

Ultrafast response of several tens picosecond

■ FEATURES

- Ultrafast response
G4176-03 : t_r , t_f = 30 ps (Typ.)
G7096-03 : t_r = 40 ps (Typ.)
- Low dark current
G4176 series : 100 pA ($T_a=25^\circ\text{C}$)
- Large photosensitive area
200 μm^2

■ APPLICATIONS

- Optical high-speed waveform measurements
- Optical communications



■ DESCRIPTION

HAMAMATSU realized MSM (Metal-Semiconductor-Metal) Photodetectors having ultrafast responses. The GaAs MSM Photodetector G4176-03 features 30 ps response time for both rise & fall while keeping a low dark current (100 pA at $T_a=25^\circ\text{C}$). The rise time of the InGaAs MSM Photodetector G7096-03 is 40 ps. Symmetrical and interdigital Schottky contacts are fabricated at the sensitive area, whose size can be larger than other kinds of fast response photodetectors. This makes easier to set up with optics. Therefore, MSM Photodetectors are suited for measurements of optical high-speed waveform and optical communications. There is no electrical polarity in MSM Photodetectors, that is, both polarities of a bias voltage are available, and the polarity of an output signal depends on its connection. Two kinds of packages are prepared for each MSM Photodetector. The package of G4176-03 & G7096-03 is a coaxial metal type (patent : Japan 2070802), which is easy to connect with an electrical SMA-connector. That of G4176-01 & G7096-01 is a TO-18, which is very common. An optical fiber or connector input types are available as a custom option. Contact your local representative for more information.

◆ G4176 SERIES ◆

■ABSOLUTE MAXIMUM RATINGS (Ta=25 °C)

Item	Symbol	Condition	Value	Unit
Bias Voltage	V _b		±10	V
Peak Input Light	Φ	Pulse width ≤1 ns ^{*1}	50 ^{*2}	mW
		Pulse width >1 ns	5 ^{*2}	mW
Operating Temperature	T _{op(a)}		-40 to +85	°C
Storage Temperature	T _{stg}		-40 to +100	°C

^{*1}: Duty ratio should be less than 50 %. (Even if the pulse width is ≤1 ns, when the duty ratio is >50 %, pulse width >1 ns is applied.)
^{*2}: This value is under the condition that the light irradiate the whole effective area (200 μm²) uniformly.
When the irradiated area is smaller than effective area of the detector, the peak input light becomes smaller in proportional to the irradiate area.

■GENERAL CHARACTERISTICS (Ta=25 °C)

Item	Symbol	Condition	Value	Unit
Spectral Response Range	λ	V _b = 7 V	450 to 870	nm
Peak Response Wavelength	λ _p	V _b = 7 V	850	nm
Effective Sensitive Area	A		0.2 × 0.2	mm ²
Chip Size			1 × 1	mm ²
Package				
G4176-03			TO-5 (Unified with SMA connector)	
G4176-01			TO-18	

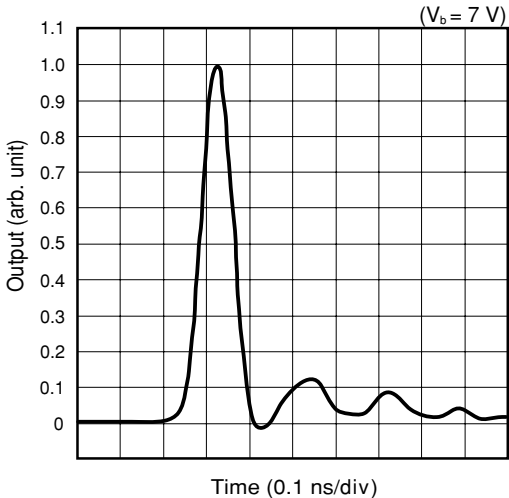
■ELECTRICAL AND OPTICAL CHARACTERISTICS (Ta=25 °C, V_b=7 V)

Item	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Radiant sensitivity	S	λ = 850 nm	0.2	0.3	-	A/W
Dark Current	I _d		-	100	300	pA
NEP ^{*3}						
G4176-03		λ = 850 nm	0.2 × 10 ⁻¹⁵	3 × 10 ⁻¹⁵	-	W/Hz ^{1/2}
G4176-01			0.2 × 10 ⁻¹⁵	4 × 10 ⁻¹⁵	-	
Terminal Capacitance	C _t					
G4176-03 ^{*4}			-	0.3	0.4	pF
G4176-01			-	0.5	0.6	
Rise Time	t _r					
G4176-03		10 to 90 %	-	30	40	ps
G4176-01			-	50	80	
Fall Time	t _f					
G4176-03		90 to 10 %	-	30	40	ps
G4176-01			-	50	80	

