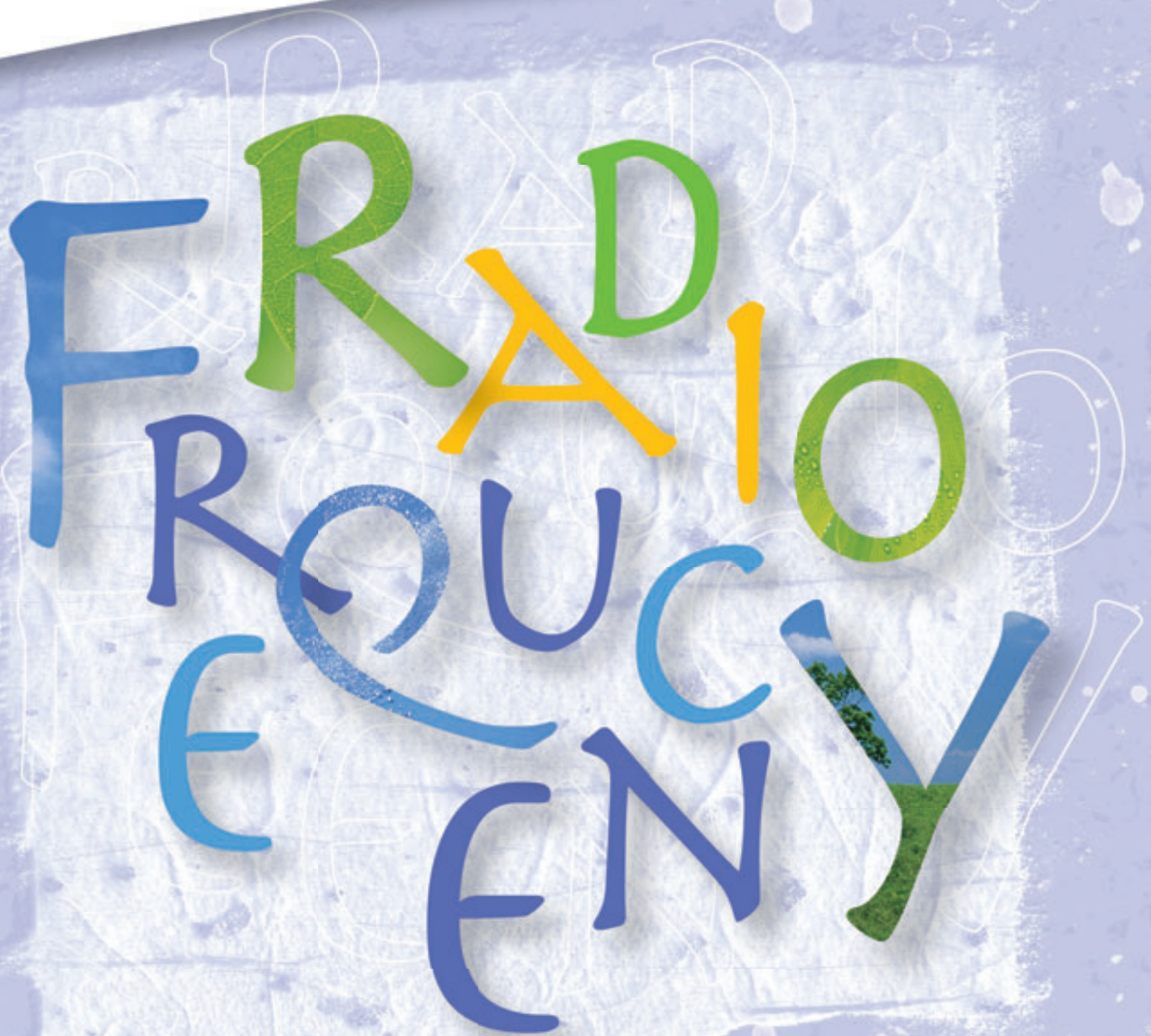


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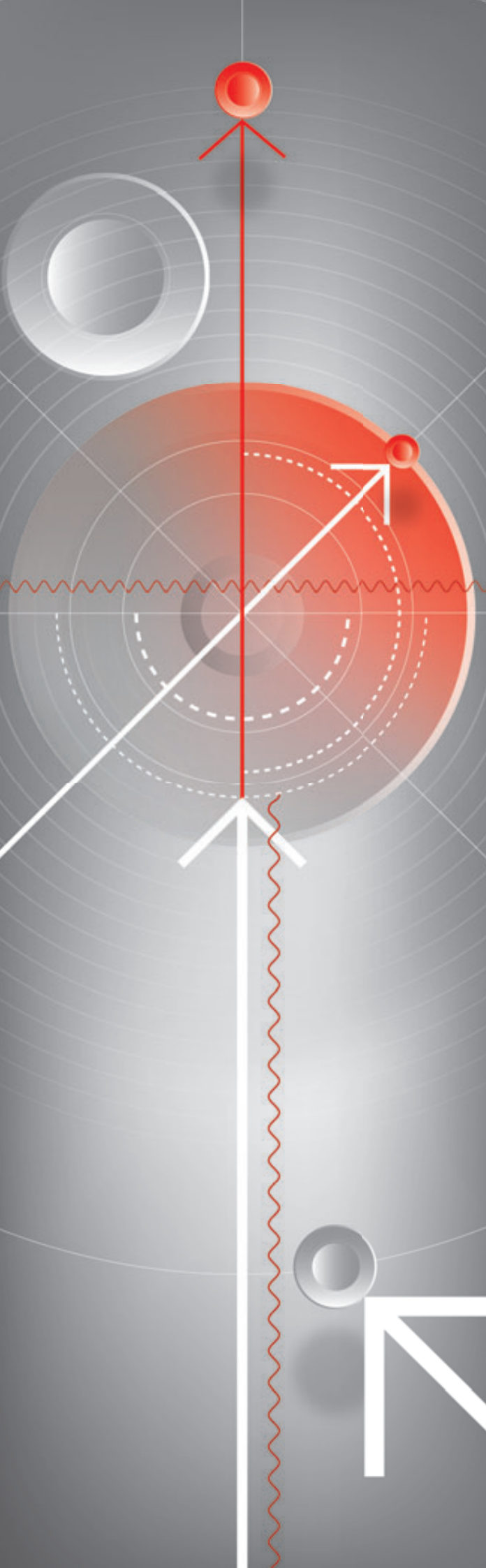
Semiconductor Catalog 2012-1

# Radio-Frequency Semiconductors



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# C O N T E N T S

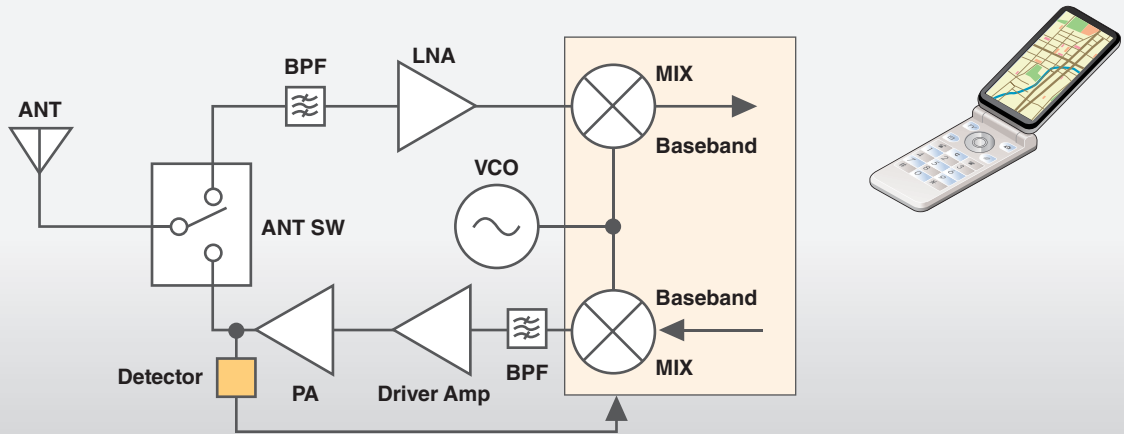
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# 1

# Recommended Products by Application

## 1.1 Cell Phones

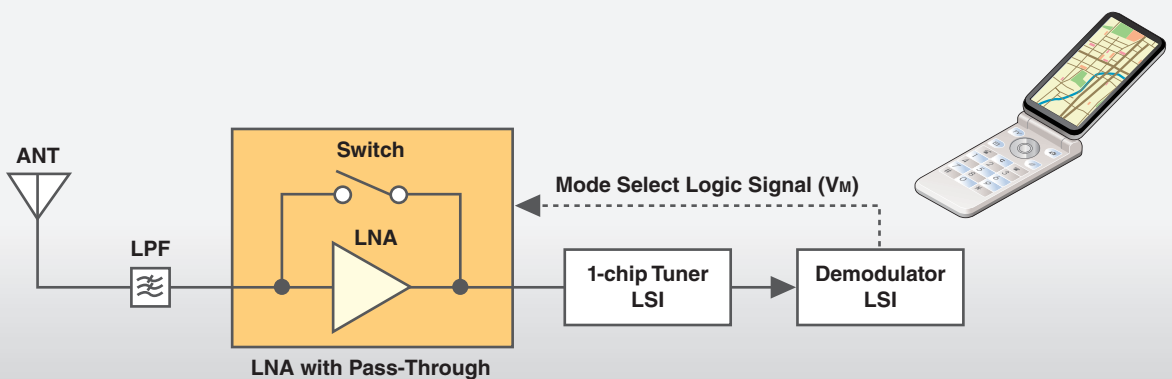
### Devices for Detector Applications: 800 MHz/2 GHz



| Applications |          | Part Number | Package | Feature                       |
|--------------|----------|-------------|---------|-------------------------------|
| Detector     | Discrete | JDH2S02FS   | fSC     | Single Schottky barrier diode |
|              |          | JDH3D01FV   | VESM    | Dual Schottky barrier diode   |
|              | IC       | TCX4A01WBG  | WCSP4   | -                             |

