

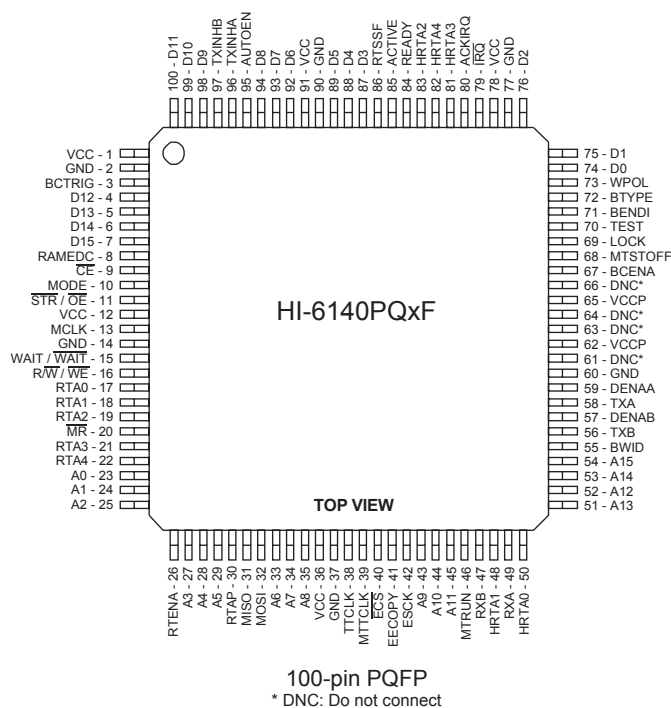
GENERAL DESCRIPTION

The HI-6140 is a 10 MBit/sec version of Holt's HI-6130 integrated BC/MT/RT solution. The part is designed for MIL-STD-1553-derived protocols that use a 10MB/sec data rate, such as Miniature Munitions Stores Interface (MMSI) or EBR-1553.

The part is available in Industrial -40°C to +85°C, or Extended -55°C to +125°C temperature ranges. Optional burn-in is available on the extended temperature range.

Refer to the HI-6130 datasheet for full functional description and operation.

PIN CONFIGURATION (TOP)



FEATURES

- 10 Mbps bit rate complies with MMSI / EBR-1553 and SAE AS5652 10Mbps network protocol
- DO-254 certifiable
- May be configured as BC, RT or MT
- 16-bit parallel host bus interface
- 64K bytes on-chip RAM with error detection/correction option
- Logic level signal interface to standard external RS-485 transceivers
- Autonomous terminal operation requires minimal host intervention
- Fully programmable Bus Controller uses 28 op code instruction set
- BC mode operation provides logic signals to simplify external MMSI Logical Hub design
- Supports all three AS5652 (MMSI) Bus Controller modes: Spec, Switch and Link modes
- Simple Monitor Terminal (SMT) Mode records commands and data separately, with 16-bit or 48-bit time tagging
- Independent time-tag counters for all terminals with 32-bit option for Bus Controller and 48-bit option for Monitor Terminal
- 64-Word Interrupt Log Buffer queues the most recent 32 interrupts. Hardware-assisted interrupt decoding quickly identifies interrupt sources
- Built-in self-test for protocol logic, digital signal paths and internal RAM
- Optional self-initialization at reset uses external serial EEPROM
- Two temperature ranges: -40°C to +85°C, or -55°C to +125°C

