MultiLink Technology Corporation

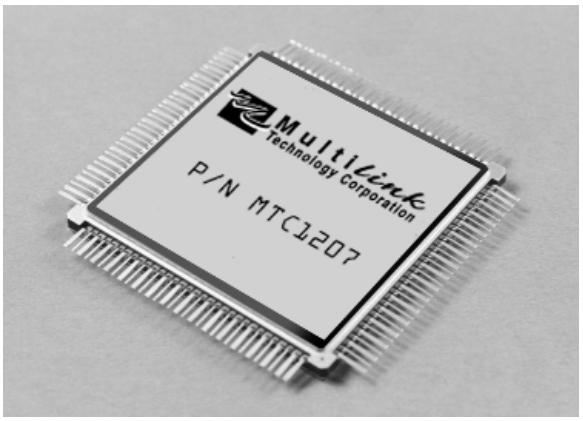
MIXED SIGNAL INTEGRATED CIRCUIT PRODUCTS

10 Gb/s 16-Bit MUX/CMU

MTC1207A, MTC1207B Product Data Sheet

Applications

- Telecom transmission systems
- SONET OC-192 and SDH STM-64 equipment
- Forward Error Correction data rates supported (10.664 Gb/s option)



Features

- 16 to 1 multiplexer (MUX)
- Reduced power consumption (2.5 W)
- Large output data amplitude
- Integrated Clock Multiplier Unit (CMU)
- Low Jitter VCO with external loop filter
- Jitter performance complies with SONET/SDH standards

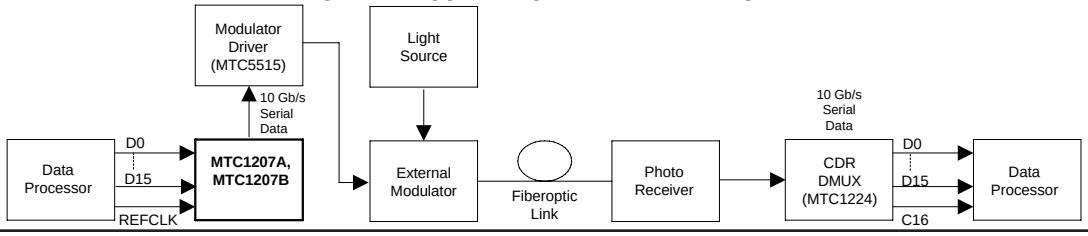
Description

The MTC1207A and 1207B are reduced power 10 Gb/s 16 to 1 multiplexers (MUX) with an integrated clock multiplier unit for use in SONET OC-192, SDH STM-64, and Forward Error Correction (FEC) systems. The MTC1207A accepts 16 different data channels at 622 Mb/s and combines them into a single 9.953 Gb/s serial data stream suitable for transmission over high speed fiberoptic networks. The MTC1207B accepts differential data at 666.5 Mb/s and is optimized for use in systems which employ FEC encoding at 10.664 Gb/s.

For each of the two devices, the minimum data output amplitude is 800 mV_{pp}, allowing direct connection to an external modulator driver such as the MTC5515. An on-chip Phase/Frequency Detector (PFD) and precision Voltage Controlled Oscillator (VCO) are used in combination with an external op-amp loop filter to convert the 622 or 666.5 MHz reference clock, supplied by the host system, into a low jitter 9.953 or 10.664 GHz clock output. The 10 Gb/s data output is retimed with respect to the high speed clock using an internal D flip flop (DFF).

All data and clock I/O are provided with on-chip 50 Ohm transmission line terminations to minimize the external component count. The MTC1207 series devices are provided in a 128 pin quad flat pack (QFP) and operate from -5.0 V and -3.5 V power supplies. The circuitry was designed for use in equipment which is required to comply with Bellcore, ANSI, and ITU-T international standards for SONET and SDH systems.

Figure 1: Typical System Block Diagram



Absolute Maximum Ratings

Caution: Exceeding the absolute maximum ratings may cause damage to this product and/or lead to reduced reliability. Functional performance is specified over the recommended operating conditions for power supply and temperature only. AC and DC device characteristics at or beyond the absolute maximum ratings are not assured or implied.