 : New product

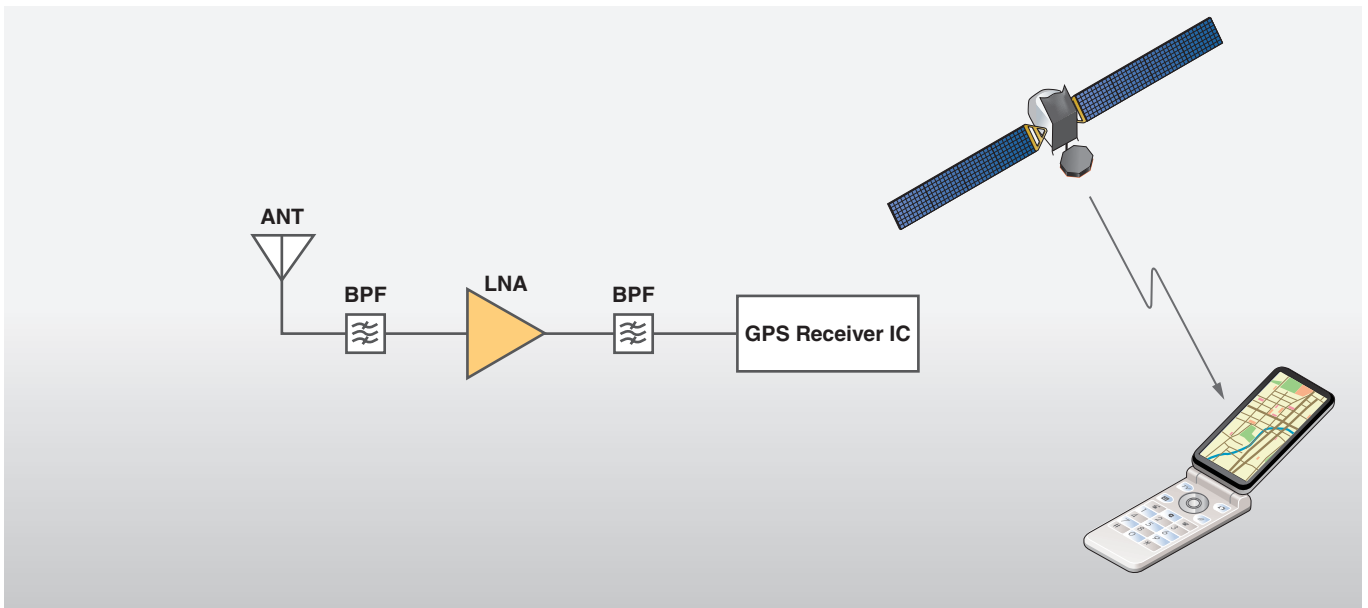
### LNAs with Bypass (Pass-Through) Circuit for Digital TV Receiver Applications: 470-860 MHz



| Applications           | Part Number   | Package | Feature  |
|------------------------|---|---------|--|
| LNAs with pass-through | TA4029CTC   | CST6C   |  |
|                        | TB7601CTC   |         | Matching circuit                                       |
|                        | TB7602CTC   |         | Matching circuit; low distortion                       |
|                        | TB7604CTC   |         | Variant of the TB7601CTC with modified logic functions |
|                        | TB7605CTC   |         | Variant of the TB7602CTC with modified logic functions |
|                        | TA4029TU  | UF6     |  |
|                        | TB7601TU  |         | Matching circuit                                       |
|                        | TB7602TU  |         | Matching circuit; low distortion                       |
|                        | TB7604TU  |         | Variant of the TB7601TU with modified logic functions  |
| TB7605TU               | Variant of the TB7602TU with modified logic functions |         |  |

# 1 Recommended Products by Application

## LNAs for GPS Receiver Applications: 1.575 GHz



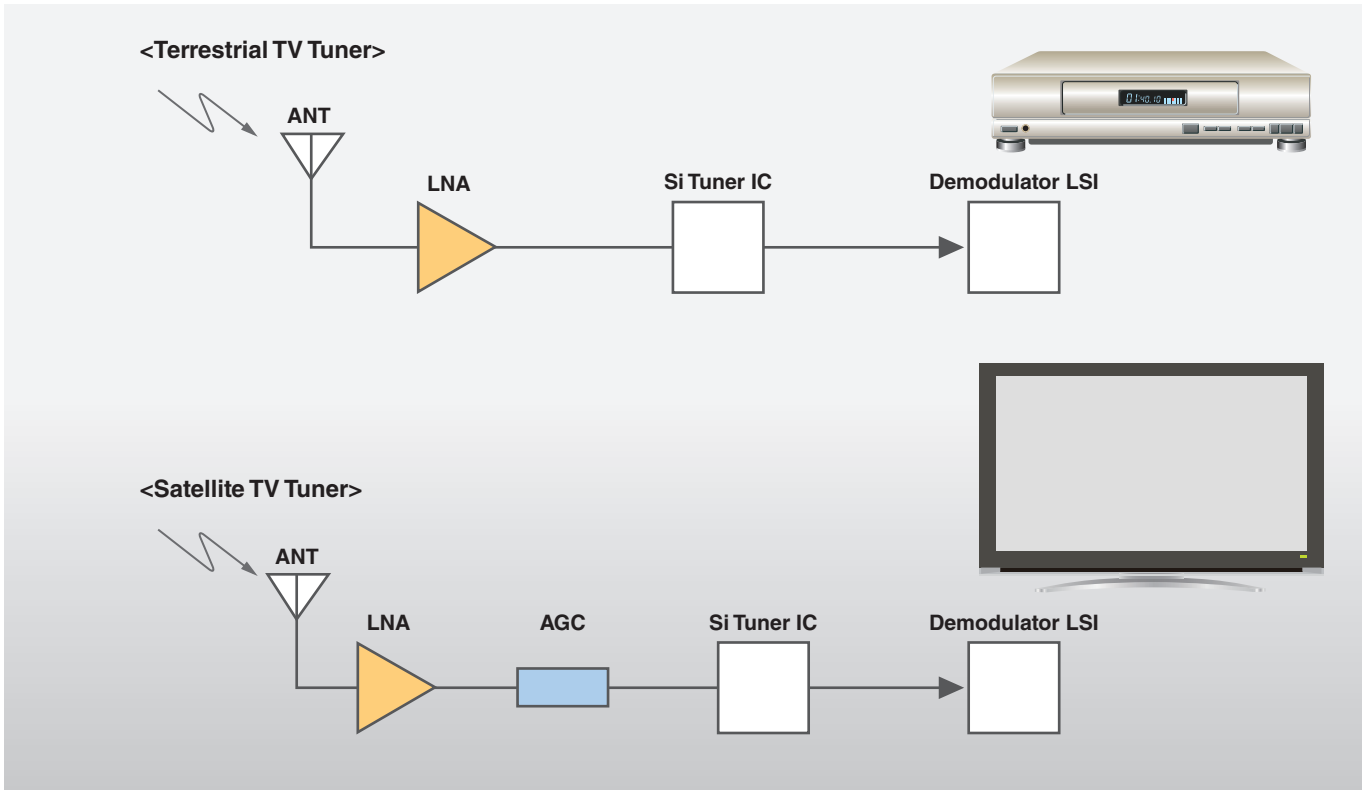
| Applications |          | Part Number      | Package | Feature   |
|--------------|----------|------------------|---------|---|
| LNA          | Discrete | <b>MT4S300T</b>  | TESQ    | Low NF (0.75 dB); low distortion (OIP3 = 8.7 dBm)<br>@Vcc = 1.8 V, Icc = 6.2 mA |
|              |          | <b>MT4S300U</b>  | USQ     |   |
|              |          | <b>MT4S301T</b>  | TESQ    | Low NF (0.76 dB)@Vcc = 1.8 V, Icc = 5.2 mA                                      |
|              |          | <b>MT4S301U</b>  | USQ     |   |
|              | MMIC     | <b>TA4032FT</b>  | TESQ    | Low NF (1 dB)@Vcc = 3 V, Icc = 5 mA<br>Small package                            |
|              |          | <b>TA4032CTC</b> | CST6C   |   |

: New product



## 1.2 TV Tuners

### 50-MHz to 900-MHz Terrestrial and 950-MHz to 2.15-GHz Satellite Broadcasting Receivers



| Applications |         | Part Number                                       | Package   | Feature  |
|--------------|---------|---|---|--|
| Terrestrial  | LNA     | MT3S111   | S-Mini  | Ultra-low NF; low distortion                                   |
|              |         | MT3S111TU   | UFM   | Ultra-low NF; low distortion                                   |
|              |         | MT3S111P  | PW-Mini   | Ultra-low NF; low distortion; high power dissipation           |
|              |         | MT3S113   | S-Mini  | Low NF; ultra-low distortion                                   |
|              |         | MT3S113TU   | UFM   | Low NF; ultra-low distortion                                   |
|              |         | MT3S113P  | PW-Mini   | Low NF; ultra-low distortion; high power dissipation           |
|              |         | MT3S15TU  | UFM   | High gain; low distortion                                      |
|              |         | MT3S19TU  | UFM   | High gain; low distortion                                      |
|              |         | MT3S19  | S-Mini  | High gain; low distortion                                      |
|              |         | MT3S19R   | SOT-23F   | High gain; low distortion; high power dissipation              |
|              |         | MT3S20TU  | UFM   | High V <sub>CEO</sub> ; low distortion                         |
|              |         | MT3S20R   | SOT-23F   | High V <sub>CEO</sub> ; low distortion; high power dissipation |
|              |         | MT3S20P   | PW-Mini   | High V <sub>CEO</sub> ; low distortion; high power dissipation |
|              |         | MT3S21P   | PW-Mini   | Low distortion; high power dissipation                         |
|              | MT3S22P | PW-Mini   | Low distortion; high power dissipation            |  |
|              | 2SC5087 | SMQ   | High V <sub>CEO</sub> ; high gain; low distortion |  |
| 2SC5087R     | SMR(R)  | High V <sub>CEO</sub> ; high gain; low distortion |   |  |
| RF           | 3SK291  | SMQ   | UHF band; low NF; high gain                       |  |
|              | 3SK292  | USQ   | UHF band; low NF; high gain                       |  |
|              | 3SK293  | SMQ   | VHF band; low NF; high gain                       |  |
|              | 3SK294  | USQ   | VHF band; low NF; high gain                       |  |
| Satellite    | LNA     | MT4S03BU  | USQ   | Low NF; low distortion   |
|              |         | MT4S24U   | USQ   | High gain; low NF; low distortion                              |
|              |         | MT4S23U   | USQ   | High gain; low NF  |
|              |         | MT4S300U  | USQ   | Ultra-low NF; low distortion                                   |
|              |         | MT4S300T  | TESQ  | Ultra-low NF; low distortion                                   |
|              |         | MT4S301U  | USQ   | High gain; Ultra-low NF  |
| MT4S301T     | TESQ    | High gain; Ultra-low NF                           |   |  |

