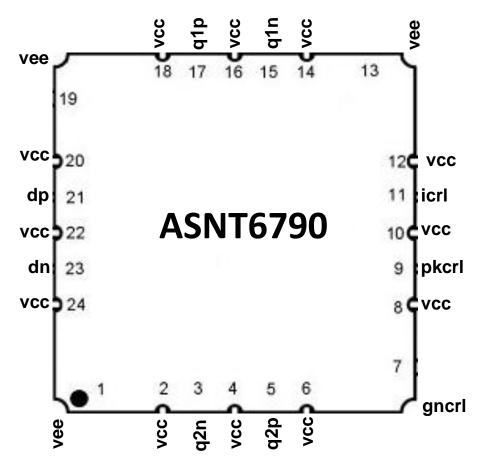


Ultra High-Speed Mixed Signal ASICs

Office: (310) 530-9400 Fax: (310) 530-9402 www.adsantec.com

ASNT6790-KHC DC-35*GHz* 1-to-2 Analog Signal Splitter

- DC to 35*GHz* broadband linear signal splitter
- Exhibits an extra-flat frequency response ideal for PAM3 and PAM4 applications
- One differential CML-type input port and two phase-matched differential CML-type output ports
- Single ended input linearity range up to $0.6V_{pk-pk}$ and differential input linearity up to $1.2V_{pk-pk}$
- Adjustable gain around from -4dB to +3dB
- Adjustable high-frequency peaking
- Adjustable internal currents for power consumption and bandwidth control
- Low jitter and limited temperature variation over industrial temperature range
- Single +3.6V or -3.6V power supply
- Power consumption: 760*mW* typical
- Fabricated in SiGe for high performance, yield, and reliability
- Custom CQFN 24-pin package





DESCRIPTION

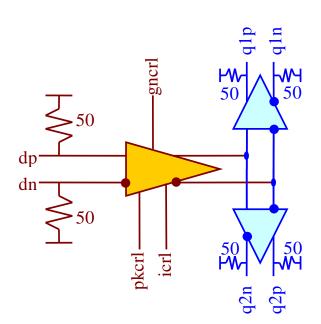


Fig. 1. Functional Block Diagram

The temperature stable ASNT6790-KHC 1-to-2 analog signal splitter is intended for use in high-speed interleaved ADCs or similar systems. Its extra-flat frequency response is ideal for PAM3 and PAM4 signals. The IC shown in Fig. 1 can receive a broad-band analog signal at its differential input dp/dn and effectively distribute it to two separate phase matched differential outputs q1p/q1n, q2p/q2n with a nominal gain of 0*dB*. A low-speed analog current control icrl is available for power consumption and bandwidth adjustments. A low-speed analog control pkcrl is available for peaking adjustments at higher frequencies (above 25*GHz*). A relatively flat frequency response with variation of no more than ±0.5*dB* within DC-to-40*GHz* can be achieved with these two control voltages. Another low-speed analog control gncrl is available for gain adjustment. A nominal gain of 0*dB* can be achieved for all corner, voltage, and temperature variations.

The part's I/O's support the CML logic interface with on chip 50*Ohms* termination to VCC and may be used differentially, AC/DC coupled, single-ended, or in any combination (also see POWER SUPPLY CONFIGURATION). In the DC-coupling mode, the input signal's common mode voltage should comply with the specifications shown in ELECTRICAL CHARACTERISTICS. In the AC-coupling mode, the input termination provides the required common mode voltage automatically.

POWER SUPPLY CONFIGURATION

The part can operate with either negative supply (vcc = 0.0V = ground and vee = -3.6V), or positive supply (vcc = +3.6V and vee = 0.0V = ground). In case of the positive supply, all I/Os need AC termination when connected to any devices with 50*Ohms* termination to ground. Different PCB layouts will be needed for each different power supply combination.

All the characteristics detailed below assume vcc = 0.0V and vee = -3.6V.



