MITSUBISHI ELECTRIC

< Low Noise GaAs HEMT >
MGF4941AL
Micro-X type plastic package

DESCRIPTION
The MGF4941AL super-low noise InGaAs HEMT (High Electron Mobility Transistor) is designed for use in Ku band amplifiers.

FEATURES
Low noise figure   @ f=12GHz
NFmin. = 0.35dB (Typ.)

High associated gain   @ f=12GHz
Gs = 13.5dB (Typ.)

APPLICATION
L to K band low noise amplifiers

QUALITY GRADE
GG

RECOMMENDED BIAS CONDITIONS
V_{DS}=2V, I_D=10mA

ORDERRING INFORMATION
Tape & reel   4000pcs./reel

RoHS COMPLIANT
MGF4941AL is a RoHS compliant product. RoHS compliance is indicated by the letter "G" after the Lot Marking.
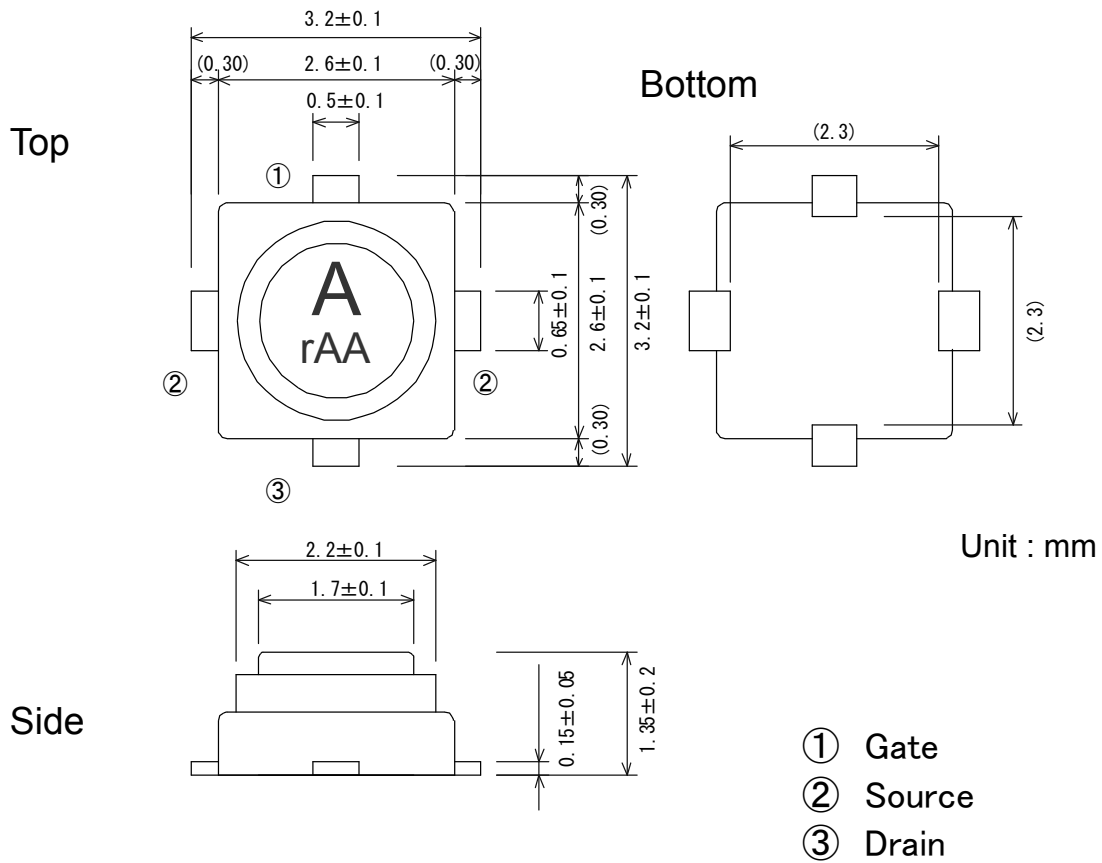
Outline Drawing

Fig.1

MITSUBISHI Proprietary
Not to be reproduced or disclosed without permission by Mitsubishi Electric

ABSOLUTE MAXIMUM RATINGS   (Ta=25°C)

