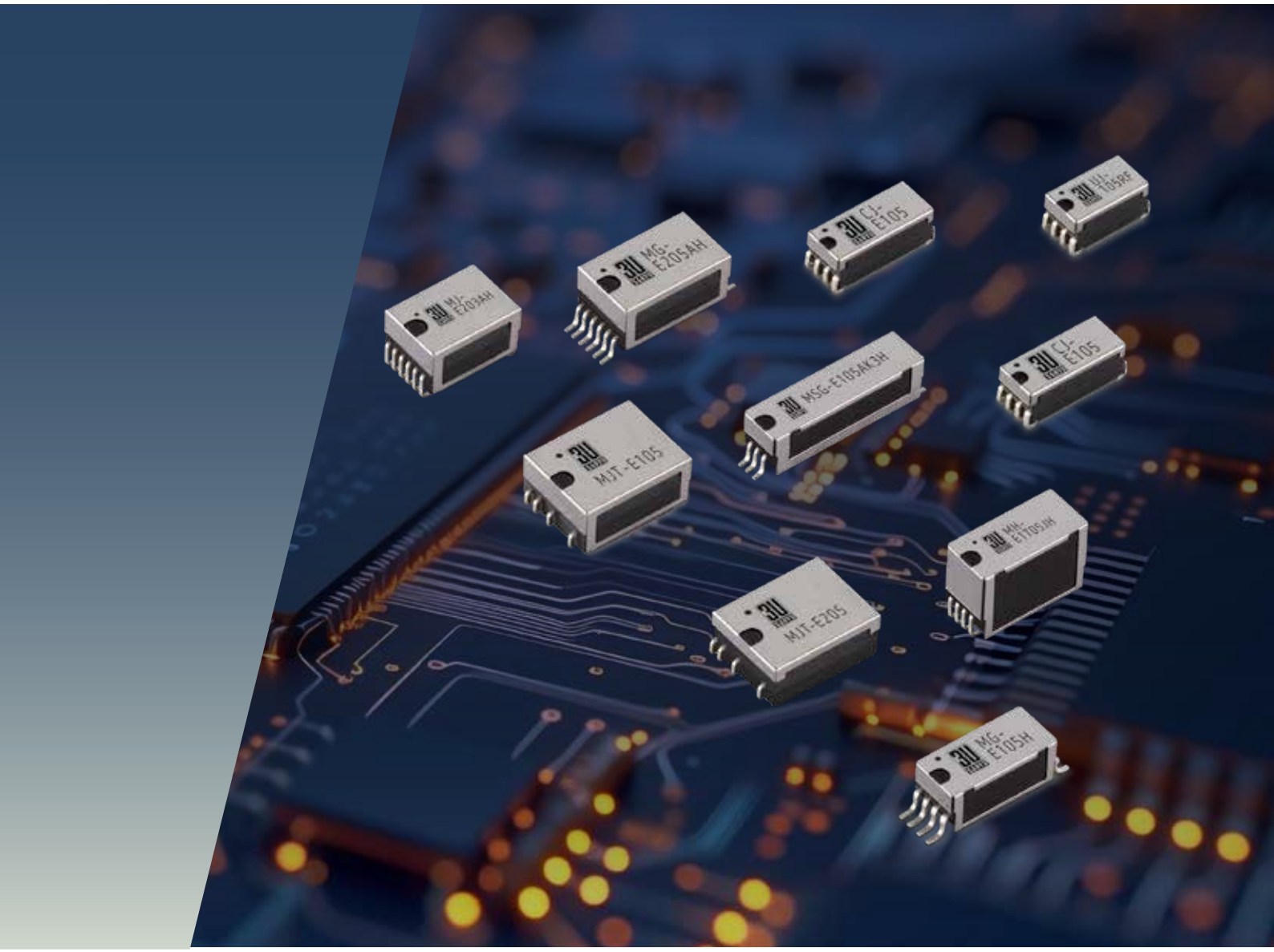
Standex DETECT Electronics

INNOVATE / CONSULT / ENGINEER / DELIVER

Sanyu SMT Reed Relays

Product Line Brochure



Customer-Centric T&M Innovation: Standex Electronics Acquires Sanyu Switch

On Feb. 20, 2024, Standex acquired Sanyu Switch Co., Ltd., a Japanese company specializing in reed relays for automated test equipment (ATE) and high-frequency applications. This partnership brings together the strengths of both companies, further enhancing Standex's capabilities.

The acquisition of Sanyu Switch by Standex Electronics brings several benefits to our customers:

- Enhanced Product Performance: Efficient, reliable products with improved miniaturization and high-frequency capabilities.
- Broader Solutions: Wider range of advanced ATE and high-frequency applications.
- Customization: Tailored solutions to meet specific needs.
- Innovation: Cutting-edge technology and ongoing advancements.

Overall, customers can expect higher quality, more reliable, and innovative solutions from Standex Electronics.

Standex Electronics is a trusted and innovative leader in the T&M market. Their dedication to customer satisfaction, global presence, engineering expertise, and ongoing innovation enables them to deliver high-quality, reliable, and customized reed relay solutions tailored to the specific needs of various T&M applications.

Greeting

Sanyu Switch continues to understand and adapt to modern needs.

Since our establishment in 1972, we have been a leading relay manufacturer, supplying essential switching elements for semiconductor testing equipment, measuring instruments, communication equipment, and more, thereby contributing to a variety of industries. Currently, we are expanding beyond reed relays into high-performance applied products to respond to the wide range of demands in the fields of testing, measurement, and instrumentation. In order to meet the demands of various industries, we are constantly engaged in the R&D of new technologies and products, and we strive to provide products globally that will become industry standards.

About Standex

A subsidiary of Standex International Corporation (NYSE: SXI), Standex Electronics has been providing high-performance product solutions since 1950. Through growth, acquisitions, and strategic collaborations with customers, Standex Electronics' technology has delivered high-quality products to customers by applying the latest engineering designs to meet the ever-changing demands of the world. This has been achieved by closely collaborating with our customers and customizing and designing solutions and products according to their individual needs. Standex Electronics is headquartered in Ohio, USA, with production facilities in the USA, Germany, China, Mexico, the UK, and Japan.

About the 3U logo

- UPGRADE Using upgraded systems
- UNIQUE Using uniquely superior concepts
- UNIVERSAL Providing services to customers around the world

Sanyu Switch provides trust and value to customers who use our products.

JQA-1745
ISO2015

Contents

Surface Mount Relays

UJ 1A J-Lead: Ultra-compact, High-frequency Relay

This product was designed to meet the high-density needs in industries such as semiconductor automatic testers and communication measuring instruments. Compared to our CJ 1A high-frequency series, the mount area is reduced by 10%.
In addition, these can support frequencies from DC to 8.0GHz, and are one of our products positioned to meet all variety of needs.

Characteristics
- Mount area: 7.95mm x 4.67mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{12}\Omega$
- Frequencies: DC to 8.0GHz (insertion loss: -4dB typ)

RoHS COMPLIANT

UJ 1A Series		UJ-103RF			UJ-105RF			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3			5.0		VDC
Coil Resistance	±10% @20°C		90			150		Ω
Must Operate	@20℃			2.8			3.75	VDC
Must Release	@20℃	0.5			0.7			VDC

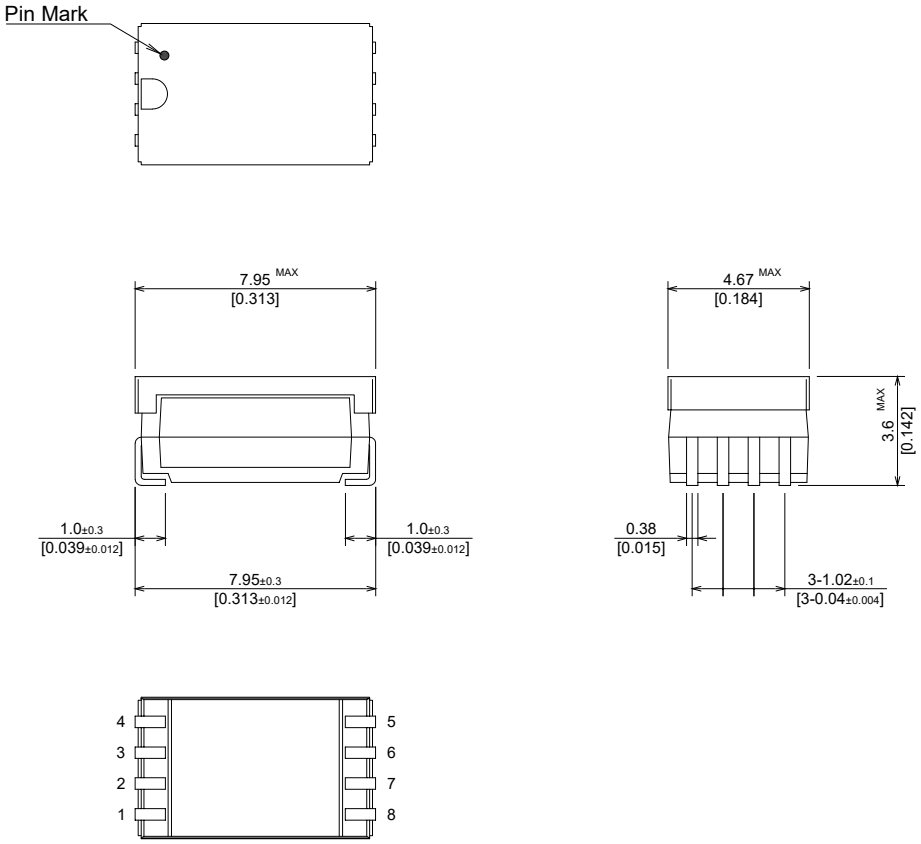
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.2	A
Carry Current	DC/Peak AC resistance(@30℃)			0.2	A
Contact Rating	DC/Peak AC resistance			3	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			200	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{12}			Ω
	Contacts to Shield	10^{12}			Ω
	Contacts to Coil	10^{12}			Ω
	Shield to Coil	10^{12}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	150			VDC
(Static)	Contacts to Shield	500			VDC
	Contacts to Coil	500			VDC
	Shield to Coil	500			VDC
Operate Time	at Nominal Coil Voltage			0.25	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

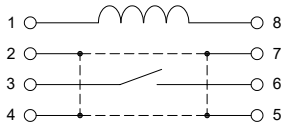
★ See p 27 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

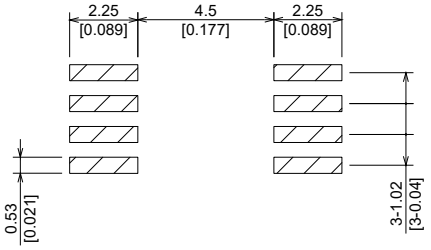
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



CJ 1A J-Lead: Ultra-compact, High-frequency SMT Relay

This product was developed to improve upon the frequency characteristics of DC to 4.0GHz and the 1.6Gbps transmission in our existing CJ series. Frequency characteristics were improved to DC-6.0GHz with the ability to reliably transmit signals at 3.2Gbps.

Characteristics
- Mount area: 9.1mm x 4.67mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 6.0GHz (insertion loss: -1dB typ)

RoHS COMPLIANT

CJ 1A Series		CJ-E103RF			CJ-E105RF			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3			5.0		VDC
Coil Resistance	±10% @20°C		90			150		Ω
Must Operate	@20℃			2.8			3.75	VDC
Must Release	@20℃	0.5			0.7			VDC

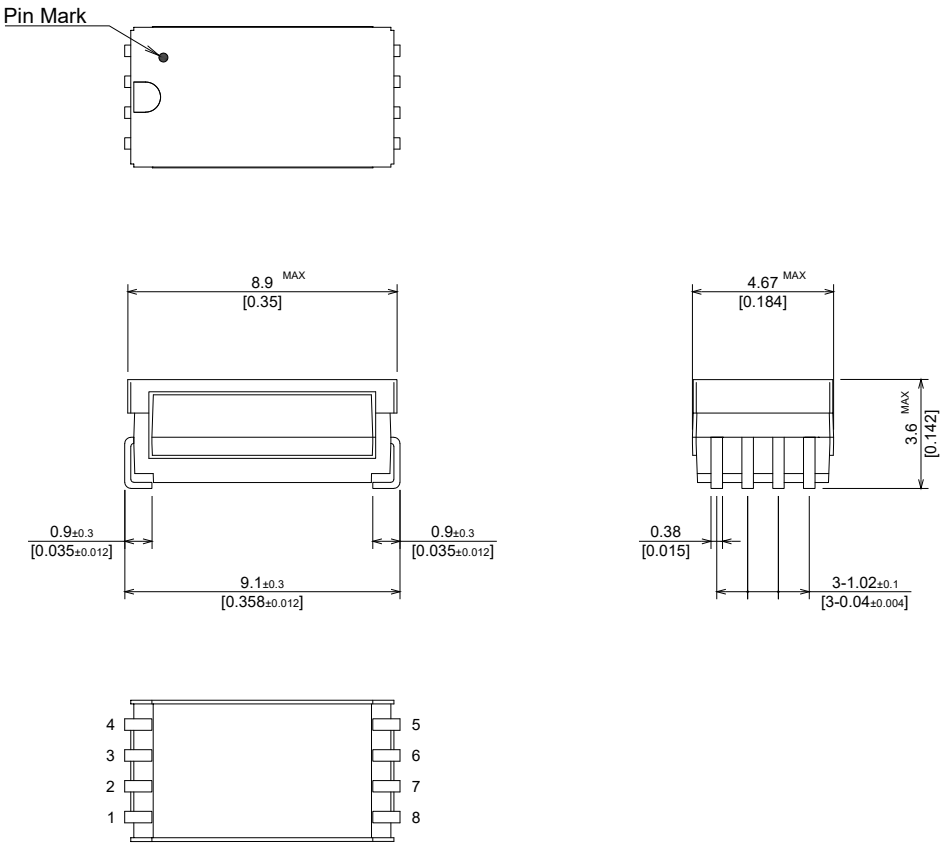
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil (at 100V 20°C 65%)	10^{11}			Ω
Dielectric Strength (Static)	Between Contacts	200			VDC
	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time (Including Bounce)	at Nominal Coil Voltage 100Hz Square Wave			0.3	msec
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

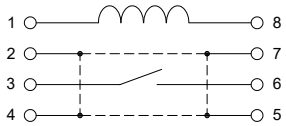
★ See p 28 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

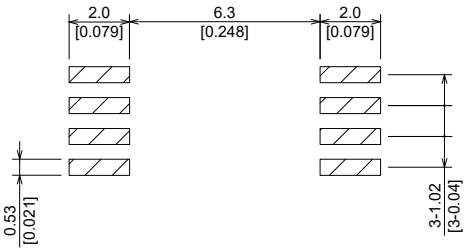
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MG 1A Gull Wing: Compact, High-frequency SMT Relay

This product was developed to improve upon the frequency characteristics of DC to 4.0GHz and the 1.6Gbps transmission in our existing MJ series. The MG/MJ series package was kept completely the same while frequency was improved to DC to 6.0GHz with reliable transmission at 3.2Gbps.

Characteristics
- Mount area: 12.7mm x 4.67mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{12}\Omega$
- Frequencies: DC to 6.0GHz (insertion loss: -3dB typ)

RoHS COMPLIANT

MG 1A Series	MG-E105H-64				
Contact Configurations	1 Form A				
Coil Specifications					
Parameters	Conditions	Min	Nom	Max	Units
Coil Voltage			5.0		VDC
Coil Resistance	±10% @20°C		200		Ω
Must Operate	@20℃			3.75	VDC
Must Release	@20℃	0.7			VDC

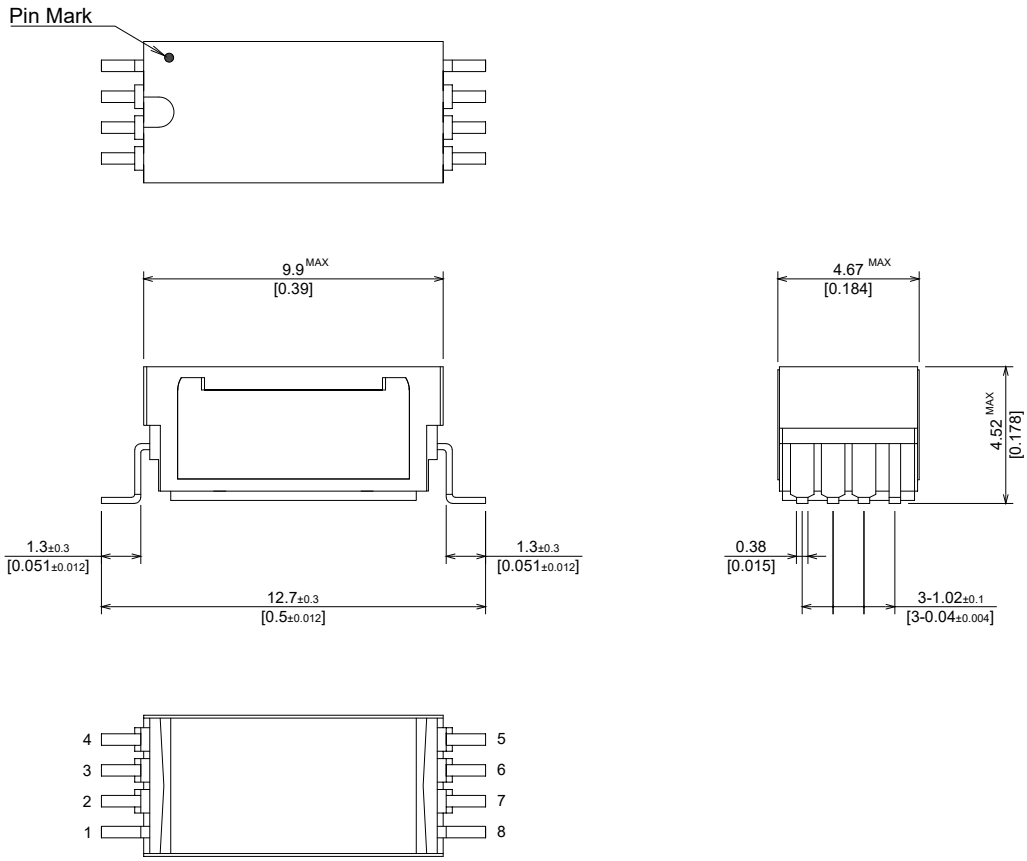
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{12}			Ω
	Contacts to Shield	10^{12}			Ω
	Contacts to Coil	10^{12}			Ω
	Shield to Coil	10^{12}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.3	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

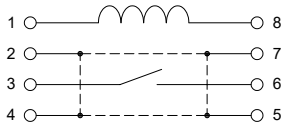
★ See p 29 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

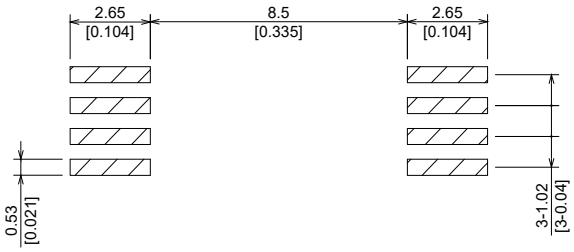
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



CJ 1A J-Lead: Ultra-compact SMT Relay

This product was developed as an even smaller version of our MJ series. This series offers a 30% reduction in mount area compared to our MJ series. While being compact, it still maintains SMT industry-standard properties and supports frequencies from DC to 4.0GHz.

Characteristics
- Mount area: 9.1mm x 3.81mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 4.0GHz (insertion loss: -3dB typ)

RoHS COMPLIANT

CJ 1A Series		CJ-E103			CJ-E105			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3			5.0		VDC
Coil Resistance	±10% @20°C		100			200		Ω
Must Operate	@20℃			2.8			3.75	VDC
Must Release	@20℃	0.5			0.7			VDC

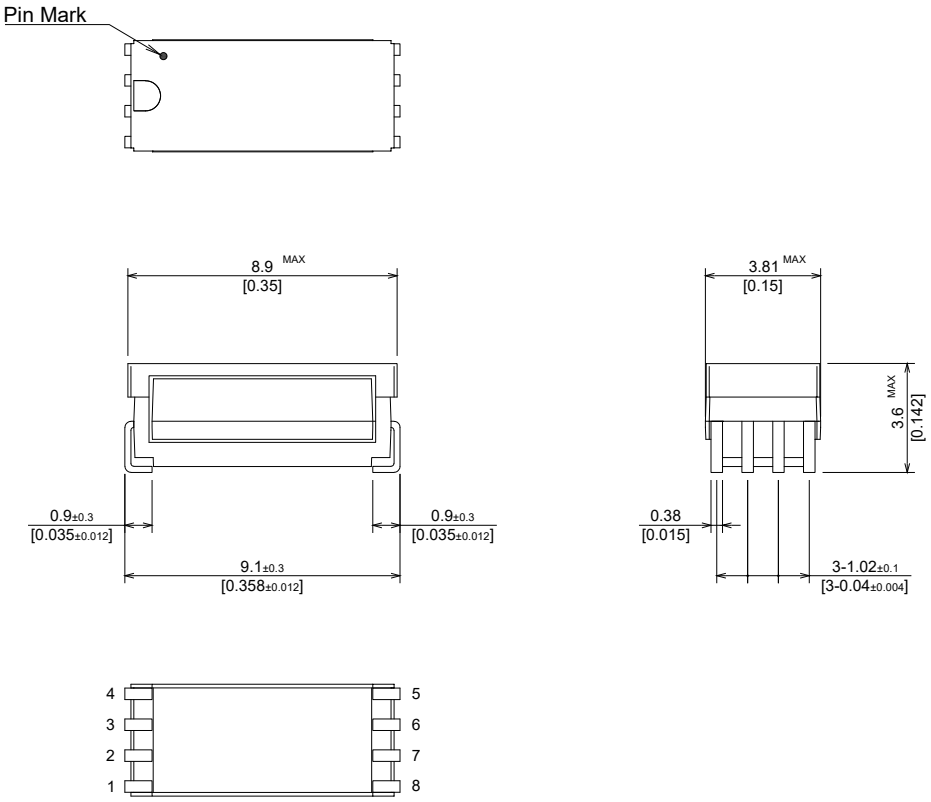
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.3	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

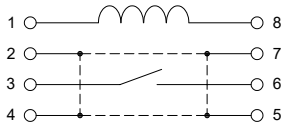
★ See p 30 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

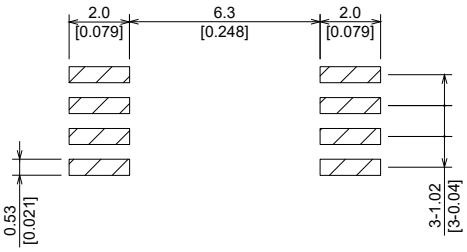
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MG 1A Gull Wing: Compact SMT Relay

This product was developed as an even smaller version of our MSG series. This series offers a 38% reduction in mount area compared to our MSG series. Since announcing this product, it has been a long-term bestseller as the industry standard for relays used in semiconductor automatic test equipment (ATE). This relay solves a variety of needs by combining both the properties and reliability required in the ATE industry.

Characteristics
- Mount area: 12.7mm x 4.67mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 4.0GHz (insertion loss: -3dB typ)

RoHS COMPLIANT

MG 1A Series		MG-E105H			MG-E112H			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			5.0			12.0		VDC
Coil Resistance	±10% @20°C		150			500		Ω
Must Operate	@20℃			3.75			8.8	VDC
Must Release	@20℃	0.7			1.2			VDC

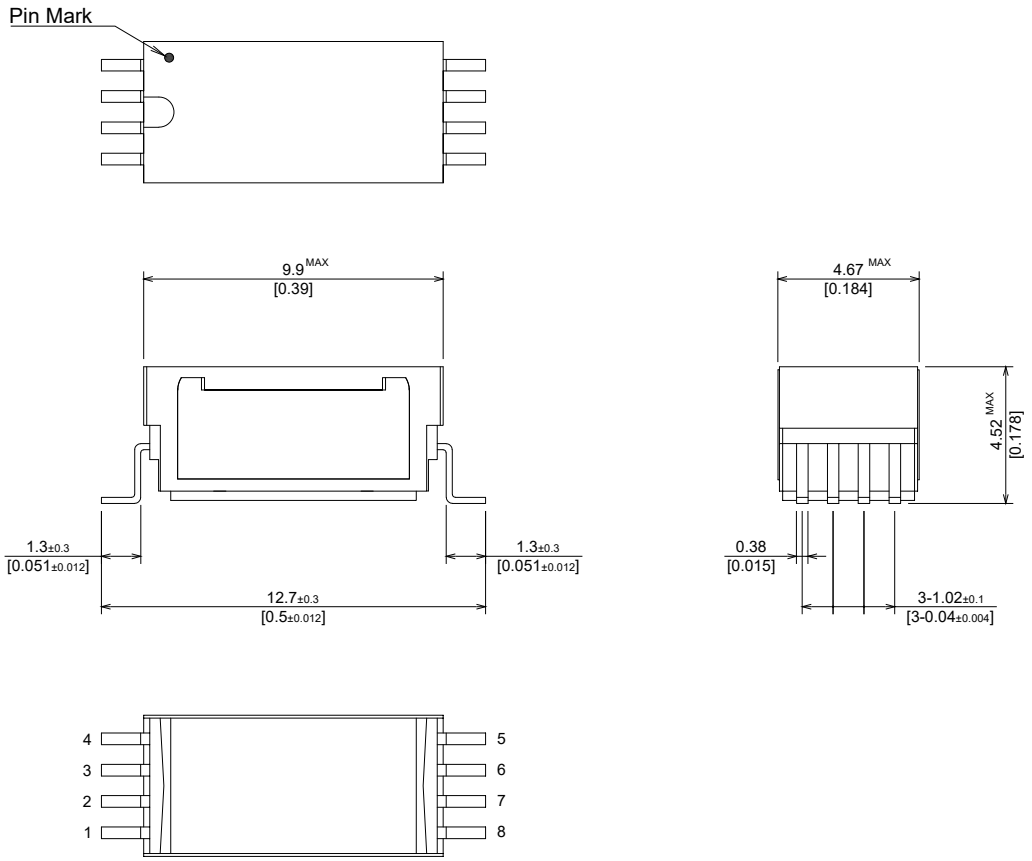
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.3	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

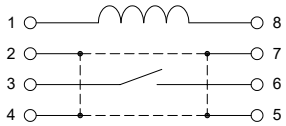
★ See p 31 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

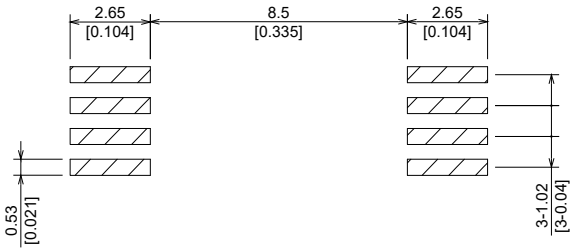
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MJ 1A J-Lead: Compact SMT Relay

This product was developed as an even smaller version of our MSG series. This series offers a 38% reduction in mount area compared to our MSG series. Since announcing this product, it has been a long-term bestseller as the industry standard for relays used in semiconductor automatic test equipment (ATE). This relay solves a variety of needs by combining both the properties and reliability required in the ATE industry.

