



**THE DATASHEET OF
2SC5012-T1-A**





2016

RF & Wireless

Semiconductors



About CEL

CEL (California Eastern Laboratories) is an engineering, sales and marketing company focused on RF Semiconductors, Optical Semiconductors and Wireless Connectivity Solutions.

CEL serves designers, OEMs and contract manufacturers in various RF, Wireless and Optical markets. With over 55 years experience in high frequency design, customer support and fulfillment, CEL is ideally positioned to provide its customers with a stable supply of products to meet their specific needs.

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.



CEL Headquarters

4590 Patrick Henry Drive
Santa Clara, CA 95054
Tel: (408) 919-2500

www.cel.com

PRODUCTS by APPLICATION

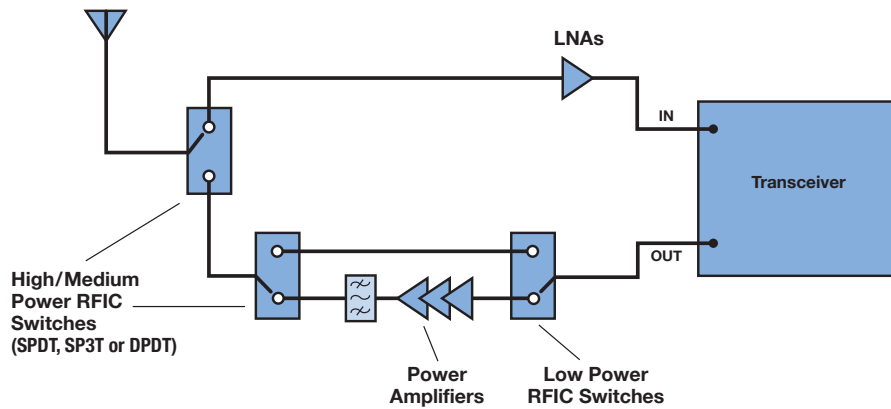
| | |
|---|---|
| Front End Components Up to 6GHz Applications | 2 |
| LNAs for 2 to 8GHz Applications | 3 |
| LNBS for 12 to 20GHz Applications | 3 |

PRODUCT SPECIFICATIONS

| | |
|---|----|
| RF Switch ICs | |
| SPDTs (Single Pole Double Throw) | 4 |
| SP3Ts (Single Pole Triple Throw) | 5 |
| DPDTs (Double Pole Double Throw) | 5 |
| GaAs FETs | |
| Low Noise GaAs FETs, 1 to 20GHz | 5 |
| Silicon MOSFET Devices | |
| RF Power LD-MOSFETs | 6 |
| MOSFET for Microphone Impedance Conversion | 6 |
| Silicon Bipolar Transistors | |
| Single Transistors | 7 |
| Twin Transistors | 8 |
| Silicon RFICs | |
| 3V Silicon MMIC Amplifiers | 8 |
| 5V Silicon MMIC Amplifiers | 9 |
| Frequency Upconverters | 9 |
| Frequency Downconverters | 9 |
| Package Dimensions | 10 |

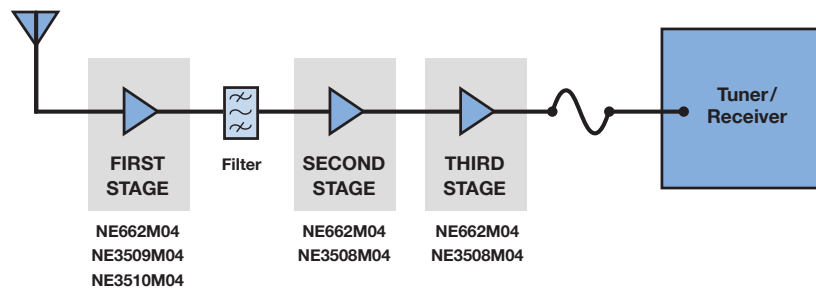
Front End Components Up to 6 GHz Applications

