



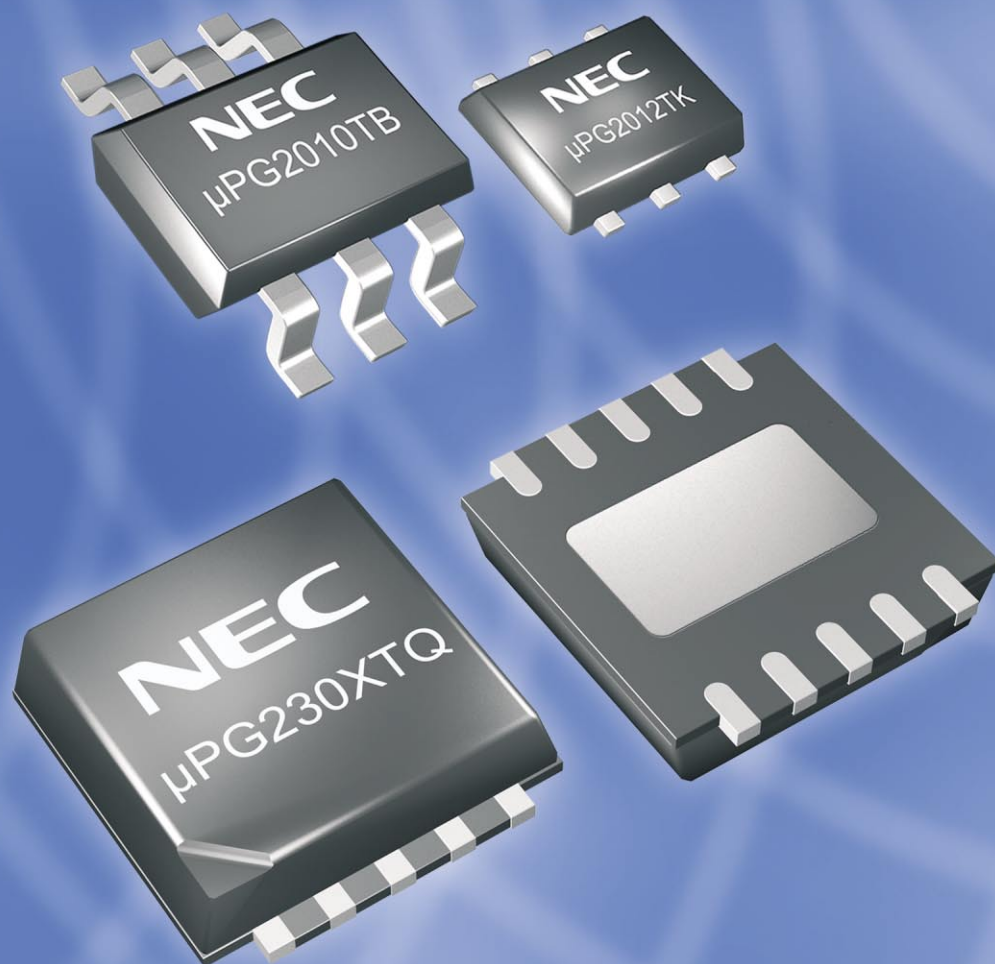
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RF & Microwave Device Overview 2003

Silicon and GaAs Semiconductors

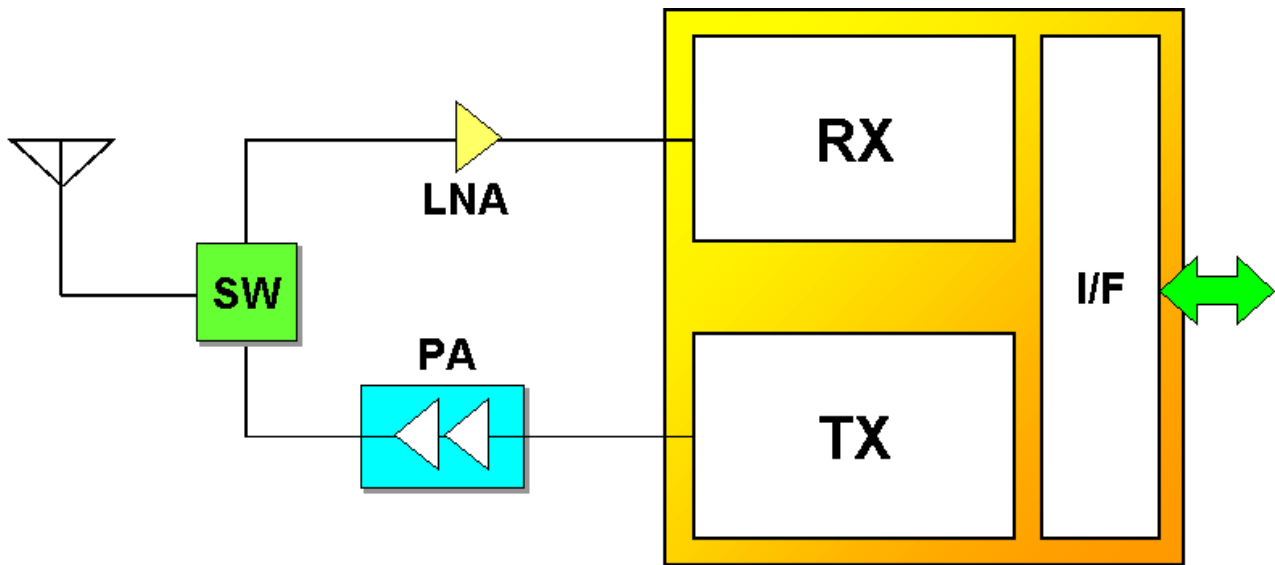


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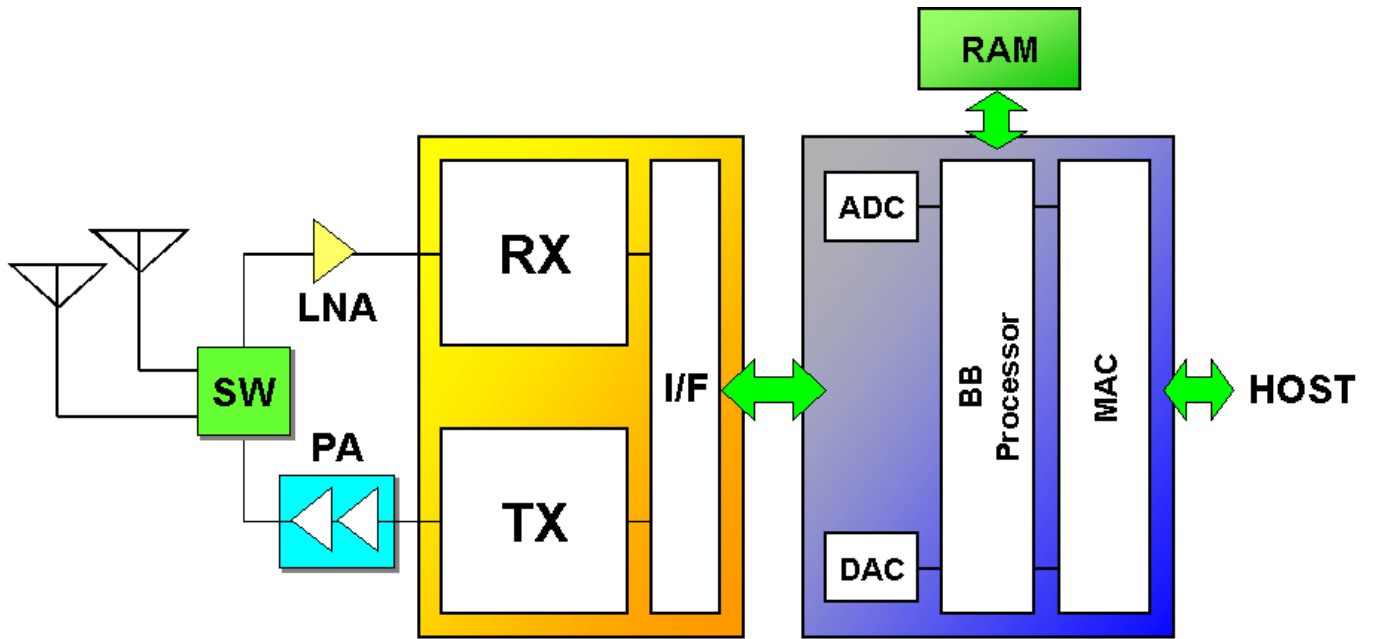
NEC

Application Examples

Bluetooth

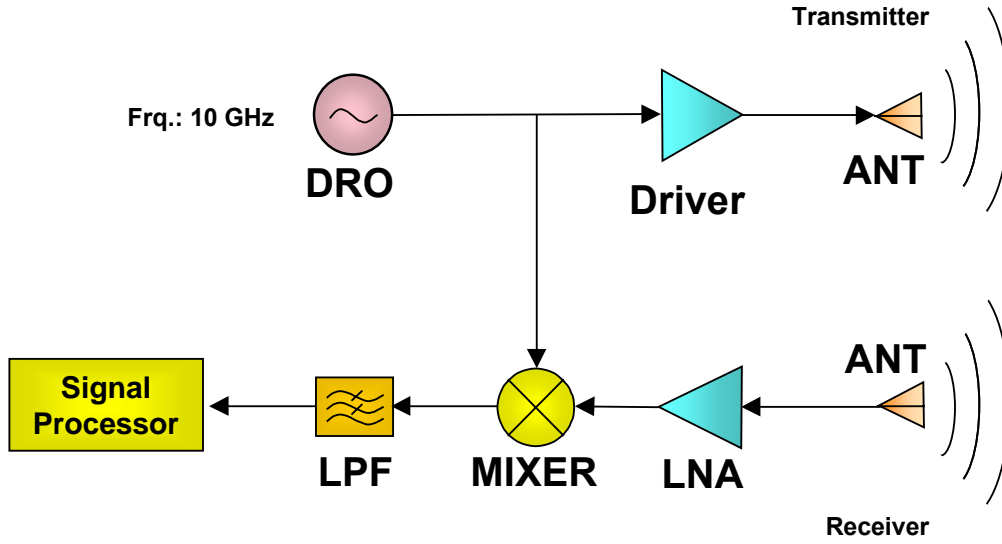


Block	Function	Device Name	Feature	Page
SW	SPDT	uPG158TB		51
		uPG2008TK	L2MM, Lead Less Package	51
		uPG2012TB/TK	Single Control Voltage	51
		uPG2015TB	Single Control Voltage	51
PA	Class one Amp.	uPG2301TQ	GaAs MMIC	50
		NE552R479A	Si LD-MOS Tr.	31
		NE664M04	Si. Bipolar Tr.	31



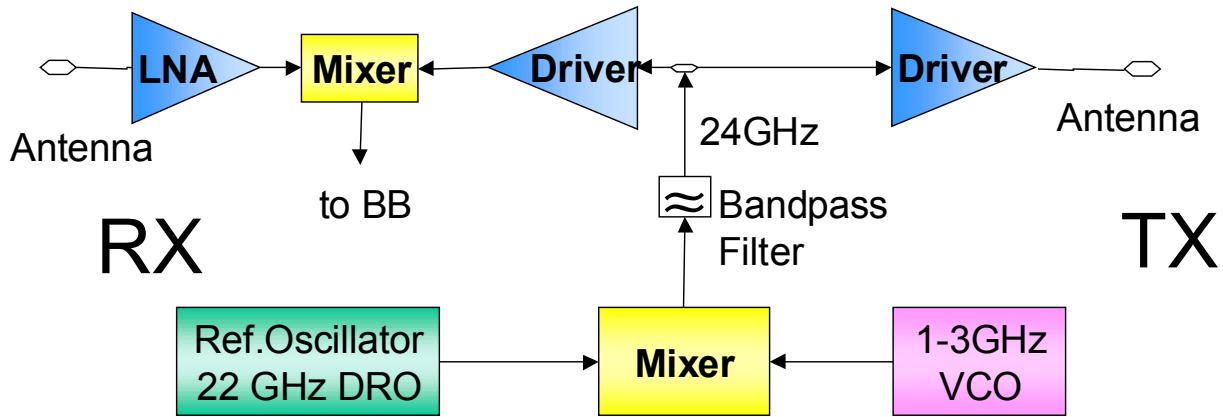
Block	Function	Device Name	Feature	Page
SW	SPDT	UPG2022TB		*
	DPDT	uPG2024TQ		*
LNA	SiGe HBT	NESG2021M05		30
		NESG2031M05		30
	GaAs HBT	NE52418		47
PA	Power Amp.	uPG2306TQ	GaAs MMIC, high Gain	*

* under development



Block	Function	Device Name	Feature	Page
DRO	Oscillator	NE66219	Posc: 7dBm @ 11GHz	27
		NE662M04	Posc: 7dBm @ 11GHz	29
DRI	Driver Amp.	NE4210S01	NF 0,5dB; Gain 13dB	47
		NESG2021M05	SiGe HBT	30
		NESG2031M05	SiGe HBT	30
		NESG2101M05	SiGe HBT	30
LNA	Low Noise Amp.	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47
MIX	Mixer	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47

24GHz FMCW Radar



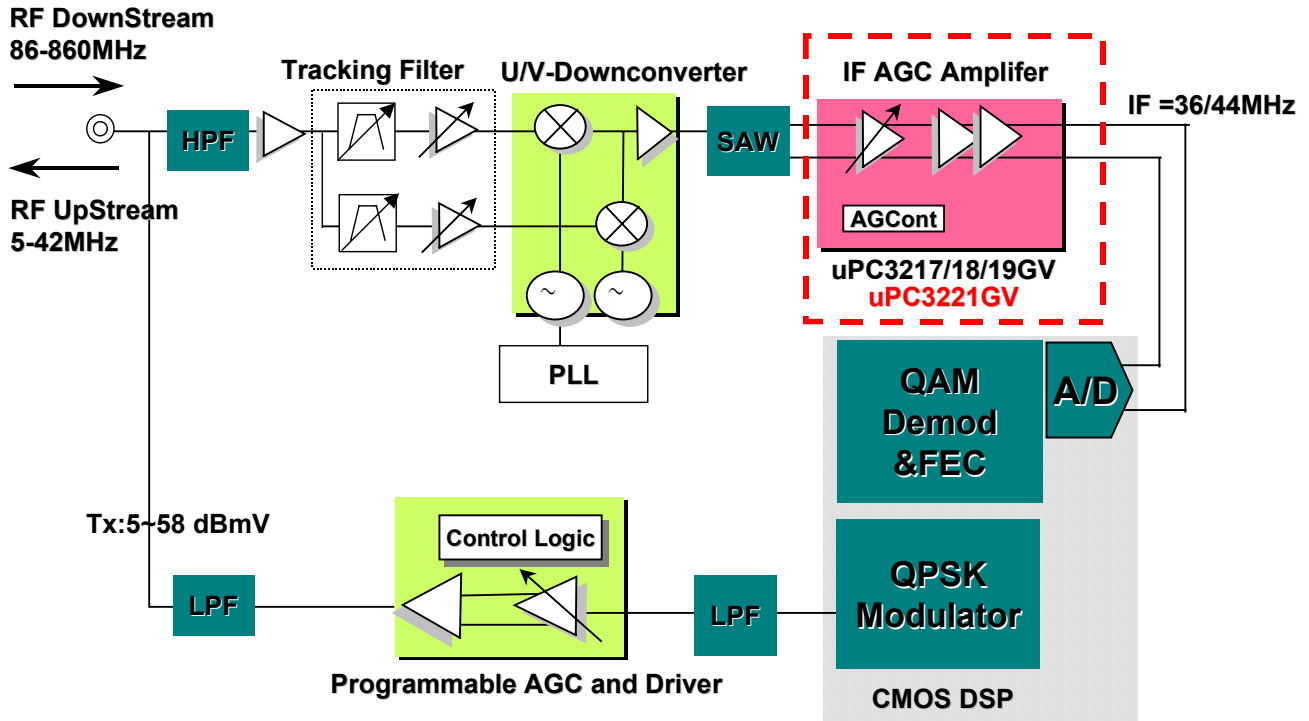
Block	Function	Device Name	Feature	Page
VCO	Osc + Buffer Amp.	UPA8XX series	Si Bipolar Twin Transistors	33,34
DRO	Oscillator	NE350184C	NF 0,7dB; Gain 12dB @20GHz	*
		NE350284C	NF 1,1dB; Gain 8dB @24GHz	*
MIX	Mixer	NE350284C	NF 1,1dB; Gain 8dB @24GHz	*
DRI	Driver Amp.	NE350284C	NF 1,1dB; Gain 8dB @24GHz	*

