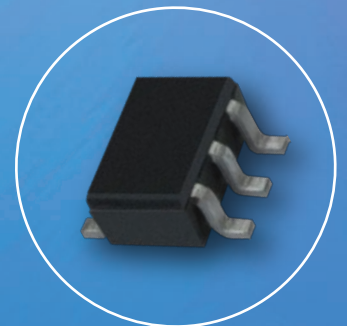
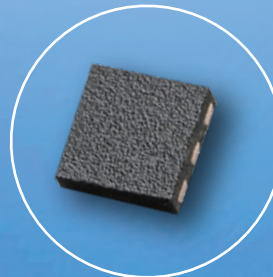
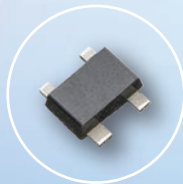


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**CEL** California Eastern Laboratories

2014

# RF & Wireless Semiconductors



**RENESAS**

# About CEL

California Eastern Laboratories (CEL) is the exclusive sales and marketing partner in the Americas for products made by the Compound Semiconductor Devices Business Division (CSDBD) of Renesas Electronics Corporation, formerly NEC Electronics Corporation. These products include RF components, Optocouplers, Solid State Relays, and Lasers and Detectors for Fiber Optics.

CEL serves designers, OEMs and contract manufacturers in the RF & Wireless, Mobilecomm, Multimedia, Broadband Communications, Industrial Control, and Automated Test Equipment (ATE) markets. With over 50 years experience in high frequency design, customer support and fulfillment, CEL is ideally positioned to provide its customers with solutions tailored to meet their specific needs.

CEL maintains extensive inventories and provides engineering and applications assistance at its technical centers in Santa Clara, CA. and Wauconda, IL. The company supports customers through sales offices, sales representatives and distributors in numerous locations.



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## PRODUCTS by APPLICATION

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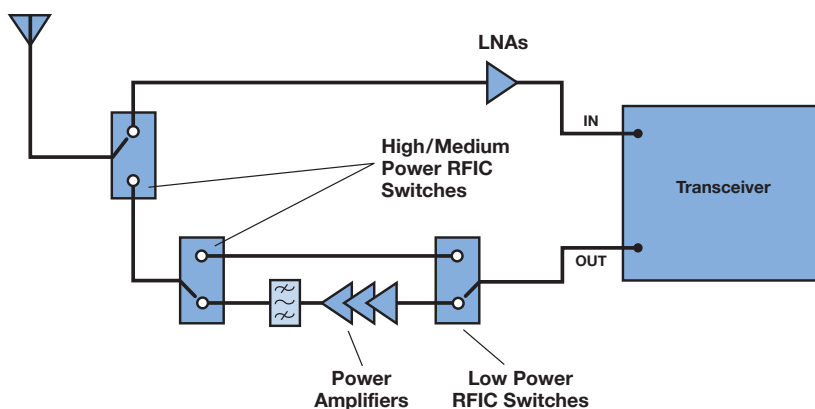
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# Front End Components for UHF to 2.5 GHz Applications

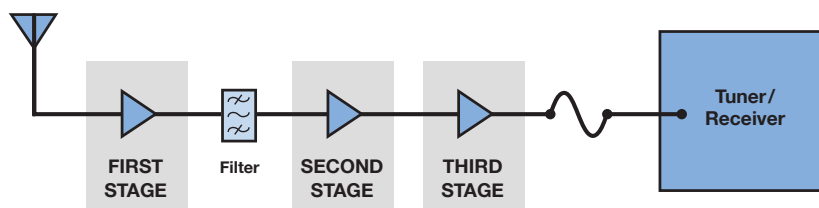
Wi-Fi • Bluetooth • ZigBee • Automated Meter Reading • Mesh & Home Area Networks • ISM Band applications



| RFIC Switches (additional P/Ns available, see page 5)               |                                                                      | 450 MHz | 915 MHz | 2.4 GHz |
|---------------------------------------------------------------------|----------------------------------------------------------------------|---------|---------|---------|
| UPG2409TB / T6X                                                     | SPDT, High power, SOT-363 and TSON/QFN package options               | ✓       | ✓       | ✓       |
| UPG2176T5N                                                          | SPDT, High power, internally terminated (absorptive)                 | ✓       | ✓       | ✓       |
| UPG2415TK / T6X                                                     | SPDT, High power, miniature and TSON/QFN package options             | ✓       | ✓       | ✓       |
| UPG2408TB / TK                                                      | SPDT, Medium power, SOT-363 and more compact package options         | ✓       | ✓       | ✓       |
| UPG2406TK                                                           | SPDT, Medium power, compact package (opposite logic vs. UPG2408TX)   | ✓       | ✓       | ✓       |
| UPG2214TB / TK                                                      | SPDT, Low power, High Isolation, SOT-363 and compact package options | ✓       | ✓       | ✓       |
| UPD5713TK                                                           | SPDT, Single Control, ideal for low frequency applications           | ✓       | ✓       |         |
| UPG2164T5N                                                          | DPDT, Diversity/Transfer Switch (two selectable RF paths on)         | ✓       | ✓       | ✓       |
| Power Amplifier Transistors (additional P/Ns available, see page 6) |                                                                      | 450 MHz | 915 MHz | 2.4 GHz |
| NE5550979A                                                          | +39.5dBm, 9W, 7.5V LD MOSFET                                         | ✓       | ✓       |         |
| NE5550234                                                           | +33dBm, 2W, 7.5V LDMOS FET                                           | ✓       | ✓       |         |
| NE664M04                                                            | +26dBm, 3.6V Silicon Discrete                                        | ✓       | ✓       | ✓       |
| NE678M04                                                            | +18dBm, 3.0 V Silicon Discrete                                       | ✓       | ✓       | ✓       |
| NE677M04                                                            | +15dBm, 3.0 V Silicon Discrete                                       | ✓       | ✓       | ✓       |
| Low Noise Amplifier Transistors                                     |                                                                      | 450 MHz | 915 MHz | 2.4 GHz |
| NE662M04                                                            | Silicon Discrete, NF = 1.1, Ga = 16.0, OIP3 = +22dBm @ 2GHz          | ✓       | ✓       | ✓       |
| NE3509M04                                                           | GaAs FET, NF = 0.40, Ga = 17.5, OIP3 = +22dBm @ 2 GHz                |         | ✓       | ✓       |
| NE3508M04                                                           | GaAs FET, NF = 0.45, Ga = 14.0, OIP3 = +31dBm @ 2 GHz                |         | ✓       | ✓       |

