

Programmable Bar Code Decode ICs

Technical Data

HBCR-2010 HBCR-2011

Features

- **Ideal for Hand Scanning and Many Automated Scanning Applications**
- **Supports Code 39, UPC / EAN / JAN, Interleaved 2 of 5, Codabar and Code 128 Standard Bar Code Symbolologies**
- **Automatic Code Recognition**
- **Serial Port Interface**
- **Full Duplex ASCII Interface**
- **Extensive Configuration Control**
- **Low Current CMOS Technology**
- **40 Pin DIP and 44 Pin PLCC Packages**
- **Audio and Visual Feedback Control**
- **Single +5 Volt Supply**

Description

Agilent's Bar Code Decoder ICs offer flexible bar code decoding capability that is designed to give OEMs the ability to address a large number of industry segments and applications. Flexibility is made possible through sophisticated firmware, which allows the ICs to accept data from a wide variety of scanners and to automatically recognize and decode the most popular bar code symbolologies. User implementation of decoder ICs is easy since it requires only a few supporting chips and components and provides a standard I/O interface.

Manufacturers of data collection terminals, point of sale terminals, keyboards, weighing scales, and other data collection and material handling equipment are finding a growing demand for bar code reading capability in their products. The HBCR-2010 series decoder ICs make it easy to add this capability without the need to invest in the development of bar code decoding software.

The bar code decoder ICs are compatible with most hand held scanners. The HBCR-2010 series



is compatible with fixed beam non-contact scanners, digital wands, digital slot readers and Symbol Technologies moving beam laser scanners.

The HBCR-2010 decoder ICs are excellent decoding solutions for a number of the stationary scanning applications found in automated systems. The scan rates for moving beam applications should be similar to the scan rates for hand held laser scanners (35 to 45 scans per second), and the scan speeds for fixed beam applications should be similar to the scan speeds typical of wands and slot readers. For moving beam applications, it is also necessary for the scanner to utilize the three laser scanner control lines.

The decoder ICs decode the bar code symbologies now in use for most applications in the industrial, retail, government, and medical market. The ICs support Code 39 (Standard or Extended), Interleaved 2 of 5, the UPC/EAN/JAN Codes, Codabar and Code 128. Whenever more than one symbology is enabled, the bar code being scanned will automatically be recognized and decoded, except for Standard and Extended Code 39 which are mutually exclusive. Bi-directional scanning is allowed for all bar codes except UPC/EAN/JAN with supplemental digits, which must be scanned with the supplemental digits last.

The I/O for the decoder ICs is full duplex, 7 bit ASCII. A serial port is available. The serial interface can be converted to an RS232C interface or connected directly to another microprocessor for data processing. Feedback to the operator is accomplished by signals for an LED and a beeper. In addition, there are programmable functions covering items such as code selection and beeper tone.

The ICs are CMOS, in either a 40 pin DIP package or a 44 pin PLCC package. All ICs require a dedicated external data memory, 2K or 8K x 8 bit static RAM (only 1K is needed) and address latch chip (a 74LS373 or equivalent). The crystal frequency is 11.059 MHz.

Performance Features

Bar Codes Supported

The decoder IC is capable of reading popular bar code symbologies : Code 39 (Standard or Extended), Interleaved 2 of 5, UPC/EAN/JAN, Codabar (NW7 Code) and Code 128.

Code 39 is an alphanumeric code, and Extended Code 39 encodes the full 128 ASCII character set by pairing Code 39 characters. Both can be read bi-directionally with message lengths of up to 32 characters. An optional checksum character can be used with these codes, and the ICs can be configured to verify this character prior to data transmission. Note that enabling Extended Code 39 will disable Code 39 since they are mutually exclusive.

Interleaved 2 of 5 code, a compact numeric only bar code, can also be read bi-directionally with message lengths from 4 to 32 characters. To enhance data accuracy, optional checksum character verification and/or message length checking can be enabled.

The following versions of the UPC, EAN and JAN bar codes can be read bi-directionally: UPC-A, UPC-E, EAN-8, EAN-13, JAN-8, and JAN-13. All versions can be enabled simultaneously or decoding can be restricted to only the UPC codes.