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



| RFIC Switches <i>(additional P/Ns available, see page 4)</i> | | 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 @ 6GHz, 27 dB Isolation @ 6GHz | | | ✓ | ✓ |
| UPG2163T5N | SPDT, 0.5-8GHz, Insertion Loss: 0.4dB @ 2.4 GHz, 0.5dB @ 6GHz | | ✓ | ✓ | ✓ |
| UPG2164T5N | DPDT, Diversity/Transfer Switch (two selectable RF paths on) | | | ✓ | ✓ |
| UPG2176T5N | SPDT, 2.4 – 6GHz, Insertion Loss: 0.5dB @ 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, 1.8-5.3V control voltage range | ✓ | ✓ | ✓ | ✓ |
| Power Amplifier Transistors <i>(additional P/Ns available, see page 7 & 9)</i> | | 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 | | | ✓ | ✓ |

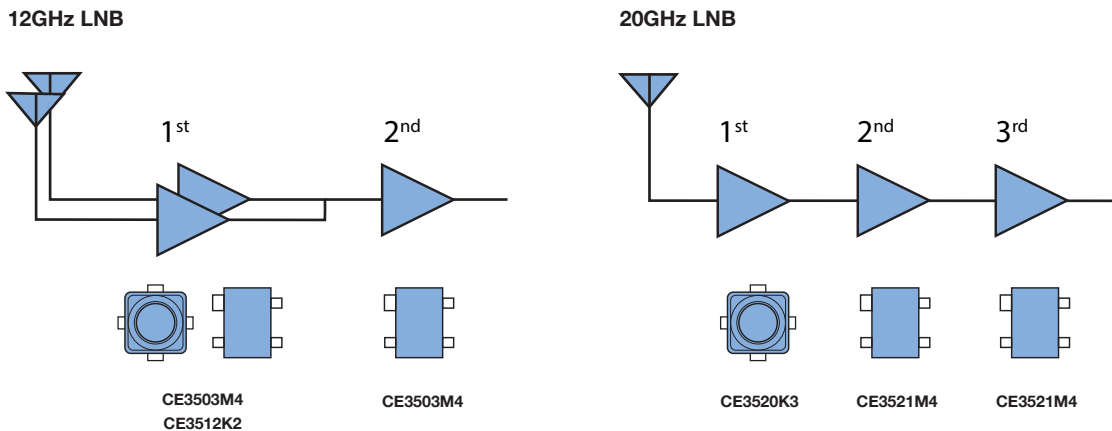
LNAs for 2 to 8GHz Applications



| Part Number | Description | NF (dB) | Gain (dB) | P1dB (dBm) | Package |
|-------------|----------------------------|---------------|---------------|------------|---------|
| NE662M04 | Silicon Bipolar Transistor | 1.1 @ 2.0GHz | 16.0 @ 2.0GHz | +11.0 | M04 |
| 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 |

(See data tables for additional specifications)