Description	Parameter	Symbol	Min.	Max.	Units
VEE_3V	Supply Voltage	$V_{EE3V(max)}$		-5	V
VEE_VCO	Supply Voltage	$V_{EE\_VCO(max)}$		-6	V
VEE_5V, VEE_CLK	Supply Voltage	$V_{EE5V(max)}$		-6	V
Data Inputs (D0-D15) 622 Mb/s (MTC1207A) 666.5 Mb/s (MTC-1207B)	DC Input Voltage	$V_{Din(max)}$		-1	V
Reference Clock Inputs (REFCLK) 622 MHz (MTC1207A) 666.5 MHz (MTC1207B)	DC Input Voltage	$V_{REFCLK(max)}$		-1	V
	Storage Temperature		-40	125	C
	Case Temperature (under power)		-5	100	C

Recommended Operating Conditions

Supply Voltage ..... see table
Operating Temperature Range (case) ..... -5°C to +75°C

Power Supply Requirements (Operating)

Description	Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
VEE_3V	Supply Voltage	V_{EE3V}	-3.3	-3.5	-3.7	V	
	Supply Current	I_{EE3V}		240		mA	
VEE_5V, VEE_CLK	Supply Voltage	V_{EE5V}	-4.7	-5.0	-5.3	V	
	Supply Current	I_{EE5V}		340		mA	
VEE_VCO	Supply Voltage	V_{EE_VCO}		-4.5		V	1
	Supply Current	I_{EE_VCO}		20		mA	
	Power Dissipation	P_D		2.5		W	

1. Connect through specified choke and resistor (contact Application Engineering for additional details).

DC Characteristics (Single Ended)

Minimum and maximum DC characteristics specified over recommended operating range for temperature and power supplies. Typical values specified at VEE_3V = -3.5V, VEE_5V = -5.0V, T_A = 25°C.

Description	Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
Data Inputs (D0-D15) 622 Mb/s (MTC1207A) 666.5 Mb/s (MTC1027B)	Input HIGH Voltage	V_{IH}	V_{CC}-150		V_{CC}	mV	1
	Input LOW Voltage	V_{IL}	V_{CC}-500		V_{CC}-350	mV	1
Clock/16 Outputs (CLK16O) 622 MHz (MTC1207A) 666.5 MHz (MTC1207B)	Output HIGH Voltage	V_{OH}	V_{CC}-150		V_{CC}	mV	2
	Output LOW Voltage	V_{OL}	V_{CC}-500		V_{CC}-350	mV	2
10 Gb/s Data Outputs (OUT)	Output HIGH Voltage	V_{OH}	V_{CC}-100		V_{CC}	mV	2
	Output LOW Voltage	V_{OL}	V_{CC}-900		V_{CC}-800	mV	2

1. On-chip 50 ohm termination to ground provided.
2. On-chip 50 ohm back termination to ground provided. Output voltages specified into 50 ohm load.

AC Characteristics

Minimum and maximum AC characteristics specified over recommended operating range for temperature and power supplies. Typical values specified at VEE_3V = -3.5V, VEE_5V = -5.0V, T_A = 25°C.