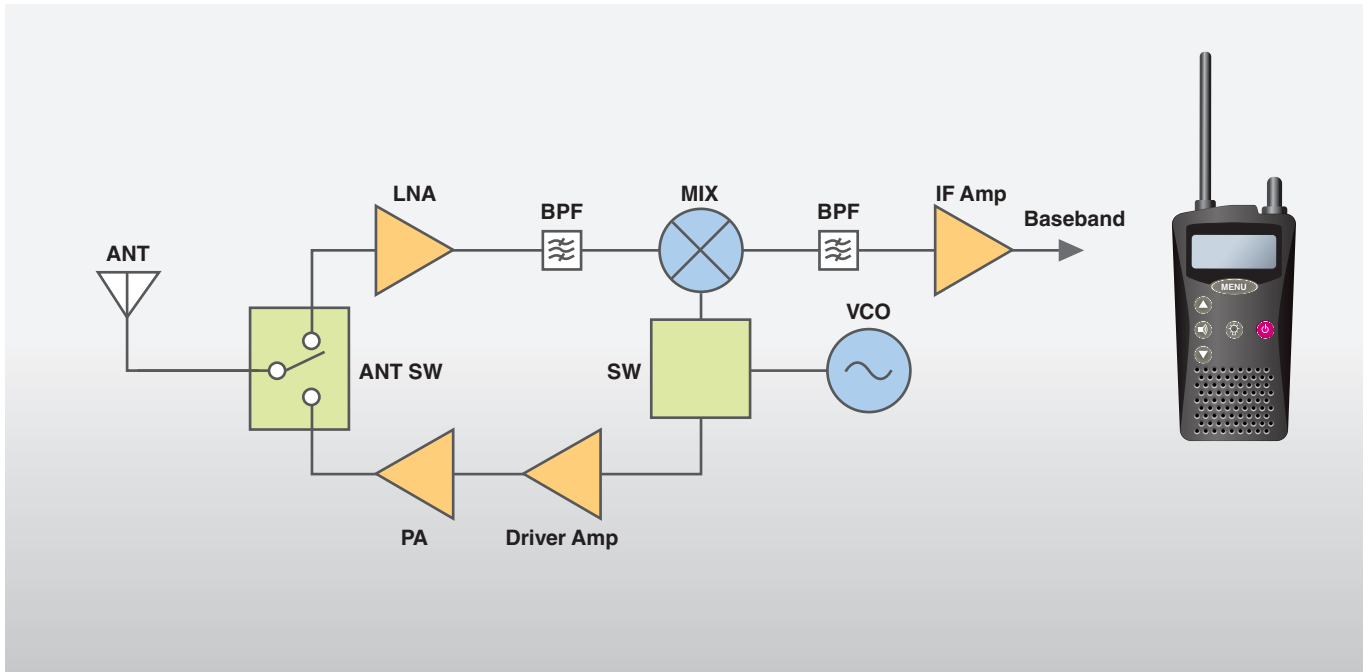
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# 1

# Recommended Products by Application

## 1.3 Low-Power Radios (FRS/GMRS)

### 470-MHz FRS/GMRS Radios and 144/430-MHz Professional and Amateur Radios



#### ● PA and Driver Amp (RF-MOSFET)

| Application | PA               | Driver Amp      | ANT_Po (W) | V <sub>DS</sub> (V) |
|-------------|------------------|-----------------|------------|---------------------|
| LMR         | <b>RFM08U9X</b>  | <b>2SK3074</b>  | 5.0        | 9.6                 |
|             | <b>RFM07U7X</b>  | <b>RFM01U7P</b> | 5.0-10.0   | 7.2                 |
|             | <b>RFM12U7X</b>  |                 | 5.0        |                     |
|             | <b>2SK3476</b>   |                 | 5.0        |                     |
| GMRS        | <b>RFM04U6P</b>  | <b>RFM00U7U</b> | 3.0        | 6.0                 |
|             | <b>2SK3756</b>   |                 | 1.5-2.0    | 4.5                 |
| FRS         | <b>2SK3078A</b>  |                 | 1.0        |                     |
| GMRS        | <b>RFM03U3CT</b> |                 | 0.5        |                     |
| FRS         | <b>RFM04U6P</b>  |                 | 1.0-2.0    |                     |
|             |                  |                 |            | 0.5                 |

: New product

#### ● LNA, MIX, VCO and Driver Amp (MMTR)

| V <sub>CEO</sub> (V) | PW-Mini                          | SOT-23F        | S-Mini         | UFM                                | USQ   | SSM            |
|----------------------|----------------------------------|----------------|----------------|------------------------------------|---|----------------|
| 12                   | <b>MT3S20P</b>                   | <b>MT3S20R</b> | <b>2SC5084</b> | <b>MT3S20TU</b>                    | <b>2SC5088</b>                                      | <b>2SC5086</b> |
| 5-6                  | <b>MT3S21P</b><br><b>MT3S22P</b> | <b>MT3S19R</b> | <b>MT3S19</b>  | <b>MT3S15TU</b><br><b>MT3S19TU</b> | <b>MT4S03BU</b><br><b>MT4S23U</b><br><b>MT4S24U</b> | -              |

: New product

#### ● LNA, MIX, VCO and Driver Amp (Dual-Gate MOSFET)

| Application | SMQ           | USQ           |
|-------------|---------------|---------------|
| VHF         | <b>3SK292</b> | <b>3SK294</b> |
| UHF         | <b>3SK291</b> | <b>3SK293</b> |

#### ● ANT SW

| Application | S-FLAT           |
|-------------|------------------|
| PIN         | <b>JDP2S12CR</b> |

: New product

#### ● Diodes

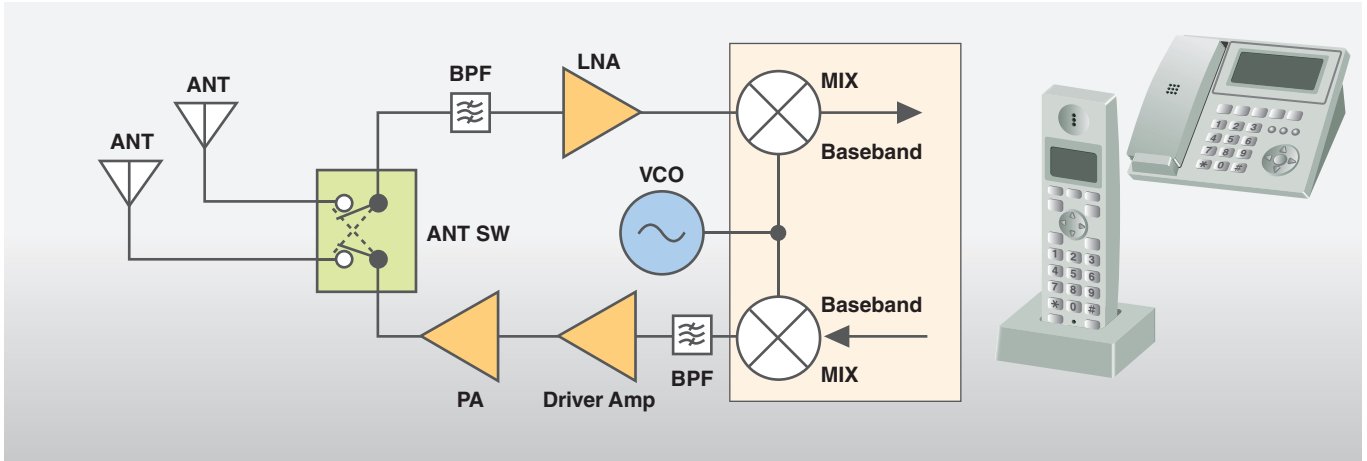
| Application | USC           | ESC             | fSC               |
|-------------|---------------|-----------------|-------------------|
| PIN         | <b>1SV307</b> | <b>1SV308</b>   | <b>JDP2S02AFS</b> |
| Band SW     | <b>1SS314</b> | <b>1SS381</b>   | -                 |
| Varicap     | <b>1SV324</b> | <b>JDV2S36E</b> | <b>JDV2S41FS</b>  |