* under development

For SRR and AGC Automotive applications

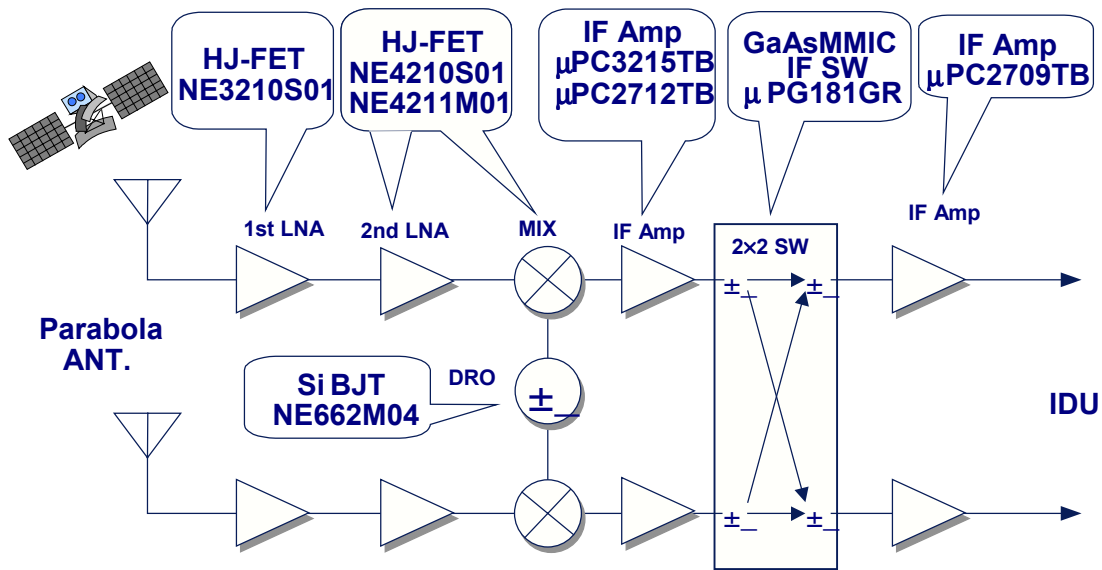
Block	Function	Device Name	Feature	Page
DRO	Oscillator	NE450184C	NF 0,9dB; Gain 10dB @24GHz	*
		NE450284C	NF 1,1dB; Gain 8dB @24GHz	*
MIX	Mixer	NE450184C	NF 0,9dB; Gain 10dB @24GHz	*
		NE450284C	NF 1,1dB; Gain 8dB @24GHz	*
LNA	Low Noise Amp.	NE450184C	NF 0,9dB; Gain 10dB @24GHz	*
		NE450284C	NF 1,1dB; Gain 8dB @24GHz	*
DRI	Driver Amp.	NE450184C	NF 0,9dB; Gain 10dB @24GHz	*
		NE450284C	NF 1,1dB; Gain 8dB @24GHz	*

* under development

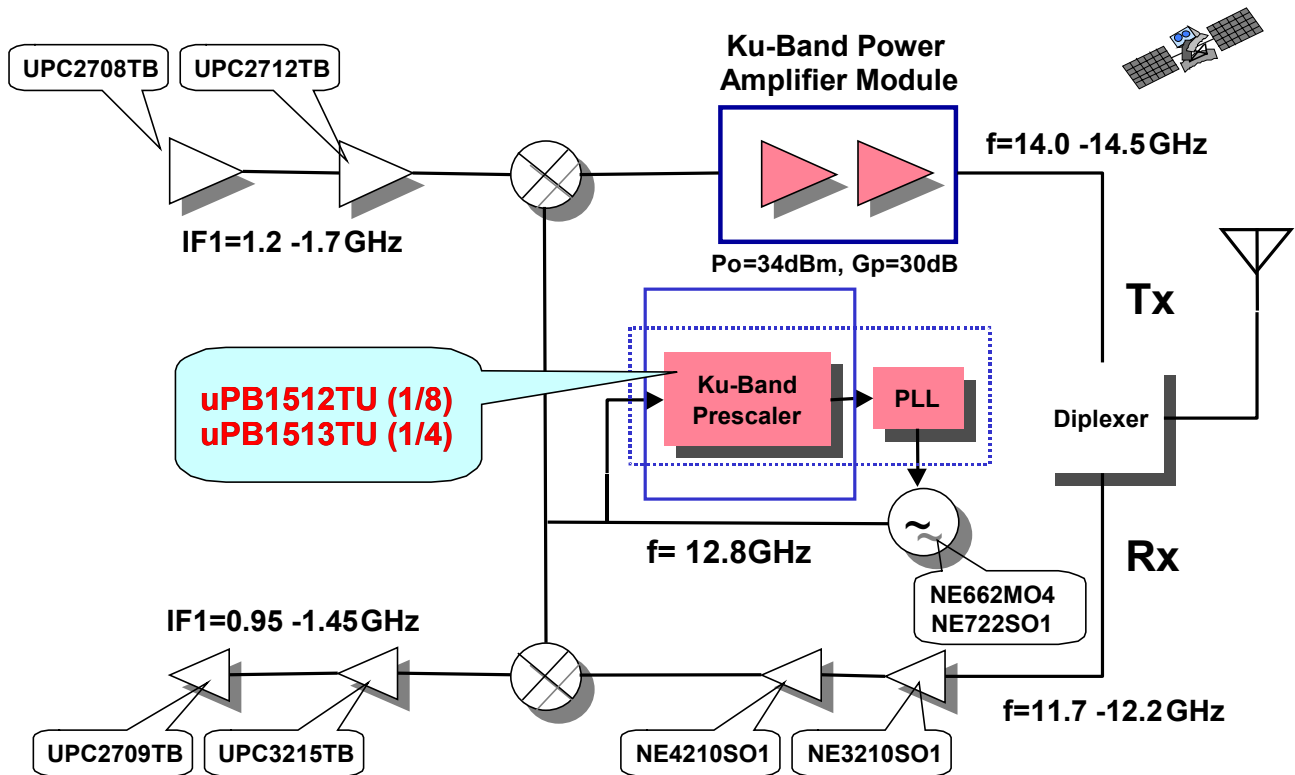


Block	Function	Device Name	Feature	Page
IF-AGC	AGC+Video Amp.	UPC3217GV	Gain 53dB; NF 6.5dB;	40
	AGC+Video Amp.	UPC3218GV	Gain 63dB; NF 3.5dB;	40
	AGC+Video Amp.	UPC3219GV	Gain 43dB; NF 9dB; High IM3	40
	AGC Amp.	UPC3221GV	Gain 53dB; NF 4dB; High IM3	*

* under development

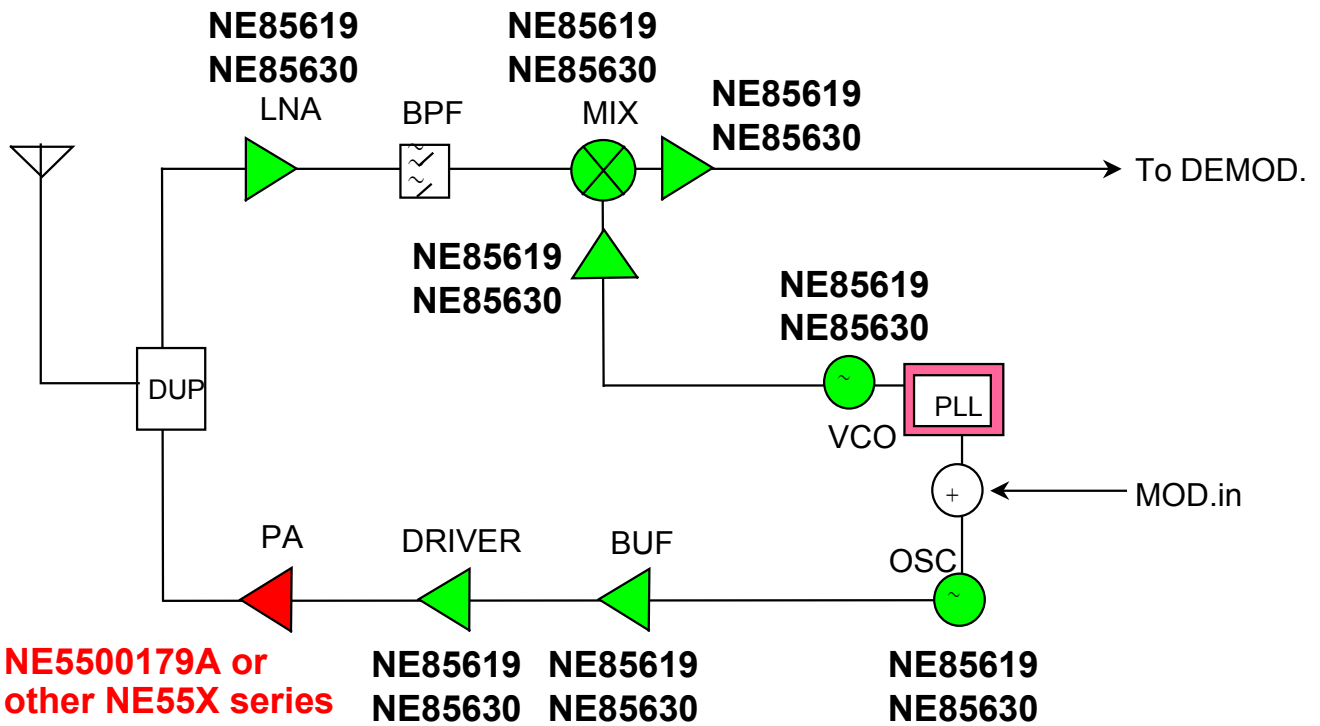


Block	Function	Device Name	Feature	Page
DRO	Oscillator	NE66219	Posc: 7dBm @ 11GHz	27
		NE662M04	Posc: 7dBm @ 11GHz	30
1 st LNA	1 st Stage LNA	NE3210S01	NF 0,35dB; Gain 13,5dB	47
2 nd LNA	2 nd Stage LNA	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47
MIX	Mixer	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47
IF Amp	IF Amp	UPC2709TB	High gain, Mid. Out put power	37
		UPC2712TB	High gain	37
		UPC3215TB	Low NF, High Isolation	37
SW	2x2 Switch	UPG181GR	Lins 5dB, ISO >30dB	51
	2x SPDT	UPG187GR	Lins 2dB, ISO >40dB	51



Block	Function	Device Name	Feature	Page
DRO	Oscillator	NE66219	Posc: 7dBm @ 11GHz	27
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1 st LNA	1 st Stage LNA	NE3210S01	NF 0,35dB; Gain 13,5dB	47
2 nd LNA	2 nd Stage LNA	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47
MIX	Mixer	NE4210S01	NF 0,5dB; Gain 13dB	47
		NE4211M01	Low cost; Gain 12dB	47
IF Amp	IF Amp	UPC2708TB	Mid. Power	37
		UPC2709TB	Mid. Power, High Gain	37
		UPC2712TB	High Gain	37
		UPC3215TB	Low NF, Low Current	37
Prescaler	SiGe Prescaler	UPB1512TU	Divide by 8, 14GHz	*
		UPB1513TU	Divide by 4, 14GHz	*

* under development



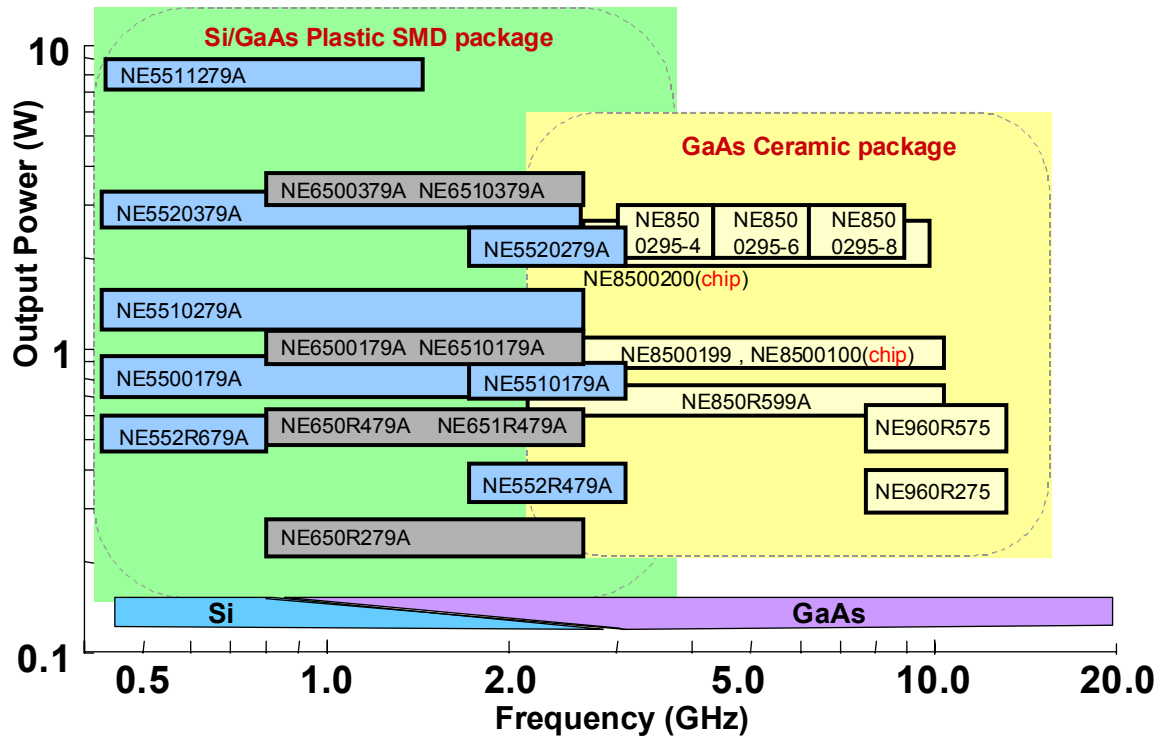
NE5500179A or other NE55X series

NE85619 NE85630
NE85619 NE85630

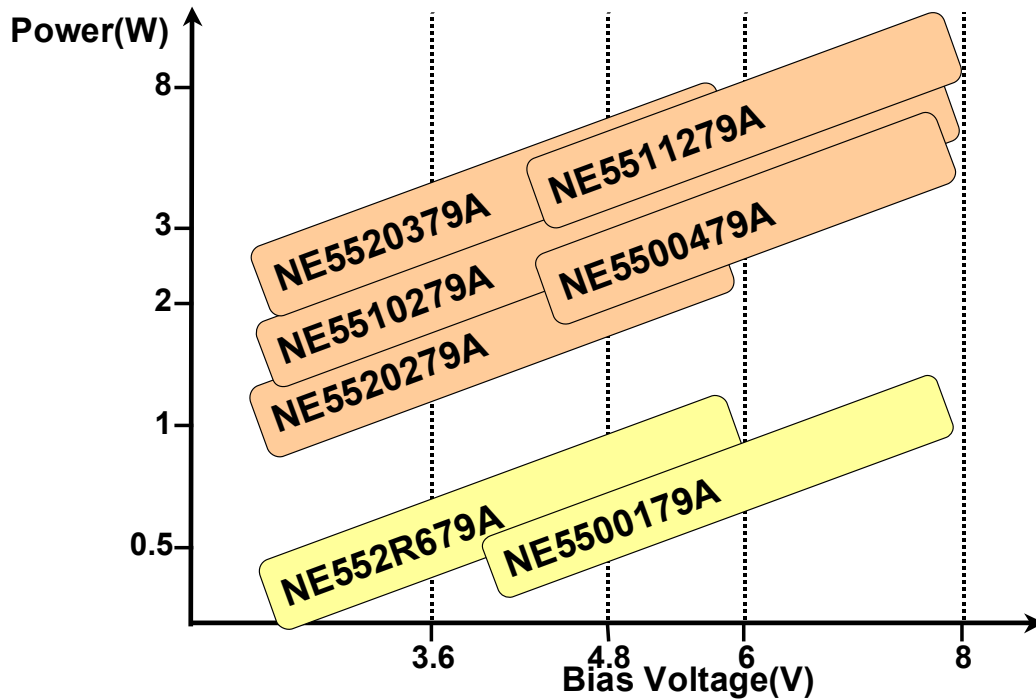
NE85619 NE85630

Block	Function	Device Name	Feature	Page
OSC	Oscillator	NE85619	Si LN Tr, 3 PIN 1.5 x 1,5 mm	27
		NE85630	Si LN Tr, 3 PIN SOT 323	28
BUF	Buffer Amp.	NE85619	Si LN Tr, 3 PIN 1.5 x 1,5 mm	27
		NE85630	Si LN Tr, 3 PIN SOT 323	28
MIX	Mixer	NE85619	Si LN Tr, 3 PIN 1.5 x 1,5 mm	27
		NE85630	Si LN Tr, 3 PIN SOT 323	28
DRI	Driver Amp.	NE85619	Si LN Tr, 3 PIN 1.5 x 1,5 mm	27
		NE85630	Si LN Tr, 3 PIN SOT 323	28
LNA	Low Noise Amp.	NE85619	Si LN Tr, 3 PIN 1.5 x 1,5 mm	27
		NE85630	Si LN Tr, 3 PIN SOT 323	28
PA	Power Amp.	NE5500179A	PMR446 PA or Driver for PMR	31
		NE5511279A	10W PA for PMR handset	31
		NE55XXX79A	PA or Driver for PMR	31