Symbol	Parameter	Ratings	Unit
V_{GDO}	Gate to drain voltage	-3	V
V_{GSO}	Gate to source voltage	-3	V
I_D	Drain current	IDSS	mA
P_T	Total power dissipation	50	mW
T_{ch}	Channel temperature	125	°C
T_{stg}	Storage temperature	-55 to +125	°C

ELECTRICAL CHARACTERISTICS   (Ta=25°C)

Symbol	Parameter	Test conditions	Limits			Unit
			MIN.	TYP.	MAX	
$V_{(BR)GDO}$	Gate to drain breakdown voltage	I_G=-10μA	-3	--	--	V
I_{GSS}	Gate to source leakage current	V_{GS}=-2V,V_{DS}=0V	--	--	50	μA
I_{DSS}	Saturated drain current	V_{GS}=0V,V_{DS}=2V	15	--	60	mA
$V_{GS(off)}$	Gate to source cut-off voltage	V_{DS}=2V,I_D=500μA	-0.1	--	-1.5	V
Gs	Associated gain	V_{DS}=2V,	12.0	13.5	--	dB
NFmin.	Minimum noise figure	I_D=10mA,f=12GHz	--	0.35	0.5	dB

Note: Gs and NFmin. are tested with sampling inspection.
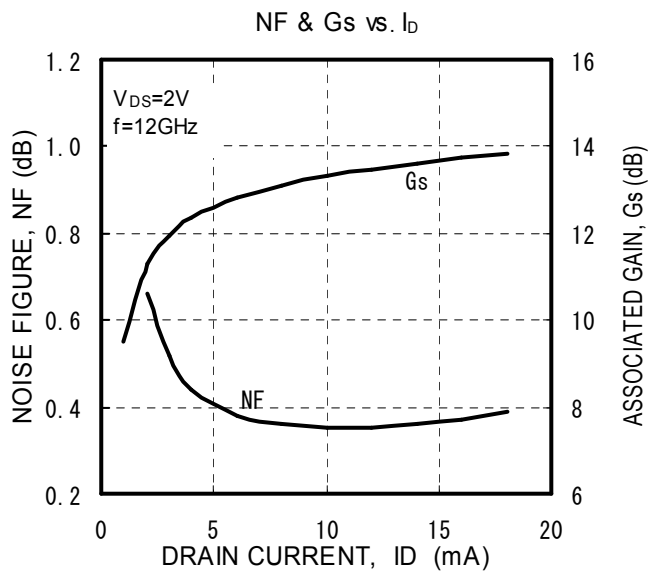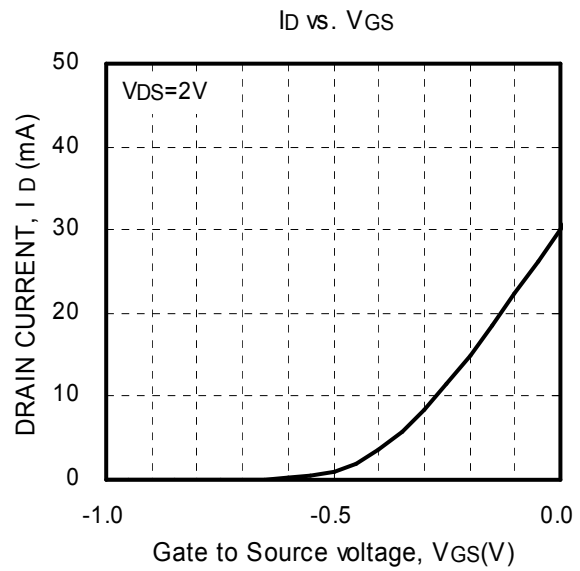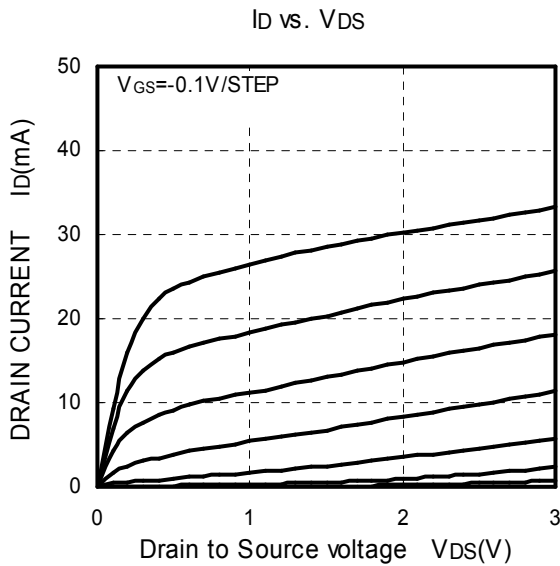
1