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## 1.4 Cordless Phones

900 MHz/1.9 GHz/2.4 GHz/5.8 GHz

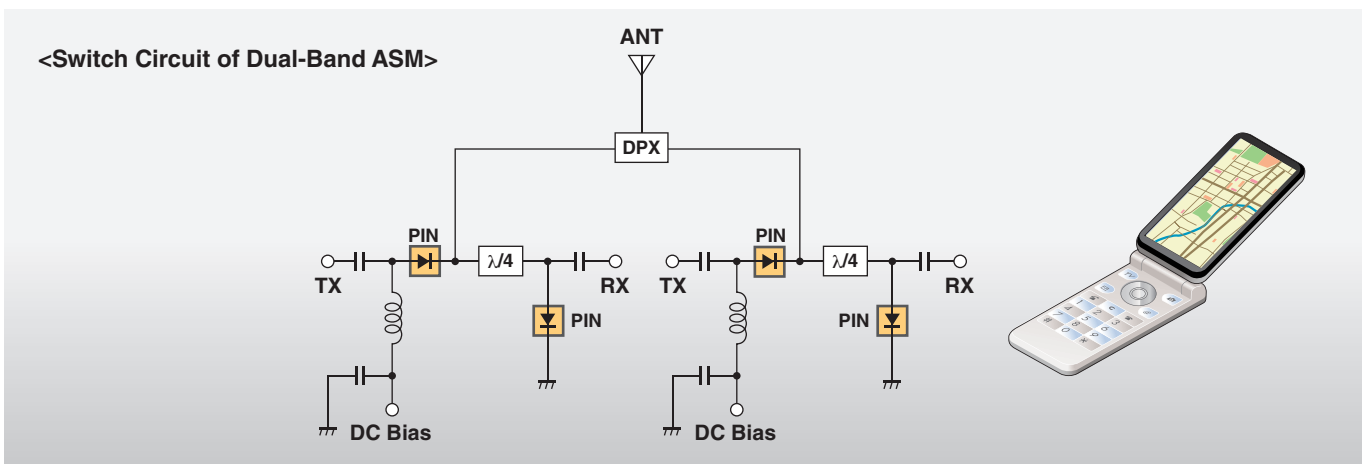


| Applications    | Part Number | Package | Feature                               |
|-----------------|-------------|---------|---------------------------------------|
| ANT SW          | JDP2S02AFS  | fSC     | Single                                |
|                 | JDP3C13U    | USM     | Dual                                  |
| PA              | MT4S301T    | TESQ    | High gain; 5.8-GHz capability         |
|                 | MT4S301U    | USQ     |                                       |
| Driver Amp, LNA | MT4S301T    | TESQ    | High gain; low NF; 5.8-GHz capability |
|                 | MT4S301U    | USQ     |                                       |
|                 | MT4S300T    | TESQ    | Low distortion; low NF                |
|                 | MT4S300U    | USQ     |                                       |
| VCO             | 2SC5086     | SSM     | High current                          |
|                 | 2SC5066     |         | Low current                           |
|                 | JDV2S41FS   | fSC     | Low resistance                        |

  : New product

## 1.5 Antenna Switch Modules (ASM)

0.9-2 GHz



| Applications | Part Number | Package | Feature         | C <sub>T</sub> |                                    | r <sub>S</sub> |  |
|--------------|-------------|---------|-----------------|----------------|------------------------------------|----------------|--|
|              |             |         |                 | (pF)           | Condition                          | (Ω)            | Condition                              |
| PIN          | JDP2S02AFS  | fSC     | Low capacitance | 0.30           | V <sub>R</sub> = 1 V,<br>f = 1 MHz | 1.0            | I <sub>F</sub> = 10 mA,<br>f = 100 MHz |
|              | JDP2S02ACT  | CST2    |                 |                |                                    |                |  |
|              | JDP2S08SC   | SC2     |                 | 0.21           |                                    |                |  |

Toshiba also offers ASMs with four diodes. For details, contact your local Toshiba sales representative.

# 2 Transistors

## 2.1 Microwave Transistors

Toshiba offers an extensive portfolio of microwave transistors suitable for a wide range of applications.

### Features

#### 1. Improves system performance.

Toshiba's microwave transistors has high performance, such as low distortion, low NF and high ESD protection. Thus they are suitable for creating high-performance designs.

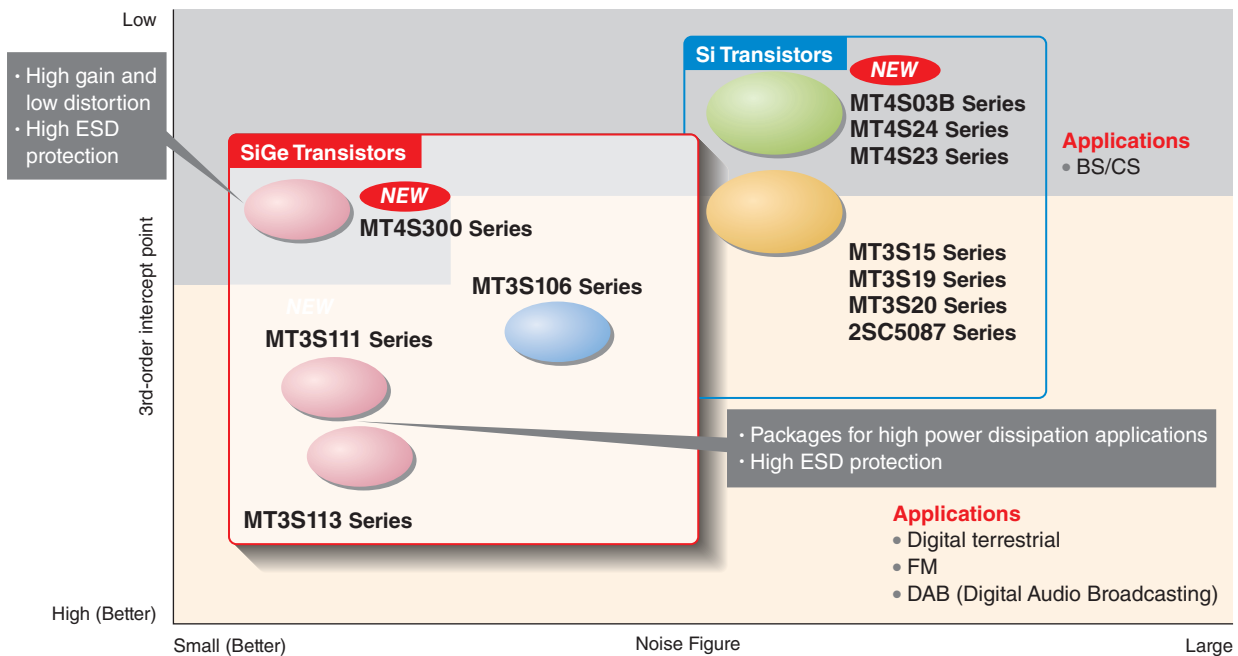
#### 2. Facilitates system design.

Since Toshiba's microwave transistors provide flexibility in circuit design according to system requirements, development time can be shortened.

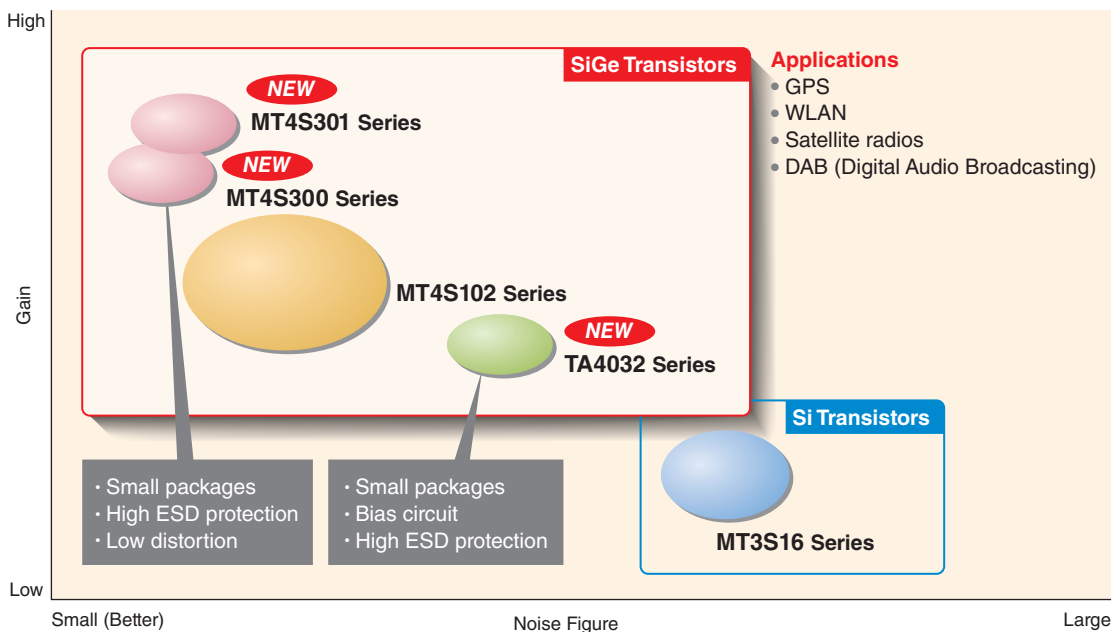
#### 3. Excellent cost performance

Toshiba's microwave transistors help to reduce system costs.

#### ● Distortion Performance vs. Noise Figure



#### ● Gain vs. Noise Figure







## Selection Guide

### Transistors for Low-Distortion and Low-Noise Amplifier Applications

Applications: Terrestrial TV tuners, satellite TV tuners, CATV tuners, DAB systems, FM tuners, radios

| Process | V <sub>CEO</sub>                                 | Supply Voltage  | Feature   | Recommended Products         |   |                     |
|---------|--|---|---|------------------------------|---|---------------------|
| Si      | 12 V   | V <sub>CC</sub> = Up to 10 V  | Low distortion and high ESD protection                      | 2SC5084 / 2SC5085            |   |                     |
|         |  |   | High gain and high ESD protection                           | 2SC5087 / 2SC5087R           |   |                     |
|         |  | V <sub>CC</sub> = 5 V<br>V <sub>CC</sub> = Up to 10 V                     | Low distortion, high P <sub>D</sub> and high ESD protection | MT3S20P                      |   |                     |
|         |  |   | Low distortion, high P <sub>D</sub> and high ESD protection | MT3S20TU                     |   |                     |
|         |  | High P <sub>D</sub> *   | MT3S20R   |                              |   |                     |
|         | 6 V  | V <sub>CC</sub> = 5 V   | Low distortion, high P <sub>D</sub> and high ESD protection | MT3S21P / MT3S22P            |   |                     |
|         |  |   | High gain, low distortion and high ESD protection           | MT3S15TU / MT3S19 / MT3S19TU |   |                     |
|         |  | High P <sub>D</sub> *   | MT3S19R   |                              |   |                     |
|         |  | SiGe  | 6 V   | V <sub>CC</sub> = 5 V        | Low distortion, ultra-low NF, high P <sub>D</sub> and high ESD protection | MT3S111P            |
|         |  |   |   |                              | High gain   | MT3S111 / MT3S111TU |
| 5.3 V   | V <sub>CC</sub> = 3.3 V<br>V <sub>CC</sub> = 5 V | Ultra-low distortion, low NF, high P <sub>D</sub> and high ESD protection | MT3S113P  |                              |   |                     |
|         |  |   | High gain   | MT3S113 / MT3S113TU          |   |                     |
| Si      | 5 V  | V <sub>CC</sub> = 3.3 V   | Low distortion, low NF and high ESD protection              | MT4S03BU                     |   |                     |
|         |  |   | High gain and low NF  | MT4S23U                      |   |                     |
|         |  |   | High gain, low distortion, low NF and high ESD protection   | MT4S24U                      |   |                     |
| SiGe    | 4 V  | V <sub>CC</sub> = 3.3 V   | Ultra-low NF, low distortion and low-voltage operation      | MT4S300U / MT4S300T          |   |                     |
|         |  |   | Ultra-low NF and high gain                                  | MT4S301U / MT4S301T          |   |                     |

