ADSANTEC
Ultra High-Speed Mixed Signal ASICs

Advanced Science And Novel Technology Company, Inc.
2790 Skypark Drive Suite 112, Torrance, CA 90505

Offices: 310-530-9400 / Fax: 310-530-9402
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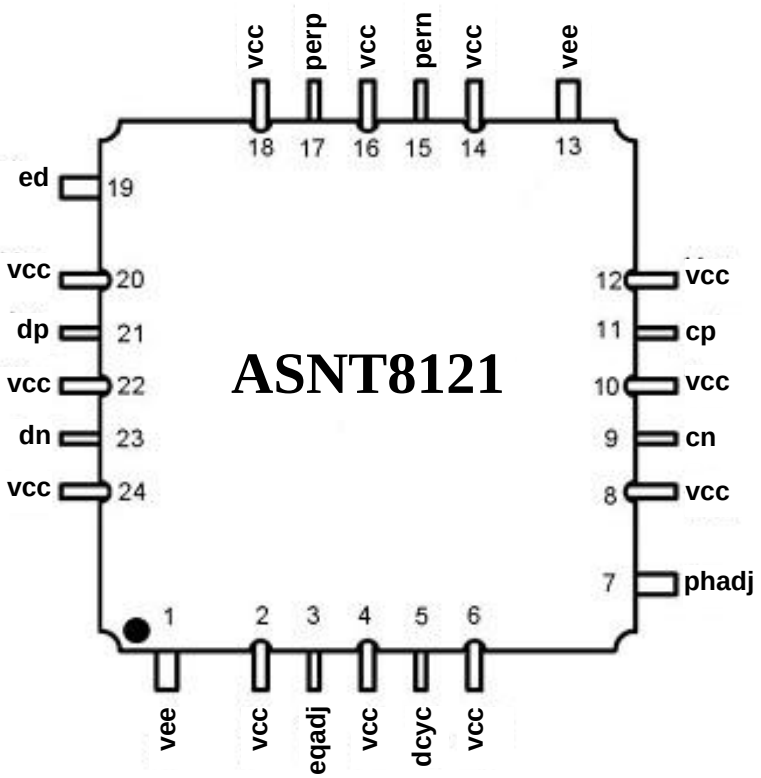
ASNT8121-KMC
DC-34*Gbps* Linear Phase Detector

- Broadband linear phase detector with differential output
- Adjustable data input equalizer with a by-pass possibility
- Selectable input clock multiplier by 2 with externally adjustable duty cycle
- Output clock duty cycle indicator
- Data edge density indicator
- Fully differential CML input data and clock interfaces
- Fully differential CML-type output phase error interface with 300*mV* single-ended swing
- Single +3.3*V* or -3.3*V* power supply
- Power consumption: 895*mW*
- Fabricated in SiGe for high performance, yield, and reliability
- Custom CQFP 24-pin package