# LNAs for L to C-Band Applications

First, second and third stage devices for applications from 1 to 8GHz



## LNAs by Application

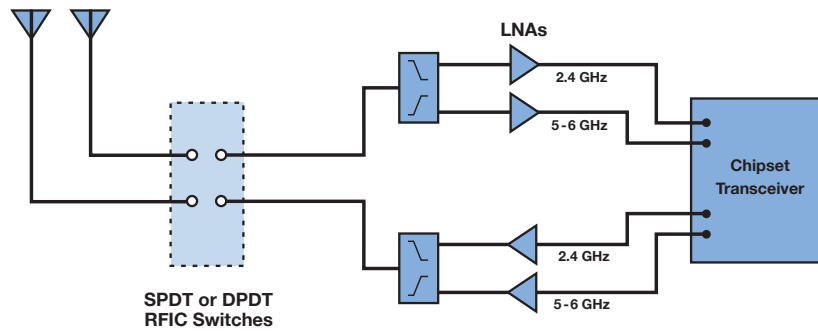
| Application             | Frequency      | FIRST STAGE                         | SECOND STAGE          | THIRD STAGE |
|-------------------------|----------------|-------------------------------------|-----------------------|-------------|
| Satellite Radio and DAB | 1.4 – 2.35 GHz | NE3508M04<br>NE3509M04<br>NE3510M04 | NE3508M04<br>NE662M04 | NE3508M04   |

## LNA Performance *(see Data Tables for additional specifications)*

| Part Number | Description        | NF (dB)       | Gain (dB)     | P1dB (dBm) | Package |
|-------------|--------------------|---------------|---------------|------------|---------|
| NE3508M04   | GaAs HJ-FET        | 0.45 @ 2.0GHz | 14.0 @ 2.0GHz | +18.0      | M04     |
| NE3509M04   | GaAs HJ-FET        | 0.40 @ 2.0GHz | 17.5 @ 2.0GHz | +14.0      | M04     |
| NE3510M04   | GaAs HJ-FET        | 0.35 @ 2.0GHz | 19.0 @ 2.0GHz | +12.0      | M04     |
| NE662M04    | Silicon Transistor | 1.1 @ 2.0GHz  | 16.0 @ 2.0GHz |            | M04     |

## 2.4 & 5.8 GHz WLAN/Wi-Fi/WiMAX Devices

Single and multi-throw switches, transistor, RFICs, discrete Silicon and GaAs low noise amplifiers designed specifically for Dual Band WLAN and WiMAX.