TYPICAL PERFORMANCE CHARACTERISTICS

At default values and with lower current/power consumption, the frequency responses of ASNT6790-KHC are shown in Fig. 2.

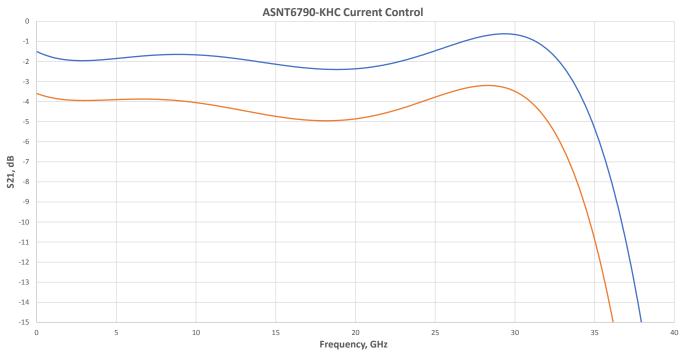


Fig. 2. Frequency Response at Lower Current/Power, Default Controls

The frequency responses at different gain controls are shown in Fig. 3.

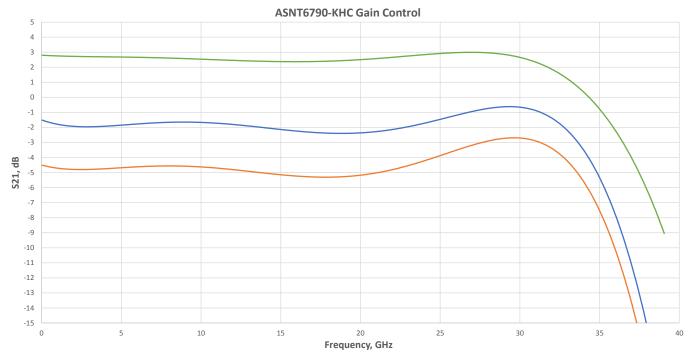
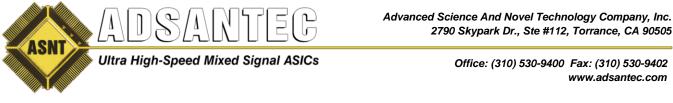


Fig. 3. Frequency Response at Minimum Gain, Default, and Maximum Gain



The frequency responses at different peaking controls are shown in Fig. 4.