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DESCRIPTION

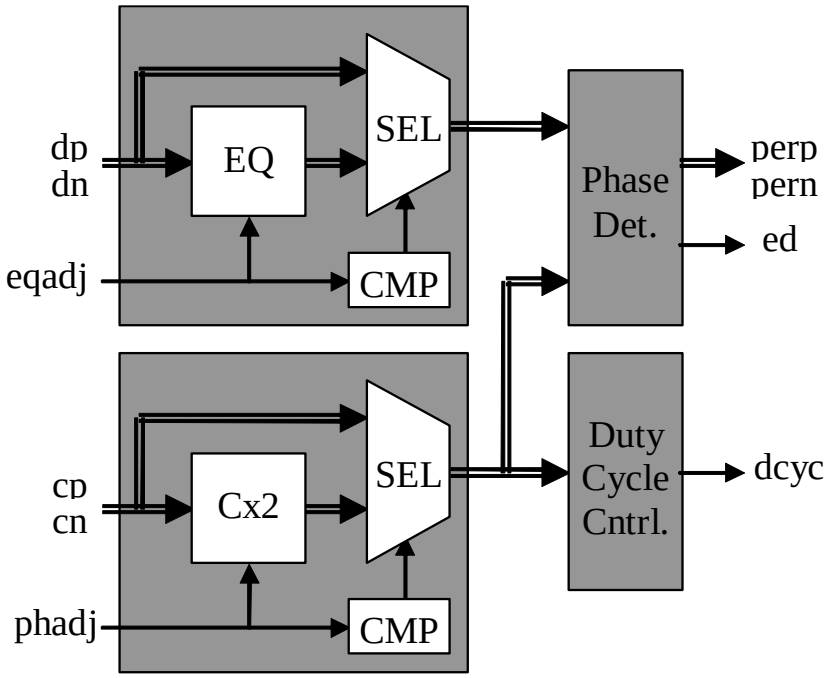

Fig. 1. Functional Block Diagram

The ASNT8121-KMC SiGe IC shown in Fig. 1 provides a differential phase error signal perp/pern that indicates the phase difference between the data dp/dn bit transitions and the edges of the input clock cp/cn. The input data spectrum can be corrected by the equalizer EQ with a frequency response adjustable by the variation of the control input signal eqadj within the voltage range from vcc to vcc-2*V*. The lower values of eqadj disable the equalizer and send the input data signal directly to the phase detector block PhaseDet. The input clock can be delivered to the phase detector block either directly or through the multiplier by 2 Cx2 with its output duty cycle adjustable by means of the phadj control voltage. The phadj control operates similar to eqadj with a tunable range from vcc to vcc-2*V* and a multiplication enabling threshold value of vcc-2*V*.

The phase detector also provides two single-ended signals ed and dcyc. The ed output delivers an analog voltage indicating the number of transitions in the data bit stream. The duty cycle control block DutyCycleCntrl generates the analog signal dcyc that indicates the clock duty cycle deviation from 50%.

The part's differential input clock and data ports 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 (see also 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. The output phase error port supports a CML-type interface with on chip 100*Ohms* termination to vcc and may be used differentially, AC/DC coupled, single-ended, or in any combination (see also POWER SUPPLY CONFIGURATION). The differential DC signaling mode is recommended for optimal performance.

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Equalizer

The simulated equalizer frequency response at different values of the eqadj signal is shown in Fig. 2 and its simulated control characteristic is shown in Fig. 3.