Characteristics
- Mount area: 10.16mm x 4.67mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 4.0GHz (insertion loss: -3dB typ)

RoHS COMPLIANT

MJ 1A Series		MJ-E105H			MJ-E112H			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			5.0			12.0		VDC
Coil Resistance	±10% @20°C		150			500		Ω
Must Operate	@20℃			3.75			8.8	VDC
Must Release	@20℃	0.7			1.2			VDC

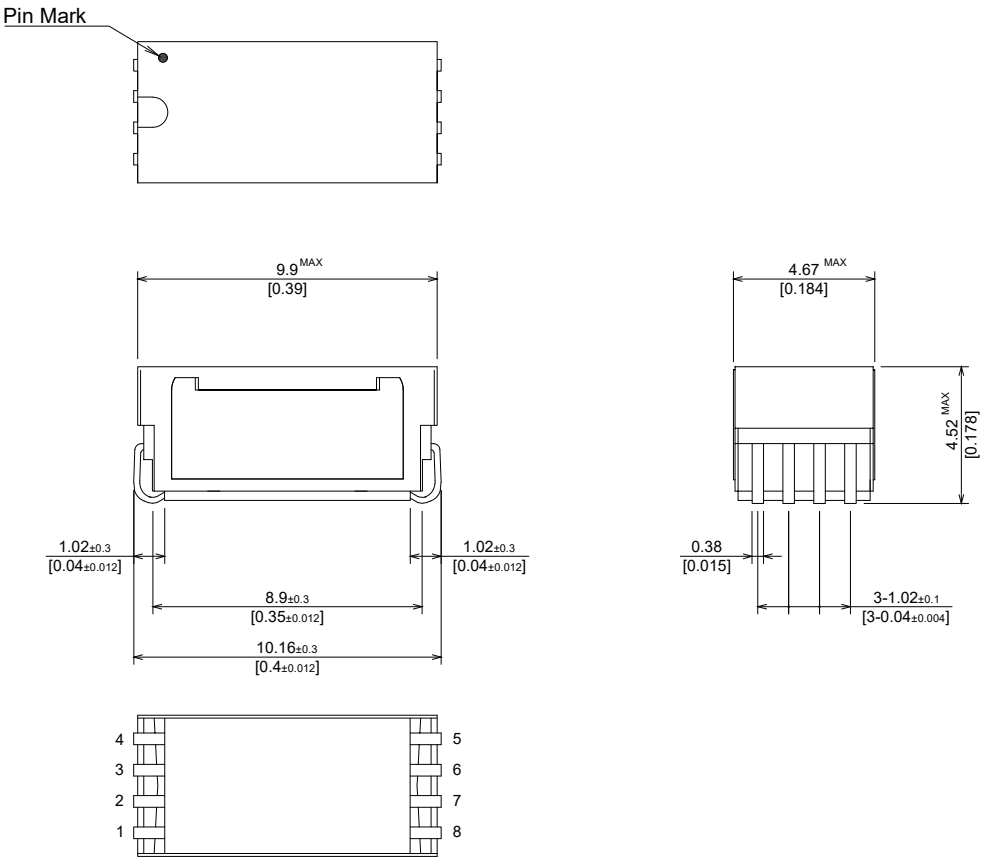
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.3	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.05	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

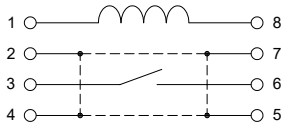
★ See p 31 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

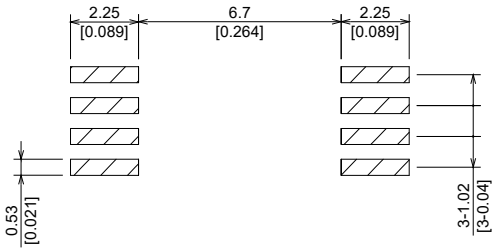
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MSG 1A Gull Wing: High Contact Capacity SMT Relay

This product was developed with the aim of increasing the industry standard maximum contact capacity of 10W to 30W. The maximum contact capacity was increased to 30W, improving the operating switching voltage to 200V, with an electrical lifespan of over 1.5 billion cycles. This resulted in a great improvement in solving load-related needs. In addition to the properties and reliability needed for semiconductor automatic testers, this product is also suitable for DC characteristic testing.

Characteristics
- Mount area: 20.4mm x 4.5mm
- Electrical lifespan: 1.5 billion (@ 1V 10mA)
- Max switching voltage: 200VDC
- Breakdown voltage: 300VDC

RoHS COMPLIANT

MSG 1A Series		MSG-105AK3H			MSG-112AK3H			
Contact Configurations		1 Form A						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			5.0			12.0		VDC
Coil Resistance	±10% @20°C		160			600		Ω
Must Operate	@20℃			3.75			8.8	VDC
Must Release	@20℃	0.7			1.2			VDC

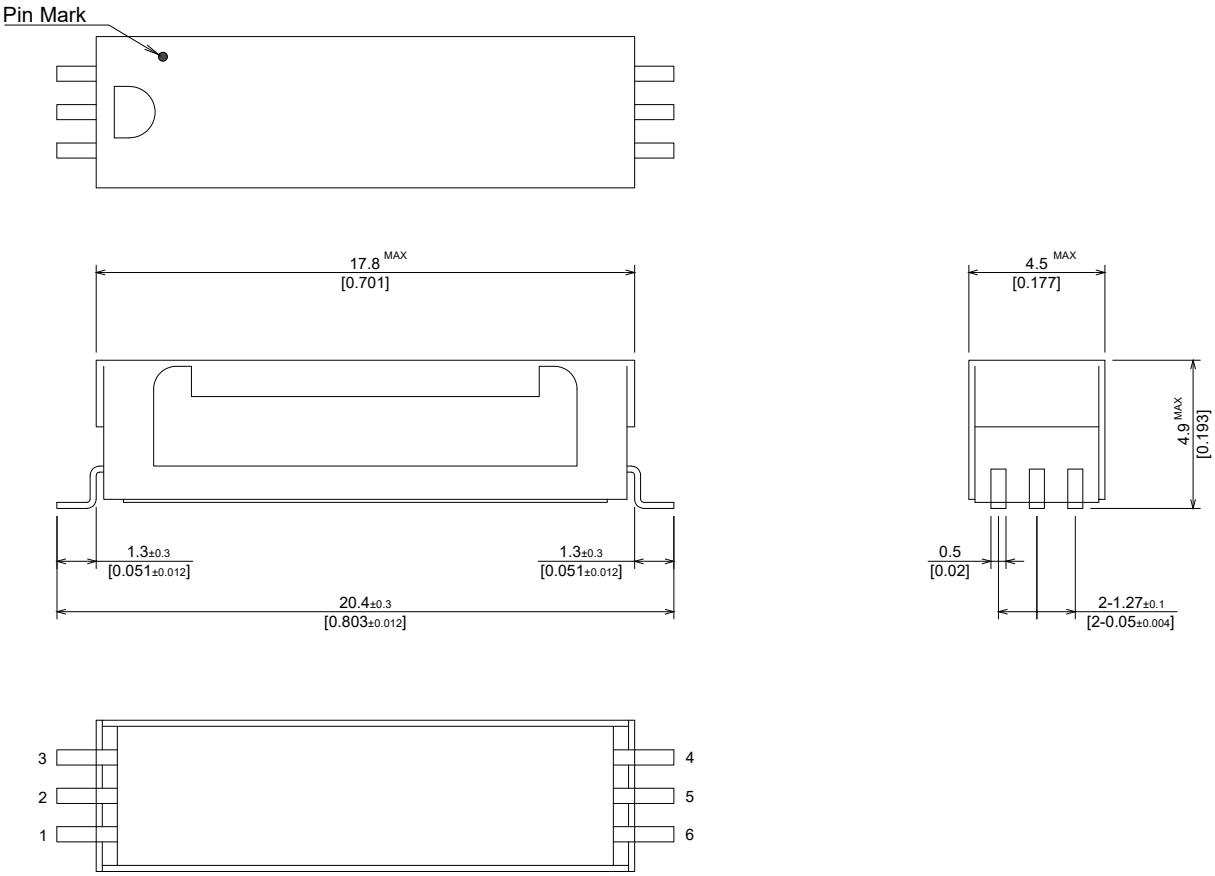
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			200	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.3	A
Contact Rating	DC/Peak AC resistance			30	W
Life Expectancy	at 1V 10mA	1500			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	300			VDC
(Static)	Contacts to Shield	500			VDC
	Contacts to Coil	500			VDC
	Shield to Coil	500			VDC
Operate Time	at Nominal Coil Voltage			0.5	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.2	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

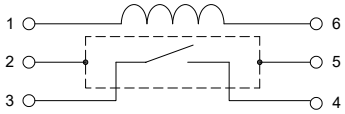
★ See p 32 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

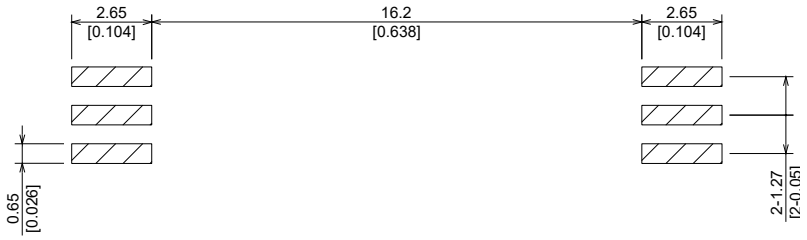
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MG 2A Gull Wing: Compact SMT Relay

This product was developed with the aim of significantly reducing the mount area while maintaining a max contact rating of 10W for a 2-make (2A) relay. Conventional 2-make relays with a max contact capacity of 10W had a mount area of 14mm^2 or more, but this series reduced the mount area by half. This series is ideal for DC pulse transmission, circuits around ATE pin electronics, and PMU circuits.

Characteristics
- Mount area: 12.7mm x 6.7mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: >$10^{11}\Omega$
- Frequencies: DC to 4.0GHz (insertion loss: -1dB typ)

RoHS COMPLIANT

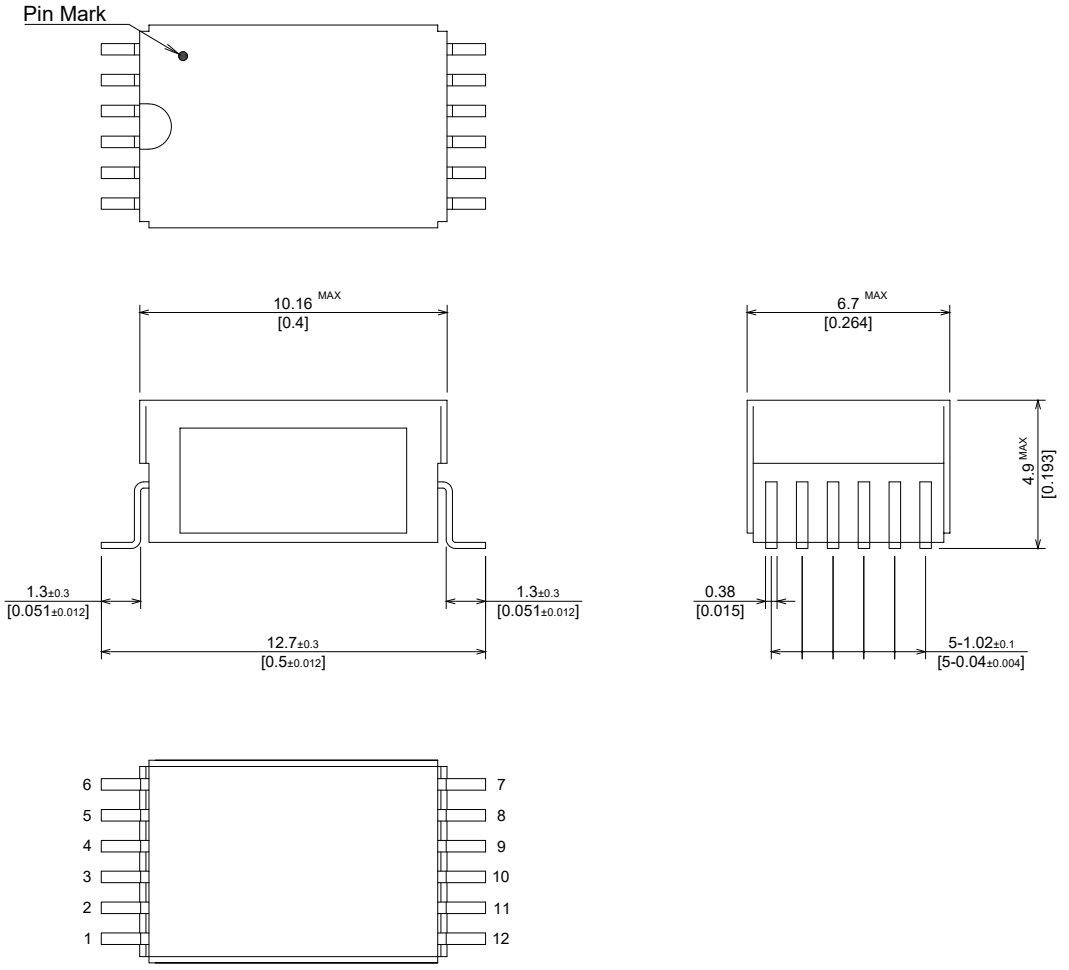
MG 2A Series		MG-E203AH			MG-E205AH			MG-E212AH			
Contact Configurations		2 Form A									
Coil Specifications											
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3			5.0			12.0		VDC
Coil Resistance	±10% @20°C		70			110			550		Ω
Must Operate	@20℃			2.8			3.75			8.8	VDC
Must Release	@20℃	0.5			0.7			1.2			VDC
Contact Ratings / Product Specifications											
Test Parameters		Test Conditions						Min	Nom	Max	Units
Switching Voltage		DC/Peak AC resistance								100	V
Switching Current		DC/Peak AC resistance								0.5	A
Carry Current		DC/Peak AC resistance(@30℃)								1.0	A
Contact Rating		DC/Peak AC resistance								10	W
Life Expectancy		at 1V 10mA						300			x10^6 Cycle
Contact Resistance		Max Initial Operete Voltage								150	mΩ
Contact Resistance Stability		Max Initial Operete Voltage								5	mΩ
Insulation Resistance		Between Contacts						10^{11}			Ω
		Contacts to Shield						10^{11}			Ω
		Contacts to Coil						10^{11}			Ω
		Shield to Coil						10^{11}			Ω
		(at 100V 20°C 65%)									
Dielectric Strength		Between Contacts						200			VDC
(Static)		Contacts to Shield						250			VDC
		Contacts to Coil						250			VDC
		Shield to Coil						250			VDC
Operate Time		at Nominal Coil Voltage								0.5	msec
(Including Bounce)		100Hz Square Wave									
Release Time		Diode Suppression								0.5	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

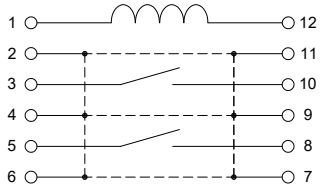
★ See p 33, 34 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

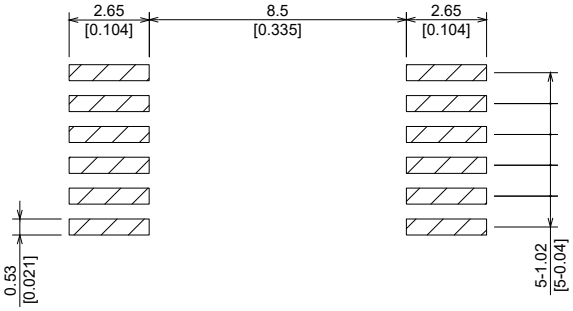
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MJ 2A J-Lead: Compact SMT Relay

This product was developed with the aim of significantly reducing the mount area while maintaining a max contact rating of 10W for a 2-make (2A) relay. Conventional 2-make relays with a max contact capacity of 10W had a mount area of 14mm^2 or more, but this series reduced the mount area by half. This series is ideal for DC pulse transmission, circuits around ATE pin electronics, and PMU circuits.

Characteristics
- Mount area: 10.8mm x 6.7mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: >$10^{11}\Omega$
- Frequencies: DC to 4.0GHz (insertion loss: -1dB typ)

RoHS COMPLIANT

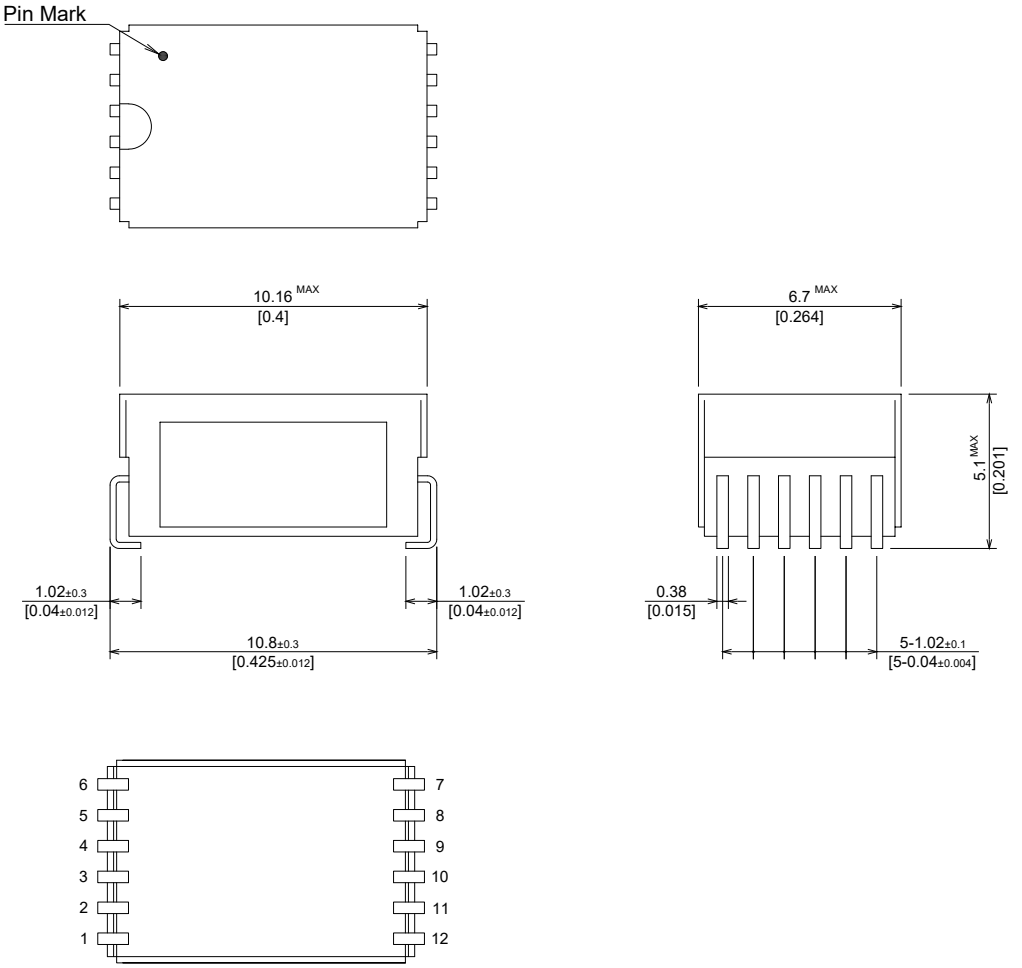
MJ 2A Series		MJ-E203AH			MJ-E205AH			MJ-E212AH			
Contact Configurations		2 Form A									
Coil Specifications											
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3			5.0			12.0		VDC
Coil Resistance	±10% @20°C		70			110			550		Ω
Must Operate	@20℃			2.8			3.75			8.8	VDC
Must Release	@20℃	0.5			0.7			1.2			VDC
Contact Ratings / Product Specifications											
Test Parameters		Test Conditions						Min	Nom	Max	Units
Switching Voltage		DC/Peak AC resistance								100	V
Switching Current		DC/Peak AC resistance								0.5	A
Carry Current		DC/Peak AC resistance(@30℃)								1.0	A
Contact Rating		DC/Peak AC resistance								10	W
Life Expectancy		at 1V 10mA						300			x10^6 Cycle
Contact Resistance		Max Initial Operete Voltage								150	mΩ
Contact Resistance Stability		Max Initial Operete Voltage								5	mΩ
Insulation Resistance		Between Contacts						10 ^{11}			Ω
		Contacts to Shield						10 ^{11}			Ω
		Contacts to Coil						10 ^{11}			Ω
		Shield to Coil						10 ^{11}			Ω
		(at 100V 20°C 65%)									
Dielectric Strength		Between Contacts						200			VDC
(Static)		Contacts to Shield						250			VDC
		Contacts to Coil						250			VDC
		Shield to Coil						250			VDC
Operate Time		at Nominal Coil Voltage								0.5	msec
(Including Bounce)		100Hz Square Wave									
Release Time		Diode Suppression								0.5	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

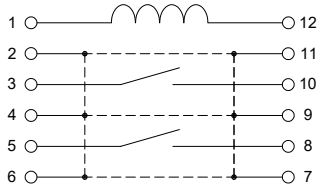
★ See p 33, 34 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

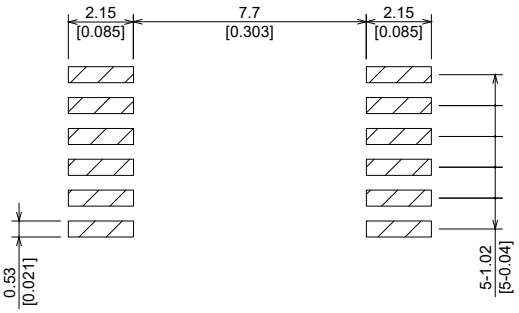
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



MH 1A1B J-Lead: Vertical SMT Relay

This product was developed to miniaturize our long-life, high-reliability MJT series. The contact configuration is single transfer (1A+1B), achieving 34% reduction in mount area compared to the MJT series. Among our SMT single transfer products, it is the smallest and most suitable for high-density mounting.

Characteristics
- Mount area: 10.16mm x 5.08mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: >$10^{11}\Omega$

RoHS COMPLIANT

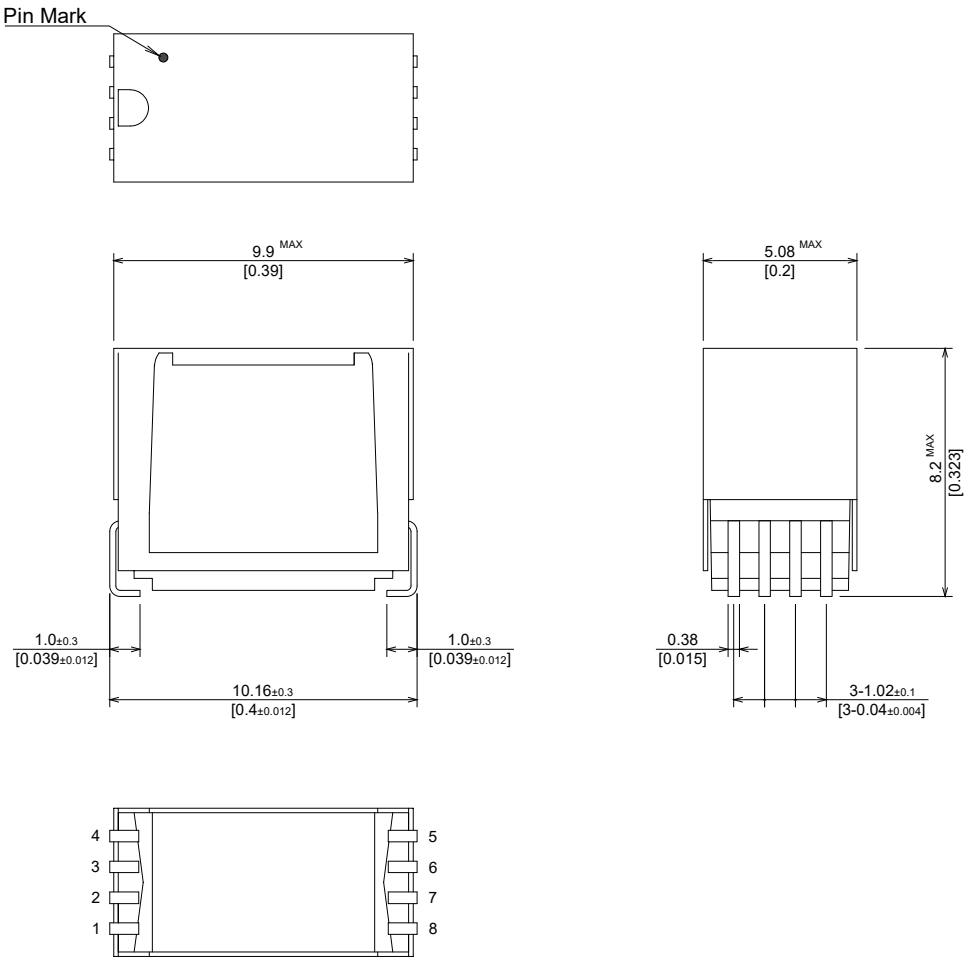
MH 1A1B Series		MH-E1T03JH			MH-E1T05JH			MH-E1T12JH			
Contact Configurations		1 Form C (A + B)									
Coil Specifications											
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3	3.6		5.0	5.5		12.0	13.2	VDC
Coil Resistance	±10% @20°C		70			110			550		Ω
Must Operate	@20℃			2.8			3.75			8.8	VDC
Must Release	@20℃	0.5			0.7			1.2			VDC
Contact Ratings / Product Specifications											
Test Parameters		Test Conditions						Min	Nom	Max	Units
Switching Voltage		DC/Peak AC resistance								100	V
Switching Current		DC/Peak AC resistance								0.5	A
Carry Current		DC/Peak AC resistance(@30℃)								1.0	A
Contact Rating		DC/Peak AC resistance								10	W
Life Expectancy		at 1V 10mA						300			x10^6 Cycle
Contact Resistance		Max Initial Operete Voltage								150	mΩ
Contact Resistance Stability		Max Initial Operete Voltage								5	mΩ
Insulation Resistance		Between Contacts						10^{11}			Ω
		Contacts to Shield						10^{11}			Ω
		Contacts to Coil						10^{11}			Ω
		Shield to Coil						10^{11}			Ω
		(at 100V 20°C 65%)									
Dielectric Strength		Between Contacts						200			VDC
(Static)		Contacts to Shield						500			VDC
		Contacts to Coil						500			VDC
		Shield to Coil						500			VDC
Operate Time		at Nominal Coil Voltage								0.5	msec
(Including Bounce)		100Hz Square Wave									
Release Time		Diode Suppression								0.5	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +60°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

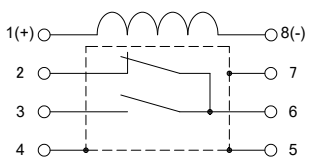
★ See p 35, 36 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

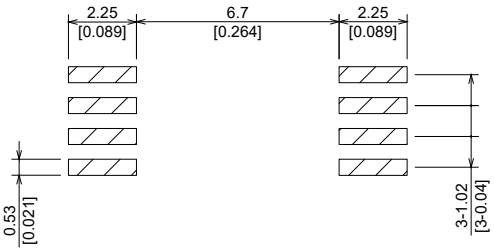
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



* Coil polarities, (+) and (-).

