

### Features

- 40-bit Serial to Parallel Converter
- 20-bit Multiplexer for TX Control bits
- Serial Out Ports for Diagnostics and Daisy Chaining
- Compatible with 5.0 V and 3.3 V CMOS Logic
- Built-in Active Pull-down for Logic Inputs
- Fast Switching
- Low Current consumption
- Lead-Free 6 mm 48-lead PQFN Package
- Halogen-Free “Green” Mold Compound
- RoHS\* Compliant and 260°C Reflow Compatible

### Description

The MADR-011007 is a 40-bit serial to parallel driver in a low cost 6 mm 48-lead PQFN plastic package. It is designed as the serial control interface for MACOM’s transmit module MAIA-010365 and receive module MAIA-009579. A 20-bit multiplexer is designed on-chip to provide TX bits control capability. High speed digital CMOS technology is utilized to achieve low power dissipation. Even though it is designed to drive GaAs FETs using a -5 V power supply, it can also be used as a general serial to parallel converter when using a +5 V power supply.

This driver, used in conjunction with MACOM’s MAIA-010365 S-Band radar transmit module, MAAP-011022 S-Band 7 W high power amplifier, and the MAIA-009579 receiver, provides a complete chipset for S-Band dual polarization air traffic control and weather radar applications.

### Ordering Information<sup>1</sup>

Part Number	Package
MADR-011007-TR0500	500 piece reel

1. Reference Application Note M513 for reel size information.

### Pin Configuration

Pin No.	Function	Pin No.	Function
1	TX2-phase 1	25	RX2-atten 4
2	TX1-phase 1	26	RX1-atten 4
3	TX1-phase 2	27	RX1-atten 3
4	TX1-phase 3	28	RX1-atten 2
5	TX1-phase 4	29	RX1-atten 1
6	TX1-phase 5	30	RX1-phase 6
7	TX1-phase 6	31	RX1-phase 5
8	TX1-atten 1	32	RX1-phase 4
9	TX1-atten 2	33	RX1-phase 3
10	TX1-atten 3	34	RX1-phase 2
11	TX1-atten 4	35	RX1-phase 1
12	TX2-atten 4	36	RX2-phase 1
13	TX2-atten 3	37	RX2-phase 2
14	TX2-atten 2	38	RX2-phase 3
15	TX2-atten 1	39	RX2-phase 4
16	TX2-phase 6	40	RX2-phase 5
17	GND	41	LOAD
18	VEE	42	CLK
19	TX_STATE	43	SER_IN
20	SNGL_DUAL	44	SER_OUT
21	RX2-phase 6	45	TX2-phase 5
22	RX2-atten 1	46	TX2-phase 4
23	RX2-atten 2	47	TX2-phase 3
24	RX2-atten 3	48	TX2-phase 2
		49	Paddle <sup>2</sup>

2. The exposed paddle centered on the package bottom must be either left "open" (no connection) or connected to V<sub>EE</sub>.

\* Restrictions on Hazardous Substances, European Union Directive 2011/65/EU.

## 40-bit Serial to Parallel Driver for GaAs FETs

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Guaranteed Operating Ranges<sup>3,4,5</sup>

Symbol	Parameter	Min.	Typ.	Max.	Unit
$V_{EE}^6$	Negative DC Supply Voltage	-5.5	-5.0	-4.5	V
$T_{OPER}$	Operating Temperature	-40	25	85	°C
$I_{OH}$	DC Output Current - High	-1	—	—	mA
$I_{OL}$	DC Output Current - Low	—	—	1	mA

3. Unused logic inputs must be tied to either GND or  $V_{EE}$ .

4. 0.01  $\mu$ F decoupling capacitors are required on the power supply line.

5. This driver can also operate at  $-3.3$  V  $V_{EE}$ , but at slower speed.

6. When using positive logic, GND should be connected to positive power supply +5 V, and  $V_{EE}$  should be connected to ground.