MITSUBISHI ELECTRIC CORPORATION

Fig.1

Top

Bottom

3.2±0.1
(0.30) 2.6±0.1 (0.30)
0.5±0.1

A
rAA

(0.30)
0.65±0.1
2.6±0.1
(0.30)
3.2±0.1

(2.3)
(2.3)

Unit : mm

Side

2.2±0.1
1.7±0.1

0.15±0.05
1.35±0.2

① Gate
② Source
③ Drain

(GD-32)

<Low Noise GaAs HEMT>

MGF4941AL
Micro-X type plastic package

TYPICAL CHARACTERISTICS (Ta=25°C)

ID vs. VDS

ID vs. VGS

NF & Gs vs. ID

<Low Noise GaAs HEMT>

MGF4941AL
Micro-X type plastic package

S PARAMETERS (VDS=2V,ID=10mA,Ta=room temperature)

Freq. (GHz)	S11 (mag)	S11 (ang)	S21 (mag)	S21 (ang)	S12 (mag)	S12 (ang)	S22 (mag)	S22 (ang)
1	0.997	−18.3	5.603	158.4	0.023	73.4	0.702	−11.1
2	0.976	−30.0	5.399	145.6	0.033	67.2	0.668	−20.1
3	0.944	−41.7	5.195	132.7	0.043	61.0	0.634	−29.1
4	0.880	−53.4	4.991	119.8	0.053	54.8	0.600	−38.1
5	0.804	−67.6	4.874	105.3	0.064	46.8	0.563	−47.6
6	0.728	−82.3	4.743	90.7	0.074	39.0	0.519	−57.2
7	0.640	−98.0	4.569	76.0	0.082	31.0	0.467	−66.6
8	0.563	−116.4	4.389	61.2	0.091	22.3	0.406	−77.4
9	0.476	−134.2	4.123	47.5	0.095	15.2	0.343	−86.1
10	0.408	−153.5	3.898	34.7	0.095	9.9	0.285	−94.4
11	0.381	−174.5	3.736	22.2	0.101	5.8	0.245	−105.3
12	0.370	163.2	3.559	9.8	0.105	1.9	0.203	−119.0
13	0.385	141.3	3.391	−2.6	0.110	−3.1	0.167	−137.9
14	0.415	124.1	3.275	−14.2	0.113	−5.8	0.156	−157.0
15	0.458	109.1	3.148	−26.2	0.117	−10.7	0.153	178.7
16	0.529	94.8	2.961	−40.7	0.131	−15.1	0.214	144.7
17	0.586	83.3	2.817	−53.4	0.142	−19.9	0.257	125.9
18	0.643	73.3	2.620	−65.9	0.153	−26.4	0.317	106.1

Noise Parameter (V$_{DS}$=2V,I$_D$=10mA, Ta=room temperature)

Freq. (GHz)	NFmin (dB)	Γopt (mag)	Γopt (ang)	Rn (Ω)
1	0.18	0.96	−32.8	17.0
2	0.19	0.93	−17.9	15.5
3	0.19	0.90	−3.0	14.0
4	0.20	0.84	11.9	12.5
5	0.23	0.79	26.8	11.0
6	0.24	0.74	41.7	9.5
7	0.26	0.65	56.6	8.0
8	0.29	0.53	73.6	6.0
9	0.31	0.44	92.6	4.5
10	0.34	0.34	113.6	3.5
11	0.37	0.28	136.5	2.5
12	0.40	0.25	161.2	2.5
13	0.45	0.25	−172.3	2.5
14	0.50	0.27	−144.2	3.0
15	0.55	0.33	−122.0	4.0
16	0.61	0.44	−97.0	5.6
17	0.66	0.55	−73.0	7.0
18	0.72	0.66	−47.0	8.7
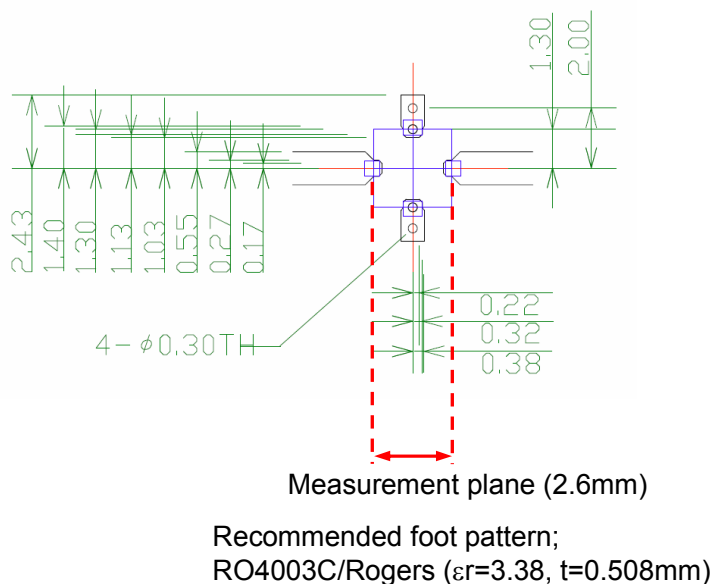
4−φ0.30TH