MGT 1A1B Gull Wing: Compact SMT Relay

This product uses two make switches to create a transfer switch (1A+1B), thereby improving lifespan and reliability. Using make contact points extends the lifespan and achieving high reliability. This product is therefore highly valued in the semiconductor tester and measurement equipment industries.

Characteristics
- Mount area: 12.7mm x 7.62mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 2.5GHz (insertion loss: -1dB typ)

RoHS COMPLIANT

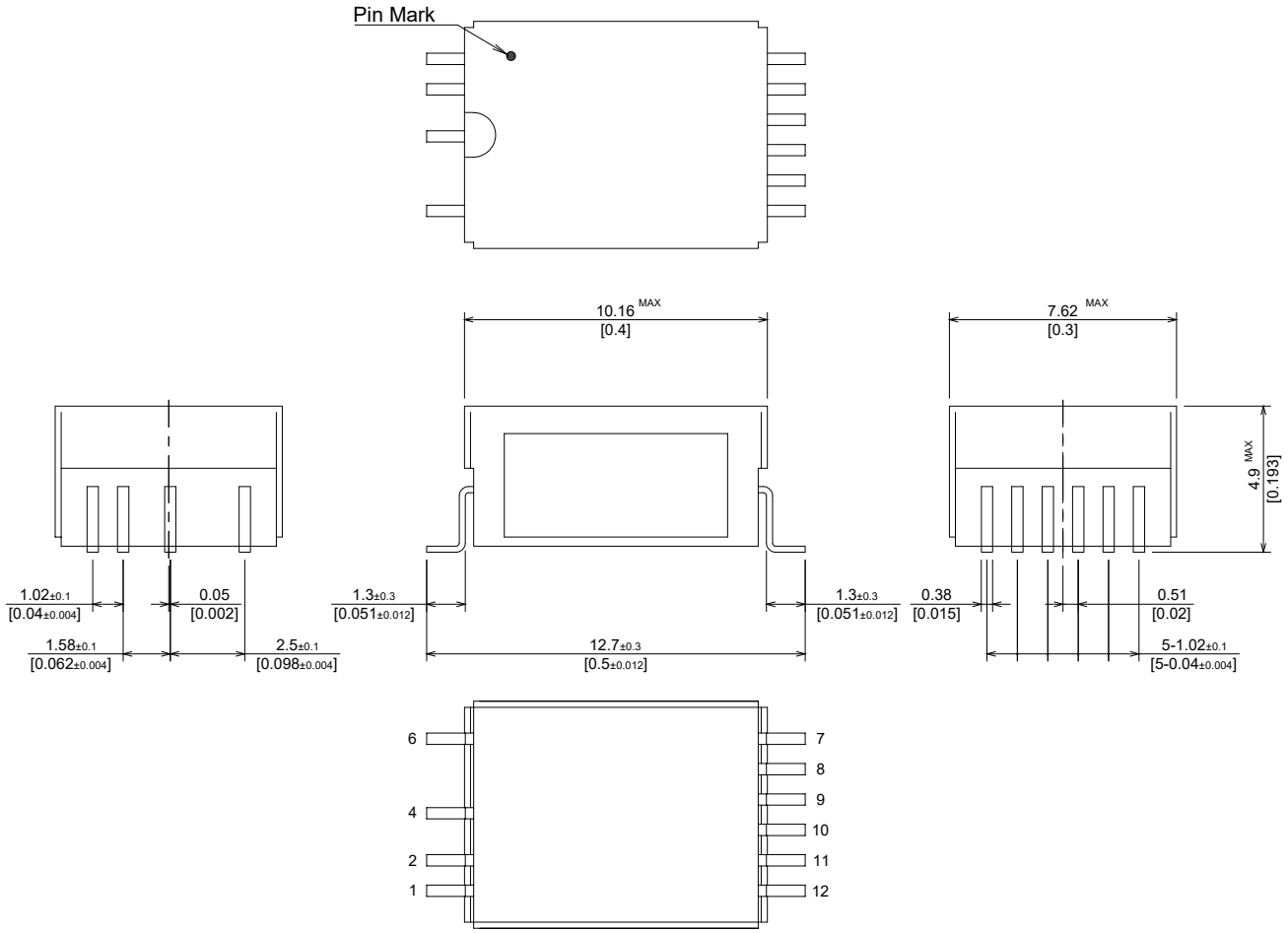
MGT 1A1B Series		MGT-E103H			MGT-E105H			MGT-E112H			
Contact Configurations		1 Form C (A + B)									
Coil Specifications											
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3	3.6		5.0	5.5		12.0	13.2	VDC
Coil Resistance	±10% @20°C		70			110			550		Ω
Must Operate	@20℃			2.8			3.75			8.8	VDC
Must Release	@20℃	0.5			0.7			1.2			VDC
Contact Ratings / Product Specifications											
Test Parameters		Test Conditions						Min	Nom	Max	Units
Switching Voltage		DC/Peak AC resistance								100	V
Switching Current		DC/Peak AC resistance								0.5	A
Carry Current		DC/Peak AC resistance(@30℃)								1.0	A
Contact Rating		DC/Peak AC resistance								10	W
Life Expectancy		at 1V 10mA						300			$x10^6$ Cycle
Contact Resistance		Max Initial Operete Voltage								150	mΩ
Contact Resistance Stability		Max Initial Operete Voltage								5	mΩ
Insulation Resistance		Between Contacts						10^{11}			Ω
		Contacts to Shield						10^{11}			Ω
		Contacts to Coil						10^{11}			Ω
		Shield to Coil						10^{11}			Ω
		(at 100V 20°C 65%)									
Dielectric Strength		Between Contacts						200			VDC
(Static)		Contacts to Shield						250			VDC
		Contacts to Coil						250			VDC
		Shield to Coil						250			VDC
Operate Time		at Nominal Coil Voltage								0.5	msec
(Including Bounce)		100Hz Square Wave									
Release Time		Diode Suppression								0.5	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +80°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

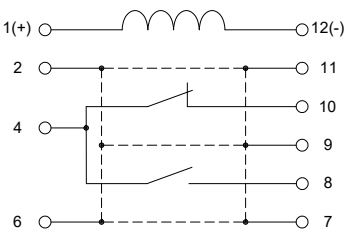
★ See p 37, 38 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

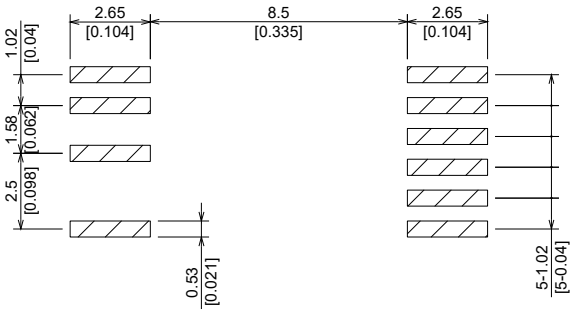
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



* Coil polarities, (+) and (-).

MJT 1A1B J-Lead: Compact SMT Relay

This product uses two make switches to create a transfer switch (1A+1B), thereby improving lifespan and reliability. Using make contact points extends the lifespan and achieving high reliability. This product is therefore highly valued in the semiconductor tester and measurement equipment industries.

Characteristics
- Mount area: 10.8mm x 7.62mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 2.5GHz (insertion loss: -1dB typ)

RoHS COMPLIANT

MJT 1A1B Series		MJT-E103H			MJT-E105H			MJT-E112H			
Contact Configurations		1 Form C (A + B)									
Coil Specifications											
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			3.3	3.6		5.0	5.5		12.0	13.2	VDC
Coil Resistance	±10% @20°C		70			110			550		Ω
Must Operate	@20℃			2.8			3.75			8.8	VDC
Must Release	@20℃	0.5			0.7			1.2			VDC

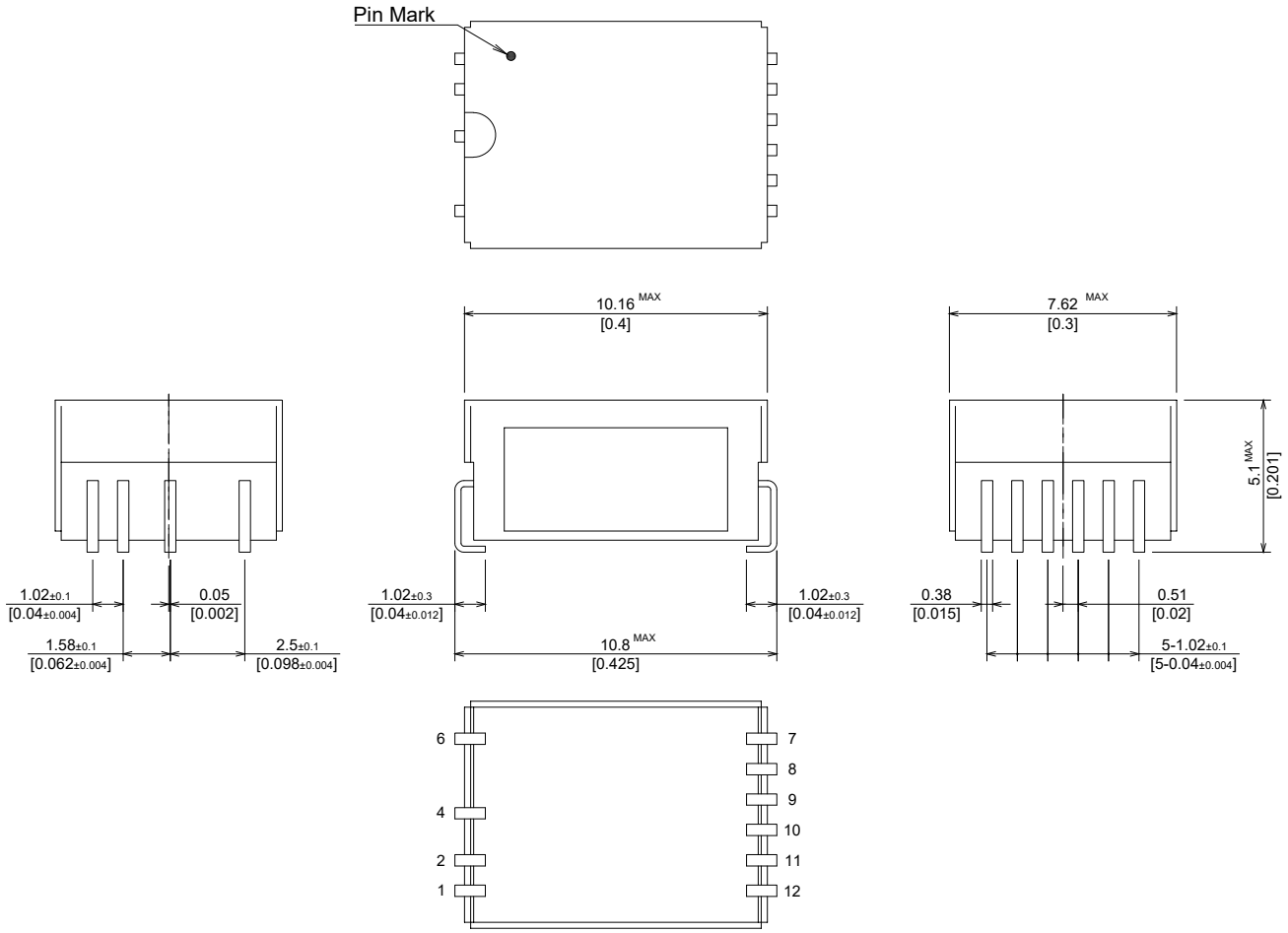
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			150	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.5	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.5	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +60°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

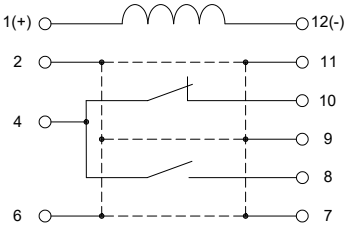
★ See p 37, 38 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

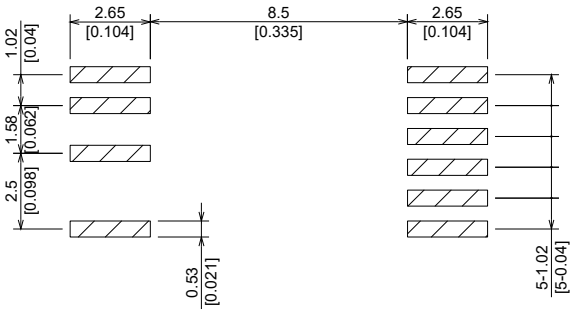
* Pin mark (●) corresponds to the terminal number 1.



Schematic <Top View>



Land Pattern Recommendation



* Coil polarities, (+) and (-).

MJ 2A2B J-Lead: Compact SMT Relay

This product was developed for use in differential circuits for semiconductor automatic testers and semiconductor inspection boards. This product consists of two transfer switches (1A+1B) in one package. As a result, compared to using two of our MGT/MJT relays, this relay reduces mount area by 25%. In addition, the electrical life is guaranteed to 300 million cycles (equivalent to a make switch) and it also supports frequencies from DC to 4.0GHz.

Characteristics
- Mount area: 10.3mm x 11.3mm
- Electrical lifespan: 300 million (@ 1V 10mA)
- Insulation resistance: $>10^{11}\Omega$
- Frequencies: DC to 4.5GHz (insertion loss: -3dB typ)

RoHS COMPLIANT

MJ 1A1B Series		MJ-E2T05N			MJ-E2T12N			
Contact Configurations		2 Form C (A + B)						
Coil Specifications								
Parameters	Conditions	Min	Nom	Max	Min	Nom	Max	Units
Coil Voltage			5.0	5.5		12.0	13.2	VDC
Coil Resistance	±10% @20°C		110			550		Ω
Must Operate	@20℃			3.75			8.8	VDC
Must Release	@20℃	0.7			1.2			VDC

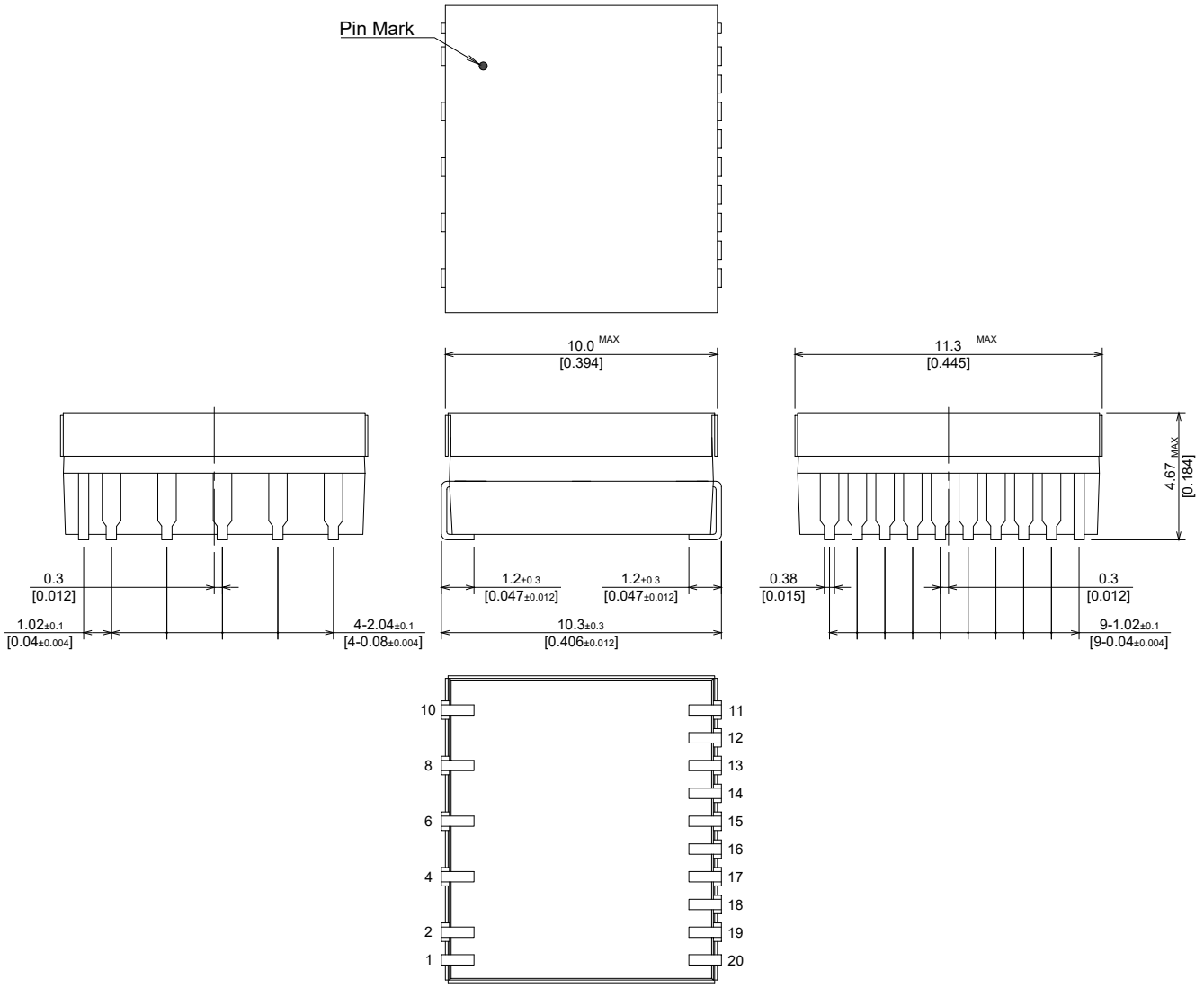
Contact Ratings / Product Specifications					
Test Parameters	Test Conditions	Min	Nom	Max	Units
Switching Voltage	DC/Peak AC resistance			100	V
Switching Current	DC/Peak AC resistance			0.5	A
Carry Current	DC/Peak AC resistance(@30℃)			1.0	A
Contact Rating	DC/Peak AC resistance			10	W
Life Expectancy	at 1V 10mA	300			$x10^6$ Cycle
Contact Resistance	Max Initial Operete Voltage			180	mΩ
Contact Resistance Stability	Max Initial Operete Voltage			5	mΩ
Insulation Resistance	Between Contacts	10^{11}			Ω
	Contacts to Shield	10^{11}			Ω
	Contacts to Coil	10^{11}			Ω
	Shield to Coil	10^{11}			Ω
	(at 100V 20°C 65%)				
Dielectric Strength	Between Contacts	200			VDC
(Static)	Contacts to Shield	250			VDC
	Contacts to Coil	250			VDC
	Shield to Coil	250			VDC
Operate Time	at Nominal Coil Voltage			0.3	msec
(Including Bounce)	100Hz Square Wave				
Release Time	Diode Suppression			0.3	msec

Measurement Reference Condition		Environmental Ratings	
Temp	: 15°C to 35°C	Operate temp	: -20°C to +60°C
Humidity	: 25% to 75%RH	Storage temp	: -40℃ to +85℃
Atmospheric Pressure	: 860 to 1060hpa	Vibration	: 20G's to 2000Hz
		Shock	: 50G's
		Processing Temp	: 260°C max for 60sec. dwell time.

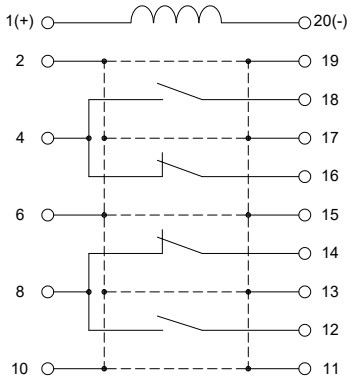
★ See p 39-42 for S-parameters and eye diagram.
★ For reel packaged version, see p 43.

Dimensions < All Dimensions are mm(inch) >

* Pin mark (●) corresponds to the terminal number 1.

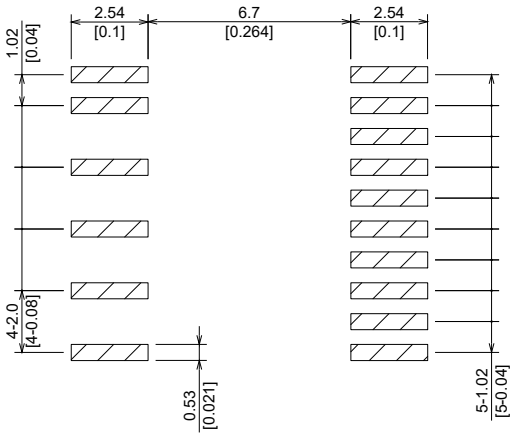


Schematic <Top View>



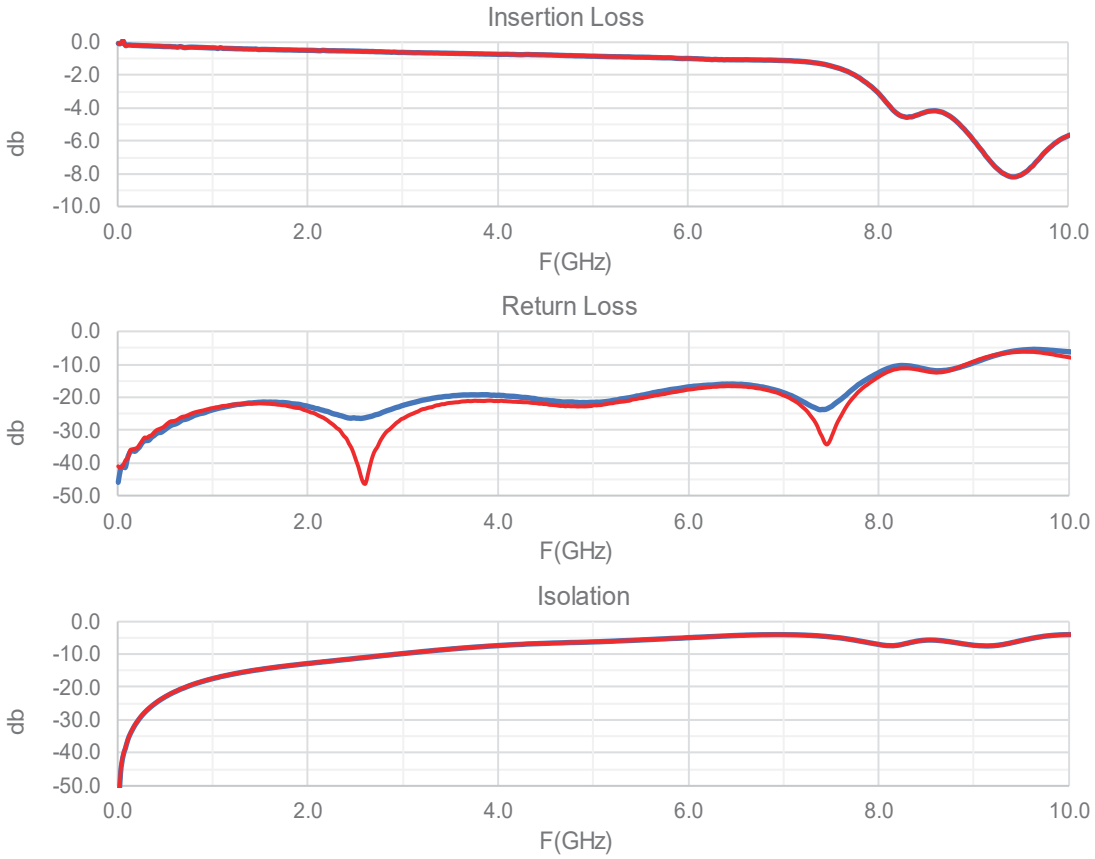
* Coil polarities, (+) and (-).