Medium Power Devices Overview



NE55XXX79A Medium Power LD-MOS FET Series



4 PACKAGE, CHARACTERISTICS CROSS-REFERENCE

4.1 Low Noise Transistors

Package fT(GHz)	Power minimold (3-Pin)	New power minimold (4-Pin)	3-Pin minimold	3-Pin super minimold	4-Pin minimold	4-Pin super minimold	3-Pin ultra super minimold (1608)	Flat-lead 3-Pin thin ultra super minimold (1408)	6-Pin super minimold High gain	Flat-lead 4-Pin thin super minimold (R type)	3-Pin Lead-Less Minimold (1005)	3-Pin Lead-Less Super Minimold (0804)
4.0												
5.0				NE58230			NE58219	NE582M03				
5.3	NE46134	NE461M02										
5.5				NE58130			NE58119					
6.0	NE46234	NE462M02										
7.0 ^{*1}	NE85634	NE856M02	NE85633	NE85630	NE85639E	NE85618Er ror! Bookmark not defined.	NE85619Er ror! Bookmark not defined.	NE856M03 Error! Bookmark not defined.			NE856M13 Error! Bookmark not defined.	NE856M33
								NE863M03 Error! Bookmark not defined.			NE863M13 Error! Bookmark not defined.	
								NE819M03			NE819M13	
9.0			NE68133	NE68130	NE68139E	NE68118	NE68119	NE681M03			NE681M13	
10.0 ^{*1}			NE68033	NE68030	NE68039E	NE68018	NE68019	NE680M03				
			NE68833	NE68830	NE68839	NE68818	NE68819	NE688M03			NE688M13	
								NE851M03			NE851M13	NE851M33
					NE68039							
12.0					NE67839	NE67818				NE678M04		
			NE68533	NE68530	NE68539E	NE68518	NE68519	NE685M03			NE685M13	NE685M33
14.0									NE696M01			
14.5					NE67739							
15.0						NE67718				NE677M04		
15.5						NE68618	NE68619					
						NE68718	NE68719	NE687M03			NE687M13	NE687M33
17.0									NE663M04			
20.0								NE894M03			NE894M13	
										NE664M04		
21.0							NE66719	NE667M03			NE667M13	
25.0										NE661M04		
							NE66219	NE662M03		NE662M04		

*1: Lower stage, low operation voltage and low phase noise type.

4.2 Dual Gate MOS FETs

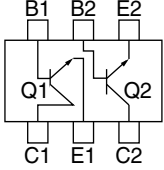
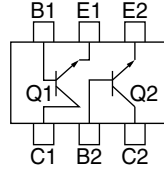
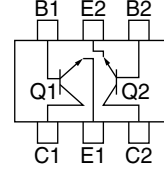
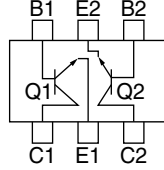
Application		Package	4 Pins Minimold	4 Pins Super Minimold
VHF Band (to 200 MHz)			NE92039	
CATV Band (to 470 MHz)				NE93218
UHF Band (to 900 MHz)	$\lambda/4$ matching			NE93318

4.3 Dual Gate GaAs FETs

Package	Remark
4-Pin Super Minimold	
NE25118	$W_g = 400 \mu m$

4.4 Twin Transistors

Twin transistors are composed of two low-noise NPN transistors integrated in a single package, and can be divided into 4 different types, depending on the pin layout. There are, moreover, 2 types of chip: a homogenous chip on which two elements with identical characteristics have been mounted “same chip”), and a heterogeneous chip on which two elements with different characteristics have been mounted “different chip”). Various package sizes are also available. The relationship between the part number and internal elements is shown in the table below.

 Type 1		 Type 2		 Type 3		 Type 4		
Same Chip						Different Chip		
for Pager		for VCO		for Mobile Communications		For VCO		
Part No.	NE No. (x2)	Part No.	NE No. (x2)	Part No.	NE No. (x2)	Part No.	NE No.	
							Q1	Q2
μ PA800T	NE68019	μ PA811T	NE68019	μ PA891TC, TD	NE728M03	μ PA841TD	NE687M03	NE728M03
μ PA801T	NE85619	μ PA810T	NE85619	μ PA892TC, TD	NE667M03	μ PA850TD	NE685M03	2SC5736
μ PA802T	NE68119	μ PA812T	NE68119			μ PA851TD	2SC5737	2SC5736
μ PA803T	NE58119	μ PA813T	NE58119			μ PA854TD	NE685M03	NE819M03
μ PA804T	NE58219					μ PA855TD	2SC5737	NE819M03
μ PA805T	NE68419					μ PA859TD	2SC5737	NE863M03
μ PA806T	NE68519					μ PA860TD	NE685M03	NE894M03
μ PA807T	NE68619					μ PA861TD	NE687M03	NE894M03
μ PA808T	NE68719			μ PA828TD	NE68719	μ PA862TD, TS	NE685M03	NE851M03
μ PA809T	NE68819	μ PA814T	NE68819	μ PA895TD, TS	NE851M03	μ PA863TD, TS	NE687M03	NE851M03
μ PA872TD	NE863M03							
μ PA873TC, TD,TS	NE852M03							

Remark Mold size

T Type : 2.0 × 1.25 × 0.9 (mm)

TC Type : 1.5 × 1.1 × 0.55 (mm)

TD Type : 1.2 × 0.8 × 0.5 (mm)

TS Type : 1.0 × 0.7 × 0.5 (mm)

5 PART NO., PRODUCTS LINE UP

5.1 Low-Noise Transistors (1/4)

A wide range of products are available, classified by function and application.

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													Outline
	V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	P _T (mW)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)				
					V _{CE} (V)	I _C (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	
4-Pin super minimold																		
NE67718	9	–	6	2	3	20	75	120	15	3	20	2.0	13	3	5	2.0	1.7	Fig.9
NE67818	9	–	6	2	3	30	75	150	12	3	30	2.0	10	3	7	2.0	1.7	Fig.9
NE68018	20	10	1.5	150	6	10	50	250	10.0	6	10	2.0	9.5	6	5	2.0	1.8	Fig.9
NE68118	20	10	1.5	150	8	20	50	250	9.0	8	20	1.0	15	8	7	1.0	1.2	Fig.9
NE68518	9	6	2.0	150	3	10	65	175	12.0	3	10	2.0	11	3	3	2.0	1.5	Fig.9
NE68618	5	3	2	30	2	7	70	140	15.5	2	7	2	12	1	3	2	1.5	Fig.9
NE68718	5	3	2	90	2	20	70	140	13	2	20	2	11	1	3	2	1.3	Fig.9
NE68818	9	6	2	150	1	3	80	160	10	3	20	2	8.5	3	7	2	1.5	Fig.9
NE85618	20	12	3.0	150	3	7	50	250	6.5	10	20	1.0	13	10	7	1.0	1.1	Fig.9
3-Pin ultra super minimold (1608)																		
NE58119	20	12	3.0	100	5	5	60	120	5.5	5	5	1.0	5.0 ^{*2}	–	–	–	–	Fig.5
NE58219	20	12	3.0	100	5	5	60	120	5.0	5	5	1.0	5.0 ^{*2}	–	–	–	–	Fig.5
NE66219	15	3.3	1.5	115	2	3	50	100	21	2	20	2	12.5	2	5	2	1.2	Fig.5
NE68019	20	10	1.5	100	3	5	80	160	8.0	3	5	2.0	7.5	3	5	2.0	1.9	Fig.5
NE68119	20	10	1.5	100	3	7	80	160	7.0	3	7	1.0	12	3	7	1.0	1.4	Fig.5
NE68519	9	6	2.0	100	3	10	65	175	12.0	3	3	2.0	8.5	3	3	2.0	1.5	Fig.5
NE68619	5	3	2	30	2	7	70	140	13	2	7	2	10.5	1	3	2	1.5	Fig.5
NE68719	5	3	2	90	2	20	70	140	11	2	20	2	10	1	3	2	1.3	Fig.5
NE68819	9	6	2	125	1	3	80	160	9.5	3	20	2	8	3	7	2	1.5	Fig.5
NE85619	20	12	3.0	100	3	7	80	160	4.5	3	7	1.0	9	3	7	1.0	1.2	Fig.5

*1: C_{ob}

*2: Base Ground

Low-Noise Transistors (2/4)

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													Outline
	V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	P _T (mW)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)				
					V _{CE} (V)	I _C (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	
									TYP.									
3-Pin super minimold																		
NE58130	20	12	3.0	200	5	5	40	200	5.5	5	5	1.0	7.0	-	-	-	-	Fig.4
NE58230	20	12	3.0	200	5	5	40	200	5.0	5	5	1.0	7.0	-	-	-	-	Fig.4
NE68030	20	10	1.5	150	3	5	50	250	8.5	3	5	2.0	7.5	3	5	2.0	1.9	Fig.4
NE68130	20	10	1.5	150	3	7	40	240	7.0	3	7	1.0	12	3	7	1.0	1.4	Fig.4
NE68530	9	6	2.0	150	3	10	65	175	12	3	10	2.0	11	3	3	2.0	1.5	Fig.4
NE68830	9	6	2	150	1	3	80	160	9	3	20	2	6.5	3	7	2	1.5	Fig.4
NE85630	20	12	3.0	150	3	7	40	250	4.5	3	7	1.0	9.0	3	7	1.0	1.2	Fig.4
3-Pin minimold																		
NE68033	20	10	1.5	200	6	10	50	250	10.0	6	10	2.0	8.0	6	5	2.0	1.8	Fig.2
NE68133	20	10	1.5	200	8	20	50	250	9.0	8	20	1.0	13.0	8	7	1.0	1.2	Fig.2
NE68533	9	6	2.0	180	3	10	65	175	12	3	10	2.0	8.5	3	3	2.0	1.5	Fig.2
NE68833	9	3	2	200	1	3	80	160	8.5	3	20	2	6.5	3	7	2	1.5	Fig.2
NE85633	20	12	3	200	10	20	50	300	7.0	10	20	1.0	11.5	10	7	1.0	1.1	Fig.2
NE97733	-20	-12	-3	200	-8	-20	20	100	8.5	-8	-20	1	12	-8	-3	1	1.5	Fig.2
NE97833	-20	-12	-3	200	-10	-15	20	100	0.5	-10	-15	1	10	-10	-3	1	2	Fig.2
Power minimold (3-Pin)																		
NE46134	30	15	30	2000	10	50	40	200	5.7	10	50	1.0	7.0	10	50	0.5	2.5	Fig.3
NE46234	25	12	2.5	1800	5	50	50	250	6.0	5	50	1.0	8.3	5	50	1.0	2.3	Fig.3
NE85634	20	12	3	1200	10	20	50	300	6.5	10	20	1.0	9.0	10	7	1.0	1.1	Fig.3
4-Pin minimold																		
NE67739	9	6	2	200	3	20	75	150	14.5	3	20	2	12	3	5	2	1.5	Fig.7
NE67839	9	6	2	200	3	30	75	150	12	3	30	2	10	3	7	2	1.5	Fig.7
NE68039E	20	10	1.5	200	6	10	50	250	10	6	10	2.0	9.5	6	5	2.0	1.8	Fig.7
NE68139E	20	10	1.5	200	8	20	50	250	9.0	8	20	1.0	15.0	8	7	1.0	1.2	Fig.7
NE68539E	9	6	2.0	180	3	10	65	175	12	3	10	2.0	11	3	3	2.0	1.5	Fig.7
NE68839	9	6	2	200	1	3	80	160	9	3	20	2	8	3	7	2	1.5	Fig.7
NE68939	9	6	2	200	3.6	100	60	-	-	-	-	-	-	-	-	-	-	Fig.7
NE69039	9	6	2	200	3.6	200	60	-	-	-	-	-	-	-	-	-	-	Fig.7
NE85639E	20	12	3	200	10	20	50	250	6.5	10	20	1.0	13.0	10	7	1.0	1.1	Fig.7

Low-Noise Transistors (3/4)

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													Outline
	V _{CB0} (V)	V _{CEO} (V)	V _{EBO} (V)	P _T (mW)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)				
					V _{CE} (V)	I _C (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	
6-Pin super minimold High gain																		
NE696M01	9	6	2	150	3	10	80	160	14	3	10	2	14	3	3	2	1.3	Fig.14
New power minimold (4-Pin)																		
NE461M02	30	15	3	2000	10	50	40	200	–	10	50	1	8.3	10	50	1	2.0	Fig.8
NE462M02	25	12	2.5	1800	5	50	50	250	6	5	50	1	10	5	50	1	–	Fig.8
NE856M02	20	12	3	1200	10	20	50	250	6.5	10	20	1	12	10	7	1	1.1	Fig.8
Flat-lead 3-Pin thin ultra super minimold (1408)																		
NE582M03	20	12	3	100	5	5	60	120	4.3	5	5	1	5 (MIN.)	–	–	–	–	Fig.6
NE662M03	15	3.3	1.5	115	2	5	60	100	20	2	20	2	17	2	5	2	1.5	Fig.6
NE667M03	15	3.3	1.5	115	2	5	50	100	21	1	10	2	11.0	2	5	2	1.1	Fig.6
NE680M03	20	10	1.5	125	3	5	80	145	8	3	5	2	7.5	3	5	2	1.9	Fig.6
NE681M03	20	10	1.5	125	3	7	80	145	7	3	7	1	12	3	7	1	1.4	Fig.6
NE685M03	9	6	2	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Fig.6
NE687M03	5	3	2	90	2	20	70	130	14	2	20	2	10	2	3	2	1.4	Fig.6
NE688M03	9	6	2	125	1	3	80	145	9.5	3	20	2	8	3	7	2	1.7	Fig.6
NE819M03	15	5.5	1.5	200	1	10	100	145	5.5	1	10	2	4.5	1	10	2	2	Fig.6
NE851M03	9	5.5	1.5	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Fig.6
NE856M03	20	12	3	125	3	7	80	145	4.5	3	7	1	10	3	7	1	1.4	Fig.6
NE863M03	9	5.5	1.5	200	1	10	100	160	5.5	1	10	2	4	1	10	2	1.8	Fig.6
NE894M03	9	3	1.5	115	1	5	50	100	20	1	20	2	13	1	5	2	1.4	Fig.6
Flat-lead 4-Pin thin super minimold (R type)																		
NE661M04	15	3.3	1.5	39	2	2	50	100	25	2	5	2	17	2	2	2	1.1	Fig.10
NE662M04	15	3.3	1.5	115	2	5	50	100	25	2	20	2	17	2	5	2	1.1	Fig.10
NE663M04	15	3.3	1.5	190	2	10	50	100	17	2	50	2	11	2	10	2	1.3	Fig.10

*1: C_{ob}

*2: MIN. Spec

Low-Noise Transistors (4/4)

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													Outline
	V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	P _T (mW)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)				
					V _{CE} (V)	I _C (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	
Flat-lead 3-Pin thin ultra super minimold (1005)																		
NE667M13	15	3.3	1.5	115	2	5	50	100	21	1	10	2	11.0	2	5	2	1.1	Fig.1
NE681M13	20	10	1.5	–	3	7	80	145	7	3	7	1	12	3	7	1	1.4	Fig.1
NE685M13	9	6	2	–	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Fig.1
NE687M13	5	3	2	–	2	20	70	130	11	2	20	2	10	2	3	2	1.3	Fig.1
NE688M13	9	6	2	–	1	3	80	145	5	1	3	2	4	1	3	2	1.9	Fig.1
NE819M13	15	5.5	1.5	–	1	10	100	145	5.5	1	10	2	4.5	1	10	2	2	Fig.1
NE851M13	9	5.5	1.5	–	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Fig.1
NE856M13	20	12	3	–	3	7	80	145	4.5	3	7	1	10	3	7	1	1.4	Fig.1
NE863M13	9	5.5	1.5	–	1	10	100	160	5.5	1	10	2	4	1	10	2	1.8	Fig.1
NE894M13	9	3	1.5	–	1	5	50	100	20	1	20	2	13	1	5	2	1.4	Fig.1
3-Pin thin ultra super minimold (1006)																		
NE685M33	9	6	2	–	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Fig.25
NE687M33	5	3	2	–	2	20	70	130	11	2	20	2	10	2	3	2	1.3	Fig.25
NE851M33	9	5.5	1.5	–	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Fig.25
6-Pin lead-less minimold (1208)																		
NE662M16	15	3.3	1.5	115	2	5	50	100	25	2	20	2	17	2	5	2	1.1	Fig.11