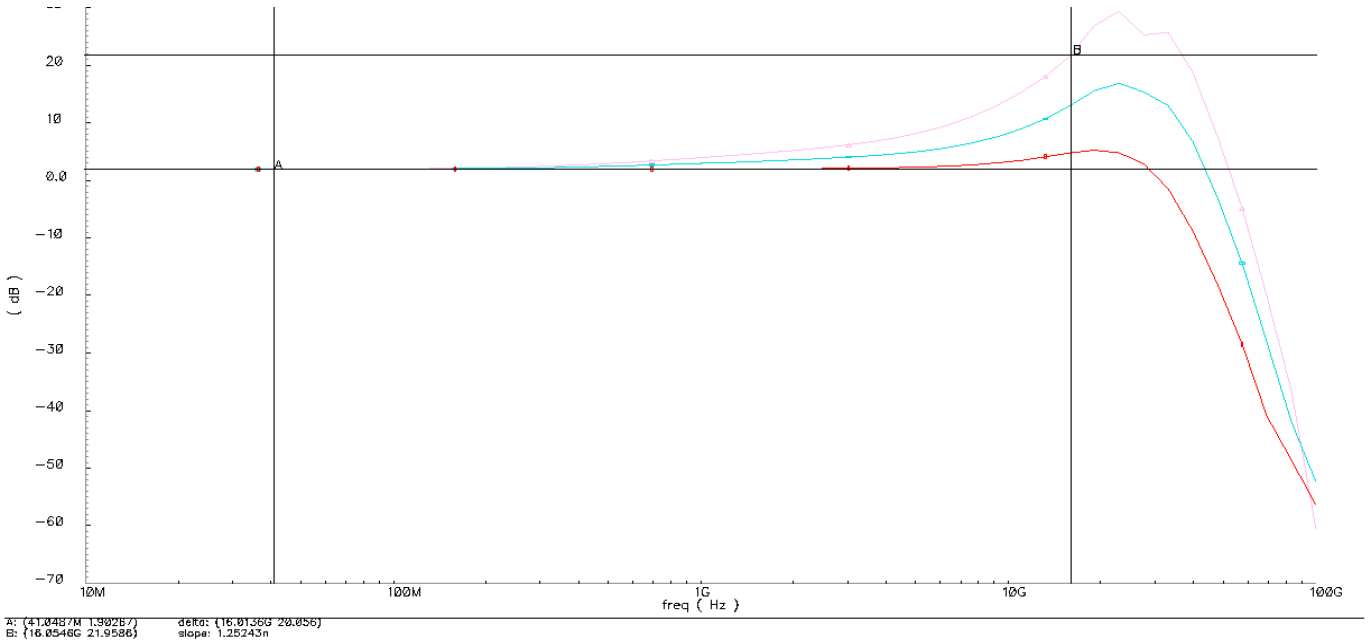

Fig. 2. Equalizer Frequency Response at Full, Half, and No Gain

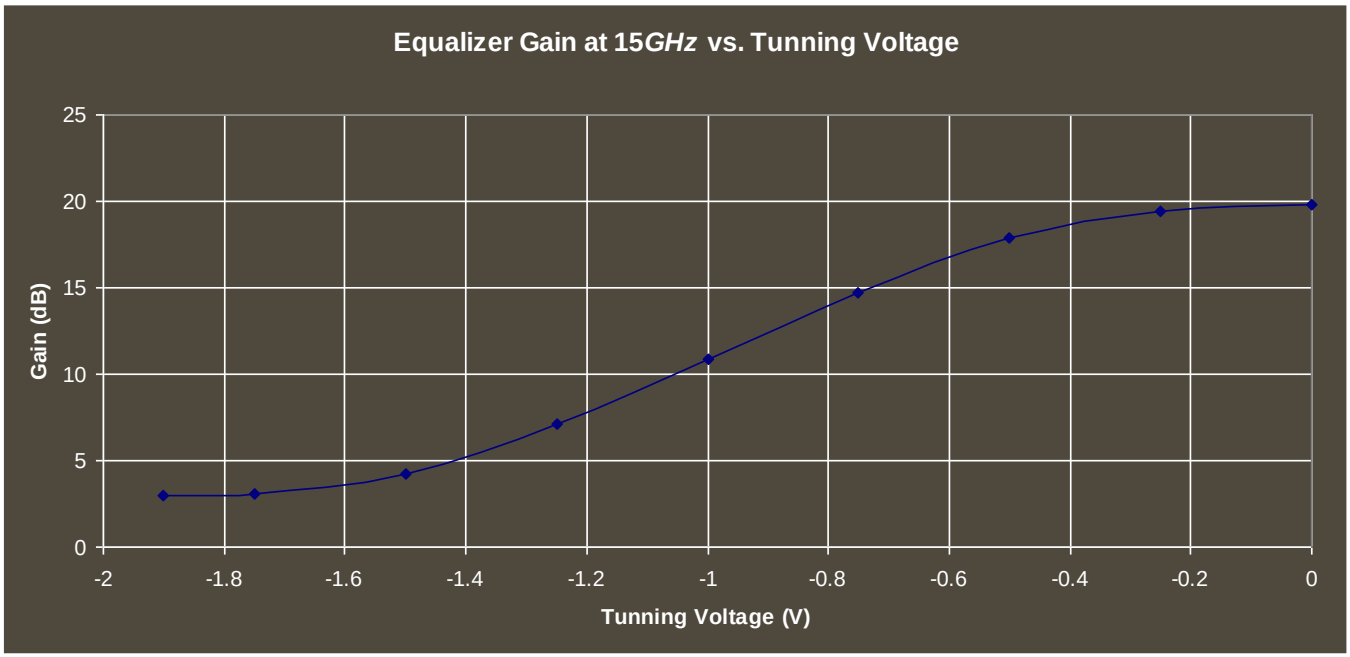

Fig. 3. Equalizer Control Characteristic

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Clock Multiplier

The multiplier delivers the input clock applied to the pins cp/cn to the phase detector core. If the phadj control voltage is below the threshold value, then the block operates as a signal repeater and the frequency of the clock is not changed. If the phadj control voltage is in the range from the threshold to vcc, then the clock frequency is doubled and its duty cycle can be adjusted by the phadj control voltage.

