0.1 GHz to 8 GHz, GaAs, Nonreflective, SP4T Switch

Enhanced Product

HMC344ATCPZ-EP

FEATURES

- Broadband frequency range: 0.1 GHz to 8 GHz
- Nonreflective 50 Ω design
- Low insertion loss: 1.7 dB at 6 GHz
- High isolation: 36 dB at 6 GHz
- High input linearity at 250 MHz to 8 GHz
  - P1dB: 28 dBm typical
  - IP3: 44 dBm typical
- Integrated 2 to 4 line decoder
- 16-lead, 3 mm × 3 mm LFCSP package
- ESD HBM rating: 250 V (Class 1A)

ENHANCED PRODUCT FEATURES

- Supports defense and aerospace applications (AQEC standard)
- Military temperature range (−55°C to +125°C)
- Controlled manufacturing baseline
- One assembly/test site
- Product change notification
- Qualification data available on request

APPLICATIONS

- Broadband telecommunications systems
- Fiber optics
- Switched filter banks
- Wireless Infrastructure below 8 GHz

FUNCTIONAL BLOCK DIAGRAM

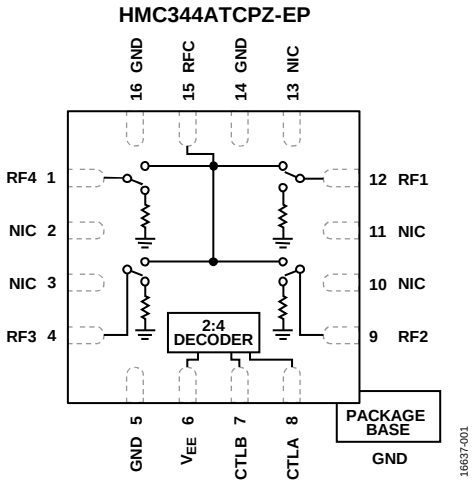

Figure 1.

GENERAL DESCRIPTION

The HMC344ATCPZ-EP is a broadband, nonreflective, single-pole, four-throw (SP4T) switch manufactured using a gallium arsenide (GaAs) metal semiconductor field effect transistor (MESFET) process. This switch offers high isolation, low insertion loss, and on-chip termination of the isolated ports.

The switch operates with a negative supply voltage (V_{EE}) range of −5 V to −3 V and requires two negative logic control voltages.

The HMC344ATCPZ-EP includes an on-chip, binary two-line to four-line decoder that provides logic control from two logic input lines.

The HMC344ATCPZ-EP comes in a 3 mm × 3 mm, 16-lead LFCSP package and operates from a 0.1 GHz to 8 GHz frequency range.

Additional application and technical information can be found in the HMC344ALP3E data sheet.

Rev. 0

Document Feedback

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REVISION HISTORY

3/2018—Revision 0: Initial Version

SPECIFICATIONS

V_{EE} = −3 V or −5 V, control voltage (V_{CTL}) = 0 V or V_{EE}, case temperature (T_{CASE}) = 25°C, 50 Ω system, unless otherwise noted.

Table 1.

