

### RELEVANT PRODUCTS

- ARA05050

### LAYOUT CONSIDERATIONS

There are two issues that must be taken into consideration when doing the PCB layout. The first is thermal management, and the second is RF related.

#### Thermal Layout Considerations

The ARA05050 will typically dissipate 0.9W, and as high as 1.2W. Since the interior of most set-top boxes and cable modems are typically at +70°C, consideration must be given to providing an adequate heat sink for the die to obtain the maximum MTF possible. To this end, the ARA05050 incorporates a heat slug in the bottom of the package, which provides a low thermal resistance path from the die to the outside of the package (See Figure 1). The typical thermal rise from the heat slug to the junction is 35°C/W; however, this is only half of the equation. Adequate heat sinking must be applied to the heat slug for good thermal dissipation. Providing a metalized pad with via holes to ground under the package will do this (see Figure 2). The part is then soldered to this pad during assembly. The recommended solder mask outline is shown in Figure 3.

#### RF Layout Considerations

The ARA05050 is an amplifier designed to drive a 75 Ohm load. Since this part connects the transmitter to the cable system, typically via a diplexer, at RF frequencies, the layout of the PCB will have an effect on the system performance. The first thing to consider in the RF layout are the connections to ground. These must be low impedance, and as short as possible. The best way to do this is to use a via hole 0.030 inches in diameter, located as close to the ground pin as possible, that connects to the ground plane (see Figure 2). Specifically, care should be given to the layout of the following connections (the traces leading from the following pins to their respective components should be as low in

impedance as is practical.):

**Pins 5 & 19:** the 20 ohm chip resistor should be as close as possible to the pins and the 1 uF capacitor should be kept close to the 20 ohm resistor.

**Pins 6–9 & 20–23:** the capacitors should be kept close to the pins.

**Pin 11:** the 1uF bypass capacitor should be kept close to the pin.

**Pin 12:** the bypass capacitor at this node should be reasonably close to the pin.

The path leading between **pins 4–10**, and the path between **pins 18–24**, should be kept as short as possible.

The bypass capacitors on the  $V_{DD}$  lines should be located as close as possible to the 10 uH inductors.

The traces leading to the RF input, and leading away from the RF output, should be 75 Ohms. Care should be taken to keep other traces, which may have clock signals on them, as far away as is practical to prevent unwanted coupling onto the signal line.

### OUTPUT DISCONNECT SWITCH

For MCNS/DOCSIS applications an external switch to disconnect the output of the ARA05050 from the diplexer is required. This switch is needed due to the output noise requirement between bursts and the requirement that any shutdown transient not exceed 7mV. The switch shown in Figure 4 meets these conditions because it does not switch any current, or voltage, on the output line. The series FET (Q1) provides 35 dB of isolation, while the shunt FET (Q2) ensures that the diplexer remains terminated into a 75 Ohm impedance. Since the switch does not draw any current, it may be driven directly from a low power CMOS logic inverter; however, the control voltages must be +5V. When the switch is in the open state, it is good general practice

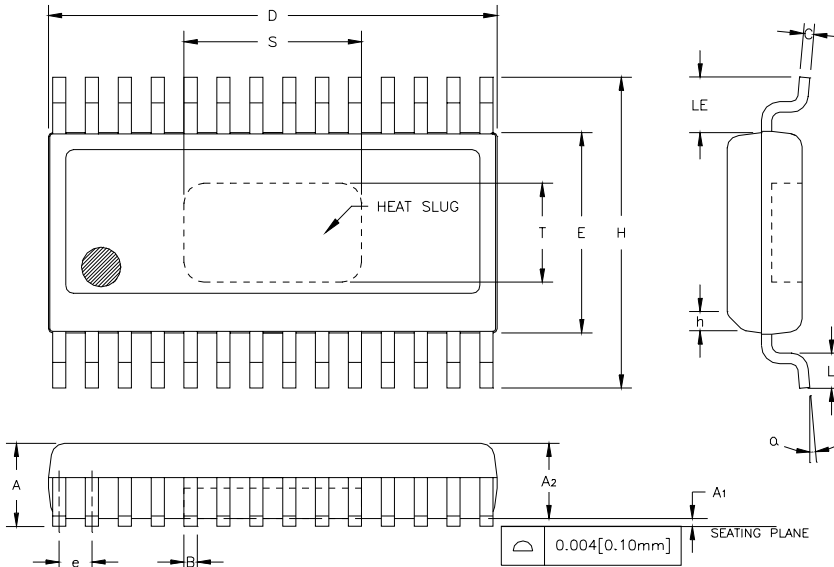
## Layout and Power Control for ARA05050