5.2 SiGe Low Noise Transistor

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													Outline
	V _{CB0} (V)	V _{CE0} (V)	V _{EB0} (V)	P _T (mW)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)				
					V _{CE} (V)	I _C (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.	V _{CE} (V)	I _C (mA)	f (GHz)	
Flat-lead 4-Pin thin super minimold																		
NESG2030M04	8	1.2	2.3	80	2	5	200	400	60	2	20	2	18	2	5	2	0.9	Fig.10
NESG2021M05	13	5	1.5	175	2	5	130	260	60	3	10	2	19	2	3	5.2	1.3	Fig.10
NESG2031M05	13	5	1.5	175	2	5	130	260	60	3	20	2	18	2	5	5.2	1.3	Fig.10
NESG2101M05	13	5	1.5	500	2	5	130	260	60	3	50	2	13.5	2	10	2	0.9	Fig.10
6-Pin lead-less minimold (1208)																		
NESG2030M16	8	1.2	2.3	80	2	5	200	400	60	2	20	2	18	2	5	2	0.9	Fig.11
NESG2021M16	13	5	1.5	175	2	5	130	260	60	3	10	2	19	2	3	5.2	1.3	Fig.11
NESG2031M16	13	5	1.5	175	2	5	130	260	60	3	20	2	18	2	5	5.2	1.3	Fig.11
NESG2101M16	13	5	1.5	190	2	15	130	260	60	3	50	2	13.5	2	10	2	0.9	Fig.11

5.3 Medium Output Power Transistors

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)						ELECTRICAL CHARACTERISTICS (T _A = 25 °C)								OUTLINE
	V _{CBO} (V)	V _{CER} (V) R = 10 Ω	V _{CEO} (V)	V _{EBO} (V)	I _C (mA)	P _T (mW)	Test Conditions			P _{1dB} (dBm)	η _c (%) @ P _{1dB}	G _L (dB)		IM ₃ (dBc) @ Δf=100kHz	
							f (GHz)	I _q (mA)	V _{CC} (V)			P _{in} (dBm)	TYP.		
										TYP.	TYP.				
NE68939	9	-	6	2	150	200	1.9	1	3.6	24	60	-	8	-	Fig.7
NE69039	9	-	6	2	300	200	1.9	1	3.6	27	70	-	6	-	Fig.7
NE677M04	9	-	6	2	50	205	1.8	8	2.8	15	50	-10	15.5	-	Fig.10
NE678M04	9	-	6	2	100	205	1.8	10	2.8	18	55	-5	13	-	Fig.10
NE664M04	13	-	5	1.5	500	215	1.8	20	3.6	26	60	15	12	-	Fig.10

5.4 Power MOS FETs

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)														OUTLINE
	V _{DS} (V)	V _{GS} (V)	I _D (A)	P _T (W)	V _{GS(OFF)} (V)				P _{out} (dBm)						η _c (%)	G _L (dB)			
					V _{DS} (V)	I _D (mA)	MIN.	MAX.	f (GHz)	V _{DS} (V)	I _{DQ} (mA)	P _{in} (dBm)	MIN.	TYP.		TYP.	P _{in} (dBm)	TYP.	
															TYP.				
NE5500179A	20	3.5	0.34	10	4.8	1	1.0	2.0	1.9	4.8	200	20	28.5	30.0	55	10	14.0	Fig.24	
NE5500479A	20	3.0	0.7	10	4.8	1	1.0	2.0	0.9	3.5	300	20	30.5	31.5	62	10	15.0	Fig.24	
NE5510279A	20	5.0	1.0	20	4.8	1	1.0	2.0	1.8	4.8	300	25	32.0	33.0	47	10	10.0	Fig.24	
NE5511279A	20	6.0	1.5	12.5	8.5	1.5	1.0	2.0	0.9	7.5	400	27	38.5	40.0	48	5	15.0	Fig.24	
NE5520279A	15	5.0	1.2	12.5	3.5	1	1.0	1.9	1.8	3.2	700	25	30.5	32.0	45	5	10.0	Fig.24	
NE5520379A	15	5.0	1.5	20	3.5	1	1.0	2.0	1.785	3.2	-	25	31.0	33.0	35	10	8.5	Fig.24	
NE552R479A	15	5.0	0.3	10.0	3.5	1	1.0	1.9	2.45	3.0	200	19	24.0	26.0	45	10	11.0	Fig.24	
NE552R679A	15	5.0	0.35	10.0	3.5	1	1.0	1.9	0.46	3.0	300	15	26.0	28.0	60	5	20.0	Fig.24	

5.5 High Power LD-MOS FETs

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)														OUTLINE
	V _{DS} (V)	V _{GS} (V)	I _D (A)	P _T (W)	V _{GS(OFF)} (V)				P _{out} (dBm)						η _c (%)	G _L (dB)			
					V _{DS} (V)	I _D (mA)	MIN.	MAX.	f (GHz)	V _{DS} (V)	I _{DQ} (mA)	P _{in} (dBm)	MIN.	TYP.		TYP.	P _{in} (dBm)	TYP.	
															TYP.				
NEM090303M-28	65	+7 -10	8	79.5	10	1	1.0	2.0	0.96	28	250	28	45	46.5	63	18	20	Fig.26	
NEM090853P-28	65	+7 -7	10	194	10	1	1.0	2.0	0.96	26	800	32	48.5	50	55	22	19	Fig.27	

5.6 Dual Gate MOS FETs

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)																		OUTLINE						
	V _{DSX} (V)	V _{G1S} (V)	V _{G2S} (V)	P _T (mW)	V _{DSS} (I _{DSX}) (mA)						V _{G1S} (OFF) (V)						V _{G2S} (OFF) (V)							NF (dB)					
					V _{DS} (V)	V _{G2S} (V)	V _{G1S} (V)	I _D		V _{DS} (V)	V _{G2S} (V)	I _D (μA)	MIN.		MAX.		V _{DS} (V)	V _{G1S} (V)	I _D (μA)	MIN.		MAX.		V _{DS} (V)	V _{G2S} (V)	I _D (mA)	f (MHz)	TYP.	
								MIN.	MAX.				MIN.	MAX.	MIN.	MAX.				MIN.	MAX.								
NE92039	18	±8	±8	200	6	3	0.75	0.01	8.0	6	3	10	0	+1.0	6	3	10	0	+1.0	6	4	10	200	1.2	Fig.7				
NE93218	18	±8	±8	150	3.5	3	0.5	0.1	5.0	3.5	3	10	-1.0	+1.0	3.5	3	10	0	+1.0	3.5	3	7	470	2.0	Fig.9				
NE93318	18	±8	±8	150	3.5	3	0.5	0.5	7.0	3.5	3	10	-1.0	+1.0	3.5	3	10	0	+1.0	3.5	3	7	900	1.8	Fig.9				

5.7 Dual Gate GaAs FETs

PART NO.	ABSOLUTE MAXIMUM RATINGS (T _A = 25 °C)				ELECTRICAL CHARACTERISTICS (T _A = 25 °C)																		OUTLINE							
	V _{DSX} (V)	V _{G1S} (V)	V _{G2S} (V)	P _T (mW)	I _{DSS} (I _{DSX}) (mA)						V _{G1S} (off) (V)						V _{G2S} (off) (V)							NF (dB)						
					V _{DS} (V)	V _{G2S} (V)	V _{G1S} (V)	I _D		V _{DS} (V)	V _{G2S} (V)	I _D (μA)	MIN.		MAX.		V _{DS} (V)	V _{G1S} (V)	I _D (μA)	MIN.		MAX.		V _{DS} (V)	V _{G2S} (V)	I _D (mA)	f (MHz)	TYP.	MAX.	
								MIN.	MAX.				MIN.	MAX.	MIN.	MAX.				MIN.	MAX.									
NE25118	13	-4.5	-4.5	120	5	0	0	5	40	5	0	100	-	-3.5	5	0	100	-	-3.5	5	1	10	900	1.1	2.5	Fig.9				

5.8 Twin Transistors (1/2)

Three types of packages suitable for reducing the size of sets are available.

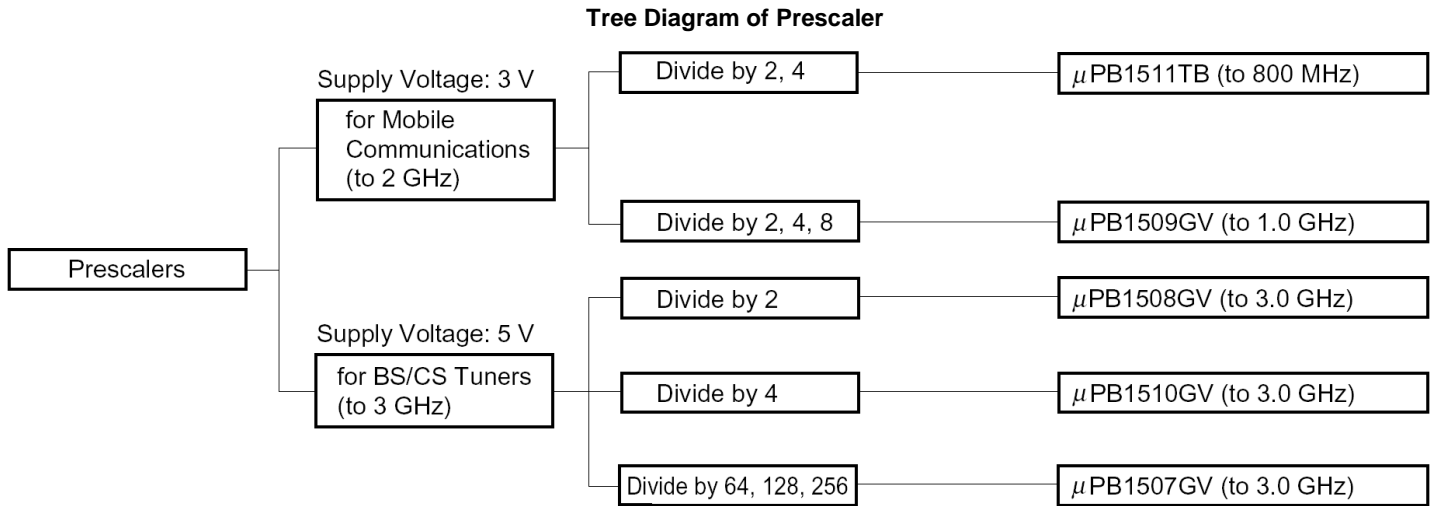
PART NO.	INTERNAL TRANSISTOR	ELECTRICAL CHARACTERISTICS (T _A = 25 °C)														PIN CONFIGURATION	OUTLINE	
		I _C MAY (mA)	h _{FE}				f _t (GHz)	S _{21e} ² (dB)			NF (dB)							
			V _{CE} (V)	I _c (mA)	MIN.	MAX.		TYP.	V _{CE} (V)	I _c (mA)	f (GHz)	MIN.	V _{CE} (V)	I _c (mA)	f (GHz)			TYP.
μPA800T	NE68019	35	3	5	80	200	8.0	1	3	2	4.5	1	3	2	1.9	Type 1	Fig.14	
μPA801T	NE85619	100	3	7	70	250	4.5	3	7	1	7	3	7	1	1.2	Type 1	Fig.14	
μPA802T	NE68119	65	3	7	70	240	7.0	3	7	1	10	3	7	1	1.4	Type 1	Fig.14	
μPA803T	NE58119	30	5	5	60	200	5.5	5	5	1	5	–	–	–	–	Type 1	Fig.14	
μPA804T	NE58219	60	5	5	60	200	5	5	5	1	5	–	–	–	–	Type 1	Fig.14	
μPA805T	NE68419	10	3	5	75	150	12	3	5	2	7	3	3	2	2.5	Type 1	Fig.14	
μPA806T	NE68519	30	3	10	75	150	12	3	10	2	7	3	3	2	1.5	Type 1	Fig.14	
μPA807T	NE68619	10	2	7	70	140	13	2	7	2	7.5	2	3	2	1.5	Type 1	Fig.14	
μPA808T	NE68719	30	2	3	70	140	11	2	20	2	7	2	3	2	1.3	Type 1	Fig.14	
μPA809T	NE68819	100	1	3	80	160	9.0	1	3	2	2.5	1	3	2	1.7	Type 1	Fig.14	
μPA810T	NE85619	100	3	7	70	250	4.5	3	7	1	7	3	7	1	1.2	Type 2	Fig.14	
μPA811T	NE68019	35	3	5	80	250	–	3	5	2	5.5	3	5	2	1.9	Type 2	Fig.14	
μPA812T	NE68119	65	3	7	70	240	7	3	7	1	10	3	7	1	1.4	Type 2	Fig.14	
μPA813T	NE58119	30	5	5	60	200	5.5	5	5	1	5	–	–	–	–	Type 2	Fig.14	
μPA814T	NE68819	100	1	3	80	160	9	3	20	2	–	3	7	2	1.5	Type 2	Fig.14	
μPA828TD	NE68819	30	2	3	70	140	11	2	20	2	7	2	3	2	1.3	Type 3	Fig.11	
μPA872TD	NE863M03	200	1	10	100	160	5.5	1	10	2	4	1	10	2	1.8	Type 1	Fig.11	
μPA873TC	NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Type 1	Fig.15	
μPA873TD	NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Type 1	Fig.11	
μPA873TS	NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9	Type 1	Fig.22	
μPA891TC	NE728M03	125	1	5	80	160	5	1	5	2	4	1	10	2	1.5	Type 3	Fig.15	
μPA891TD	NE728M03	125	1	5	80	160	5	1	5	2	4	1	10	2	1.5	Type 3	Fig.11	
μPA892TC	NE667M03	115	2	5	50	100	21	1	10	2	11.0	2	5	2	1.1	Type 3	Fig.15	
μPA892TD	NE667M03	115	2	5	50	100	21	1	10	2	11.0	2	5	2	1.1	Type 3	Fig.11	
μPA895TD	NE851M03	125	2	5	65	130	13.5	2	5	2	10	1	5	2	1.3	Type 3	Fig.11	
μPA895TS	NE851M03	125	2	5	65	130	13.5	2	5	2	10	1	5	2	1.3	Type 3	Fig.22	

Twin Transistors (2/2)

PART NO.	INTERNAL TRANSISTOR	ELECTRICAL CHARACTERISTICS (T _A = 25 °C)														PIN CONFIGURATION	OUTLINE
		I _C MAX (mA)	h _{FE}				f _T (GHz)	S _{21e} ² (dB)				NF (dB)					
			V _{CE} (V)	I _C (mA)	MIN.	MAX.		V _{CE} (V)	I _C (mA)	f (GHz)	MIN.	V _{CE} (V)	I _C (mA)	f (GHz)	TYP.		
							TYP.										
μPA841TD	Q1:NE687M03	90	2	20	70	130	14	2	20	2	10	2	3	2	1.4	Type 4	Fig.11
	Q2:NE728M03	125	1	5	80	160	5	1	5	2	4	1	10	2	1.5		
μPA850TD	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.11
	Q2:2SC5736	200	1	5	100	145	5	1	5	2	4.5	1	5	2	2		
μPA851TD	Q1:2SC5737	90	1	10	70	140	12	1	10	2	9	1	3	2	1.5	Type 4	Fig.11
	Q2:2SC5736	200	1	5	100	145	5	1	5	2	4.5	1	5	2	2		
μPA854TD	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.11
	Q2:NE819M03	200	1	10	100	145	5.5	1	10	2	4.5	1	10	2	2		
μPA855TD	Q1:2SC5737	90	1	10	70	140	12	1	10	2	9	1	3	2	1.5	Type 4	Fig.11
	Q2:NE819M03	200	1	10	100	145	5.5	1	10	2	4.5	1	10	2	2		
μPA859TD	Q1:2SC5737	90	1	10	70	140	12	1	10	2	9	1	3	2	1.5	Type 4	Fig.11
	Q2:NE863M03	200	1	10	100	160	5.5	1	10	2	4	1	10	2	1.8		
μPA860TD	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.11
	Q2:NE894M03	115	1	5	50	100	20	1	20	2	13	1	5	2	1.4		
μPA861TD	Q1:NE687M03	90	2	20	70	130	14	2	20	2	10	2	3	2	1.4	Type 4	Fig.11
	Q2:NE894M03	115	1	5	50	100	20	1	20	2	13	1	5	2	1.4		
μPA862TC	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.15
	Q2:NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9		
μPA862TD	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.11
	Q2:NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9		
μPA862TS	Q1:NE685M03	125	3	10	75	140	12	3	10	2	8.5	3	3	2	1.5	Type 4	Fig.22
	Q2:NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9		
μPA863TD	Q1:NE687M03	90	2	20	70	130	14	2	20	2	10	2	3	2	1.4	Type 4	Fig.11
	Q2:NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9		
μPA863TS	Q1:NE687M03	90	2	20	70	130	14	2	20	2	10	2	3	2	1.4	Type 4	Fig.22
	Q2:NE851M03	200	1	5	100	145	5	1	5	2	4	1	10	2	1.9		