UPC, EAN, and JAN codes printed with complementary two digit or five digit supplemental encodings can be read in two different ways. If the codes are enabled without the supplemental encodings, then only the main part of symbols printed with supplemental encodings will be read. If the reading of supplemental encodings is enabled, then only symbols with these supplements will be read. Whenever supplemental encodings are enabled, the bar code symbols must be read in the direction that results in the supplements being scanned last.

Codabar, a numeric only bar code with special characters, can be read bi-directionally for message lengths up to 32 characters. The start and stop characters are normally transmitted, but can be suppressed by a software command.

Code 128, a full ASCII bar code, can also be scanned bi-directionally with message lengths of up to 32 characters.

Scanner Input

The decoder ICs are designed to accept data from hand held digital scanners or slot readers with the following logic state: black = high, white = low. They also accept data from hand held laser scanners with the opposite logic states: black = low, white = high. The scanner type pin (SCT) must be driven prior to power up or hard reset to identify the type of scanner attached to it.

The automatic laser shutoff feature delay time is adjustable by software commands. Applications which require extreme accuracy may need the redundancy check feature. If either motor failure sensing or calculation of the ratio of laser on time to off time is needed for an application, it must be supported with external circuitry.

Scanner input can be disabled by software command. This allows an application program to control when an operator can enter data, preventing inadvertent data entry. It also allows the program to verify each scan before enabling subsequent scans.

There is also a single read mode which allows the application program to stop bar code data entry until a "Next Read" command is received, allowing the host computer to process data transmissions before enabling subsequent reads.

Data Communications

The serial port supports a wide range of baud rates, parities, stop bits, and terminator characters, as described in Summary of Features and Configuration Control table. Software control of data transmission is accomplished with an Xon/Xoff (DC1/DC3) handshake. There is also an RTS/CTS hardware handshake.

Feedback Features

Both audio and visual feedbacks are possible with the decoder ICs. In both cases, the outputs from the ICs must be buffered before driving the actual feedback mechanism. An LED or beeper connected to the decoder ICs can

be controlled directly by the IC, with signals generated by successful decodes or can be controlled by the host system.

Power Requirements

The decoder IC operates from a +5 volt DC power supply. The maximum current draw is 19mA. The maximum power supply ripple voltage should be less than 100 mV, peak-to-peak.

Configuration Control

Configuration of the decoder IC is determined by hardware connections and/or through software commands. Hardware selection is limited to key operating parameters. A greater range of configuration control is available via software commands. A summary of the decoder IC features and configuration control is presented in Summary of Features and Configuration Control table.

Handling Precautions

The decoder ICs are extremely sensitive to electrostatic discharge (ESD). It is important that proper anti-static procedures be observed when handling the ICs. The package should not be opened except in a static free environment.

Manuals

The decode IC Users Manual covers the following topics:

- Data output formats
- I/O interfaces
- Laser input timing diagrams
- Escape sequence syntax and functionality
- Example schematics
- All configurable options
- Bar code menus
- Scanner positioning and tilt
- Sample bar code symbols
- Appendices describing bar code symbologies.

Ordering Information

Part Number	Description
HBCR-2010	CMOS, 40 pin DIP, bulk ship, no manuals
HBCR-2011	CMOS, 44 pin PLCC, bulk ship, no manuals
Option A01	IC individually boxed with manuals
HBCR-2997	Series 2010 manuals

Recommended Operating Conditions

Parameter	Symbol	Minimum	Maximum	Units	Notes
Supply Voltage	V _{CC}	4.0	6.0	V	1
Ambient Temperature	T _A	- 40	+ 85	°C	
Crystal Frequency	XTAL	0 (DC)	12.000	MHz	2
Element Time Interval (Moving Geam)	ETI _M	22	555	μs	2, 3, 4
Element time Interval (Fixed Beam)	ETI _F	150	70,000	μs	3, 4
Element Time Interval (Contact Scanner)	ETI _C	150	70 000	μs	3, 4

Notes:

1. Maximum power supply ripple of 100 mV peak-to-peak.
2. The HBCR-2010 series uses a 11.059 MHz crystal. For different crystal frequencies, multiply the specified baud rate and beeper frequencies by (crystal frequency/11.059 MHz) and multiply the element time interval ranges by (11.059 MHz/crystal frequency).
3. At the specified crystal frequency.
4. Corresponds to a scan rate of 35 to 45 scans per second.