Description	Parameter	Symbol	Min.	Typ.	Max.	Units	Notes
10 Gb/s Data Outputs (OUT)	Data Rate (MTC1207A)	f_B		9.95328		Gb/s	
	Data Rate (MTC1207B)	f_B		10.664		Gb/s	
	Output Voltage Swing (Single Ended)	V_{OUT}	650			mV	1
	Rise/Fall Time	t_r, t_f	26	30	34	ps	2
	Pulse width (relative to bit period)	PW %	95	100	105	%	
	Output Match	S_{22}			-6	dB	5
Data Inputs (D0-D15) 622 Mb/s (MTC 1207A) 666.5 Mb/s (MTC1207B)	Input Voltage Swing (Differential)	$V\ DIN_{(dif)}$	200		1600	mV_{pp}	7
	Input Voltage Swing (Single Ended)	$V\ DIN_{(se)}$	400		800	mV_{pp}	8
	Input Resistance	R_{DIN}	40	50	60	Ohms	10
Clock/16 Outputs (CLK16O) 622 Mhz (MTC1207A) 666.5 MHz (MTC1207B)	Output Voltage Swing (Single Ended)	V_{CLK16O}	330			mV_{pp}	9
	Rise/Fall Time	t_r, t_f	100	150	200	ps	2
	Setup Time (Data to CLK16O)	t_s			100	ps	6
	Hold Time (Data to CLK16O)	t_h			100	ps	6
	REFCLK to CLK16O Delay	t_{del}			140	ps	
10 GHz Clock Output (CLK)	Frequency (A)	f_{CLK}		9.95328		GHz	
	Frequency (B)	f_{CLK}		10.664		GHz	
	Output Voltage Swing		250	350		mV_{pp}	9
	Jitter Transfer				-20	dB/decade	3
					0.1	dB	4
	Jitter Generation				0.1	UI_{pp}	
	Output Match	S_{22}	-10	-12		dB	5
Reference Clock Inputs (REFCLK) 622 MHZ (MTC1207A) 666.5 MHz (MTC1207B)	Input Voltage Swing (Differential)	$V_{REFCLK(dif)}$	400		1600	mV_{pp}	7
	Input Voltage Swing (Single Ended)	$V_{REFCLK(se)}$	400		800		8
	Input Resistance	$V_{REFCLKin}$	40	50	60	Ohms	10
Phase frequency Detector (PFD)	Phase Detector Gain	A_{PD}	64			mv/rad	

1. On-chip 50 ohm back termination to ground provided. Differential voltage measured into 2 x 50 ohm termination to ground.
2. Measured from 20 to 80% points.
3. At frequencies greater than 8 MHz.
4. At frequencies less than 8 MHz.
5. At frequencies less than 10 GHz.
6. See timing diagram (Figure 3).
7. AC coupled measurement. Differential voltage measured at 2 x 50 ohm to ground inputs (on-chip terminations provided).
8. AC coupled measurement. Single ended voltage measured at 50 ohm to ground input (on-chip terminations provided).
9. AC coupled measurement. Single ended voltage measured into 50 ohm termination to ground input.
10. Measured with respect to ground.

