltage	GND -0.3	0.2 V_{CC}	V	Driven by External Clock Generator	
V_{IH}	Input High Voltage	0.7 V_{CC}	V_{CC} +0.3	V		
V_{IL}	Input Low Voltage	GND -0.3	0.2 V_{CC}	V		
V_{RH}	Reset Input High Voltage	0.8 V_{CC}	V_{CC}	V		
V_{RL}	Reset Input Low Voltage	GND -0.3	0.2 V_{CC}	V		
V_{OH}	Output High Voltage	V_{CC} -0.4		V	I_{OH} = -2.0 mA	
V_{OH}	Output High Voltage	VCC 0.6		V	I_{OH} = -2.0 mA	1
V_{OL}	Output Low Voltage		0.8	V	I_{CL} = 4 mA	1
V_{OL}	Output Low Voltage		4	V	I_{CL} = 4 mA	
I_{OL}	Output Low	8	20	mA	V_{OL} = V_{CC} -2.2V	1
I_{IL}	Input Leakage	-1	1	µA	V_N = 0V 5.25V	2
I_{OL}	Output Leakage	-1	1	µA	V_N = 0V 5.25V	
I_{CC}	V_{CC} Supply Current		12	mA	@ 5.0 MHz	
POR	Power On Reset	84	196	ms		
SCI	Standby Current		4	mA	HALT Mode V_{IN} = 0V_{CC} @ 5 MHz	
SC2	Standby Current		20	µA	STOP Mode V_{IN} = 0V	
R_P	Pull Up Resistor	6.76	14.04	Kohm		
R_P	Pull Up Resistor (P26-P27)	1.8	3	Kohm		
R_P	Pull Up Resistor (Reset)	40	80	Kohm		

Notes:
1. Ports P37-P34. These may be used for LEDs or as general-purpose outputs requiring high sink current.
2. Input pin without pull-up resistor.

ABSOLUTE MAXIMUM RATINGS

Sym	Description	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7.0	V
T_{STG}	Storage Temp	-65	+150	°C
T_A	Oper Ambient Temp	0	+105	°C

Note:
*Voltage on all pins with respect to GND.

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

DC CHARACTERISTICS

Z08615

(V_{CC} = 4.75V to 5.25V @ 0°C to -55°C)

Sym	Parameter	Min	Max	Unit	Condition	Notes
V_{CH}	Clock Input High Voltage	3.8	V_{CC}	V	Driven by External Clock Generator	
V_{CL}	Clock Input Low Voltage	-0.3	0.8	V	Driven by External Clock Generator	
V_{IH}	Input High Voltage	2.0	V_{CC}	V		
V_{IL}	Input Low Voltage	-0.3	0.8	V		
V_{RH}	Reset Input High Voltage	3.8	V_{CC}	V		
V_{RL}	Reset Input Low Voltage	-0.3	0.8	V		
V_{OH}	Output High Voltage	2.0		V	I_{OH} = -250 µA (Port 2 only)	
V_{OH}	Output High Voltage	2.4		V	I_{OH} = -250 µA (Port 3 only)	
V_{OL}	Output Low Voltage		0.8	V	I_{OL} = 10.0 mA	1
I_{IL}	Input Leakage	-10	10	µA	V_{IN} = 0V, 5.25V	3
I_{OL}	Output Leakage	-10	10	µA	V_{IN} = 0V, 5.25V	2
I_{IR}	Reset Input Current	-335	-775	µA	V_{IN} = 0V	
I_{R1}	Input Current	-335	-775	µA	Pull-up resistor = 10.4 Kohms, V_{IN} = 0V	
I_{R2}	Input Current	-1.6	-2.9	mA	Pull-up resistor = 2.4 Kohms, V_{IN} = 0V	
I_{CC}	V_{CC} Supply Current		150	mA		
WDT	Watch-Dog Timer		2.0	mA	V_{OL} = 0.4 Volt	

Notes:

1. Ports P37-P34 may be used to sink 12 mA at 2.8V. These may be used for LEDs or as general-purpose outputs requiring high sink current.
2. P00-P07, P10-P17, P20-P25, P30-P33 as output mode open-drain as a logic one.
3. P04-P07, P10-P17, P20-P23, P30-P33 as input mode.

ABSOLUTE MAXIMUM RATINGS

Sym	Description	Min	Max	Units
V_{CC}	Supply Voltage*	-0.3	+7.0	V
T_{STG}	Storage Temp	-65	+150	°C
T_A	Oper Ambient Temp	†	†	

Note:

*Voltage on all pins with respect to GND.