Absolute Maximum Ratings

Parameter	Symbol	Minimum	Maximum	Units	Notes
Storage Temperature	T _S	- 55	+ 150	°C	
Supply Voltage	V _{CC}	- 0.5	+ 7.0	V	2
Pin Voltage	V _{IN}	- 0.5	V _{CC} + 0.5	V	1, 2

Notes:

1. Voltage on any pin with respect to ground.
2. T_A = 25 °C.

DC Characteristics

(T_A = - 40°C to +85°C, V_{CC} = 4.5 V to 5.5 V, V_{SS} = 0 V)

Symbol	Parameter	2010 Pins	2011 Pins	Min.	Max.	Units	Test Conditions
V _{IL}	Input Low Voltage	All	All	-0.5	0.2 V _{CC} - 0.1	V	
V _{IH}	Input High Voltage	except 9, 18	Except 10, 20	0.2V _{CC} +0.9	V _{CC} + 0.5	V	
V _{IH1}	Input High Voltage	9, 18	10, 20	0.7 V _{CC}	V _{CC} + 0.5	V	
V _{OL}	Output Low Voltage	1-8, 10-17, 21-28	2-9, 11, 13-19, 24-31		0.45	V	I _{OL} = 1.6 mA
V _{OL1}	Output Low Voltage	30, 32-39	33, 36-43		0.45	V	I _{OL} = 3.2 mA
V _{OH}	Output High Voltage	1-8, 10-17, 21-28	2-9, 11, 13-19, 24-31	2.4 0.75 V _{CC} 0.9 V _{CC}		V V V	I _{OH} = -60 μA I _{OH} = -30 μA I _{OH} = -10 μA
V _{OH}	Output High Voltage	30, 32-39	33, 36-43	2.4 0.75 V _{CC} 0.9 V _{CC}		V V V	I _{OH} = -400 μA I _{OH} = -150 μA I _{OH} = -40 μA
I _{IL}	Input Low Current	1-8, 10-17, 21-28	2-9, 11, 13-19, 24-31	-10	-200	μA	V _{IN} = 0.45 V
I _{IL2}	Input Low Current	18	20		-3.2	μA	V _{IN} = 0.45 V
I _{IL1}	Input Leakage Current	32-39	36-43		± 10	μA	0.45 ≤ V _{IN} ≤ V _{CC}
R _{RST}	Pulldown Resistor	9	10	20	125	KΩ	
I _{CC}	Power Supply Current	-	-		18	mA	All outputs disconnected
I _{CC}	Idle Mode Power Supply Current	-	-		9	mA	Note 1.

Note: 1. Applies only in Wand Mode with no scanning or I/O operation in progress.

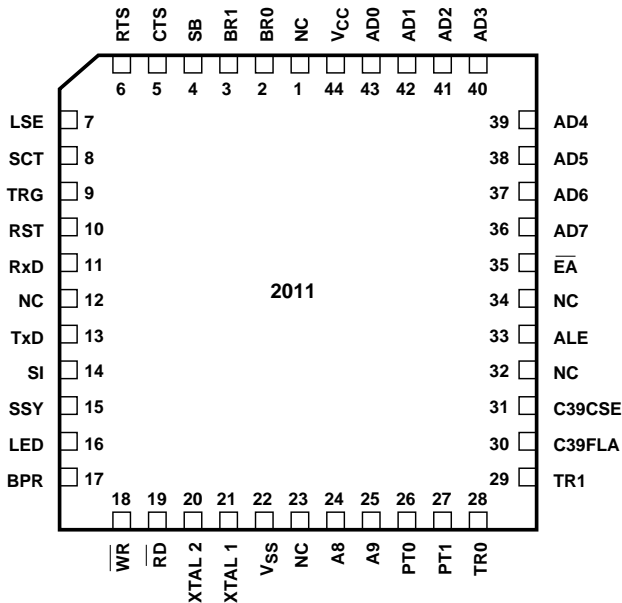
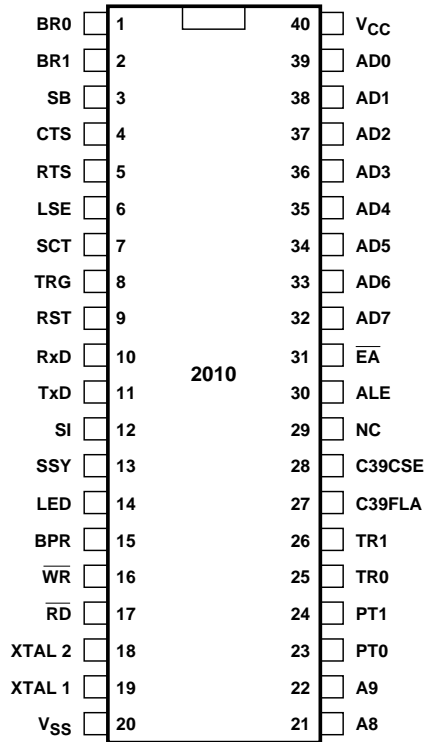
Summary of Features and Configuration Control