## Performance over Guaranteed Operating Range

Symbol	Parameter	Test Conditions	Min.	Typ.	Max.	Unit
$V_{IH}$	Input High Voltage	Guaranteed High Input Voltage	-1.5	0.0	0.0	V
$V_{IL}$	Input Low Voltage	Guaranteed Low Input Voltage	-5.5	-5.0	-3.5	V
$V_{OH}$	Output High Voltage	$I_{OH} = -250 \mu A$	—	-0.1	—	V
$V_{OL}$	Output Low Voltage	$I_{OL} = 250 \mu A$	—	$V_{EE} + 0.1$	—	V
$I_{IN}$	Input Leakage Current (per Input)	$V_{IN} = GND$ or $V_{EE}$	—	80	—	$\mu A$
$I_{OH}$	DC Output Current-High (per Output)	$V_{EE} = -5.0$ V	-1	—	—	mA
$I_{OL}$	DC Output Current-Low (per Output)	$V_{EE} = -5.0$ V	—	—	1	mA
$I_{EE}$	Quiescent Supply Current	$V_{IN} = GND$ or $V_{EE}$ , No Output Load	—	—	400	$\mu A$
$T_D$	Propagation Delay	50% LOAD signal to 90% $V_O$	—	12	—	ns
$C_{IN}$	Input Capacitance	—	—	6	—	pF

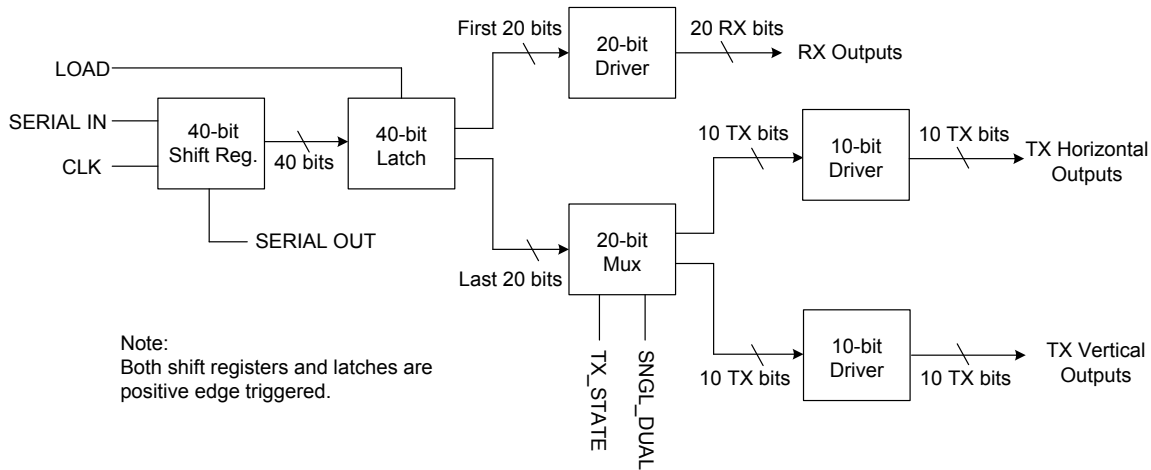
## Absolute Maximum Ratings

Symbol	Parameter	Min.	Max.	Unit
$V_{EE}$	Negative DC Supply Voltage	-7.0	0.3	V
$V_{IN}$	DC Input Voltage	$V_{EE} - 0.3$	0.3	V
$V_O$	DC Output Voltage	$V_{EE} - 0.3$	0.3	V
$T_{OPER}$	Operating Temperature	-55	125	°C
$T_{STG}$	Storage Temperature	-65	150	°C
ESD	ESD Sensitivity (HBM)	2.0	—	kV