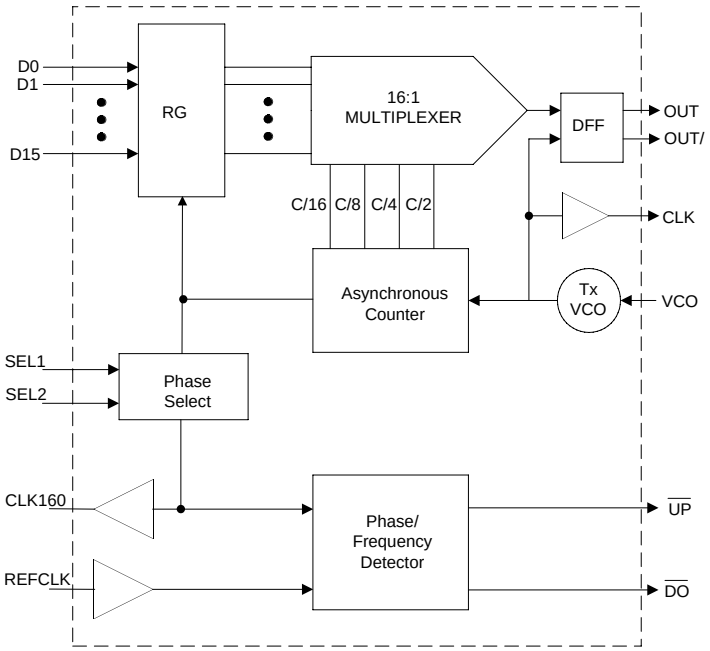


Figure 2: Block Diagram

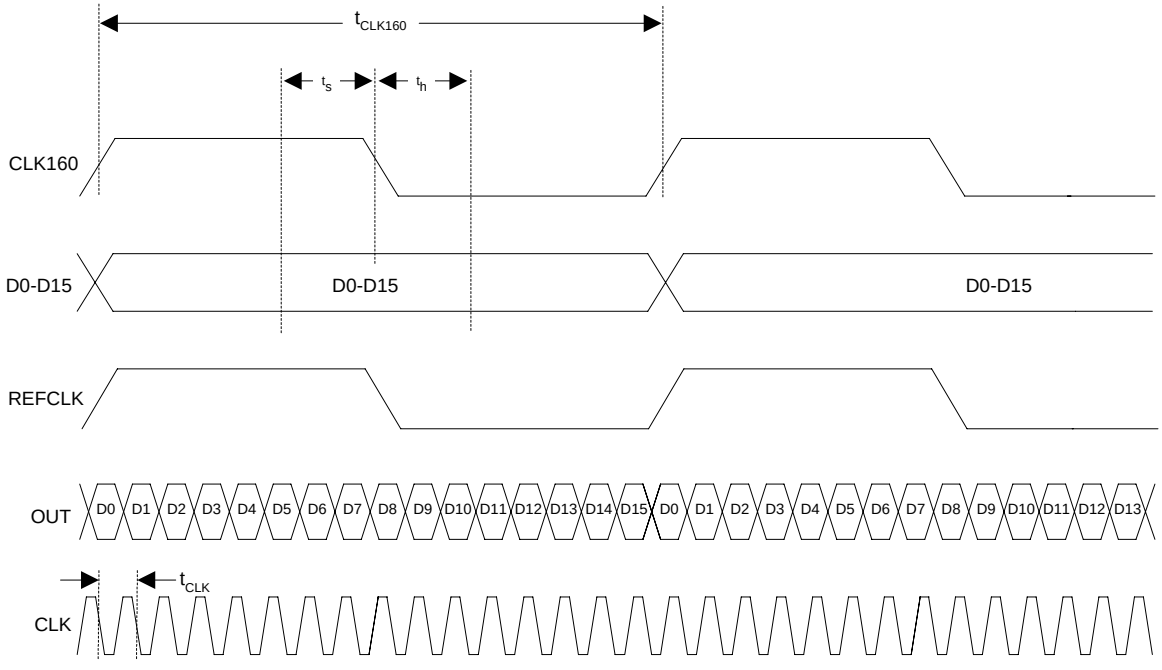
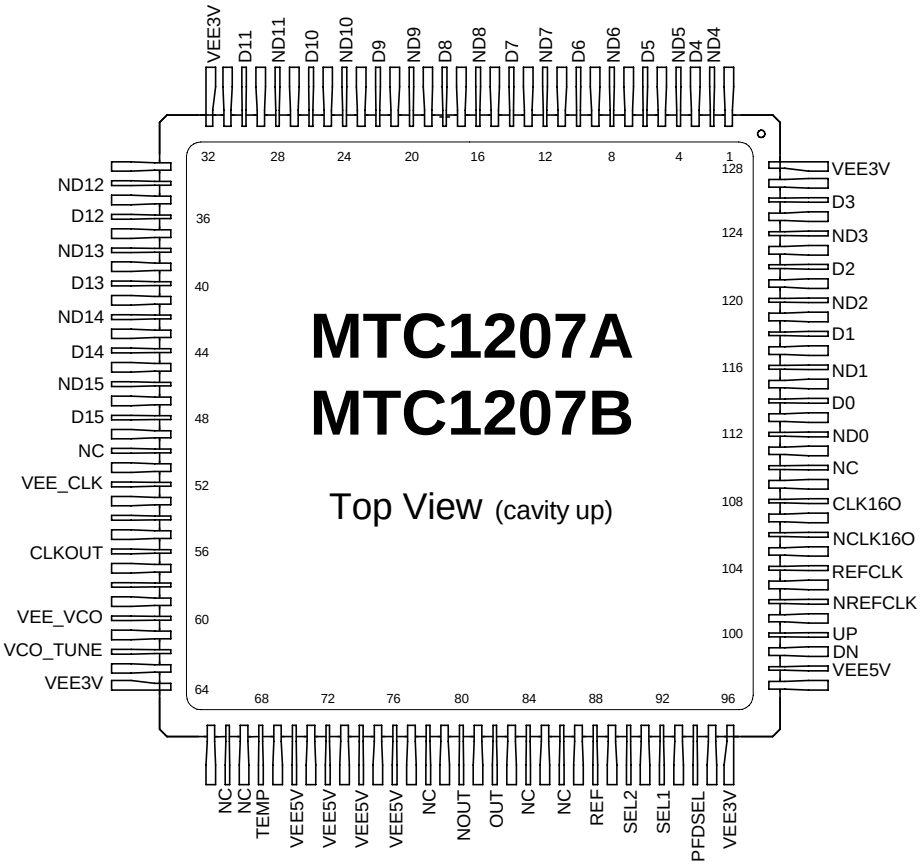


