# THE DATASHEET OF

# 2SC5013-T1-A

CEL

2016

# RF & Wireless

## Semiconductors


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Product Selection Guide

# About CEL

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

## PRODUCTS by APPLICATION



## PRODUCT SPECIFICATIONS




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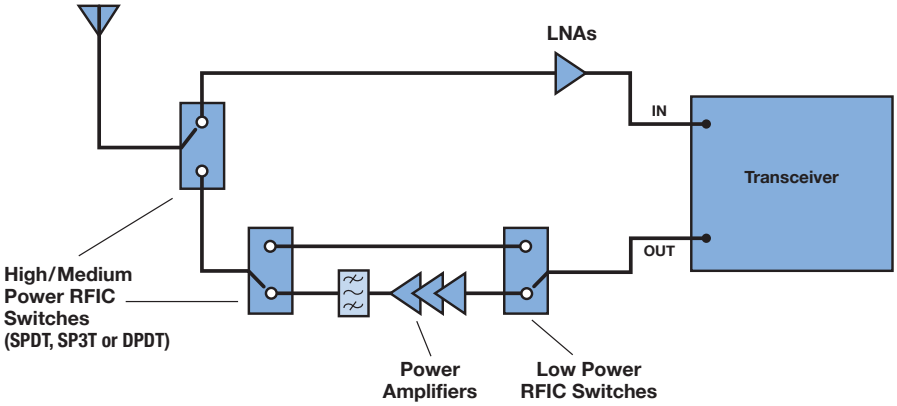
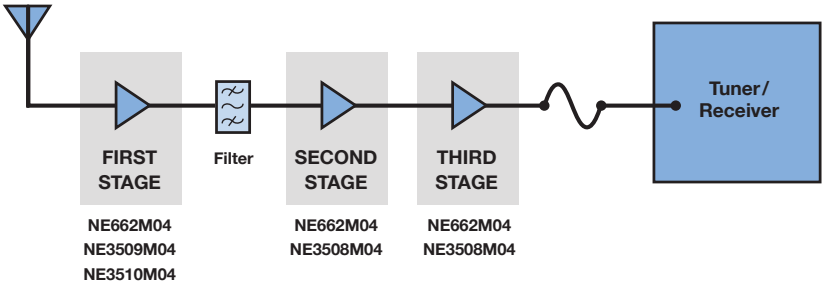
# Front End Components Up to 6 GHz Applications

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




| RFIC Switches *(additional P/Ns available, see page 4)* | | 450 MHz | 915 MHz | 2.4 GHz | 6 GHz |
|---|---|---|---|---|---|
| NEW **CG2163X3** | SPDT, High Power and High Isolation for WLAN | | | ✔ | ✔ |
| NEW **CG2176X3** | SPDT, High Power & High Isolation Absorptive Dual Band Switch | | | ✔ | ✔ |
| NEW **CG2179M2** | SPDT, Low cost , Insertion Loss: 0.45dB @2.5GHz | ✔ | ✔ | ✔ | |
| NEW **CG2185X2** | SPDT, for Dual Band WLAN, Insertion Loss: 0.4dB @ 6GHz, small package | | | ✔ | ✔ |
| NEW **CG2214M6** | SPDT, Insertion Loss: 0.35GHz @ 2.5GHz, Isolation = 25 @ 2.5GHz | ✔ | ✔ | ✔ | |
| NEW **CG2415M6** | SPDT, Dual Band High Power for WLAN | | ✔ | ✔ | ✔ |
| NEW **CG2430X1** | SP3T, Insertion Loss: 0.60dB @ 6GHz, Isolation = 25dB @ 6GHz | ✔ | ✔ | ✔ | ✔ |
| **UPG2162T5N** | DPDT, Insertion Loss: 0.85 dB @ 6 GHz, 27 dB Isolation @ 6GHz | | | ✔ | ✔ |
| **UPG2163T5N** | SPDT, 0.5-8GHz, Insertion Loss: 0.4 dB @ 2.4 GHz, 0.5 dB @ 6 GHz | | ✔ | ✔ | ✔ |
| **UPG2164T5N** | DPDT, Diversity/Transfer Switch (two selectable RF paths on) | | | ✔ | ✔ |
| **UPG2176T5N** | SPDT, 2.4 – 6 GHz, Insertion Loss: 0.5 dB @ 2.4 GHz, internal terminations | | | ✔ | ✔ |
| **UPG2406TK** | SPDT, 1.8 or 2.7V control voltage, 0.50 dB Insertion Loss @ 2.5GHz | ✔ | ✔ | ✔ | |
| **UPG2408TB / TK** | SPDT, 3V, 0.50dB Insertion Loss, SOT-363 and SMD Packages | ✔ | ✔ | ✔ | |
| **UPG2409TB / T6X** | SPDT, High Power wide bandwidth, SOT-363 / TSON packages | ✔ | ✔ | ✔ | T6X only |
| **UPG2415TK / T6X** | SPDT, for Dual Band WLAN, low insertion loss for Access Point applications | T6X only | ✔ | ✔ | ✔ |
| **UPG2422TK** | SPDT,for Dual Band WLAN, 1.8-5.3 V control voltage range | ✔ | ✔ | ✔ | ✔ |
| **Power Amplifier Transistors** (additional P/Ns available, see page 7 & 9) | | 450 MHz | 915 MHz | 2.4 GHz | 6 GHz |
| **NE5550234** | +33dBm, 2W, 7.5V LDMOS FET | ✔ | ✔ | | |
| **NE5550979A** | +39.5dBm, 9W, 7.5V LD MOSFET | ✔ | ✔ | | |
| **NE664M04** | +26dBm, 3.6V Silicon Discrete | ✔ | ✔ | ✔ | |
| **NE677M04** | +15dBm, 3.0 V Silicon Discrete | ✔ | ✔ | ✔ | |
| **NE678M04** | +18dBm, 3.0 V Silicon Discrete | ✔ | ✔ | ✔ | |
| **Low Noise Amplifier Transistors** | | 450 MHz | 915 MHz | 2.4 GHz | 6 GHz |
| **NE662M04** | Silicon Discrete, NF = 1.1, Ga = 16.0, OIP3 = +22dBm @ 2GHz | ✔ | ✔ | ✔ | |
| **NE3508M04** | GaAs FET, NF = 0.45, Ga = 14.0, OIP3 = +31dBm @ 2GHz | | | ✔ | ✔ |
| **NE3509M04** | GaAs FET, NF = 0.40, Ga = 17.5, OIP3 = +22dBm @ 2GHz | | | ✔ | ✔ |