### GaAs RFIC Switches to 2.5GHz — Single & Multi Throw

**UPG2408TB** SPDT, 3V, 0.50dB Insertion Loss, High ESD immunity

**UPG2406TK** SPDT, 1.8 or 2.7V control voltage, 0.45dB Insertion Loss @ 2GHz, High ESD immunity

### GaAs RFIC Switches – Broadband to 6GHz

**UPG2422TK** SPDT for Dual Band WLAN, very cost-effective, 1.8-5.3V control voltage range

**UPG2163T5N** SPDT, Insertion Loss: 0.4dB @ 2.4GHz, 0.5dB @ 6GHz, Isolation = 30dB @ 6GHz

**UPG2176T5N** SPDT 2.4 – 6GHz, Insertion Loss: 0.5dB @ 2.4GHz, 0.7dB @ 5.5GHz, internal terminations

**UPG2415TK/T6X** SPDT for Dual Band WLAN, high power, low insertion loss for Access Point applications

**UPG2409T6X** SPDT for Dual Band WLAN, high power, low insertion loss for Access Point applications

**UPG2409TB** SPDT 2.0 – 4.0GHz, Insertion Loss: 0.45dB @ 2.5GHz, 0.6dB @ 3.8GHz

**UPG2164T5N** DPDT, Insertion Loss: 0.5dB @ 2.4GHz, 0.7dB @ 5.5GHz, 17 dB Isolation @ 6GHz

**UPG2162T5N** DPDT, Insertion Loss: 0.6dB @ 2.4GHz, 0.85dB @ 5.5GHz, 27 dB Isolation @ 6GHz

### LNAs

**NE3509M04** GaAs HJ FET, super low 0.40dB noise figure, 17dB gain @ 2.5GHz, OIP3 = +22dBm

**NE3508M04** GaAs HJ FET, super low 0.45dB noise figure, 14dB gain @ 2.5GHz, OIP3 = +31dBm

# RF Switch ICs

## SPDTs (Single Pole Double Throw)

| Part Number | TYPICAL ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C) |                      |                                |                            |                                              |                                              | Package Code | Description                                                                                            |
|-------------|------------------------------------------------------------|----------------------|--------------------------------|----------------------------|----------------------------------------------|----------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------|
|             | Frequency (GHz, max)                                       | Control Voltages (V) | Insertion Loss (dB)            | Isolation (dB)             | Input Power @ 0.1 dB compression point (dBm) | Input Power @ 1.0 dB compression point (dBm) |              |                                                                                                        |
| UPD5713TK   | 2.5                                                        | +1.8, 2.8/0          | 0.80 @ 2GHz                    | 25 @ 2GHz                  | +17                                          | +21                                          | TK           | Single Control (1.8-V <sub>dd</sub> ), small size package, CMOS                                        |
| UPG2009TB   | 3.0                                                        | +2.8/0               | 0.30 @ 2GHz                    | 28 @ 2GHz                  | +34                                          | –                                            | TB           | High power handling, low insertion loss, high isolation                                                |
| UPG2030TK   | 3.0                                                        | +2.8/0               | 0.30 @ 2GHz                    | 27 @ 2GHz                  | +27                                          | +30                                          | TK           | Medium power, small size package                                                                       |
| UPG2155TB   | 2.5                                                        | +2.6/0               | 0.40 @ 2GHz                    | 19 @ 2GHz                  | +37                                          | –                                            | TB           | High power handling, low harmonics, lowest cost high power switch                                      |
| UPG2163T5N  | 8.0                                                        | +3.0/0               | 0.4 @ 2.5GHz<br>0.5 @ 6GHz     | 35 @ 2.5GHz<br>30 @ 6GHz   | –                                            | +35 @ 2.5GHz<br>+29 @ 6GHz                   | T5N          | Highest isolation, great 2.4 and 6GHz performance                                                      |
| UPG2176T5N  | 6.0                                                        | +3.0/0               | 0.55 @ 3.5GHz                  | 24 @ 3.5GHz                | –                                            | +37                                          | T5N          | Absorptive, high power and high linearity to 6GHz                                                      |
| UPG2214TB   | 3.0                                                        | +1.8, 3.0/0          | 0.30 @ 2GHz                    | 27 @ 2GHz                  | +23                                          | +20 (1.8V),<br>26(3.0V)                      | TB           | Low insertion loss, high isolation, medium power, 1.8V-5.3V.                                           |
| UPG2214TK   | 3.0                                                        | +1.8, 3.0/0          | 0.30 @ 2GHz                    | 27 @ 2GHz                  | +23                                          | +20 (1.8V),<br>26(3.0V)                      | TK           | Small size package, low insertion loss, high isolation, medium power, 1.8V-5.3V.                       |
| UPG2406TK   | 3.0                                                        | +1.8, 2.7/0          | 0.45 @ 2GHz                    | 19 @ 2GHz                  | +29                                          | +25 (1.8V),<br>30.5 (3.0V)                   | TK           | Small size package, cost effective medium power, 1.8V-5.3V                                             |
| UPG2408TB   | 3.0                                                        | +3.0/0               | 0.48 @ 2GHz                    | 19 @ 2GHz                  | +29                                          | –                                            | TB           | Lowest cost medium power for UHF-3GHz                                                                  |
| UPG2408TK   | 3.0                                                        | +3.0/0               | 0.48 @ 2GHz                    | 19 @ 2GHz                  | +29                                          | –                                            | TK           | Small size package, cost effective medium power                                                        |
| UPG2409TB   | 3.8                                                        | +3.0/0               | 0.45 @ 2.5GHz<br>0.60 @ 3.8GHz | 26 @ 2.5GHz<br>19 @ 3.8GHz | +33.5                                        | +35                                          | TB           | Lowest Cost high power SPDT, for Access Points to 3.8GHz                                               |
| UPG2409T6X  | 6.0                                                        | +3.0/0               | 0.45 @ 2.5GHz<br>0.65 @ 6GHz   | 30 @ 2.5GHz<br>27 @ 6GHz   | +34                                          | +36                                          | T6X          | High power, for Access Points to 6GHz, 1.5mm QFN package                                               |
| UPG2415TK   | 6.0                                                        | +3.0/0               | 0.45 @ 2.5GHz<br>0.65 @ 6GHz   | 28 @ 2.5GHz<br>26 @ 6GHz   | +31                                          | +34                                          | TK           | High power handling for Access Points to 6GHz, small size package                                      |
| UPG2415T6X  | 6.0                                                        | +3.0/0               | 0.45 @ 2.5GHz<br>0.55 @ 6GHz   | 28 @ 2.5GHz<br>26 @ 6GHz   | +31                                          | +35                                          | T6X          | High power handling for Access Points to 6GHz, 1.5mm QFN package                                       |
| UPG2422TK   | 6.0                                                        | +1.8, 3.0/0          | 0.35 @ 2.5GHz,<br>0.55 @ 6GHz  | 28 @ 2.5GHz<br>24 @ 6GHz   | +28 @ 2-6GHz                                 | +31 @ 6GHz                                   | TK           | Lowest cost 6GHz SPDT, medium power, small size package, low insertion loss, high isolation, 1.8V-5.3V |

## DPDTs (Double Pole Double Throw)

| Part Number | TYPICAL ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C) |                      |                               |                            |                                             |                                             | Package Code | Description                                                    |
|-------------|------------------------------------------------------------|----------------------|-------------------------------|----------------------------|---------------------------------------------|---------------------------------------------|--------------|----------------------------------------------------------------|
|             | Frequency (GHz, max)                                       | Control Voltages (V) | Insertion Loss (dB)           | Isolation (dB)             | Input Power @0.1 dB compression point (dBm) | Input Power @1.0 dB compression point (dBm) |              |                                                                |
| UPG2164T5N  | 6.0                                                        | +3.0/0               | 0.5 @ 2.4GHz<br>0.7 @ 5.5GHz  | 25 @ 2.4GHz<br>17 @ 5.5GHz | –                                           | +31<br>+29                                  | T5N          | Lowest cost, lowest insertion loss DPDT. 6GHz operation.       |
| UPG2162T5N  | 6.0                                                        | +3.0/0               | 0.6 @ 2.4GHz<br>0.85 @ 5.5GHz | 30 @ 2.4GHz<br>27 @ 5.5GHz | –                                           | +31<br>+29                                  | T5N          | Best isolation of all DPDTs, up to 6GHz operation              |
| UPD5738T6N  | 2.5                                                        | +2.8/0               | 0.8 @ 1GHz                    | 22 @ 1GHz                  | +15                                         | +20                                         | T6N          | Only one control pin, low frequency operation, CMOS, 1.5V-3.6V |