\*: P<sub>D</sub> (Power dissipation)  : New product

### Transistors for Low-Noise Amplifier Applications

Applications: GPS systems, cordless phones, WLAN, satellite radios, DAB systems

| Process | V <sub>CEO</sub> | Supply Voltage              | Feature   | Recommended Products |
|---------|------------------|-----------------------------|---|----------------------|
| SiGe    | 3 V              | V <sub>CC</sub> = Up to 2 V | Ultra-low NF  | MT4S102U / MT4S102T  |
|         |                  |                             | High gain, ultra-low NF, RF capability and high ESD protection  | MT4S301U / MT4S301T  |
|         | 4 V              | V <sub>CC</sub> = Up to 3 V | High gain, ultra-low NF, low distortion and high ESD protection | MT4S300U / MT4S300T  |

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# 2 Transistors

## 2.2 RF-MOSFET

Toshiba's RF-MOSFETs are ideal for RF power amplifier applications.

### Features

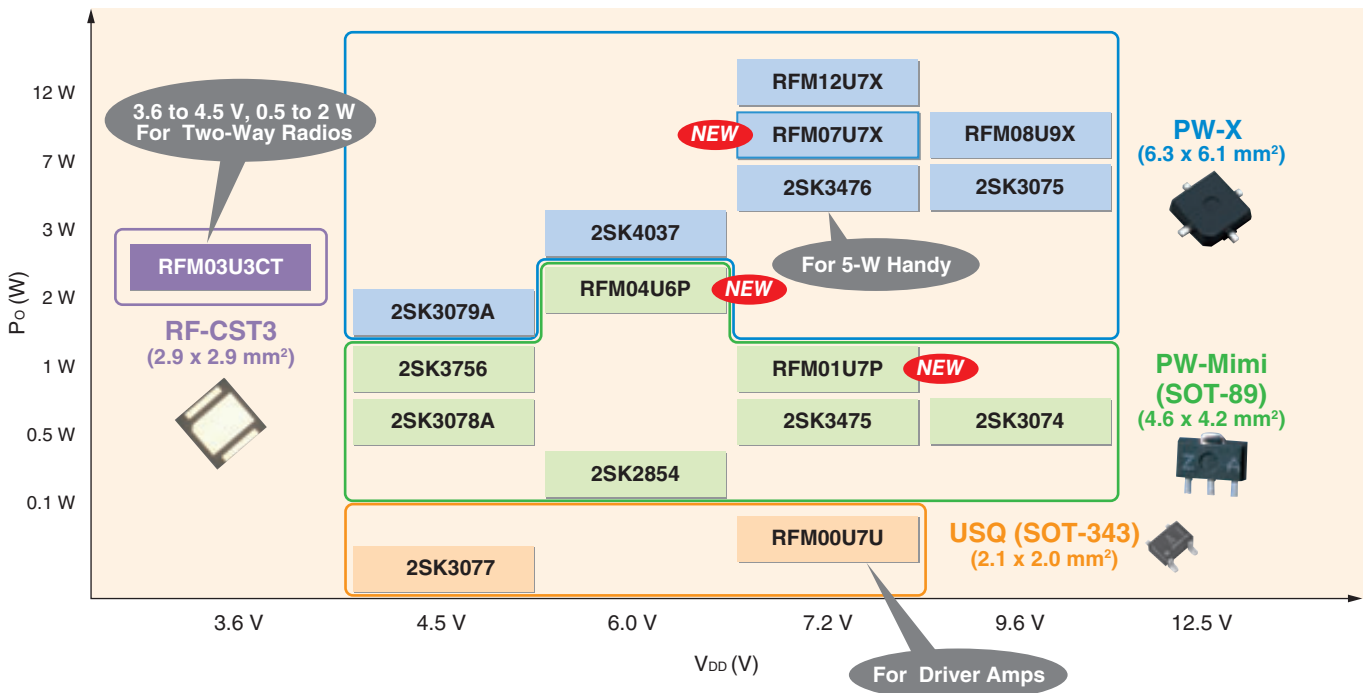
#### 1. Wide Lineup

Available with output power up to 12 W and supply voltage from 3.6 V to 12.5 V for final and driver amplifier applications.

#### 2. Maximum output load mismatch of 20:1 (all phase)

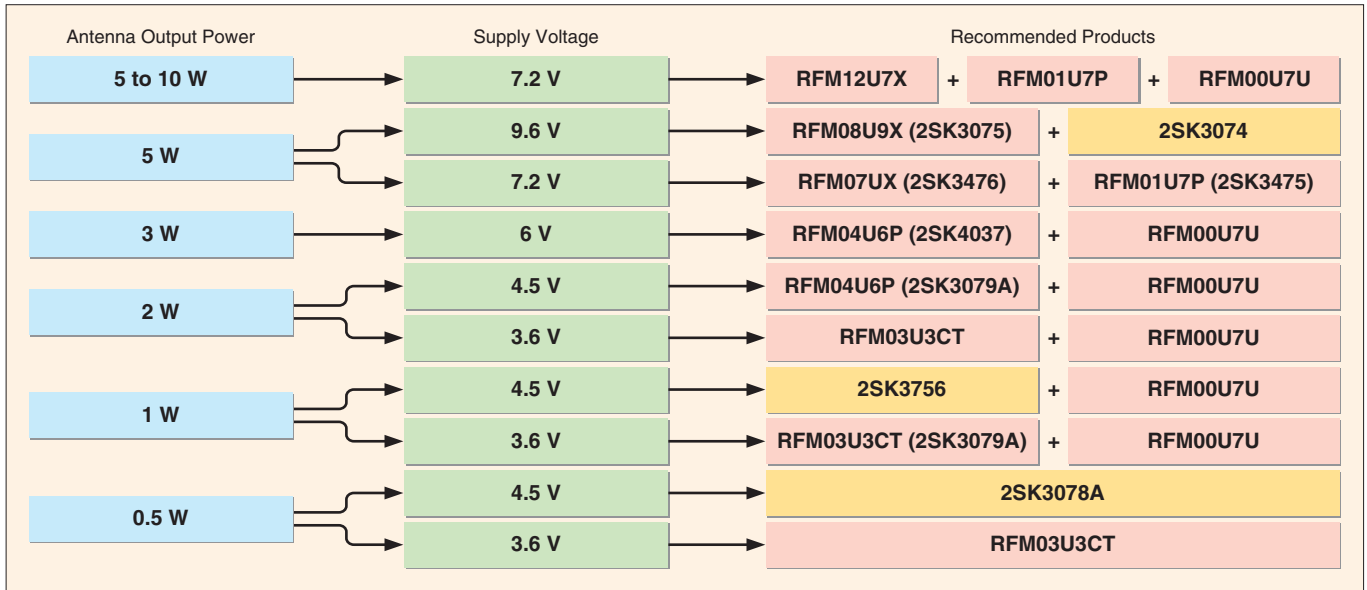
Toshiba's RF-MOSFETs can be used as the final amp.

#### RF-MOSFET Lineup





## Selection Guide



  : New product

## Selection Table

| Applications                                     | Part Number | Absolute Maximum Ratings (Tc = 25°C) |                    |                    | Po (W) |                     |         |                    | Package |
|--|-------------|--------------------------------------|--------------------|--------------------|--------|---------------------|---------|--------------------|---------|
|  |             | V <sub>DS</sub> (V)                  | P <sub>D</sub> (W) | I <sub>D</sub> (A) | Min    | Test Conditions     |         |                    |         |
|  |             |                                      |                    |                    |        | V <sub>DD</sub> (V) | f (MHz) | P <sub>i</sub> (W) |         |
| UHF/VHF<br>Professional radios<br>Amateur radios | RFM12U7X    | 20                                   | 20                 | 4                  | 11.5   | 7.2                 | 520     | 1.0                | PW-X    |
|  | RFM08U9X    | 36                                   | 20                 | 5                  | 7.5    | 9.6                 | 520     | 0.5                | PW-X    |
|  | 2SK3075     | 30                                   | 20                 | 5                  | 7.5    | 9.6                 | 520     | 0.5                | PW-X    |
|  | 2SK3476     | 20                                   | 20                 | 3                  | 7      | 7.2                 | 520     | 0.5                | PW-X    |
|  | 2SK3074     | 30                                   | 3                  | 1                  | 0.63   | 9.6                 | 520     | 0.02               | PW-Mini |
|  | RFM03U3CT   | 16                                   | 7                  | 2.5                | 2.3    | 3.6                 | 520     | 0.1                | RF-CST3 |
|  | 2SK3475     | 20                                   | 3                  | 1                  | 0.63   | 7.2                 | 520     | 0.02               | PW-Mini |
|  | RFM01U7P    | 20                                   | 3                  | 1                  | 1.0    | 7.2                 | 520     | 0.1                | PW-Mini |
|  | 2SK2854     | 10                                   | 0.5                | 0.5                | 0.2    | 6                   | 849     | 0.02               | PW-Mini |
| FRS/GMRS   | 2SK4037     | 12                                   | 20                 | 3                  | 3.55   | 6                   | 470     | 0.3                | PW-X    |
|  | RFM04U6P    | 16                                   | 7                  | 2                  | 3.5    | 6.0                 | 470     | 0.2                | PW-Mini |
|  | 2SK3079A    | 10                                   | 20                 | 3                  | 2.24   | 4.5                 | 470     | 0.1                | PW-X    |
|  | 2SK3756     | 7.5                                  | 3                  | 1                  | 1.26   | 4.5                 | 470     | 0.1                | PW-Mini |
|  | 2SK3078A    | 10                                   | 3                  | 0.5                | 0.63   | 4.5                 | 470     | 0.1                | PW-Mini |
| Drivers  | 2SK3077     | 10                                   | 0.25               | 0.1                | 0.032  | 4.8                 | 915     | 0.001              | USQ     |
|  | RFM00U7U    | 20                                   | 0.25               | 0.1                | 0.1    | 7.2                 | 520     | 0.01               | USQ     |