# LNAs for 2 to 8 GHz Applications

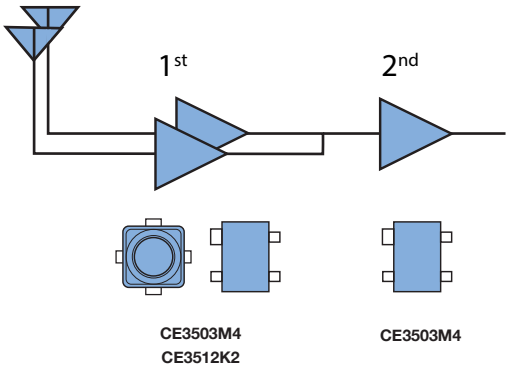



| Part Number | Description | NF (dB) | Gain (dB) | P1dB (dBm) | Package |
|---|---|---|---|---|---|
| **NE662M04** | Silicon Bipolar Transistor | 1.1 @ 2.0 GHz | 16.0 @ 2.0 GHz | +11.0 | M04 |
| **NE3508M04** | GaAs HJ-FET | 0.45 @ 2.0 GHz | 14.0 @ 2.0 GHz | +18.0 | M04 |
| **NE3509M04** | GaAs HJ-FET | 0.40 @ 2.0 GHz | 17.5 @ 2.0 GHz | +14.0 | M04 |
| **NE3510M04** | GaAs HJ-FET | 0.35 @ 2.0 GHz | 19.0 @ 2.0 GHz | +12.0 | M04 |

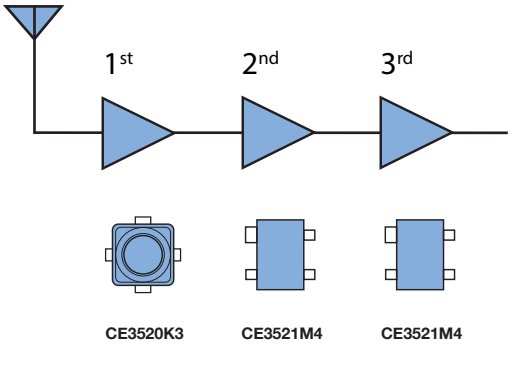
*(See data tables for additional specifications)*

# LNBs for 12 to 20GHz Applications

**12GHz LNB**




**20GHz LNB**




| | Part Number | NF TYP (dB) | Ga TYP (dB) | Conditions | | |
|---|---|---|---|---|---|---|
| | | | | Freq. (GHz) | $V_{DS}$ (V) | $I_D$ (mA) |
| Ku Band 12GHz | CE3503M4 | 0.45 | 13.2 | 12 | 2 | 10 |
| | CE3512K2 | 0.30 | 13.7 | 12 | 2 | 10 |
| K Band 20GHz | CE3520K3 | 0.55 | 13.8 | 20 | 2 | 10 |
| | CE3521M4 | 0.70 | 11.9 | 20 | 2 | 10 |