Stresses greater than those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; operation of the device at any condition above those indicated in the operational sections of these specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CHIP-ON-BOARD (COB) BENEFITS

The demand in the marketplace for COB has been increasing. An increasing number of customers are choosing COB production over other means primarily due to two reasons:

- Lead time reduction and
- Cost advantage.

Zilog offers essentially the same lead time for COB as for packaged parts. By using the COB process assembly and material handling time is greatly reduced, thereby saving costs that are usually incurred with packaged devices.

COB is a one stop shopping experience. By combining administrative, procurement, material handling and product costs the customer saves the fees associated with performing those tasks separately.

In summary, COB offers many benefits not seen with packaged parts. Saving cost and lead time results in greater efficiency. In some cases, adherence to regulatory requirements (EMI/ESD), are easier to meet with this type of assembly process.

COB REQUIREMENTS

The Quote:

Due to the uniqueness of each COB program, Zilog must quote each customer program individually. Pricing and manufacturing is completed on an individual customer design basis. Each COB module is different, pricing will vary according to the customer's needs. By providing a Bill of Material (BOM), Zilog accesses the customer's specific requirements and formulates a quote tailored to the customer's needs (see sample, page 1-8). This results in a customized quote based on the "total cost" required for Zilog to produce and test a completed COB module. The factory quotation includes the initial samples, which Zilog supplies against a production purchase order contingent upon sample acceptance (see production qualification criterion sample page 1-12).

Along with the factory quote, a NRE tooling charge will apply to most COB assemblies. The charge is approximately $25K for fixtures particular to your board and test program development.

Required Documentation:

Quotations are generated in the factory, based on the following information:

- Circuit design and PCB layout (supplied by either Zilog or the customer).
- BOM including vendor and vendor part number for each component.
- Your test specifications to insure all parameters are met.
- Your required volume needed on a monthly basis.
- Acceptance criteria.

The sample COB checklist (page 7) displays the specific deliverables which are provided by either Zilog or the customer and then, approved by both parties. Since all COB requirements are customer-specific, some items may not apply. See samples (pages 1-7 through 1-12) for specific references to some of the above items.

SAMPLE: COB CHECKLIST

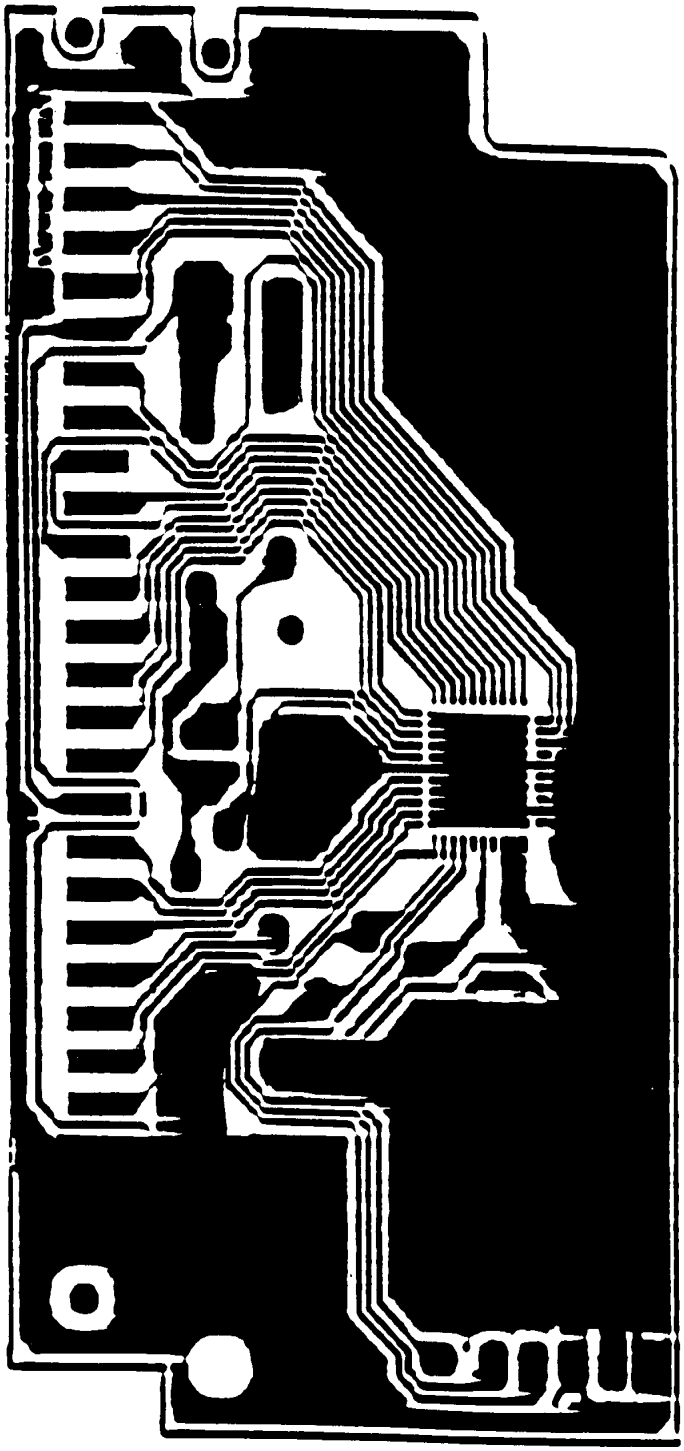
			Person Responsible		
	Deliverable	**Closure Date(s)**	**ZILOG**	**Customer**	**Initial**
1	Schematic				
2	Mechanical Outline/Mounting Details				
3	Artwork				
4	Silkscreen				
5	Assembly/Fab Drawing				
6	BOM				
7	Connection Details				
8	Electrical Specifications				
9	Production Test Specifications				
10	Shipping Configuration				
11	Quality Testing				
12	Workmanship Specifications				
13	Keyboard Controller PSI				
14	Production Quality Specifications				
15					
16					
17					
18					
19					
20	Sample Delivery				

