HAMAMATSU

PHOTON IS OUR BUSINESS

FLAT PANEL TYPE MULTIANODE PMT ASSEMBLY H13700 SERIES

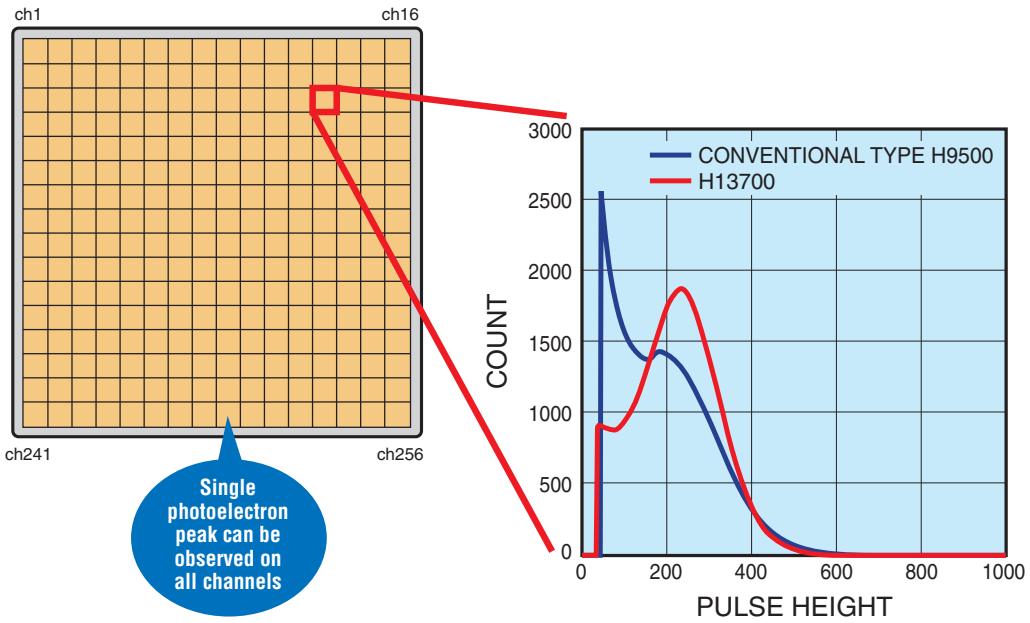
FEATURES

- High quantum efficiency: 33 % Typ.
- High collection efficiency: 80 % Typ.
- Single photoelectron peaks observable at every anode (pixel)
- Wide effective area: 48.5 mm × 48.5 mm
- 16 × 16 multianode,
  pixel size: 3 mm × 3 mm / anode

APPLICATIONS

- Academic research
  (RICH, gamma ray telescope, etc.)
- Nuclear medicine equipment
  (PET, gamma camera, etc.)
- Neutron imaging

SINGLE PHOTON COUNTING (EXAMPLE)



TPMHB0915EA

SPECIFICATIONS

Type No.	Spectral response		Ⓐ Photo-cathode material	Ⓑ Window material	Ⓒ Dynode structure / stages	Maximum ratings			Cathode characteristics			Anode to cathode supply voltage
	Range	Peak wavelength				Supply voltage between anode and cathode	Average anode output current in total	Divider current at -1100 V	Luminous Ⓓ		Blue Ⓔ sensitivity index (CS 5-58)	
	(nm)	(nm)				(V)	(μA)	(μA)	Min. (μA/lm)	Typ. (μA/lm)	Typ.	(V)
H13700	300 to 650	400	BA	K	MC/10	-1100	100	185	60	75	12	-1000
H13700-03	185 to 650	400	BA	U	MC/10	-1100	100	185	60	75	12	-1000

NOTE: Ⓐ BA: Bialkali Ⓑ K: Borosilicate glass, U: UV glass Ⓒ MC: Metal channel

Ⓓ The light source is a tungsten filament lamp operated at a distribution temperature of 2856 K. Supply voltage is 150 volts between the cathode and all other electrodes connected together as anode.

Ⓔ The value is cathode output current when a blue filter(corning CS 5-58 polished to 1/2 stock thickness) is interposed between the light source and the tube under the same condition as Note Ⓓ.

Ⓕ Measured with the same light source as Note Ⓓ and with the anode-to-cathode supply voltage and voltage distribution ratio shown in Table 1 below.

