MADRCC0006, MADR-009151-000DIE

Single Driver for GaAs FET Switches and Attenuators

Rev. V6

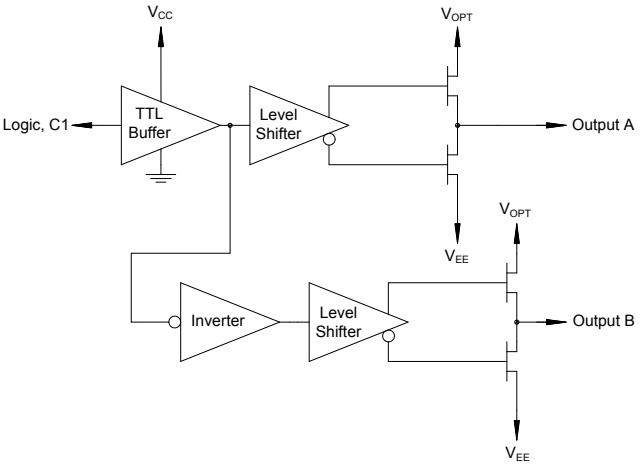
Features

- High Speed CMOS Technology
- Single Channel
- Positive Voltage Control
- Low Power Dissipation
- Low Cost Plastic SOIC-8 Package
- 100% Matte Tin Plating over Copper
- Halogen-Free “Green” Mold Compound
- 260°C Reflow Compatible
- MADRCC0006 is RoHS* Compliant Version of SWD-109

Description

The MADRCC0006 is a single channel driver used to translate TTL control inputs into gate control voltages for GaAs FET microwave switches and attenuators. High speed analog CMOS technology is utilized to achieve low power dissipation at moderate to high speeds, encompassing most microwave switching applications. The output high level is optionally 0 to +2 V (relative to GND) to optimize the intermodulation products of the control devices at low frequencies.

Functional Schematic



Ordering Information[1]

Part Number	Package
MADRCC0006	SOIC-8
MADRCC0006TR	1000 piece reel, SOIC-8
MADR-0009151-000DIE	Die[2]

1. Reference Application Note M513 for reel size information.
2. Die sales are available in waffle packs in increments of 100 pieces.

Pin Configuration[3]

Pin No.	Function
1	Output A
2	GND
3	V_{CC}
4	C1, Logic
5	V_{EE}
6	V_{OPT}
7	GND
8	Output B

3. The bottom of the die should be isolated for part number MADR-009151-000DIE.

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

Guaranteed Operating Ranges

Symbol	Parameter[4]	Unit	Min.	Typ.	Max.
V_{CC}	Positive DC Supply Voltage	V	4.5	5.0	5.5
V_{EE}	Negative DC Supply Voltage	V	-8.5	-5.0	-4.5
V_{OPT}[5]	Optional DC Output Supply Voltage	V	0	1.0	2.0
V_{OPT}-V_{EE}	Negative Supply Voltage Range	V	4.5	6.5	11.0
V_{CC}-V_{EE}	Positive to negative Supply Range	V	9.0	10.0	14.0
T_A	Operating Ambient temperature	°C	-40	+25	+85
I_{OH}	DC Output Current - High	mA	—	—	-1.0
I_{OL}	DC Output Current - Low	mA	—	—	1.0
T_{RISE}, T_{FALL}	Maximum Input Rise or Fall Time	ns	—	—	500

4. All voltages are relative to GND.
5. V_{OPT} is grounded for most applications. To improve the intermodulation performance and the 1 dB compression point of GaAs control devices at low frequencies, V_{OPT} can be increased to between 1 and 2 V. The nonlinear characteristics of the GaAs control devices will approximate performance at 500 MHz. It should be noted that the control current is on the GaAs MMICs will increase when positive controls are applied.
6. MACOM recommends that V_{CC} be powered on before V_{EE} and powered off after V_{EE}.