to set the programmable attenuator to its maximum attenuation setting. This will increase the isolation between the cable modem output and upstream modulator, and provide the first stage amplifier with a 75 Ohm termination. The switching speed of the output disconnect switch is shown in Figure 5.

### DEVICE SHUTDOWN

In some applications it may be desirable to shut the ARA05050 down for power saving. This can be done

by applying a negative voltage to pin 10 to shut down the input stage, and to pin 24 to shut down output stage (see Figure 6). Shutting down both amplifier stages will reduce the current drawn from the +5V supply to typically 10 mA. If only one stage is shutdown, it is recommended that the programmable attenuator be set to a minimum of 16 dB to provide a good impedance match to the remaining stage.



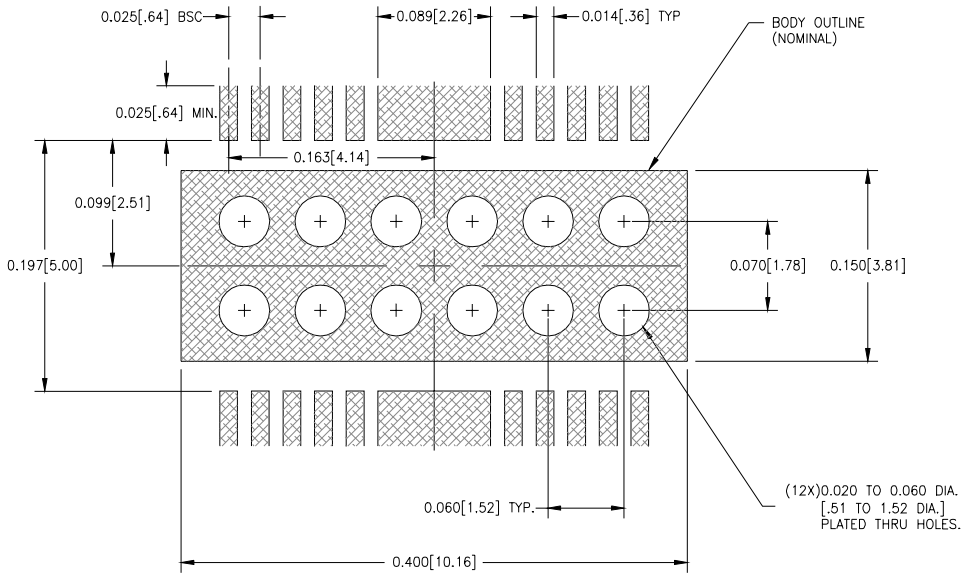
S <sub>W</sub> B <sub>OL</sub>	INCHES		MILLIMETERS		NOTE
	MIN.	MAX.	MIN.	MAX.	
A	0.058	0.068	1.47	1.73	
A1	0.000	0.004	0.00	0.10	
A2	0.054	0.060	1.37	1.52	
B	0.008	0.014	0.20	0.35	5
C	0.007	0.012	0.18	0.30	5
D	0.385	0.393	9.78	9.98	2
E	0.151	0.157	3.84	3.99	3
e	0.025	BSC	0.64	BSC	4
H	0.228	0.244	5.79	6.20	
h	0.015x45°		0.38x45°		
L	0.016	0.032	0.41	0.81	
LE	0.042	—	1.07	—	
α	0°	8°	0°	8°	
S	0.105	0.135	2.67	3.43	6
T	0.045	0.075	1.41	1.91	6

#### NOTES:

1. CONTROLLING DIMENSION: INCHES
2. DIMENSION "D" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS AND GATE BURRS SHALL NOT EXCEED 0.006 [0.15mm] PER SIDE.
3. DIMENSION "E" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSIONS. INTER-LEAD FLASH AND PROTRUSIONS SHALL NOT EXCEED 0.010 [0.25mm] PER SIDE.
4. MAXIMUM LEAD TWIST/SKEW TO BE  $\pm 0.0035$  [0.089mm].
5. LEAD WIDTH "B" AND THICKNESS "C" MAX. DIMENSION IS AFTER PLATING.
6. DIMENSIONS "S" AND "T" INDICATE EXPOSED SLUG AREA.