*(See data tables for additional specifications)*

# RF Switch ICs

## SPDTs (Single Pole Double Throw)

| Part Number | TYPICAL ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C) | | | | | | Pkg. Code[1] | 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) | | |
| NEW CG2163X3 | 6.0 | 1.8, 3.0, 5.0 | 0.40 @ 2.5GHz<br>0.50 @ 6GHz | 40 @ 2.5GHz<br>31 @ 6GHz | – | +33 @ 2.5GHz<br>+32 @ 6GHz | X3 | Highest Isolation, great 2.4 and 6GHz performance |
| NEW CG2176X3 | 5.85 | 1.8, 3.0, 5.0 | 0.45 @ 2.5GHz<br>0.50 @ 3.8GHz<br>0.55 @ 5.85GHz | 30 @ 2.5GHz<br>25 @ 3.8GHz<br>22 @ 5.85GHz | – | – | X3 | **Absorptive**, Highest Power Switch |
| NEW CG2179M2 | 3.0 | 1.8, 3.0, 5.0 | 0.45 @ 2.5GHz | 26 @ 2.5GHz | +30 @ 3GHz | – | M2 | Low Cost General Purpose SPDT |
| NEW CG2185X2 | 6.0 | 1.8, 3.0, 5.0 | 0.35 @ 2.5GHz<br>0.40 @ 6GHz | 28 @ 2.5GHz<br>26 @ 6GHz | +29 @ 2.5GHz<br>+29 @ 6GHz | +32 @ 2.5GHz<br>+32 @ 6GHz | X2 | SPDT specified to 6GHz with a very small & thin package |
| NEW CG2214M6 | 3.0 | 1.8, 3.0, 5.0 | 0.35 @ 2.5GHz | 25 @ 2.5GHz | +30 @ 3GHz | – | M6 | General Purpose SPDT |
| NEW CG2415M6 | 6.0 | 1.8, 3.0, 5.3 | 0.35 @ 2.5GHz<br>0.45 @ 6GHz | 32 @ 2.5GHz<br>26 @ 6GH | +31 @ 2.5GHz<br>+31 @ 6GHz | – | M6 | High Power SPDT for WLAN Access Point, small size package |
| UPD5713TK | 2.5 | 1.8, 2.8, 3.6 | 0.95 @ 2.5GHz | 22.5 @ 2.5GHz | +17 @ 1GHz | +21 @ 1GHz | TK | Single Control (1.8-$V_{DD}$), small size package, CMOS |
| UPG2009TB | 3.0 | 2.7, 2.8, 3.0 | 0.40 @ 2.5GHz | 25 @ 2.5GHz | +34 @ 1GHz | – | TB | High power handling, low insertion loss, high isolation |
| UPG2030TK | 3.0 | 2.7, 2.8, 5.4 | 0.35 @ 2.5GHz | 24 @ 2.5GHz | +27 @ 2.5GHz | – | TK | Medium power, small size package |
| UPG2155TB | 2.5 | 2.4, 2.6, 5.0 | 0.45 @ 2.5GHz | 17 @ 2.5GHz | +37.5 @ 1.8GHz | – | TB | High power handling, low harmonics, high power switch |
| UPG2163T5N | 8.0 | 2.8, 3.0, 5.0 | 0.40 @ 2.5GHz<br>0.50 @ 6GHz<br>0.90 @ 8GHz | 38@ 2.5GHz<br>30 @ 6GHz<br>23 @ 8GHz | – | +31 @ 2.5GHz<br>+29 @ 6GHz | T5N | High isolation, great 2.4 and 6GHz performance |
| UPG2176T5N | 6.0 | 2.5, 3.0, 5.0 | 0.45 @ 2.5GHz<br>0.70 @ 6GHz | 27 @ 2.5GHz<br>21 @ 6GHz | – | +37 @ 2.5GHz<br>+37 @ 2.85GHz | T5N | **Absorptive**, high power and high linearity to 6GHz |
| UPG2214TB | 3.0 | 1.8, 3.0, 5.3 | 0.35 @ 2.5GHz | 26 @ 2.5GHz | +23 @ 2.5GHz | +27 @ 2.5GHz | TB | Low insertion loss, high isolation, medium power, 1.8V-5.3V. |
| UPG2214TK | 3.0 | 1.8, 3.0, 5.3 | 0.35 @ 2.5GHz | 26 @ 2.5GHz | +23 @ 2.5GHz | +27 @ 2.5GHz | TK | Small size package, low inseriton loss, high isolation, medium power, 1.8V-5.3V. |
| UPG2406TB | 3.0 | 1.8, 2.7, 5.3 | 0.47 @2.5GHz | 17 @ 2.5GHz | +29 @ 2.5GHz | +30.5 @ 2.5GHz | TB | General Purpose SPDT |
| UPG2406TK | 3.0 | 1.8, 2.7, 5.3 | 0.47 @ 2.5GHz | 17 @ 2.5GHz | +29 @ 2.5GHz | +30.5 @ 2.5GHz | TK | Small size package, cost effective medium power, 1.8V-5.3V |
| UPG2408TB | 3.0 | 2.5, 3.0, 5.3 | 0.50 @ 2.5GHz | 18 @ 2.5GHz | +29 @ 2.5GHz | – | TB | Low cost medium power for UHF-3GHz |
| UPG2408TK | 3.0 | 2.5, 3.0, 5.3 | 0.50 @ 2.5GHz | 18 @ 2GHz | +29 @ 2.5GHz | – | TK | Small size package, cost effective medium power |
| UPG2409TB | 3.8 | 2.7, 3.0, 5.3 | 0.45 @ 2.5GHz | 26 @ 2.5 GHz | +33.5 @ 2.5GHz | +35 @ 2.5GHz | TB | High power SPDT, for Access Points to 3.8GHz |
| UPG2409T6X | 6.0 | 2.7, 3.0, 3.3 | 0.45 @ 2.5GHz<br>0.65 @ 6GHz | 30 @ 2.5 GHz<br>27 @ 6 GHz | +34 @ 2.5GHz<br>+34 @ 6GHz | +36 @ 2.5GHz<br>+36 @ 6GHz | T6X | High power, for Access Points to 6GHz, 1.5mm QFN package |
| UPG2415TK | 6.0 | 2.7, 3.0, 5.3 | 0.45 @ 2.5GHz<br>0.65 @ 6GHz | 28 @ 2.5 GHz<br>26 @ 6 GHz | +31 @ 2.5GHz<br>+31 @ 6GHz | +34 @ 2.5GHz<br>+34 @ 6GHz | TK | High power handling for Access Points to 6GHz, small size package |
| UPG2415T6X | 6.0 | 2.7, 3.0, 3.3 | 0.45 @ 2.5GHz<br>0.55 @ 6GHz | 28 @ 2.5 GHz<br>26 @ 6 GHz | +31 @ 2.5GHz<br>+31 @ 6GHz | +35 @ 2.5GHz<br>+35 @ 6GHz | T6X | High power handling for Access Points to 6GHz, 1.5mm QFN package |
| UPG2422TK | 6.0 | 1.8, 3.0, 5.3 | 0.35 @ 2.5GHz<br>0.55 @ 6GHz | 28 @ 2.5GHz<br>24 @ 6GHz | +28 @ 2.5GHz<br>+28 @ 6GHz | +31 @ 2.5GHz<br>+31 @ 6GHz | TK | Low cost 6GHz SPDT, medium power, small size package, low inseriton loss, high isolation, 1.8V-5.3V |

Notes: **1.** See Package Dimensions on page 10

# RF Switch ICs continued

### SP3Ts (Single Pole Triple Throw)

| Part Number[1] | TYPICAL ELECTRICAL CHARACTERISTICS (TA = 25°C) | | | | | | Package Code[1] | 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) | | |
| NEW CG2430X1 | 6.0 | 1.8, 3.0, 5.0 | 0.50 @ 2.5GHz<br>0.60 @ 6GHz | 28 @ 2.5GHz<br>25 @ 6GHz | +28 @ 2.5GHz<br>+28 @ 6GHz | +31 @ 2.5GHz<br>+31 @ 6GHz | X1 | SP3T specified to 6GHz with high isolation |