LNAs for 12 to 20GHz Applications



| | 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 0.50 @ 6GHz | 40 @ 2.5GHz 31 @ 6GHz | - | +33 @ 2.5GHz +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 0.50 @ 3.8GHz 0.55 @ 5.85GHz | 30 @ 2.5GHz 25 @ 3.8GHz 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 0.40 @ 6GHz | 28 @ 2.5GHz 26 @ 6GHz | +29 @ 2.5GHz +29 @ 6GHz | +32 @ 2.5GHz +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 0.45 @ 6GHz | 32 @ 2.5GHz 26 @ 6GH | +31 @ 2.5GHz +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 0.50 @ 6GHz 0.90 @ 8GHz | 38 @ 2.5GHz 30 @ 6GHz 23 @ 8GHz | - | +31 @ 2.5GHz +29 @ 6GHz | T5N | High isolation, great 2.4 and 6GHz performance |
| UPG2176T5N | 6.0 | 2.5, 3.0, 5.0 | 0.45 @ 2.5GHz 0.70 @ 6GHz | 27 @ 2.5GHz 21 @ 6GHz | - | +37 @ 2.5GHz +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 0.65 @ 6GHz | 30 @ 2.5 GHz 27 @ 6 GHz | +34 @ 2.5GHz +34 @ 6GHz | +36 @ 2.5GHz +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 0.65 @ 6GHz | 28 @ 2.5 GHz 26 @ 6 GHz | +31 @ 2.5GHz +31 @ 6GHz | +34 @ 2.5GHz +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 0.55 @ 6GHz | 28 @ 2.5 GHz 26 @ 6 GHz | +31 @ 2.5GHz +31 @ 6GHz | +35 @ 2.5GHz +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 0.55 @ 6GHz | 28 @ 2.5GHz 24 @ 6GHz | +28 @ 2.5GHz +28 @ 6GHz | +31 @ 2.5GHz +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 0.60 @ 6GHz | 28 @ 2.5GHz 25 @ 6GHz | +28 @ 2.5GHz +28 @ 6GHz | +31 @ 2.5GHz +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 0.85 @ 6GHz | 30 @ 2.5GHz 27 @ 6GHz | - | +31 @ 2.5GHz +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 0.70 @ 6GHz | 25 @ 2.5GHz 17 @ 6GHz | - | +31 @ 2.5GHz +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 20GHz Typical Specifications @ TA = 25°C

| Part Number | Gate Length (μm) | Gate Width (μm) | Test Frequency (GHz) | NF/GA Bias | | NF _{OPT} (dB) | G _A (dB) | I _{DSS} (mA) | Power Bias | | P _{1dB} (dBm) | Package Code ¹ | Package Description |
|---------------------|------------------|-----------------|----------------------|---------------------|----------------------|------------------------|---------------------|-----------------------|---------------------|----------------------|------------------------|---------------------------|---------------------|
| | | | | V _{DS} (V) | I _{DS} (mA) | | | | V _{DS} (V) | I _{DS} (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 @ Tc = 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 _{DSO} (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 | 23.5 | 0.46 | +15 | 7.5 | 40 | 34 | Plastic SMD |
| | +32.2 | 18.3 | 0.90 | +17 | 7.5 | 40 | | |
| NE5550279A | +33 | 22.5 | 0.46 | +15 | 7.5 | 40 | 79A | Plastic SMD |
| NE5550779A | +38.5 | 22 | 0.46 | +25 | 7.5 | 140 | 79A | Plastic SMD |
| | +37.4 | 17 | 0.90 | +27 | 7.5 | 140 | | |
| NE5550979A | +39.5 | 22 | 0.46 | +25 | 7.5 | 200 | 79A | Plastic SMD |
| | +38.6 | 16 | 0.90 | +27 | 7.5 | 200 | | |

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/GA V _{CE} (V) | NF/GA I _c (mA) | NF TYP (dB) | G _A TYP (dB) | MAG TYP (dB) | IS ₂₁ EL | | | f _r TYP (GHz) | h _{FE} TYP | I _c MAX (mA) | Die | Pkg. Code ¹ | Package Style |
|-------------|--------------|---------------------------|---------------------------|-------------|-------------------------|--------------|---------------------|---------------------|----------|--------------------------|---------------------|-------------------------|--------------|------------------------|---------------|
| | | | | | | | V _{CE} (V) | I _c (mA) | TYP (dB) | | | | | | |
| 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) | | | R _{LIN} (dB) | R _{LOUT} (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. 100–2400MHz 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) | V _{CC} (V) | ELECTRICAL CHARACTERISTICS ³ (T _A = 25°C) | | | | | | | | | | | Package Code ⁴ | Package Style |
|------------------------|--|---------------------|---|-----|------|---------|-----------|------|------|-----------|------------|------------------------|-----------|---------------------------|---------------|
| | | | I _{CC} (mA) | | | NF (dB) | Gain (dB) | | | RLIN (dB) | RLOUT (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. Z_L = 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, PLOIN = -5 dBm 3. PIN = 0 dBm 4. See Package Dimensions on page 10