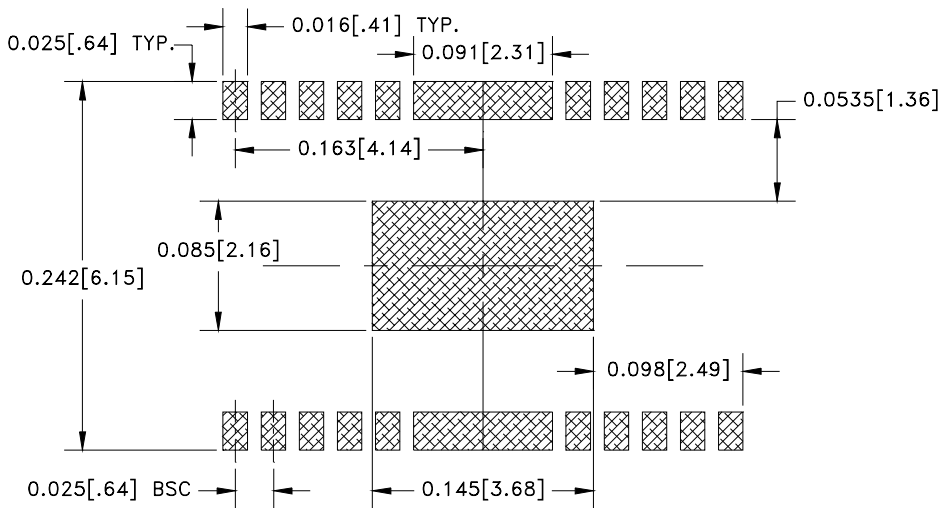
0-

Figure 1: S12 Package Outline - 28 Pin SSOP with Heat Slug



\* Dimensions are in Inches [Millimeters]

Figure 2: PC Board Layout



\* Dimensions are in Inches [Millimeters]