Phase Detector

The simulated transfer characteristics of the phase detector at 30*Gb/s* data rates is shown in Fig. 4.

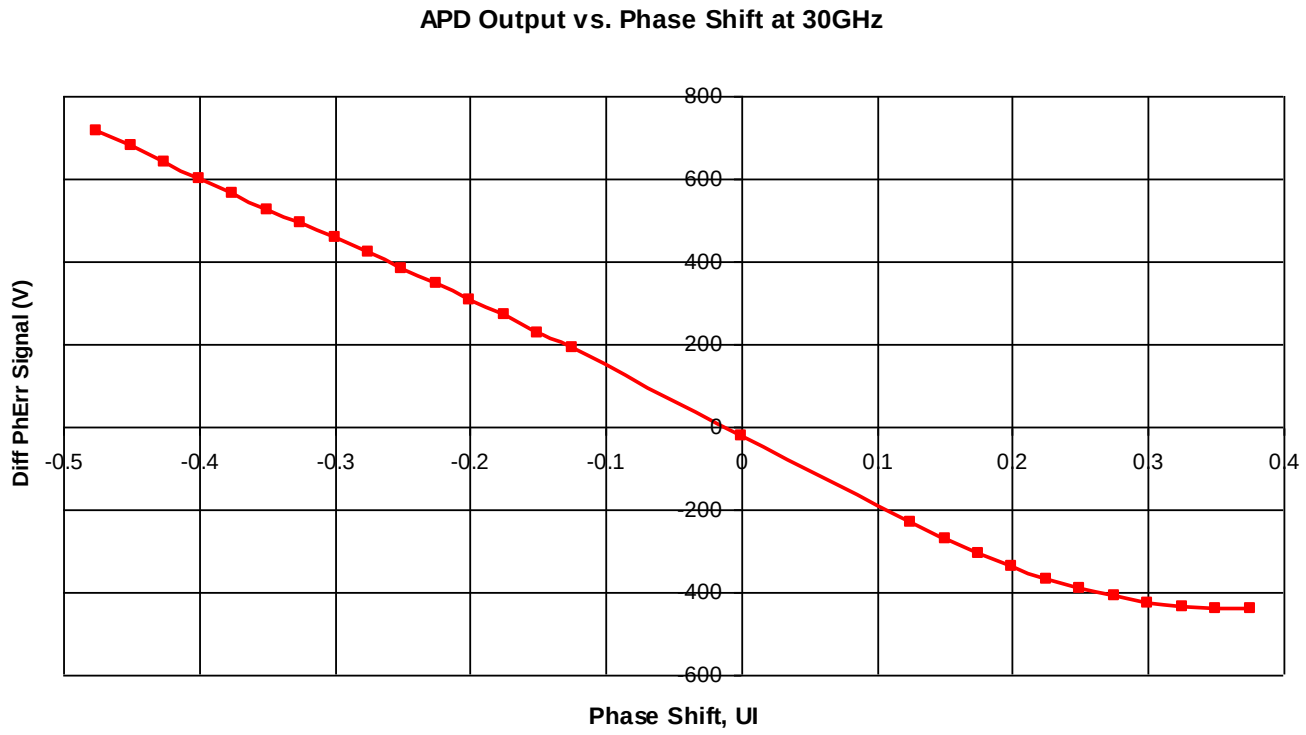

Fig. 4. Simulated Phase Detector Characteristic at 30Gb/s Data Rate

POWER SUPPLY CONFIGURATION

The part can operate with either a negative supply (vcc = 0.0*V* = ground and vee = −3.3*V*), or a positive supply (vcc = +3.3*V* and vee = 0.0*V* = ground). In case of a 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 = 0.0*V* and vee = -3.3*V*.