Ⓖ Measured with the same supply voltage and voltage distribution ratio as Note Ⓕ after 30 minutes storage in darkness.

Ⓗ Those are test data when a signal from a central channel (P120) of 256 anodes is used, while all photocathode are illuminated by pulsed light source.

Ⓙ The rise time is the time for the output pulse to rise from 10 % to 90 % of the peak amplitude when the whole photocathode is illuminated by a delta function light pulse.

Ⓚ The electron transit time is the interval between the arrival of delta function light pulse at the entrance window of the tube and the time when the anode output reaches the peak amplitude. In measurement, the whole photocathode is illuminated.

Ⓛ Also called transit time jitter. This is the fluctuation in electron transit time between individual pulses in the single photoelectron event, and defined as the FWHM of the frequency distribution of electron transit time.

Table 1: Voltage distribution ratio and supply voltage

Electrodes	K	Dy1	Dy2	Dy3	Dy4	Dy5	Dy6	Dy7	Dy8	Dy9	Dy10	GR	P
Distribution ratio	2	1	1	1	1	1	1	1	1	1	1	0.5	

Supply voltage: -1000 V, K: Cathode, Dy: Dynode, GR: Guard ring P: Anode

Figure 1: Typical spectral response

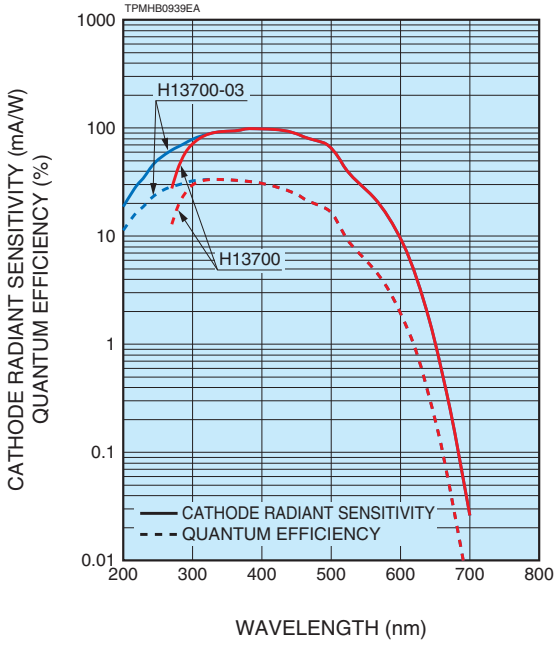
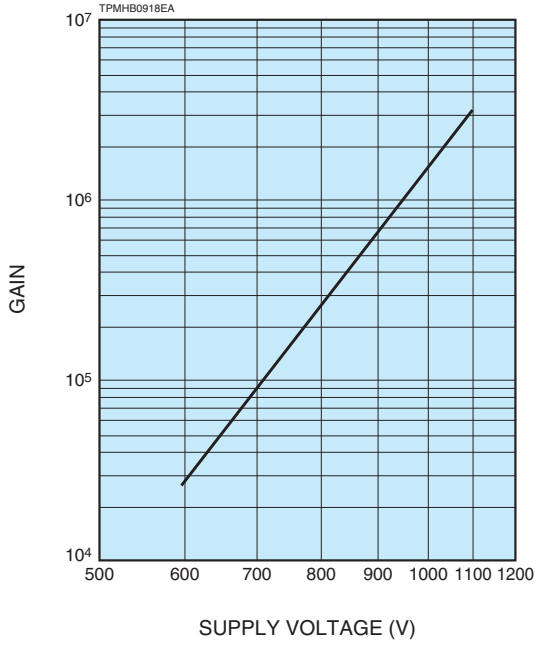
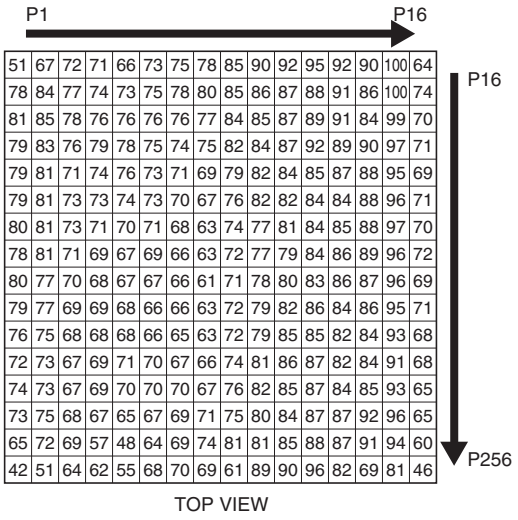