Parameter	Symbol	Test Conditions/Comments	Min	Typ	Max	Unit
FREQUENCY RANGE	f		0.1		8	GHz
INSERTION LOSS						
Between RFC and RF1 to RF4 (On)		0.1 GHz to 2 GHz		1.4	2.0	dB
		2 GHz to 4 GHz		1.4	2.0	dB
		4 GHz to 6 GHz		1.7	2.2	dB
		6 GHz to 8 GHz		2.1	2.5	dB
ISOLATION						
Between RFC and RF1 to RF4 (Off)		0.1 GHz to 2 GHz	39	43		dB
		2 GHz to 4 GHz	33	37		dB
		4 GHz to 6 GHz	32	36		dB
		6 GHz to 8 GHz	28	32		dB
RETURN LOSS						
RFC and RF1 to RF4 (On)		0.1 GHz to 2 GHz	12	16		dB
		2 GHz to 4 GHz	12	16		dB
		4 GHz to 6 GHz	11	16		dB
		6 GHz to 8 GHz	6	11		dB
RF1 to RF4 (Off)		0.1 GHz to 8 GHz	11	16		dB
SWITCHING						
Rise and Fall Time	t_{RISE}, t_{FALL}	10% to 90% of radio frequency (RF) output		35		ns
On and Off Time	t_{ON}, t_{OFF}	50% V_{CTL} to 90% of RF output		75		ns
INPUT LINEARITY[1]		f = 250 MHz to 8 GHz				
1 dB Power Compression	P1dB	V_{EE} = −5 V	23	28		dBm
		V_{EE} = −3 V		25		dBm
Third-Order Intercept	IP3	10 dBm per tone, 1 MHz spacing				
		V_{EE} = −5 V	40	44		dBm
		V_{EE} = −3 V		44		dBm
SUPPLY		V_{EE} pin				
Voltage	V_{EE}		−5		−3	V
Current	I_{EE}			2.5	6	mA
DIGITAL CONTROL INPUTS		CTLA and CTLB pins				
Voltage	V_{CTL}					
Low	V_{INL}	V_{EE} = −5 V	−3		0	V
		V_{EE} = −3 V	−1		0	V
High	V_{INH}	V_{EE} = −5 V	−5		−4.2	V
		V_{EE} = −3 V	−3		−2.2	V
Current	I_{CTL}					
Low	I_{INL}			40		µA
High	I_{INH}			0.10		µA
OPERATING TEMPERATURE			−55		+125	°C

[1] Input linearity performance degrades at frequencies less than 250 MHz.

ABSOLUTE MAXIMUM RATINGS

For recommended operating conditions, see Table 1.

Table 2.

Parameter	Rating
Negative Supply Voltage (V_{EE})	−7 V
Digital Control Input Voltage Range	V_{EE} − 0.5 V to +1 V
RF Input Power (See Figure 2)	
f = 250 MHz to 8 GHz, T_{CASE} = 85°C	
V_{EE} = −5 V	
Through Path	31 dBm
Terminated Path	26.5 dBm
Hot Switching	22 dBm
V_{EE} = −3 V	
Through Path	28 dBm
Terminated Path	23.5 dBm
Hot Switching	19 dBm
Temperature	
Junction, T_J	150°C
Storage	−65°C to +150°C
Reflow	260°C
Junction to Case Thermal Resistance, θ_{JC}	
Through Path	107°C/W
Terminated Path	137°C/W
Electrostatic Discharge (ESD) Sensitivity	
Human Body Model (HBM)	250 V (Class 1A)

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

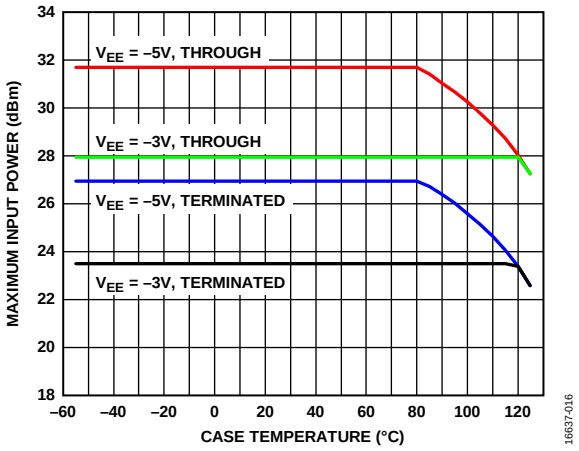

Figure 2. Maximum Input Power vs. Case Temperature Plot

ESD CAUTION

ESD (electrostatic discharge) sensitive device. Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