Feature	Function or Value	Hardware/ Software Control ^[1]	Default Setting ^[2]
Scanner Type	Contact reader or moving beam laser scanner	Hardware	Moving beam laser scanner
Laser Shutoff Delay	Defines laser on time prior to automatic shutoff from 0 to 10 seconds in 100 ms steps	Software	3 seconds
Laser Redundancy Check	Enables requirement for two consecutive, identical decodes for a good read	Software	Disabled
Scanner Input Enable	Enables data acquisition from the scanner	Software	Enabled
Single Read Mode	Enables requirement for a "Next Read" command before processing the next scanner input signal	Software	Disabled
	Extended Code 39	Both	
Code Select	Code 39 Interleaved 2 of 5 UPC/EAN/JAN Codes Codabar Code 128	Software	Code 39 Interleaved 2 of 5 UPC/EAN/JAN Codabar Code 128
UPC/EAN/JAN Decoding	UPC/EAN/JAN together, or UPC only	Software	UPC/EAN/JAN together
Options	Enable 2 or 5 digit supplements	Software	Supplements disabled
Codabar Data Transmission Option	Transmit or suppress Start/Stop characters	Software	Transmit
Check Characters	Code 39 check character verification	Both	
	Interleaved 2 of 5 check character verification	Software	No Verification
Interleaved 2 of 5 Label Length Check	User Defined from 4 to 32 characters (even only) or variable length	Software	Variable length
Baud Rate	1200, 2400, 4800, 9600	Hardware	1200 Baud
Parity	0's, 1's, Odd, Even	Hardware	0's
Stop Bits	1 or 2	Hardware	1
Terminator Character	CR, CRLF, ETX, None	Hardware	
	User defined (10 characters max.)	Software	C _R
Header Character	User defined (10 characters max.)	Software	No header character
Data Output Pacing	RTS/CTS	Hardware	No
	X _{ON} /X _{OFF}	Software	Pacing
Good Read Beep Select	Enables good read beep (1 of 16 tones)	Software	Beep tone = 12
Sound Tone	Command to sound tones (1 of 16)	Software	N/A
LED Control	Controls LED driver circuit	Software	LED to flash upon good read
Status Request	Gives status of decoder IC Configuration	Software	N/A
Hard Reset	Resets decoder IC to hardware configuration and default software settings	Software	N/A

Notes:

1. Hardware control is accomplished by tying appropriate input pins high or low. Software commands are sent by means of escape sequences.
2. Default settings are those settings which result when the relevant pins have been tied to +5 V and no software commands have been sent to the decoder IC.