Notes: **1.** See Package Dimensions on page 10

### DPDTs (Double Pole Double Throw)

| Part Number | TYPICAL ELECTRICAL CHARACTERISTICS (TA = 25°C) | | | | | | Package Code[1] | 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) | | |
| UPD5738T6N | 2.5 | 1.5, 2.8, 3.6 | 0.8 @ 1GHz | 22 @ 1GHz | +15 @ 1GHz | +20 @ 1GHz | T6N | Only one control pin, low frequency operation, CMOS, 1.5V-3.6V |
| UPG2162T5N | 6.0 | 2.8, 3.0, 5.0 | 0.60 @ 2.5GHz<br>0.85 @ 6GHz | 30 @ 2.5GHz<br>27 @ 6GHz | – | +31 @2.5GHz<br>+29 @6GHz | T5N | Best isolation of all DPDTs, up to 6GHz operation |
| UPG2164T5N | 6.0 | 2.8, 3.0, 5.0 | 0.50 @2.5GHz<br>0.70 @6GHz | 25 @ 2.5GHz<br>17 @ 6GHz | – | +31 @2.5GHz<br>+29 @6GHz | T5N | Lowest cost, lowest insertion loss DPDT. 6GHz operation. |

Notes: **1.** See Package Dimensions on page 10

# GaAs FETs

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

| Part Number | Gate Length (µm) | Gate Width (µm) | Test Frequency (GHz) | NF/GA Bias | | NFOPT (dB) | GA (dB) | IDSS (mA) | Power Bias | | P1dB (dBm) | Package Code[1] | Package Description |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | VDS (V) | IDS (mA) | | | | VDS (V) | IDS (mA) | | | |
| NEW CE3503M4 | – | – | 12 | 2.0 | 10 | 0.45 | 13.2 | 47 | – | – | – | M4 | Plastic SMD |
| NEW CE3512K2 | – | – | 12 | 2.0 | 10 | 0.30 | 13.7 | 47 | – | – | – | K2 | Micro-X Plastic |
| NEW CE3520K3 | – | – | 20 | 2.0 | 10 | 0.55 | 13.8 | 40 | – | – | – | K3 | Micro-X Plastic |
| NEW CE3521M4 | – | – | 20 | 2.0 | 10 | 0.70 | 11.9 | 40 | – | – | – | M4 | Plastic SMD |
| NE3210S01 | 0.2 | 160 | 12 | 2.0 | 10 | 0.35 | 13.5 | 40 | – | – | – | S01 | Plastic SMD |
| NE3503M04 | 0.2 | 160 | 12 | 2.0 | 10 | 0.55 | 11.5 | 40 | – | – | – | M04 | Plastic SMD |
| NE3508M04 | 0.6 | 800 | 2 | 2.0 | 10 | 0.45 | 14.0 | 90 | 3.0 | 30 | +18.0 | M04 | Plastic SMD |
| NE3509M04 | 0.6 | 400 | 2 | 2.0 | 10 | 0.40 | 17.5 | 45 | 3.0 | 20 | +14.0 | M04 | Plastic SMD |
| NE3510M04 | 0.6 | 280 | 2 | 2.0 | 10 | 0.35 | 19.0 | 70 | 3.0 | 30 | +12.0 | M04 | Plastic SMD |
| NE3511S02 | 0.2 | 160 | 12 | 2.0 | 10 | 0.30 | 13.5 | 40 | – | – | – | S02 | Micro-X Plastic |
| NE3512S02 | 0.2 | 160 | 12 | 2.0 | 10 | 0.35 | 13.5 | 40 | – | – | – | S02 | Micro-X Plastic |
| NE3513M04 | 0.2 | 160 | 12 | 2.0 | 6 | 0.45 | 13.0 | 30 | – | – | – | M04 | Plastic SMD |
| NE3514S02 | 0.2 | 160 | 20 | 2.0 | 10 | 0.75 | 10.0 | 40 | – | – | – | S02 | Micro-X Plastic |
| NE3515S02 | 0.2 | 200 | 12 | 2.0 | 10 | 0.3 | 12.5 | 60 | 3.0 | 25 | +14.0 | S02 | Micro-X Plastic |
| NE3516S02 | 0.2 | 160 | 12 | 2.0 | 10 | 0.35 | 14.0 | 30 | – | – | – | S02 | Micro-X Plastic |
| NE3517S03 | 0.2 | 160 | 20 | 2.0 | 10 | 0.70 | 13.5 | 40 | – | – | – | S03 | Micro-X Plastic |
| NE3520S03 | – | 160 | 20 | 2.0 | 10 | 0.65 | 13.5 | 40 | – | – | – | S03 | Micro-X Plastic |
| NE3521M04 | – | – | 20 | 2.0 | 10 | 0.85 | 11 | 45 | – | – | – | M04 | Plastic SMD |
| NE4210S01 | 0.2 | 160 | 12 | 2.0 | 10 | 0.50 | 13.0 | 40 | – | – | – | S01 | Plastic SMD |

Notes: **1.** See Package Dimensions on page 10

# Silicon MOSFET Devices

## RF Power LD-MOSFETs Typical Specifications @ $T_C$ = 25°C

| Part Number | $P_{OUT}$ (dBm) TYP | Linear Gain (dB) TYP | Test Conditions | | | | Package Code[1] | Package Description |
|---|---|---|---|---|---|---|---|---|
| | | | Freq (GHz) | $P_{IN}$ (dBm) | $V_{DS}$ (V) | $I_{DSQ}$ (mA) | | |
| NE5531079A | +40.0 | 20.5 | 0.46 | +25 | 7.5 | 200 | 79A | Plastic SMD |
| NE55410GR | +40.4 | 25 | 2.1 | +16 | 28 | 120 | GR | Plastic SMD |
| 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 | Plastic SMD |
| NE5550279A | +33 | 22.5 | 0.46 | +15 | 7.5 | 40 | 79A | Plastic SMD |
| 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 | Plastic SMD |
| 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 | Plastic SMD |