Figure 2: Typical gain



Anode characteristics													Type No.
Luminous Ⓕ		Gain Ⓕ	Dark current per channel Ⓖ		Dark current in total Ⓖ		Time response Ⓗ			Pulse linearity per channel [±2 % deviation]	Uniformity between each anode		
Min. (A/lm)	Typ. (A/lm)	Typ.	Typ. (nA)	Max. (nA)	Typ. (nA)	Max. (nA)	Rise time Typ. (ns) Ⓙ	Transit time Typ. (ns) Ⓚ	Transit time spread Typ. (ns) Ⓛ	(mA)	Typ.	Max.	
—	110	1.5×10^6	0.02	—	5	50	0.45	5.2	0.38	0.15	1: 3	1: 5	**H13700**
—	110	1.5×10^6	0.02	—	5	50	0.45	5.2	0.38	0.15	1: 3	1: 5	**H13700-03**

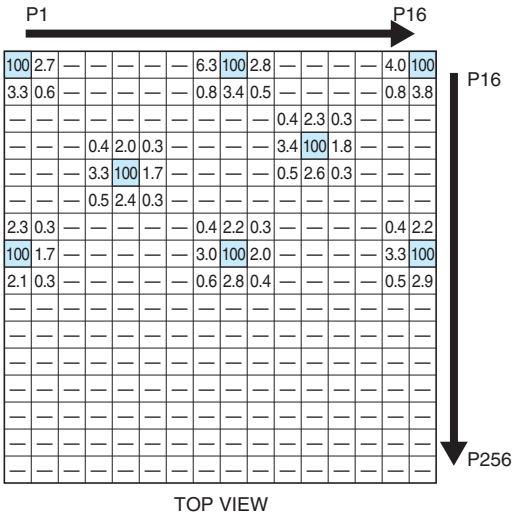
Figure 3: Anode uniformity (Example)



51	67	72	71	66	73	75	78	85	90	92	95	92	90	100	64
78	84	77	74	73	75	78	80	85	86	87	88	91	86	100	74
81	85	78	76	76	76	76	77	84	85	87	89	91	84	99	70
79	83	76	79	78	75	74	75	82	84	87	92	89	90	97	71
79	81	71	74	76	73	71	69	79	82	84	85	87	88	95	69
79	81	73	73	74	73	70	67	76	82	82	84	84	88	96	71
80	81	73	71	70	71	68	63	74	77	81	84	85	88	97	70
78	81	71	69	67	69	66	63	72	77	79	84	86	89	96	72
80	77	70	68	67	67	66	61	71	78	80	83	86	87	96	69
79	77	69	69	68	66	66	63	72	79	82	86	84	86	95	71
76	75	68	68	68	66	65	63	72	79	85	85	82	84	93	68
72	73	67	69	71	70	67	66	74	81	86	87	82	84	91	68
74	73	67	69	70	70	70	67	76	82	85	87	84	85	93	65
73	75	68	67	65	67	69	71	75	80	84	87	87	92	96	65
65	72	69	57	48	64	69	74	81	81	85	88	87	91	94	60
42	51	64	62	55	68	70	69	61	89	90	96	82	69	81	46

SUPPLY VOLTAGE: -1000 V
LIGHT SOURCE: TUNGSTEN LAMP with BLUE FILTER
(DC LIGHT)
SPOT ILLUMINATION (APERTURE SIZE): 3 mm square
on each channel

Figure 4: Anode cross-talk (Example)