## GaAs FETs

Low Noise GaAs FETs, 1 to 20GHz Typical Specifications @ TA = 25°C

| Part Number | Gate Length (μm) | Gate Width (μm) | Recommended Frequency Range (GHz) | Test Frequency (GHz) | NF/GA Bias          |                      | NF <sub>OPT</sub> (dB) | GA (dB) | Power Bias          |                      | P <sub>1dB</sub> (dBm) | Chip / Package Code | Chip / Package Description |
|-------------|------------------|-----------------|-----------------------------------|----------------------|---------------------|----------------------|------------------------|---------|---------------------|----------------------|------------------------|---------------------|----------------------------|
|             |                  |                 |                                   |                      | V <sub>DS</sub> (V) | I <sub>DS</sub> (mA) |                        |         | V <sub>DS</sub> (V) | I <sub>DS</sub> (mA) |                        |                     |                            |
| NE3503M04   | 0.2              | 160             | 2 to 18                           | 12                   | 2.0                 | 10                   | 0.55                   | 11.5    | —                   | —                    | —                      | M04                 | Plastic SMD                |
| NE3508M04   | 0.6              | 800             | 1 to 6                            | 2                    | 2.0                 | 10                   | 0.40                   | 14.0    | 3.0                 | 30                   | +18.0                  | M04                 | Plastic SMD                |
| NE3509M04   | 0.6              | 400             | 1 to 6                            | 2                    | 2.0                 | 10                   | 0.45                   | 17.5    | 3.0                 | 20                   | +14.0                  | M04                 | Plastic SMD                |
| NE3510M04   | 0.6              | 280             | 1 to 6                            | 2                    | 2.0                 | 10                   | 0.35                   | 19.0    | 3.0                 | 30                   | +12.0                  | M04                 | Plastic SMD                |
| NE3511S02   | 0.2              | 160             | 4 to 18                           | 12                   | 2.0                 | 10                   | 0.30                   | 13.5    | —                   | —                    | —                      | S02                 | Micro-X Plastic            |
| NE3512S02   | 0.2              | 160             | 4 to 18                           | 12                   | 2.0                 | 10                   | 0.35                   | 13.5    | —                   | —                    | —                      | S02                 | Micro-X Plastic            |
| NE3513M04   | 0.2              | 160             | 10 to 14                          | 12                   | 2.0                 | 6                    | 0.45                   | 13.0    | —                   | —                    | —                      | M04                 | Plastic SMD                |
| NE3514S02   | 0.2              | 160             | 4 to 20                           | 20                   | 2.0                 | 10                   | 0.75                   | 10.0    | —                   | —                    | —                      | S02                 | Micro-X Plastic            |
| NE3515S02   | 0.2              | 200             | 6 to 18                           | 12                   | 2.0                 | 10                   | 0.3                    | 12.5    | 3.0                 | 25                   | +14.0                  | S02                 | Micro-X Plastic            |
| NE3516S02   | 0.2              | 160             | 6 to 18                           | 12                   | 2.0                 | 10                   | 0.35                   | 14.0    | —                   | —                    | —                      | S02                 | Plastic SMD                |
| NE3520S03   | —                | 160             | 10 to 26                          | 20                   | 2.0                 | 10                   | 0.65                   | 13.5    | —                   | —                    | —                      | S03                 | Micro-X Plastic            |
| NE3521M04   | —                | —               | 10 to 26                          | 20                   | 2.0                 | 10                   | 0.85                   | 11      | —                   | —                    | —                      | M04                 | Plastic SMD                |

## Silicon MOSFET Devices

RF Power LD-MOSFETs Typical Specifications @ Tc = 25°C

| Part Number | P <sub>OUT</sub> (dBm) TYP | Linear Gain (dB) TYP | Test Conditions |                       |                     |                       | Package Description  |
|-------------|----------------------------|----------------------|-----------------|-----------------------|---------------------|-----------------------|----------------------|
|             |                            |                      | Freq (GHz)      | P <sub>IN</sub> (dBm) | V <sub>DS</sub> (V) | I <sub>DSQ</sub> (mA) |                      |
| NE5550234   | +33<br>+32.2               | 23.5<br>18.3         | 0.46<br>0.90    | +15<br>+17            | 7.5<br>7.5          | 40<br>40              | 34 Pkg: Compact SMT  |
| NE5550279A  | +33                        | 22.5                 | 0.46            | +15                   | 7.5                 | 40                    | 79A Pkg: Compact SMT |
| NE5550779A  | +38.5<br>+37.4             | 22<br>17             | 0.46<br>0.90    | +25<br>+27            | 7.5<br>7.5          | 140<br>140            | 79A Pkg: Compact SMT |
| NE5550979A  | +39.5<br>+38.6             | 22<br>16             | 0.46<br>0.90    | +25<br>+27            | 7.5<br>7.5          | 200<br>200            | 79A Pkg: Compact SMT |
| NE5531079A  | +40.0                      | 20.5                 | 0.46            | +25                   | 7.5                 | 200                   | 79A Pkg: Compact SMT |

MOSFET for Microphone Impedance Conversion

| Part Number | Supply Voltage (V) | Circuit Current (μA) | Input Capacitance (pF) | Voltage Gain (dB) | Output Noise Voltage (dBV) | Total Harmonic Distortion (%) | HBM ESD (KV) | M53 Package (mm) |
|-------------|--------------------|----------------------|------------------------|-------------------|----------------------------|-------------------------------|--------------|------------------|
| NE5820M53   | 2                  | 85                   | 1.5                    | -3                | -114                       | 0.1                           | >8           | 1.0 x 1.2 x 0.33 |



