To our customers,

Old Company Name in Catalogs and Other Documents

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Renesas Electronics website: http://www.renesas.com

April 1st, 2010
Renesas Electronics Corporation

Issued by: Renesas Electronics Corporation (http://www.renesas.com)

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RENESAS

GaAs MES FET

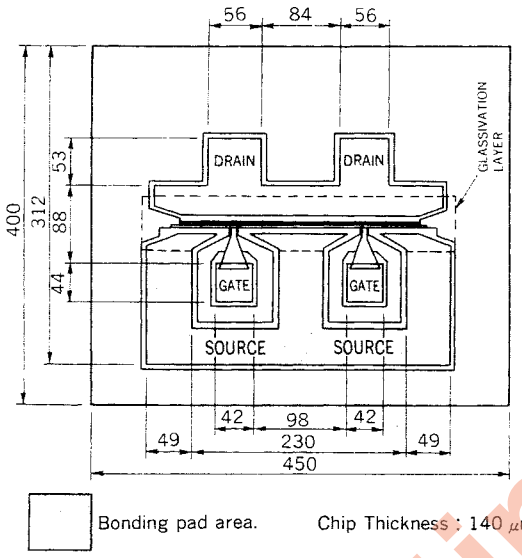
NE673

LOW NOISE Ku-K BAND GaAs FET
N-CHANNEL GaAs MES FET

PHYSICAL DIMENSIONS

NE67300 (Chip)

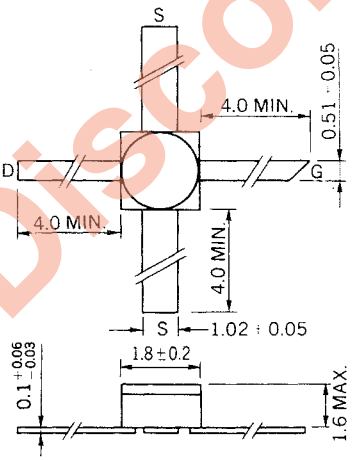
(Units in μm)



Bonding pad area. Chip Thickness : 140 μm

PACKAGE CODE - 83

(Units in mm)



DESCRIPTION

The NE673 features a super low noise figure and high associated gain through K-band by employing a recessed 0.3 μm gate and triple epitaxial technology for industrial and space applications. The device is available as a chip (NE67300) and in two hermetically sealed packages (NE67383 and NE67383-4). The chip's gate and channel are glassivated with a thin layer of Si_3N_4 for mechanical protection. The NE67383 is selected for NF_{opt} performance at 12 GHz. NE67383-4 is selected for NF_{opt} performance at 4.0 GHz.

FEATURES

- Very high $f_{max.}$: 100 GHz
- Low noise figure :
  - NF 0.4 dB, G_a 14.5 dB @f = 4 GHz
  - NF 0.8 dB, G_a 11.5 dB @f = 8 GHz
  - NF 1.4 dB, G_a 10.0 dB @f = 12 GHz
  - NF 1.9 dB, G_a 8.0 dB @f = 18 GHz
  - NF 3.3 dB, G_a 6.0 dB @f = 26 GHz
- 0.3 μm recessed gate
- Proven reliability and stability

ORDERING INFORMATION

PART NUMBER	PACKAGE CODE
NE67300	00 (CHIP)
NE67383	83
NE67383-4	83

ABSOLUTE MAXIMUM RATINGS (T_a = 25 °C)

Drain to Source Voltage	V_{DS}	5.0	V	
Gate to Source Voltage	V_{GS}	-6.0	V	
Drain Current	I_{DS}	120	mA	
RF Input Power	P_{in}	40	mW	
Total Power Dissipation	P_T	400*1, *3	mW	(NE67300)
		270*2	mW	(NE67383, NE67383-4)
Channel Temperature	T_{ch}	175	°C	
Storage Temperature	T_{stg}	-65 to +175	°C	

*1 T_a = 100 °C

*2 T_a = 55 °C

*3 R_{th} (channel to case) for chips mounted on a copper heatsink.