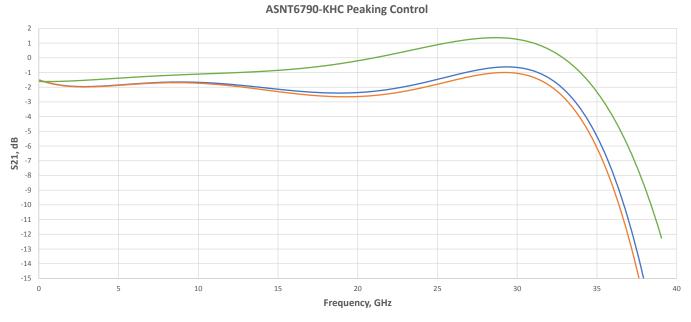


Fig. 4. Frequency Response at Minimum Peaking, Default, and Maximum Peaking



PAM4 SIGNAL EYE PROPAGATION

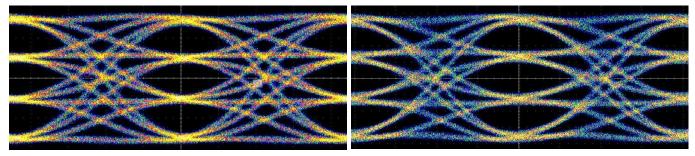


Fig.5. PAM4 at 25Gbaud, 800mV Differential Peak-Peak, Left: Input, Right: Output

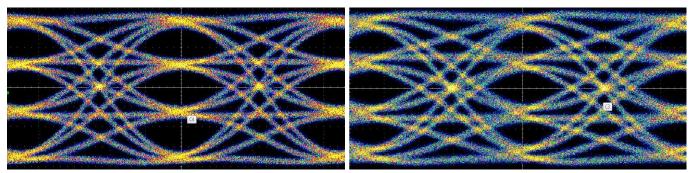


Fig.6. PAM4 at 32Gbaud, 800mV Differential Peak-Peak, Left: Input, Right: Output

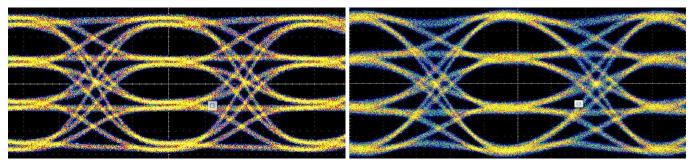


Fig.7. PAM4 at 25Gbaud, 1200mV Differential Peak-Peak, Left: Input, Right: Output

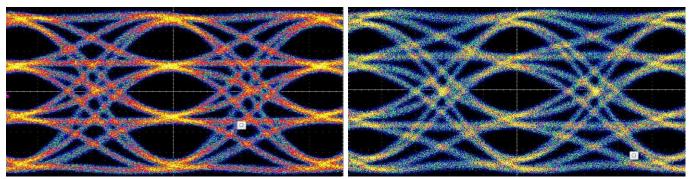


Fig.8. PAM4 at 32Gbaud, 1200mV Differential Peak-Peak, Left: Input, Right: Output



ABSOLUTE MAXIMUM RATINGS

Caution: Exceeding the absolute maximum ratings shown in Table 1 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 assumed or implied. All min and max voltage limits are referenced to ground.

Parameter	Min	Max	Units
Supply Voltage (vee)		-3.9	V
Power supply current		300	mA
Input Voltage	vcc-1.0	vcc+0.4	V
RF Input Voltage Swing (SE)		0.8	V
Analog control voltages	vee	VCC	V
Case Temperature		+90	°С
Storage Temperature	-40	+100	°С
Operational Humidity	10	98	%
Storage Humidity	10	98	%

Table 1. Absolute Maximum Ratings

TERMINAL FUNCTION

TERMINAL		AL	DESCRIPTION			
Name	No.	Туре				
dp	21	CML	Differential high-speed data inputs with internal SE 500hms			
dn	23	input	termination to VCC			
q1p	17	CML				
q1n	15	output	Differential high-speed data outputs with internal SE 50Ohms			
q2p	5	CML	termination to vcc. Require external SE 500hms termination to vcc			
q2n	3	output				
anorl	7	Analog gain control w			internal 15KOhms termination to vcc and	
gncrl			35KOhms termination to vee.			
pkcrl	9	Analog				
рксп)	Control				
icrl	11		Analog current control with internal 24 <i>KOhms</i> termination to vcc and 84.5 <i>KOhms</i> termination to vee.			
ICII	11					
	Supply and Termination Voltages					
Name	Description			Pin Number		
vcc	Positive power supply $(+3.6V \text{ or } 0)$			2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24		
vee	Negative power supply $(0V \text{ or } -3.6V)$			1, 13, 19		