BLOCK DIAGRAM

HI-6140 10MBit / Sec 1553 Terminal (RS-485) with Host Parallel Bus Interface

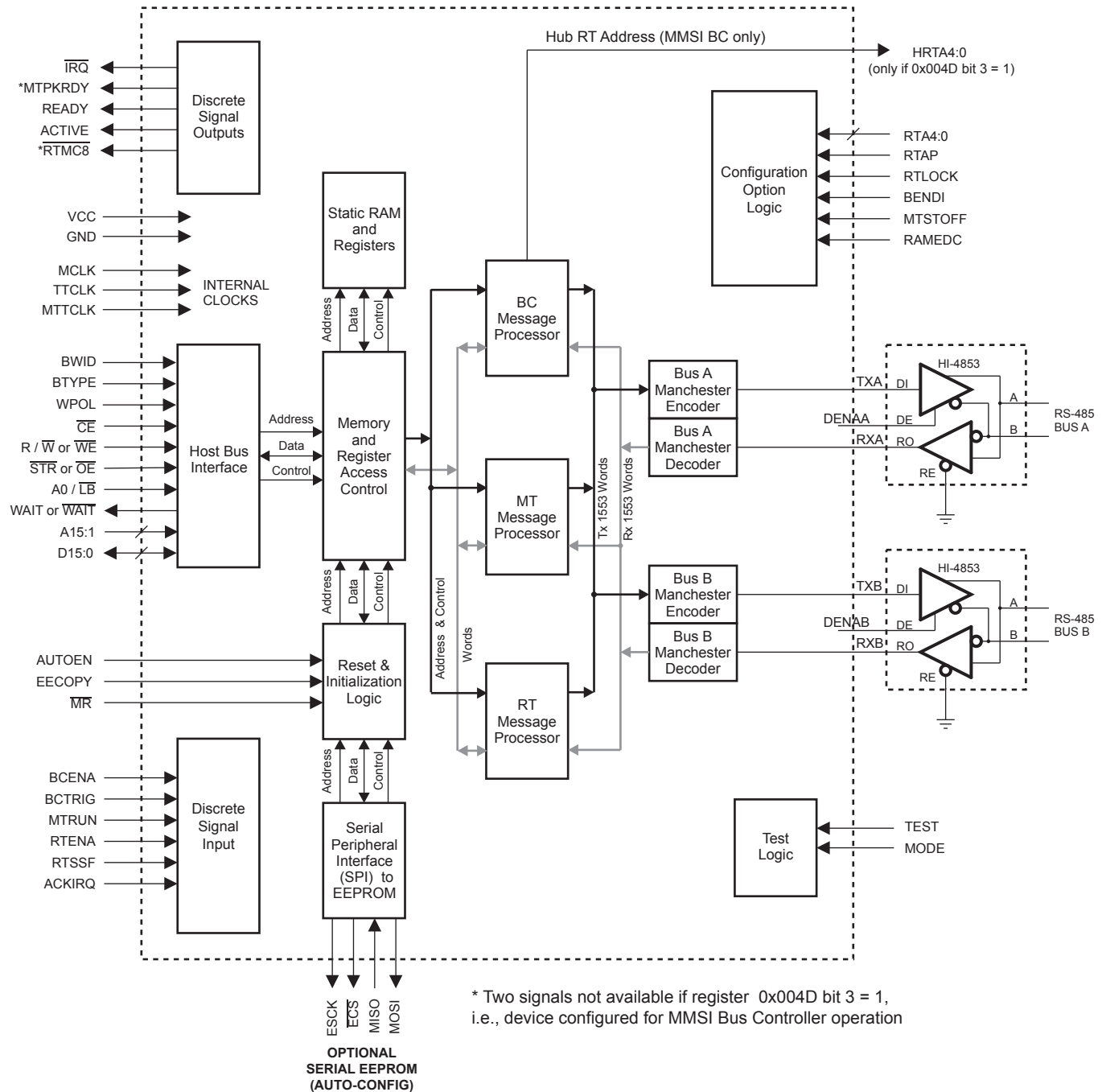


Figure 1. HI-6140 Block Diagram

HI-6140

PIN DESCRIPTIONS

See HI-6130 datasheet for full Pin Descriptions.

Table 1. Pins that apply to HI-6140 only

Pin	Function	Description
TXA	Output	Unipolar Transmit Data output for Bus A. Connect this pin to the Driver Input (DI) pin of external RS-485 Transceiver. When building an AS5652 MMSI Bus Controller, this signal goes to the BC Logical Hub which routes commands to selected hub-RT link(s).
RXA	Input 50KΩ pull-up	Unipolar Receive Data input from Bus A. Connect this pin to the Receiver Output (RO) pin of external RS-485 Transceiver. When building an AS5652 MMSI Bus Controller, this signal comes from the BC Logical Hub which routes RT command responses from selected hub-RT link(s) into the HI-6140 operating in BC mode.
TXB	Output	Unipolar Transmit Data output for Bus B. Connect this pin to the Driver Input (DI) pin of external RS-485 Transceiver. When building an AS5652 MMSI Bus Controller, this signal goes to the BC Logical Hub which routes commands to selected hub-RT link(s).
RXB	Input 50KΩ pull-up	Unipolar Receive Data input from Bus B. Connect this pin to the Receiver Output (RO) pin of external RS-485 Transceiver. When building an AS5652 MMSI Bus Controller, this signal comes from the BC Logical Hub which routes RT command responses from selected hub-RT link(s) into the HI-6140 operating in BC mode.
DENAA	Output	Driver Enable output for Bus A. Connect this pin to the driver enable (DE) input pin of external Bus A RS-485 transceiver. When building an AS5652 MMSI Bus Controller, this signal goes to the BC Logical Hub for routing BC Command Words.
DENAB	Output	Driver Enable output for Bus B. Connect this pin to the driver enable (DE) input pin of external Bus B RS-485 transceiver. When building an AS5652 MMSI Bus Controller, this signal goes to the BC Logical Hub for routing BC Command Words.
HRTA4:0	Output	AS5652 (MMSI) Bus Controller Hub RT Address. The MMSI BC outputs a 5-bit parallel RT address before issuing a new Command Word. The Logical Hub uses the hub RT address for Hub-RT link selection. HRTA outputs only available when register 0x004D bit 3 is logic 1. When selected, the following pins are not available: TEST4, TEST6, RTMC8, MTPKRDY.