Frequency Downconverters

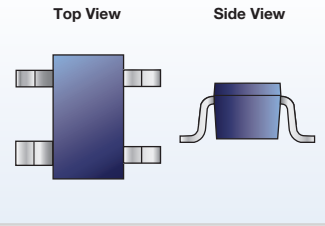
| Part Number | ELECTRICAL CHARACTERISTICS (T _A = 25°C) | | | | | | | Package Code ² | Package Style |
|------------------------|--|---|---------------------|----------------------|----------------------|------------------------|-------------------|---------------------------|---------------|
| | RF 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

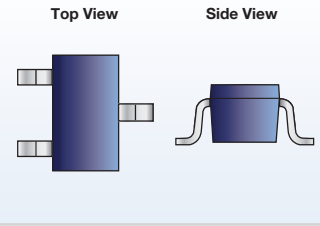
Package Dimensions Units in mm

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

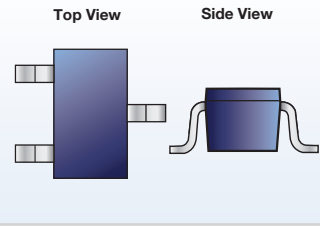
18 Package (1.25 x 2.0 x 0.9)



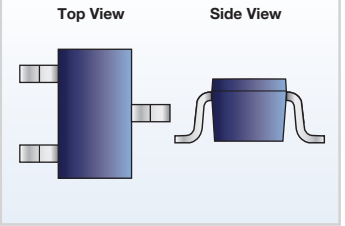
19 Package (0.8 x 1.6 x 0.75)



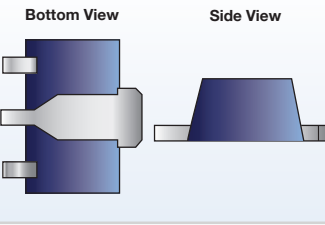
30 Package (1.25 x 2.0 x 0.9)



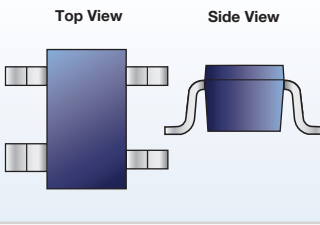
33 Package (1.5 x 2.9 x 1.4)



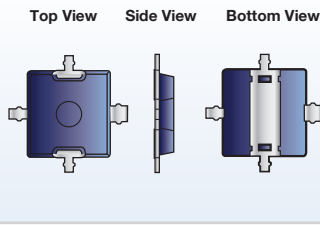
34 Package (2.5 x 4.5 x 1.5)



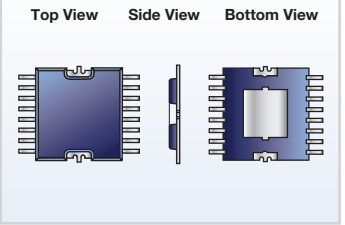
39 Package (1.5 x 2.9 x 1.1)



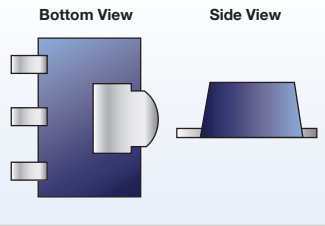
79A Package (4.2 x 4.4 x 0.9)



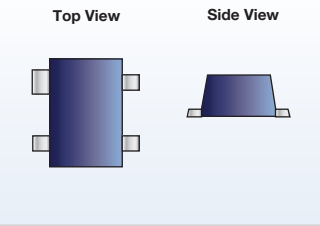
GR Package (5.2 x 5.5 x 0.9)