Note: Initialing the appropriate deliverables is a written acceptance of that deliverable by either the customer or Zilog for the specified closure date indicated.

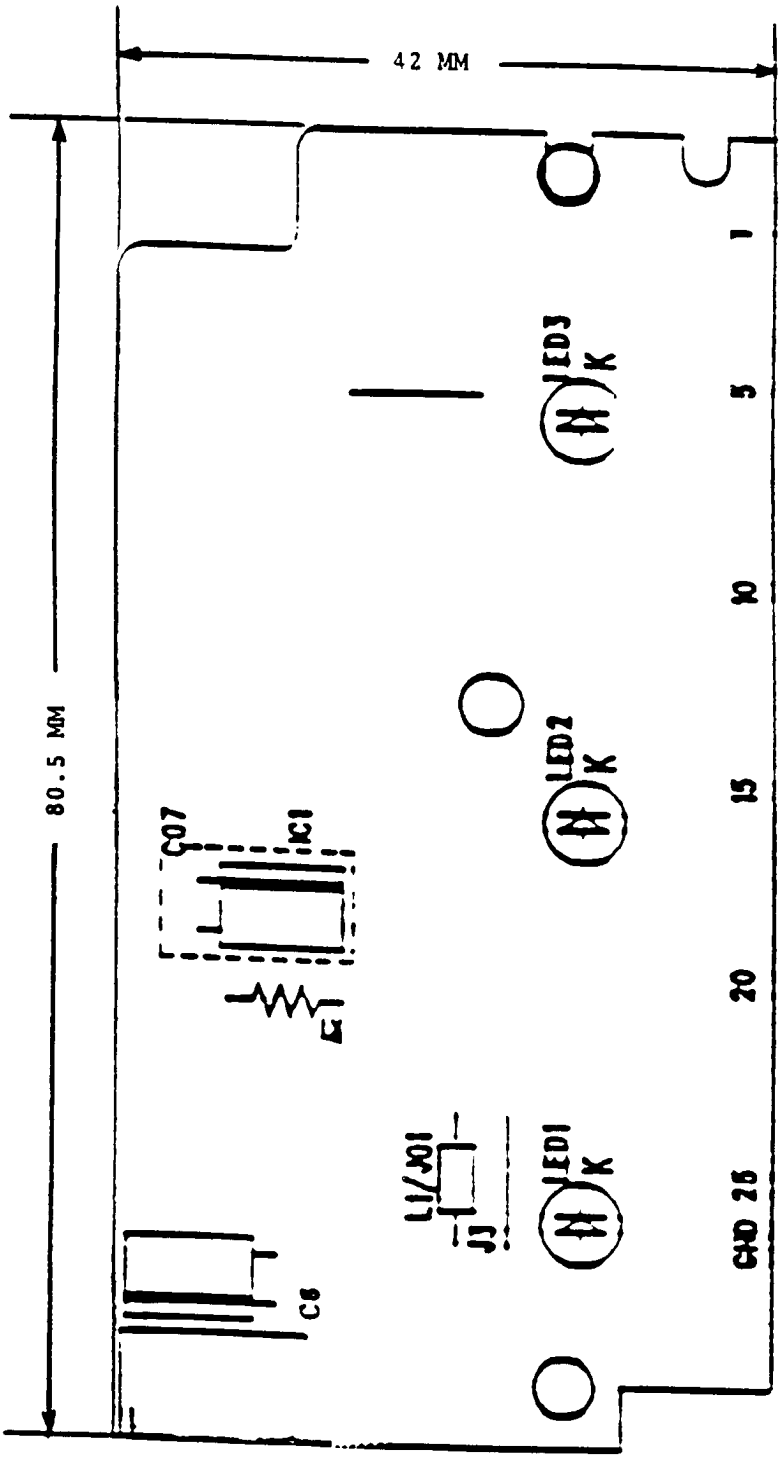
SAMPLE: BILL OF MATERIALS

ITEM	PART NO.	PL REV	QTY REQUIRED NEXT ASSEMBLY 1	2	3	4	5	6	7	8	9	TL	PART NAME/DESCRIPTION	SPECIAL FIELDS [VENDOR] VENDOR P/N
1		1				1						1	PCB ASSY	
2		1					1					1	PCB, FAB	
3							1					1	IC	
4							1					1	CAP 16V ELECT. RAD.	
5		1					1					1	CAP 50V ELECT. RAD.	
6							1					1	CAP CER/X7R	
7							1					1	CAP CER/X7R	
8							2					2	CAP 50V CER/X7R	
9							1					1	CAP CER/X7R	
10		1					1					1	RES	
11							3					3	LED, RED T1 3/4	
12							1					1	JUMPER	
13		1					1					1	SCHEMATIC DIAGRAM	

SAMPLE: PCB ARTWORK



SAMPLE: PCB (COMPONENT SIDE)



SAMPLE: COB ASSEMBLY PRODUCTION TEST SPECIFICATION

Zilog Keyboard Controller die/wafers are fully tested in accordance with the latest applicable customer product specification prior to assembly operation.

Each module is functionally tested as indicated below to ensure proper assembly and compliance with the COB module product specification.

KEYBOARD MODULE TEST PLAN

POWER CONSUMPTION:

Upon power-up, module supply current is measured.

I_{CC}_____MAX

BASIC-ASSURANCE-TEST:

Power-On-Reset (POR) is tested to confirm start up functionality of the module. After power-up, data communication is monitored for an AA code within 700 ms.

LED SINK CURRENT:

The module LEDs are activated and current is measured to ensure data and clock lines are functional and LEDs operate properly. Sink current for each port is 20mA max.