Figure 3: Solder Mask Outline

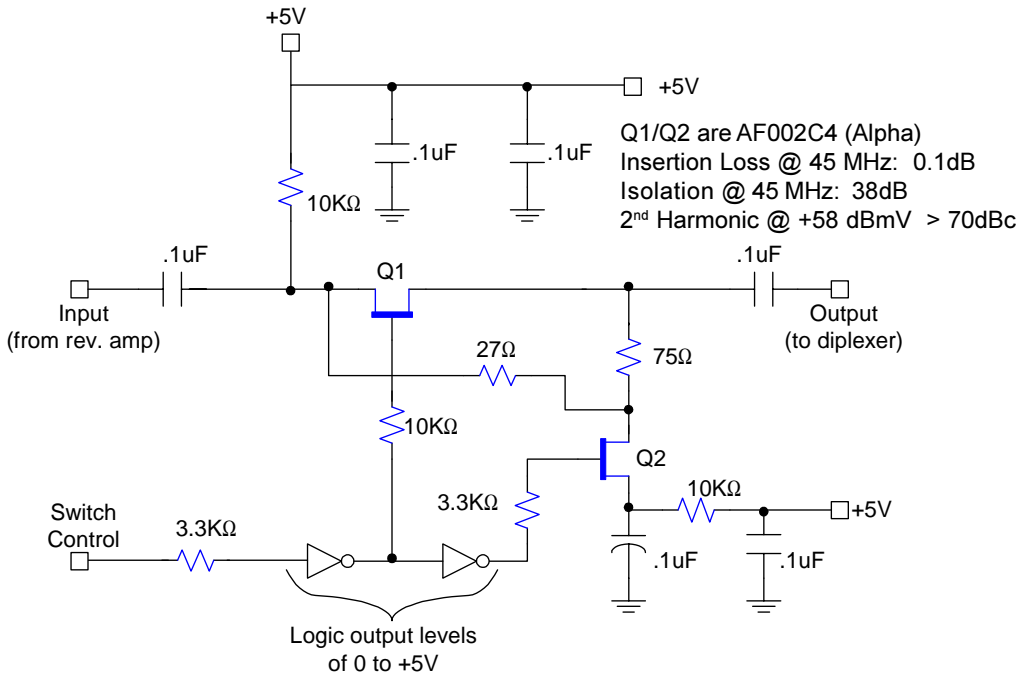


Figure 4: Output Switch

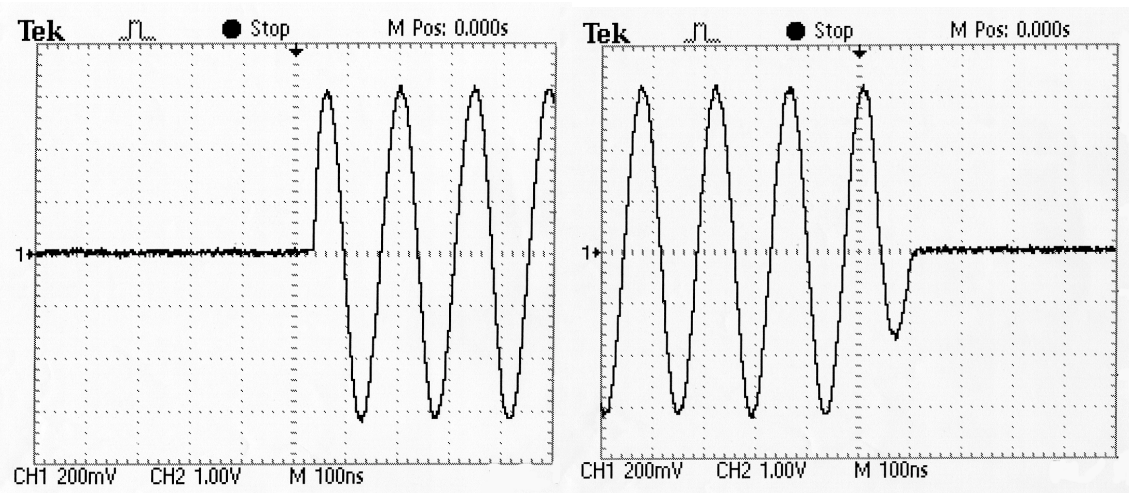


Figure 5: Switching Speed of Output Disconnect Switch

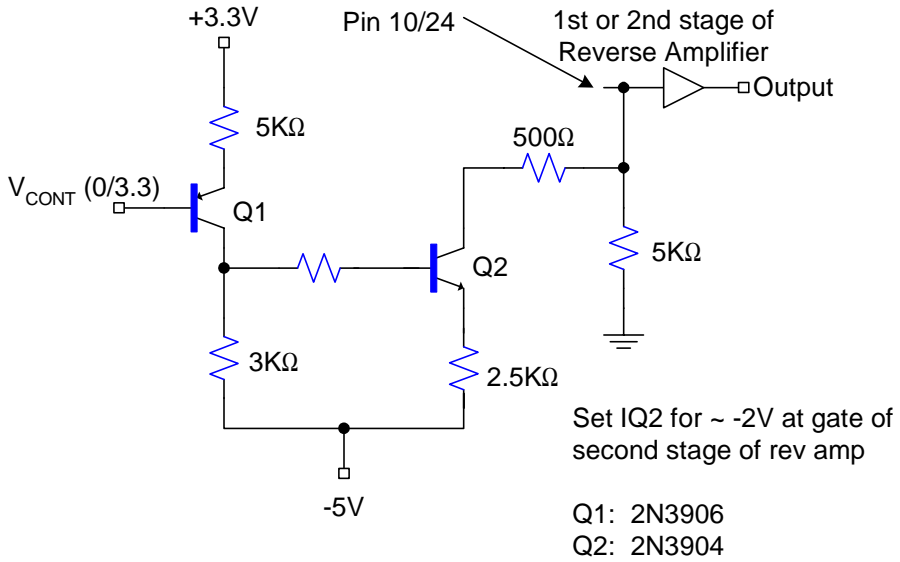


Figure 6: Negative Voltage Shutdown Circuit

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