  : New product

## 2.3 Dual-Gate MOSFET

### Selection Table

| Applications | Part Number | Absolute Maximum Ratings |                     |                     | Electrical Characteristics |                     |  |            |                                    |                     |                      |                                      |                     |                     |                      | Package |
|--------------|-------------|--------------------------|---------------------|---------------------|----------------------------|---------------------|--|------------|------------------------------------|---------------------|----------------------|--------------------------------------|---------------------|---------------------|----------------------|---------|
|              |             | V <sub>DS</sub> (V)      | I <sub>D</sub> (mA) | P <sub>D</sub> (mW) | I <sub>DSS</sub> Max       |                     |  |            | I <sub>Y</sub> f <sub>1</sub> Typ. |                     |                      | G <sub>ps</sub> /N <sub>F</sub> Typ. |                     |                     |                      |         |
|              |             |                          |                     |                     | I <sub>DSS</sub> (mA)      | V <sub>DS</sub> (V) | V <sub>G1S</sub> /V <sub>G2S</sub> (V) | @1kHz (mS) | V <sub>DS</sub> (V)                | I <sub>D</sub> (mA) | V <sub>G2S</sub> (V) | G <sub>ps</sub> (dB/dB)              | V <sub>DS</sub> (V) | I <sub>D</sub> (mA) | V <sub>G2S</sub> (V) |         |
| VHF RF, MIX  | 3SK292      | 12.5                     | 30                  | 150                 | 0.1                        | 6                   | 0/4.5                                  | 23.5       | 6                                  | 10                  | 4.5                  | 26.0/1.4                             | 6                   | 10                  | 4.5                  | 500     |
|              | 100         |                          |                     |                     |                            |                     |  |            |                                    |                     |                      |                                      |                     |                     |                      |         |
| UHF RF, MIX  | 3SK291      | 12.5                     | 30                  | 150                 | 0.1                        | 6                   | 0/4.5                                  | 26.0       | 6                                  | 10                  | 4.5                  | 22.5/1.5                             | 6                   | 10                  | 4.5                  | 800     |
|              | 100         |                          |                     |                     |                            |                     |  |            |                                    |                     |                      |                                      |                     |                     |                      |         |

# 3 Diodes

## 3.1 Variable-Capacitance Diodes (VCD)

### Features

Toshiba offers a line of variable-capacitance diodes (VCDs) ideal for tuner and VCO applications.

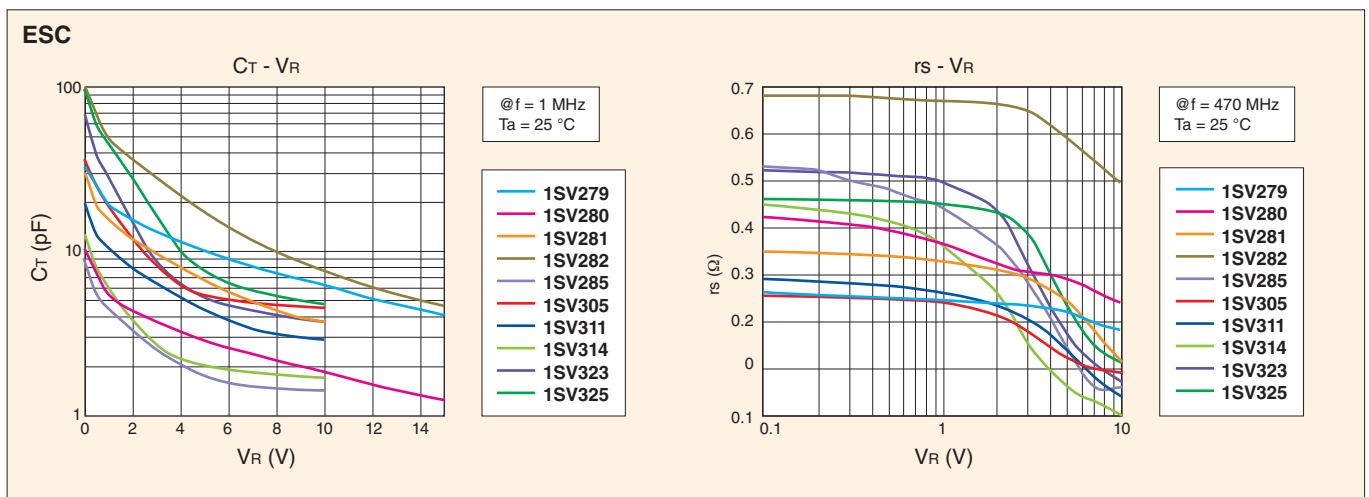
Toshiba's product portfolio includes VCDs with a wide range of capacitances, capacitance ratios and control voltages. They are offered in the industry-standard packages such as USC (SOD-323), ESC (SOD-523) and fSC (SOD-923) to meet diverse customer needs.

### Selection Table

| Applications | Absolute Maximum Ratings | Electrical Characteristics (Ta = 25°C) |                           |                    |                           |                    |                                       |                         |     |           | fSC (SOD-923) | ESC (SOD-523) | USC (SOD-323) | USQ (SOT-343) | S-Mini (SOT-346, SC-59) |
|--------------|--------------------------|--|---------------------------|--------------------|---------------------------|--------------------|---------------------------------------|-------------------------|-----|-----------|---------------|---------------|---------------|---------------|-------------------------|
|              |                          | V <sub>R</sub> (V)                     | C <sub>T1</sub> Typ. (pF) |                    | C <sub>T2</sub> Typ. (pF) |                    | C <sub>T1</sub> /C <sub>T2</sub> Typ. | r <sub>s</sub> Typ. (Ω) |     |           |               |               |               |               |                         |
|              |                          |  | V <sub>R</sub> (V)        | V <sub>R</sub> (V) | V <sub>R</sub> (V)        | V <sub>R</sub> (V) |                                       | f (MHz)                 |     |           |               |               |               |               |                         |
| VCO          | 10                       | 44-49.5                                | 1                         | 9.2-12             | 4                         | 4.3                | 0.4                                   | 4                       | 100 |           | 1SV325        | 1SV324        |               |               |                         |
|              | 10                       | 44-49.5                                | 1                         | 5.4-7.3            | 6                         | 7.5                | 0.4                                   | 4                       | 100 |           | JDV2S36E      |               |               |               |                         |
| TV tuners    | 34                       | 35.5                                   | 2                         | 2.85               | 25                        | 12.5               | 0.6                                   | 5                       | 470 |           | 1SV282        | 1SV262        |               |               |                         |
| VCO          | 10                       | 26.5-29.5                              | 1                         | 6.0-7.1            | 4                         | 4.3                | 0.4                                   | 4                       | 100 |           | 1SV323        | 1SV322        |               |               |                         |
|              | 10                       | 17.3-19.3                              | 1                         | 5.3-6.6            | 4                         | 3.0                | 0.27-0.35                             | 1                       | 470 |           | 1SV305        | 1SV304        | JDV4P08U      |               |                         |
|              | 10                       | 16                                     | 1                         | 8.0                | 4                         | 2.0                | 0.28                                  | 1                       | 470 |           | 1SV281        | 1SV270        |               |               |                         |
|              | 15                       | 14-16                                  | 2                         | 5.5-6.5            | 10                        | 2.5                | 0.2                                   | 5                       | 470 | JDV2S41FS | 1SV279        | 1SV229        |               |               |                         |
|              | 10                       | 9.7-11.1                               | 1                         | 4.45-5.45          | 4                         | 2.1                | 0.28-0.33                             | 1                       | 470 | JDV2S09FS | 1SV311        | 1SV310        |               |               |                         |
|              | 10                       | 7.3-8.4                                | 0.5                       | 2.75-3.4           | 2.5                       | 2.5-2.55           | 0.35                                  | 1                       | 470 | JDV2S10FS | 1SV314        |               |               |               |                         |
|              | 10                       | 4.5                                    | 1                         | 2.0                | 4                         | 2.3                | 0.42                                  | 1                       | 470 | JDV2S07FS | 1SV285        | 1SV277        |               |               |                         |
| 15           | 3.8-4.7                  | 2                                      | 1.5-2.0                   | 10                 | 2.4                       | 0.44               | 1                                     | 470                     |     | 1SV280    | 1SV239        |               |               |               |                         |
| FM tuners    | 15                       | 30.5                                   | 3                         | 12.7               | 8                         | 2.1-2.6            | 0.3                                   | 3                       | 100 |           |               |               |               | 1SV228        |                         |

□ : New product

### Performance Characteristics Curves





## Carrier Tape Specification for Diode Pairs

### Packing for Paired and Unpaired Diodes

| Tape | Packing  | Quantity     |              |
|------|----------|--------------|--------------|
|      |          | ESC          | USC          |
| TPH2 | Paired   | 6400 to 8000 | 2400 to 3000 |
| TPH3 | Unpaired | 8000         | 3000         |

### Paired Diode Packing Using TPH2

#### Specification

For paired diodes, packing is guaranteed as shown in Figure 1 and Table 1.