Figure 3: Timing Diagram



Note: All unlabeled pins are ground

Figure 5: Pin Diagram

Pin	Name	Description	Function input, output, control, supply, no connect
1	GND	Ground	supply
2	D4/	Data bit 4 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
3	D4	Data bit 4 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
4	D5/	Data bit 5 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
5	GND	Ground	supply
6	D5	Data bit 5 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
7	GND	Ground	supply
8	D6/	Data bit 6 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
9	GND	Ground	supply
10	D6	Data bit 6 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
11	GND	Ground	supply
12	D7/	Data bit 7 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
13	GND	Ground	supply
14	D7	Data bit 7 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
15	GND	Ground	supply
16	D8/	Data bit 8 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
17	GND	Ground	supply
18	D8	Data bit 8 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
19	GND	Ground	supply
20	D9/	Data bit 9 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
21	GND	Ground	supply
22	D9	Data bit 9 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
23	GND	Ground	supply
24	D10/	Data bit 10 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
25	GND	Ground	supply

Pin	Name	Description	Function input, output, control, supply, no connect
26	D10	Data bit 10 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
27	GND	Ground	supply
28	D11/	Data bit 11 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
29	GND	Ground	supply
30	D11	Data bit 11 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
31	GND	Ground	supply
32	VEE3V	Power supply. Connect to – 3.5 V. See evaluation circuit schematic for bypass recommendation.	supply
33	GND	Ground	supply
34	D12/	Data bit 12 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
35	GND	Ground	supply
36	D12	Data bit 12 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
37	GND	Ground	supply
38	D13/	Data bit 13 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
39	GND	Ground	supply
40	D13	Data bit 13 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
41	GND	Ground	supply
42	D14/	Data bit 14 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
43	GND	Ground	supply
44	D14	Data bit 14 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
45	GND	Ground	supply
46	D15/	Data bit 15 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
47	GND	Ground	supply
48	D15	Data bit 15 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
49	GND	Ground	supply
50	NC	No connection.	NC

Pin	Name	Description	Function input, output, control, supply, no connect
51	GND	Ground	supply
52	VEE_CLK	Power supply for internal clock circuitry. Connect to VEE5V. See evaluation circuit schematic for bypass recommendation.	supply
53	GND	Ground	supply
54	GND	Ground	supply
55	GND	Ground	supply
56	CLKOUT	Clock output – 9.953 GHz (MTC1207A) or 10.664 GHz (MTC1207B). Internally AC coupled.	output
57	GND	Ground	supply
58	GND	Ground	supply
59	GND	Ground	supply
60	VEE_VCO	Power supply for internal VCO. Connect to VEE5V via specified series resistor and choke. See evaluation circuit schematic for recommendation configuration.	supply
61	GND	Ground	supply
62	VCO_TUNE	Voltage controlled oscillator control input. Connect to external PLL loop (refer to evaluation circuit schematic).	control
63	GND	Ground	supply
64	VEE3V	Power supply. Connect to – 3.5 V. See evaluation circuit schematic for bypass recommendation.	supply
65	GND	Ground	supply
66	NC	No connection	NC
67	NC	No connection.	NC
68	TEMP	Chip temperature measurement (consult factory)	output
69	GND	Ground	supply
70	VEE5V	Power supply. Connect to – 5.0 V. See evaluation circuit schematic for bypass recommendation.	supply
71	GND	Ground	supply
72	VEE5V	Power supply. Connect to – 5.0 V. See evaluation circuit schematic for bypass recommendation.	supply
73	GND	Ground	supply
74	VEE5V	Power supply. Connect to – 5.0 V. See evaluation circuit schematic for bypass recommendation.	supply
75	GND	Ground	supply