DATA & CLOCK COMMUNICATION TIMING:

Appropriate rows and columns are shorted to simulate key closer and generation of the make code. Data and clock lines have a duty cycle of 50% $\pm$ 10% and period of 80µs $\pm$ 10%.

TYPEMATIC RATE:

Key closure is simulated by shorting a row and a column line. First make code is measured at 12ms nominal. The next make code is measured at 500ms $\pm$ 20%.

KEYBOARD FUNCTIONAL TEST:

Selected rows and columns are shorted to simulate key depression and the generation of a predetermined make code on the data communication line.

MECHANICAL TEST:

Each COB assembly may be subject to shock and flex testing to assure mechanical stability.

SAMPLE: PRODUCTION QUALIFICATIONS

SAMPLE
PRODUCTION QUALIFICATIONS

1. Function Test

No.	Test Item	Condition of Test
1.	Keyboard Function Test	
2.	Check Timing / Parameter(s)	
3.	Others	
4.	Others	

2. Test for Agency Approval

No.	Test Item	Condition of Test
1.	ESD Test	
2.	EFT Test	
3.	EMI Test	

3. Environmental Test

No.	Test Item	Condition of Test
1.	High Temperature/Humidity Test	
2.	Temperature Cycle Test	
3.	High Temperature Test	
4.	Low Temperature Test	
5.	Function Test under High Temperature	
6.	Function Test under High Temperature / Humidity Test	
7.	Function Test under Low Temperature	
8.	Thermal Shock Test	
9.	Vibration Test	
10.	Hydrogen Sulfide Gas Test	

4. Other Test / Check Item

No.	Test Item	Condition of Test
1.	Soldering Test	
2.	Open/Short Test	
3.	Surface Temperature Check	
4.	Visual Check	
5.	Dimension Check	

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