Notes: **1.** See Package Dimensions on page 10

## 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) | Package Code[1] |
|---|---|---|---|---|---|---|---|---|
| NE5820M53 | 2 | 85 | 1.5 | -3 | -114 | 0.1 | >8 | M53 |

Notes: **1.** See Package Dimensions on page 10

# Silicon Bipolar Transistors

## Single Transistors

| Part Number | JEITA[1] Part Number | NPN /PNP | fT TYP (GHz) | Test Freq (GHz) | Test VCE (V) | NF TYP (dB) | MAG TYP (dB) | hFE (TYP) | VCEO MAX (V) | Ic MAX (mA) | Package[2] Type |
|---|---|---|---|---|---|---|---|---|---|---|---|
| NE202930 | NA | NPN | 11 | 1 | 5 | 1.5 | 15 | 140 | 6 | 100 | 30 / SOT-323 |
| NE46134 | 2SC4536 | NPN | 5.3 | 1 | 10 | 2 | 9 | 120 | 15 | 250 | 34 / SOT-89 |
| NE461M02 | 2SC5337 | NPN | 5.3 | 1 | 10 | 2 | 10 | 120 | 15 | 250 | M02 / SOT-89 |
| NE46234 | 2SC4703 | NPN | 6 | 1 | 5 | 2.3 | – | 150 | 12 | 150 | 34 / SOT-89 |
| NE462M02 | 2SC5338 | NPN | 6 | 1 | 5 | 2.3 | – | 150 | 12 | 150 | M02 / SOT-89 |
| NE66219 | 2SC5606 | NPN | 21 | 2 | 2 | 1.2 | 14 | 80 | 3.3 | 35 | 19 / SOT-523 |
| NE662M04 | 2SC5508 | NPN | 25 | 2 | 2 | 1.1 | 19 | 70 | 3.3 | 35 | M04 / SOT-343F |
| NE663M04 | 2SC5509 | NPN | 15 | 2 | 2 | 1.2 | 14 | 70 | 3.3 | 100 | M04 / SOT-343F |
| NE664M04 | 2SC5754 | NPN | 20 | 2 | 3 | – | 12 | 60 | 5 | 500 | M04 / SOT-343F |
| NE67718 | 2SC5750 | NPN | 15 | 2 | 3 | 1.7 | 15 | 120 | 6 | 50 | 18 / SOT-343 |
| NE67739 | 2SC5454 | NPN | 14.5 | 2 | 3 | 1.5 | 14 | 110 | 6 | 50 | 39 / SOT-143 |
| NE677M04 | 2SC5751 | NPN | 15 | 2 | 3 | 1.7 | 16 | 120 | 6 | 50 | M04 / SOT-343F |
| NE67818 | 2SC5752 | NPN | 12 | 2 | 3 | 1.7 | 13 | 120 | 6 | 100 | 18 / SOT-343 |
| NE67839 | 2SC5455 | NPN | 12 | 2 | 3 | 1.5 | 14 | 110 | 6 | 100 | 39 / SOT-143 |
| NE678M04 | 2SC5753 | NPN | 12 | 2 | 3 | 1.7 | 13.5 | 120 | 6 | 100 | M04 / SOT-343F |
| NE68018 | 2SC5013 | NPN | 10 | 2 | 6 | 1.8 | 13 | 100 | 10 | 35 | 18 / SOT-343 |
| NE68019 | 2SC5008 | NPN | 8 | 2 | 3 | 1.9 | 11.5 | 120 | 10 | 35 | 19 / SOT-523 |
| NE68030 | 2SC4228 | NPN | 8 | 2 | 3 | 1.9 | – | 100 | 10 | 35 | 30 / SOT-323 |
| NE68033 | 2SC3585 | NPN | 10 | 2 | 6 | 1.8 | 10 | 100 | 10 | 35 | 33 / SOT-23 |
| NE68039 | 2SC4095 | NPN | 10 | 2 | 6 | 1.8 | 12 | 100 | 10 | 35 | 39 / SOT-143 |
| NE68118 | 2SC5012 | NPN | 9 | 1 | 8 | 1.2 | 18 | 100 | 10 | 65 | 18 / SOT-343 |
| NE68119 | 2SC5007 | NPN | 7 | 1 | 3 | 1.4 | 16.5 | 120 | 10 | 65 | 19 / SOT-523 |
| NE68130 | 2SC4227 | NPN | 7 | 1 | 3 | 1.4 | 13 | 140 | 10 | 65 | 30 / SOT-323 |
| NE68133 | 2SC3583 | NPN | 9 | 1 | 8 | 1.2 | 15 | 100 | 10 | 65 | 33 / SOT-23 |
| NE68139 | 2SC4094 | NPN | 9 | 1 | 8 | 1.2 | 17 | 150 | 10 | 65 | 39 / SOT-143 |
| NE68518 | 2SC5015 | NPN | 12 | 2 | 3 | 1.5 | 13 | 110 | 6 | 30 | 18 / SOT-343 |
| NE68519 | 2SC5010 | NPN | 12 | 2 | 3 | 1.5 | 11 | 110 | 6 | 30 | 19 / SOT-523 |
| NE68539 | 2SC4957 | NPN | 12 | 2 | 3 | 1.5 | – | 110 | 6 | 30 | 39 / SOT-143 |
| NE85618 | 2SC5011 | NPN | 6.5 | 1 | 10 | 1.1 | 16 | 120 | 12 | 100 | 18 / SOT-343 |
| NE85619 | 2SC5006 | NPN | 4.5 | 1 | 3 | 1.2 | 12.5 | 120 | 12 | 100 | 19 / SOT-523 |
| NE85630 | 2SC4226 | NPN | 4.5 | 1 | 3 | 1.2 | – | 110 | 12 | 100 | 30 / SOT-323 |
| NE85633 | 2SC3356 | NPN | 7 | 1 | 10 | 1.1 | 13 | 120 | 12 | 100 | 33 / SOT-23 |
| NE85634 | 2SC3357 | NPN | 6.5 | 1 | 10 | 1.8 | 10 | 120 | 12 | 100 | 34 / SOT-89 |
| NE85639 | 2SC4093 | NPN | 7 | 1 | 10 | 1.1 | 14.2 | 120 | 12 | 100 | 39 / SOT-143 |
| NE856M02 | 2SC5336 | NPN | 6.5 | 1 | 10 | 1.1 | 13.5 | 120 | 12 | 100 | M02 / SOT-89 |
| NE97733 | 2SA1977 | PNP | 8.5 | 1 | -8 | 1.5 | – | 60 | -12 | -50 | 33 / SOT-23 |
| NE97833 | 2SA1978 | PNP | 5.5 | 1 | -10 | 2 | – | 40 | -12 | -50 | 33 / SOT-23 |