5.9 Prescalers

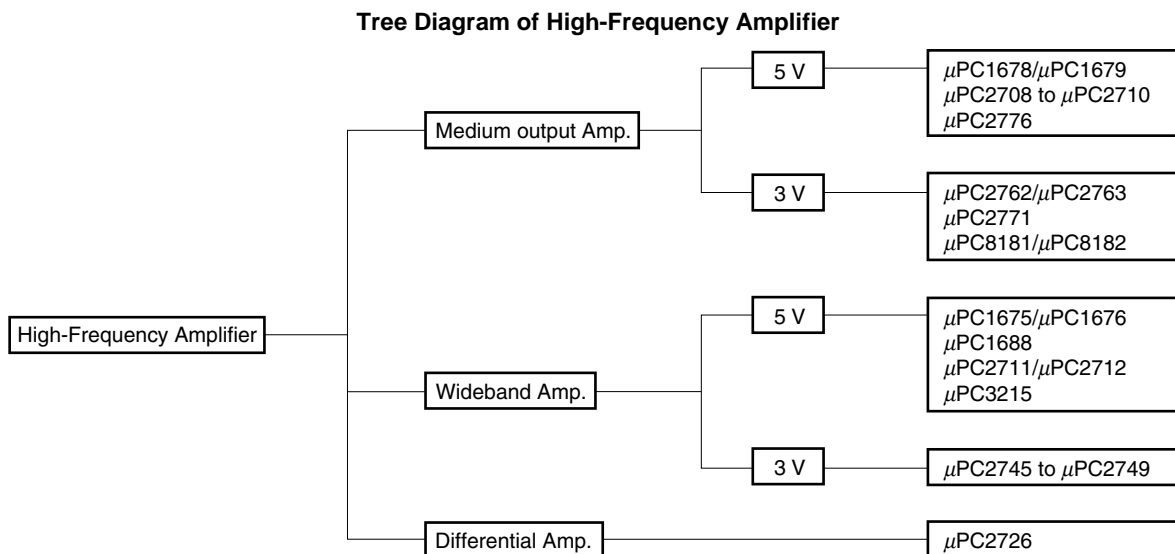
A range of prescalers classified by system, division ratio, pin layout, and package are provided by NEC. The lineup features prescalers with frequency characteristics ideal for devices such as mobile communication equipment and BS/CS tuners, as well as those employing a 175-mil SSOP package.



PART NO.	ELECTRICAL CHARACTERISTICS (T _A = 25 °C)											FUNCTION	OUTLINE
	f _{in} (GHz)		P _{in} (dBm)		P _{out} (dBm)				V _{CC} (V)	I _{CC} (mA)			
	MIN.	MAX.	MIN.	MAX.	f _{in} (GHz)	P _{in} (dBm)	MIN.	TYP.		MIN.	MAX.		
μPB1507GV	0.5	3.0	-15	+6	0.5 to 3.0	-10 to +6	1.2 V _{p-p}	1.6 V _{p-p}	5	12.5	26.5	64, 128, 256	Fig.17
μPB1508GV	0.5	3.0	-15	+6	2	0	-12	-7	5	7.0	14.5	2	Fig.17
μPB1509GV	0.05	1.0	-20	0	0.05 to 1.0	-20 to 0	0.1 V _{p-p}	0.2 V _{p-p}	2.2 to 5	3.5	5.9	2, 4, 8	Fig.17
μPB1510GV	0.5	3.0	-15	+6	2	0	-12	-7	5	15 typ.		4	Fig.17
μPB1511TB	0.05	0.8	-20	0	0.05 to 0.8	-20 to 0	0.2 V _{p-p}	0.3 V _{p-p}	2.2 to 3.3	3.1	4.1	2,4	Fig.14

5.10 High-Frequency Amplifiers (1/2)

In response to a variety of marketplace demands, NEC has made available a series of high-frequency amplifier ICs that includes an abundant product lineup. The package range also features a selection ideal for slim and compact applications.



PART NO.	Test Conditions		ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													OUTLINE
	V _{CC} (V)	f (GHz)	I _{CC} (mA) *1			f _u (GHz) *2		G _P (dB)			NF (dB)	ISL (dB)	P _o (dBm)			
			MIN.	TYP.	MAX.	MIN.	TYP.	MIN.	TYP.	MAX.	TYP.	TYP.	P _{in} (dBm)	MIN.	TYP.	
μPC1678GV	5	0.5	40	49	60	1.7	2.0	21	23	25	6.0	35	+3	+15.5	+17.5	Fig.17
μPC1688G	5	0.5	14	19	24	0.9	1.1	18	21	23	4.0	27	-5	2	4	Fig.7

*1: No input signal

*2: Upper limit of operating frequency

High-Frequency Amplifiers (2/2)

PART NO.	Test Conditions		ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													OUTLINE
	V _{CC} (V)	f (GHz)	I _{CC} (mA) *1			f _u (GHz) *2		G _P (dB)			NF (dB)	ISL (dB)	P _{O(sat)} (dBm)			
			MIN.	TYP.	MAX.	MIN.	TYP.	MIN.	TYP.	MAX.	TYP.	TYP.	P _{in} (dBm)	MIN.	TYP.	
μPC2708TB	5	1	20	26	33	2.7	2.9	13	15	18.5	6.5	23	0	+7.5	+10	Fig.14
μPC2709T μPC2709TB	5	1	19	25	32	2.0	2.3	21	23	26.5	5	31	0	+9	+11.5	Fig.13 Fig.14
μPC2710TB	5	0.5	16	22	29	0.7	1.0	30	33	36.5	3.5	39	-8	+11	+13.5	Fig.14
μPC2711TB	5	1	9	12	15	2.7	2.9	11	13	16.5	5	30	0	-2	+1	Fig.14
μPC2712TB	5	1	9	12	15	2.2	2.6	18	20	23.5	4.5	33	-2	0	+3	Fig.14
μPC2745TB	3	0.5	5	7.5	10	2.3	2.7	9	12	14	6	38	-6	-4	-1	Fig.14
μPC2746TB	3	0.5	5	7.5	10	1.1	1.5	16	19	21	4.0	45	-6	-3	0	Fig.14
μPC2747TB	3	0.9	3.8	5	7	1.5	1.8	9	12	14	3.3	40	-8	-9.5	-7	Fig.14
μPC2748TB	3	0.9	4.5	6	8	1.2	1.5	16	19	21	2.8	40	-8	-6	-3.5	Fig.14
μPC2749TB	3	1.9	4	6	8	2.5	2.9	13	16	18.5	4.0	30	-6	-9	-6	Fig.14
μPC2762TB	3	0.9 1.9	-	26.5	35	2.7	2.9	11 11.5	13 14.5	16 17.5	6.5 7.0	27 25	+3 +3	-	+9.0 +8.5	Fig.14
μPC2763TB	3	0.9 1.9	-	27	35	2.0	2.4	18 16.5	20 19.5	23 22.5	5.5 5.5	30 29	-3 -3	-	+11 +8.0	Fig.14
μPC2771TB	3	0.9 1.5	-	36	45	1.7	2.1	19 17	21 20	24 23	6.0 6.0	30 30	-3 -3	-	+12.5 +11	Fig.14
μPC2776TB	5	1.0	18	25	33	2.3	2.7	21	23	26	6.0	32	-	+4	+6.5	Fig.14
μPC3215TB	5	1.5	10.5	14.0	17.5	2.5	2.9	18.5	20.5	-	2.3	44	0	-	3.5	Fig.14

*1: No input signal

*2: Upper limit of operating frequency

PART NO.	Test Conditions		ELECTRICAL CHARACTERISTICS (T _A = 25 °C)													OUTLINE
	V _{CC} (V)	f (GHz)	I _{CC} (mA)			f (GHz)		G _P (dB)			NF (dB)	ISL (dB)	P _{O(1 dB)} (dBm)			
			MIN.	TYP.	MAX.	MIN.	MAX.	MIN.	TYP.	MAX.	TYP.	TYP.	MIN.	TYP.		
μPC8181TB	3	0.9 2.4	-	23.0	30.0	0.1	2.4	16.0 19.0	19.0 22.0	22.0 25.0	4.5 4.5	33 31.5	6.0 4.5	9.5 7.0	Fig.14	
μPC8182TB	3	0.9 2.4	-	30.0	38.0	0.1	2.4	19.0 18.0	21.5 20.5	25.0 24.0	4.5 5.0	33 31	7.0 5.5	9.5 8.0	Fig.14	

5.11 Down Converters

NEC provides a range of down converters classified by system, density, and package. The lineup features high frequency characteristics ideal for ground-wave TV/VCR, BS/CS tuners and CATV, and mobile communication. Different types, such as those incorporating an AGC circuit and those employing a compact package, are also available.

<for Mobile Communication>

PART NO.	ELECTRICAL CHARACTERISTICS (T _A = 25°C)						OUTLINE
	I _{CC} (mA)		CG1 (dB)		NF1 (dB)		
	V _{CC} (V)	TYP	f _{RFIn} (MHz)	TYP	f _{RFIn} (MHz)	TYP	
μPC2756TB	3	6.0	900	14	900	10	Fig.14
μPC2757TB	3	5.6	800	15	800	10	Fig.14
μPC2758TB	3	11	800	19	800	9	Fig.14
μPC8112TB	3	8.5	900	15	900	9	Fig.14

<for CATV Tuner>

PART NO.	ELECTRICAL CHARACTERISTICS (T _A = +25 °C)												OUTLINE			
	I _{CC} (mA)		CG _{MAX} (dB)		CG _{MIN} (dB)		GCR (dB)		IIP ₃		IIP ₃			f _{in} (MHz) *1		
	V _{CC} (V)	TYP.	16-17		16-17		V _{AGC} (V)	TYP.	16-17 (dBm)		16-17 (dBm)			-	MIN.	MAX.
			Pin	TYP.	pin	TYP.			pin	TYP.	pin	TYP.				
μPC2798GR	5	35.5	short	74	short	39	1 to 4	32	short	-14	open	-8	-	30	250	Fig.20
	9	47	short	78.5	short	43.5			short	-	open	-7.5				

*1: Input frequency range of AGC amplifier.

5.12 Up Converters

This is a frequency up converter series for transmission-stage of mobile communication equipment. The series includes the μ PC8106, which focuses on low-distortion characteristics, the low-current-consuming μ PC8109, and the high-IP₃ μ PC8163. Selection can be made based on the system. Both T (minimold) and TB (super minimold) packages are available (except for the μ PC8163, which supports only the TB package).

PART NO.	ELECTRICAL CHARACTERISTICS (T _A = 25 °C)										OUTLINE
	I _{CC} (mA)		CG ₁ (dB)		CG ₂ (dB)		NF ₁ (dB) *1		P _{O(sat)} (dBm) (P _{IN} = 0dBm)		
	V _{CC} (V)	TYP.	f _{RFout} (MHz)	TYP.	f _{RFout} (MHz)	TYP.	f _{RFout} (MHz)	TYP.	f _{RFout} (MHz)	TYP.	
μ PC8106TB	3	9	900	10 9	1900	7	900	8.5	1900	-4	Fig.14
μ PC8109TB	3	5	900	7 6	1900	5 4	900	8.5	900	-5.5	Fig.14
μ PC8163TB	3	16.5	830	9	1900	5.5	830	12.5	830	-0.5	Fig.14
μ PC8172TB	3	9	900	9.5	2400	8.5	900	9.5	900 2400	+0.5 -0.5	Fig.14
μ PC8187TB	2.8	15	830	11	1900	11	830	11	830 2400	+4.0 +1.0	Fig.14

*1: Refer to data sheet of each device.

5.13 Differential input/output Amplifiers

This is a VHF wideband differential input/output amplifier IC that uses a high-frequency process. Two packages are available: an 8-pin SOP and an 8-pin SSOP.

PART NO.	ELECTRICAL CHARACTERISTICS (V _{CC±} = ±6 V, T _A = +25 °C)														OUTLINE	
	A _{vd} *1			BW (MHz)	V _n (μV _{r.m.s})		CMR (dB)			SVR (dB)		V _{O(off)} (V)	V _{O(CM)} (V)	I _{sink} (mA)		I _{CC} (mA)
	MIN.	TYP.	MAX.	TYP.	f _{in} (Hz)	TYP.	V _{cm} (V)	f (MHz)	TYP.	ΔV (V)	TYP.	TYP.	TYP.	TYP.		TYP.
μ PC1663GV	200	320	500	120	10 k to 10 M	3	±1	0.1	94	±0.5	70	0.3	2.9	3.6	13	Fig.17

*1: These performances are adjustable with gain selection terminals. (G_{2A}, G_{2B})

5.14 Modulators/Demodulators

As quadrature modulator and demodulator IC series for mobile communication, NEC Compound Semiconductor Devices, Ltd. provides the ICs for W-CDMA. The series consists of μ PC8195K for IF-AGC + quadrature modulator ICs and μ PC8190K and μ PC8194K for IF-AGC + quadrature demodulator ICs. Two type of IF plan can be selectable as the kit use of μ PC8190K and μ PC8191K or μ PC8194K and μ PC8195K.

AGC + IQ Demodulators

Part Number	Main Characteristics (TYP.)		Package	Outline
μ PC8190K	$V_{CC} = 3.0\text{ V}$, $I_{CC} = 9\text{ mA}$, Voltage Gain: $80\text{ dB}@V_{cont} = 2.5\text{ V}/-20\text{ dB}@V_{cont} = 0.5\text{ V}$ IIP ₃ : $-55\text{ dBm}@V_{cont} = 2.5\text{ V}/+5\text{ dBm}@V_{cont} = 0.5\text{ V}$, NF: $8.0\text{ dB}@V_{cont} = 2.5\text{ V}/70\text{ dB}@V_{cont} = 0.5\text{ V}$, IF Local frequency = 760 MHz	IF = 380 MHz	20-pin QFN 0.4 mm pin pitch	Fig.19
μ PC8194K		IF = 190 MHz		

AGC + IQ Modulators

Part Number	Main Characteristics (TYP.)		Package	Outline
μ PC8191K	$V_{CC} = 3.0\text{ V}$, $I_{CC} = 31.0\text{ mA}$, IF Local frequency = 760 MHz, OIP ₃ : $+17.7\text{ dBm}@Max\text{ Gain}$, P _{out} : $-10\text{ dBm}@V_{cont} = 2.5\text{ V}/-85\text{ dBm}@V_{cont} = 0.5\text{ V}$ I/Q in = 400 mV _{P-P} (Diff.)	IF _{out} = 570 MHz	20-pin QFN 0.4 mm pin pitch	Fig.19
μ PC8195K		IF _{out} = 380 MHz		

5.15 Variable Gain Amplifiers

NEC provides the following lineup of variable-gain amplifiers for AGC of systems such as those in mobile communication and digital CATV.