Measurement plane (2.6mm)

Recommended foot pattern;
RO4003C/Rogers (εr=3.38, t=0.508mm)

Note:

We are ready to provide nonlinear model for ADS and MWO users. If you are interested, please contact our sales offices.

MITSUBISHI ELECTRIC CORPORATION

<Low Noise GaAs HEMT>

MGF4941AL
Micro-X type plastic package

S PARAMETERS

(VDS=2V,ID=10mA,Ta=room temperature)

Freq. (GHz)	S11 (mag)	S11 (ang)	S21 (mag)	S21 (ang)	S12 (mag)	S12 (ang)	S22 (mag)	S22 (ang)
1	0.989	-13.9	5.497	164.6	0.017	78.9	0.637	-10.6
2	0.967	-28.2	5.416	149.6	0.028	70.9	0.626	-21.1
3	0.929	-41.5	5.278	135.0	0.040	61.7	0.610	-31.1
4	0.882	-54.4	5.172	121.5	0.051	53.3	0.586	-40.5
5	0.822	-65.9	4.932	108.0	0.061	45.9	0.572	-50.8
6	0.757	-79.5	4.959	94.1	0.071	37.6	0.538	-60.3
7	0.686	-93.3	4.826	80.4	0.080	29.9	0.502	-69.8
8	0.611	-108.8	4.732	66.8	0.086	22.7	0.456	-78.6
9	0.533	-125.1	4.587	53.6	0.092	16.2	0.408	-86.5
10	0.463	-143.6	4.403	40.5	0.096	10.2	0.359	-93.8
11	0.411	-164.1	4.140	27.8	0.100	4.8	0.311	-100.7
12	0.382	174.7	4.010	15.6	0.105	0.1	0.267	-108.9
13	0.378	152.3	3.782	3.3	0.111	-4.7	0.221	-119.3
14	0.395	131.4	3.653	-9.1	0.115	-9.7	0.182	-135.4
15	0.435	113.6	3.514	-21.3	0.121	-14.6	0.152	-157.0
16	0.486	99.0	3.366	-32.9	0.126	-19.8	0.134	177.7
17	0.543	86.2	3.172	-45.3	0.133	-25.5	0.139	145.4
18	0.603	73.7	3.049	-57.7	0.140	-31.2	0.183	115.8
19	0.663	61.2	2.877	-70.2	0.147	-37.9	0.251	95.1
20	0.704	50.1	2.641	-81.3	0.152	-45.0	0.309	80.2
21	0.746	40.5	2.470	-91.5	0.156	-52.4	0.363	70.0
22	0.778	32.3	2.311	-102.3	0.156	-58.0	0.411	59.8

NOISE PARAMETERS (VDS=2V,ID=10mA, Ta=25°C)

Board: εr=2.2

Thickness: 0.25mm

(4−φ0.3: through−hole)

Freq. (GHz)	Γopt (mag)	Γopt (ang)	rn	NFmin (dB)
2	0.671	13.9	0.370	0.20
4	0.598	37.2	0.262	0.22
6	0.537	60.8	0.197	0.25
8	0.474	86.2	0.155	0.29
10	0.399	119.2	0.102	0.32
12	0.329	147.6	0.062	0.35
14	0.299	173.6	0.069	0.40
16	0.349	-143.9	0.083	0.49
18	0.392	-106.5	0.109	0.59
20	0.432	-73.0	0.146	0.73
22	0.467	-42.7	0.180	0.96