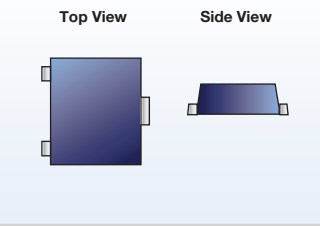
M02 Package (2.45 x 4.5 x 1.5)



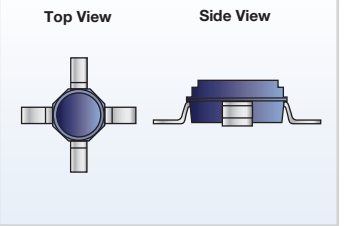
M4 / M04 Package (1.25 x 2.0 x 0.6)



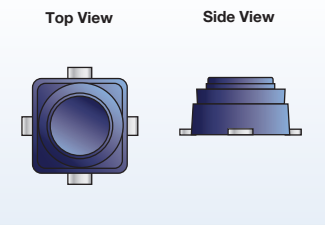
M53 Package (1.0 x 1.2 x 0.33)



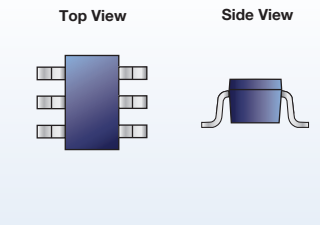
S01 Package (2.0 x 2.0 x 1.5)



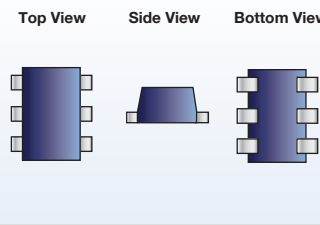
K2 / K3 / S02 / S03 Package (2.6 x 2.6 x 1.5)



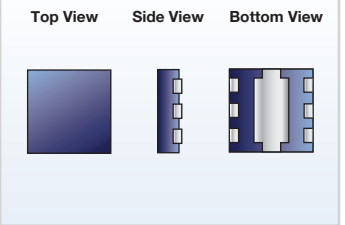
T / TB / M2 Package (1.25 x 2.0 x 0.9)



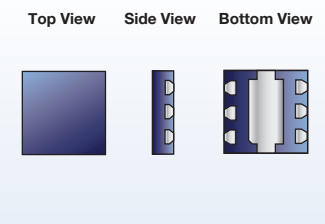
M6 / TK Package (1.1 x 1.5 x 0.55)



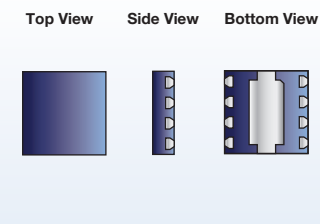
T5N / X3 Package (1.5 x 1.5 x 0.37)



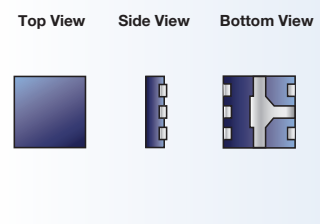
T6N / T6X Package (1.5 x 1.5 x 0.37)