^{*3}: Noise Equivalent Power
^{*4}: Value on Chip

Figure 1: Optical Pulse Response

■ G4176-03
(Including time response of light source, bias-tee and oscilloscope)



■ G4176-01
(Including time response of light source, assembly circuit and oscilloscope)

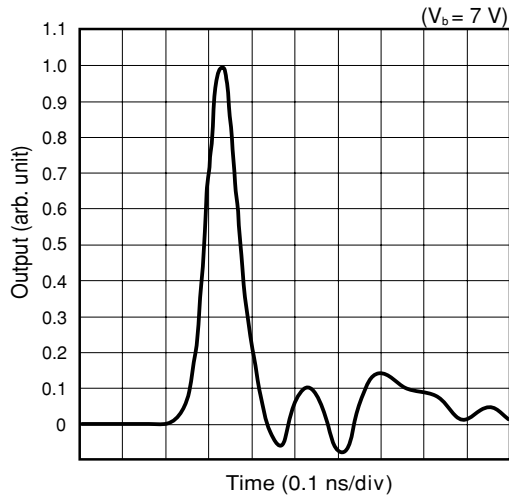


Figure 2: Spectral Response

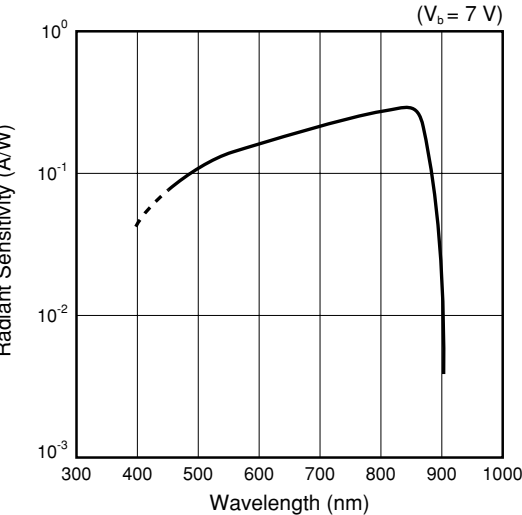
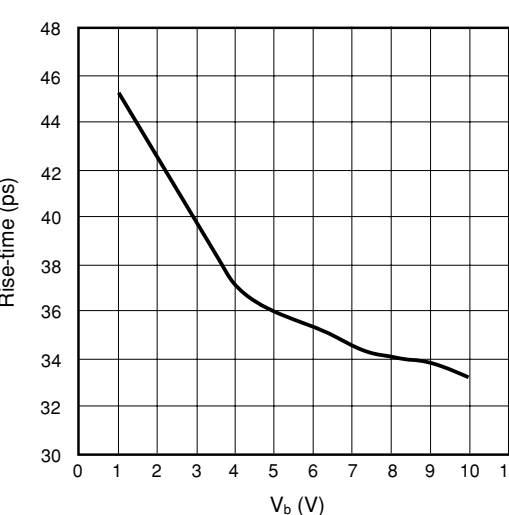


Figure 3: Rise Time vs. Applied Voltage (G4176-03)



◆ G7096 SERIES ◆

■ ABSOLUTE MAXIMUM RATINGS (Ta=25 °C)

Item	Symbol	Condition	Value	Unit
Bias Voltage	V_b		± 10	V
Peak Input Light	Φ	Pulse width ≤ 1 ns ^{*1}	10^{-2}	mW
		Pulse width > 1 ns	2^{-2}	mW
Operating Temperature	$T_{op(a)}$		-40 to +85	°C
Storage Temperature	T_{stg}		-40 to +100	°C

*1: Duty ratio should be less than 50 %. (Even if the pulse width is ≤ 1 ns, when the duty ratio is > 50 %, pulse width > 1 ns is applied.)

*2: This value is under the condition that the light irradiate the whole effective area ($200 \mu m^2$) uniformly.
When the irradiated area is smaller than effective area of the detector, the peak input light becomes smaller in proportional to the irradiate area.

■ GENERAL CHARACTERISTICS (Ta=25 °C)

Item	Symbol	Condition	Value	Unit
Spectral Response Range	λ	$V_b = 7$ V	850 to 1650	nm
Peak Response Wavelength	λ_p	$V_b = 7$ V	1500	nm
Effective Sensitive Area	A		0.2×0.2	mm ²
Chip Size			1×1	mm ²
Package				
G7096-03			TO-5 (Unified with SMA connector)	
G7096-01			TO-18	

■ ELECTRICAL AND OPTICAL CHARACTERISTICS (Ta=25 °C, $V_b=7$ V)