# Silicon Bipolar Transistors

## Small Signal Silicon Devices

| Part Number | TEST f (GHz) | NF/GA               |                      | NF TYP (dB) | GA TYP (dB) | MAG/MSG             |                     |          | f <sub>T</sub> TYP (GHz) | h <sub>FE</sub> TYP | I <sub>C</sub> MAX (mA) | Package Description                              |
|-------------|--------------|---------------------|----------------------|-------------|-------------|---------------------|---------------------|----------|--------------------------|---------------------|-------------------------|--------------------------------------------------|
|             |              | V <sub>CE</sub> (V) | I <sub>CO</sub> (mA) |             |             | V <sub>CE</sub> (V) | I <sub>C</sub> (mA) | TYP (dB) |                          |                     |                         |                                                  |
| NE202930    | 1.0          | 5                   | 5                    | 1.15        | 13.5        | 5                   | 30                  | 15.5     | 11                       | 140                 | 100                     | 30 Pkg: 3 pin Super Mini Mold, SOT-323 style     |
| NE662M04    | 2.0          | 2                   | 5                    | 1.1         | 16          | 2                   | 20                  | 20       | 23                       | 70                  | 35                      | M04 Pkg: 4 pin low profile SOT-343 style         |
| NE66219     | 2.0          | 2                   | 5                    | 1.5         | 12.0        | 2                   | 20                  | 14       | 21                       | 80                  | 35                      | 19 Pkg: 3 pin Ultra-Super Mini Mold, SC-90 style |
| NE68018     | 2.0          | 6                   | 5                    | 1.8         | 10.0        | 1                   | 1                   | 12.5     | 10                       | 100                 | 35                      | 18 Pkg: 4 pin Super Mini Mold                    |
| NE68019     | 2.0          | 3                   | 5                    | 1.9         | 9.0         | 1                   | 1                   | 12.0     | 8                        | 120                 | 35                      | 19 Pkg: 3 pin Ultra-Super Mini Mold, SC-90 style |
| NE68030     | 2.0          | 6                   | 5                    | 1.7         | 9.5         | 6                   | 10                  | 8.5      | 10                       | 100                 | 35                      | 30 Pkg: 3 pin Super Mini Mold, SOT-323 style     |
| NE68033     | 2.0          | 6                   | 5                    | 1.8         | 9.0         | 6                   | 10                  | 8.0      | 10                       | 100                 | 35                      | 33 Pkg: 3 pin Mini Mold, SOT-23 style            |
| NE68039     | 2.0          | 6                   | 5                    | 1.7         | 11.0        | 6                   | 10                  | 9.0      | 10                       | 100                 | 35                      | 39 Pkg: 4 pin Mini Mold                          |
| NE68118     | 1.0          | 2.5                 | 3                    | 1.1         | 13.0        | 2.5                 | 3                   | 16.0     | 9                        | 100                 | 65                      | 18 Pkg: 4 pin Super Mini Mold                    |
| NE68119     | 1.0          | 2.5                 | 3                    | 1.1         | 12.0        | 2.5                 | 3                   | 15.5     | 7                        | 120                 | 65                      | 19 Pkg: 3 pin Ultra-Super Mini Mold, SC-90 style |
| NE68130     | 1.0          | 8                   | 7                    | 1.5         | 13.5        | 8                   | 20                  | 13.0     | 7                        | 120                 | 65                      | 30 Pkg: 3 pin Super Mini Mold, SOT-323 style     |
| NE68133     | 1.0          | 8                   | 7                    | 1.2         | 13.0        | 8                   | 20                  | 11.0     | 9                        | 100                 | 65                      | 33 Pkg: 3 pin Mini Mold, SOT-23 style            |
| NE68139     | 1.0          | 8                   | 7                    | 1.2         | 13.5        | 8                   | 20                  | 15.0     | 9                        | 100                 | 65                      | 39 Pkg: 4 pin Mini Mold, SOT-143 style           |
| NE68518     | 2.0          | 2.5                 | 3                    | 1.5         | 8.5         | 2.5                 | 3                   | 12.0     | 12                       | 110                 | 30                      | 18 Pkg: 4 pin Super Mini Mold                    |
| NE68519     | 2.0          | 2.5                 | 3                    | 1.5         | 7.5         | 2.5                 | 3                   | 11.0     | 12                       | 110                 | 30                      | 19 Pkg: 3 pin Ultra-Super Mini Mold, SC-90 style |
| NE85618     | 1.0          | 2.5                 | 3                    | 1.4         | 11.0        | 2.5                 | 3                   | 14.0     | 6.5                      | 120                 | 100                     | 18 Pkg: 4 pin Super Mini Mold                    |
| NE85619     | 1.0          | 2.5                 | 3                    | 1.5         | 10.0        | 2.5                 | 3                   | 13.5     | 4.5                      | 120                 | 100                     | 19 Pkg: 3 pin Ultra-Super Mini Mold, SC-90 style |
| NE85630     | 1.0          | 10                  | 7                    | 1.3         | 12.0        | 10                  | 20                  | 12.0     | 4.5                      | 110                 | 100                     | 30 Pkg: 3 pin Super Mini Mold, SOT-323 style     |
| NE85633     | 1.0          | 10                  | 7                    | 1.4         | 9.0         | 10                  | 20                  | 11.5     | 7                        | 120                 | 100                     | 33 Pkg: 3 pin Mini Mold, SOT-23 style            |
| NE85639     | 1.0          | 10                  | 7                    | 1.5         | 13.5        | 10                  | 20                  | 13.0     | 7                        | 120                 | 100                     | 39 Pkg: 4 pin Mini Mold, SOT-143 style           |
| NE97733     | 1.0          | -8                  | -3                   | 1.5         | 10.0        | -8                  | -20                 | 12.0     | 8.5                      | 60                  | -50                     | 33 Pkg: 3 pin Mini Mold, SOT-23 style (PNP)      |
| NE97833     | 1.0          | -10                 | -3                   | 2.0         | 7.0         | -10                 | -15                 | 10.0     | 5.5                      | 40                  | -50                     | 33 Pkg: 3 pin Mini Mold, SOT-23 style (PNP)      |