Note: The HI-6140 may function as a single remote terminal (RT), whereas HI-613x devices can function as two independent RTs. The pin assignments for dual RT operation in HI-613x (e.g. RT1A4-0, RT2A4-0, RT1AP, RT2AP, etc.) are replaced with pin assignments for a single RT in HI-6140 (e.g. RTA4:0, RTAP, etc.). Descriptions and functionality remain the same.

OPERATION

Refer to the HI-6130 datasheet for detailed operation and register descriptions. See below for unique HI-6140 attributes.

Operational and Protocol Considerations for 10Mbit/sec

The HI-6140 is designed for use in MIL-STD-1553B 10Mbps applications, such as Miniature Munitions Stores Interface (MMSI) or EBR-1553. The device produces dual redundant Manchester II bi-phase encoded data for transmission on dual RS-485 busses. External, half-duplex, 20Mbps slew rate controlled RS-485 transceivers (HI-4853) are recommended for connection to the RS-485 busses (see “Figure 1. HI-6140 Block Diagram” on page 2 and “Pin Descriptions” on page 3).

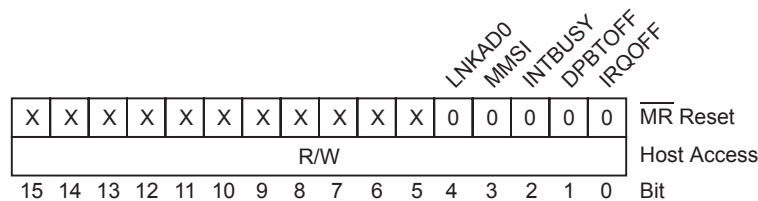
Timing differences compared to MIL-STD-1553B (measured mid-parity to mid-sync):

- Minimum intermessage Gap = 1μs (vs 4μs for MIL-STD-1553B)
- Minimum No Response Timeout = 8μs (vs 12μs for MIL-STD-1553B)
- RT response time must begin in range 400ns to 4μs

System Architecture

SAE AS5652 MMSI network is as a “star” configuration with each remote terminal connected to a central Bus Controller using a dedicated RS-485 cable. A Logical Hub provides the individual RT interfaces, a series of Hub-to-RT links. The Logical Hub routes commands from the BC to the selected RT (or to all RTs, in the case of broadcast commands). The Hub also routes RT responses from the selected RT back to the BC. To simplify design of a Logical Hub outside a HI-6140-based MMSI BC, the device has **two configuration bits [4,3] in the Extended Configuration Register (0x004D) which apply only for MMSI Bus Controller service.** The functionality of register 0x004D is as follows:

Extended Configuration Register (0x004D)



Bit No.	Mnemonic	Function
15 – 6	-----	Not Used.
5	Reserved	Do not use. Setting these bits may cause unpredictable behavior.
4	LNKADO	Hub-RT Address output Enable. Enables a 5-bit parallel Hub RT Address output. This 5-bit value is updated at least 250ns before a new Command Word is issued by the BC. The Hub uses this value to activate the appropriate Hub-RT link for Command Word transmission. The link remains active for the RT response to the BC.