Item	Symbol	Condition	Value			Unit
			Min.	Typ.	Max.	
Radiant sensitivity	S	$\lambda = 1.3 \mu m$	0.2	0.4	-	A/W
Dark Current	I_d		-	5	20	μA
NEP ^{*3}		$\lambda = 1.3 \mu m$	0.2×10^{-10}	2×10^{-10}	-	W/Hz ^{1/2}
			0.2×10^{-10}	3×10^{-10}	-	
Terminal Capacitance	C_t		-	0.7	0.8	pF
			-	0.9	1.0	
Rise Time	t_r	10 to 90 %	-	40	60	ps
			-	60	80	
Fall Time	t_f	90 to 10 %	-	60	100	ps
			-	80	100	

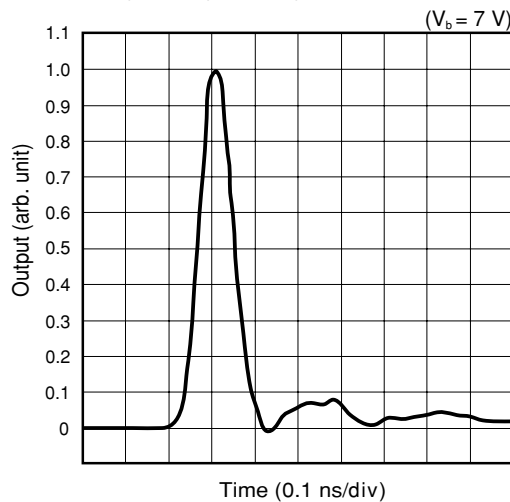
*3: Noise Equivalent Power

*4: Value on Chip

Figure 4: Optical Pulse Response

■ G7096-03

(Including time response of light source, bias-tee and oscilloscope)



■ G7096-01

(Including time response of light source, assembly circuit and oscilloscope)

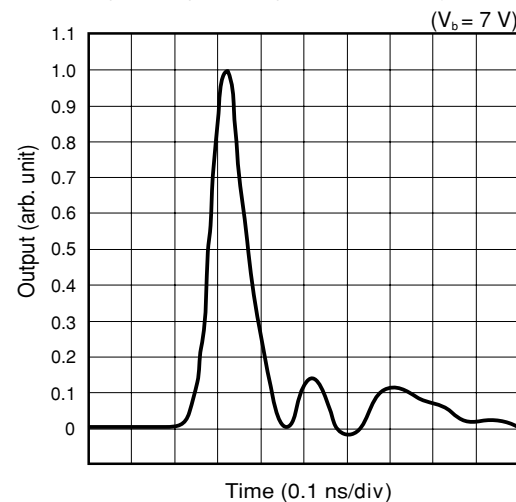


Figure 5: Spectral Response

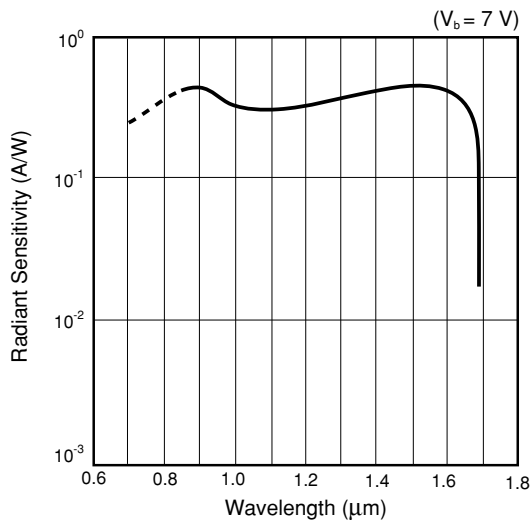
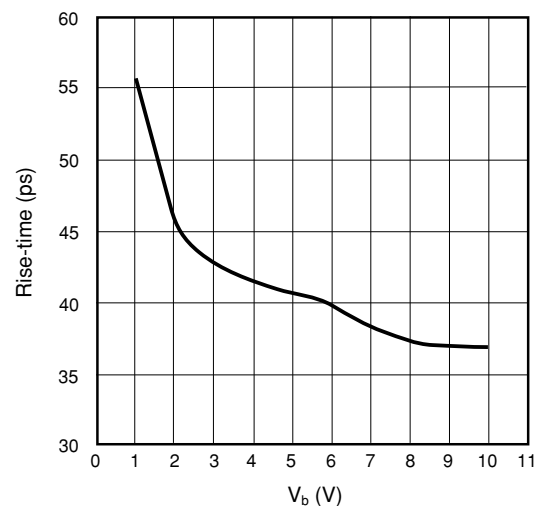
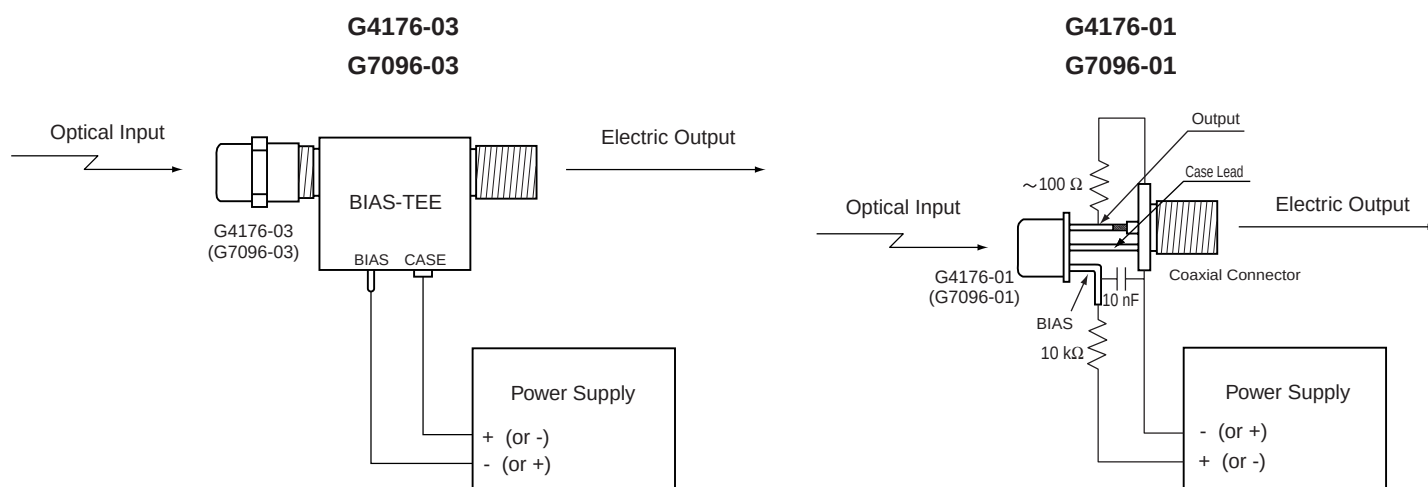