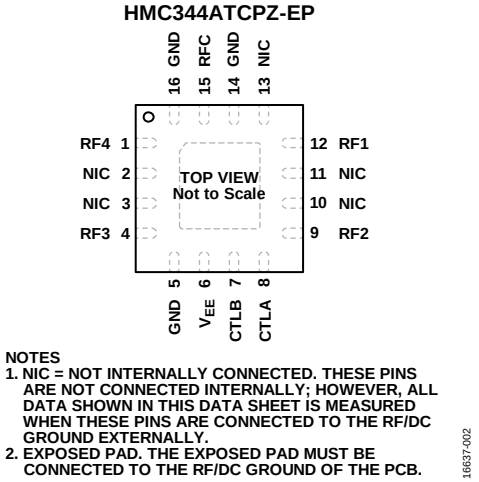

Figure 3. Pin Configuration

Table 3. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	RF4	RF4 Port. This pin is dc-coupled and matched to 50 Ω. A dc blocking capacitor is required if the RF line potential does not equal 0 V dc.
2, 3, 10, 11, 13	NIC	Not Internally Connected. These pins are not connected internally; however, all data shown in this data sheet is measured when these pins are connected to the RF/dc ground externally.
4	RF3	RF3 Port. This pin is dc-coupled and matched to 50 Ω. A dc blocking capacitor is required if the RF line potential does not equal 0 V dc.
5, 14, 16	GND	Ground. These pins connect to the RF/dc ground of the PCB.
6	V_{EE}	Negative Supply Voltage Pin.
7	CTLB	Control Input 2 Pin. See Table 4 for the control voltage truth table.
8	CTLA	Control Input 1 Pin. See Table 4 for the control voltage truth table.
9	RF2	RF2 Port. This pin is dc-coupled and matched to 50 Ω. A dc blocking capacitor is required if the RF line potential does not equal 0 V dc.
12	RF1	RF1 Port. This pin is dc-coupled and matched to 50 Ω. A dc blocking capacitor is required if the RF line potential does not equal 0 V dc.
15	RFC	RF Common Port. This pin is dc-coupled and matched to 50 Ω. A dc blocking capacitor is required if the RF line potential does not equal 0 V dc.
	EPAD	Exposed Pad. The exposed pad must be connected to the RF/dc ground of the PCB.

Table 4. Control Voltage Truth Table

Digital Control Input		RF Paths			
CTLA	**CTLB**	**RFC to RF1**	**RFC to RF2**	**RFC to RF3**	**RFC to RF4**
High	High	Insertion loss (on)	Isolation (off)	Isolation (off)	Isolation (off)
Low	High	Isolation (off)	Insertion loss (on)	Isolation (off)	Isolation (off)
High	Low	Isolation (off)	Isolation (off)	Insertion loss (on)	Isolation (off)
Low	Low	Isolation (off)	Isolation (off)	Isolation (off)	Insertion loss (on)

INTERFACE SCHEMATICS

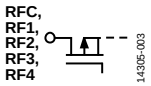

Figure 4. RFC and RF1 to RF4 Interface Schematic

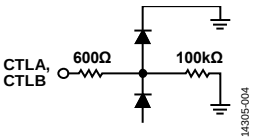

Figure 5. CTLA and CTLB Interface Schematic

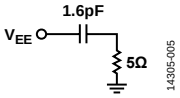

Figure 6. V_{EE} Interface Schematic

TYPICAL PERFORMANCE CHARCTERISTICS

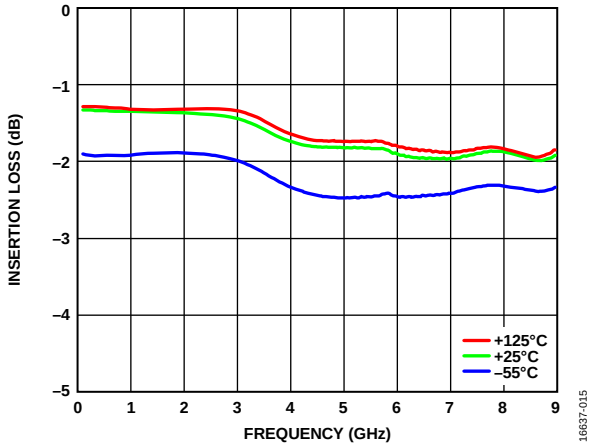

Figure 7. Insertion Loss vs. Frequency at Various Temperatures, Between RFC and RF1