DC Characteristics over Guaranteed Operating Range

Symbol	Parameter	Test Conditions		Units	Min.	Typ.	Max.
V_{IH}	Input High Voltage	Guaranteed High Input Voltage		V	2.0	—	—
V_{IL}	Input Low Voltage	Guaranteed Low Input Voltage		V	—	—	0.8
V_{OH}	Output High Voltage	I_{OH} = -1 mA	V_{EE} = max.	V	V_{OPT} -0.1	—	—
V_{OL}	Output Low Voltage	I_{OL} = 1 mA	V_{EE} = max.	V	—	—	V_{EE} +0.1
I_{IN}	Input Leakage Current	V_{IN} = V_{CC} or GND	V_{EE} = min.	µA	—	.01	10
I_{CC}	Quiescent Supply Current	V_{CC} = max. V_{OPT} = min. or max.	V_{EE} = min. V_{IN} = V_{CC} or GND	µA	—	—	100
D I_{CC}	Additional Supply Current, per TTL Input pin	V_{CC}= max.	V_{IN} = V_{CC} -2.1 V	mA	—	—	1.0

AC Characteristics Over Guaranteed Operating Range[7]

Symbol	Parameter	Unit	-55 to +25°C	≤+85°C	≤+125°C
T_{PLH}	Propagation Delay	ns	22	25	30
T_{PHL}	Propagation Delay	ns	22	25	30
T_{TLH}	Output Rising Transition Time	ns	9.0	9.0	9.0
T_{THL}	Output Falling Transition Time	ns	8.0	8.0	8.0
T_{SKEW}	Delay Skew, Output A to Output B	ns	4.0	4.0	4.0
C_{IN}	Input Capacitance	pF	10	10	10
C_{PDC}	Power Dissipation Capacitance[8]	pF	10	10	10
C_{PDE}	Power Dissipation Capacitance[8]	pF	140	140	140

7. V_{CC} = 4.5 V, V_{OPT} - V_{EE} = min or max, V_{OPT} = 0 V, C_L = 25 pF, T_{RISE}, T_{FALL} = 6 ns. These conditions represent the worst case for slow delays.
8. Total Power Dissipation is calculated by the following formula: PD = V_{CC} ^{2}fC_{PDC} + (V_{OPT}-V_{EE}) ^{2}fC_{PDE}.

Absolute Maximum Ratings[9,10,11]

Symbol	Parameter	Unit	Min.	Max.
V_{CC}	Positive DC Supply Voltage	V	-0.5	7.0
V_{EE}	Negative DC Supply Voltage	V	-9.0	0.5
V_{OPT}	Optional DC Output Supply Voltage	V	-0.5	V_{CC} +0.5
V_{OPT}-V_{EE}	Output to Negative Supply Voltage Range	V	-0.5	11.0
V_{CC}-V_{EE}	Positive to Negative Supply Voltage Range	V	-0.5	14.0
V_I	DC Input Voltage	V	-0.5	V_{CC} +0.5
I_I	DC Input Current	mA	-25	25
V_O	DC Output Voltage	V	V_{EE} –0.5	V_{OPT} +0.5
P_D[12]	Power Dissipation in Still Air	mW	—	500
V_O	DC Output Current	mA	-25	25
T_{STG}	Storage Temperature	°C	-65	150

9. All voltages are referenced to GND. All inputs and outputs incorporate latch-up protection structures.
10. Exceeding any one or combination of these limits may cause permanent damage to this device.
11. MACOM does not recommend sustained operation near these survivability limits.
12. Derate -7 mW/°C from 65°C to 85°C.

Truth Table

Input	Outputs	
C1	A	B
Logic “0”	V_{EE}	V_{OPT}
Logic “1”	V_{OPT}	V_{EE}

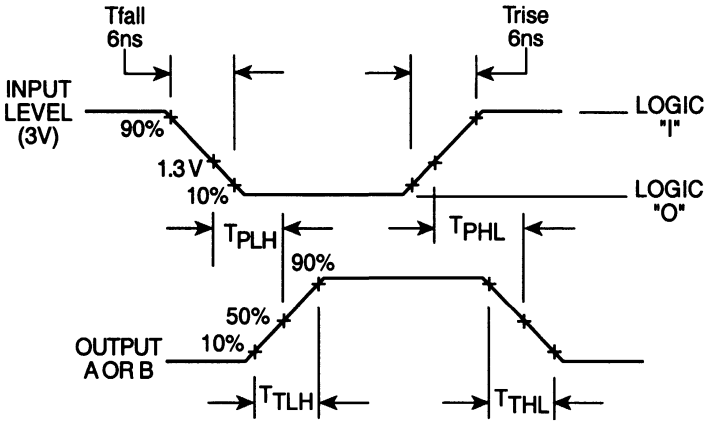
Handling Procedures

Please observe the following precautions to avoid damage:

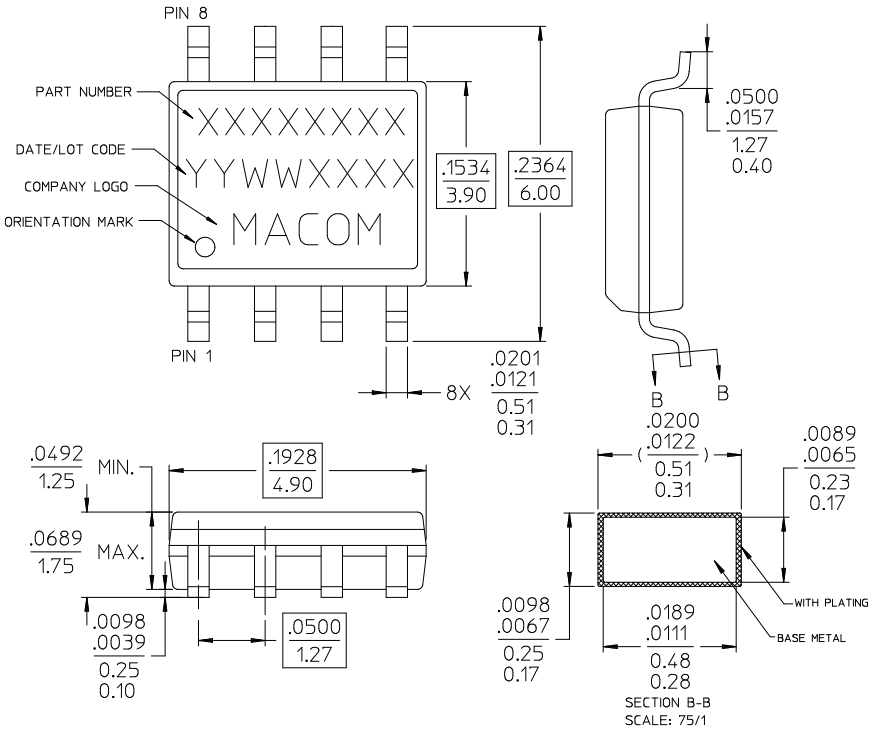
Static Sensitivity

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

Switching Waveforms



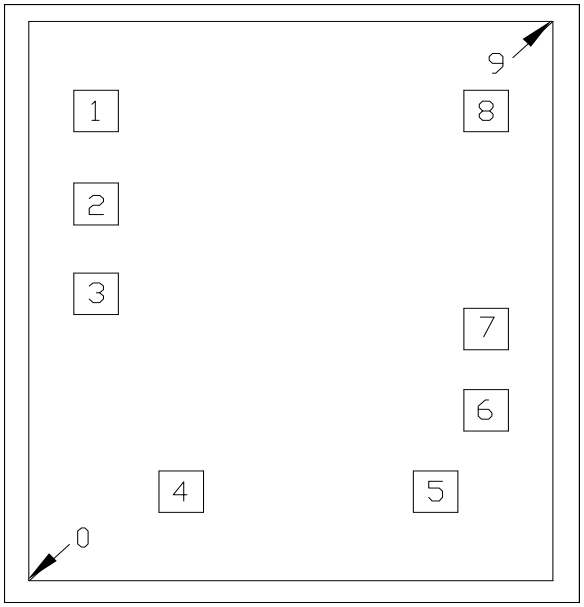
Lead-Free, SOIC-8†



Notes:
1. Reference JEDEC MS-012-AA for additional dimensional and tolerance information.
2. Reference M538 application note for footprint information.
3. All dimensions shown as inches/mm.

† Reference Application Note M538 for lead-free solder reflow recommendations.

DIE Outline Drawing



Pad Configuration[13,14]

Die Size: 1080 x 1240 µm (nominal)

Pad No.	X (µm) nominal	Y (µm) nominal	Pad Size (µm)
0	0	0	Lower left edge of die
1	138	1042	92 x 92
2	138	835.5	92 x 92
3	138	636.75	92 x 92
4	313.75	198	92 x 92
5	838.5	198	92 x 92
6	942	378	92 x 92
7	942	558	92 x 92
8	942	1042	92 x 92
9	1080	1240	Upper right edge of die

13. All X,Y dimensions are at bond pad center.
14. Die thickness is 9.5 mils.

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MADRCC0006