HBCR-2010 Series Pinout



Mnemonic	Description
BR0	Baud Rate Select 0
BR1	Baud Rate Select 1
SB	Stop Bits
PT0	Parity Select 0
PT1	Parity Select 1
TR0	Trailer Select 0
TR1	Trailer Select 1
CTS	Clear to Send
RTS	Request to Send
RxD	Received Data
TxD	Transmitted Data
TRG	Trigger Input
LSE	Laser Scan Enable
SSY	Laser Synchronization
SCT	Scanner Type
LED	LED Control
BPR	Beeper Control
RST	Reset
SI	Scanner Input
NC	No Connect
EA	Connect to +5 V
ALE	Address Latch Enable
WR	Memory Write
RD	Memory Read
XTAL 1	Crystal Input 1
XTAL 2	Crystal Input 2
C39FLA	Code 39 Full ASCII Conversion
C39CSE	Code 39 Check Character Enable
AD0-AD7	Address/Data Bits 0-7
A8	Memory Address Line 8
A9	Memory Address Line 9
Vss	Ground
Vcc	+5 V Power

Escape Sequence Summary

Command	Description	Command	Description
<esc> - y<n>B	Good Read Beep Select	<esc> - y<n>0<text>	Trailer Select
<esc> - y<n>C	Industrial Code Select	<esc> - y<n>S	Status Request
<esc> - y<n>D	Checksum Verification Select	<esc> - y<n>T	Sound Tone
<esc> - y<n>E	Decoding Options	<esc> - y<n>J	Single Read Mode
<esc> - y<n>F	Code Select	<esc> - y<n>K	Next Read
<esc> - y<n>G	Check Character Select	<esc> - y<n>R	Laser Redundancy Check
<esc> - y<n>H	Decoding Options	<esc> - y<n>V	Laser Shutoff Delay
<esc> - y<n>L	LED Control	<esc> - y<n>U	UPC/EAN/JAN Options
<esc> - y<n>M	Interleaved 2 of 5 Length Check	<esc> - y<n>W	Scanner Enable
<esc> - y<n>N<text>	Header Select	<esc> - y<n>X	DC1/ DC3 Pacing
<esc> E	Hard Reset		

Note:

<esc> is the ASCII escape character, 27 decimal, 1B hex.

IC Reset Circuits

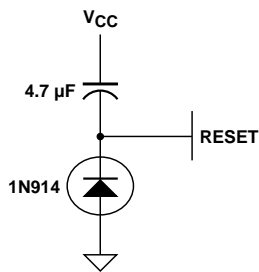


Figure 1.

Mechanical Dimensions

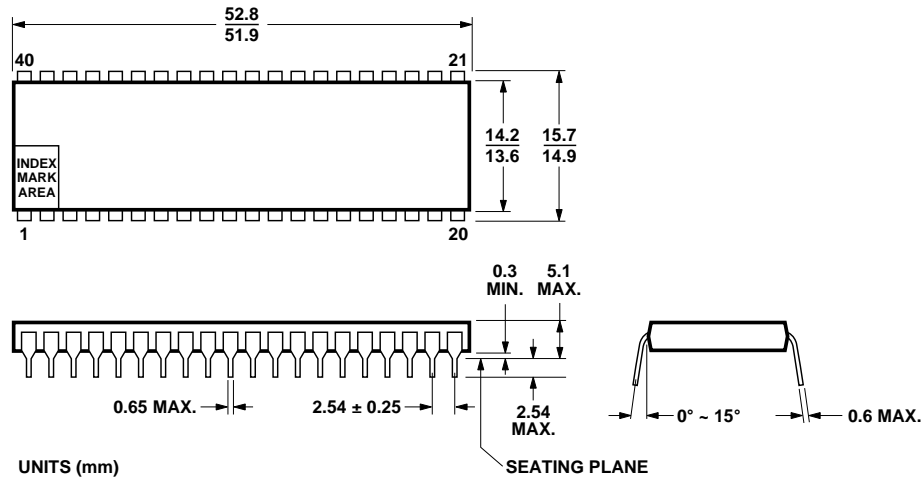


Figure 2. HBCR-2010.