Pin	Name	Description	Function input, output, control, supply, no connect
76	VEE5V	Power supply. Connect to – 5.0 V. See evaluation circuit schematic for bypass recommendation.	supply
77	GND	Ground	supply
78	NC	No connection.	NC
79	GND	Ground	supply
80	OUT/	Data output - 9.953 GHz (MTC1207A) or 10.664 GHz (MTC1207B) (inverting). Contains on-chip back termination 50 Ω to ground.	output
81	GND	Ground	supply
82	OUT	Data output - 9.953 GHz (MTC1207A) or 10.664 GHz (MTC1207B) (non-inverting). Contains on-chip back termination 50 Ω to ground.	output
83	GND	Ground	supply
84	NC	No connection.	NC
85	GND	Ground	supply
86	NC	No connection.	NC
87	GND	Ground	supply
88	REF	Used for output data swing adjusting. Must be connected to VEE5V through a resistor. Consult factory for details.	
89	GND	Ground	supply
90	SEL2	Phase select. Normally connected to ground. Can be used in conjunction with pin 92 to adjust phase of 622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) clock for optimum placement within data eye. Contact factory for details.	control
91	GND	Ground	supply
92	SEL1	Phase select. Normally connected to ground. Can be used in conjunction with pin 90 to adjust phase of 622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) clock for optimum placement within data eye. Contact factory for details.	control
93	GND	Ground	supply
94	PFDSEL	Phase/frequency input selector. Leave open or connect to VEE3V to select 622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) REFCLK. Connect to GND to select 155.52 MHz (MTC1207A) or 166.625 MHz (MTC1207B) REFCLK.	control
95	GND	Ground	supply
96	VEE3V	Power supply. Connect to – 3.5 V. See evaluation circuit schematic for bypass recommendation.	supply
97	GND	Ground	supply
98	VEE5V	Power supply. Connect to – 5.0 V. See evaluation circuit schematic for bypass recommendation.	supply

Pin	Name	Description	Function input, output, control, supply, no connect
99	DN	Phase frequency detector down, negative going pulses. Connect to external PLL loop (refer to evaluation circuit schematic).	control
100	UP	Phase frequency detector up, negative going pulses. Connect to external PLL loop (refer to evaluation circuit schematic).	control
101	GND	Ground	supply
102	REFCLK/	Reference clock input (inverting). Connect to 622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) reference clock. On-chip 50 Ω termination to ground provided. (note: 155.52/166.625 MHz available using PFDSEL pin 94)	input
103	GND	Ground	supply
104	REFCLK	Reference clock input (non-inverting). Connect to 622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) reference clock. On-chip 50 Ω termination to ground provided. (note: 155.52/166.625 MHz available using PFDSEL pin 94)	input
105	GND	Ground	supply
106	CLK16O/	622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) clock output (inverting). Clock divided by 16. Back terminated 50 Ω to ground.	output
107	GND	Ground	supply
108	CLK16O	622 MHz (MTC1207A) or 666.5 MHz (MTC1207B) clock output (non-inverting). Clock divided by 16. Back terminated 50 Ω to ground.	output
109	GND	Ground	supply
110	NC	No connection.	NC
111	GND	Ground	supply
112	D0/	Data bit 0 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
113	GND	Ground	supply
114	D0	Data bit 0 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
115	GND	Ground	supply
116	D1/	Data bit 1 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
117	GND	Ground	supply
118	D1	Data bit 1 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
119	GND	Ground	supply
120	D2/	Data bit 2 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
121	GND	Ground	supply
122	D2	Data bit 2 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
123	GND	Ground	supply

Pin	Name	Description	Function input, output, control, supply, no connect
124	D3/	Data bit 3 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (inverting). On-chip 50 Ω termination to ground provided.	input
125	GND	Ground	supply
126	D3	Data bit 3 input - 622 Mb/s (MTC1207A) or 666.5 Mb/s (MTC1207B) (non-inverting). On-chip 50 Ω termination to ground provided.	input
127	GND	Ground	supply
128	VEE3V	Power supply. Connect to – 3.5 V. See evaluation circuit schematic for bypass recommendation.	supply