ELECTRICAL CHARACTERISTICS (T_a = 25 °C)

PART NUMBER		NE67300			NE67383/NE67383-4			UNIT	TEST CONDITIONS
PACKAGE CODE		00 (CHIP)			83				
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.		
Saturated Drain Current	I_{DSS}	20	40	120	20	40	120	mA	V_{DS} = 3 V, V_{GS} = 0
Pinch-off Voltage	V_P	-0.5	-1.1	-3.5	-0.5	-1.1	-3.5	V	V_{DS} = 3 V, I_{DS} = 0.1 mA
Transconductance	g_m	20	50	100	20	50	100	mS	V_{DS} = 3 V, I_{DS} = 10 mA
Gate to Source Leakage Current	I_{GS}		1.0	10		1.0	10	μA	V_{GS} = -5 V
Thermal Resistance	R_{th}			190*3			450	°C/W	channel to case

PERFORMANCE SPECIFICATIONS (T_a = 25 °C)

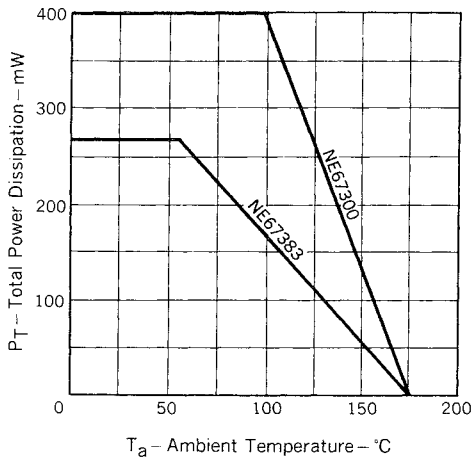
PART NUMBER		NE67300			NE67383/NE67383-4*4			UNIT	TEST CONDITIONS	
PACKAGE CODE		00 (CHIP)			83					
CHARACTERISTIC	SYMBOL	MIN.	TYP.	MAX.	MIN.	TYP.	MAX.			
Maximum Frequency	$f_{max.}$		100			100		GHz	V_{DS} = 3 V, I_{DS} = 30 mA	
Maximum Available Gain *5	MAG		15			15		dB	V_{DS} = 3 V, I_{DS} = 30 mA	f = 8 GHz
			12			12		dB		f = 12 GHz
			8.5			8.5		dB		f = 18 GHz
Optimum Noise Figure	NF_{opt}		0.4			0.4	0.6*4	dB	V_{DS} = 3 V, I_{DS} = 10 mA	f = 4 GHz
			0.8			0.8		dB		f = 8 GHz
			1.4	1.6		1.4	1.6	dB		f = 12 GHz
			1.9					dB		f = 18 GHz
			3.3					dB		f = 26 GHz
Associated Gain at Optimum Noise Figure	G_a		14.5		12.0*4	14.5		dB	V_{DS} = 3 V, I_{DS} = 10 mA	f = 4 GHz
			11.5			11.5		dB		f = 8 GHz
		8.5	10.0		8.5	10.0		dB		f = 12 GHz
			8.0					dB		f = 18 GHz
			6.0					dB		f = 26 GHz
Output Power at 1 dB Gain Compression Point	$P_{O(1\,dB)}$		14.5			14.5		dBm	V_{DS} = 3 V, I_{DS} = 30 mA	f = 12 GHz

*4 NE67383-4 is tested for NF_{opt} at 4.0 GHz. The standard NE67383 is tested at 12.0 GHz.

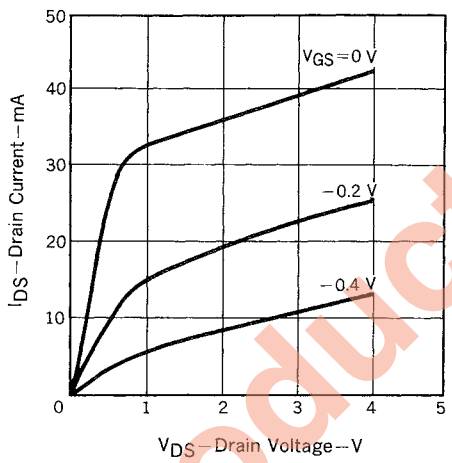
*5 Gain Calculations : $MAG = \frac{|S_{21}|}{|S_{12}|}(K \pm \sqrt{K^2 - 1})$, $K = \frac{1 + |\Delta|^2 - |S_{11}|^2 - |S_{22}|^2}{2|S_{12}||S_{21}|}$, $\Delta = S_{11}S_{22} - S_{21}S_{12}$, $MSG = \frac{|S_{21}|}{|S_{12}|}$