PART NO.	V _{CC} (V)	I _{CC} (mA)	V _{AGC} (V)	V _{AGC} up vs. Gain	f (GHz)	P _O (1dB)	OUTPUT CIRCUIT	FEATURES	OUTLINE
μ PC8119T	2.7 to 3.3	11	0.6 to 2.4	down	0.1 to 1.92	+3	Open Collector	PDC, PHS, etc.	Fig.13
μ PC8120T	2.7 to 3.3	11	0.6 to 2.4	up	0.1 to 1.92	+3	Open Collector	PDC, PHS, etc.	Fig.13
μ PC8204TK	2.7 to 3.3	11.5	0 to 3.3	up	0.8 to 2.5	+4	Open Collector	PHS, W-LAN, etc.	Fig.12
μ PC3217GV	4.5 to 5.5	23	0 to 5	up	0.01 to 0.1	-	Emitter Follower	Digital CATV, etc.	Fig.17
μ PC3218GV	4.5 to 5.5	23	0 to 5	up	0.01 to 0.1	-	Emitter Follower	Digital CATV, etc.	Fig.17
μ PC3219GV	4.5 to 5.5	36.5	0 to 5	up	0.01 to 0.1	-	Emitter Follower	Digital CATV, etc.	Fig.17
μ PC3220GV	4.5 to 5.5	38	0 to 3	up	0.01 to 0.1	-	Emitter Follower	Digital CATV, etc.	Fig.17

*1: Supply voltage of video amplifier block equal 4.5 to 10 V.

*2: Supply voltage of AGC amplifier block and video amplifier block equal 5 V.

5.16 Low current high-frequency amplifiers

NEC provides the following lineup of buffer amplifiers for cellular and cordless telephones.

PART NO	V _{CC} (V)		1 GHz Output port matching frequency			1.66 GHz Output port matching frequency			1.9 GHz Output port matching frequency			OUTLINE
			G _p (dB)	ISL (dB)	P _O (1dB) (dBm)	G _p (dB)	ISL (dB)	P _O (1dB) (dBm)	G _p (dB)	ISL (dB)	P _O (1dB) (dBm)	
μPC8128TB	2.4 to 3.3	2.8	12.5	39	-4	13	39	-4	13	37	-4	Fig.14
μPC8151TB	2.4 to 3.3	4.2	12.5	38	+2.5	15	36	+1.5	15	34	+0.5	Fig.14
μPC8152TB	2.4 to 3.3	5.6	23	40	-4.5	19.5	36	-8.5	17.5	35	-8.5	Fig.14
μPC8178TB	2.4 to 3.3	1.9	11	39	-4.0	11.5	40	-7.0	11.5	38	-7.5	Fig.14
μPC8178TK	2.4 to 3.3	1.9	11.0	40	-5.5	11.0	41	-8.0	11.0	42	-8.0	Fig.12
μPC8179TB	2.4 to 3.3	4.0	13.5	44	+3.0	15.5	42	+1.5	15.5	41	+1.0	Fig.14
μPC8179TK	2.4 to 3.3	4.0	13.5	43	+2.0	15.5	42	+0.5	16.0	42	+0.5	Fig.12

5.17 BiCMOS, CMOS PLL Synthesizers

Under development

5.18 Bipolar PLL Synthesizer

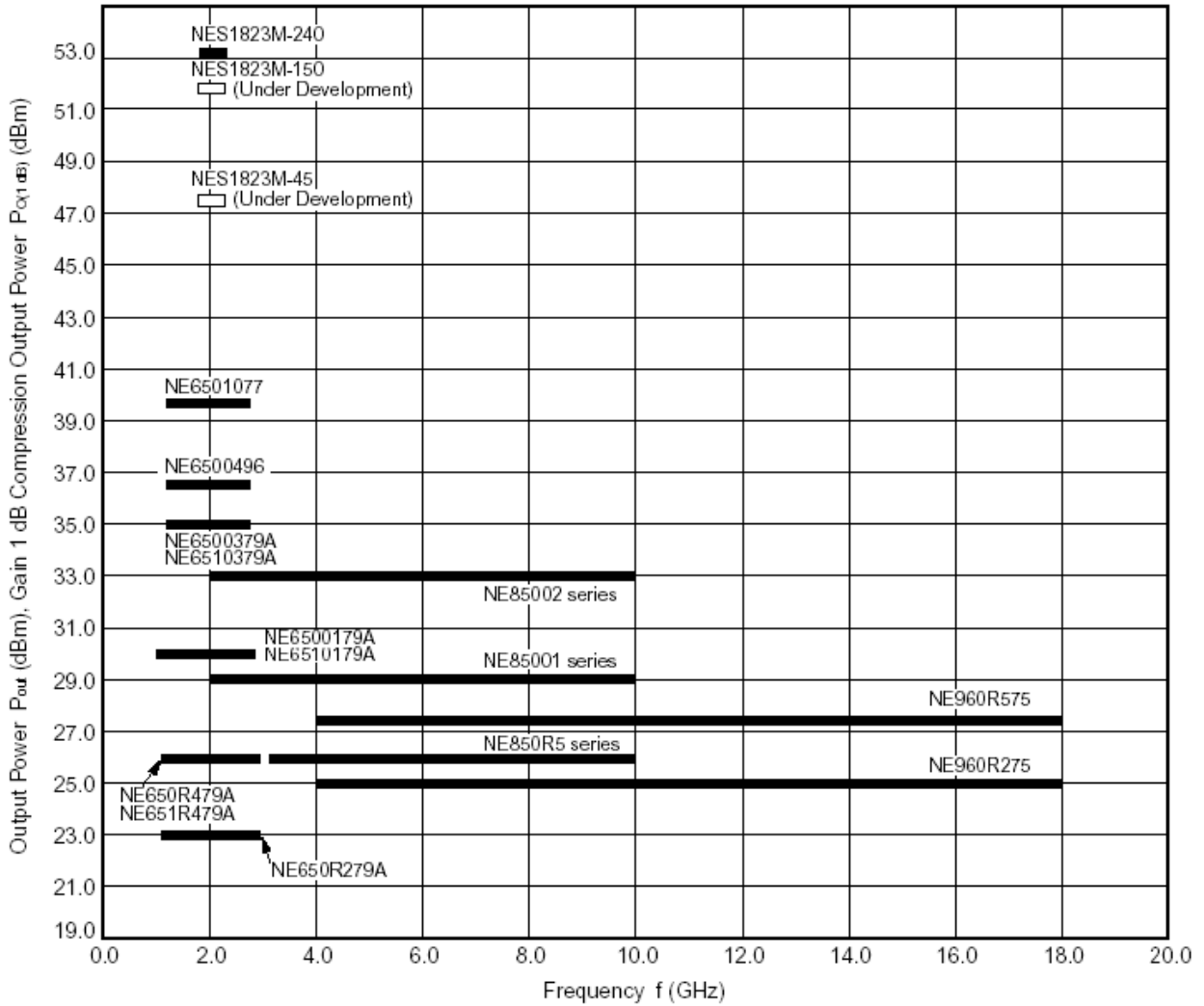
An IC for GPS receivers that integrates an RF/IF frequency down converter and a PLL frequency synthesizer on a single chip is available from NEC. The fixed frequency division eliminates the need for counter data input.

RF/IF FREQUENCY Down Converter + PLL Frequency SYNTHESIZER IC FOR GPS RECEIVER

PART NO.	Receive Frequency (MHz)	Reference Frequency (MHz)	2 nd IF Frequency (MHz)	VCO Frequency (MHz)	V _{CC} (V)	I _{CC} (mA)	CG (dB)	OUTLINE
μPB1005K	1575.42	16.368	4.092	1636.80 (Fix)	2.7 to 3.3	45	72 to 92	Fig.22
μPB1007K	1575.42	16.368	4.092	1636.80 (Fix)	2.7 to 3.3	25	100 to 120	Fig.22

Power GaAs FET

OUTPUT POWER, GAIN 1 dB COMPRESSION OUTPUT POWER vs. FREQUENCY



8 ELECTRICAL CHARACTERISTICS TABLE

8.1 HJ-FET (Hetero Junction FET)

Part Number	Pack- age Code	ELECTRICAL CHARACTERISTICS ($T_A = +25\text{ }^\circ\text{C}$, $V_{DS} = 2\text{V}$)																	
		I_{DSS} (mA)			V_P (V)			g_m (mS)			MSG./MAG.			NF_{opt}			Ga		
		MIN.	TYP.	MAX.	I_D (mA)	V_P (V)		I_D (mA)	g_m (mS)		I_{DS} (mA)	f (GHz)	(dB) TYP.	I_{DS} (mA)	f (GHz)	(dB) TYP.	I_{DS} (mA)	f (GHz)	(dB) TYP.
						MIN.	MAX.		TYP.	TYP.									
NE3210S01	S01	15	40	70	0.1	-0.2	-2.0	10	40	55	10	12	15	10	12	0.35	10	12	13.5
NE4210S01	S01	15	40	70	0.1	-0.2	-2.0	10	40	55	10	12	15	10	12	0.50	10	12	13.0
NE429M01	M01	20	60	90	0.1	-0.2	-2.0	10	45	60	10	12	11	10	12	0.9	10	12	10.0
NE4211M01	M01	15	40	70	0.1	-0.2	-2.0	10	40	55	10	12	13	10	12	0.75	10	12	12.0
NE34018	18	30	-	120	0.1	-0.2	-2.0	5	30	-	5	2	18	5	2	0.6	5	2	16
NE38018	18	40	-	170	0.1	-0.1	-1.5	5	50	-	5	2	16	5	2	0.55	5	2	14.5

8.2 GaAs HBT

Part Number	Pack- age Code	ELECTRICAL CHARACTERISTICS ($T_A = +25\text{ }^\circ\text{C}$, $V_{DS} = 2\text{V}$)															
		h_{FE}				OIP3			MSG./MAG.			NF			Ga		
		I_C (mA)	h_{FE}			I_C (mA)	f (GHz)	(dBm) TYP.	I_C (mA)	f (GHz)	(dB) TYP.	I_C (mA)	f (GHz)	(dB) TYP.	I_C (mA)	f (GHz)	(dB) TYP.
			MIN.	TYP.	MAX.												
NE52418	18	3	100	140	180	10	2	25	3	2	18	3	2	1.0	3	2	17

8.3 HJ-FET (Hetero Junction FET) Chip

Part Number	ELECTRICAL CHARACTERISTICS ($T_A = +25\text{ }^\circ\text{C}$, $V_{DS} = 2\text{V}$)										PERFORMANCE SPECIFICATIONS ($T_A = +25\text{ }^\circ\text{C}$, $V_{DS} = 2\text{V}$)					
	I_{DSS} (mA)			V_P (V)			g_m (mS)			NF_{opt}			Ga			
	MIN.	TYP.	MAX.	I_D (mA)	V_P (V)		I_D (mA)	g_m (mS)		I_D (mA)	f (GHz)	(dB) TYP.	I_D (mA)	f (GHz)	(dB) TYP.	
					MIN.	MAX.		TYP.	TYP.							
NE321000	15	40	70	0.1	-0.2	-2.0	10	40	55	10	12	0.35	10	12	13.5	
NE32500	20	60	90	0.1	-0.2	-2.0	10	45	60	10	12	0.45	10	12	12.5	

8.4 GaAs MES FET Hermitical Package

Part Number	Pack- age Code	ELECTRICAL CHARACTERISTICS (T _A = +25 °C, V _{DS} = 3V)																	
		I _{DSS} (mA)			V _P (V)			g _m (mS)			MSG./MAG. (dB)			NF _{opt} (dB)			G _a (dB)		
		MIN.	TYP.	MAX.	I _D (mA)	V _P (V)		I _D (mA)	g _m (mS)		I _{DS} (mA)	f (GHz)	(dB)	I _{DS} (mA)	f (GHz)	(dB)	I _{DS} (mA)	f (GHz)	(dB)
						MIN.	MAX.		MIN.	TYP.									
NE71383B	83B	20	40	120	0.1	-0.5	-3.5	10	20	50	-	-	-	10	12	1.6	10	12	9.5

8.5 GaAs MES FET

Part Number	Pack- age Code	ELECTRICAL CHARACTERISTICS (T _A = +25 °C, V _{DS} = 3V)									PERFORMANCE SPECIFICATIONS (T _A = +25 °C, V _{DS} = 3V)									
		I _{DSS} (mA)			V _P (V)			g _m (mS)			MSG./MAG. (dB)			PN (10 KHz offpet) dBC/Hz			G _s (dB)			
		MIN.	TYP.	MAX.	I _D (mA)	V _P (V)		I _D (mA)	g _m (mS)		I _{DS} (mA)	f (GHz)	(dB)	I _{DS} (mA)	f (GHz)	TYP.	I _{DS} (mA)	f (GHz)	(dB)	
						MIN.	MAX.		MIN.	TYP.										TYP.
NE722S01	S01	60	90	120	0.1	-0.5	-4.0	30	20	45	-	-	-	-	-	-	-	30	12	6.0

8.6 GaAs MES FET Chip

Part Number	ELECTRICAL CHARACTERISTICS (T _A = +25 °C, V _{DS} = 3V)									PERFORMANCE SPECIFICATIONS (T _A = +25 °C, V _{DS} = 3V)							
	I _{DSS} (mA)			V _P (V)			g _m (mS)			NF _{opt} (dB)			G _a (dB)	P _{O(1 dB)} (dBm)			
	MIN.	TYP.	MAX.	I _D (mA)	V _P (V)		I _D (mA)	g _m (mS)		I _D (mA)	f (GHz)	(dB)	(dB)	I _D (mA)	f (GHz)	(dBm)	
					MIN.	MAX.		MIN.	TYP.								TYP.
NE71300	20	40	120	0.1	-0.5	-3.5	10	20	50	10	12	1.6	9.5	30	12	14.5	
NE72200	60	90	120	0.1	-0.5	-4.0	30	20	45	10	4	0.8	12	30	12	15	

8.7 UHF Dual Gate GaAs MES FET

Part Number	Pack- age Code	ELECTRICAL CHARACTERISTICS (T _A = +25 °C, V _{DS} = 5V)																		
		BV _{DSX}				I _{DSS}			V _{G1S(off)}		V _{G2S(off)}	I _{G1SS}			I _{G2SS}	NF @ 900MHz		G _{PS}		
		V _{G1S} (V)	V _{G2S} (V)	I _D (μA)	V _P (V)		I _{DSS} (mA)	I _D (mA)	V _{G1S} (V)	V _{G2S} (V)	V _{G2S} (V)	V _{DS} (V)	V _{G1S} (V)	V _{G2S} (V)	I _{G1SS} (μA)	I _{G2SS} (μA)	V _{G2S} (V)	I _D (mA)	(dB)	(dB)
					MIN.	MAX.														
NE25118	18	-	-	-	-	5	40	0.1	-3.5	-3.5	0	-4	0	10	10	1	10	1.1	20	

8.8 L, S-Band Internally Matched Power GaAs FET Series

Part Number	V _{DS} (V)	I _{DSset} (mA)	f (GHz)	P _{1dB} (dBm)	G _L (dB)	η _{add} (%)	Frequency Range (GHz)	Package
				TYP.	TYP.	TYP.		
NES1823M-45 *	12.0	4000	2.20	46.5	12	46.5	1.8 to 2.3	T-86M
NES1823M-180*	12.0	2000	2.17	52.5	12.5	48	1.8 to 2.3	T-92M
NES1823M-240	12.0	3000	2.17	53.8	12	-	1.8 to 2.3	T-92M

* under development

8.9 L to C Band Driver Power GaAs FET

Part Number	V _{DS} (V)	I _{DSset} (mA)	f (GHz)	P _{1dB} (dBm)	G _L (dB)	η _{add} (%)	Frequency Range (GHz)	Package
				TYP.	TYP.	TYP.		
NE6500379A	6.0	500	1.9	35.0	10.0	50	0.8 to 3.0	79A
NE6500496	10.0	≤400	2.3	36.0 ^{Note1}	11.5 ^{Note2}	45	2.3	96
NE6501077	10.0	≤1000	2.3	39.5 ^{Note1}	10.5	40	2.3	77
NE650103M	10.0	≤1500	2.3	40	11.0	42	2.3	3M
NE650R279A	6.0	50	1.9	23.0	16.0	45	0.8 to 3.0	79A
NE650R479A	6.0	100	1.9	26.0	14.0	45	0.8 to 3.0	79A
NE6500179A	6.0	200	1.9	30.0	12.0 ^{Note4}	45	0.8 to 3.0	79A
NE6510179A	3.5	200	1.9	32.5 ^{Note3}	10.0	58	0.8 to 3.0	79A
NE6510379A	3.5	200	1.9	32.5 ^{Note3}	8.0	52	0.8 to 3.0	79A
NE651R479A	3.5	50	1.9	27.0 ^{Note3}	12.0	60	0.8 to 3.0	79A
NE8500199	10.0	200	7.2	28.5 ^{Note1}	9.0 ^{Note2}	-	2.0 to 10.0	99
NE8500295-4	10.0	450	4.2	33.8 ^{Note1}	10.5 ^{Note2}	-	3.5 to 5.5	95
NE8500295-6	10.0	450	6.5	33.8 ^{Note1}	9.5 ^{Note2}	-	5.5 to 7.5	95
NE8500295-8	10.0	450	8.5	33.5 ^{Note1}	8.0 ^{Note2}	-	7.5 to 8.5	95
NE850R599A	10.0	100	7.2	25.5 ^{Note1}	9.5 ^{Note2}	-	2.0 to 10.0	99