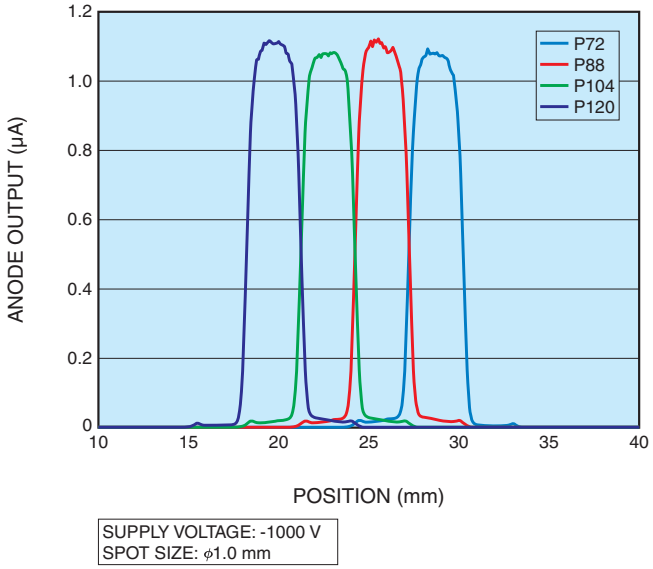


100	2.7	—	—	—	—	—	6.3	100	2.8	—	—	—	—	4.0	100
3.3	0.6	—	—	—	—	—	0.8	3.4	0.5	—	—	—	—	0.8	3.8
—	—	—	—	—	—	—	—	—	—	0.4	2.3	0.3	—	—	—
—	—	—	0.4	2.0	0.3	—	—	—	—	3.4	100	1.8	—	—	—
—	—	—	3.3	100	1.7	—	—	—	—	0.5	2.6	0.3	—	—	—
—	—	—	0.5	2.4	0.3	—	—	—	—	—	—	—	—	—	—
2.3	0.3	—	—	—	—	—	0.4	2.2	0.3	—	—	—	—	0.4	2.2
100	1.7	—	—	—	—	—	3.0	100	2.0	—	—	—	—	3.3	100
2.1	0.3	—	—	—	—	—	0.6	2.8	0.4	—	—	—	—	0.5	2.9
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

SUPPLY VOLTAGE: -1000 V
LIGHT SOURCE: TUNGSTEN LAMP with BLUE FILTER
(DC LIGHT)
FIBER SIZE: ϕ1.0 mm (KURARAY: CLEAR FIBER NA=0.72)