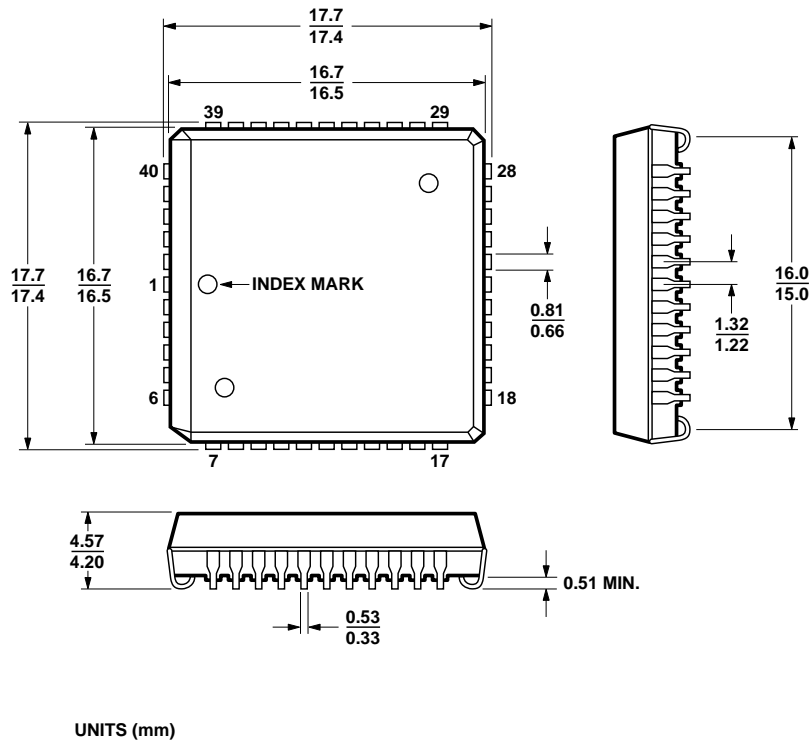


Figure 3. HBCR-2011.

PLCC Solder Pad Reference

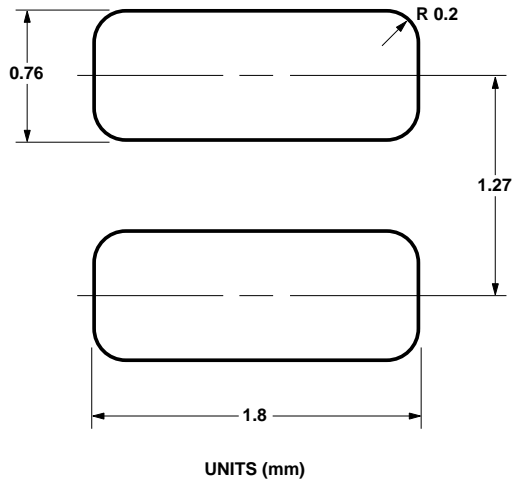


Figure 4. Pad Size.

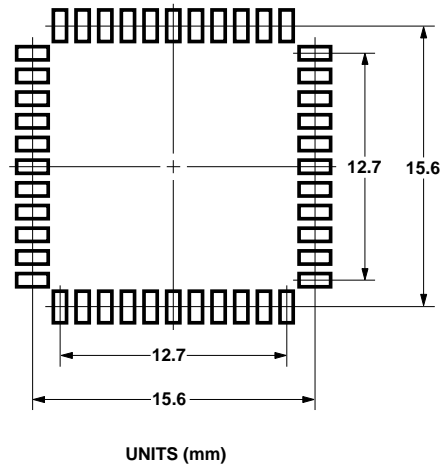


Figure 5. Pad Placement.

PLCC Drying

Whenever Vapor Phase or Infrared Reflow technologies are used to mount the PLCC packages, there is a possibility that previously absorbed moisture, heated very rapidly to the reflow temperatures, may cause the package to crack from internal stress. There is a reliability concern that moisture may then enter the package over a period of time, and metal corrosion may take place, degrading the IC performance.

To reduce the amount of absorbed moisture and prevent cracking, all of the PLCC ICs should undergo one of the following baking cycles. The parts **MUST** then be mounted within 48 hours.

If the parts are not mounted within 48 hours, they **MUST** be rebaked.

The total number of baking cycles must not exceed two (2). If the ICs are baked more than twice, Agilent cannot guarantee the performance and reliability of the parts.

Neither bake cycle can be performed in the standard shipping tubes. The ICs must be baked in an ESD safe, mechanically stable container, such as an aluminum tube or pan.