Note: rn is normarised by 50 ohm.
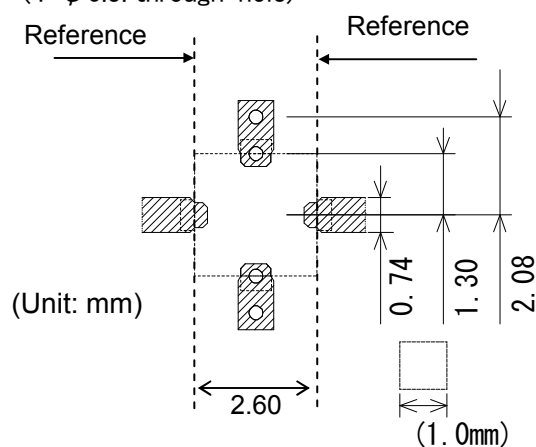
Reference   Reference

(Unit: mm)

0.74   1.30   2.08

2.60

(1.0mm)

Note:

We are ready to provide nonlinear model for ADS and MWO users. If you are interested, please contact our sales offices.

5

MITSUBISHI ELECTRIC CORPORATION

S PARAMETERS

(VDS=0V,VGS=0V,Ta=room temperature)

Freq.	S11		S21		S12		S22	
(GHz)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
1	0.996	-12.6	0.008	90.7	0.008	93.1	0.700	167.0
2	0.998	-25.4	0.019	92.4	0.019	92.2	0.696	154.5
3	0.988	-38.1	0.032	90.0	0.032	90.6	0.703	142.2
4	0.984	-50.8	0.048	86.4	0.048	86.3	0.708	129.1
5	0.971	-62.6	0.068	80.5	0.069	81.0	0.710	117.1
6	0.963	-77.1	0.092	72.6	0.092	72.7	0.718	104.8
7	0.949	-92.8	0.119	62.9	0.120	62.9	0.730	92.6
8	0.936	-110.9	0.149	51.8	0.150	52.2	0.739	81.3
9	0.915	-131.2	0.181	39.2	0.182	39.5	0.750	70.7
10	0.892	-153.9	0.211	25.5	0.211	25.9	0.760	60.8
11	0.878	-178.2	0.235	10.8	0.237	11.1	0.769	51.6
12	0.870	157.5	0.252	-3.9	0.252	-3.9	0.785	42.8
13	0.868	133.9	0.258	-18.6	0.259	-18.6	0.795	34.7
14	0.875	113.0	0.257	-32.0	0.257	-32.0	0.805	26.9
15	0.883	94.9	0.250	-44.4	0.249	-44.1	0.815	19.2
16	0.895	79.7	0.238	-55.0	0.238	-54.9	0.824	11.6
17	0.901	66.6	0.225	-64.2	0.225	-64.0	0.833	5.2
18	0.912	54.7	0.213	-72.0	0.215	-71.8	0.845	0.1
19	0.923	43.8	0.205	-78.8	0.205	-78.7	0.856	-3.7
20	0.934	34.0	0.201	-85.1	0.202	-85.5	0.861	-8.4
21	0.947	25.0	0.195	-92.1	0.193	-92.7	0.859	-13.1
22	0.945	17.6	0.188	-98.3	0.188	-98.5	0.854	-18.2

(VDS=0V,VGS=-2.5V,Ta=room temperature)