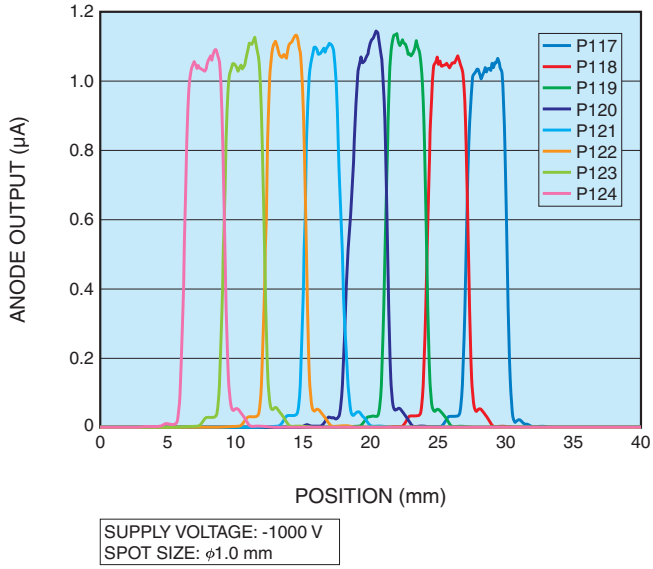
Figure 5: Cross uniformity

X-axis



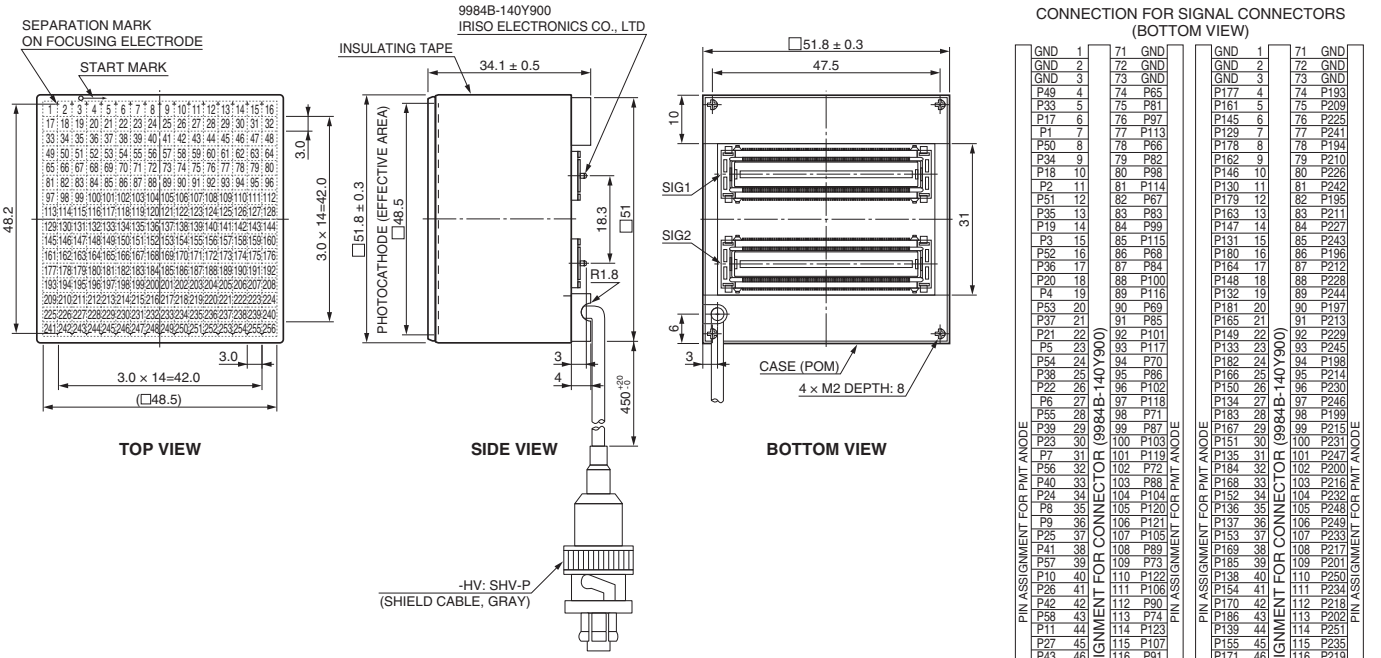
SUPPLY VOLTAGE: -1000 V
SPOT SIZE: ϕ1.0 mm

Y-axis



SUPPLY VOLTAGE: -1000 V
SPOT SIZE: ϕ1.0 mm

Figure 6: Dimensional outline (Unit: mm)



CONNECTION FOR SIGNAL CONNECTORS
(BOTTOM VIEW)

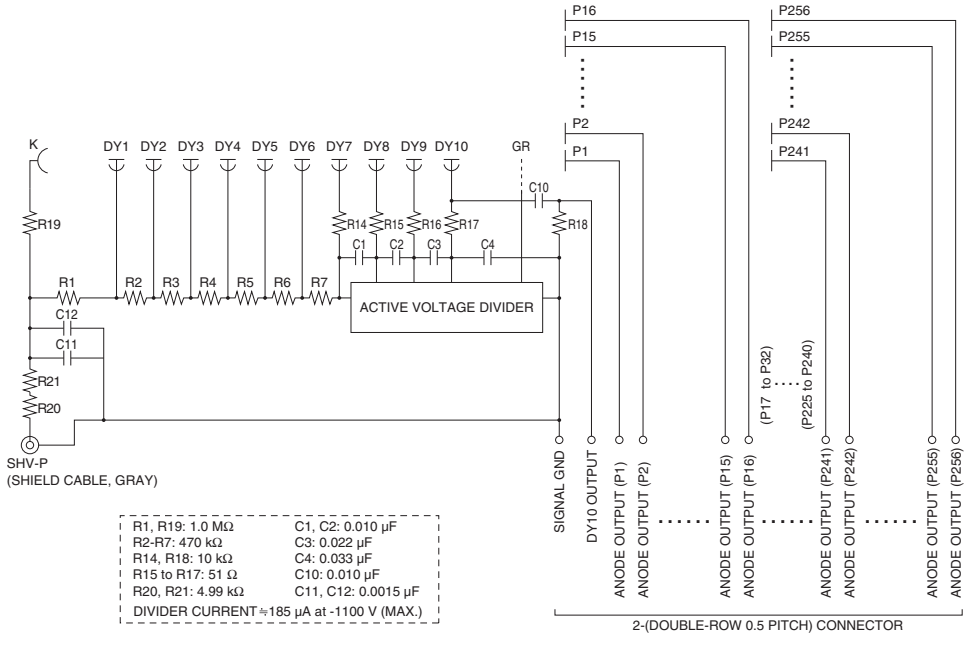
PIN ASSIGNMENT FOR PMT ANODE / PIN ASSIGNMENT FOR CONNECTOR (9984B-140Y900)