Figure 1 Paired Diode Packing Specification Based on Capacitances

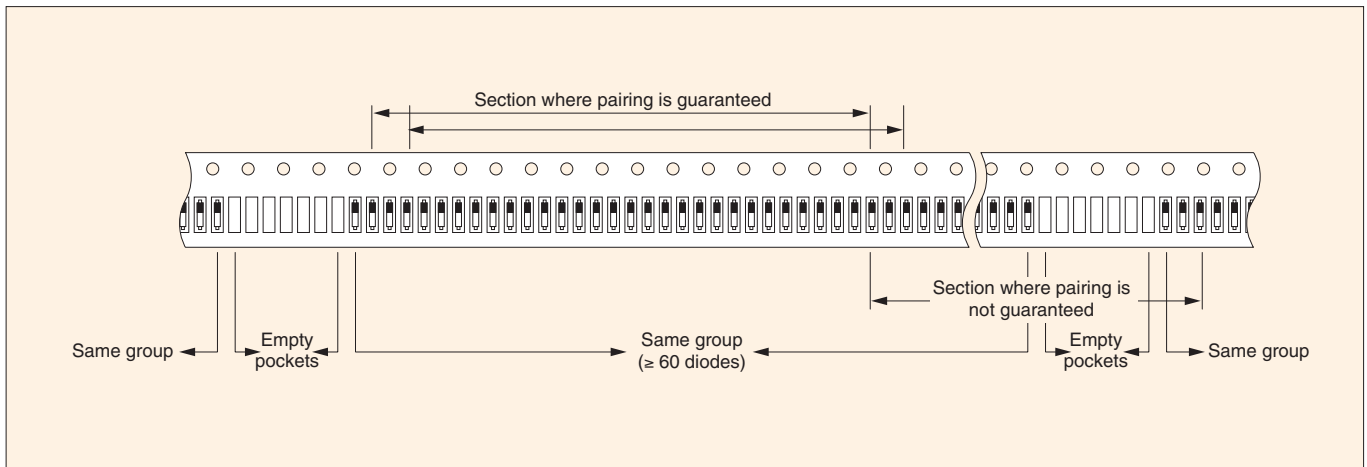


Table 1 Pairing Specification

| Item                                | Tape  |
|-------------------------------------|---|
| Section where pairing is guaranteed | Any 15 consecutive diodes in the same group   |
| Number of diodes per group          | $\geq 60$ diodes<br>(Integer multiple of this number when paired; generally, a multiple of 4) |
| Number of groups per reel           | ESC: $\leq 30$ groups, USC: $\leq 9$ groups   |

### Group Boundaries

Group boundaries are indicated by four consecutive empty pockets.

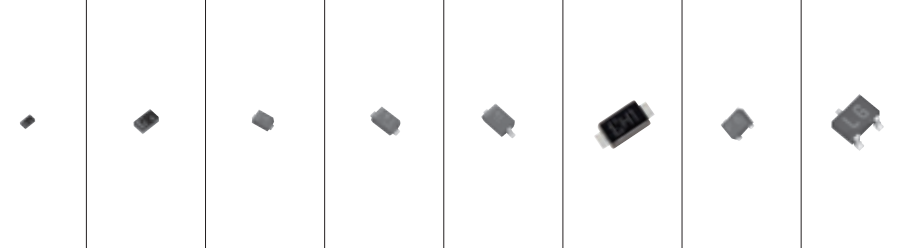









# 3 Diodes

## 3.2 PIN Diodes

### Features

- Ideal for RF switching applications.
- Available in the ultra-small SC2 package (0.62 x 0.32 mm) and in single and dual versions to meet customer needs for space-critical applications.

### Selection Table

| Applications    | Absolute Maximum Ratings |                | Electrical Characteristics (Ta = 25°C) |  |      |                     |     |                 |   |               |  |  |        |  |                      |
|-----------------|--------------------------|----------------|--|--|------|---------------------|-----|---|---|---------------|--|--|--------|--|----------------------|
|                 | V <sub>R</sub>           | I <sub>F</sub> | V <sub>F</sub> Max                     | C <sub>T</sub> Typ.  |      | r <sub>s</sub> Typ. |     | SC2   | CST2  | fSC (SOD-923) | ESC (SOD-523)  | USC (SOD-323)  | S-FLAT | TESQ   | USM (SOT-323, SC-70) |
|                 | (V)                      | (mA)           | (V)                                    | I <sub>F</sub> (mA)  | (pF) | V <sub>R</sub> (V)  | (Ω) | I <sub>F</sub> (mA)   | f (MHz)   |               |  |  |        |  |                      |
|                 |                          |                |  |  |      |                     |     |   |   |               |  |  |        |  |                      |
| Standard        | 30                       | 50             | 1.00                                   | 0.3  | 1    | 10                  | 100 |   |   |               | 1SV308<br>        | 1SV307<br>      |        |  |                      |
|                 |                          |                | 0.94                                   |  |      |                     |     | JDP2S02ACT<br> | JDP2S02AFS<br> |               | JDP4P02AT<br> |  |        |  |                      |
|                 |                          |                | 0.95                                   | JDP2S08SC<br> |      |                     |     |   |   |               |  |  |        |  |                      |
|                 |                          |                | 0.98                                   |  |      |                     |     |   |   |               |  |  |        | JDP3C02AU<br> |                      |
| Low capacitance |                          |                | 0.91                                   | 0.24   | 2.1  |                     |     |   |   |               |  |  |        | JDP3C13U<br>  |                      |
| High power      | 180                      | 1000           | 1.00                                   | 1.0  | 40   | 0.4                 |     |   |   |               |  | JDP2S12CR<br> |        |  |                      |

 : New product



### 3.3 Band-Switching Diodes

#### Features

- Ideal for switching applications.
- Available in single and dual versions with total capacitance ( $C_T$ ) of less than 1.0 pF for RF applications.

#### Selection Table

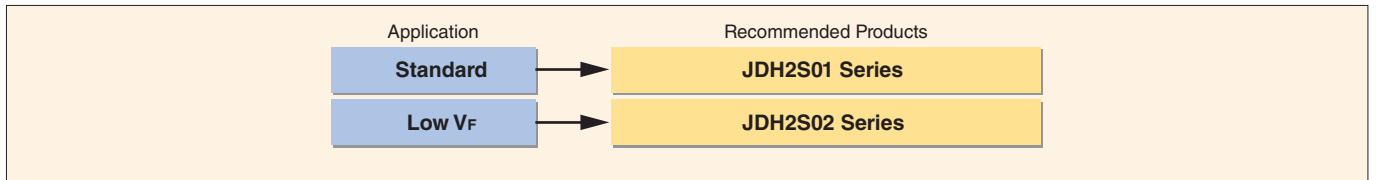
| Applications | Absolute Maximum Ratings |       | Electrical Characteristics ( $T_a = 25^\circ\text{C}$ ) |               |              |               |               |            | ESC<br>(SOD-523)  | USC<br>(SOD-323)  | SSM<br>(SOT-416, SC-75) | USM<br>(SOT-323, SC-70)                | S-Mini<br>(SOT-346, SC-59)             |
|--------------|--------------------------|-------|---|---------------|--------------|---------------|---------------|------------|-------------------|-------------------|-------------------------|--|--|
|              | $V_R$                    | $I_F$ | $V_F$<br>Max  | $C_T$<br>Typ. |              | $r_s$<br>Typ. |               |            |                   |                   |                         |  |  |
|              | (V)                      | (mA)  |   | (pF)          | $V_R$<br>(V) | ( $\Omega$ )  | $I_F$<br>(mA) | f<br>(MHz) |                   |                   |                         |  |  |
| Single       |                          | 100   |   | 0.7           |              | 0.5-0.6       |               |            | <b>1SS381</b><br> | <b>1SS314</b><br> |                         |  |  |
| Dual         | 30                       | 50    | 0.85  | 2             | 0.80-0.85    | 6             | 0.6           | 2          | 100               |                   | <b>1SS364</b><br>       | <b>1SS312</b><br><br><b>1SS313</b><br> | <b>1SS268</b><br><br><b>1SS269</b><br> |

### 3.4 Schottky Barrier Diodes (SBD)

#### Features

- Ideal for RF detector applications.
- Available in the ultra-small SC2 package (0.62 x 0.32 mm) and in single and dual versions to meet customer needs for space-critical applications.

#### Selection Guide



#### Selection Table

| Applications | Absolute Maximum Ratings |       | Electrical Characteristics ( $T_a=25^\circ\text{C}$ ) |               |               |                      | SC2                  | fSC<br>(SOD-923)  | USC<br>(SOD-323)     | VESM<br>(SOT-723)   | SSM<br>(SOT-416, SC-75) | S-Mini<br>(SOT-346, SC-59)             |
|--------------|--------------------------|-------|---|---------------|---------------|----------------------|----------------------|-------------------|----------------------|---------------------|-------------------------|--|
|              | $V_R$                    | $I_F$ | $V_F$<br>Max  | $C_T$<br>Typ. |               |                      |                      |                   |                      |                     |                         |  |
|              | (V)                      | (mA)  |   | (V)           | $I_F$<br>(mA) | (pF)                 |                      |                   |                      |                     |                         |  |
| Standard     | 6                        | 30    | 0.5   | 10            | 0.8           | 0                    |                      |                   |                      |                     |                         | <b>1SS154</b><br><br><b>1SS271</b><br> |
|              | 4-5                      | 25-30 | 0.25  | 2             | 0.6           | 0.2                  | <b>JDH2S01FS</b><br> | <b>1SS315</b><br> | <b>JDH3D01FV</b><br> | <b>JDH3D01S</b><br> | <b>1SS295</b><br>       |  |
| Low Vf       | 10                       | 10    | 0.24  | 1             | 0.25-0.30     | <b>JDH2S02SC</b><br> | <b>JDH2S02FS</b><br> |                   |                      |                     |                         |  |



## 4.1 Radio-Frequency Cell Packs (MMIC)

Toshiba's MMICs integrate peripheral circuits on the same chip to help reduce product size and parts count.

### Features

#### 1. Helps reduce circuit area.

The bias circuit and matching circuits are integrated.