- Notes**
1. P_O (min) (-4: P_{in} = 24.5 dBm, -6: P_{in} = 25.5 dBm, -8: P_{in} = 27.0 dBm)
 2. G_L (min)
 3. P_{out}
 4. P_{in} = 0 dBm

8.10 Ku Band Power GaAs FET

Part Number	V _{DS} (V)	I _{DSset} (mA)	f (GHz)	P _{1dB} (dBm)	G _L (dB)	η _{add} (%)	Frequency Range (GHz)	Package
				TYP.	TYP.	TYP.		
NE960R275	9.0	90	14.5	25.0	10.0	35	4 to 18	75
NE960R575	9.0	180	14.5	27.5	9.0	30	4 to 18	75

8.11 GaAs Analog MMIC (Wideband Amplifier)

Part Number	PERFORMANCE SPECIFICATIONS (T _A = +25 °C)										
	CONDITION		I _{DD} (mA)		f(GHz)	G _P (dB)	P _{adj1} (dBc)		P _{adj2} (dBc)		CONDITION P _{out} = +8 dBm, 21 kHz Bandwidth
	V _{DD} (V)		MIN.	MAX.		TYP.	TYP.	MAX.	TYP.	MAX.	
μPG2115TB	+3.0		12	16	0.893 to 0.96	17	-60	-55	-70	-65	Ch1: Δf=±50 kHz, Ch2: Δf=±100 kHz
μPG2126TB	+3.6		14	20	0.893 to 0.96	16	-60	-55	-70	-65	Ch1: Δf=±50 kHz, Ch2: Δf=±100 kHz
			26	32	1.429 to 1.453	26	-60	-55	-70	-65	Ch1: Δf=±50 kHz, Ch2: Δf=±100 kHz
μPG2304TK	+2.8		3.5	4.0	0.68 to 0.77	2	-60	-55	-70	-65	Ch1: Δf=±50 kHz, Ch2: Δf=±100 kHz

8.12 GaAs Analog MMIC (AGC Amplifier)

Part Number	PERFORMANCE SPECIFICATIONS (T _A = +25 °C)													
	CONDITION				I _{DD} (mA)	I _{AGC} (mA)	f(GHz)	G _P (dB)	ΔG _P (dB)	G _{AGC} (dB)	P _{O(1dB)} (dBm)		ISL(dB)	
	V _{DD} (V)	V _{DD1} (V)	V _{DD2} (V)	V _{SS} (V)	TYP.	TYP.		TYP.	MAX.	TYP.	MIN.	TYP.	MIN.	TYP.
μPG2106TB	-	+3	+3	-	25	0.2	0.889 to 0.96	30	-	40	-	-	-	-
μPG2110TB	-	+3	+3	-	25	0.2	1.429 to 1.453	27	-	40	-	-	-	-
μPG2128TB	-	+3	+3.5	-	40	0.2	1.429 to 1.453	28	-	40	-	-	-	-
μPG2130TB	-	+3	+3.5	-	25	0.2	1.429 to 1.453	30	-	42	-	-	-	-

8.13 GaAs Analog MMIC (Bluetooth Amplifier)

Part Number	PERFORMANCE SPECIFICATIONS (T _A = +25 °C)												
	CONDITION			I _{CC} (mA)	I _{SD} (μA)	f(GHz)	G _P (dB)	G _{CR} (dB)	η _C (%)	P _{out 1} (dBm)		P _{out 2} (dBm), V _{cont} = 0V	
	V _{cc1,2} (V)	V _{cont} (V)	V _{enable} (V)	TYP.	TYP.		TYP.	TYP.	TYP.	MIN.	TYP.	TYP.	MAX.
μPG2301TQ	+3.3	+2.5	+2.9	120	0.1	2.4 to 2.5	23	23	50	+21	+23	0	+1

8.14 DBS IF Switch

Part Number	FUNCTION	PERFORMANCE SPECIFICATIONS (T _A = +25°C)						Package
		CONDITION	L _{INS} (dB)		ISL(dB)	RL _{out} (dB)	CONDITION	
		f(GHz)	TYP.	MAX.	TYP.	MIN.		
μPG181GR	DBS 2 × 2 IF Switch	0.95 to 2.15	5.0	7.0	33	13	@V _{CONT} = +5V/0V	16HTSSOP
μPG183GR	DBS 4 × 2 IF Switch	0.95 to 2.15	7.0	9.0	26.5	10	@V _{CONT} = +5V/0V	16HTSSOP
μPG186TQ	DBS High ISL SPDT	0.95 to 2.15	1.5	2.5	45	10	@V _{CONT} = +5V/0V	
μPG187GR	DBS 2 × 2 IF Switch	0.95 to 2.15	1.5	3.0	42	10	@V _{CONT} = +5V/0V	16HTSSOP
μPG188GR	DBS 4 × 2 IF Switch	0.95 to 2.15	7.0	9.0	30	10	@V _{CONT} = +5V/0V	16HTSSOP

8.15 GaAs Switch MMIC

Part Number	FUNCTION	PERFORMANCE SPECIFICATIONS (T _A = +25 °C)									
		CONDITION	L _{ins} (dB)		RL _{in} (dB)		P _{in} (1dB) (dBm)	T _{sw} (ns)	ISL (dB)		
		f(GHz)	TYP.	MAX.	MIN.	TYP.				TYP.	TYP.
μPG152TA	SPDT Switch	0.1 to 2.5	0.6	1.0	11	–	@2GHz, V _{CONT} = +3 V/0 V	+30	30	22	
μPG153TB	SPDT Switch	0.1 to 2.5	0.7	0.9	11	15	@2GHz, V _{CONT} = +3 V/0 V	+33	30	13	
μPG154TB	SPDT Switch	0.1 to 2.5	0.65	0.9	11	15	@2GHz, V _{CONT} = +3 V/0 V	+30	30	21 ^{Notes3}	
μPG155TB	SPDT Switch	0.1 to 2.5	0.75	1.0	11	15	@2GHz, V _{CONT} = +3 V/0 V	+34	30	16	
μPG158TB	SPDT Switch	0.1 to 2.5	0.4	0.65	13	19	@2GHz V _{CONT} = +3 V/0 V	+26.5	50	27	
μPG2006TB,TK	SPDT Switch	0.1 to 2.5	0.4	0.6	16	21	@2GHz, V _{CONT} = +1.8V/0 V	+20	50	29	
μPG2008TK,TB	SPDT Switch	0.1 to 2.5	0.5	0.8	13	20	@2GHz, V _{CONT} = +2.8 V/0 V	+25	50	25	
μPG2009TB	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz, V _{CONT} = +2.8 V/0 V	+34	50	28	
μPG2010TB	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz, V _{CONT} = +2.8 V/0 V	+34	300	28	
μPG2012TB,TK	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz V _{CONT} = +2.8 V/0 V	+25	300	29	
μPG2015TB	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz, V _{CONT} = +2.8 V/0 V	+30	300	28	

Notes @f = 2 GHz, C_x = 2 pF

8.16 Single Control Voltage GaAs Switch MMIC

Part Number	FUNCTION	PERFORMANCE SPECIFICATIONS (T _A = +25 °C)									
		CONDITION	L _{ins} (dB)		RL _{in} (dB)		P _{in} (1dB) (dBm)	T _{sw} (ns)	ISL (dB)		
		f(GHz)	TYP.	MAX.	MIN.	TYP.				TYP.	TYP.
μPG2010TB	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz, V _{CONT} = +2.8 V/0 V	+34	300	28	
μPG2012TB,TK	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz V _{CONT} = +2.8 V/0 V	+25	300	29	
μPG2015TB	SPDT Switch	0.1 to 2.5	0.3	0.5	15	20	@2GHz, V _{CONT} = +2.8 V/0 V	+30	300	28	

8.17 Multi-Chip Module for CATV

Part Number	Function	Remark	Package
MC-77xx series	Wide Band Amplifier for 50 M to 770 MHz CATV Pre Amp. (Push-Pull)	For further information, please contact your local NEC sales office.	7-pin special package
	Wide Band Amplifier for 50 M to 770 MHz CATV Post Amp. (Power Doubler)		
MC-78xx series	Wide Band Amplifier for 50 to 860 MHz CATV Pre Amp. (Push-Pull)		
	Wide Band Amplifier for 50 to 860 MHz CATV Post Amp. (Power Doubler)		

12 MARKING, h_{FE} RANK INFORMATION FOR MINIMOLD DEVICES

12.1 Bipolar Transistors

PART NO.	OLD Rank	NEW Rank	MARKING	SPECIFICATION	PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION	
NE461M02		QQ	QQ	h _{FE} = 40 to 80	NE856M02		RH	RH	h _{FE} = 50 to 100	
		QR	QR	h _{FE} = 60 to 120			RF	RF	h _{FE} = 80 to 160	
		QS	QS	h _{FE} = 100 to 200			RE	RE	h _{FE} = 125 to 250	
NE462M02		SH	SH	h _{FE} = 50 to 100	NE856M03		EB	TC	h _{FE} = 80 to 110	
		SF	SF	h _{FE} = 80 to 160			FB	TD	h _{FE} = 100 to 145	
		SE	SE	h _{FE} = 125 to 200						
NE582M03		EB	TA	h _{FE} = 60 to 90	NE856M13	R2	EB	C1	h _{FE} = 80 to 110	
		FB	TB	h _{FE} = 80 to 120		R3	FB	C2	h _{FE} = 100 to 145	
NE661M04		FB	T78	h _{FE} = 50 to 100	NE46134		SH	–	QQ	h _{FE} = 40 to 80
							SF	–	QR	h _{FE} = 60 to 120
							SE	–	QS	h _{FE} = 100 to 200
NE662M04		FB	T79	h _{FE} = 50 to 100	NE46234		U16	–	SH	h _{FE} = 50 to 100
NE663M04		FB	T80	h _{FE} = 50 to 100			U17	–	SF	h _{FE} = 80 to 160
NE664M04		FB	R57	h _{FE} = 40 to 100			U18	–	SE	h _{FE} = 125 to 250
NE677M04		FB	R54	h _{FE} = 75 to 150	NE58030		–	–	U16	h _{FE} = 60 to 120
							–	–	U17	h _{FE} = 90 to 180
							–	–	U18	h _{FE} = 120 to 240
NE678M04		FB	R55	h _{FE} = 75 to 150	NE58119		T72	–	U16	h _{FE} = 60 to 120
							T73	–	U17	h _{FE} = 90 to 180
							T74	FB	U18	h _{FE} = 120 to 240
NE680M03		EB	TH	h _{FE} = 80 to 110	NE58130		T72	–	T72	h _{FE} = 40 to 80
		FB	TJ	h _{FE} = 100 to 145			T73	–	T73	h _{FE} = 60 to 120
NE681M03		EB	TE	h _{FE} = 80 to 110	NE58133		T74	–	T74	h _{FE} = 100 to 200
		FB	TF	h _{FE} = 100 to 145						
NE681M13		EB	D1	h _{FE} = 80 to 110	NE58219		EB	T72	h _{FE} = 40 to 80	
		FB	D2	h _{FE} = 100 to 145			FB	T73	h _{FE} = 60 to 120	
NE685M03		EB	TK	h _{FE} = 75 to 110	NE66719		FB	77	h _{FE} = 60 to 120	
		FB	TL	h _{FE} = 95 to 140			FB	UB	h _{FE} = 50 to 100	
NE685M13		EB	Y1	h _{FE} = 75 to 110	NE667M03		FB	UB	h _{FE} = 50 to 100	
		FB	Y2	h _{FE} = 95 to 140						
NE687M03		EB	TN	h _{FE} = 75 to 100	NE667M13		FB	C5	h _{FE} = 50 to 100	
		FB	TP	h _{FE} = 90 to 130						
NE687M13		EB	W1	h _{FE} = 70 to 110	NE685M33		FB	Y2	h _{FE} = 70 to 140	
		FB	W2	h _{FE} = 90 to 130			FB	W2	h _{FE} = 70 to 140	
NE688M03		EB	TS	h _{FE} = 80 to 110	NE687M33					
		FB	TT	h _{FE} = 100 to 145						
NE688M13		EB	T1	h _{FE} = 80 to 110						
		FB	T2	h _{FE} = 100 to 145						
NE696M01		FB	T95	h _{FE} = 80 to 160						

PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION	PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION
NE58230	T75	-	T75	hFE = 40 to 80	NE68330	R6A	-	R6A	hFE = 50 to 100
	T76	-	T76	hFE = 60 to 120		R6B	-	R6B	hFE = 80 to 160
	T77	-	T77	hFE = 100 to 200		R6C	-	R6C	hFE = 125 to 250
NE58233	T75	EB	T75	hFE = 40 to 80	NE68333	K	P	R62	hFE = 50 to 250
	T76	FB	T76	hFE = 60 to 120	NE68339E	R64	RFD	R64	hFE = 50 to 250
	T77	GB	T77	hFE = 100 to 200					
NE61030	R13	-	R13	hFE = 60 to 150	NE68518		KB	T83	hFE = 75 to 150
NE66219		FB	UA	hFE = 50 to 100	NE68519	-	FB	83	hFE = 75 to 150
NE67739		FB	R54	hFE = 75 to 150	NE68530	T83	-	T83	hFE = 75 to 150
NE67839		FB	R55	hFE = 75 to 150	NE68533	T83	FB	T83	hFE = 75 to 150
NE68018		EB	R46	hFE = 50 to 100	NE68539E	T83	-	T83	hFE = 75 to 150
		FB	R47	hFE = 80 to 160	NE68618		FB	T84	hFE = 70 to 140
		GB	R48	hFE = 125 to 250					
NE68019	-	FB	44	hFE = 80 to 160	NE68619		FB	84	hFE = 70 to 140
NE68030	R43	-	R43	hFE = 50 to 100	NE68630		FB	T84	hFE = 70 to 140
	R44	-	R44	hFE = 80 to 160	NE68633		FB	T84	hFE = 70 to 140
	R45	-	R45	hFE = 125 to 250					
NE68033	R43	Q	R43	hFE = 50 to 100	NE68639		FB	T84	hFE = 70 to 140
	R44	R	R44	hFE = 80 to 160	NE68718		FB	T86	hFE = 70 to 140
	R45	S	R45	hFE = 125 to 250					
NE68039E	R46	RDF	R46	hFE = 50 to 100	NE68719		FB	86	hFE = 70 to 140
	R47	RDG	R47	hFE = 80 to 160	NE68818		FB	T88	hFE = 80 to 160
	R48	RDH	R48	hFE = 125 to 250					
NE68118	-	EB	R36	hFE = 50 to 100	NE68819		FB	88	hFE = 80 to 160
	-	FB	R37	hFE = 80 to 160					
	-	GB	R38	hFE = 125 to 250					
NE68119	-	FB	34	hFE = 80 to 160					
NE68130	R33	-	R33	hFE = 40 to 90					
	R34	-	R34	hFE = 70 to 150					
	R35	-	R35	hFE = 110 to 240					
NE68132	K	-	K	hFE = 50 to 250					
NE68133	R33	Q	R33	hFE = 50 to 100					
	R34	R	R34	hFE = 80 to 160					
	R35	S	R35	hFE = 125 to 250					
NE68139E	R36	RCF	R36	hFE = 50 to 100					
	R37	RCG	R37	hFE = 80 to 160					
	R38	RCH	R38	hFE = 125 to 250					

PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION	PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION
NE68830		FB	T88	$h_{FE} = 80$ to 160	NE85630	R23 R24 R25	– – –	R23 R24 R25	$h_{FE} = 40$ to 80 $h_{FE} = 70$ to 140 $h_{FE} = 125$ to 250
NE68833		FB	T88	$h_{FE} = 80$ to 160					
NE68839		FB	T88	$h_{FE} = 80$ to 160	NE85632	K	–	K	$h_{FE} = 50$ to 300
NE68939		KB	T89	$h_{FE} = 60$ to	NE85633	R23 R24 R25	Q R S	R23 R24 R25	$h_{FE} = 50$ to 100 $h_{FE} = 80$ to 160 $h_{FE} = 125$ to 250
NE69039		KB	T90	$h_{FE} = 60$ to					
NE85618	– – –	EB FB GB	R26 R27 R28	$h_{FE} = 50$ to 100 $h_{FE} = 80$ to 160 $h_{FE} = 125$ to 250	NE85634	RH RF RE	– – –	RH RF RE	$h_{FE} = 50$ to 100 $h_{FE} = 80$ to 160 $h_{FE} = 125$ to 250
NE85619	–	FB	24	$h_{FE} = 80$ to 160	NE85639E	R26 R27 R28	RBF RBG RBH	R26 R27 R28	$h_{FE} = 50$ to 100 $h_{FE} = 80$ to 160 $h_{FE} = 125$ to 250
NE819M03		FB	TY	$h_{FE} = 100$ to 145					
NE819M13		FB	Y5	$h_{FE} = 100$ to 145	NE97733		FB	T92	$h_{FE} = 20$ to 100
NE851M03		FB	80	$h_{FE} = 100$ to 145	NE97833		FB	T93	$h_{FE} = 20$ to 100
NE851M13		FB	E7	$h_{FE} = 100$ to 145	NE894M03		FB	UE	$h_{FE} = 50$ to 100
NE851M33		FB	E7	$h_{FE} = 100$ to 145	NE894M13		FB	B7	$h_{FE} = 50$ to 100
NE863M03		FB	UC	$h_{FE} = 100$ to 160					
NE863M13		FB	D5	$h_{FE} = 100$ to 160					

12.2 Dual Gate MES/MOS FET

PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION	PART NO.	OLD SPECIFICATION	NEW SPECIFICATION	MARKING	SPECIFICATION
NE25118	U71 U72 U73 U74	– – – –	U71 U72 U73 U74	$I_{DSS} = 5$ to 15 mA $I_{DSS} = 10$ to 25 mA $I_{DSS} = 20$ to 35 mA $I_{DSS} = 30$ to 40 mA	NE93218 NE93239	– U1E	U1E UAE	U1E U1E	$I_{DSX} = 0.1$ to 5.0 mA $I_{DSX} = 0.1$ to 5.0 mA
NE92039	V21 V22	VBA VBB	V21 V22	$I_{DSX} = 0.01$ to 3 mA $I_{DSX} = 1$ to 8 mA					

13 MARKINGS VS. PART NO. ON HIGH FREQUENCY IC OF 4-PIN/6-PIN/SUPER MINIMOLD

MARKING	PART NO.		MARKING	PART NO.
C1C	uPC1688G		C3G	uPC8187TB
C1D	uPC2708TB		C3H	uPC3215TB
C1E	uPC2709T		G1B	uPG152TA
C1E	uPC2709TB		G1J	uPG153TB
C1F	uPC2710TB		G1K	uPG154TB
C1G	uPC2711TB		G1L	uPG155TB
C1H	uPC2712TB		G1M	uPG158TB
C1Q	uPC2745TB		G1V	uPG2106TB
C1R	uPC2746TB		G1Y	uPG2110TB
C1S	uPC2747TB		G2J	uPG2006TB
C1T	uPC2748TB		G2K	uPG2126TB
C1U	uPC2749TB		G2M	uPG2128TB
C1W	uPC2756TB		G2P	uPG2130TB
C1X	uPC2757TB		G2R	uPG2008TK
C1Y	uPC2758TB		G2T	uPG168TB
C1Z	uPC2762TB		G2U	uPG2009TB
C2A	uPC2763TB		G2Y	uPG2010TB
C2D	uPC8106TB		G3A	uPG2012TB
C2G	uPC8109TB		G3B	uPG2134TB
C2H	uPC2771TB		G3C	uPG2135TK
C2K	uPC8112TB		G3D	uPG2008TB
C2L	uPC2776TB		G3F	uPG2304TK
C2M	uPC8119T		G3H	uPG2012TK
C2N	uPC8120T		G3J	uPG2015TB
C2P	uPC8128TB		G3L	uPG2022TB
C2U	uPC8151TB		G3P	uPG2030TB
C2Y	uPC8163TB		G3R	uPG2030TK
C2Z	uPB1511TB		G3V	uPG2131T5D
C3A	uPC8172TB		6A	uPC8172TK
C3B	uPC8178TB		6B	uPC8178TK
C3C	uPC8179TB		6C	uPC8179TK
C3E	uPC8181TB		6E	uPC8204TK
C3F	uPC8182TB			

REMARKS Each part number has a marking one by one. This marking is to know part number and has no other meaning. The marking is three letters but not part number because minimold package is too small to mark number over three letters. When the part number has plural size packages, part number has plural package cords but only one marking.

REMARKS PACKAGE CORD ON MINIMOLD (μ P Part number case)

Product released before 1990	Product released between 1990 and April 1996	Product released after April 1996
'G' only	'T' only	Minimold : TA Super minimold : TB Flat-lead thin-type ultra super minimold : TC/TK

(2SC and 3SK have no package code)

14 INDEX

MC-77xx series	52	NE67739.....	28	NE8500199.....	49	μPA808T	33
MC-78xx series	52	NE677M04.....	31	NE8500295-4.....	49	μPA809T	33
NE25118	32, 48	NE67818.....	27	NE8500295-6.....	49	μPA810T	33
NE321000	47	NE67839.....	28	NE8500295-8.....	49	μPA811T	33
NE3210S01	47	NE678M04.....	31	NE850R599A.....	49	μPA812T	33
NE32500	47	NE68018.....	27	NE851M03.....	29	μPA813T	33
NE34018	47	NE68019.....	27	NE851M13.....	30	μPA814T	33
NE38018	47	NE68030.....	28	NE851M33.....	30	μPA828TD.....	33
NE4210S01	47	NE68033.....	28	NE85618.....	27	μPA841TD.....	34
NE4211M01	47	NE68039E.....	28	NE85619.....	27	μPA850TD.....	34
NE429M01	47	NE680M03.....	29	NE85630.....	28	μPA851TD.....	34
NE46134	28	NE68118.....	27	NE85633.....	28	μPA854TD.....	34
NE461M02	29	NE68119.....	27	NE85634.....	28	μPA855TD.....	34
NE46234	28	NE68130.....	28	NE85639E.....	28	μPA859TD.....	34
NE462M02	29	NE68133.....	28	NE856M02.....	29	μPA860TD.....	34
NE52418	47	NE68139E.....	28	NE856M03.....	29	μPA861TD.....	34
NE5500179A.....	31	NE681M03.....	29	NE856M13.....	30	μPA862TC.....	34
NE5500479A.....	31	NE681M13.....	30	NE863M03.....	29	μPA862TD.....	34
NE5510279A.....	31	NE68518.....	27	NE863M13.....	30	μPA862TS.....	34
NE5511279A.....	31	NE68519.....	27	NE894M03.....	29	μPA863TD.....	34
NE5520279A.....	31	NE68530.....	28	NE894M13.....	30	μPA863TS.....	34
NE5520379A.....	31	NE68533.....	28	NE92039.....	32	μPA872TD.....	33
NE552R479A	31	NE68539E.....	28	NE93218.....	32	μPA873TC.....	33
NE552R679A	31	NE685M03.....	29	NE93318.....	32	μPA873TD.....	33
NE58119	27	NE685M13.....	30	NE960R275	49	μPA873TS.....	33
NE58130	28	NE685M33.....	30	NE960R575	49	μPA891TC.....	33
NE58219	27	NE68618.....	27	NE97733.....	28	μPA891TD.....	33
NE58230	28	NE68619.....	27	NE97833.....	28	μPA892TC.....	33
NE582M03	29	NE68718.....	27	NEM090303M-28.....	31	μPA892TD.....	33
NE6500179A.....	49	NE68719.....	27	NEM090853P-28	31	μPA895TD.....	33
NE6500379A.....	49	NE687M03.....	29	NES1823M-180	49	μPA895TS.....	33
NE6500496	49	NE687M13.....	30	NES1823M-240	49	μPB1005K	41
NE650103M	49	NE687M33.....	30	NES1823M-45.....	49	μPB1007K	41
NE6501077	49	NE68818.....	27	NESG2021M05.....	30	μPB1507GV	35
NE650R279A	49	NE68819.....	27	NESG2021M16.....	30	μPB1508GV	35
NE650R479A	49	NE68830.....	28	NESG2030M04.....	30	μPB1509GV	35
NE6510179A.....	49	NE68833.....	28	NESG2030M16.....	30	μPB1510GV	35
NE6510379A.....	49	NE68839.....	28	NESG2031M05.....	30	μPB1511TB.....	35
NE651R479A	49	NE688M03.....	29	NESG2031M16.....	30	μPC1663GV.....	39
NE661M04	29	NE688M13.....	30	NESG2101M05.....	30	μPC1678GV.....	36
NE66219	27	NE68939.....	28, 31	NESG2101M16.....	30	μPC1688G	36
NE662M03	29	NE69039.....	28, 31	μPA800T	33	μPC2708TB.....	37
NE662M04	29	NE696M01.....	29	μPA801T	33	μPC2709T	37
NE662M16	30	NE71300.....	48	μPA802T	33	μPC2709TB.....	37
NE663M04	29	NE71383B.....	48	μPA803T	33	μPC2710TB.....	37
NE664M04	31	NE72200.....	48	μPA804T	33	μPC2711TB.....	37
NE667M03	29	NE722S01	48	μPA805T	33	μPC2712TB.....	37
NE667M13	30	NE819M03.....	29	μPA806T	33	μPC2745TB.....	37
NE67718	27	NE819M13.....	30	μPA807T	33	μPC2746TB.....	37

μPC2747TB.....	37	μPC8106TB.....	39	μPC8187TB.....	39	μPG2006TB,TK.....	51
μPC2748TB.....	37	μPC8109TB.....	39	μPC8190K.....	40	μPG2008TK, TB.....	51
μPC2749TB.....	37	μPC8112TB.....	38	μPC8191K.....	40	μPG2009TB.....	51
μPC2756TB.....	38	μPC8119T.....	40	μPC8194K.....	40	μPG2010TB.....	51
μPC2757TB.....	38	μPC8120T.....	40	μPC8195K.....	40	μPG2012TB,TK.....	51
μPC2758TB.....	38	μPC8128TB.....	41	μPC8204TK.....	40	μPG2015TB.....	51
μPC2762TB.....	37	μPC8151TB.....	41	μPG152TA.....	51	μPG2106TB.....	50
μPC2763TB.....	37	μPC8152TB.....	41	μPG153TB.....	51	μPG2110TB.....	50
μPC2771TB.....	37	μPC8163TB.....	39	μPG154TB.....	51	μPG2115TB.....	50
μPC2776TB.....	37	μPC8172TB.....	39	μPG155TB.....	51	μPG2126TB.....	50
μPC2798GR.....	38	μPC8178TB.....	41	μPG158TB.....	51	μPG2128TB.....	50
μPC3215TB.....	37	μPC8178TK.....	41	μPG181GR.....	51	μPG2130TB.....	50
μPC3217GV.....	40	μPC8179TB.....	41	μPG183GR.....	51	μPG2301TQ.....	50
μPC3218GV.....	40	μPC8179TK.....	41	μPG186TQ.....	51	μPG2304TK.....	50
μPC3219GV.....	40	μPC8181TB.....	37	μPG187GR.....	51		
μPC3220GV.....	40	μPC8182TB.....	37	μPG188GR.....	51		

15 CROSS REFERENCE

NE	EIAJ	NE	EIAJ	NE	EIAJ
NE25118	3SK299	NE68130	2SC4227	NE819M03	2SC5745
NE46134	2SC4536	NE68133	2SC3583	NE819M13	2SC5746
NE461M02	2SC5337	NE68139E	2SC4094	NE851M03	2SC5800
NE46234	2SC4703	NE681M03	2SC5433	NE851M13	2SC5801
NE462M02	2SC5338	NE681M13	2SC5615	NE85618	2SC5011
NE58119	2SC5005	NE68518	2SC5015	NE85619	2SC5006
NE58130	2SC4570	NE68519	2SC5010	NE85630	2SC4226
NE58219	2SC5004	NE68530	2SC4959	NE85633	2SC3356
NE58230	2SC4571	NE68533	2SC4955	NE85634	2SC3357
NE582M03	2SC5431	NE68539E	2SC4957	NE85639E	2SC4093
NE661M04	2SC5507	NE685M03	2SC5435	NE856M02	2SC5336
NE66219	2SC5606	NE685M13	2SC5617	NE856M03	2SC5432
NE662M04	2SC5508	NE68618	2SC5180	NE856M13	2SC5614
NE662M16	2SC5704	NE68619	2SC5181	NE86319	2SC5675
NE663M04	2SC5509	NE68718	2SC5185	NE863M03	2SC5676
NE664M04	2SC5754	NE68719	2SC5186	NE863M13	2SC5677
NE66719	2SC5667	NE687M03	2SC5436	NE894M03	2SC5786
NE667M03	2SC5668	NE687M13	2SC5618	NE894M13	2SC5787
NE667M13	2SC5674	NE68818	2SC5194	NE92039	3SK222
NE67718	2SC5750	NE68819	2SC5195	NE92239	3SK223
NE67739	2SC5454	NE68830	2SC5193	NE92439	3SK224
NE677M04	2SC5751	NE68833	2SC5191	NE93039	3SK230
NE67818	2SC5752	NE68839	2SC5192	NE93139	3SK231
NE67839	2SC5455	NE688M03	2SC5437	NE93218	3SK254
NE678M04	2SC5753	NE68939	2SC5288	NE93239	3SK252
NE68018	2SC5013	NE69039	2SC5289	NE93318	3SK255
NE68019	2SC5008	NE696M01	2SC5369	NE93339	3SK253
NE68030	2SC4228	NE72819	2SC5599	NE97733	2SA1977
NE68033	2SC3585	NE728M03	2SC5600	NE97833	2SA1978
NE68039E	2SC4095	NE728M13	2SC5601	NESG2030M04	2SC5761
NE680M03	2SC5434	NE73019	2SC5602	NESG2030M16	2SC5843
NE68118	2SC5012	NE730M03	2SC5603		
NE68119	2SC5007	NE730M13	2SC5604		

EIAJ	NE	EIAJ	NE	EIAJ	NE
2SA1977	NE97733	2SC5191	NE68833	2SC5617	NE685M13
2SA1978	NE97833	2SC5192	NE68839	2SC5618	NE687M13
2SC3356	NE85633	2SC5193	NE68830	2SC5667	NE66719
2SC3357	NE85634	2SC5194	NE68818	2SC5668	NE667M03
2SC3583	NE68133	2SC5195	NE68819	2SC5675	NE86319
2SC3585	NE68033	2SC5288	NE68939	2SC5674	NE667M13
2SC4093	NE85639E	2SC5289	NE69039	2SC5676	NE863M03
2SC4094	NE68139E	2SC5336	NE856M02	2SC5677	NE863M13
2SC4095	NE68039E	2SC5337	NE461M02	2SC5704	NE662M16
2SC4226	NE85630	2SC5338	NE462M02	2SC5745	NE819M03
2SC4227	NE68130	2SC5369	NE696M01	2SC5746	NE819M13
2SC4228	NE68030	2SC5431	NE582M03	2SC5750	NE67718
2SC4536	NE46134	2SC5432	NE856M03	2SC5751	NE677M04
2SC4570	NE58130	2SC5433	NE681M03	2SC5752	NE67818
2SC4571	NE58230	2SC5434	NE680M03	2SC5753	NE678M04
2SC4703	NE46234	2SC5435	NE685M03	2SC5754	NE664M04
2SC4955	NE68533	2SC5436	NE687M03	2SC5761	NESG2030M04
2SC4957	NE68539E	2SC5437	NE688M03	2SC5786	NE894M03
2SC4959	NE68530	2SC5454	NE67739	2SC5787	NE894M13
2SC5004	NE58219	2SC5455	NE67839	2SC5800	NE851M03
2SC5005	NE58119	2SC5507	NE661M04	2SC5801	NE851M13
2SC5006	NE85619	2SC5508	NE662M04	2SC5843	NESG2030M16
2SC5007	NE68119	2SC5509	NE663M04	3SK222	NE92039
2SC5008	NE68019	2SC5599	NE72819	3SK223	NE92239
2SC5010	NE68519	2SC5600	NE728M03	3SK224	NE92439
2SC5011	NE85618	2SC5601	NE728M13	3SK230	NE93039
2SC5012	NE68118	2SC5602	NE73019	3SK231	NE93139
2SC5013	NE68018	2SC5603	NE730M03	3SK252	NE93239
2SC5015	NE68518	2SC5604	NE730M13	3SK253	NE93339
2SC5180	NE68618	2SC5606	NE66219	3SK254	NE93218
2SC5181	NE68619	2SC5614	NE856M13	3SK255	NE93318
2SC5185	NE68718	2SC5615	NE681M13	3SK299	NE25118
2SC5186	NE68719	2SC5616	NE688M13		