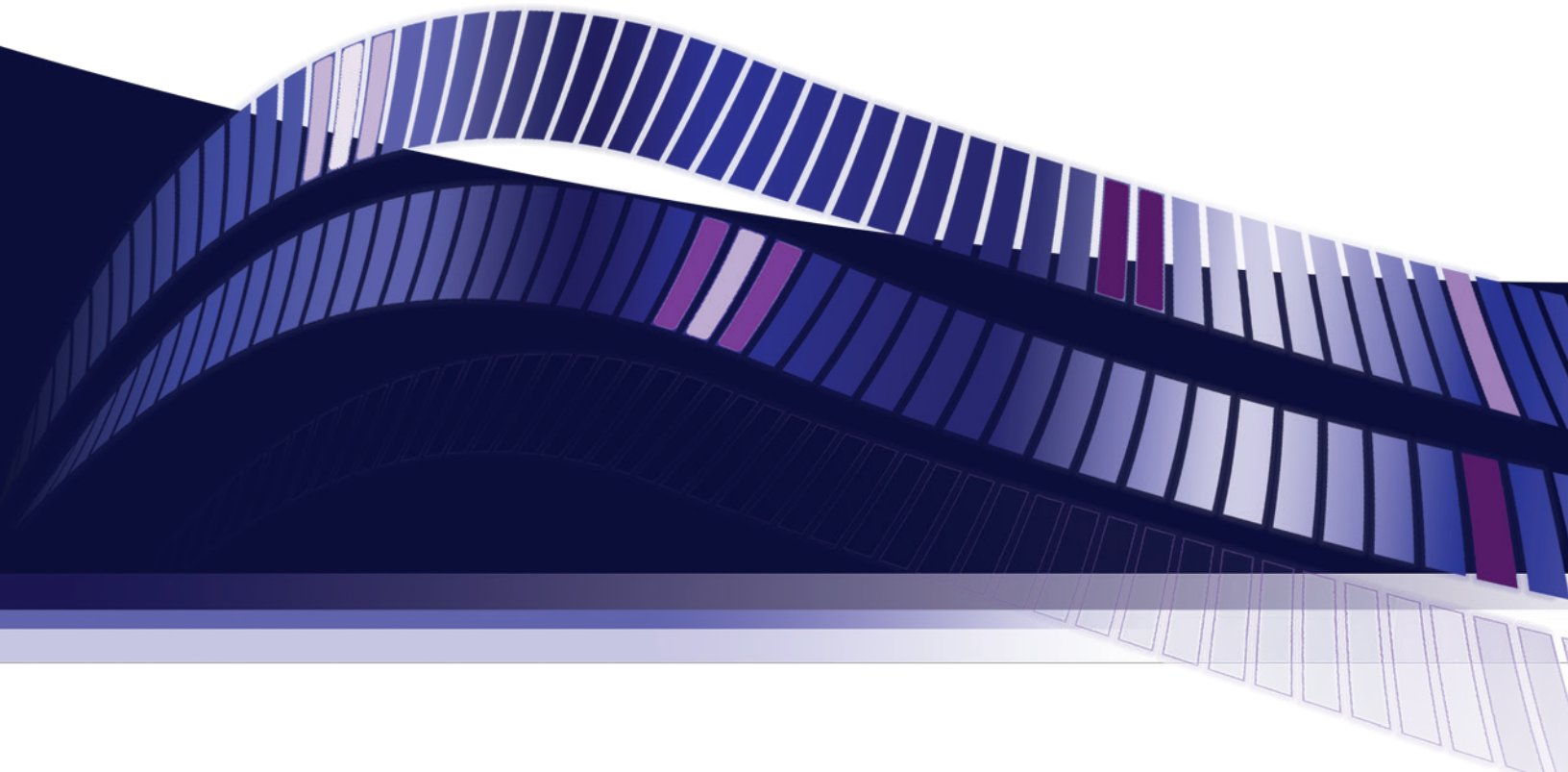


X1 Package (1.5 x 1.5 x 0.37)



X2 Package (1.0 x 1.0 x 0.37)





CEL Contact Us

4590 Patrick Henry Drive
Santa Clara, CA 95054
Tel: (408) 919-2500
E-mail: rfw@cel.com




Learn more
www.cel.com/rf

For a complete list of sales offices, representatives and distributors,
Please visit our website: www.cel.com/contactus

Looking for pricing, stock, or lifecycle information?

Click below to explore more details on WIN SOURCE:

 [View 2SC5012-T1-A on WIN SOURCE](#)

 [CEL Information](#)

Optimize Your Supply Chain with WIN SOURCE Solutions

-  Global Sourcing Solution
-  Obsolete Management
-  Cost Control Management
-  Shortage Management
-  Alternative Solution
-  Excess Inventory Management