Figure 6: Rise Time vs. Applied Voltage (G7096-03)

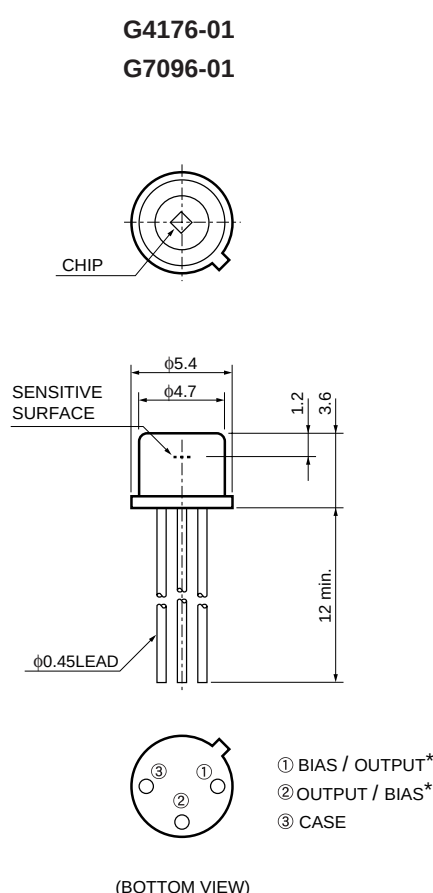
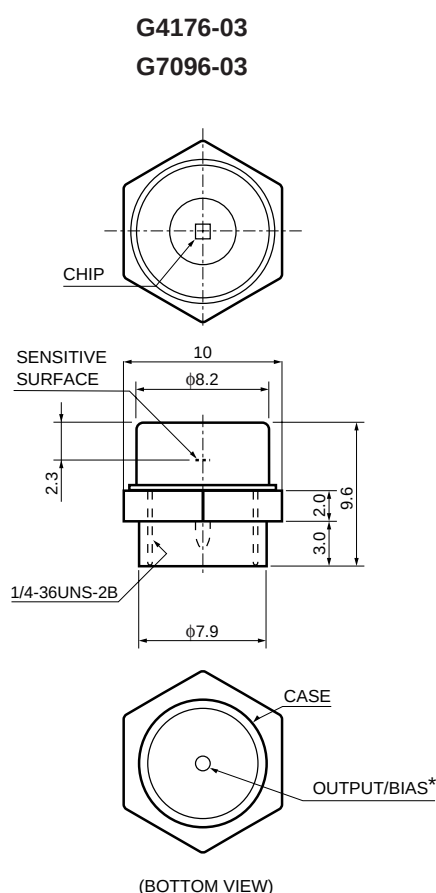


ULTRAFAST MSM PHOTODETECTORS G4176 SERIES (GaAs) , G7096 SERIES (InGaAs)

CONNECTION EXAMPLES



DIMENSIONAL OUTLINES (Unit : mm)



* Both polarities of the bias voltage are available.

HAMAMATSU

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