HI-6140

Bit No.	Mnemonic	Function
3	MMSI	<p>MMSI Link Mode Enable.</p> <p>AS5652 MMSI defines 3 RT addressing modes: Spec mode, Switch mode and Link mode. The unique addressing for MMSI Link mode is enabled when this register 0x004D bits 4:3 are both high. In this configuration, the 5-bit Hub RT Address (HRTA) output reflects the Command Word in the HI-6140 BC Instruction List; the Hub uses this value for routing BC command (and RT response) to (and from) the selected Hub-RT link. However the serial command output from the TXA or TXB transmit data output from the HI-6140 will always contain the embedded RT address 0 (00000 at command word bits 15:11).</p> <p>Note: No special addressing consideration is needed for design of an AS5652 MMSI RT based on the HI-6140 device.</p>
2	INTBUSY	<p>Report terminal Busy status for RT message interrupts; i.e. sets WASBUSY flag bit 9 in log buffer Interrupt Identification Word.</p> <p>See HI-6130 datasheet description of bit 2 register 0x004D for more details.</p>
1	DPBTOFF	<p>Disable ping pong DPB pointer toggle when the received valid command is illegal, or when a message occurs with Busy status.</p> <p>See HI-6130 datasheet description of bit 1 register 0x004D for more details.</p>
0	IRQOFF	<p>Suppress $\overline{\text{IRQ}}$ interrupt pin assertion for enabled RT message interrupts when the command is illegal or the message results in RT Busy status.</p> <p>See HI-6130 datasheet description of bit 0 register 0x004D for more details.</p>

HI-6140

Bus Dead Time and No Response Time-Out Delays

The 10Mbit/sec bit rate will result in a reduction of these times by a factor of 10 compared to the HI-6130. This will result in the following updates to BC, RT and MT Configuration Register bits [15,14]. Comments referring to the "RT Validation Test Plan" in the HI-6130 datasheet do not apply for HI-6140.

BC (Bus Controller) Configuration Register (0x0032)

Bit No.	Mnemonic	R/W	Reset	Function		
15 – 14	BCTO1:0	R/W	0	BC Time Out Select. This 2-bit field selects the BC “no response” time-out delay from four available selections. Excluding RT-RT commands, response delay is measured from command word mid-parity bit to status word mid-sync:		
				Bit 15:14	Bus Dead Time	Time Out (excludes RT-RT)
				00	1.6µs	1.8µs
				01	2.1µs	2.3µs
				10	8.0µs	8.2µs
				11	13.8µs	14.0µs
				Bit 15:14	TxRT Bus Dead Time	RT-RT Time Out*
				00	1.9µs	6.1µs
				01	2.4µs	6.6µs
10	8.0µs	12.2µs				
11	13.8µs	18.0µs				
All time out select values have ±100ns tolerance.						

SMT Configuration Register (0x0029)

Bit No.	Mnemonic	R/W	Reset	Function				
15 – 14	MTTO1:0	R/W	0	MT Time Out Select. This 2-bit field selects the Monitor “no response” time-out delay from four available selections. Excluding RT-RT commands, the delay is measured from command word mid-parity bit to status word mid-sync.				
				Bit 15:14	Bus Dead Time	Time Out (excludes RT-RT)	RT-RT Bus Dead Time	RT-RT Time Out
				00	1.6µs	1.8µs	1.9µs	6.1µs
				01	2.1µs	2.3µs	2.4µs	6.6µs
				10	8.0µs	8.2µs	8.0µs	12.2µs
				11	13.8µs	14.0µs	13.8µs	18.0µs