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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 (assumed vcc).

Table 1. Absolute Maximum Ratings

Parameter	Min	Max	Units
Supply Voltage (vee)		-3.6	*V*
Power Consumption		0.98	*W*
RF Input Voltage Swing (SE)		1.0	*V*
Case Temperature		+90	*ºC*
Storage Temperature	-40	+100	*ºC*
Operational Humidity	10	98	*%*
Storage Humidity	10	98	*%*

TERMINAL FUNCTIONS

TERMINAL			DESCRIPTION
Name	**No.**	**Type**	
High-Speed I/Os			
dp	21	CML input	Differential high-speed data input signals with internal SE 50*Ohms* termination to vcc
dn	23		
cp	11	CML input	Differential high-speed clock input signals with internal SE 50*Ohms* termination to vcc
cn	9		
perp	17	Analog output	Differential phase error output with internal SE 100*Ohms* terminations to vcc.
pern	15		
eqadj	3	Analog input	Equalization level adjust / equalizer enable
phadj	7	Analog input	Duty cycle adjust / clock multiplier enable
dcyc	5	Analog output	Duty cycle indicator signal
ed	19	Analog output	Edge density indicator signal

Supply and Termination Voltages		
Name	**Description**	**Pin Number**
vcc	Positive power supply (+3.3*V* or 0)	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24
vee	Negative power supply (0*V* or -3.3*V*)	1, 13

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ELECTRICAL CHARACTERISTICS

PARAMETER	MIN	TYP	MAX	UNIT	COMMENTS
General Parameters					
vee	-3.1	-3.3	-3.5	*V*	±6%
vcc		0.0		*V*	External ground
*I*vee		270		*mA*	
Power consumption		895		*mW*	
Junction temperature	-40	25	125	*°C*	
HS Input Data (dp/dn)					
Data Rate	DC		34	*Gbps*	
Voltage swing, pk-pk	10		300	*mV*	Single ended, unused input not connected or AC terminated
CM Voltage Level	vcc-0.3		vcc	*V*	Must match for both inputs
HS Input Clock (cp/cn)					
Frequency	DC		17	*GHz*	
Voltage swing, pk-pk	10		300	*mV*	Single ended, unused input not connected or AC terminated
CM Voltage Level	vcc-0.3		vcc	*V*	Must match for both inputs
Phase Error Output (perp/pern)					
Linear range		300		*mV*	Single-ended
CM Voltage Level		vcc-0.275		*V*	
Tuning ports (eqadj, phadj)					
Linear control range	-2		0	*V*	
Switching threshold		-2		*V*	
Output indicators (ed, dcyc)					
Voltage range	-3.3		0.0	*V*	

PACKAGE INFORMATION

The die is housed in a custom 24-pin CQFP package shown in Fig. 5. The package's leads will be trimmed to a length of 1.0*mm*. After trimming, the package's leads will be further processed as follows:

1. The lead's gold plating will be removed per the following sections of J-STD-001D:
   - 3.9.1 Solderability
   - 3.2.2 Solder Purity Maintenance
   - 3.9.2 Solderability Maintenance
   - 3.9.3 Gold Removal
2. The leads will be tinned with Sn63Pb37 solder

The package provides a center heat slug located on its back side to be used for heat dissipation. ADSANTEC recommends for this section be soldered to the VCC plain, which is ground for a negative supply, or power for a positive supply.

The part's identification label is ASNT8121-KMC. 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 characters after the dash represent the package's manufacturer, type, and pin out count.