ELECTRICAL CHARACTERISTICS

Ivee100210250 mA AtPower consumption320755950 mW AtJunction temperature-2550125°CInput Analog (dp/dn)BandwidthDC35 GHz Common mode voltage levelvccVIrSingle-ended voltage swing, pk-pk; unused input not connected or AC600 mV THIsingle-ended voltage swing, pk-pk; unused input not connected or AC1.2VTInput Noise DensityTBD $nV/sqrt(Hz)$ TBDS11TBDdBTBDdBS11Gain Control Signal (gncrl)Control rangevee+2vee+3.6VControl rangevee+1.5vee+3.6VDefault voltage levelvee+1.5VControl rangevee+1.5vee+3.3VDefault voltage levelvee+2.8VControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent Control Signal (jcrl)Control rangevee+2.8VCurrent adjustment03dBJBJBJBJBJBCurrent adjustment03JBJBJBDefault voltage levelvee+2.3vee+3.3VJBControl range <t< th=""><th>PARAMETER</th><th>MIN</th><th>TYP</th><th>MAX</th><th>UNIT</th><th>COMMENTS</th></t<>	PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
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Power consumption 320 755 950 mW AtJunction temperature -25 50 125 $^{\circ}C$ Input Analog (dp/dn)BandwidthDC 35 GHz Common mode voltage levelvCc V IrSingle-ended voltage swing, pk-pk; 600 mV THunused input not connected or AC 600 mV THterminated 600 mV THSingle-ended voltage swing, pk-pk; 1.2 V Tunused input not connected or AC 1.2 V THInput Noise DensityTBD $nV/sqrt(Hz)$ TBDS11TBD dB dB S11TBD dB dB Control rangevee+2vee+3.6 V Default voltage levelvee+2.5 V D Control rangevee+1.5vee+2.6 V Default voltage levelvee+1.9 V P Peak Control Signal (pkcrl)Control rangevee+2.3 V Control rangevee+2.3vee+3.3 V Default voltage levelvee+2.8 V V Control rangevee+2.8 V V Control rangevee+2.8 V V Control rangevee+2.8 V V Control rangevee+2.8 V V Control rangevee+2.4 V V Control rangevee+2.5 V D Default voltage level V <	VCC		0.0		V	External ground
Junction temperature -25 50 125 $^{\circ}C$ Input Analog (dp/dn)BandwidthDC 35 GHz Common mode voltage levelvcc V IrSingle-ended voltage swing, pk-pk; unused input not connected or AC 600 mV THSingle-ended voltage swing, pk-pk; unused input not connected or AC 600 mV THSingle-ended voltage swing, pk-pk; unused input not connected or AC 1.2 V TInput Noise DensityTBD $nV/sqrt(Hz)$ THDInput Noise DensityTBD dB dB S11TBD dB dB S11TBD dB dB Control rangevee+2vee+3.6 V Default voltage levelvee+2.5 V Q Control rangevee+1.5vee+1.6 V Default voltage levelvee+1.5vee+2.6 V Default voltage levelvee+1.3 V Q Control rangevee+2.3vee+3.3 V Default voltage levelvee+2.8 V Q Control rangevee+2.8 V Q	Ivee	100		250	mA	At max. control range
Input Analog (dp/dn)BandwidthDC35 GHz Common mode voltage levelvccVIrSingle-ended voltage swing, pk-pk; unused input not connected or AC600 mV THIsingle-ended voltage swing, pk-pk; unused input not connected or AC1.2VTHSingle-ended voltage swing, pk-pk; unused input not connected or AC1.2VTHInput Noise DensityTBD $nV/sqrt(Hz)$ THInput Noise DensityTBD dB 511S11TBD dB TBD dB Control rangevee+2vee+3.6VDefault voltage levelvee+2.5VGain adjustment-4-403 dB 0Current Control Signal (pkcrl)Control rangevee+1.5vee+3.3VDefault voltage levelvee+2.3vee+3.3VDefault voltage levelvee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent adjustment0210250mA0Output Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWinOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWinOutput Analog (q1p/q1n, q2p/q2n) </td <td>Power consumption</td> <td>320</td> <td>755</td> <td>950</td> <td>mW</td> <td>At max. control range</td>	Power consumption	320	755	950	mW	At max. control range
BandwidthDC35 GHz Common mode voltage levelVCCVIrSingle-ended voltage swing, pk-pk; unused input not connected or AC600 mV TFterminated600 mV TFSingle-ended voltage swing, pk-pk; unused input not connected or AC1.2VTFInput Noise DensityTBD $nV/sqrt(Hz)$ THInput Noise DensityTBD dB TBD dB S11TBD dB TBD dB S11TBD dB TBD dB Control rangevee+2vee+3.6VDefault voltage levelvee+1.5vee+2.6VControl rangevee+1.5vee+2.6VDefault voltage levelvee+1.9VPeak Control Signal (pkcrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCControl rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VVControl rangevee+2.8VVControl rangevee+2.8VVControl rangevee-2.8VVControl rangevee-2.8VVControl rangevee-2.8VVControl range </td <td>Junction temperature</td> <td>-25</td> <td>50</td> <td>125</td> <td>°C</td> <td></td>	Junction temperature	-25	50	125	°C	