DEVICE CHARACTERISTICS (T_a = 25 °C)

POWER DERATING CURVE

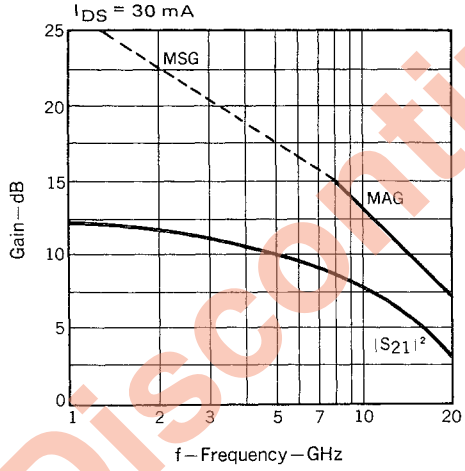


DC PERFORMANCE

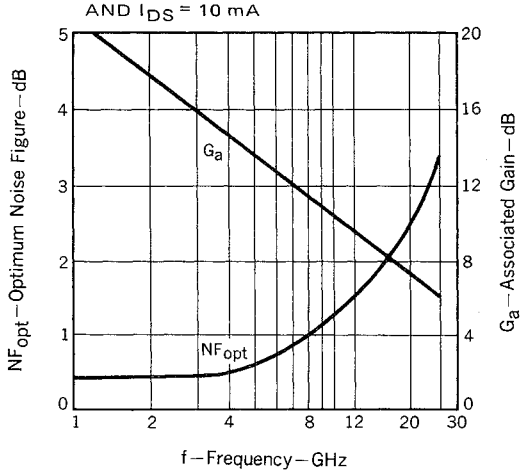


TYPICAL CHARACTERISTICS (T_a = 25 °C)

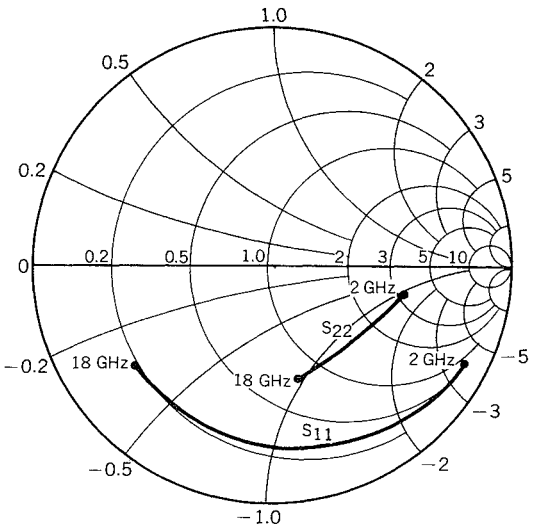
TYPICAL GAIN vs. FREQUENCY FOR THE NE67383 AT V_{DS} = 3 V AND I_{DS} = 30 mA