Land Pattern Recommendation



UJ-1xxRF

S-Parameters

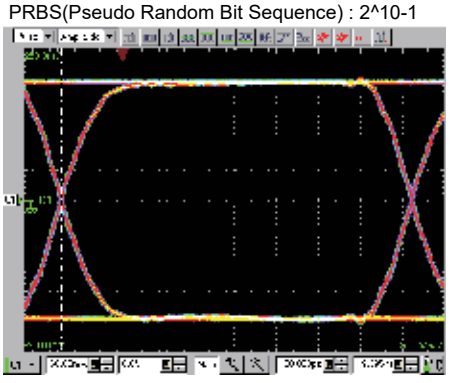


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

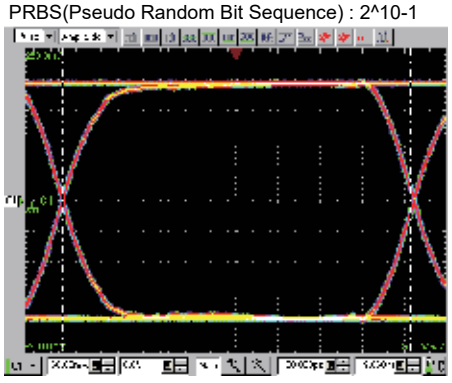
PRBS(Pseudo Random Bit Sequence) : 2^10-1



UJ-105RF with Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

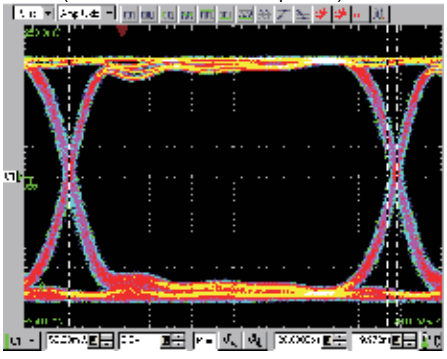
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 30ps Bit Rate : 6.4Gb/s

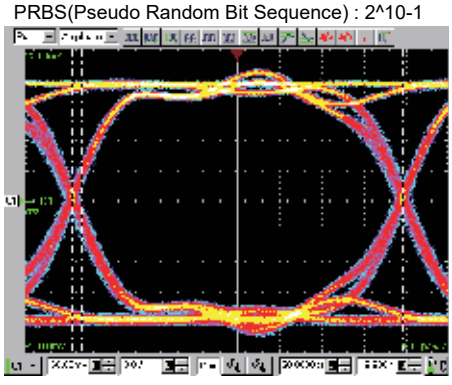
PRBS(Pseudo Random Bit Sequence) : 2^10-1



UJ-105RF with Fixture

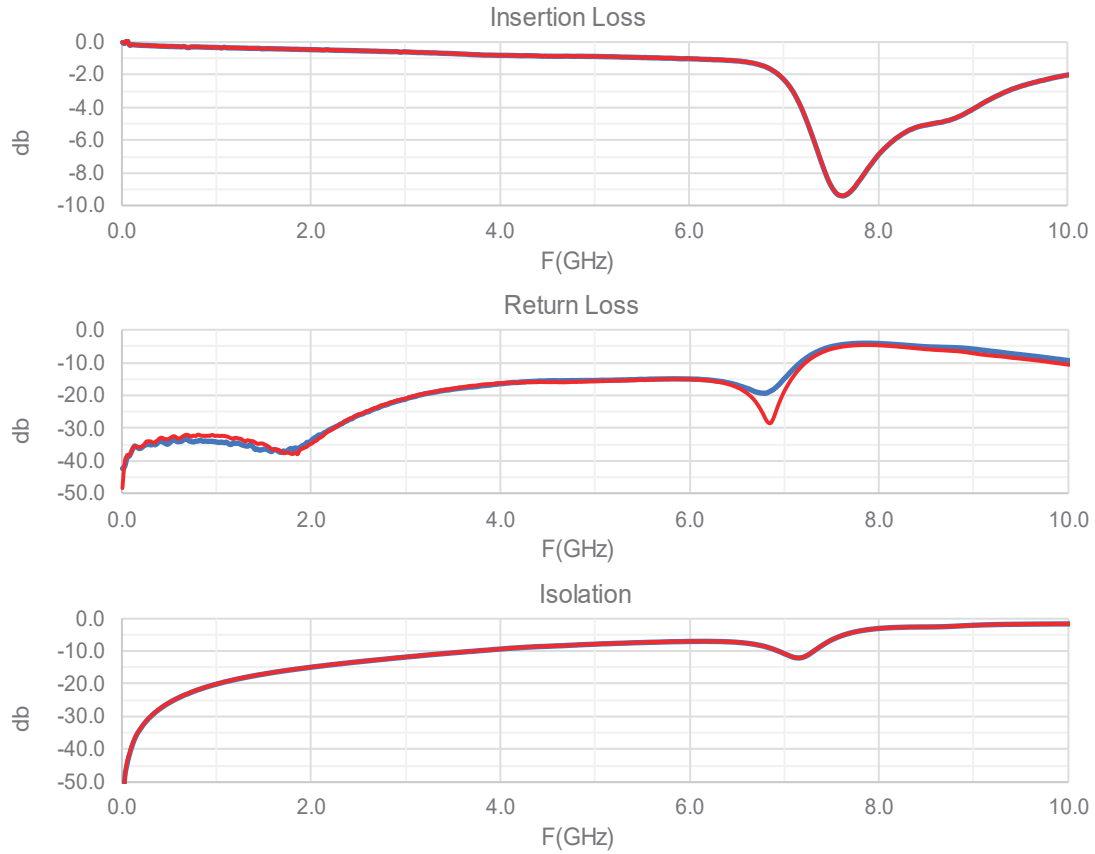
Rise Time ≒ 30ps Bit Rate : 6.4Gb/s

PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-1xxRF

S-Parameters

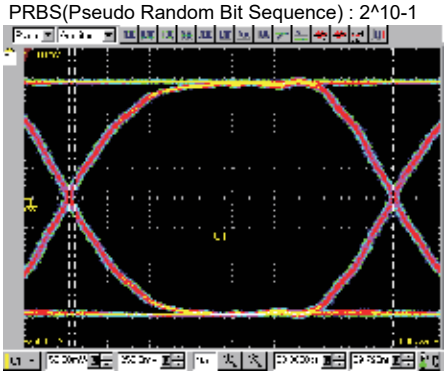


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

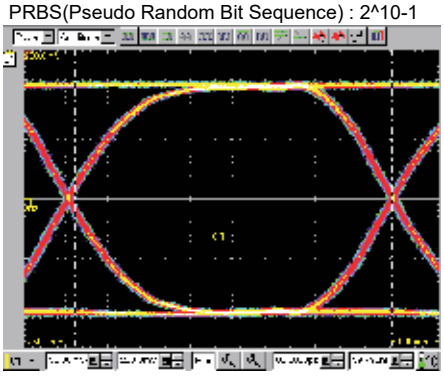
PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-E105RF with Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

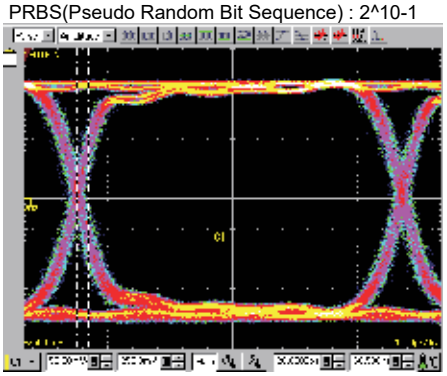
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 30ps Bit Rate : 6.4Gb/s

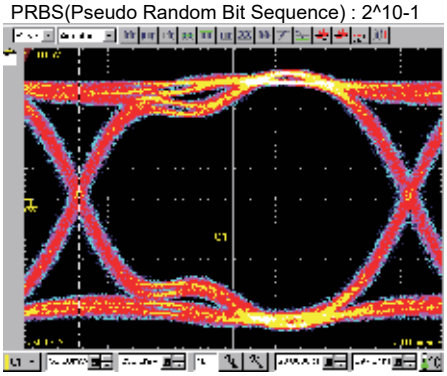
PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-E105RF with Fixture

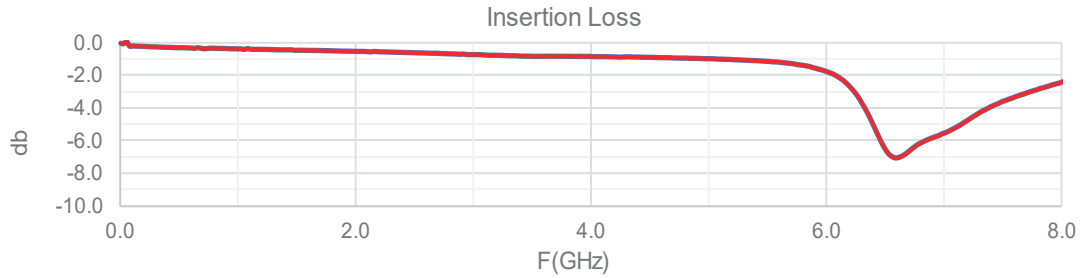
Rise Time ≒ 30ps Bit Rate : 6.4Gb/s

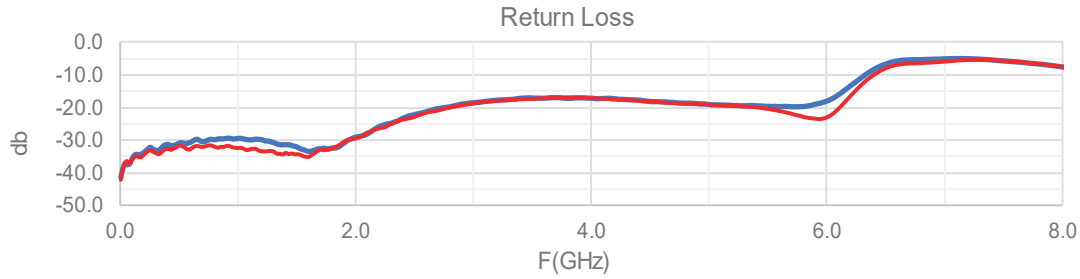
PRBS(Pseudo Random Bit Sequence) : 2^10-1

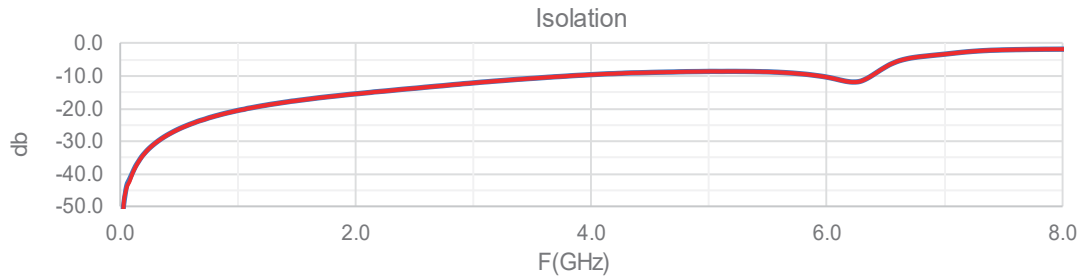


MG-E105H-64

S-Parameters





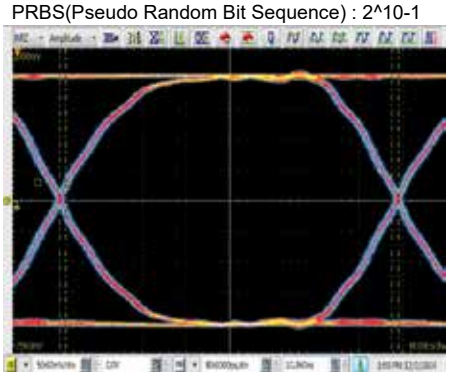


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

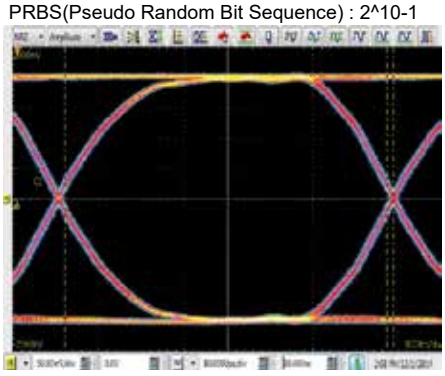
PRBS(Pseudo Random Bit Sequence) : 2^10-1



MG-E105H-64 with Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

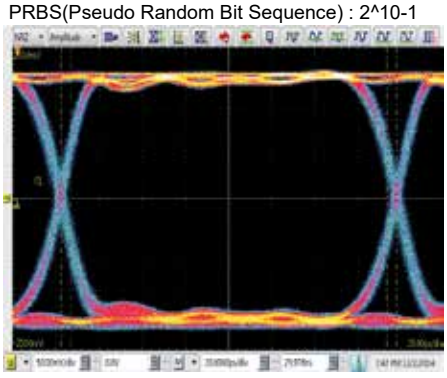
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

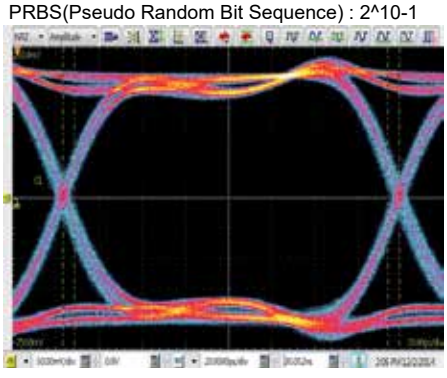
PRBS(Pseudo Random Bit Sequence) : 2^10-1



MG-E105H-64 with Fixture

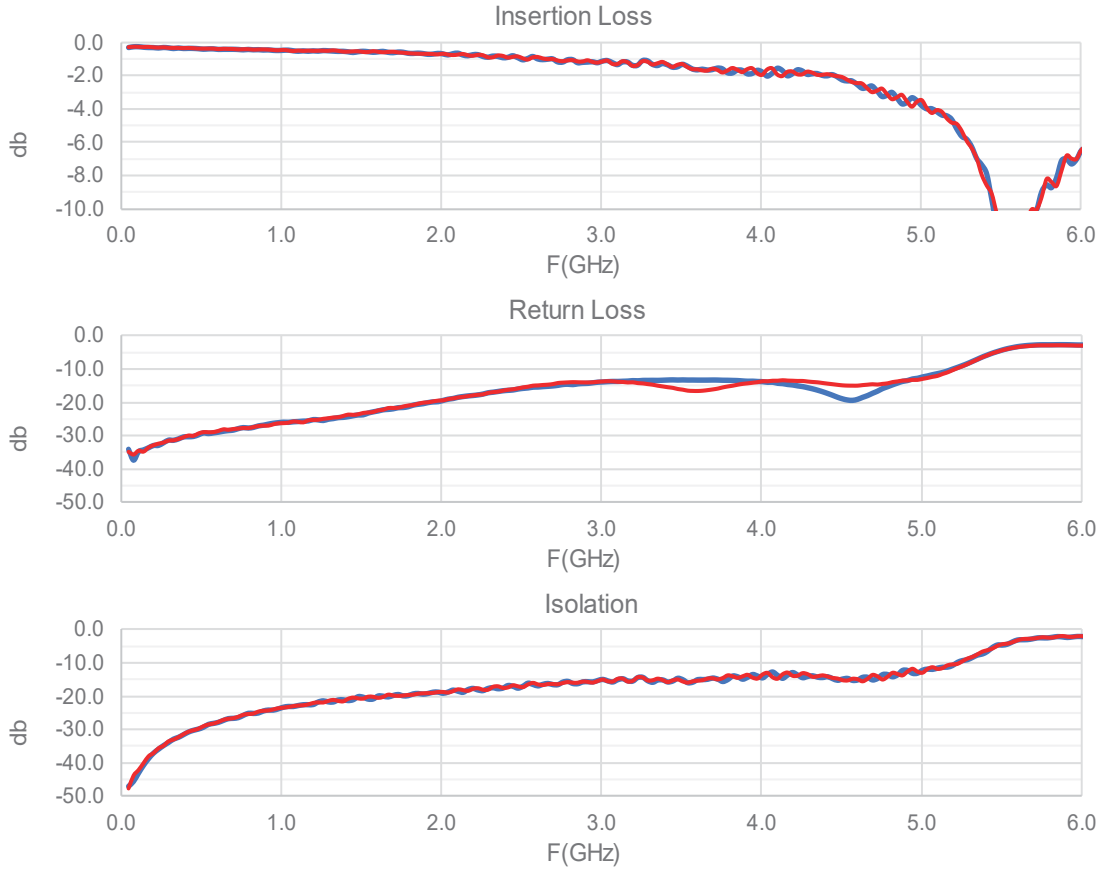
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-1xx

S-Parameters

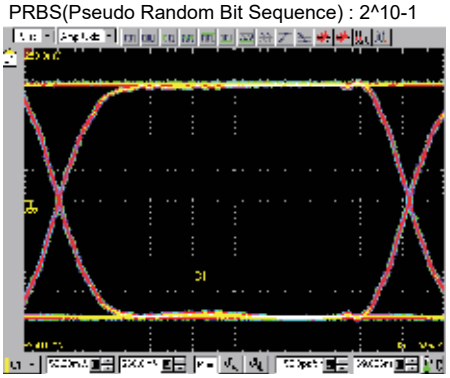


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 800Mb/s

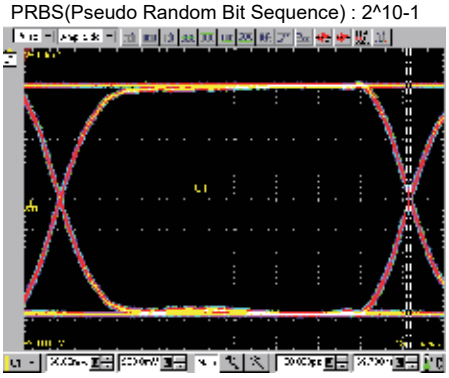
PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-E105 with Fixture

Rise Time ≒ 250ps Bit Rate : 800Mb/s

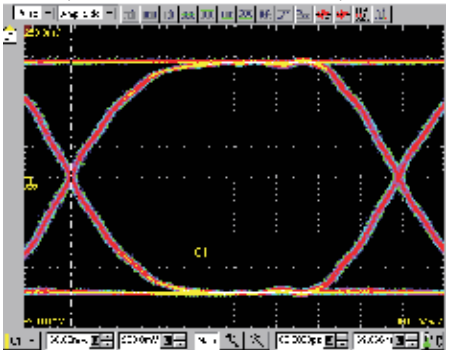
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

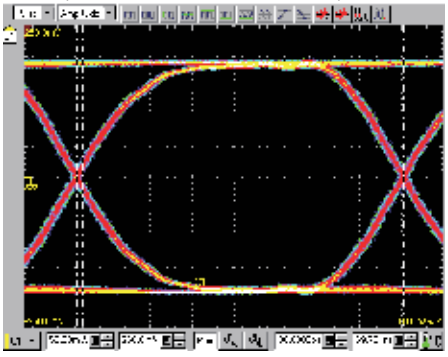
PRBS(Pseudo Random Bit Sequence) : 2^10-1



CJ-E105 with Fixture

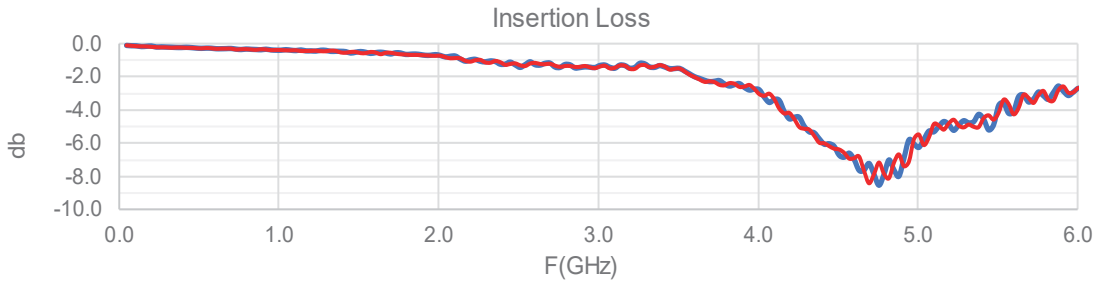
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

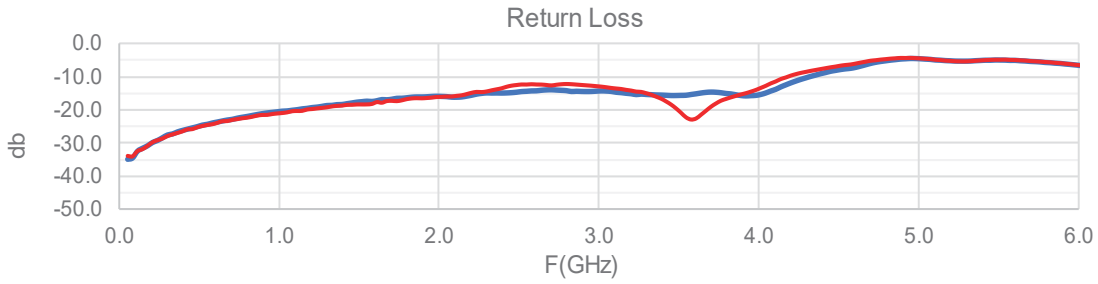
PRBS(Pseudo Random Bit Sequence) : 2^10-1

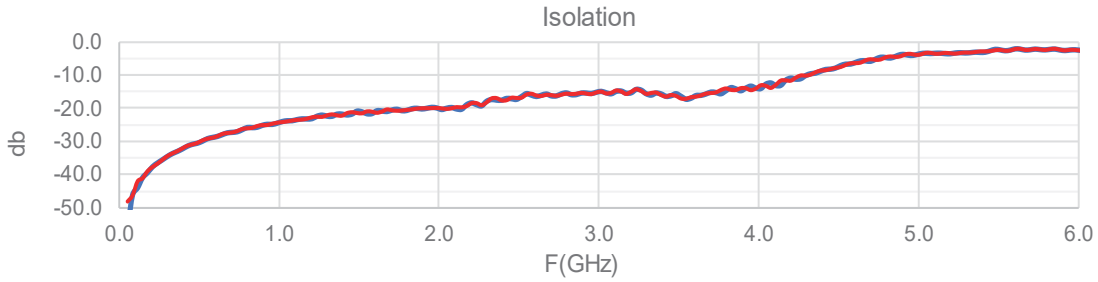


MG/MJ-E1xx

S-Parameters





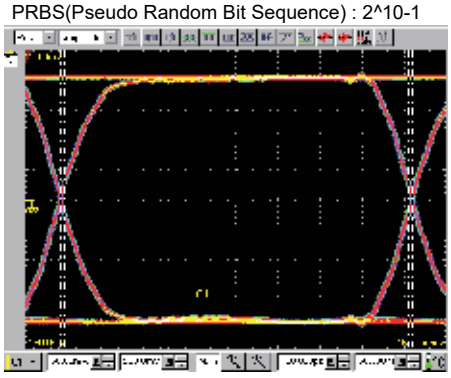


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 800Mb/s

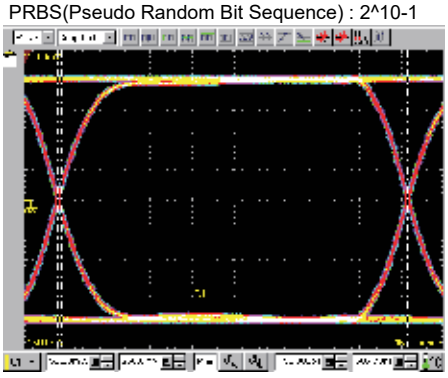
PRBS(Pseudo Random Bit Sequence) : 2^10-1



MJ-E105 with Fixture

Rise Time ≒ 250ps Bit Rate : 800Mb/s

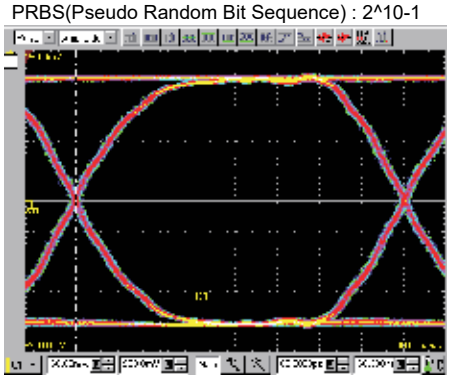
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

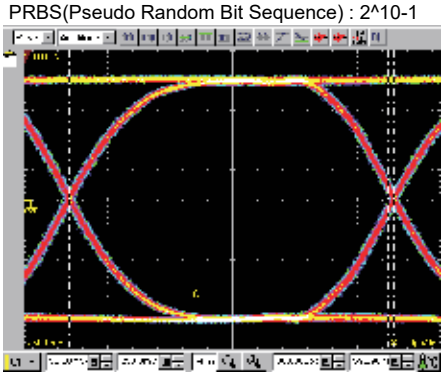
PRBS(Pseudo Random Bit Sequence) : 2^10-1



MJ-E105 with Fixture

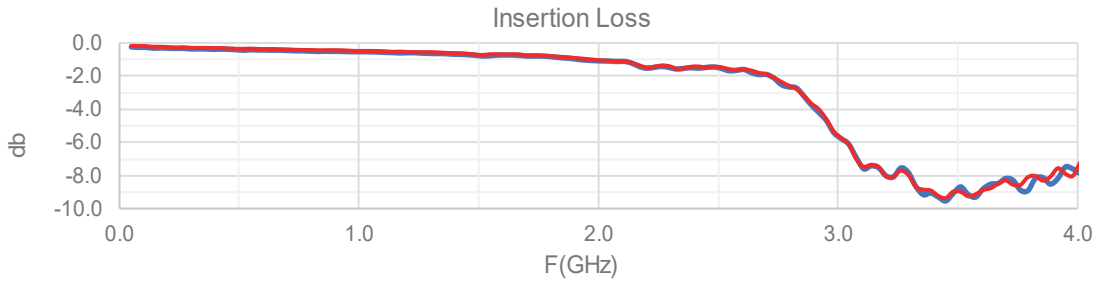
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s

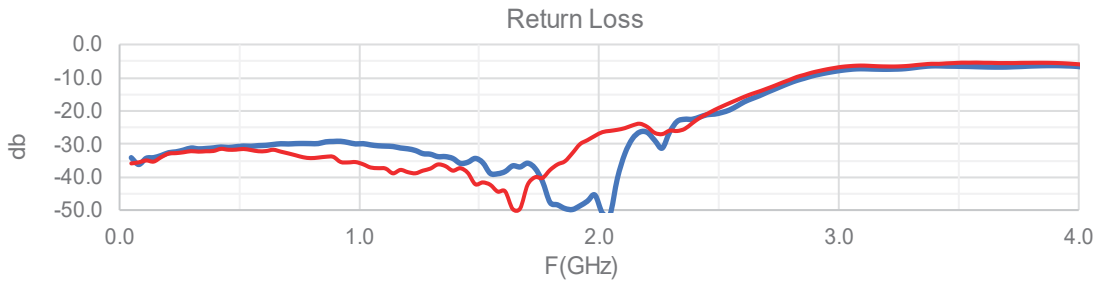
PRBS(Pseudo Random Bit Sequence) : 2^10-1

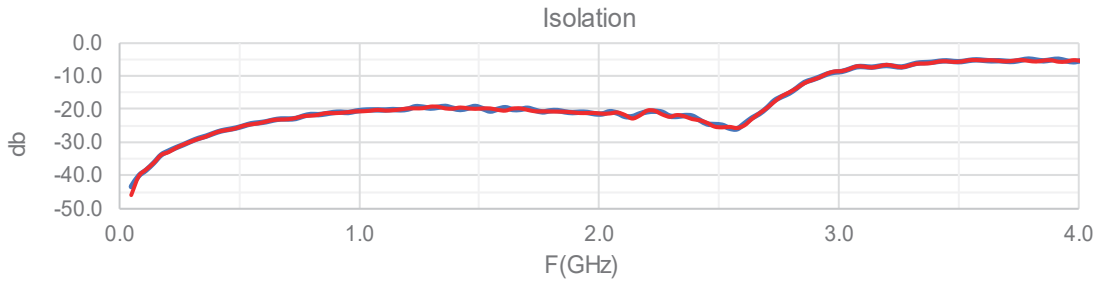


MSG-105AK3H

S-Parameters





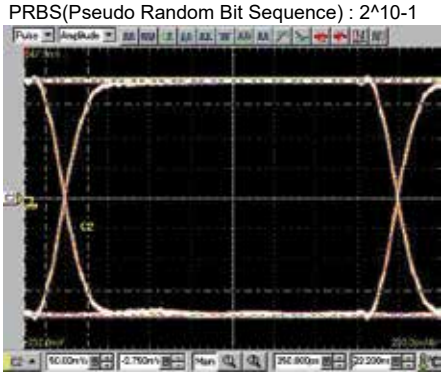


Eye Diagram

Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 500Mb/s

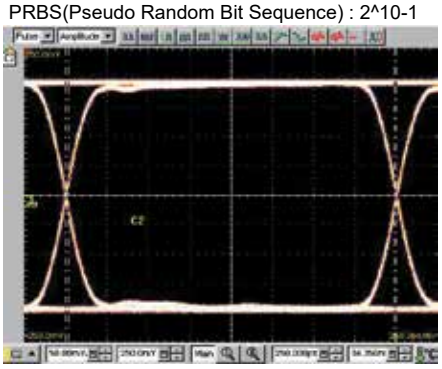
PRBS(Pseudo Random Bit Sequence) : 2^10-1



MSG-105AK3H with Fixture

Rise Time ≒ 250ps Bit Rate : 500Mb/s

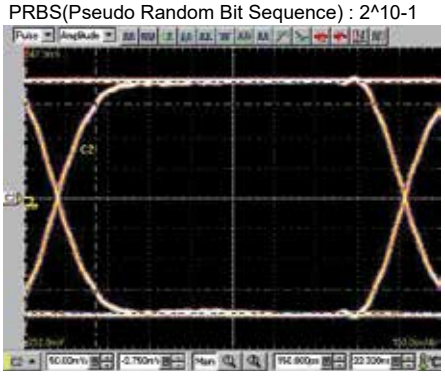
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture

Rise Time ≒ 250ps Bit Rate : 800Mb/s

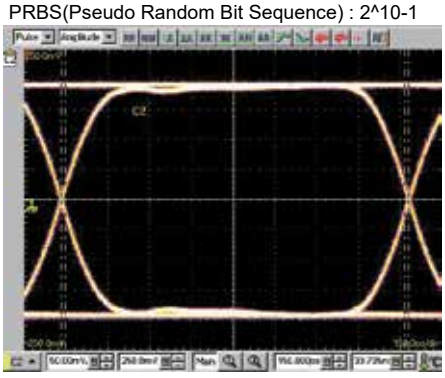
PRBS(Pseudo Random Bit Sequence) : 2^10-1



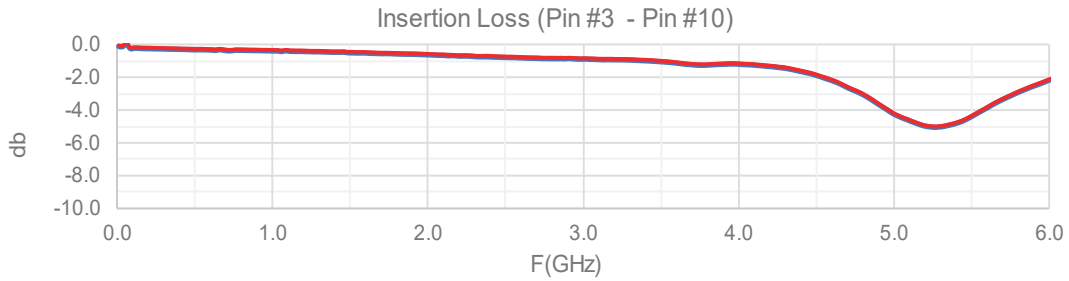
MSG-105AK3H with Fixture

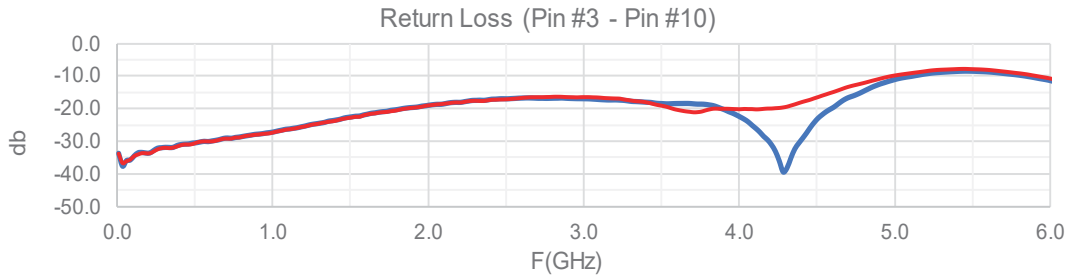
Rise Time ≒ 250ps Bit Rate : 800Mb/s

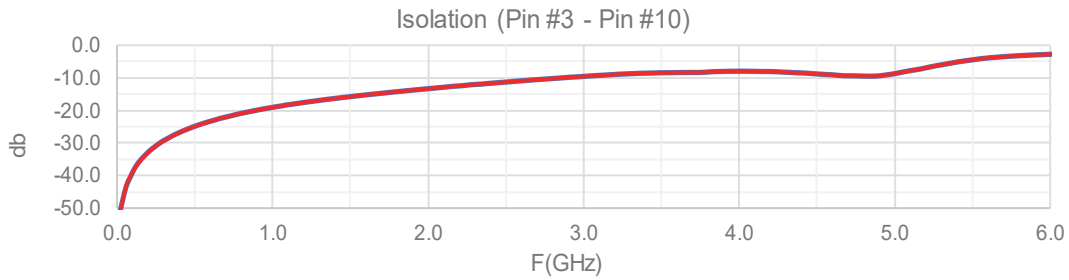
PRBS(Pseudo Random Bit Sequence) : 2^10-1

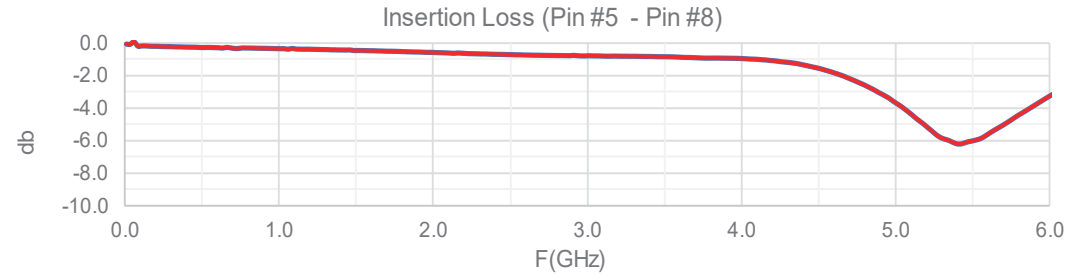


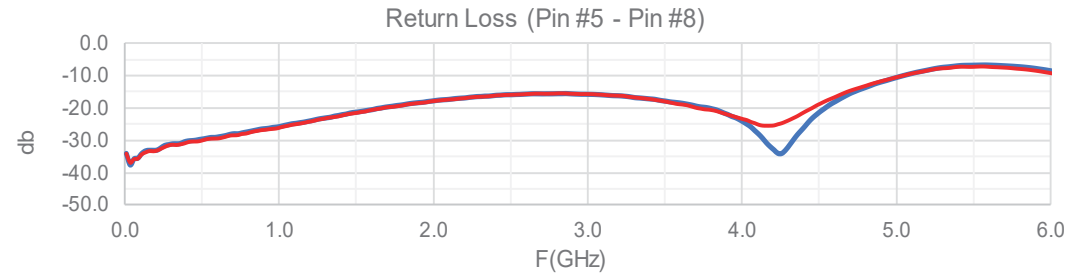
S-Parameters

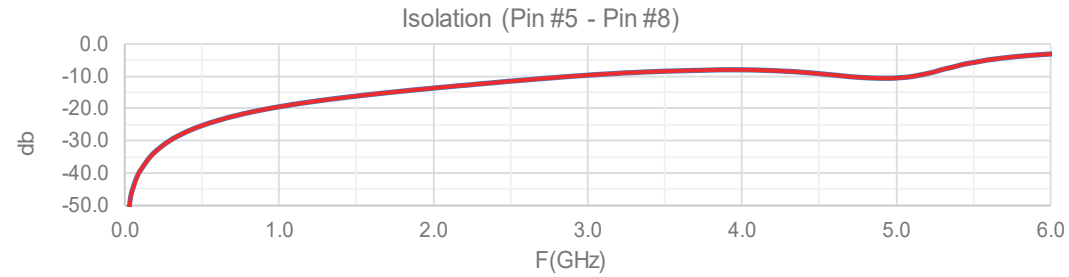








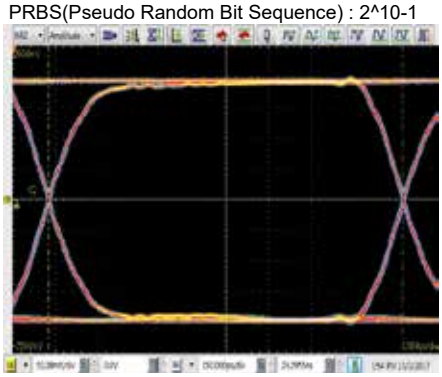




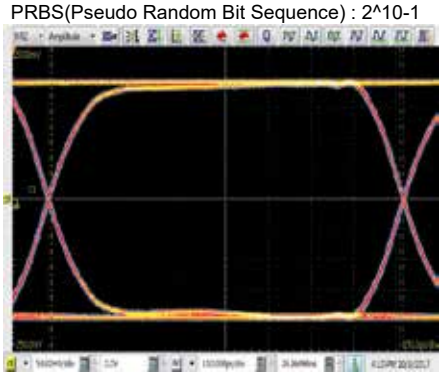
MG/MJ-E2xxAH

Eye Diagram

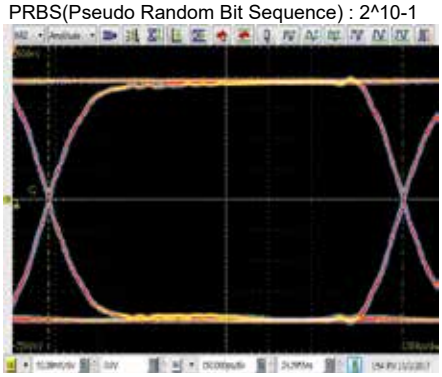
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



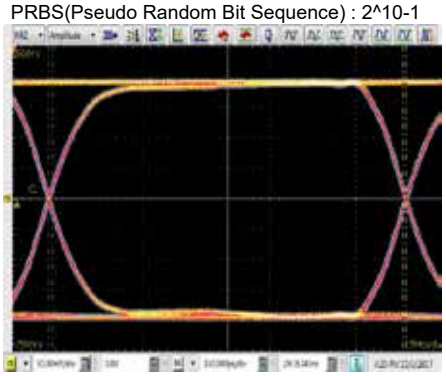
MG-E205AH with Fixture : Pin #3 - Pin #10
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



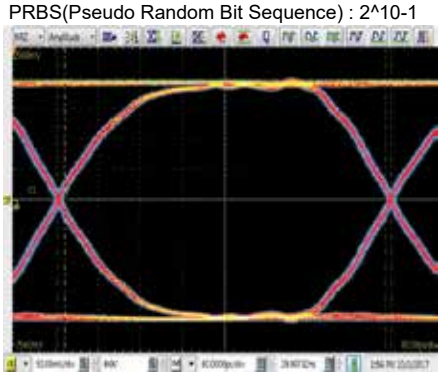
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



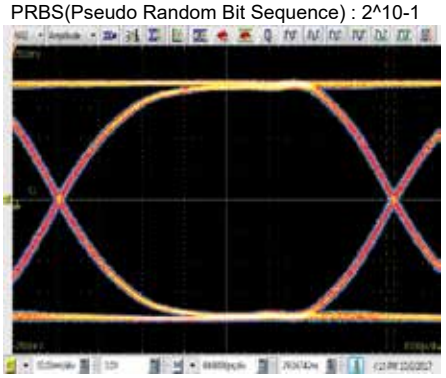
MG-E205AH with Fixture : Pin #5 - Pin #8
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



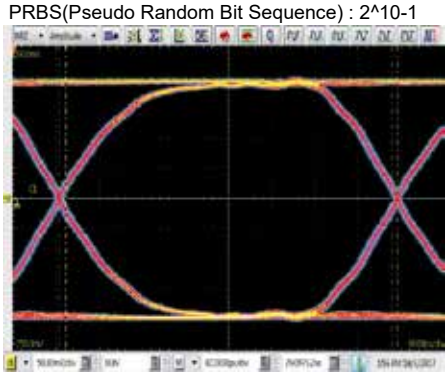
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



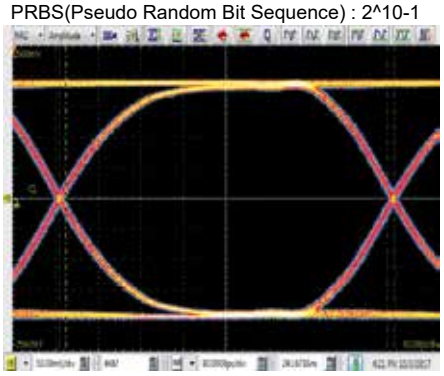
MG-E205AH with Fixture : Pin #3 - Pin #10
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

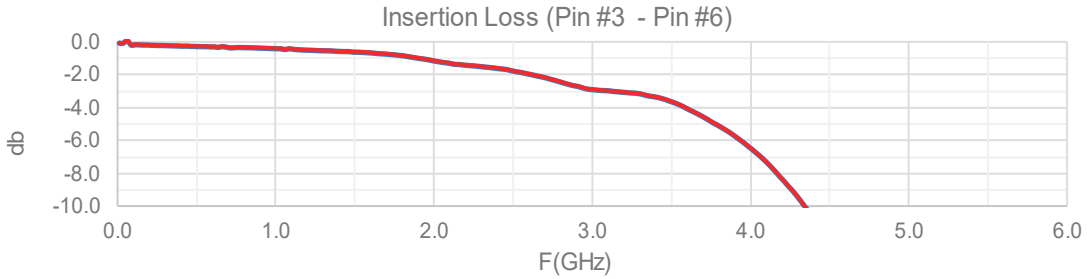


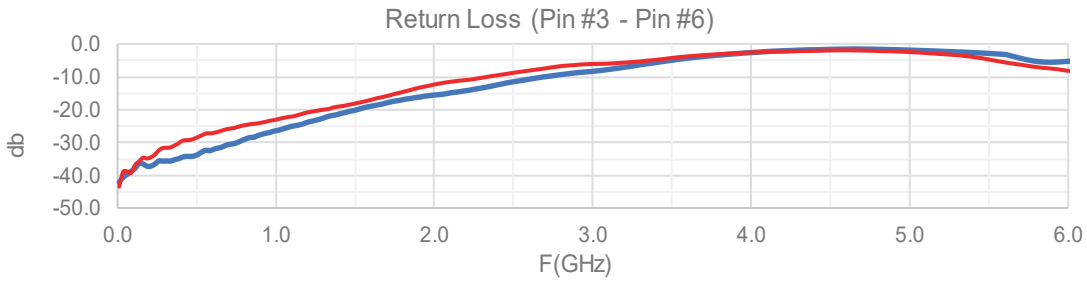
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

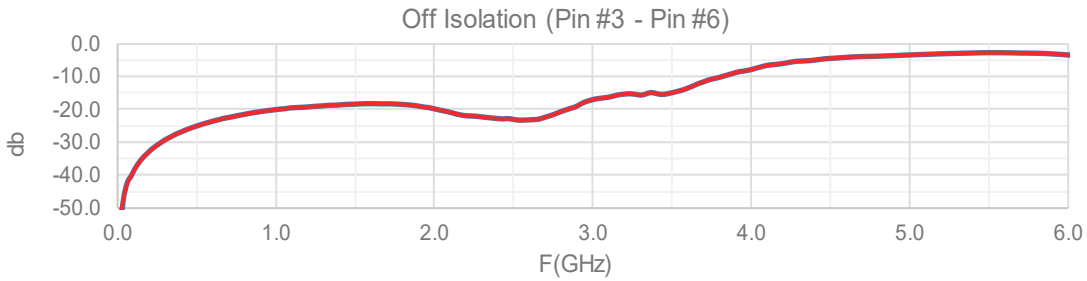


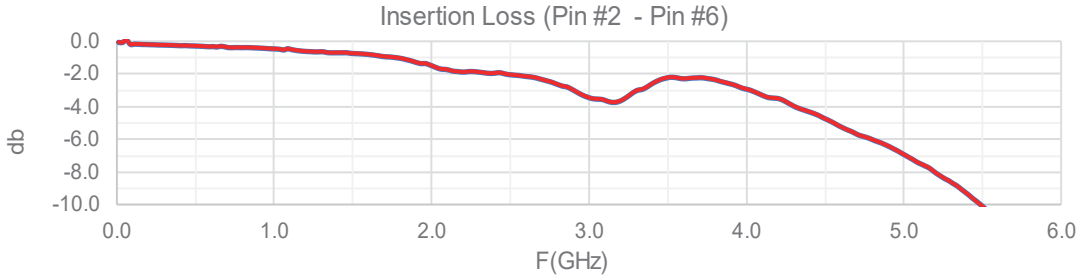
MG-E205AH with Fixture : Pin #5 - Pin #8
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

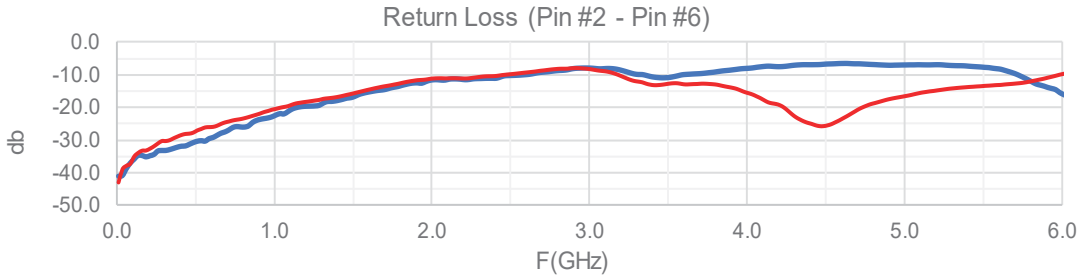


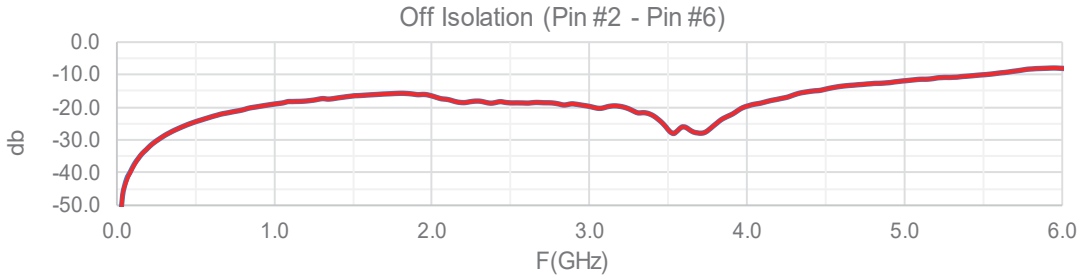

Insertion Loss (Pin #3 - Pin #6)
db
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Return Loss (Pin #3 - Pin #6)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #3 - Pin #6)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Insertion Loss (Pin #2 - Pin #6)
db
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)

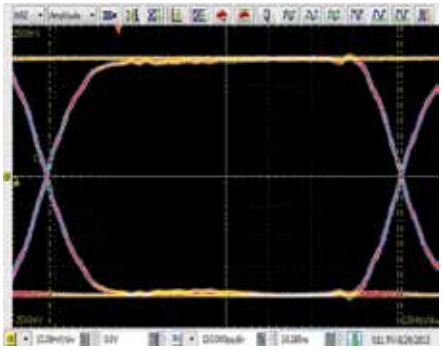

Return Loss (Pin #2 - Pin #6)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #2 - Pin #6)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)

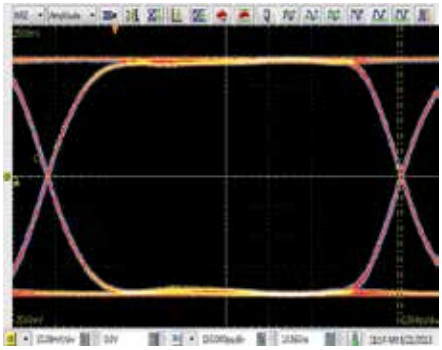
MH-E1TxxJH

Eye Diagram

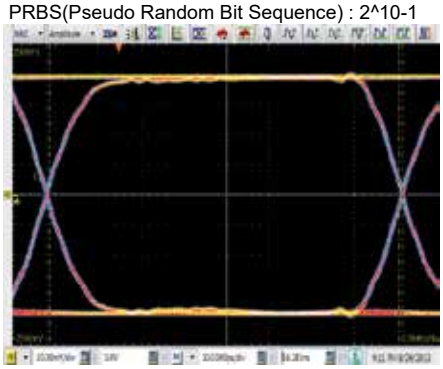
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



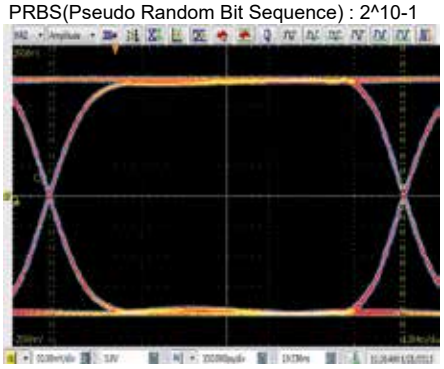
MH-E1T05JH with Fixture : Pin #2 - Pin #6
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



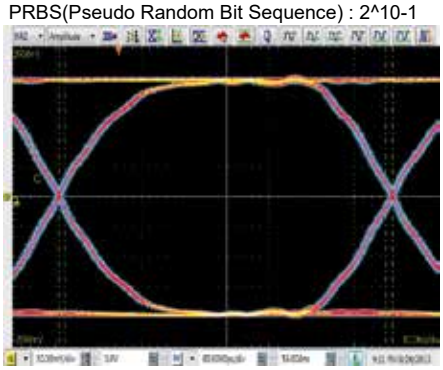
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



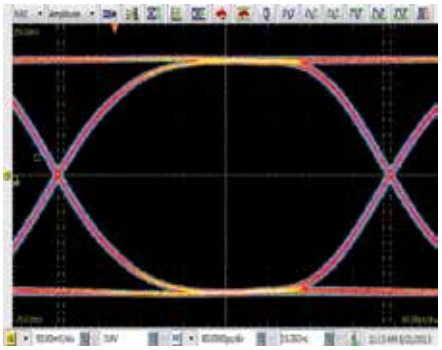
MH-E1T05JH with Fixture : Pin #3 - Pin #6
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



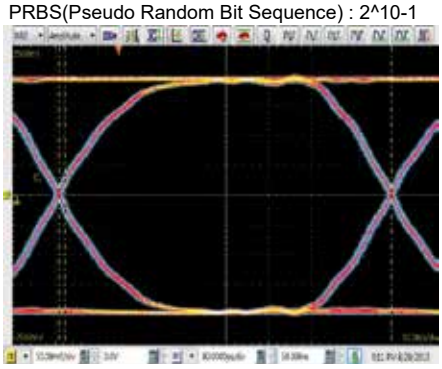
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



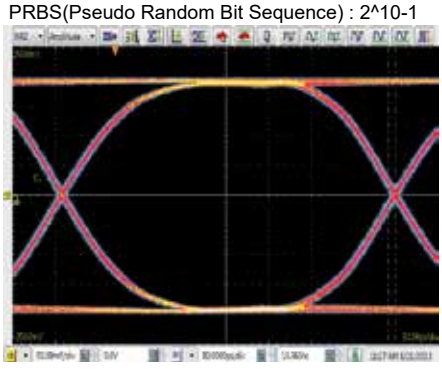
MH-E1T05JH with Fixture : Pin #2 - Pin #6
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

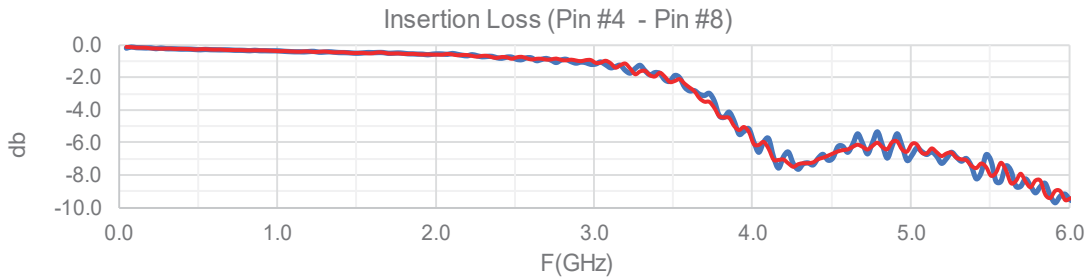


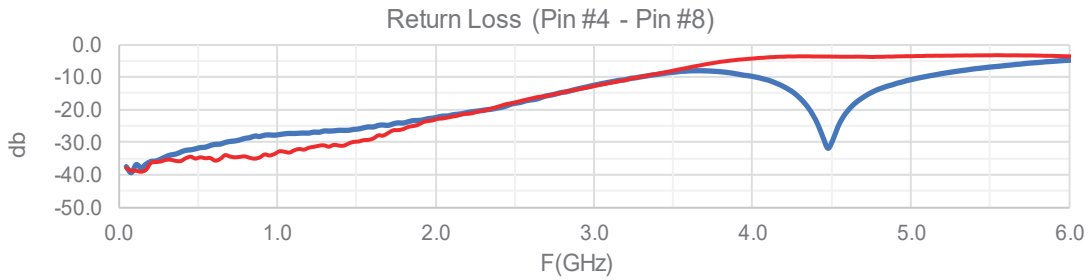
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

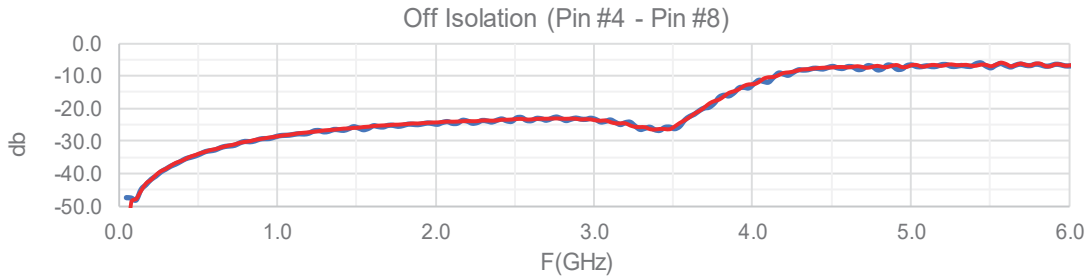


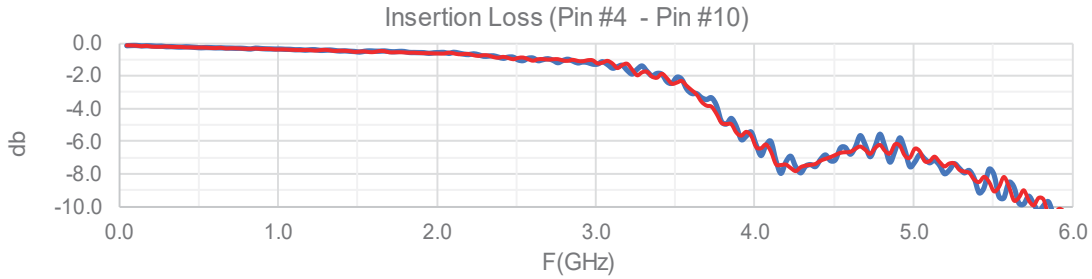
MH-E1T05JH with Fixture : Pin #3 - Pin #6
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

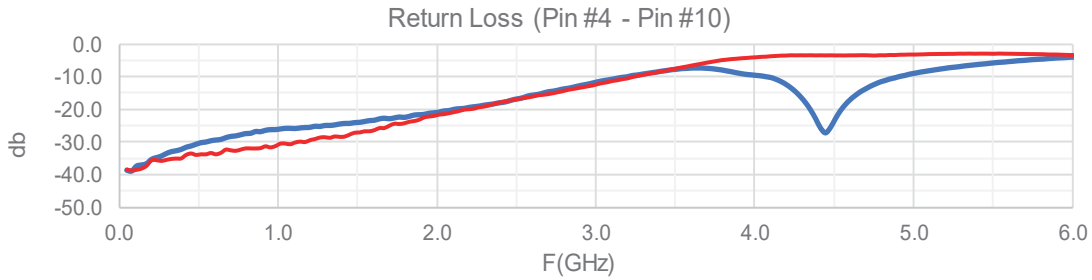


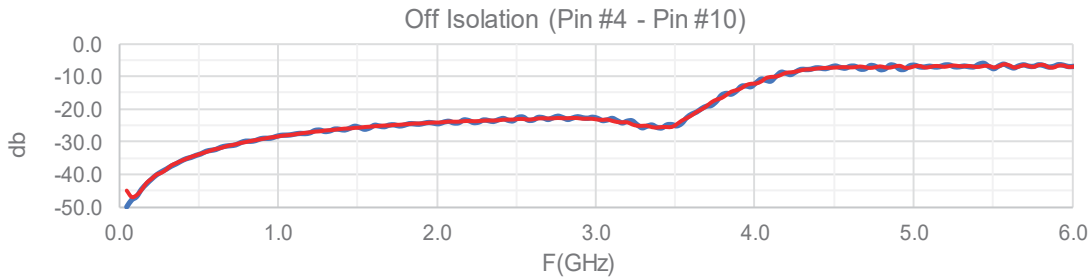

Insertion Loss (Pin #4 - Pin #8)
db
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Return Loss (Pin #4 - Pin #8)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #4 - Pin #8)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Insertion Loss (Pin #4 - Pin #10)
db
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)