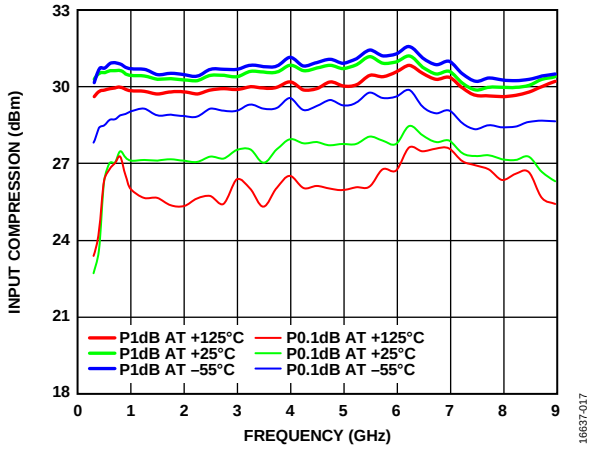

Figure 8. Input Compression vs. Frequency at Various Temperatures, V_{EE} = –5 V

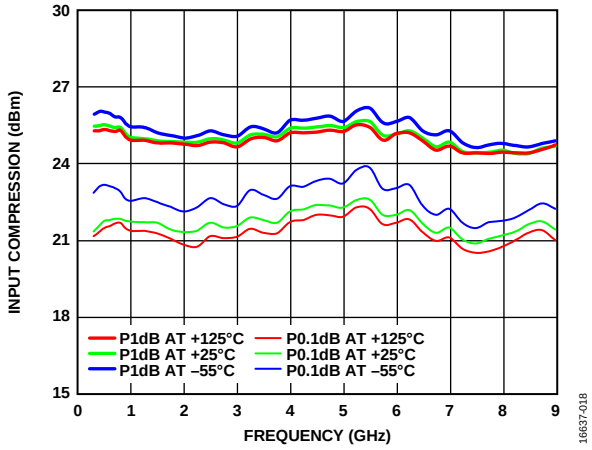

Figure 9. Input Compression vs. Frequency at Various Temperatures, V_{EE} = –3 V

OUTLINE DIMENSIONS

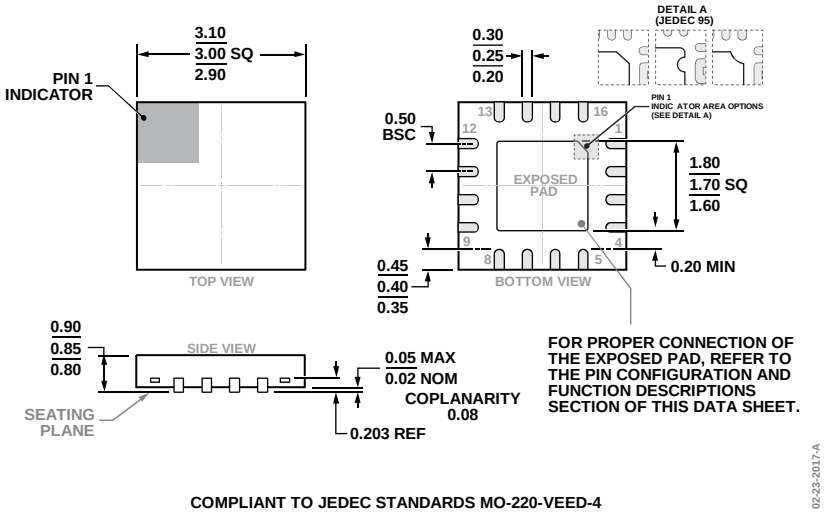

Figure 10. 16-Lead Lead Frame Chip Scale Package [LFCSP]
3 mm × 3 mm Body and 0.85 mm Package Height
(CP-16-51)
Dimensions shown in millimeters

ORDERING GUIDE

Model[1]	Temperature Range	Package Description	Package Option
HMC344ATCPZ-EP-PT	−55°C to +125°C	16-Lead Lead Frame Chip Scale Package [LFCSP]	CP-16-51
HMC344ATCPZ-EP-R7	−55°C to +125°C	16-Lead Lead Frame Chip Scale Package [LFCSP]	CP-16-51

[1] All models are RoHS compliant parts.

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