## 40-bit Serial to Parallel Driver for GaAs FETs

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### Function Diagram



### Serial Bit Stream Definition<sup>7</sup>

Bit No.	Bit Function	Bit No.	Bit Function
1	RX2-phase 1	21	TX-phase 1-A
2	RX2-phase 2	22	TX-phase 1-B
3	RX2-phase 3	23	TX-phase 2-A
4	RX2-phase 4	24	TX-phase 2-B
5	RX2-phase 5	25	TX-phase 3-A
6	RX2-phase 6	26	TX-phase 3-B
7	RX2-atten 1	27	TX-phase 4-A
8	RX2-atten 2	28	TX-phase 4-B
9	RX2-atten 3	29	TX-phase 5-A
10	RX2-atten 4	30	TX-phase 5-B
11	RX1-phase 1	31	TX-phase 6-A
12	RX1-phase 2	32	TX-phase 6-B
13	RX1-phase 3	33	TX-atten 1-A
14	RX1-phase 4	34	TX-atten 1-B
15	RX1-phase 5	35	TX-atten 2-A
16	RX1-phase 6	36	TX-atten 2-B
17	RX1-atten 1	37	TX-atten 3-A
18	RX1-atten 2	38	TX-atten 3-B
19	RX1-atten 3	39	TX-atten 4-A
20	RX1-atten 4	40	TX-atten 4-B

7. Bit No. 1 should be the first bit going into the serial interface.

### TX Mux Truth Table

Vertical Beam Bits		SNGL_DUAL	
		L	H
TX_STATE	L <sup>8</sup>	A <sup>9</sup>	B <sup>9</sup>
	H <sup>8</sup>	A	A

Horizontal Beam Bits		SNGL_DUAL	
		L	H
TX_STATE	L	B	A
	H	B	B

8. For  $V_{EE} = -5\text{ V}$ , Logic "L" =  $-5\text{ V}$ , and Logic "H" =  $0\text{ V}$ .

9. "A" represents odd bits of the 20-bit TX bit stream, and "B" represents even bits of the 20-bit TX bit stream.

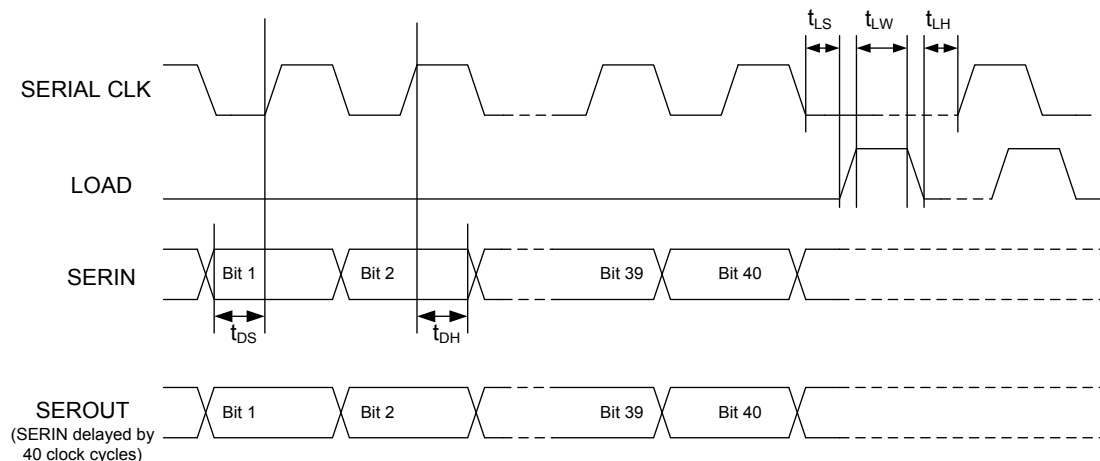
### Handling Procedures

Please observe the following precautions to avoid damage:

### Static Sensitivity

Silicon Circuits are sensitive to electrostatic discharge (ESD) and can be damaged by static electricity. Proper ESD control techniques should be used when handling these devices.

### Serial Interface Timing Diagram



### Serial Interface Timing Characteristics

Symbol	Parameter	Typical performance			Unit
		-40°C	+25°C	+85°C	
$t_{SCK}$	Min. Serial Clock Period	100	100	100	ns
$t_{DS}$	Min. DATA Set-up Time	20	20	20	ns
$t_{DH}$	Min. DATA Hold Time	20	20	20	ns
$t_{LS}$	Min. LOAD Set-up Time	20	20	20	ns
$t_{LW}$	Min. LOAD Pulse Width	20	20	20	ns
$t_{LH}$	Min. Serial CLK Hold Time from LOAD	20	20	20	ns



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