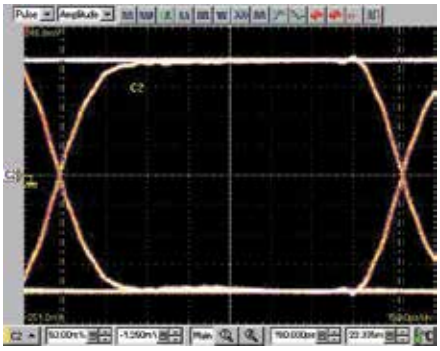

Return Loss (Pin #4 - Pin #10)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #4 - Pin #10)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)

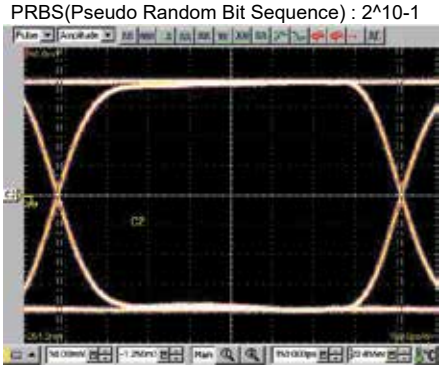
MGT/MJT-E1xxH

Eye Diagram

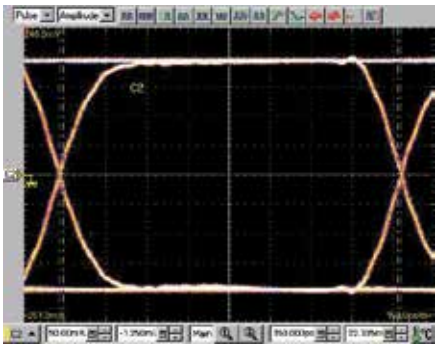
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



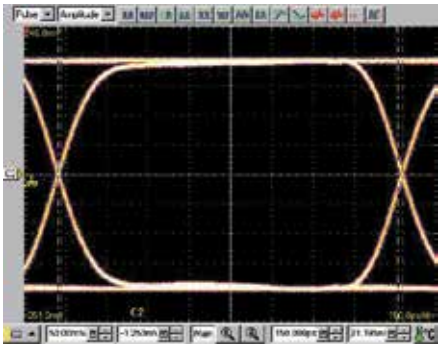
MGT-E105H with Fixture : Pin #4 - Pin #8
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



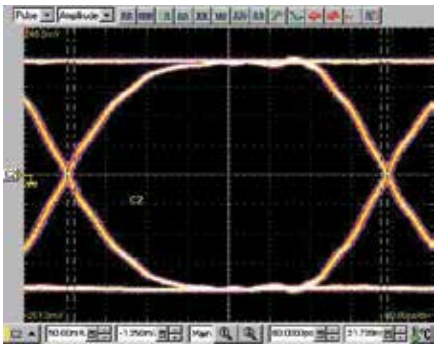
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



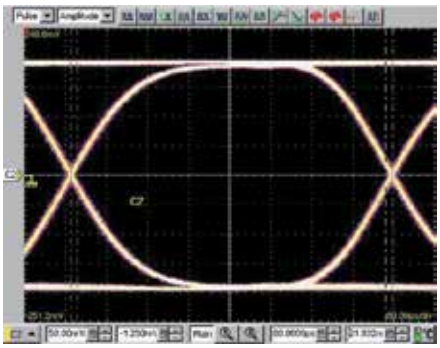
MGT-E105H with Fixture : Pin #4 - Pin #10
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



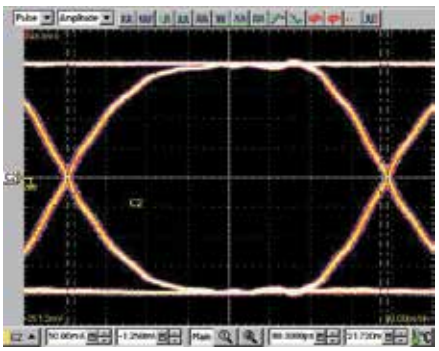
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



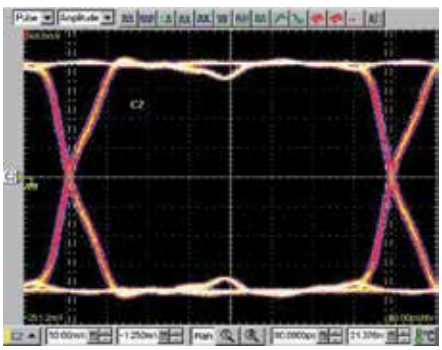
MGT-E105H with Fixture : Pin #4 - Pin #8
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

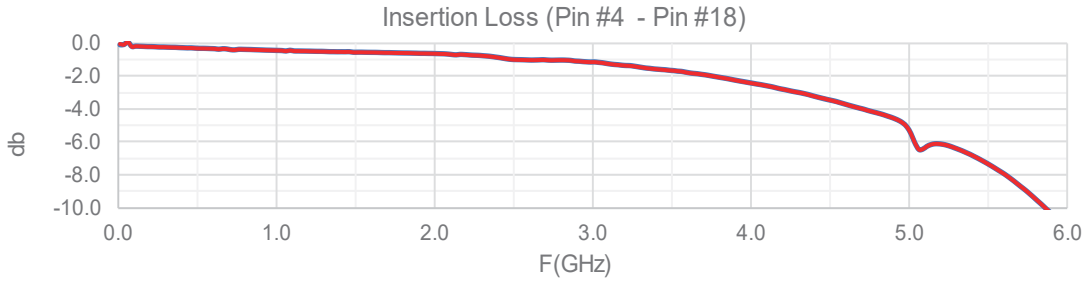


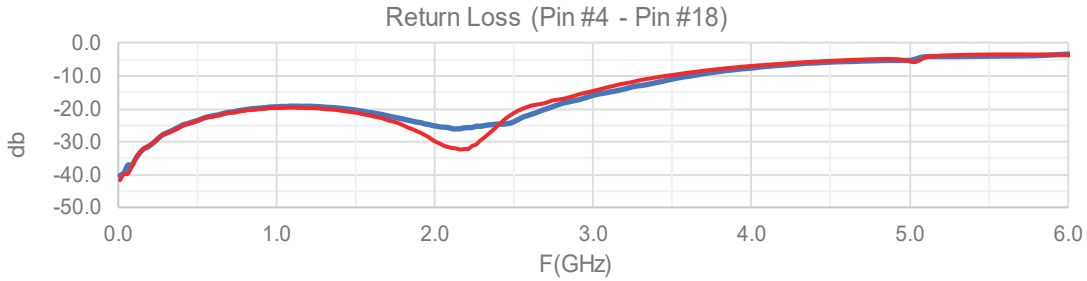
MGT-E105H with Fixture : Pin #4 - Pin #10
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1

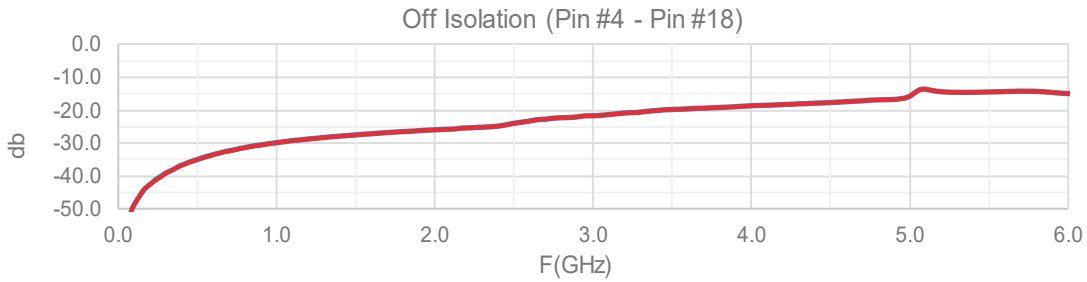


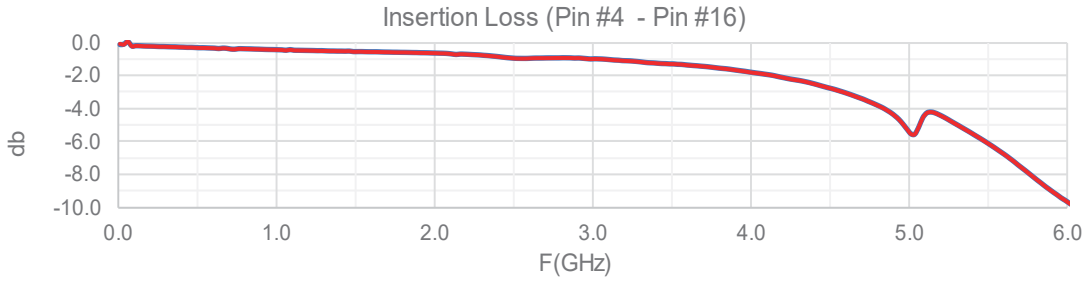
MJ-E2TxxN

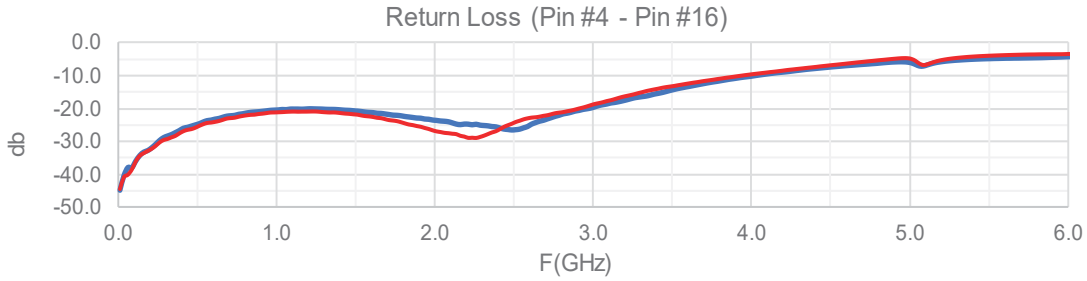
S-Parameters

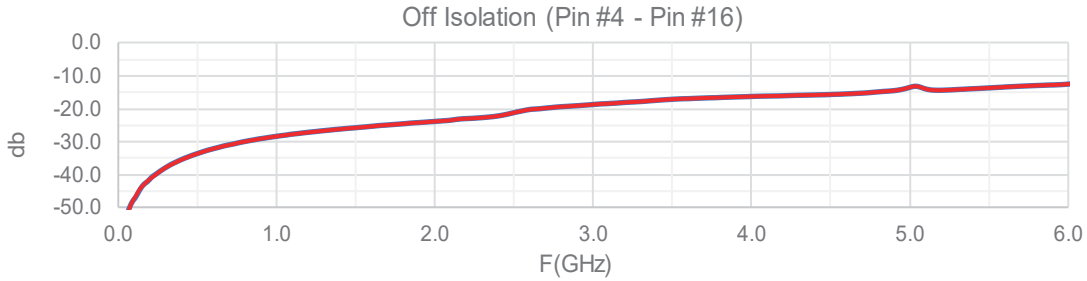


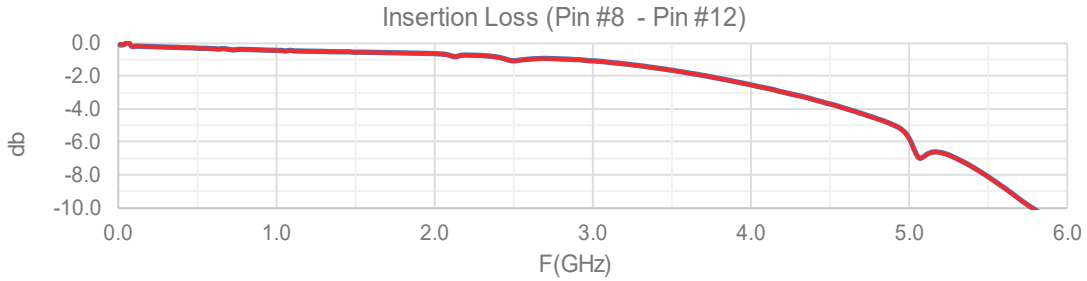


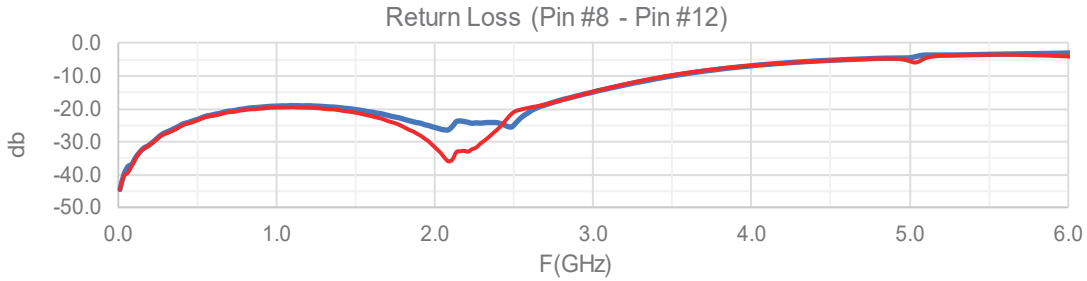


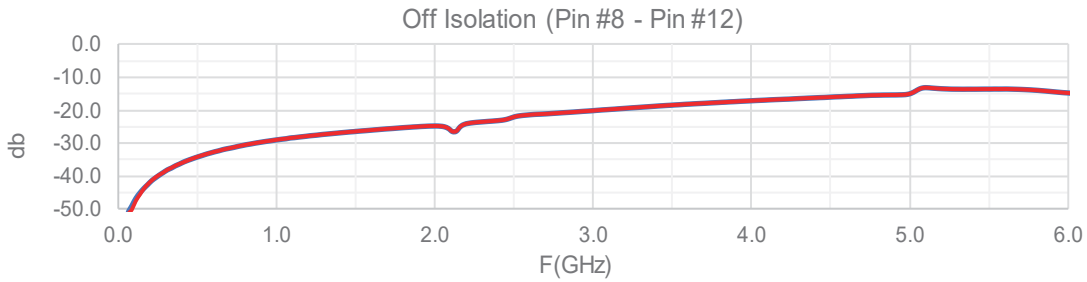







Insertion Loss (Pin #8 - Pin #12)
db
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Return Loss (Pin #8 - Pin #12)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #8 - Pin #12)
db
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-20.0
-30.0
-40.0
-50.0
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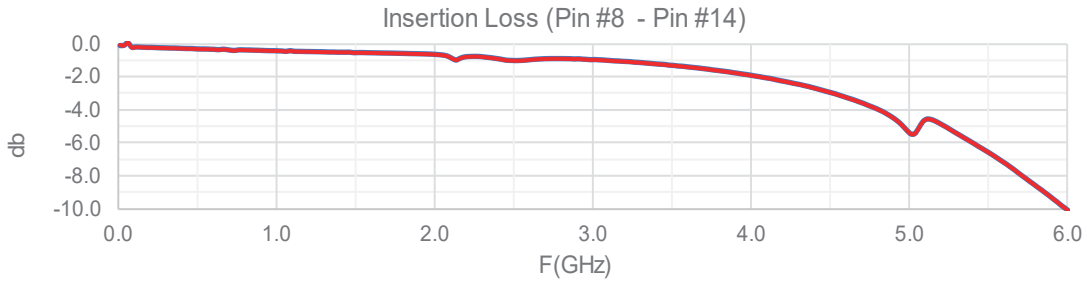
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Insertion Loss (Pin #8 - Pin #14)
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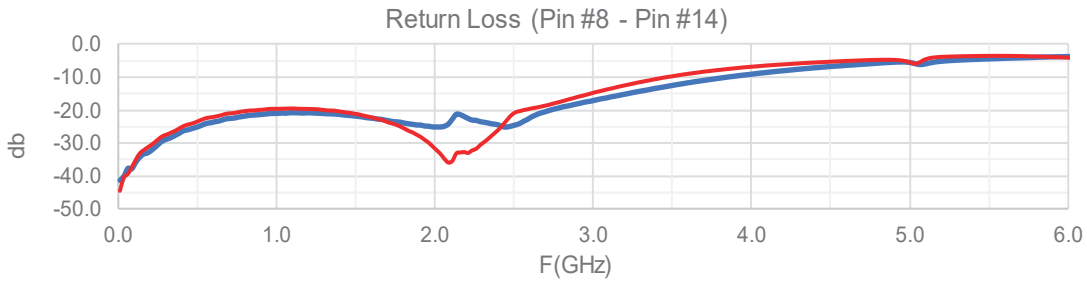
-2.0
-4.0
-6.0
-8.0
-10.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Return Loss (Pin #8 - Pin #14)
db
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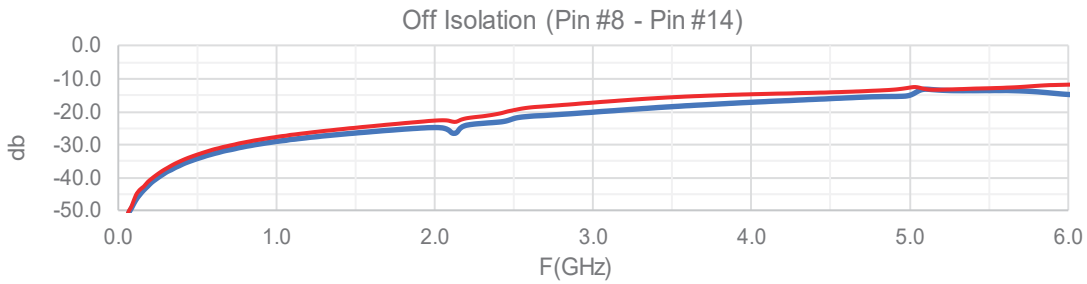
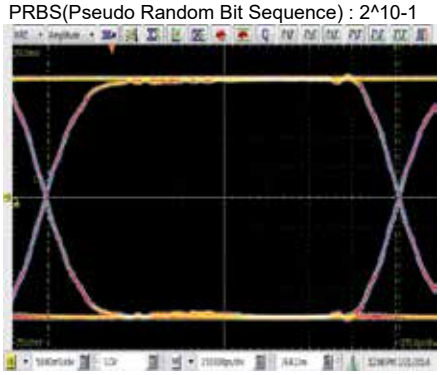
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)


Off Isolation (Pin #8 - Pin #14)
db
0.0
-10.0
-20.0
-30.0
-40.0
-50.0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
F(GHz)

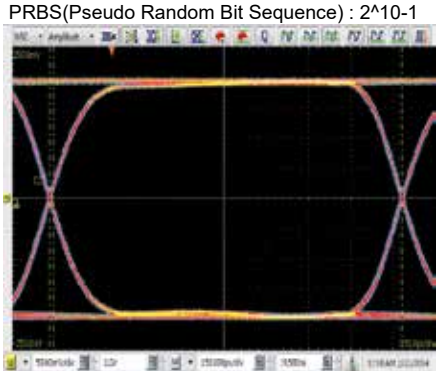
MJ-E2TxxN

Eye Diagram

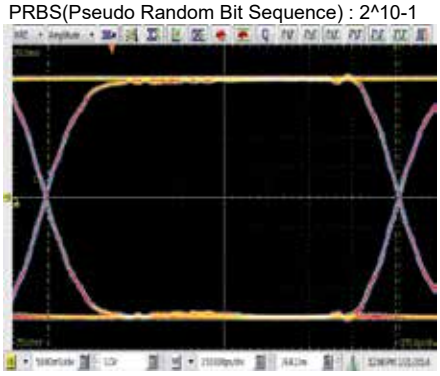
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



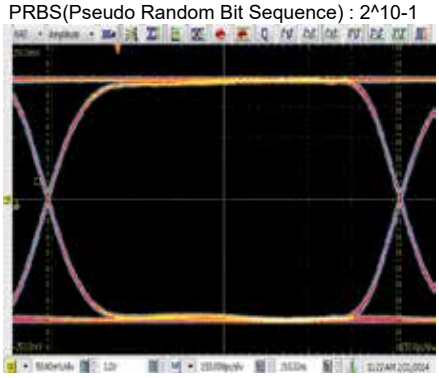
MJ-E2T05N with Fixture : Pin #4 - Pin #18
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



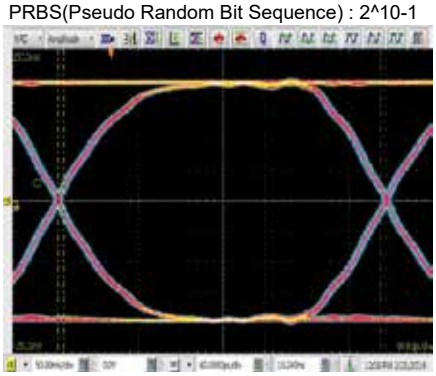
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



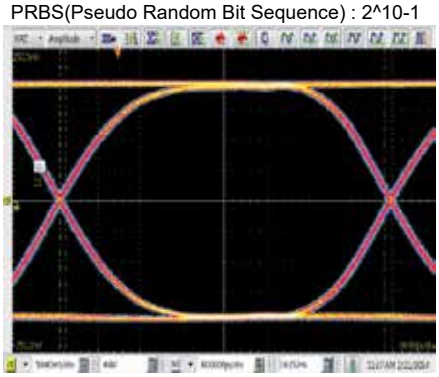
MJ-E2T05N with Fixture : Pin #4 - Pin #16
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



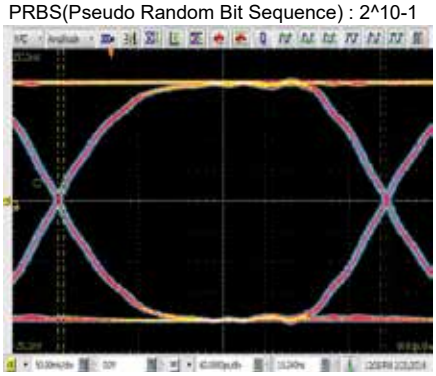
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



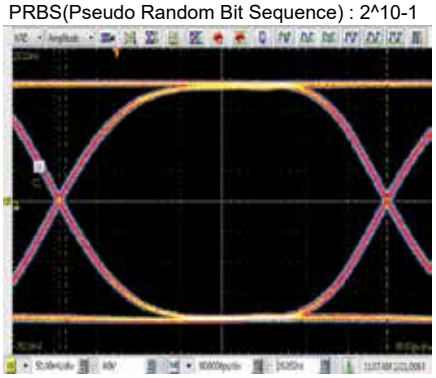
MJ-E2T05N with Fixture : Pin #4 - Pin #18
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



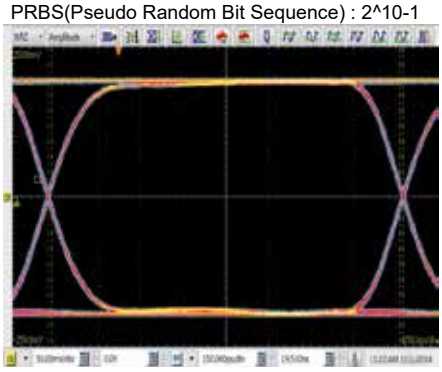
MJ-E2T05N with Fixture : Pin #4 - Pin #16
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



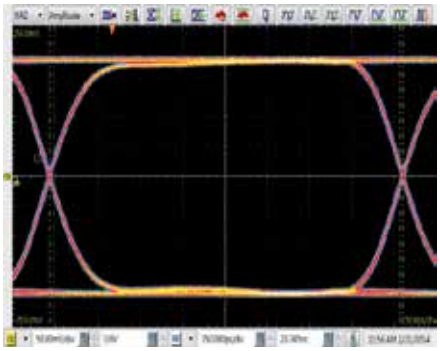
MJ-E2TxxN

Eye Diagram

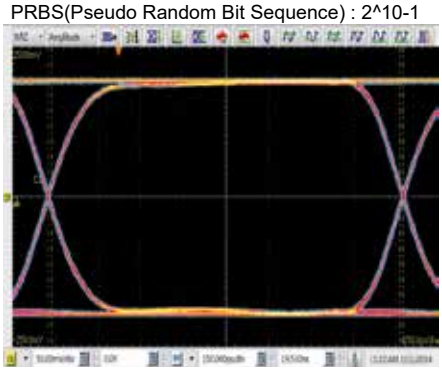
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



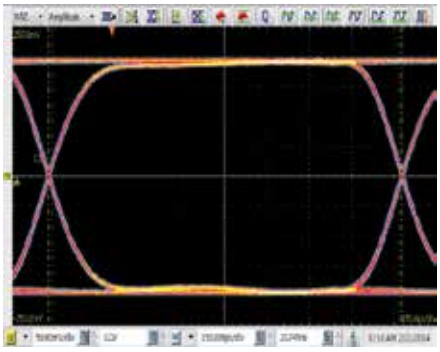
MJ-E2T05N with Fixture : Pin #8 - Pin #12
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



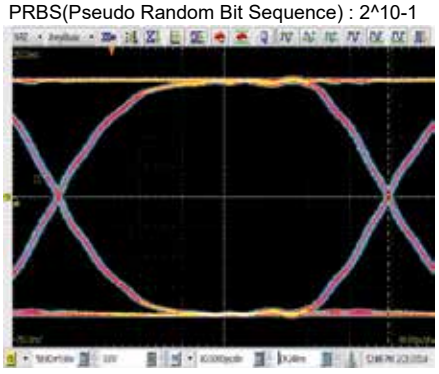
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



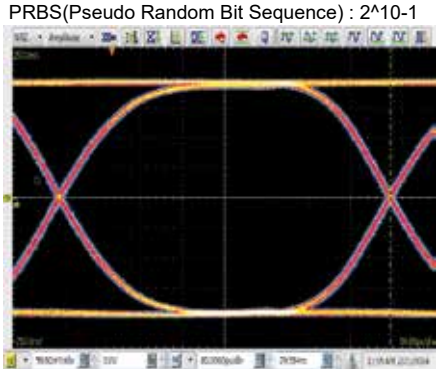
MJ-E2T05N with Fixture : Pin #8 - Pin #14
Rise Time ≒ 250ps Bit Rate : 800Mb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



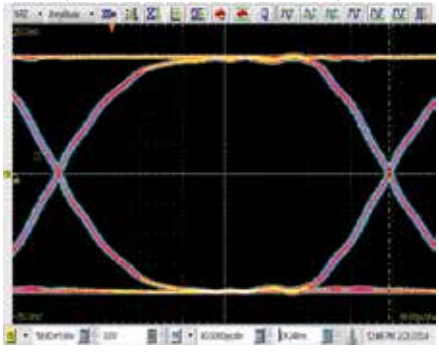
Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