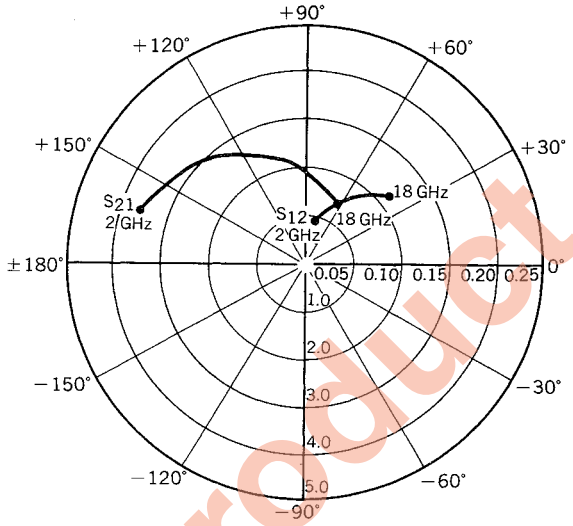


TYPICAL NOISE FIGURE AND ASSOCIATED GAIN vs. FREQUENCY FOR THE NE67383 AT V_{DS} = 3 V AND I_{DS} = 10 mA



NE67300 S-PARAMETERS

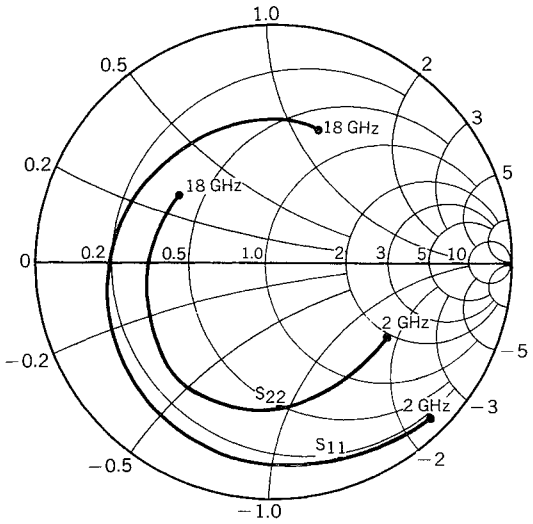


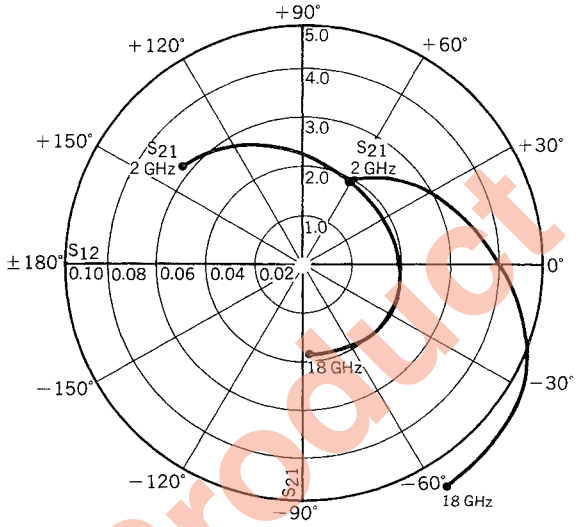


S-MAGN AND ANGLES: (V_{DS} = 3 V, I_{DS} = 10 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.95	−26	3.54	161	0.04	79	0.59	−13
4000	0.89	−50	3.10	141	0.06	66	0.58	−24
6000	0.82	−70	2.83	126	0.08	56	0.54	−33
8000	0.78	−88	2.49	114	0.09	51	0.50	−42
10000	0.73	−102	2.15	104	0.10	48	0.47	−48
12000	0.71	−114	1.95	93	0.10	43	0.45	−55
14000	0.71	−122	1.93	90	0.11	44	0.47	−62
16000	0.67	−128	1.64	76	0.11	43	0.49	−64
18000	0.66	−140	1.47	63	0.11	40	0.52	−70

NE67383 S-PARAMETERS





S-MAGN AND ANGLES: (V_{DS} = 3 V, I_{DS} = 10 mA)

frequency (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
2000	0.97	−43	3.17	140	0.04	61	0.63	−32
4000	0.88	−79	2.64	107	0.06	35	0.61	−58
6000	0.84	−103	2.28	81	0.07	20	0.62	−77
8000	0.78	−126	1.94	56	0.07	12	0.62	−94
10000	0.71	−146	1.81	38	0.07	4	0.61	−107
12000	0.64	−174	1.87	12	0.08	−7	0.60	−123
14000	0.59	157	1.99	−11	0.10	−15	0.57	−139
16000	0.57	111	2.09	−42	0.11	−31	0.47	−169
18000	0.62	64	1.79	−84	0.11	−58	0.43	137

CHIP HANDLING

DIE ATTACHMENT

Die attach can be accomplished with a Au-Sn (300±10 °C) preforms in a forming gas environment. Epoxy die attach is not recommended.

BONDING

Gate and drain bonding wires should be minimum length, semi-hard gold wire (3-8 % elongation) 20 microns or less in diameter.

Bonding should be performed with a wedge tip that has a taper of approximately 15 %. Die attach and bonding time should be kept to a minimum. As a general rule, the bonding operation should be kept within a 280 °C — 5 minute curve. If longer periods are required, the temperature should be lowered.

PRECAUTIONS

The user must operate in a clean, dry environment. The chip channel is glassivated for mechanical protection only and does not preclude the necessity of a clean environment.

The bonding equipment should be periodically checked for sources of surge voltage and should be properly grounded at all times. In fact, all test and handling equipment should be grounded to minimize the possibilities of static discharge.

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