Freq.	S11		S21		S12		S22	
(GHz)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)	(mag)	(ang)
1	1.003	-8.2	0.022	80.5	0.023	79.5	0.998	-9.2
2	0.998	-16.7	0.045	72.1	0.045	71.9	0.990	-18.6
3	0.994	-24.6	0.067	62.9	0.067	63.2	0.995	-27.7
4	0.991	-32.2	0.088	54.8	0.089	54.7	0.993	-36.7
5	0.986	-38.9	0.109	46.3	0.110	46.5	0.993	-46.8
6	0.983	-46.7	0.133	37.4	0.132	37.5	0.985	-56.3
7	0.977	-54.4	0.157	28.6	0.158	28.7	0.982	-65.6
8	0.972	-63.3	0.183	18.8	0.184	18.6	0.970	-75.4
9	0.963	-72.7	0.211	8.3	0.210	8.5	0.962	-85.2
10	0.950	-83.2	0.237	-2.6	0.238	-2.7	0.956	-95.5
11	0.938	-94.7	0.263	-14.9	0.264	-14.8	0.945	-106.4
12	0.929	-107.7	0.289	-27.8	0.289	-27.8	0.932	-118.6
13	0.916	-121.9	0.310	-42.3	0.312	-42.2	0.921	-132.8
14	0.911	-137.5	0.326	-58.6	0.327	-58.7	0.914	-149.6
15	0.904	-155.7	0.324	-76.7	0.325	-76.6	0.909	-167.8
16	0.903	-175.3	0.305	-95.2	0.306	-95.4	0.911	173.5
17	0.910	163.6	0.269	-114.1	0.271	-114.4	0.916	153.5
18	0.914	142.1	0.219	-131.5	0.220	-131.6	0.924	133.0
19	0.912	121.4	0.172	-145.0	0.172	-144.9	0.926	114.9
20	0.927	103.4	0.136	-160.1	0.136	-160.2	0.939	99.3
21	0.955	87.0	0.089	-178.2	0.090	-176.6	0.961	84.2
22	0.971	72.1	0.048	167.9	0.049	171.4	0.968	69.8

Note: We are ready to provide nonlinear model for ADS and MWO users. If you are interested, please contact our sales offices.

<Low Noise GaAs HEMT>

MGF4941AL

Micro-X type plastic package

Keep safety first in your circuit designs!

- Mitsubishi Electric Corporation puts the maximum effort into making semiconductor products better and more reliable, but there is always the possibility that trouble may occur with them. Trouble with semiconductors may lead to personal injury, fire ore property damage. Remember to give due consideration to safety when making your circuit designs, with appropriate measures such as (i) placement of substitutive, auxiliary circuits, (ii) use of non-flammable material or (iii) prevention against any malfunction or mishap.

Notes regarding these materials

- These materials are intended as a reference to assist our customers in the selection of the Mitsubishi semiconductor product best suited to the customer's application; they do not convey any license under any intellectual property rights, or any other rights, belonging to Mitsubishi Electric Corporation or a third party.
- Mitsubishi Electric Corporation assumes no responsibility for any damage, or infringement of any third-party's rights, originating in the use of any product data, diagrams, charts, programs, algorithms, or circuit application examples contained in these materials.
- All information contained in these materials, including product data, diagrams, charts, programs and algorithms represents information on products at the time of publication of these materials, and are subject to change by Mitsubishi Electric Corporation without notice due to product improvements or other reasons. It is therefore recommended that customers contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for the latest product information before purchasing a product listed herein.
  The information described here may contain technical in accuracies or typographical errors.
  Mitsubishi Electric Corporation assumes no responsibility for any damage, liability, or other loss rising from these inaccuracies or errors.
  Please also pay attention to information published by Mitsubishi Electric Corporation by various means, including the Mitsubishi Semiconductor home page (http://www.mitsubishielectric.com/).
- When using any or all of the information contained in these materials, including product data, diagrams, charts, programs, and algorithms, please be sure to evaluate all information as a total system before making a final decision on the applicability of the information and products. Mitsubishi Electric Corporation assumes no responsibility for any damage, liability or other loss resulting from the information contained herein.
- Mitsubishi Electric Corporation semiconductors are not designed or manufactured for use in a device or system that is used under circumstances in which human life is potentially at stake. Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor when considering the use of a product contained herein for any specific purposes, such as apparatus or systems for transportation, vehicular, medical, aerospace, nuclear, or undersea repeater use.
- The prior written approval of Mitsubishi Electric Corporation is necessary to reprint or reproduce in whole ore in part these materials.
- If these products or technologies are subject to the Japanese export control restrictions, they must be exported under a license from the Japanese government and cannot be imported into a country other than the approved destination.
  Any diversion or re-export contrary to the export control laws and regulations of Japan and/or the country of destination is prohibited.
- Please contact Mitsubishi Electric Corporation or an authorized Mitsubishi Semiconductor product distributor for further details on these materials or the products contained therein.

MITSUBISHI ELECTRIC CORPORATION