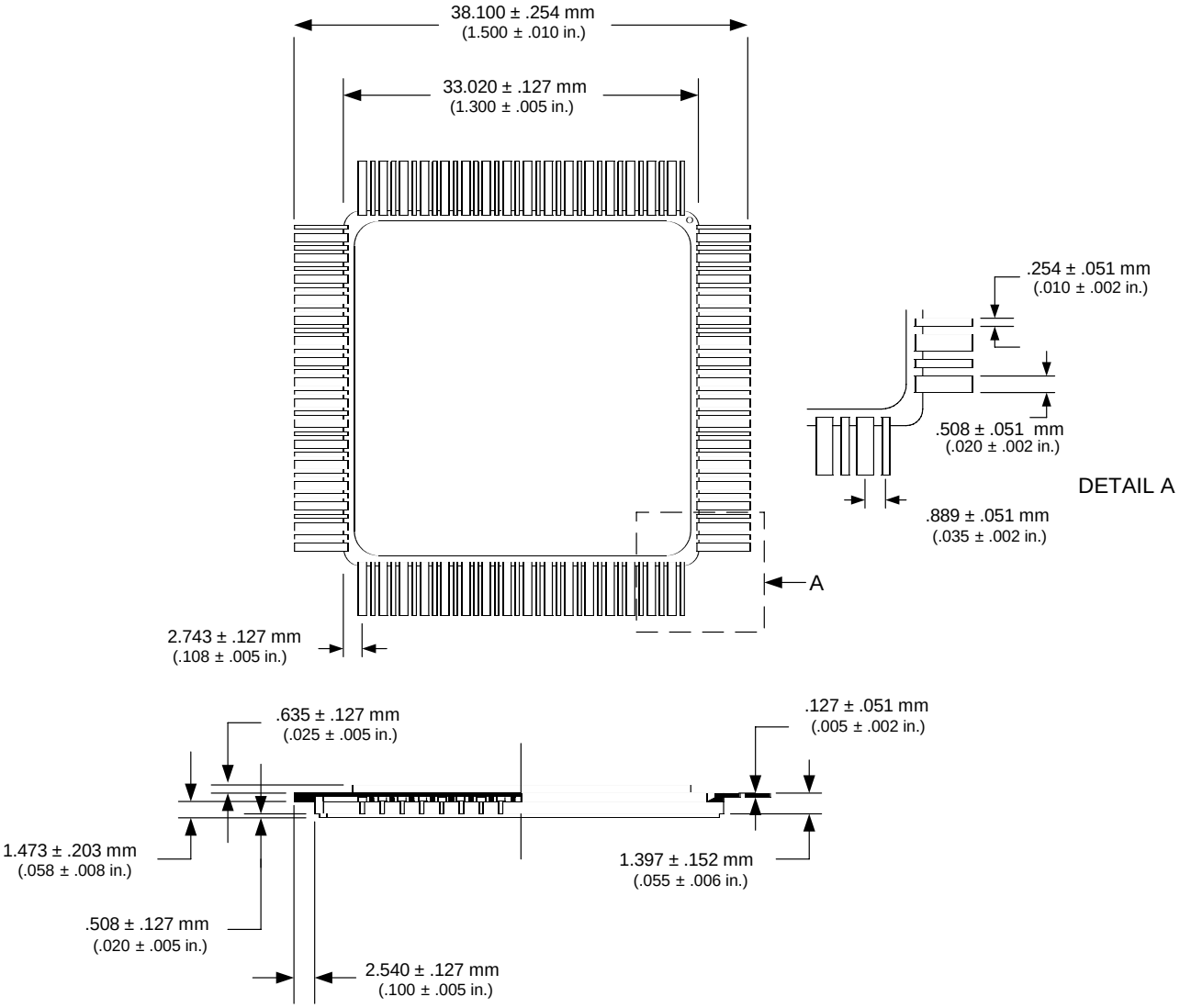


Figure 5: Package Dimensions

Ordering Information

Part #:	Description:
MTC1207A	9.953 Gb/s 16 Bit MUX/CMU
MTC1207A-EV	9.953 Gb/s 16 Bit MUX/CMU with evaluation board
MTC1207B	10.664 Gb/s 16 Bit MUX/CMU
MTC1207B-EV	10.664 Gb/s 16 Bit MUX/CMU with evaluation board

For additional ordering information, please contact

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