Notes: **1.** JEITA ( Japan Electronics and Information Technology Association ) equivalent part number **2.** See Package Dimensions on page 10

# Silicon Bipolar Transistors continued

### Twin Transistors

| Part Number | TEST f (GHz) | NF/$G_A$ $V_{CE}$ (V) | NF/$G_A$ $I_C$ (mA) | NF TYP (dB) | $G_A$ TYP (dB) | MAG TYP (dB) | $\|S_{21E}\|^2$ $V_{CE}$ (V) | $\|S_{21E}\|^2$ $I_C$ (mA) | $\|S_{21E}\|^2$ TYP (dB) | $f_T$ TYP (GHz) | $h_{FE}$ TYP | $I_C$ MAX (mA) | Die | Pkg. Code[1] | Package Style |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| UPA800T | 2.0 | 3 | 5 | 1.9 | 9.0 | 12.0 | 3 | 5 | 7.5 | 8 | 120 | 35 | 2 each NE680 | T | SOT-363 |
| UPA801T | 1.0 | 3 | 7 | 1.2 | 10.0 | 14.0 | 3 | 7 | 9.0 | 4.5 | 120 | 100 | 2 each NE856 | T | SOT-363 |
| UPA802T | 1.0 | 3 | 7 | 1.4 | 14.0 | 16.0 | 3 | 7 | 12.0 | 7.0 | 100 | 65 | 2 each NE681 | T | SOT-363 |
| UPA806T | 2.0 | 3 | 3 | 1.5 | 7.5 | 11.0 | 3 | 10 | 8.5 | 12.0 | 110 | 30 | 2 each NE685 | T | SOT-363 |
| UPA810T | 1.0 | 3 | 7 | 1.2 | 10.0 | 14.0 | 3 | 7 | 9.0 | 4.5 | 120 | 100 | 2 each NE856 | T | SOT-363 |
| UPA811T | 2.0 | 3 | 5 | 1.9 | 9.0 | 12.0 | 3 | 5 | 7.5 | 8 | 120 | 35 | 2 each NE680 | T | SOT-363 |
| UPA812T | 1.0 | 3 | 7 | 1.4 | 14 | 16.0 | 3 | 7 | 12.0 | 7 | 100 | 65 | 2 each NE681 | T | SOT-363 |

Notes: **1.** See Package Dimensions on page 10

# Silicon RFICs

### 3V Silicon MMIC Amplifiers

| Part Number | Typical Frequency Range @ 3dB down (MHz) | ELECTRICAL CHARACTERISTICS[5] ($T_A$ = 25°C) | | | | | | | | | | | | Package Code[6] | Package Style |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | $I_{CC}$ (mA) | | | NF (dB) | Gain (dB) | | | $RL_{IN}$ (dB) | $RL_{OUT}$ (dB) | $P_{1dB}$ (dBm) | ISOL (dB) | | |
| | | | MIN | TYP | MAX | TYP | MIN | TYP | MAX | TYP | TYP | TYP | TYP | | |
| UPC2745TB[1] | 2700 | 3 | 5 | 7.5 | 10 | 6.0 | 9 | 12 | 14 | 11 | 5.5 | -3.0 | 38 | TB | SOT-363 |
| UPC2746TB[1] | 1500 | 3 | 5 | 7.5 | 10 | 4.0 | 16 | 19 | 21 | 13 | 8.5 | -3.7 | 45 | TB | SOT-363 |
| UPC2748TB[2] | 1500 | 3 | 4.5 | 6 | 8 | 2.8 | 16 | 19 | 21 | 11.5 | 8.5 | -8.5 | 40 | TB | SOT-363 |
| UPC2749TB[3] | 2900 | 3 | 4 | 6 | 8 | 4 | 13 | 16 | 18.5 | 10 | 13 | -12.5 | 30 | TB | SOT-363 |
| UPC2762TB[3] | 2900 | 3 | – | 27 | 35 | 7.0 | 11.5 | 15.5 | 17.5 | 8.5 | 12 | +7 | 25 | TB | SOT-363 |
| UPC2771TB[2] | 2200 | 3 | – | 36 | 45 | 6 | 19 | 21 | 24 | 14 | 9 | +11.5 | 30 | TB | SOT-363 |
| UPC8178TK[3] | 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[3] | Note 4 | 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.** f = 500 MHz test condition **2.** f = 900 MHz test condition **3.** f = 1900 MHz test condition **4.** 100 – 2400 MHz with output port matching **5.** $Z_L$ = 50 Ω for all Electrical Characteristics
**6.** See Package Dimensions on page 10