## Medium Power Transistors

| Part Number | TEST f (GHz) | P <sub>1dB</sub>    |                      |           | MAG / MSG           |                     |          | f <sub>T</sub> TYP (GHz) | h <sub>FE</sub> TYP | I <sub>C</sub> MAX (mA) | Package Description                      |
|-------------|--------------|---------------------|----------------------|-----------|---------------------|---------------------|----------|--------------------------|---------------------|-------------------------|------------------------------------------|
|             |              | V <sub>CE</sub> (V) | I <sub>CQ</sub> (mA) | TYP (dBm) | V <sub>CE</sub> (V) | I <sub>C</sub> (mA) | TYP (dB) |                          |                     |                         |                                          |
| NE46134     | 1.0          | 12.5                | 100                  | 27.5      | 10                  | 50                  | 9        | 5.5                      | 100                 | 250                     | 34 Pkg: 4 pin SOT-89 style               |
| NE461M02    | 1.0          | 12.5                | 100                  | 27.5      | 10                  | 50                  | 11       | 5.5                      | 120                 | 250                     | M02 Pkg: 4 pin high gain SOT-89 style    |
| NE663M04    | 2.0          | 2                   | 50                   | 16        | 2                   | 50                  | 15       | 18                       | 100                 | 100                     | M04 Pkg: 4 pin low profile SOT-343 style |
| NE664M04    | 1.8          | 3.6                 | 200                  | 26        | 3                   | 100                 | 12       | 20                       | 60                  | 500                     | M04 Pkg: 4 pin low profile SOT-343 style |
| NE677M04    | 1.8          | 2.8                 | 23                   | 15        | 3                   | 20                  | 16       | 15                       | 120                 | 50                      | M04 Pkg: 4 pin low profile SOT-343 style |
| NE678M04    | 1.8          | 2.8                 | 40                   | 18        | 3                   | 30                  | 13.5     | 12                       | 120                 | 100                     | M04 Pkg: 4 pin low profile SOT-343 style |
| NE85634     | 1.0          | 10                  | 40                   | 22        | 10                  | 40                  | 11       | 6.5                      | 120                 | 100                     | 34 Pkg: 4 pin SOT-89 style               |
| NE856M02    | 1.0          | 10                  | 40                   | 22        | 10                  | 50                  | 14       | 6.5                      | 120                 | 100                     | M02 Pkg: 4 pin high gain SOT-89 style    |

## Twin Transistors

| Part Number | TEST f (GHz) | NF/GA               | NF/GA               | NF       | GA       | MAG (dB) | IS <sub>21EI</sub>  |                     |          | f <sub>T</sub> TYP (GHz) | h <sub>FE</sub> TYP | I <sub>C</sub> MAX (mA) | Pkg. Code | Package Style | Die   |
|-------------|--------------|---------------------|---------------------|----------|----------|----------|---------------------|---------------------|----------|--------------------------|---------------------|-------------------------|-----------|---------------|-------|
|             |              | V <sub>CE</sub> (V) | I <sub>C</sub> (mA) | TYP (dB) | TYP (dB) |          | V <sub>CE</sub> (V) | I <sub>C</sub> (mA) | TYP (dB) |                          |                     |                         |           |               |       |
| UPA800T     | 2.0          | 3                   | 5                   | 1.9      | 9.0      | 12.0     | 3                   | 5                   | 7.5      | 8                        | 120                 | 35                      | S06       | SOT-363       | NE680 |
| UPA801T     | 1.0          | 3                   | 7                   | 1.2      | 10.0     | 14.0     | 3                   | 7                   | 9.0      | 4.5                      | 120                 | 100                     | S06       | SOT-363       | NE856 |
| UPA802T     | 1.0          | 3                   | 7                   | 1.4      | 14.0     | 16.0     | 3                   | 7                   | 12.0     | 7.0                      | 100                 | 65                      | S06       | SOT-363       | NE681 |
| UPA806T     | 2.0          | 3                   | 3                   | 1.5      | 7.5      | 11.0     | 3                   | 10                  | 8.5      | 12.0                     | 110                 | 30                      | S06       | SOT-363       | NE685 |
| UPA810T     | 1.0          | 3                   | 7                   | 1.2      | 10.0     | 14.0     | 3                   | 7                   | 9.0      | 4.5                      | 120                 | 100                     | S06       | SOT-363       | NE856 |
| UPA811T     | 2.0          | 3                   | 5                   | 1.9      | 9.0      | 12.0     | 3                   | 5                   | 7.5      | 8                        | 120                 | 35                      | S06       | SOT-363       | NE680 |



## 3V Silicon MMIC Amplifiers

| Part Number            | Typical Frequency Range @ 3dB down (MHz) | ELECTRICAL CHARACTERISTICS <sup>1</sup> (T <sub>A</sub> = 25°C) |                      |     |     |         |           |      |      |                       |                        |                        |           | Package Code | Package Style       |
|------------------------|------------------------------------------|-----------------------------------------------------------------|----------------------|-----|-----|---------|-----------|------|------|-----------------------|------------------------|------------------------|-----------|--------------|---------------------|
|                        |                                          | V <sub>CC</sub> (V)                                             | I <sub>CC</sub> (mA) |     |     | NF (dB) | Gain (dB) |      |      | R <sub>LIN</sub> (dB) | R <sub>LOUT</sub> (dB) | P <sub>1dB</sub> (dBm) | ISOL (dB) |              |                     |
|                        |                                          |                                                                 | MIN                  | TYP | MAX | TYP     | MIN       | TYP  | MAX  | TYP                   | TYP                    | TYP                    | TYP       |              |                     |
| UPC2745TB <sup>2</sup> | 2700                                     | 3                                                               | 5                    | 7.5 | 10  | 6.0     | 9         | 12   | 14   | 11                    | 5.5                    | -3.0                   | 38        | S06 / TB     | SOT-363             |
| UPC2746TB <sup>2</sup> | 1500                                     | 3                                                               | 5                    | 7.5 | 10  | 4.0     | 16        | 19   | 21   | 13                    | 8.5                    | -3.7                   | 45        | S06 / TB     | SOT-363             |
| UPC2748TB <sup>3</sup> | 1500                                     | 3                                                               | 4.5                  | 6   | 8   | 2.8     | 16        | 19   | 21   | 11.5                  | 8.5                    | -8.5                   | 40        | S06 / TB     | SOT-363             |
| UPC2749TB <sup>4</sup> | 2900                                     | 3                                                               | 4                    | 6   | 8   | 4       | 13        | 16   | 18.5 | 10                    | 13                     | -12.5                  | 30        | S06 / TB     | SOT-363             |
| UPC2762TB <sup>4</sup> | 2900                                     | 3                                                               | —                    | 27  | 35  | 7.0     | 11.5      | 15.5 | 17.5 | 8.5                   | 12                     | +7                     | 25        | S06 / TB     | SOT-363             |
| UPC8178TK <sup>4</sup> | 2700                                     | 3                                                               | 1.4                  | 1.9 | 2.4 | 5.5     | 9.0       | 11.0 | 13.5 | 8                     | —                      | -8.0                   | 41        | TK           | 6 pin Recessed Lead |
| UPC8179TK <sup>4</sup> | Note 5                                   | 3                                                               | 2.9                  | 4.0 | 5.4 | 5.0     | 13.0      | 15.5 | 17.5 | 7                     | —                      | 0.5                    | 42        | TK           | 6 pin Recessed Lead |