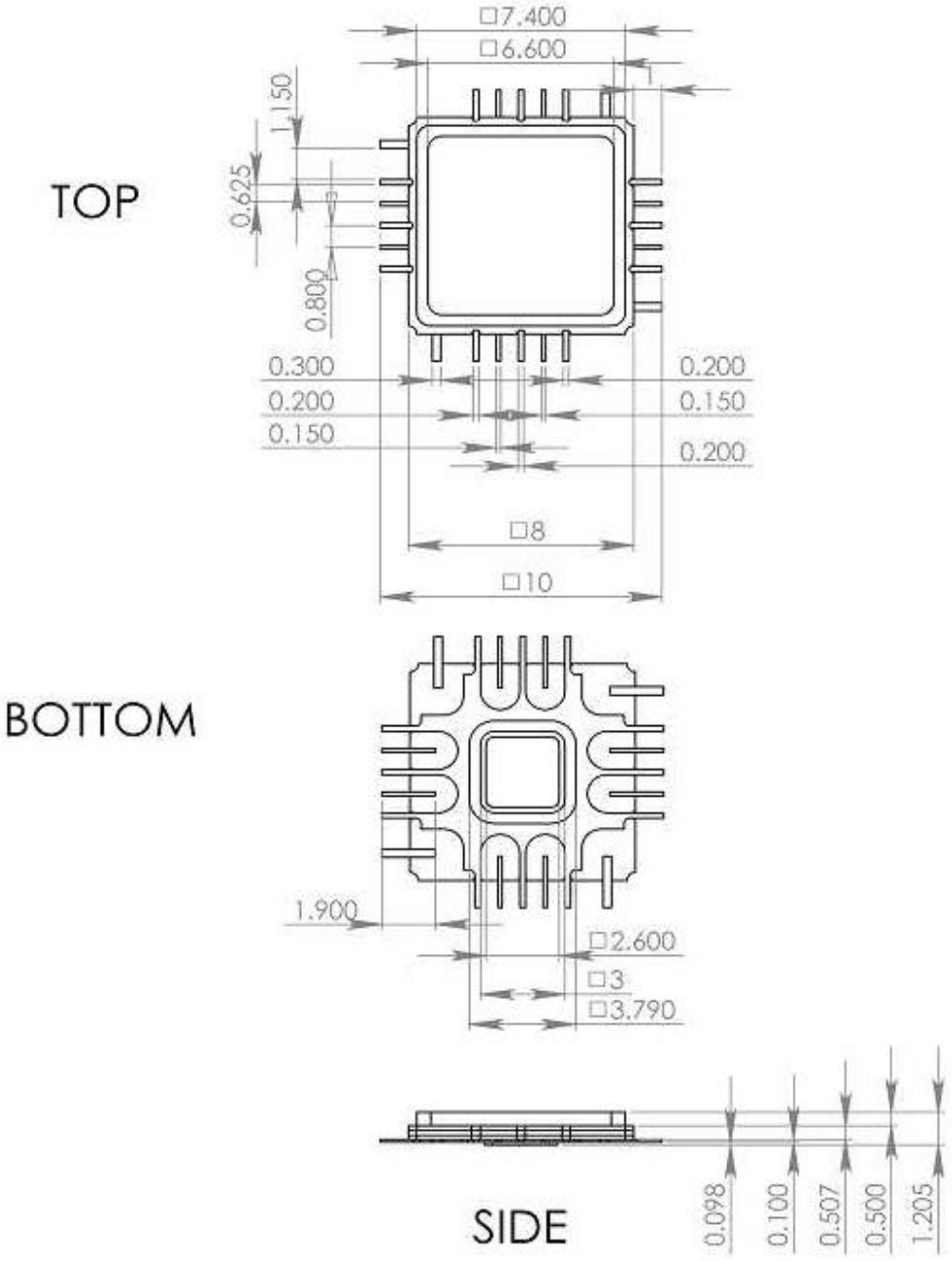

Fig. 5. CQFP 24-Pin Package Drawing (All Dimensions in mm)

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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
1.2.2	11-2024	Updated Package Information
1.1.2	02-2020	Updated Package Information
1.0.2	07-2019	Updated Letterhead
1.0.1	08-2015	First release
1.0.0	09-2014	Preliminary release