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Single-ended voltage swing, pk-pk; terminated 600 mV TFSingle-ended voltage swing, pk-pk; unused input not connected or AC 600 mV THSingle-ended voltage swing, pk-pk; unused input not connected or AC 1.2 V THInput Noise DensityTBD $nV/sqrt(Hz)$ TBD $nV/sqrt(Hz)$ S11TBD dB TBD dB S11TBD dB TBD dB Control rangevee+2vee+3.6 V Default voltage levelvee+2.5 V TControl rangevee+1.5vee+2.6 V Default voltage levelvee+1.9 V PPeaking adjustment03 dB Control rangevee+2.3vee+3.3 V Default voltage levelvee+2.8 V V Control rangevee+2.8 V <	Bandwidth	DC		35	GHz	-3 <i>dB</i>
Integration of the prime prime of the prime primo	Common mode voltage level		VCC		V	Internally generated
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Single-ended voltage swing, pk-pk; unused input not connected or AC1.2VTInput Noise DensityTBD $nL/2$ VTHInput Noise DensityTBD $nV/sqrt(Hz)$ TBD dB S11TBD dB TBD dB TBDControl rangevee+2vee+3.6VVControl rangevee+2.5VGain adjustment-403 dB Control rangevee+1.5vee+2.6VControl rangevee+1.5vee+3.8VControl rangevee+1.5vee+3.3VControl rangevee+1.5vee+2.6VControl rangevee+1.9VControl rangevee+2.3vee+3.3VControl rangevee+2.3vee+3.3VCurrent Control Signal (icrl)Control rangevee+2.8VVCurrent Control Signal (icrl)Control rangevee+2.3vee+3.3VCurrent Control Signal (icrl)Control rangevee+2.8VVCurrent Control Signal (icrl)Control rangevee+2.3vee+3.3VControl rangevee+2.6VSignal (icrl)Control rangevee-2.3vee+3.4VCurrent Control Signal (icrl)Control range </td <td></td> <td></td> <td></td> <td>600</td> <td></td> <td>THD $< 0.4\%$ at 5<i>GHz</i></td>				600		THD $< 0.4\%$ at 5 <i>GHz</i>
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terminated1.2VTHInput Noise DensityTBD $nV/\text{sqrt}(Hz)$ S11TBD dB S11TBD dB TBD dB Control rangevee+2vee+2.5VGain adjustment-4-40Outrol rangevee+1.5Vee+1.5vee+2.6VVDefault voltage levelvee+1.9VPeaking adjustment03Control rangevee+2.3Vee+2.3vee+3.3VVDefault voltage levelvee+2.8Current adjustment100210250MAOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0dB4B	Single-ended voltage swing, pk-pk;			1.2	V	THD < 4% at $2GHz$
Input Noise DensityTBD $nV/sqrt(Hz)$ Input Noise DensityTBD dB TBD dB S11TBD dB TBD dB Control range $vee+2$ Vee+3.6VDefault voltage level $vee+2.5$ VGain adjustment-40Outrol range $vee+1.5$ Vee+1.5 $vee+2.6$ VDefault voltage level $vee+1.9$ VPeaking adjustment003Default voltage level $vee+2.3$ Vee+2.3 $vee+3.3$ VDefault voltage level $vee+2.8$ VCurrent adjustment100100210250 mA Common mode level $vcc-0.6$ VSmall signal differential gain0dBGain variation with optimal ± 0.5				1.2		THD < 2.3% at 5 <i>GHz</i>
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S11TBD dB TBD dB TBD dB TBD dB Control rangeVee+2Vee+2Vee+3.6VDefault voltage levelvee+2.5VGain adjustment-403Control rangeVee+1.5vee+2.6VDefault voltage levelvee+1.5vee+2.6VDefault voltage levelvee+1.9VPeaking adjustment03 dB Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VControl rangevee+2.8VControl rangevee+2.8VControl rangevee+2.8VControl rangevee+2.8VControl rangevee+2.8VControl rangevee+2.8VCurrent adjustment100210250MAOutput Analog (q1p/q1n, q2p/q2n)Common mode levelVcc-0.6VSmall signal differential gain0 dB Gain variation with optimal ± 0.5 dB	Input Noise Density		TBD		<i>nV</i> /sqrt(<i>Hz</i>)	
S11TBD dB TBD dB TBD dB Control rangeVee+2vee+3.6VDefault voltage levelvee+2.5V0Gain adjustment-403 dB Peak Control Signal (pkcrl)Control rangevee+1.5vee+2.6VDefault voltage levelvee+1.9V0Peaking adjustment03 dB 0Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8V0Current Control Signal (icrl)Control rangevee+2.8VCurrent adjustment100210250mAOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0 dB dB			TBD		dB	at 3GHz