Notes: 1. Z<sub>L</sub> = 50 Ω for all Electrical Characteristics 2. f = 500 MHz test condition 3. f = 900 MHz test condition 4. f = 1900 MHz test condition  
5. 100 – 2400 MHz with output port matching

## 5V Silicon MMIC Amplifiers

| Part Number            | Typical Frequency Range @ 3dB down (MHz) | ELECTRICAL CHARACTERISTICS <sup>1</sup> (T <sub>A</sub> = 25°C) |                      |     |      |         |           |      |      |                       |                        |                        |           | Package Code | Package Style |
|------------------------|------------------------------------------|-----------------------------------------------------------------|----------------------|-----|------|---------|-----------|------|------|-----------------------|------------------------|------------------------|-----------|--------------|---------------|
|                        |                                          | V <sub>CC</sub> (V)                                             | I <sub>CC</sub> (mA) |     |      | NF (dB) | Gain (dB) |      |      | R <sub>LIN</sub> (dB) | R <sub>LOUT</sub> (dB) | P <sub>1dB</sub> (dBm) | ISOL (dB) |              |               |
|                        |                                          |                                                                 | MIN                  | TYP | MAX  | TYP     | MIN       | TYP  | MAX  | TYP                   | TYP                    | TYP                    | TYP       |              |               |
| UPC2708TB <sup>3</sup> | 2900                                     | 5                                                               | 20                   | 26  | 33   | 6.5     | 13        | 15   | 18.5 | 11                    | 20                     | +9.2                   | 23        | S06 / TB     | SOT-363       |
| UPC2709TB <sup>3</sup> | 2300                                     | 5                                                               | 19                   | 25  | 32   | 5.0     | 21        | 23   | 26.5 | 10                    | 10                     | +8.7                   | 31        | S06 / TB     | SOT-363       |
| UPC2710TB <sup>2</sup> | 1000                                     | 5                                                               | 16                   | 22  | 29   | 3.5     | 30        | 33   | 36.5 | 6                     | 12                     | +10.8                  | 39        | S06 / TB     | SOT-363       |
| UPC3223TB <sup>3</sup> | 3200                                     | 5                                                               | 15                   | 19  | 24   | 4.5     | 20.5      | 23   | 22.5 | 12                    | 12                     | +6.5                   | 33        | S06 / TB     | SOT-363       |
| UPC3224TB <sup>3</sup> | 3200                                     | 5                                                               | 7.0                  | 9.0 | 12.0 | 4.3     | 19        | 21.5 | 24   | 12                    | 17                     | -3.5                   | 40        | S06 / TB     | SOT-363       |

Notes: 1. Z<sub>L</sub> = 50 Ω for all Electrical Characteristics 2. f = 500 MHz test condition 3. f = 1000 MHz test condition 4. f = 1900 MHz test condition

## Frequency Upconverters

| Part Number            | ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C) |                                 |                     |                      |                      |                                     |                   |                  | Package Code | Package Style |
|------------------------|----------------------------------------------------|---------------------------------|---------------------|----------------------|----------------------|-------------------------------------|-------------------|------------------|--------------|---------------|
|                        | IF Input Frequency Range @3 dB Down (MHz)          | RF Output Frequency Range (MHz) | V <sub>CC</sub> (V) | I <sub>CC</sub> (mA) | Conversion Gain (dB) | P <sub>SAT</sub> <sup>1</sup> (dBm) | Noise Figure (dB) | OIP <sub>3</sub> |              |               |
|                        | TYP                                                | TYP                             |                     | TYP                  | TYP                  | TYP                                 | TYP               |                  |              |               |
| UPC8106TB <sup>2</sup> | 50-400                                             | 400-2000                        | 3.0                 | 9.0                  | 10.0                 | -2.0                                | 8.5               | +5.5             | S06 / TB     | SOT-363       |
| UPC8172TB <sup>3</sup> | 50-400                                             | 800-2500                        | 3.0                 | 9.0                  | 8.5                  | 0.0                                 | 10.4              | +6.0             | S06 / TB     | SOT-363       |

Notes: 1. PIN = 0 dBm 2. RF = 900 MHz, LO = 660 MHz, PLO = -5 dBm 3. RF = 1900 MHz, LO = 1660 MHz, PLOIN = -5 dBm

## Frequency Downconverters

| Part Number            | ELECTRICAL CHARACTERISTICS (T <sub>A</sub> = 25°C) |                                            |                     |                      |                      |                        |                   |                       | Package Code | Package Style |
|------------------------|----------------------------------------------------|--------------------------------------------|---------------------|----------------------|----------------------|------------------------|-------------------|-----------------------|--------------|---------------|
|                        | RF Input Frequency Range @3 dB Down (MHz)          | IF Output Frequency Range @3 dB Down (MHz) | V <sub>CC</sub> (V) | I <sub>CC</sub> (mA) | Conversion Gain (dB) | P <sub>SAT</sub> (dBm) | Noise Figure (dB) | Test Condition (Note) |              |               |
|                        | TYP                                                | TYP                                        |                     | TYP                  | TYP                  | TYP                    | TYP               |                       |              |               |
| UPC2756TB              | 100-2000                                           | 10-300                                     | 3.0                 | 5.9                  | 14                   | -12                    | 13                | 3                     | S06 / TB     | SOT-363       |
| UPC2757TB <sup>1</sup> | 100-2000                                           | 20-300                                     | 3.0                 | 5.6                  | 13                   | -8                     | 13                | 4                     | S06 / TB     | SOT-363       |
| UPC2758TB <sup>1</sup> | 100-2000                                           | 20-300                                     | 3.0                 | 11                   | 17                   | -4                     | 13                | 4                     | S06 / TB     | SOT-363       |
| UPC8112TB <sup>1</sup> | 800-2000                                           | 100-300                                    | 3.0                 | 8.5                  | 13                   | -3                     | 11.2              | 5                     | S06 / TB     | SOT-363       |