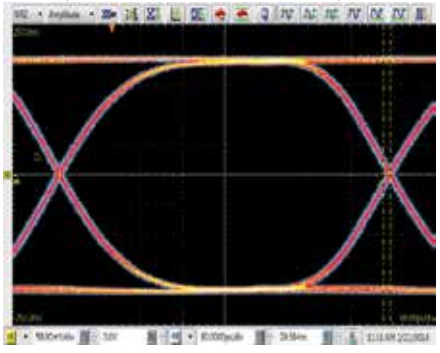
MJ-E2T05N with Fixture : Pin #8 - Pin #12
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



Thru_Fixture
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



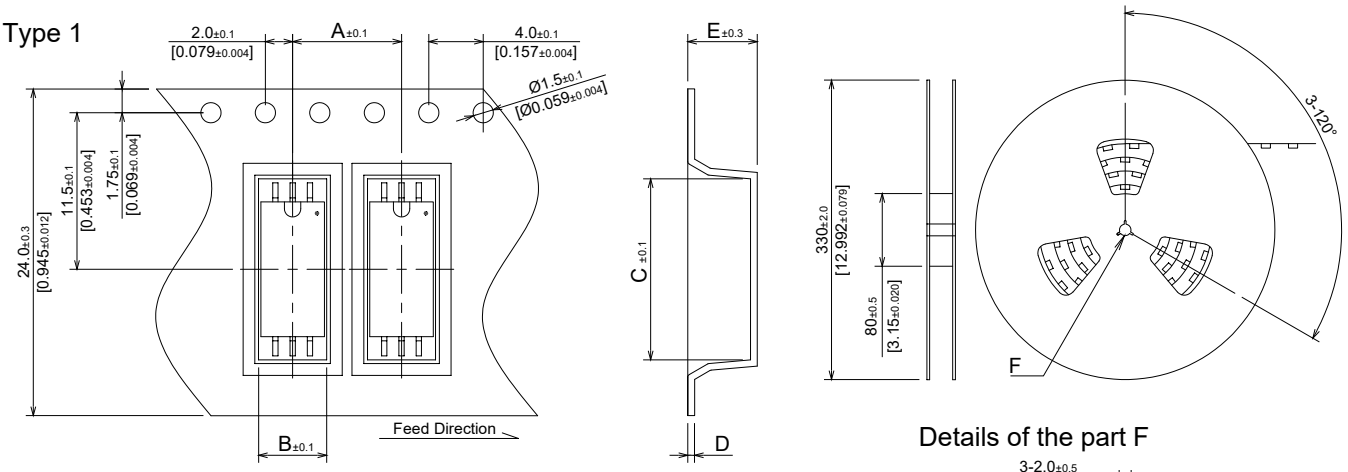
MJ-E2T05N with Fixture : Pin #8 - Pin #14
Rise Time ≒ 250ps Bit Rate : 1.6Gb/s
PRBS(Pseudo Random Bit Sequence) : 2^10-1



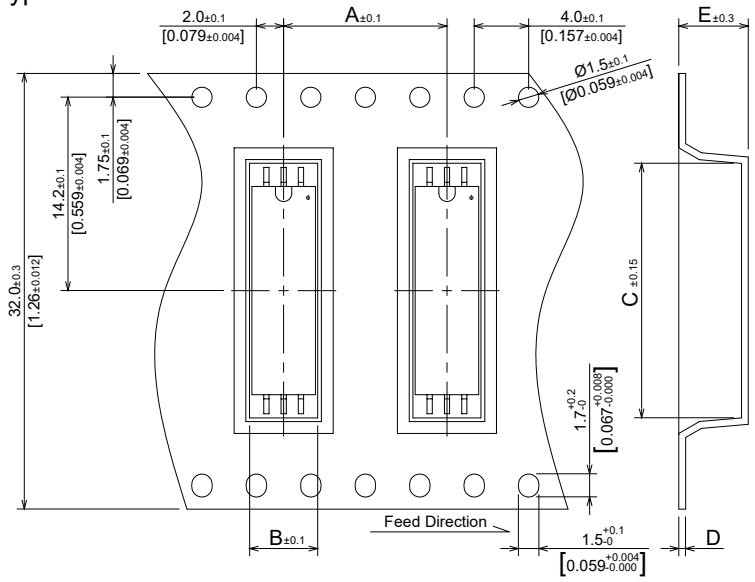
Dimensions of Tape and Reel

< All Dimensions are mm [inch] >

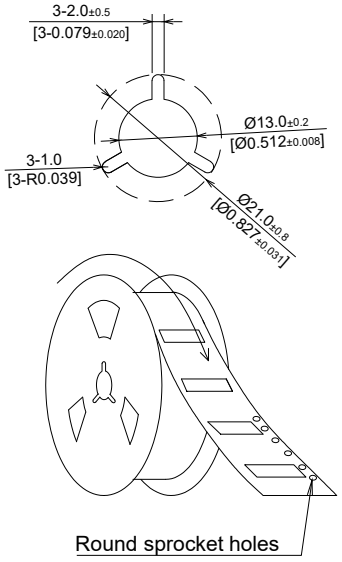
Type 1



Type 2



Details of the part F



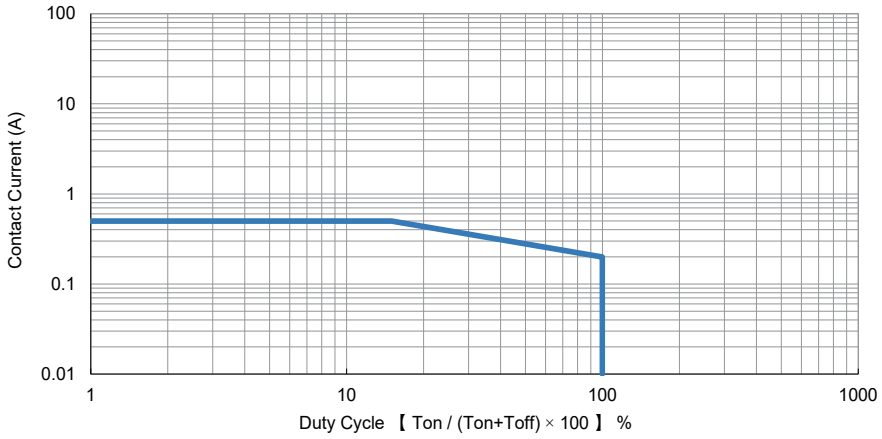
Packing conforms to EIA standard EIA-481-2 or EIA-481-3

Dimensions value detail and Packing Quantity

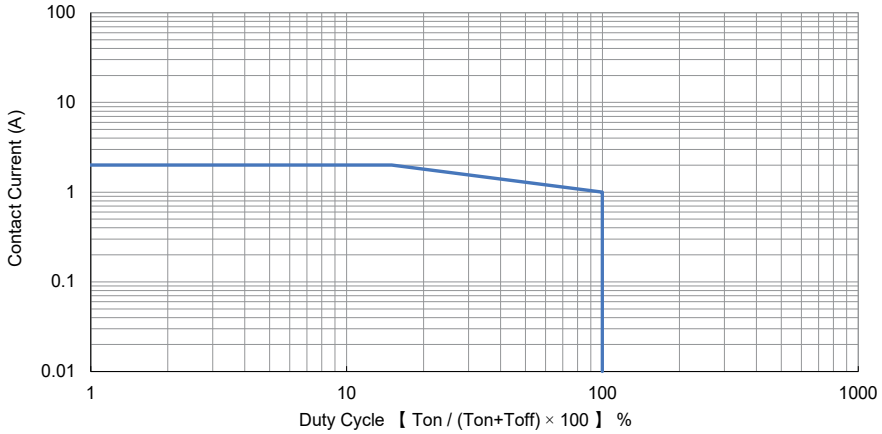
Model Name	Type	A		B		C		D		E		SPQ
		mm	inch	mm	inch	mm	inch	mm	inch	mm	inch	
UJ-1xxRF	1	8.0	0.315	4.9	0.193	8.5	0.335	0.5	0.020	4.4	0.173	2,000
CJ-E1xxRF	1	12.0	0.472	4.9	0.193	9.4	0.370	0.4	0.016	4.3	0.169	1,000
MG-E105H-64	1	12.0	0.472	5.0	0.197	13.3	0.524	0.5	0.020	5.1	0.201	1,000
CJ-E1xx	1	8.0	0.315	4.0	0.157	9.5	0.374	0.5	0.020	4.4	0.173	2,000
MG-E1xx	1	12.0	0.472	5.0	0.197	13.3	0.524	0.5	0.020	5.1	0.201	1,000
MJ-E1xx	1	12.0	0.472	4.9	0.193	11.0	0.433	0.4	0.016	5.5	0.217	1,000
MSG-1xxAK3H	2	12.0	0.472	4.9	0.193	20.8	0.819	0.5	0.020	5.4	0.213	1,000
MG-E2xxAH	1	12.0	0.472	7.0	0.276	13.2	0.520	0.5	0.020	5.7	0.224	500
MJ-E2xxAH	1	12.0	0.472	6.8	0.268	10.4	0.409	0.5	0.020	6.0	0.236	500
MH-E1TxxJH	1	12.0	0.472	5.4	0.213	10.75	0.423	0.5	0.020	9.0	0.354	500
MGT-E1xxH	1	12.0	0.472	8.0	0.315	13.1	0.516	0.5	0.020	5.7	0.224	500
MJT-E1xxH	1	12.0	0.472	8.3	0.327	11.0	0.433	0.5	0.020	5.9	0.232	500
MJ-E2TxxN	1	16.0	0.630	11.6	0.457	10.6	0.417	0.5	0.020	5.5	0.217	500

Pulse current reduction curve

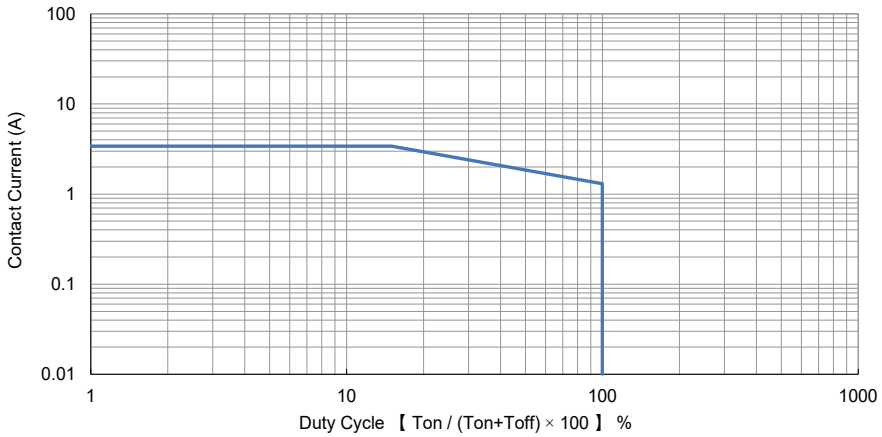
UJ Series



CJ / MG / MJ / MH / MGT / MJT Series



MSG Series

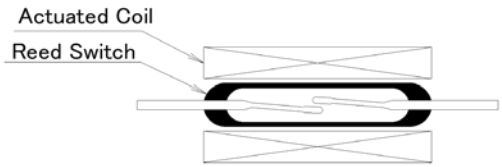


Overview of Reed Relays

1) What are reed relays

A reed relay is based around a reed switch. A reed switch contains two ferromagnetic reeds sealed inside a glass tube facing each other with a small gap between them. The glass tube is filled with an inert gas to prevent the contacts from being activated, and the contacts are plated with a special metal.

The relay opens and closes the contacts by moving the switch reeds with the magnetic force generated from a coil wound around the glass tube of the switch.



2) Comparison of reed relays and other relays

Item	Reed Relay	Mechanical Relay (hinged)	Mechanical Relay (plunger)	SSR	Optical MOS
Appearance	◎	◎	△	○	◎
Number of contact poles	○	○	◎	△	△
Power consumption	○	○	△	◎	◎
Response speed	○	△	△	◎	○
Contact reliability	○	△	△	◎	◎
Bounce	○	△	△	◎	◎
Insulation	○	○	◎	△	○
Durability	○	○	△	◎	◎
Transient response	◎	◎	◎	△	△
Operation noise	○	△	△	◎	◎
Vibration and shock resistance	△	△	△	◎	◎
Surrounding environment	○	△	△	○	◎
Contact resistance	◎	◎	◎	△	△
Current leakage	◎	◎	◎	△	○
Opening and closing capacity	○	○	◎	◎	△

3) Terminology

Terms	Explanation		
		Non-operating state	Operating state
1 Contact types	Form A (1 make)		
	Form B (1 break)		
	Form C (transfer)		
	Form C (A+B) (make-break)		
	Form (A+B) (make-break)		
2 Rated voltage	This is the specified voltage that is applied to the coil to operate the relay. The allowable fluctuation of the rated voltage is within ±10% (at 20°C).		
3 Coil resistance	The coil resistance of the relay is expressed in Ω.		
4 Operate voltage	This is the minimum coil voltage required to operate the relay. For example, if a voltage of 3.3V is applied to a relay with an operating voltage of 3.75V, it will not operate.		
5 Release voltage	This is the coil voltage required to return an activated relay to a deactivated state. For example, if a voltage of 0.5V is applied to a relay with a release voltage of 1.2V, it will assume a deactivated state. If a voltage of 1.5V is applied, it will not assume a deactivated state.		
6 Maximum switching voltage	This is the max voltage (at 1mA) that can open/close the contacts when a load is connected. ("peak voltage value" for AC) However, please use within the maximum contact capacity (see 9. below). Using a voltage that exceeds the maximum switching voltage may cause the contacts to melt or accelerate deterioration.		
7 Maximum switching current	This is the max current that can open/close the contacts when a load is connected to the contacts. ("peak current value" for AC) However, please use within the maximum contact capacity (see 9. below). Using a current that exceeds the maximum switching current may cause the contacts to melt or accelerate deterioration.		
8 Maximum carry current	This is the maximum current that can flow continuously after the contacts are closed. When opening the contacts, do so at a current value less than the maximum switching current.		
9 Maximum contact capacity	This is the maximum load capacity (switching voltage x switching current) that can be switched without practical problems. Using a capacity value that exceeds the maximum contact capacity may cause the contacts to melt or accelerate deterioration.		
10 Electrical lifespan	This is the lifespan when a load is applied to the contacts. The lifespan of a relay varies depending on the size and type of load, and frequency of use.		
11 Contact resistance (initial value)	This is the resistance between the terminals when the contacts are closed.		
12 Contact resistance variation (initial value)	The contact resistance is measured 5 times and a range between the min and max values is set to ensure stability of the value.		
13 Insulation resistance	This is the resistance of the insulated parts between contacts/coils/conductive terminals and non-conductive terminals (such as an iron core frame or iron core), or between contacts themselves.		
14 Electrostatic capacitance	This is the capacitance between contacts, coils, and conductive terminals.		
15 Breakdown voltage	This is the limit value at which insulation breakdown does not occur between each conductor of the relay. This is the voltage that can be withstood even if a surge is applied between the contacts when the contacts are not operating. For a voltage pulse applied immediately after the contacts operate, the maximum switching voltage is the standard value.		
16 Operate time	This is the time from when the rated voltage is applied to the coil until the contacts operate. (Including bounce. Form A/Form C/FORM (A+B))		
17 Release time	This is the time it takes for the contacts to reset after the rated voltage is removed from the coil. (Including bounce. Form B/Form C/FORM (A+B))		
18 Vibration	This is the vibration resistance value that does not cause changes in properties.		
19 Shock	This is the shock resistance value that does not cause changes in properties.		

4) Precautions for use

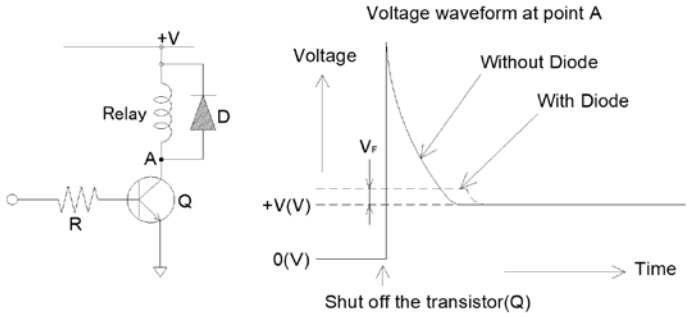
4-1) Adding a surge absorbing diode

When driving a coil, please add a clamp diode in parallel to the coil as shown in the diagram on the right.

4-2) Back electromotive force (EMF) of the coil

This is the voltage that occurs in an inductive circuit when the current changes and the polarity of the induced voltage at each instant is opposite to the polarity of the applied voltage.This phenomenon does not occur during direct current flow where the current does not change; however,care must be taken as back EMF occurs when the current begins to flow or is cut off.

The voltage waveform at point A in the diagram can be as much as 10 times the applied voltage,and when a reed relay (coil) on/off is controlled by a transistor,this can exceed the transistor's withstand voltage (V CE) and destroy the transistor.For this reason, a protection circuit of a diode in parallel with the reed relay (coil) is effective in absorbing the back EMF.



* If a diode is installed, the release time will be slower due to the influence of VF (diode forward voltage).

4-3) Terminal bending

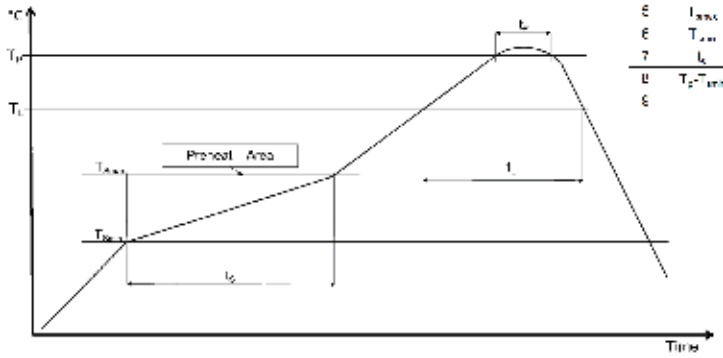
When bending the relay terminals for installation, hold the terminals in place with lead pliers before bending them. When bending, be careful not to put undue stress on the base of the terminal.

4-4) Soldering conditions

a) Soldering iron: 300 to 350°C

b) Automatic soldering: 230 to 260°C

c) For reflow soldering



No	Symbol	Content	Condition
1	T_P	Peak temperature	260°C
2	t_p	Time in peak temperature	60s max
3	T_L	Liquidous temperature	217°C
4	t_L	Time (t_L) maintained above T_L	60s~150s
5	T_{smax}	Preheat Max temperature	200°C
6	T_{smin}	Preheat Min temperature	150°C
7	t_s	Preheating time	60s~120s
8	T_P-T_{smax}	Cooling rate	6°C/s max
9		Number of reflow cycles	Three times

4-5) Cleaning

If, after soldering the relay, the board is washed with a solvent (alcohol-based, freon-based) or pure water to remove flux, please note the following:

a) Cleaning with solvents may cause markings to fade, chip, or disappear.

b) Avoid ultrasonic cleaning

c) Do not perform cleaning in a bath with a large magnetic field as this will change the properties of the relay.

* Please contact us regarding whether cleaning is possible.

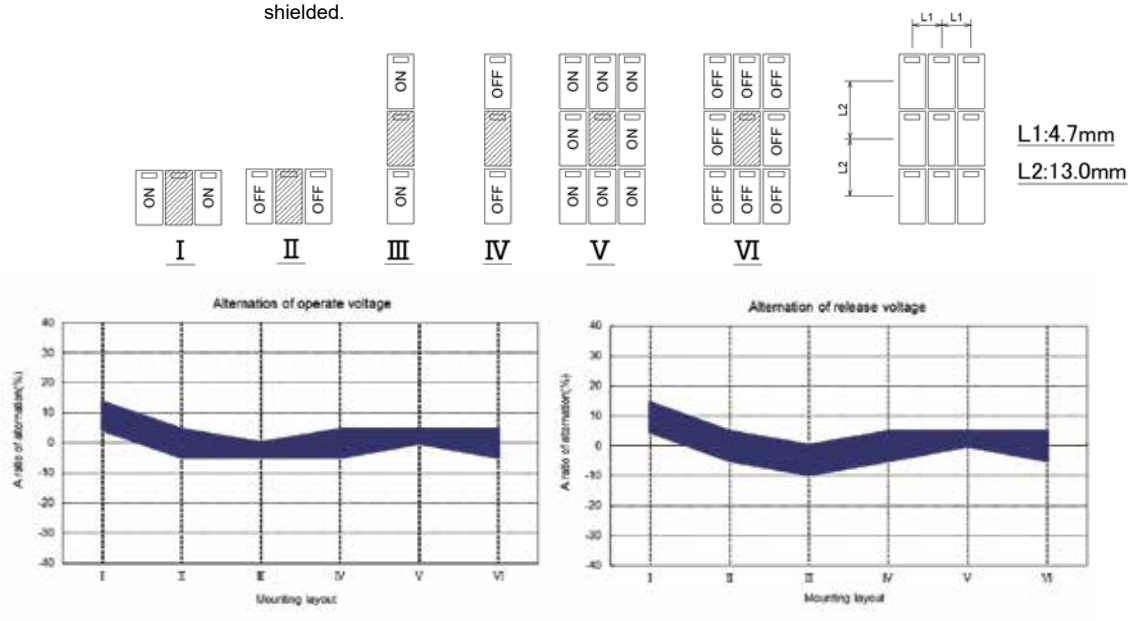
4-6) Magnetic interference

When multiple reed relays are mounted close together, mutual magnetic interference occurs,causing operating and release voltage fluctuations.The diagrams below illustrate how different configurations of surrounding reed relays can magnetically interfere with the reed relay in the center. This value changes depending on whether or not electricity is applied.

The graphs shows the variations in operation of the central reed relay.

A magnetic shield is an effective way to suppress these fluctuations.

Note: Using a relay in an environment where a strong magnetic field is generated by an external transformer or permanent magnet may cause the relay to malfunction even if it is magnetically shielded.



4-7) Mechanical shock

The properties of the relay may change if it is subjected to mechanical shock, such as being dropped

4-8) Contact protection

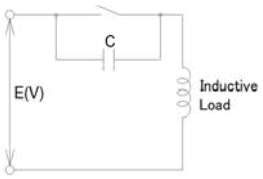
The use of contact protection elements and protection circuits can keep back EMF low, but note that using them incorrectly can have the opposite effect.

The table below shows some typical examples of contact protection circuits.

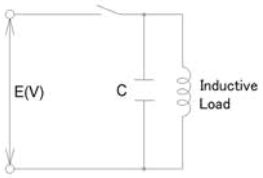
a) Inductive load

Item / Category	Circuit Example	Applications AC	Applications DC	Properties, etc.	Component selection
CR Method		○	○	When used with AC voltage, the load impedance must be significantly smaller than the CR impedance. When the contacts are open, current flows through the capacitor and resistor to the inductive load.	C & R guidelines: Capacitor: 0.5 to 1 μF per 1A of contact current. Resistor: 0.5 to 1 Ω per 1V of contact voltage. The set times, due to the nature of the inductive load and variations in relay characteristics. Please confirm this through experiments, keeping in mind that the capacitor is responsible for the discharge control effect when the contacts are opened, and the resistor is responsible for limiting the current when the circuit is next turned on. Generally, the withstand voltage of the capacitor should be 200 to 300V. For AC circuits, use AC capacitors (no polarity).
		○	○	If the load is a relay or solenoid, the release time will be delayed. When the power supply voltage is 24 or 48V, it is better to connect between the loads. When it is 100 to 200V, connecting between the contacts is better.	
Diode Method			○	The energy stored in the inductive load is passed in the form of current to the coil via a parallel diode, and is dissipated as Joule heat by the resistance of the inductive load.	Use a diode with a reverse withstand voltage of 10 times or more than the circuit voltage and a forward current equal to or greater than the inductive load current. In electronic circuits, if the circuit voltage is not very high, use one with a reverse withstand voltage of about 2 to 3 times the power supply voltage (or more).
Diode + Zener Diode Method			○	Operates when the reverse time is similar to the diode method.	Use a zener diode with a zener voltage about the same as the power supply voltage.
Varistor Method			○	This method uses the constant voltage characteristics of the varistor to prevent high voltage from being applied across the contacts. When the power supply voltage is 24 or 48V, it is better to connect between the loads. When it is 100 to 200V, connecting between the contacts is better.	

Avoid using circuits like those shown below.



Very effective in extinguishing the arc when cut off, but because capacitance is stored in C when the contacts are opened,a short-circuit current flows in C when the contacts are closed,making them susceptible to becoming fused together.

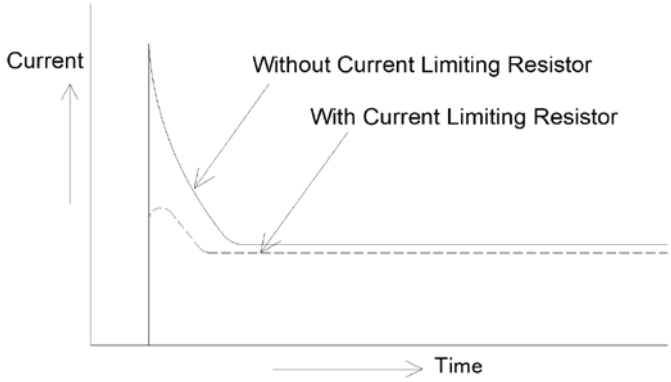


Very effective in extinguishing the arc when cut off,but a charging current flows in C when the contacts are closed making them susceptible to becoming fused together.

b) Lamp load (inrush current), etc

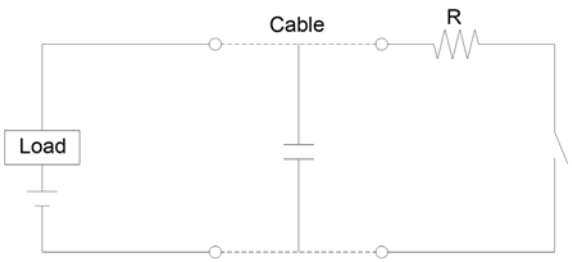
When the contact load is a lamp, motor, solenoid, capacitor, etc., an inrush current several times to several dozen times the steady-state current flows when the contact is closed.'If this inrush current exceeds the allowable range, it can cause contact failure due to contact fusion or transfer of contact metal. The allowable inrush current of a reed relay is determined by factors such as the magnitude of the inrush current, its waveform, and the number of cycles required of the reed relay contacts.

Inserting a current-limiting resistor in series with the contacts is an effective way to suppress the inrush current below the maximum switching current. Please refer to the diagram to check whether the product can be used under the actual conditions.



c) Line-to-line stray capacitance

Inrush current that occurs when line-to-line stray capacitance is large can be a problem.As shown in the figure, the charge stored in the stray capacitance between the lines is discharged when the contacts are closed.The smaller the impedance of the wiring cable and the longer the cable, the greater the contact wear.Please insert a current-limiting resistor in series with the contact as a protection circuit to suppress the inrush current.