TBD dB TBD dB TBD dB TBD dB Control rangeVee+2Vee+2vee+3.6VDefault voltage levelvee+2.5VGain adjustment-403Peak Control Signal (pkcrl)Control rangevee+1.5vee+2.6Default voltage levelvee+1.9VPeaking adjustment03 dB Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VControl rangevee+2.8VCurrent adjustment100210250mAMOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0 dB dB	S11		TBD		dB	at 10 <i>GHz</i>
Gain Control Signal (gncrl)Control rangevee+2vee+3.6VDefault voltage levelvee+2.5VGain adjustment-403dBPeak Control Signal (pkcrl)Control rangevee+1.5vee+2.6VDefault voltage levelvee+1.9VPeaking adjustment03dBCurrent Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.3vee+3.3VCurrent Control Signal (icrl)Current adjustment100210250mAOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0dBdBGain variation with optimal $+0.5$ dBdB	511		TBD		dB	at 20GHz
Control range $vee+2$ $vee+3.6$ V Default voltage level $vee+2.5$ V Gain adjustment -4 0 3 Peak Control Signal (pkcrl) Control range $vee+1.5$ $vee+2.6$ V V V Default voltage level $vee+1.9$ V Peaking adjustment 0 3 dB Current Control Signal (icrl) Control range $vee+2.3$ $vee+3.3$ V V V V Default voltage level $vee+2.8$ V Current adjustment 100 250 mA Output Analog (q1p/q1n, q2p/q2n) Common mode level $vcc-0.6$ V Small signal differential gain 0 dB Gain variation with optimal $+0.5$ dB			TBD		dB	at 25GHz
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Control rangevee+1.5vee+2.6VDefault voltage levelvee+1.9VPeaking adjustment03 dB Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VVCurrent adjustment100210250mAOutput Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0 dB dB	Gain adjustment	-4	0	3	dB	
Default voltage level $vee+1.9$ V Peaking adjustment03 dB Current Control Signal (icrl)Control range $vee+2.3$ $vee+3.3$ V Default voltage level $vee+2.8$ V V Current adjustment100210250 mA Output Analog (q1p/q1n, q2p/q2n)Common mode level $vcc-0.6$ V WiSmall signal differential gain0 dB dB		Peak C	ontrol Si	gnal (pkC	erl)	
Peaking adjustment03 dB Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent adjustment100210250 mA Output Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0 dB dB	Control range	vee+1.	.5 v	ee+2.6		
Current Control Signal (icrl)Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent adjustment100210250Output Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VSmall signal differential gain0dBGain variation with optimal+0.5dB	Default voltage level		vee+1.9		V	at ±3.6V supply
Control rangevee+2.3vee+3.3VDefault voltage levelvee+2.8VCurrent adjustment100210250 Output Analog (q1p/q1n, q2p/q2n) Common mode levelvcc-0.6VSmall signal differential gain0 dB Gain variation with optimal+0.5 dB	Peaking adjustment	0		3	dB	at 28GHz
Default voltage level $vee+2.8$ V Current adjustment100210250 mA Output Analog (q1p/q1n, q2p/q2n)Common mode level $vcc-0.6$ V WiSmall signal differential gain0 dB dB Gain variation with optimal $+0.5$ dB dB		Current	t Control	Signal (i	crl)	
Current adjustment100210250 mA Output Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0 dB dB Gain variation with optimal ± 0.5 dB dB	Control range	vee+2.	.3 v	'ee+3.3	V	
Output Analog (q1p/q1n, q2p/q2n)Common mode levelvcc-0.6VWiSmall signal differential gain0dBGain variation with optimal+0.5dB	Default voltage level		vee+2.8		V	at ±3.6V supply
Common mode levelvcc-0.6 V WiSmall signal differential gain0 dB Gain variation with optimal ± 0.5 dB	Current adjustment	100	210	250	mA	
Common mode levelvcc-0.6 V WiSmall signal differential gain0 dB Gain variation with optimal ± 0.5 dB	Ou	itput An	alog (q1p	/q1n, q2	p/q2n)	
Gain variation with optimal $+0.5$ dB	Common mode level		vcc-0.6		V	With external 50 <i>Ohms</i> DC termination
+U 3 ///	Small signal differential gain		0		dB	up to 30GHz
penning control bethings	1		±0.5		dB	Up to 30 <i>GHz</i>
Output referred 1 <i>dB</i>	Output referred 1 <i>dB</i>		>6		dBm	Single-Ended, 20Gbps