Note: 1. AGC Amp and Mixer Block only

## CEL/JEITA<sup>1</sup> Cross Reference List

| CEL Part Number | JEITA <sup>1</sup> Part Number |
|-----------------|--------------------------------|
| NE46134         | 2SC4536                        |
| NE461M02        | 2SC5337                        |
| NE46234         | 2SC4703                        |
| NE66219         | 2SC5606                        |
| NE662M04        | 2SC5508                        |
| NE663M04        | 2SC5509                        |
| NE664M04        | 2SC5754                        |
| NE677M04        | 2SC5751                        |
| NE678M04        | 2SC5753                        |
| NE68018         | 2SC5013                        |
| NE68019         | 2SC5008                        |
| NE68030         | 2SC4228                        |
| NE68033         | 2SC3585                        |
| NE68118         | 2SC5012                        |

| CEL Part Number | JEITA <sup>1</sup> Part Number |
|-----------------|--------------------------------|
| NE68119         | 2SC5007                        |
| NE68130         | 2SC4227                        |
| NE68133         | 2SC3583                        |
| NE68139         | 2SC4094                        |
| NE68518         | 2SC5015                        |
| NE68519         | 2SC5010                        |
| NE85618         | 2SC5011                        |
| NE85619         | 2SC5006                        |
| NE85630         | 2SC4226                        |
| NE85633         | 2SC3356                        |
| NE85634         | 2SC3357                        |
| NE856M02        | 2SC5336                        |
| NE97733         | 2SA1977                        |
| NE97833         | 2SA1978                        |

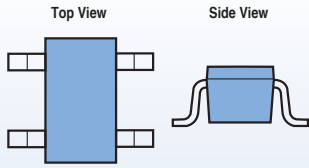
Notes: 1. JEITA = Japan Electronics and Information Technology Industries Association

# Package Dimensions Units in mm

These dimensions are for the package only. For detailed dimensions including leads, please refer to the datasheet.

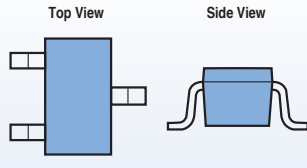
**18 Package**

(1.25 x 2.0 x 0.9)



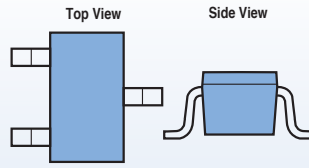
**19 Package**

(0.8 x 1.6 x 0.75)



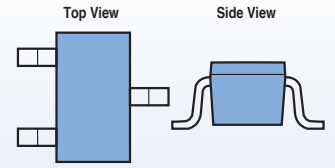
**30 Package**

(1.25 x 2.0 x 0.9)



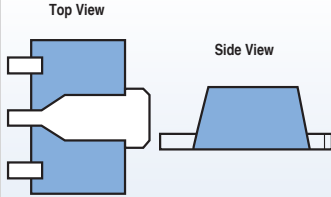
**33 Package**

(1.5 x 2.9 x 1.4)



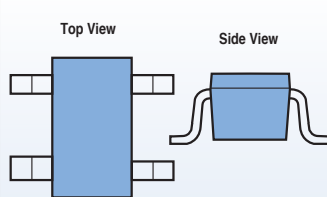
**34 Package**

(2.5 x 4.5 x 1.5)



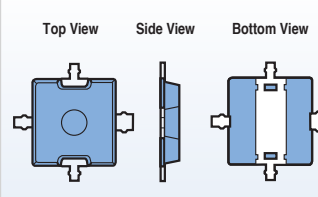
**39 Package**

(1.5 x 2.9 x 1.1)



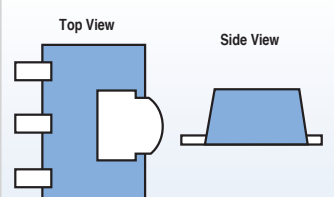
**79A Package**

(4.2 x 4.4 x 0.9)



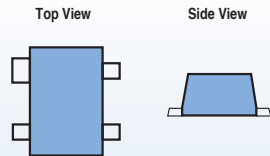
**M02 Package**

(2.45 x 4.5 x 1.5)



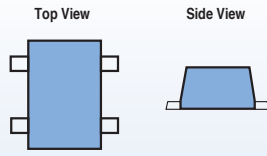
**M04 Package**

(1.25 x 2.0 x 0.6)



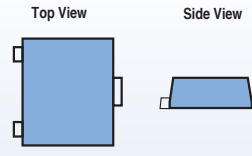
**M05 Package**

(1.25 x 2.0 x 0.6)



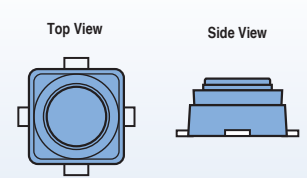
**M53 Package**

(1.0 x 1.2 x 0.33)



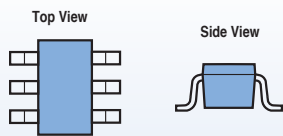
**S02 / S03 Package**

(2.6 x 2.6 x 1.5)



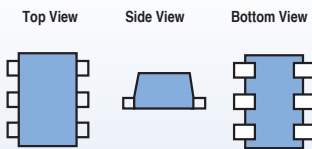
**T / TB / S06 Package**

(1.25 x 2.0 x 0.9)



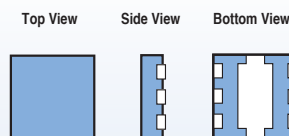
**TK Package**

(1.1 x 1.5 x 0.55)



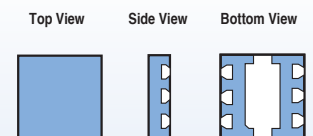
**T5N / T6N Package**

(1.5 x 1.5 x 0.37)



**T6X / TSON 6 Package**

(1.5 x 1.5 x 0.37)



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