## 5V Silicon MMIC Amplifiers

| Part Number | Typical Frequency Range @ 3dB down (MHz) | ELECTRICAL CHARACTERISTICS[3] ($T_A$ = 25°C) | | | | | | | | | | | | Package Code[4] | Package Style |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $V_{CC}$ (V) | $I_{CC}$ (mA) | | | NF (dB) | Gain (dB) | | | $RL_{IN}$ (dB) | $RL_{OUT}$ (dB) | $P_{1dB}$ (dBm) | ISOL (dB) | | |
| | | | MIN | TYP | MAX | TYP | MIN | TYP | MAX | TYP | TYP | TYP | TYP | | |
| UPC2708TB[2] | 2900 | 5 | 20 | 26 | 33 | 6.5 | 13 | 15 | 18.5 | 11 | 20 | +9.2 | 23 | TB | SOT-363 |
| UPC2709TB[2] | 2300 | 5 | 19 | 25 | 32 | 5.0 | 21 | 23 | 26.5 | 10 | 10 | +8.7 | 31 | TB | SOT-363 |
| UPC2710TB[1] | 1000 | 5 | 16 | 22 | 29 | 3.5 | 30 | 33 | 36.5 | 6 | 12 | +10.8 | 39 | TB | SOT-363 |
| UPC3223TB[2] | 3200 | 5 | 15 | 19 | 24 | 4.5 | 20.5 | 23 | 22.5 | 12 | 12 | +6.5 | 33 | TB | SOT-363 |
| UPC3224TB[2] | 3200 | 5 | 7.0 | 9.0 | 12.0 | 4.3 | 19 | 21.5 | 24 | 12 | 17 | -3.5 | 40 | TB | SOT-363 |

Notes: **1.** f = 500 MHz test condition **2.** f = 1000 MHz test condition **3.** ZL = 50 Ω for all Electrical Characteristics **4.** See Package Dimensions on page 10

## Frequency Upconverters

| Part Number | ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C) | | | | | | | | Package Code[4] | Package Style |
|---|---|---|---|---|---|---|---|---|---|---|
| | IF Input Frequency Range @3 dB Down (MHz) | RF Output Frequency Range (MHz) | $V_{CC}$ (V) | $I_{CC}$ (mA) | Conversion Gain (dB) | $P_{SAT}$[3] (dBm) | Noise Figure (dB) | $OIP_3$ | | |
| | TYP | TYP | | TYP | TYP | TYP | TYP | | | |
| UPC8106TB[1] | 50-400 | 400-2000 | 3.0 | 9.0 | 10.0 | -2.0 | 8.5 | +5.5 | TB | SOT-363 |
| UPC8172TB[2] | 50-400 | 800-2500 | 3.0 | 9.0 | 8.5 | 0.0 | 10.4 | +6.0 | TB | SOT-363 |

Notes: **1.** RF = 900 MHz, LO = 660 MHz, PLO = -5 dBm **2.** RF = 1900 MHz, LO = 1660 MHz, $P_{LOIN}$ = -5 dBm **3.** PIN = 0 dBm **4.** See Package Dimensions on page 10

## Frequency Downconverters

| Part Number | ELECTRICAL CHARACTERISTICS ($T_A$ = 25°C) | | | | | | | Package Code[2] | Package Style |
|---|---|---|---|---|---|---|---|---|---|
| | RF Input Frequency Range @3 dB Down (MHz) | IF Output Frequency Range @3 dB Down (MHz) | $V_{CC}$ (V) | $I_{CC}$ (mA) | Conversion Gain (dB) | $P_{SAT}$ (dBm) | Noise Figure (dB) | | |
| | TYP | TYP | | TYP | TYP | TYP | TYP | | |
| UPC2756TB | 100-2000 | 10-300 | 3.0 | 5.9 | 14 | -12 | 13 | TB | SOT-363 |
| UPC2757TB[1] | 100-2000 | 20-300 | 3.0 | 5.6 | 13 | -8 | 13 | TB | SOT-363 |
| UPC2758TB[1] | 100-2000 | 20-300 | 3.0 | 11 | 17 | -4 | 13 | TB | SOT-363 |
| UPC8112TB[1] | 800-2000 | 100-300 | 3.0 | 8.5 | 13 | -3 | 11.2 | TB | SOT-363 |

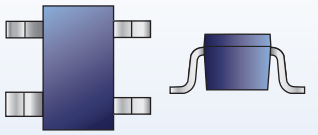
Note: **1.** AGC Amp and Mixer Block only **2.** See Package Dimensions on page 10

# Package Dimensions Units in mm

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

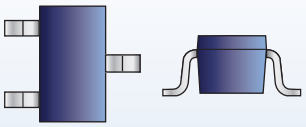
**18 Package** (1.25 x 2.0 x 0.9)

Top View Side View



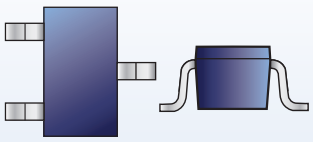
**19 Package** (0.8 x 1.6 x 0.75)

Top View Side View



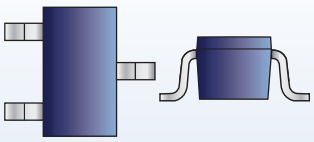
**30 Package** (1.25 x 2.0 x 0.9)

Top View Side View



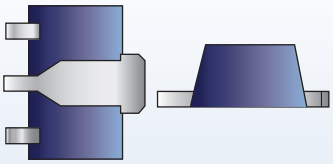
**33 Package** (1.5 x 2.9 x 1.4)

Top View Side View



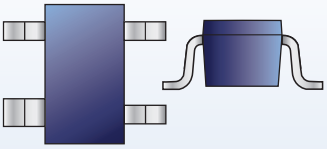
**34 Package** (2.5 x 4.5 x 1.5)

Bottom View Side View



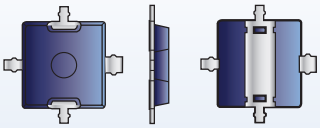
**39 Package** (1.5 x 2.9 x 1.1)

Top View Side View



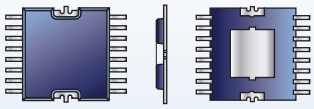
**79A Package** (4.2 x 4.4 x 0.9)

Top View Side View Bottom View



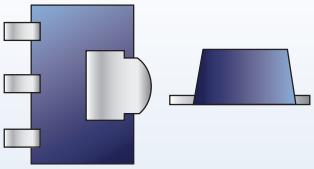
**GR Package** (5.2 x 5.5 x 0.9)