GND	1	71	GND	GND	1	71	GND
GND	2	72	GND	GND	2	72	GND
GND	3	73	GND	GND	3	73	GND
P49	4	74	P65	P177	4	74	P193
P33	5	75	P81	P161	5	75	P209
P17	6	76	P97	P145	6	76	P225
P1	7	77	P113	P129	7	77	P241
P50	8	78	P66	P178	8	78	P194
P34	9	79	P82	P162	9	79	P210
P18	10	80	P98	P146	10	80	P226
P2	11	81	P114	P130	11	81	P242
P51	12	82	P67	P179	12	82	P195
P35	13	83	P83	P163	13	83	P211
P19	14	84	P99	P147	14	84	P227
P3	15	85	P115	P131	15	85	P243
P52	16	86	P68	P180	16	86	P196
P36	17	87	P84	P164	17	87	P212
P20	18	88	P100	P148	18	88	P228
P4	19	89	P116	P132	19	89	P244
P53	20	90	P69	P181	20	90	P197
P37	21	91	P85	P165	21	91	P213
P21	22	92	P101	P149	22	92	P229
P5	23	93	P117	P133	23	93	P245
P54	24	94	P70	P182	24	94	P198
P38	25	95	P86	P166	25	95	P214
P22	26	96	P102	P150	26	96	P230
P6	27	97	P118	P134	27	97	P246
P55	28	98	P71	P183	28	98	P199
P39	29	99	P87	P167	29	99	P215
P23	30	100	P103	P151	30	100	P231
P7	31	101	P119	P135	31	101	P247
P56	32	102	P72	P184	32	102	P200
P40	33	103	P88	P168	33	103	P216
P24	34	104	P104	P152	34	104	P232
P8	35	105	P120	P136	35	105	P248
P9	36	106	P121	P137	36	106	P249
P25	37	107	P105	P153	37	107	P233
P41	38	108	P89	P169	38	108	P217
P57	39	109	P73	P185	39	109	P201
P10	40	110	P122	P138	40	110	P250
P26	41	111	P106	P154	41	111	P234
P42	42	112	P90	P170	42	112	P218
P58	43	113	P74	P186	43	113	P202
P11	44	114	P123	P139	44	114	P251
P27	45	115	P107	P155	45	115	P235
P43	46	116	P91	P171	46	116	P219
P59	47	117	P75	P187	47	117	P203
P12	48	118	P124	P140	48	118	P252
P28	49	119	P108	P156	49	119	P236
P44	50	120	P92	P172	50	120	P220
P60	51	121	P76	P188	51	121	P204
P13	52	122	P125	P141	52	122	P253
P29	53	123	P109	P157	53	123	P237
P45	54	124	P93	P173	54	124	P221
P61	55	125	P77	P189	55	125	P205
P14	56	126	P126	P142	56	126	P254
P30	57	127	P110	P158	57	127	P238
P46	58	128	P94	P174	58	128	P222
P62	59	129	P78	P190	59	129	P206
P15	60	130	P127	P143	60	130	P255
P31	61	131	P111	P159	61	131	P239
P47	62	132	P95	P175	62	132	P223
P63	63	133	P79	P191	63	133	P207
P16	64	134	P128	P144	64	134	P256
P32	65	135	P112	P160	65	135	P240
P48	66	136	P96	P176	66	136	P224
P64	67	137	P80	P192	67	137	P208
GND	68	138	GND	GND	68	138	GND
GND	69	139	GND	GND	69	139	GND
DY10	70	140	GND	GND	70	140	GND

SIG1 SIG2

NOTE: 2 SET OF SOCKET WILL BE ATTACHED.
(9984S-140Y943, IRISO ELECTRONICS CO., LTD)

Figure 7: Internal circuit



R1, R19: 1.0 MΩ	C1, C2: 0.010 μF
R2-R7: 470 kΩ	C3: 0.022 μF
R14, R18: 10 kΩ	C4: 0.033 μF
R15 to R17: 51 Ω	C10: 0.010 μF
R20, R21: 4.99 kΩ	C11, C12: 0.0015 μF
DIVIDER CURRENT≒185 μA at -1100 V (MAX.)	

TPMHA0618EC

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