PACKAGE INFORMATION

The chip die is housed in a custom 24-pin CQFN package shown in Fig. 9. The package provides a center heat slug located on its back side to be used for heat dissipation. ADSANTEC recommends for this section to be soldered to the **vcc** plain, which is ground for a negative supply, or power for a positive supply.

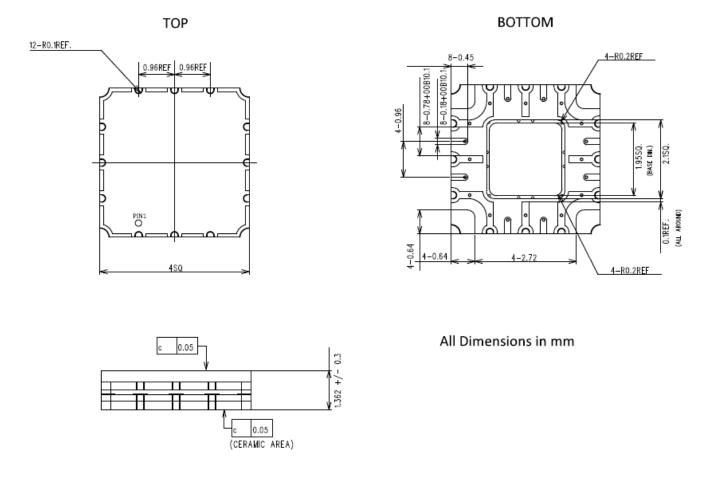


Fig. 9. CQFN 24-Pin Package Drawing (All Dimensions in mm)

The part's identification label is ASNT6790-KHC. The first 8 characters of the name before the dash identify the bare die including general circuit family, fabrication technology, specific circuit type, and part version while the 3 digits after the underscore represent the package's manufacturer, type, and pin out count.

This device complies with Commission Delegated Directive (EU) 2015/863 of 4 June 2015 amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances (Text with EEA relevance) on the restriction of the use of certain hazardous substances in electrical and electronics equipment (RoHS Directive) in accordance with the definitions set forth in the directives for all ten substances.



REVISION HISTORY

[Revision	Date	Changes		
ſ	1.0.2	09-2023	First release		