4-9) Thermoelectromotive force

When dissimilar metals are connected and the junction is kept at different temperatures, a current flows through the circuit due to the Seebeck effect. The electromotive force that generates this current is called thermoelectromotive force. For reed relays, thermal electromotive forces are generated between the dissimilar metals of the terminals, contact pieces, and contact points.

When a thermocouple is switched using a reed relay, this thermoelectromotive force can cause a difference between the measured temperature and actual temperature.

Seebeck effect :

A phenomenon when different metals A and B are bonded in a ring to create a closed circuit.The two junctions are kept at different temperatures, generating an electromotive force at the junctions and causing an electric current to flow. This is the opposite of the Peltier effect.If the temperature is reversed, the electromotive force (current) will also be reversed.This phenomenon is the mechanism behind thermocouples because it allows measurement over a relatively wide temperature range.

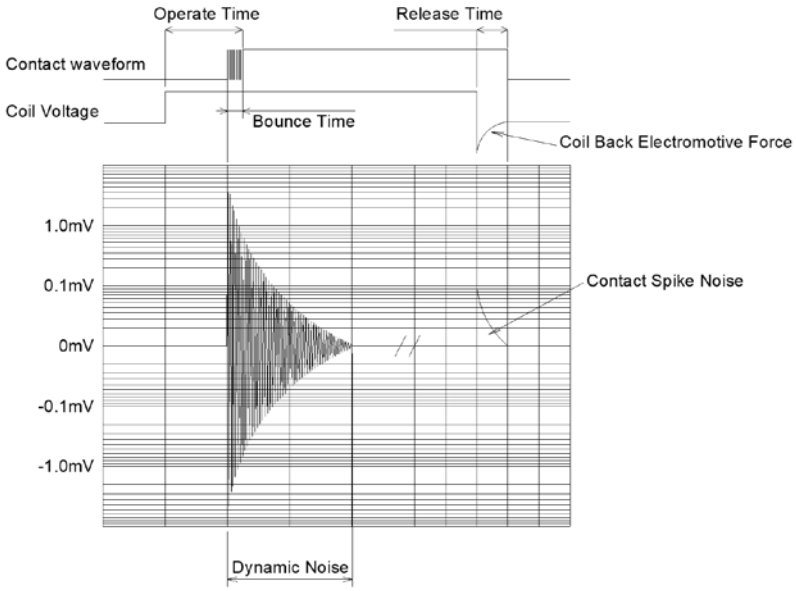
4-10) Dynamic properties of reed relays

When current flows through a reed relay, there is a consistent sequence of events that occur.

These phenomena occur regardless of the type of reed relay.

Details of these contact phenomena are shown in the figure below.

Figure: Overview of dynamic properties



Dynamic noise is a noise component that is generated mainly due to the wavering of the contacts that continues even after the bounce has ended.

Dynamic Noise

After the contacts close, the energy dissipates with damped oscillation similar to that of a plucked harp string.

During damped vibration, some areas on the contacts are stressed and generate an electrical signal.

This electrical signal is an AC audible signal with a very wide frequency range that oscillates with damped sine waves, with the amplitude and duration of the noise depending on the following conditions.

* Contact spike noise occurs when the contacts try to separate from each other after the applied voltage on the coil is removed.

- Spring strength
- Seal glass properties
- Contact material
- Coil drive power

5) Explanation of operation and measurement

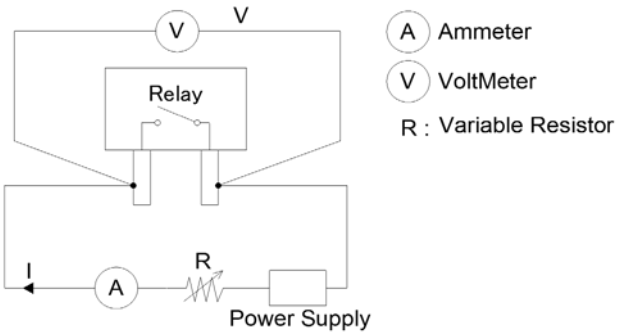
5-1) Contact resistance

Contact resistance is the combined value of the inherent resistance of the conductors that make up the circuit,such as the movable parts, terminals, and contacts, and the resistance at the point where the contacts come into contact.

The contact resistance value is an initial value, and the level of this value does not indicate whether the relay will be good or bad in actual use.The contact resistance is measured using the voltage drop method (four terminal method) as shown in the figure, with a measurement current of 1mA.

Contact measurement schematic diagram

$$\text{Contact Resistance} = \frac{V}{I}\ [\Omega]$$



5-2) Operate and release voltage

a) Operate voltage

This is the minimum voltage required for all contacts to operate when the coil voltage is increased either suddenly or gradually.

b) Release voltage

This is the voltage at which all contacts return to their original position when the coil voltage is decreased either suddenly or gradually.

5-3) Operate time

The time from when the rated voltage is applied to the coil until the contacts operate.

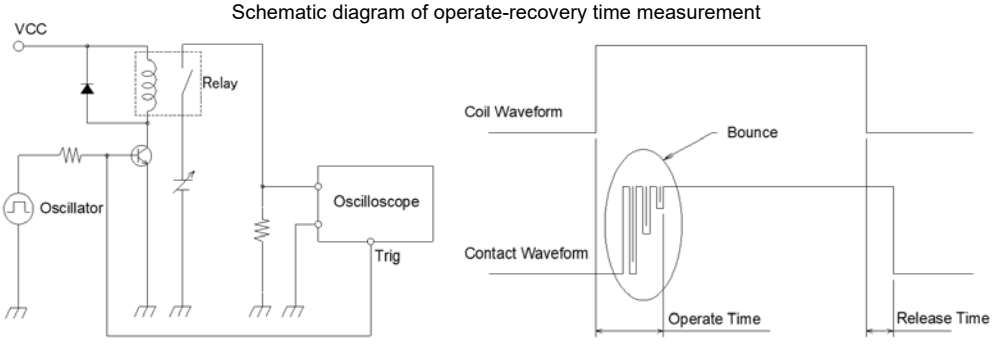
In the case of a reed relay with multiple contacts, unless otherwise specified, it will be the time it takes for the slowest contact to operate.

5-4) Release time

The time it takes for the contacts to return to their original position after the rated voltage is removed from the coil.

In the case of a reed relay with multiple contacts, unless otherwise specified, it will be the time it takes for the slowest contact to return to its original position.

Schematic diagram of operate-recovery time measurement



* What is bounce?

An intermittent switching phenomenon between contacts caused by vibration from the collision of the moving part of a contact with the moving part of the opposing contact or the backstop.

5-5) Capacitance

In a reed relay, capacitance occurs between each conductor.

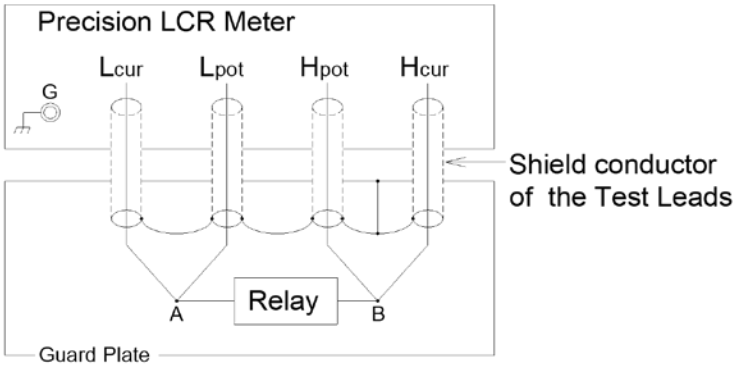
The conditions for measuring capacitance are listed below.

a) Measurement conditions

Bias voltage : 1VDC

Measurement frequency : 1MHz

Capacitance measurement schematic diagram



* When measuring capacitance, the object to be measured is suspended above the shield plate.

b) Measurement method

b-1) Points A and B are positioned based on the distance between the terminals of the relay to be measured.

b-2) The LCR Meter is calibrated.

b-3) Points A and B are connected to the relay and capacitance is measured.

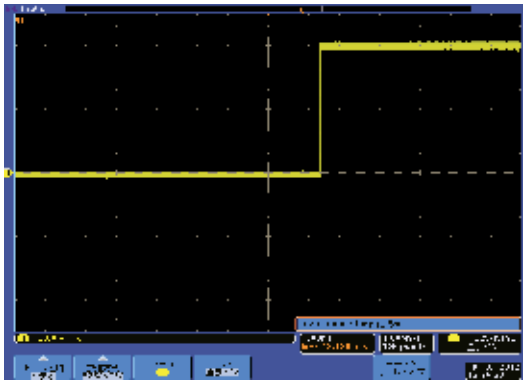
(If an electrostatic shield is attached, the terminal is connected to the GND terminal of the LCR Meter to measure the capacitance.)

5-6) Breakdown voltage

This is the limit value at which no dielectric breakdown occurs when voltage is applied for one minute to the insulated parts between contacts, coils, between conductive terminals and non-current-carrying metal parts (such as an iron core frame or iron core), or between contacts.

Testing is done in a dark room with no radiation (light or X-rays) and a leakage current (current for detecting dielectric breakdown) of 1mA.

A distinctive feature of this test is that it is performed using a fast rising waveform when measuring the breakdown voltage.(The voltage waveform during a breakdown voltage test is shown below.)



Oscilloscope Settings

Voltage range : 50V/1div

Frequency range : 1ms/1div

Exai Example of voltage waveform when 200V is applied

5-7) Insulation resistance

This refers to the resistance of the insulated parts between contacts/coils/conductive terminals and non-current-carrying metal parts (such as an iron core frame or iron core), or between contacts themselves.

This value is for the relay alone and does not include the lands on the PCB, etc.

5-8) High-frequency properties

At Sanyu, when testing high-frequency properties, we mainly evaluate the following.

TDR(Time Domain Reflectometry)

TDT(Time Domain Transmission)

Isolation

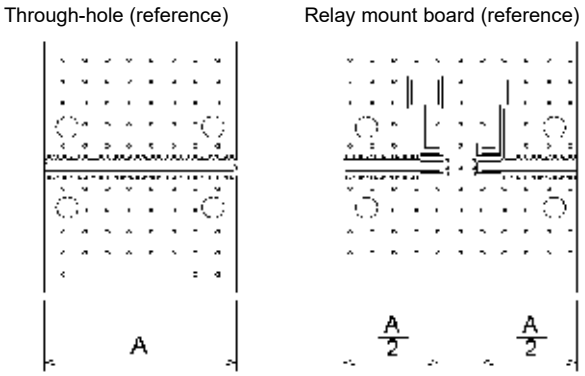
Insertion Loss

Return Loss

a) Measurement board

We use the following types of boards for evaluation.

Please note that the wiring on the board may differ depending on the product shape.



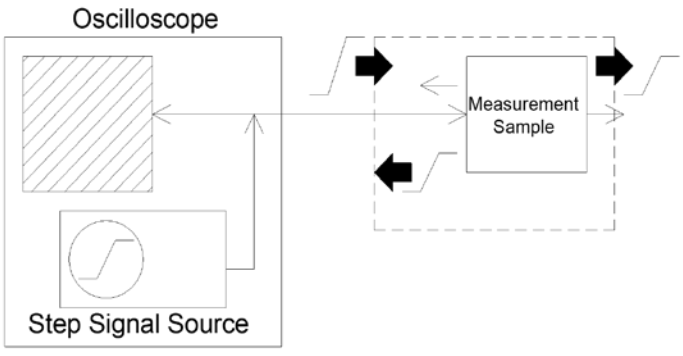
The characteristic impedance of the transmission line is 50 Ω.

(Board specifications used are an example.)

b) TDR/TDT

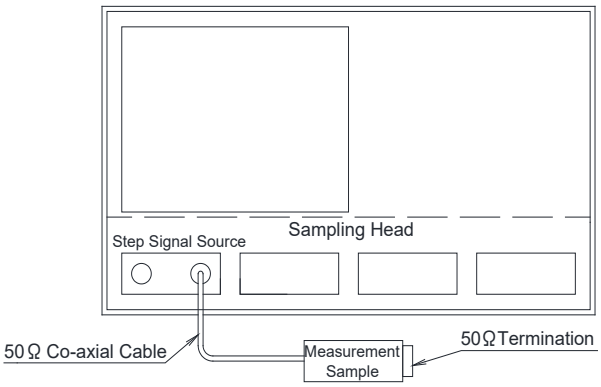
TDR measurements consist of a step signal source and a wideband oscilloscope to capture the reflected signal at the impedance discontinuity in the transmission line and display the voltage and impedance values of the reflected signal as a function of time.Additionally, measurement of the propagated transmission signal is called TDT and is used to measure propagation delay.

Since transmitted signals are distorted by reflections and delays, TDR/TDT provide intuitive measurement results and are essential evaluation criteria.



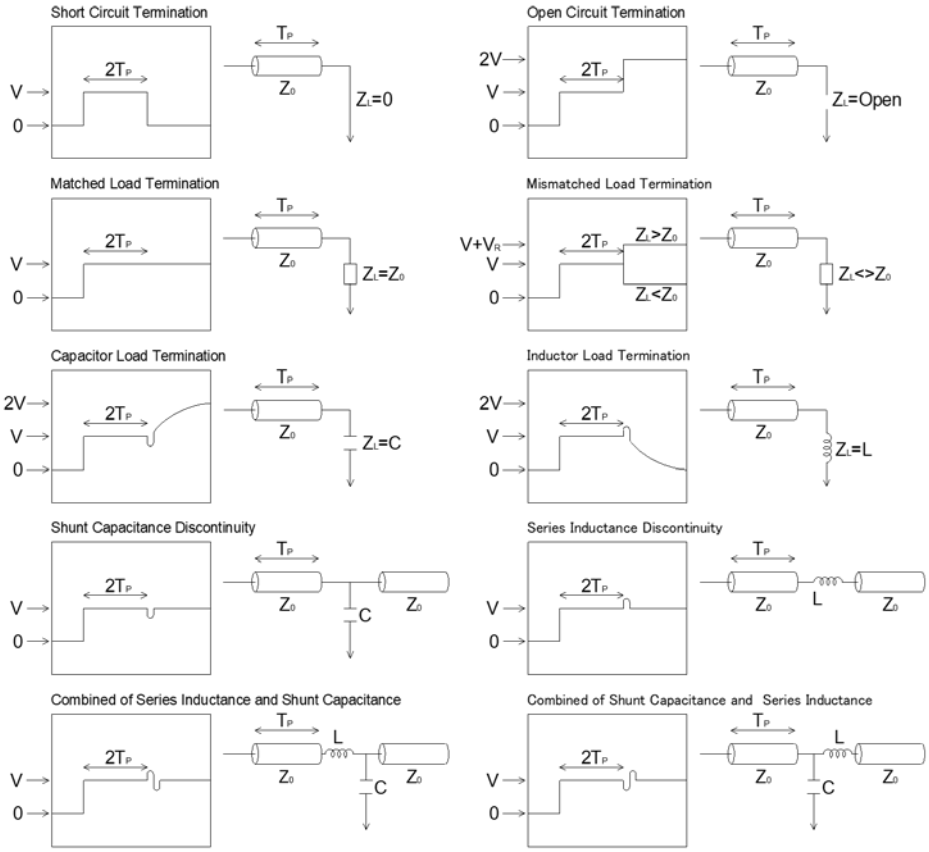
b-1) TDR measurement overview

TDR measurement schematic diagram



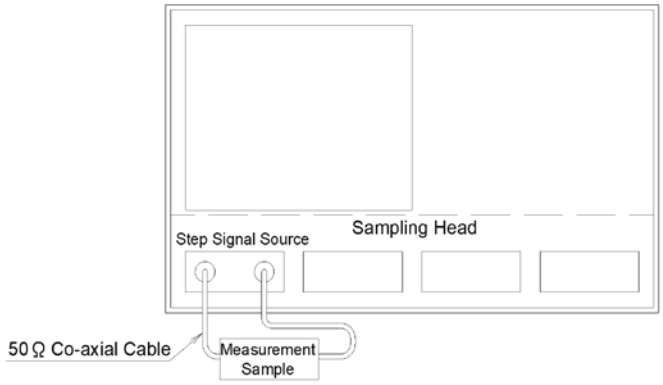
b-2) Measurement method

When the device under test is connected to the measurement equipment and output is started from the TDR signal source channel, a waveform appears on the wideband oscilloscope screen.The impedance state of the measurement sample can be understood from the waveform.
An example of a TDR measurement waveform is shown below.



b-3) TDT measurement overview

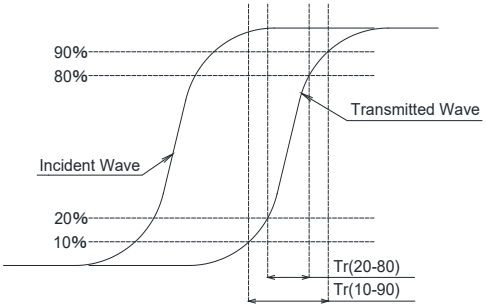
TDT measurement schematic diagram



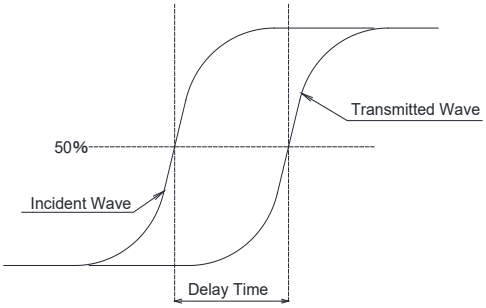
b-4) Measurement method

The voltage output from the step signal source is applied to the measurement sample and the transmitted wave is monitored. An example of a TDT measurement waveform is shown below.

Rise Time



Delay Time Waveform

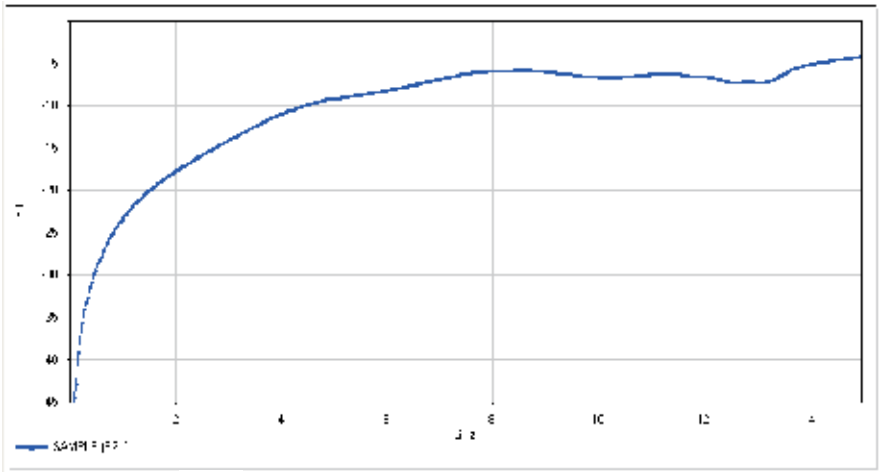


c) Isolation

This indicates the degree of insulation for high-frequency signals.

Even when the relay contacts are open,high-frequency signals can leak due to stray capacitance.The insulation that suppresses this leakage is called isolation. An example of an isolation measurement result is shown below.

Isolation measurement sample

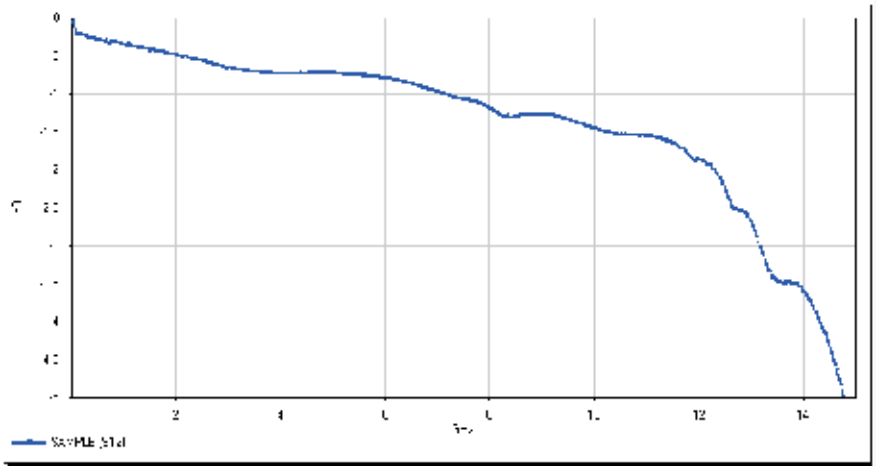


d) What is insertion loss?

This refers to the high-frequency signal insertion loss in the transmission line (when the relay is closed).

It represents the loss due to impedance mismatch in the circuit of the device under test.

Insertion loss measurement sample

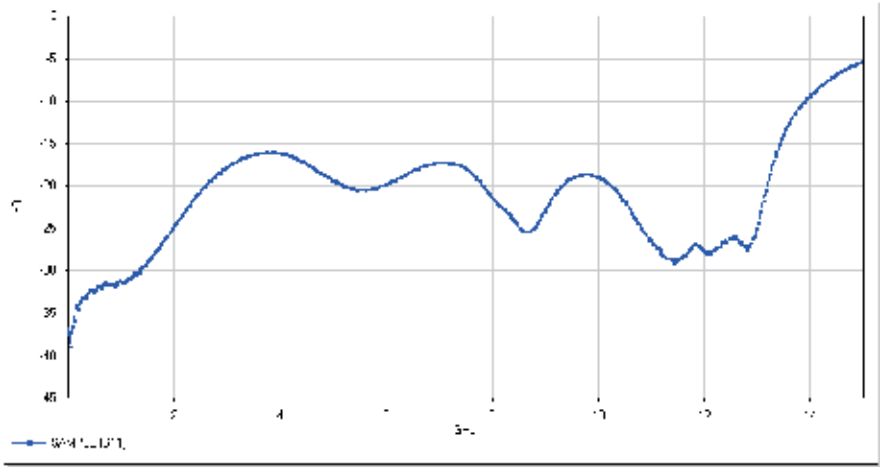


e) What is return loss?

This refers to the reflection from the device under test (when the relay is closed).

When an incident wave in a transmission line encounters an impedance mismatch, a reflected wave is generated.
If the impedance is matched, there will be no reflections.

Return loss measurement sample

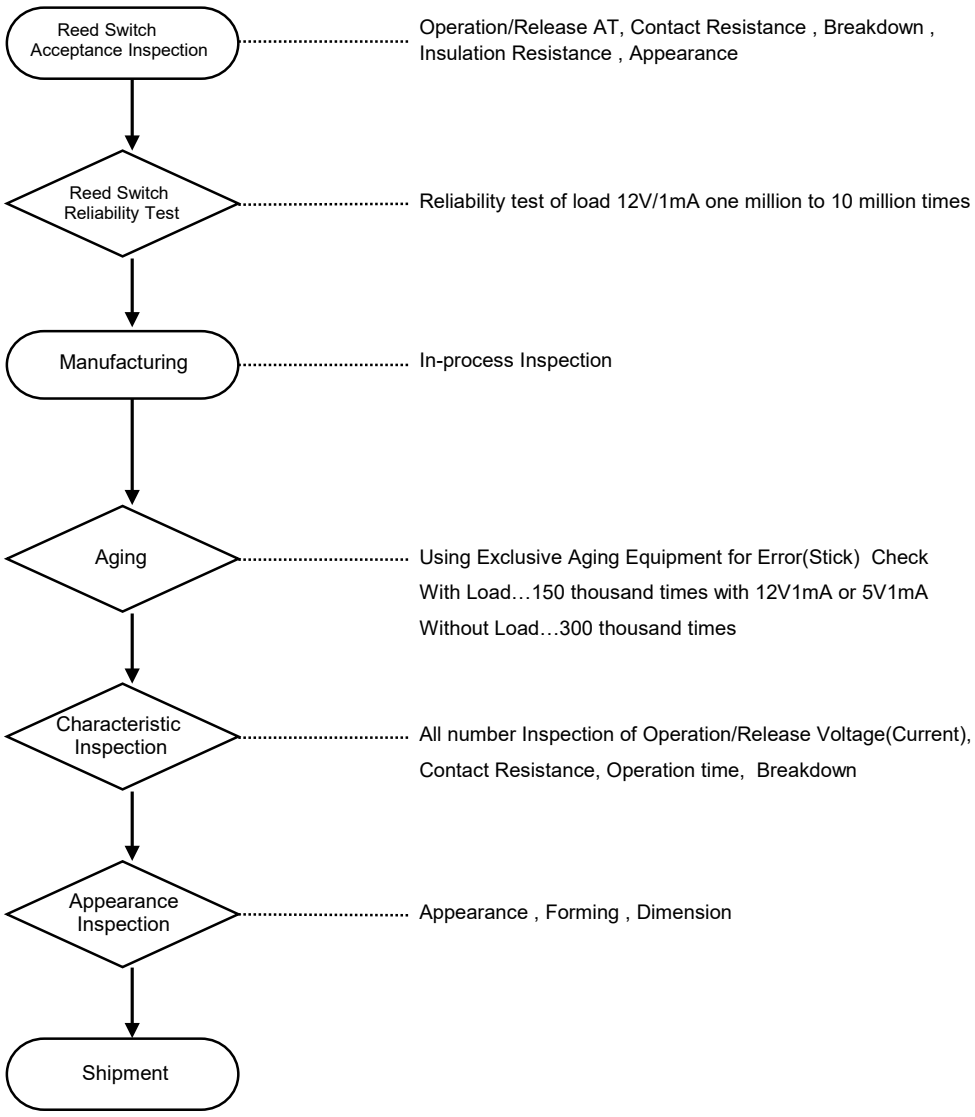


f) Regarding of high frequency data

We can provide our product high frequency data with De-embeding.
Please feel free to ask our sales team.

6) Reed and mercury relay quality

Quality control is carried out according to the following flow chart.



6-1) Aging (with and without load)

Although the contact points are plated, the surfaces are covered in countless tiny irregularities.

If left in this state, the contact resistance will become slightly unstable, so aging is done to smooth and stabilize the contact surface.

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   Refers to comprehensive catalogs, individual catalogs, specifications, manuals, etc. related to Our Products.This also includes what is provided through electronic media.
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［ Inquiries ］　Japan　e-mail: sanyusales@standexelectronics.com
Singapore　e-mail: sales@sanyu-sg.com

Head Office/Tokyo Sales Office/Overseas Sales
Maruwa building 3-9-23 Nishigotanda,Shinagawa-ku,Tokyo,Japan 141-0031
TEL: +81-3-3490-2251　FAX: +81-3-3490-5677

Osaka Sales Office
Krepis21 4-6-3 Toyosaki,Kita-ku,Osaka-shi,Osaka,Japan 531-0072
TEL: +81-6-6377-5502　FAX: +81-6-6377-5588

Kyushu Sales Office
1639-2 Muro Ozu-machi,Kikuchi-gun, Kumamoto,Japan 869-1235
TEL: +81-96-213-4550　FAX: +81-96-213-4551

Singapore　Sanyu Electric Pte. Ltd.
Block 4010, Ang Mo Kio Ave.10, #05-14,Techplace1, Singapore 569626
TEL: +65-6458-2377

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