Top View Side View Bottom View



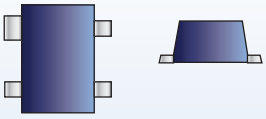
**M02 Package** (2.45 x 4.5 x 1.5)

Bottom View Side View



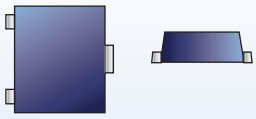
**M4 / M04 Package** (1.25 x 2.0 x 0.6)

Top View Side View



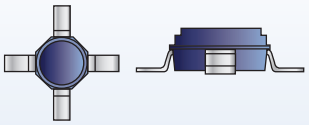
**M53 Package** (1.0 x 1.2 x 0.33)

Top View Side View



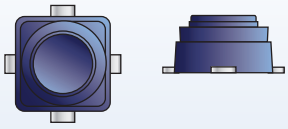
**S01 Package** (2.0 x 2.0 x 1.5)

Top View Side View



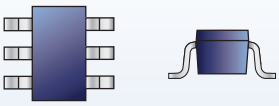
**K2 / K3 / S02 / S03 Package** (2.6 x 2.6 x 1.5)

Top View Side View



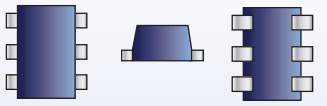
**T / TB / M2 Package** (1.25 x 2.0 x 0.9)

Top View Side View



**M6 / TK Package** (1.1 x 1.5 x 0.55)

Top View Side View Bottom View



**T5N / X3 Package** (1.5 x 1.5 x 0.37)

Top View Side View Bottom View

**T6N / T6X Package** (1.5 x 1.5 x 0.37)

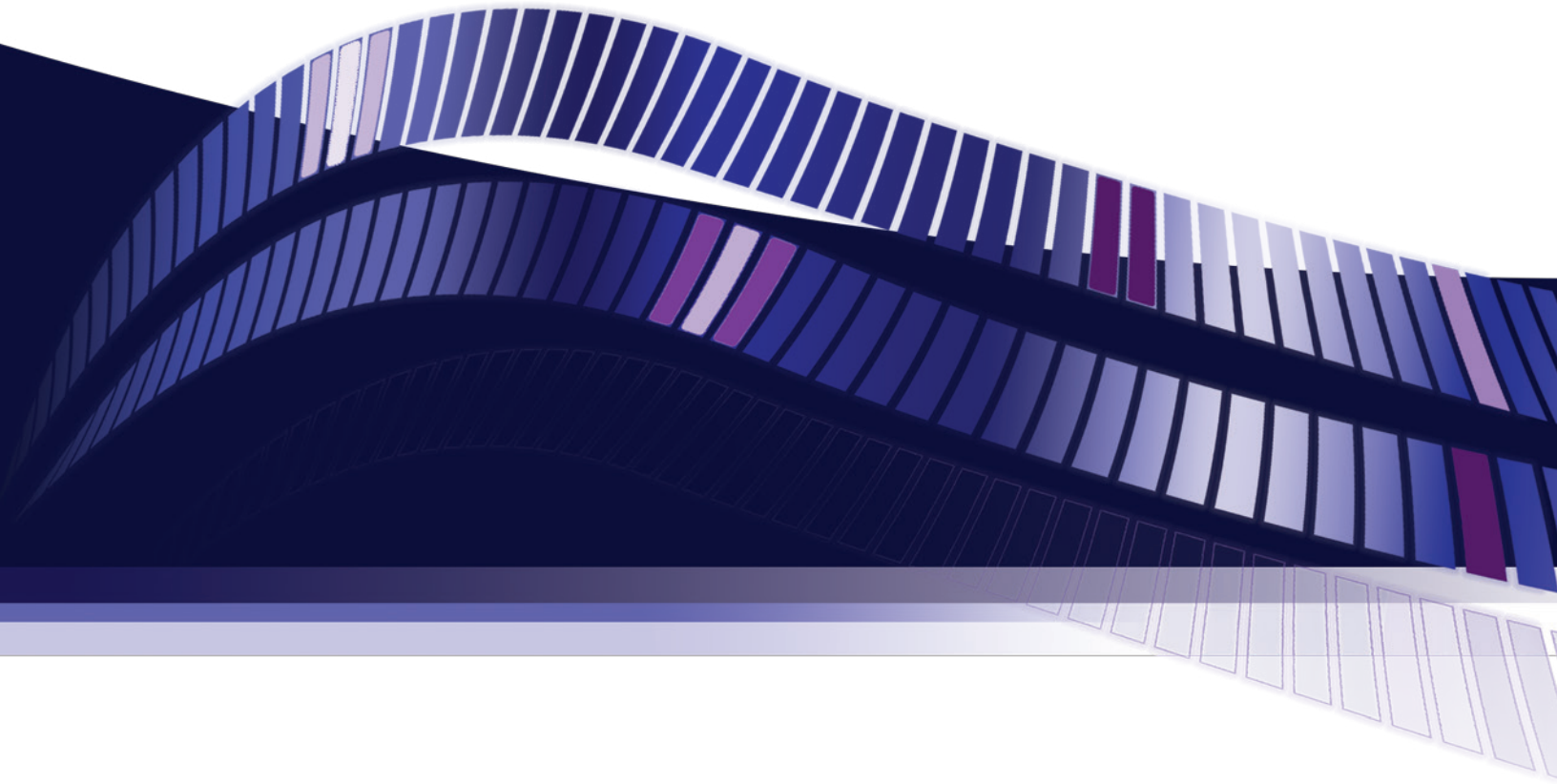
Top View Side View Bottom View

**X1 Package** (1.5 x 1.5 x 0.37)

Top View Side View Bottom View

**X2 Package** (1.0 x 1.0 x 0.37)

Top View Side View Bottom View

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