Cycle	Temperature	Time	Notes
A	125°C	24 Hours	
B	60°C	96 Hours	1

Note:

1. Cycle B must be done in an atmosphere of < 5 % relative humidity air or nitrogen.

Contact Scanner Input Circuit

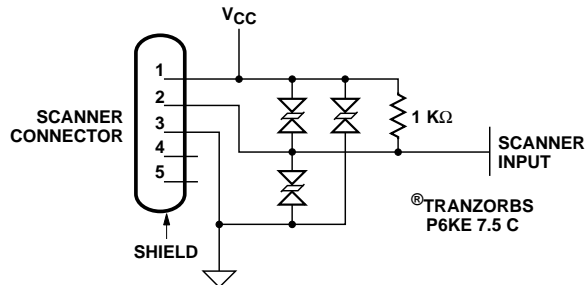


Figure 6. Recommended Interface.

Notes:

1. The shield MUST be connected to ground for proper scanner operation.
2. The ® TRANZORBS are optional. If the application requires the frequent changing of the scanners, they are highly recommended.

® TRANZORB is a registered trademark of General Semiconductor Industries, Tempe, AZ.

Moving Beam Scanner Input Circuits

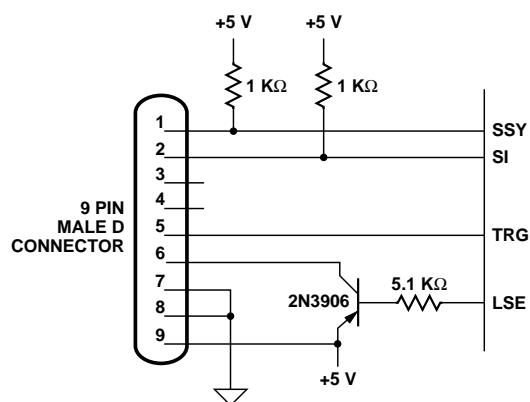


Figure 7. 5 Volt Laser Interface.

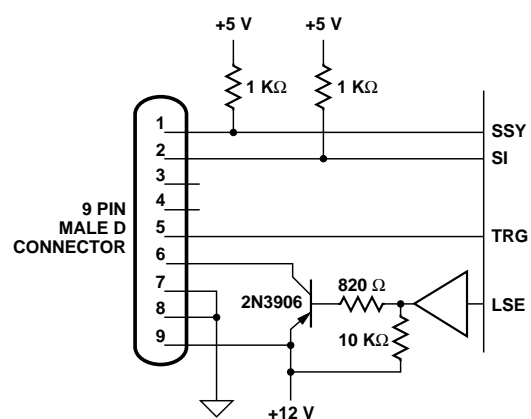


Figure 8. 12 Volt Laser Interface.

External Clock Drivers

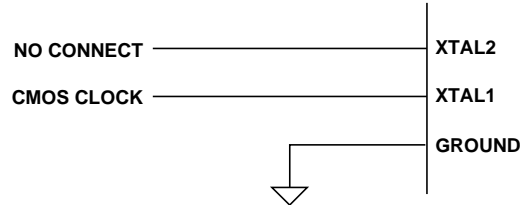


Figure 9.

Block Diagram

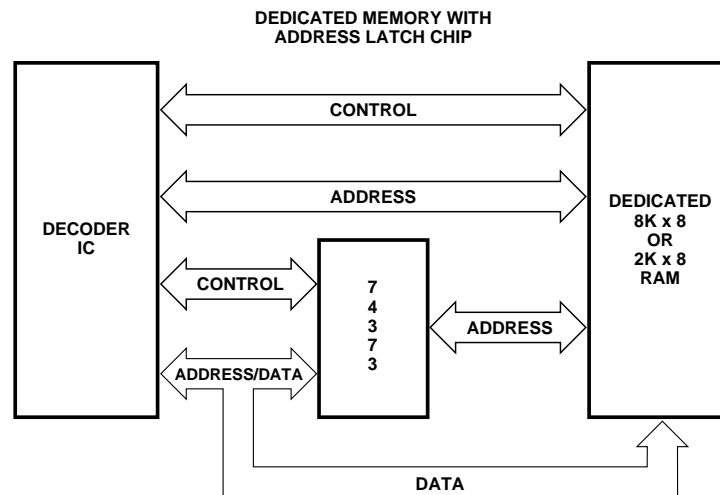
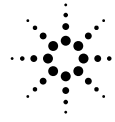


Figure 10.



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