HI-6140

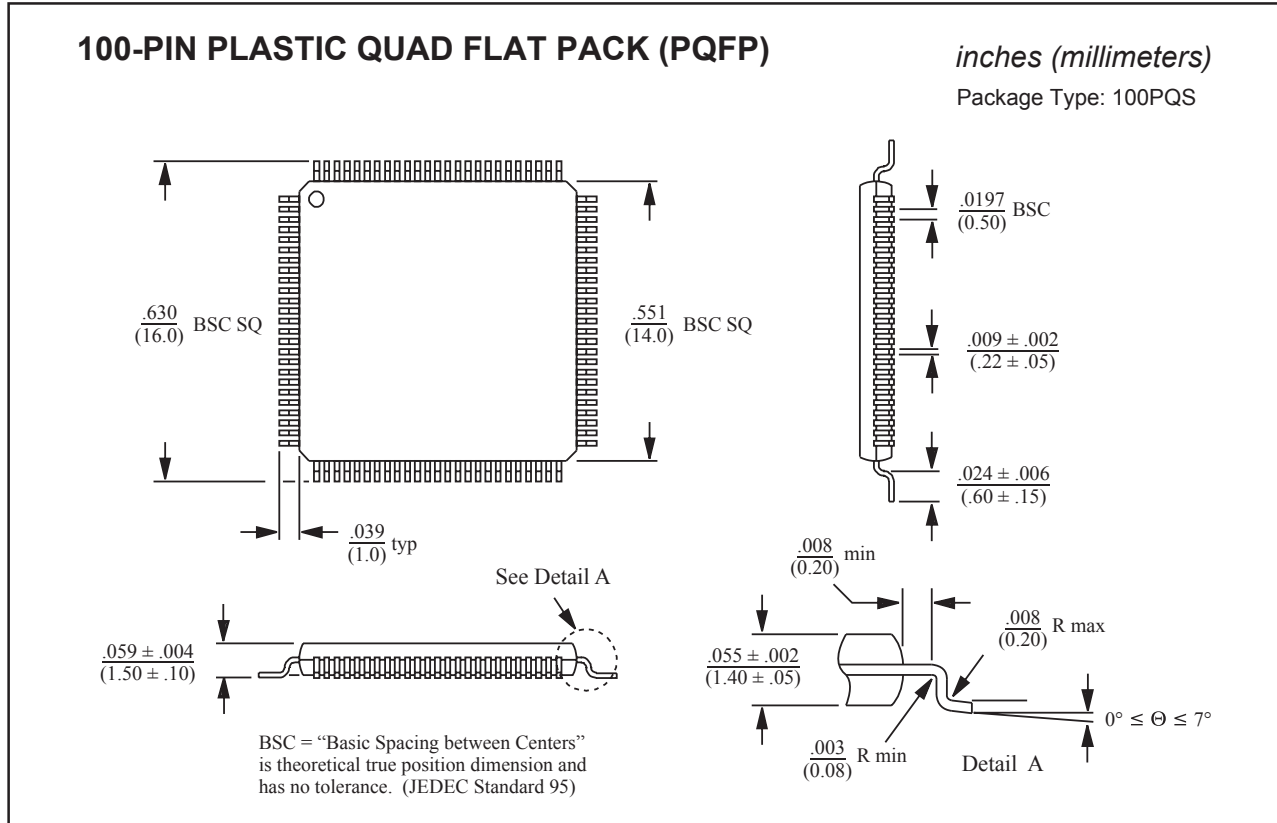
Remote Terminal Configuration Register (0x0017)

Bit No.	Mnemonic	R/W	Reset	Function		
15 – 14	RTTO1:0	R/W	0	RT-RT Time Out Select. This 2-bit field selects the “no response” time-out delay for RT-to-RT receive commands from four available selections:		
				Bit 15:14	Bus Dead Time	RT-RT Time Out
				00	1.5µs	5.7µs
				01	2.0µs	6.2µs
				10	8.0µs	12.2µs
				11	13.8µs	18.0µs

Protocol Considerations

- For 10Mbit/sec MMSI applications, single terminal BC, RT or MT operation is recommended.
- In SAE AS5652, transmit mode codes 0,4 and 5 are reserved, not used. Receive mode codes 20-21 are reserved, not used. These mode commands correspond to “Dynamic Bus Control”, and two variants each of “Bus Shutdown” and “Override Bus Shutdown” mode commands.
- All RT-RT commands are prohibited in MMSI applications. For multi-drop 10Mbit/sec EBR-1553 applications, the HI-6140 processes conventional RT-RT messages normally. Nonsense RT-RT messages having mode code (one or both command words with subaddress 0 or 31 decimal) gives unpredictable results. Therefore, encoding nonsense mode code RT-RT messages for BC is not recommended.

PACKAGE DIMENSIONS



HI-6140

ORDERING INFORMATION

HI - 6140 PQ x E

PART NUMBER	LEAD FINISH
F	100% Matte Tin (Pb-free, RoHS compliant)

PART NUMBER	TEMPERATURE RANGE	FLOW	BURN IN
I	-40°C to +85°C	I	No
T	-55°C to +125°C	T	No
M	-55°C to +125°C	M	Yes

PART NUMBER	PACKAGE DESCRIPTION
PQ	100 PIN PLASTIC QUAD FLAT PACK, PQFP (100PQS)

HOLT INTEGRATED CIRCUITS

HI-6140

REVISION HISTORY

Revision	Date	Description of Change
DS6140, Rev. New	05/02/12	Initial Release.
Rev. A	01/03/13	Corrected pin-out. Updated pin names and pin descriptions.
Rev. B	12/03/2020	Add more details on functionality of “Extended Configuration Register (0x004D)”. Update bus Dead Times and No Response Time-Out delays for registers 0x0032, 0x0029 and 0x0017.