Toshiba's MMICs are suitable for high-density board assembly due to use of a compact package and help to reduce system size.

#### 2. Simplifies product design and reduce design times.

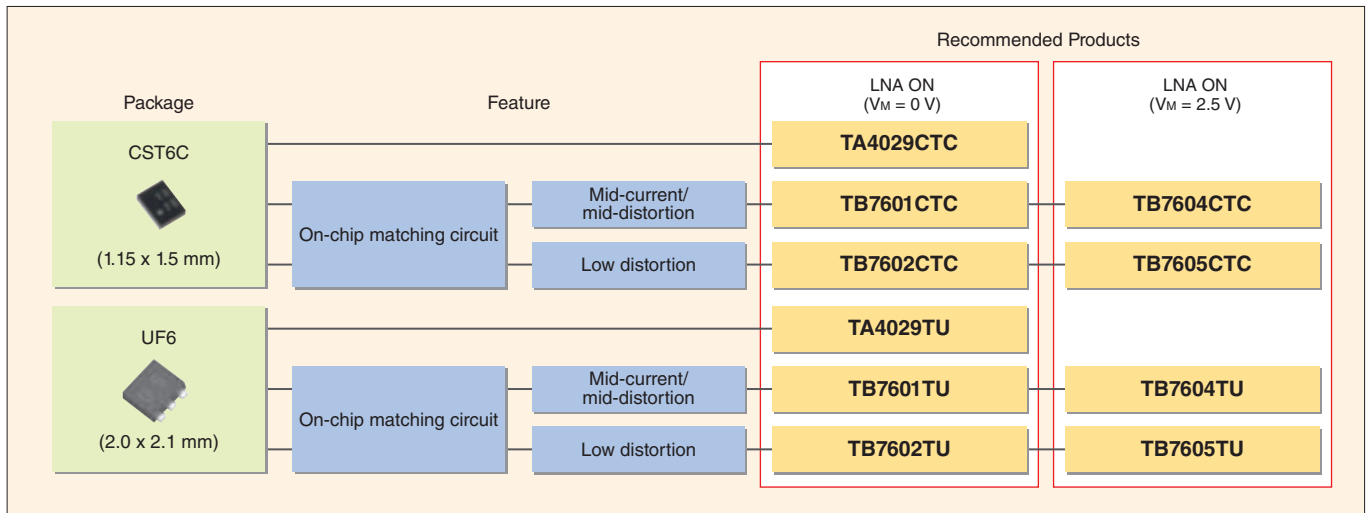
For optimum performance, bias conditions are preprogrammed, reducing the workload of system designers. Toshiba's MMICs provide excellent matching with upstream and downstream components.

#### 3. Reduces system performance variations.

Using MMICs helps reduce system performance variations and thus makes it easier to satisfy performance requirements than using discrete components.

### Selection Guide

#### ● LNAs with Bypass [Pass-Through] Circuit (50 to 1000 MHz)



### Selection Table

Typical,  $T_a = 25^\circ\text{C}$

| Applications                  | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | Gain (1) (dB) | NF (dB) | I <sub>cc</sub> (mA) | Gain (2) (dB) | Condition  |                     | Package |
|-------------------------------|---------------------------|-------------|-----------------------|---------------|---------|----------------------|---------------|------------|---------------------|---------|
|                               |                           |             |                       |               |         |                      |               | freq.(MHz) | V <sub>cc</sub> (V) |         |
| VHF/UHF amps<br>TV tuner amps | 50 to 1000                | TA4029CTC   | 2.5                   | 13.0          | 1.2     | 4.0                  | -2.0          | 1000       | 2.5                 | CST6C   |
|                               |                           | TA4029TU    |                       |               |         |                      |               |            |                     | UF6     |
|                               |                           | TB7601CTC   | 2.5                   | 14.0          | 1.4     | 4.0                  | -2.5          | 1000       | 2.5                 | CST6C   |
|                               |                           | TB7601TU    |                       |               |         |                      |               |            |                     | UF6     |
|                               |                           | TB7602CTC   | 2.5                   | 15.0          | 1.3     | 6.0                  | -2.5          | 1000       | 2.5                 | CST6C   |
|                               |                           | TB7602TU    |                       |               |         |                      |               |            |                     | UF6     |
|                               |                           | TB7604CTC   | 2.5                   | 14.0          | 1.4     | 4.0                  | -2.5          | 1000       | 2.5                 | CST6C   |
|                               |                           | TB7604TU    |                       |               |         |                      |               |            |                     | UF6     |
|                               |                           | TB7605CTC   | 2.5                   | 15.0          | 1.3     | 6.0                  | -2.5          | 1000       | 2.5                 | CST6C   |
|                               |                           | TB7605TU    |                       |               |         |                      |               |            |                     | UF6     |



## Selection Table

### LNA (Up to 3 GHz)

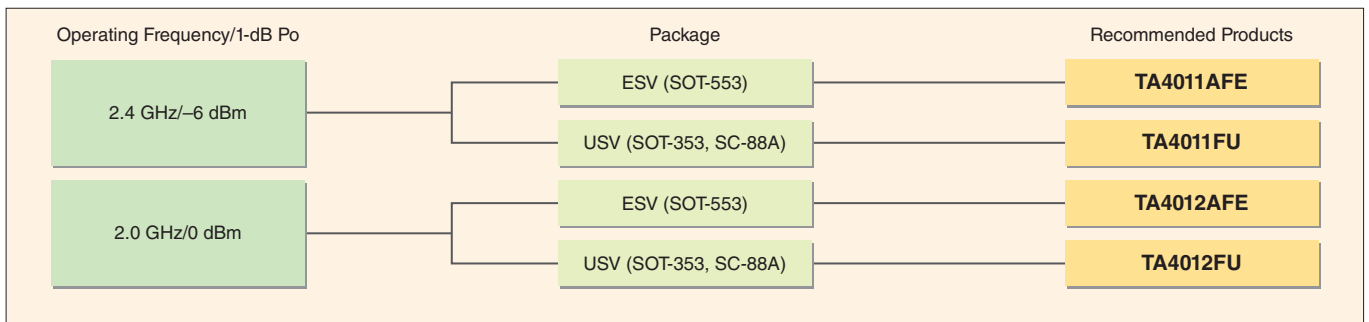
Typical, Ta = 25°C

| Applications   | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | Gain (dB) | NF (dB) | I <sub>cc</sub> (mA) | OIP <sub>3</sub> (dBm) | Condition   |                     | Package |
|----------------|---------------------------|-------------|-----------------------|-----------|---------|----------------------|------------------------|-------------|---------------------|---------|
|                |                           |             |                       |           |         |                      |                        | Freq. (MHz) | V <sub>cc</sub> (V) |         |
| GPS, WLAN amps | Up to 3000                | TA4032FT    | 3                     | 14.8      | 1.0     | 5                    | 5.9                    | 1575        | 3                   | TESQ    |
|                |                           | TA4032CTC   | 3                     | 15.9      | 0.96    | 5                    | 3.5                    |             |                     | CST6C   |

  : New product

## Selection Guide

### Wideband Amplifiers (Up to 2.4 GHz)



## Selection Table

### Wideband Amplifiers (Up to 2.4 GHz)

Typical, Ta = 25°C

| Applications | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | Bandwidth (GHz) | I <sub>cc</sub> Typ. (mA) | Po (dBmW) | Conditions  |                     | Package             |
|--------------|---------------------------|-------------|-----------------------|-----------------|---------------------------|-----------|-------------|---------------------|---------------------|
|              |                           |             |                       |                 |                           |           | Freq. (MHz) | V <sub>cc</sub> (V) |                     |
| VHF/UHF amps | Up to 2400                | TA4011AFE   | 2                     | 2.4             | 3.5                       | -6@Po1dB  | 1500        | 2                   | ESV(SOT-553)        |
|              |                           | TA4011FU    |                       |                 |                           |           |             |                     | USV(SOT-353,SC-88A) |
|              | Up to 2000                | TA4012AFE   | 2                     | 2.0             | 6.5                       | 0@Po1dB   | 1500        | 2                   | ESV(SOT-553)        |
|              |                           | TA4012FU    |                       |                 |                           |           |             |                     | USV(SOT-353,SC-88A) |

### Mixers

Typical, Ta = 25°C

| Applications   | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | G <sub>MIX</sub> (dB) | NF <sub>MIX</sub> (dB) | I <sub>cc</sub> (mA) | Po (dBmW) | Conditions                             |                     | Package      |
|----------------|---------------------------|-------------|-----------------------|-----------------------|------------------------|----------------------|-----------|--|---------------------|--------------|
|                |                           |             |                       |                       |                        |                      |           | f <sub>RF</sub> /f <sub>LO</sub> (MHz) | V <sub>cc</sub> (V) |              |
| VHF/UHF mixers | 800                       | TA4101F     | 5                     | -3.5                  | 9.0                    | 5.7                  | -9        | 800/860                                | 5                   | SM8(SOT-505) |

### Downconverters

Typical, Ta = 25°C

| Applications   | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | C. Gain (dB) | NF (dB) | I <sub>cc</sub> (mA) | IIP <sub>3</sub> (dBmW) | Conditions                             |                     | Package      |
|----------------|---------------------------|-------------|-----------------------|--------------|---------|----------------------|-------------------------|--|---------------------|--------------|
|                |                           |             |                       |              |         |                      |                         | f <sub>RF</sub> /f <sub>LO</sub> (MHz) | V <sub>cc</sub> (V) |              |
| Downconverters | 1000                      | TA4107F     | 4.5                   | -0.5         | 12      | 29.5                 | 12                      | 1000/950                               | 4.5                 | SM8(SOT-505) |



## Selection Guide

### VHF Differential Amplifiers (10 to 100 MHz)

| Function | Operating Voltage | Package       | Features       | Recommended Products |
|----------|-------------------|---------------|----------------|----------------------|
| MGC*     | 5 V               | SM8 (SOT-505) | Low distortion | TA4022F              |
|          |                   |               | Low current    | TA4023F              |
| AGC**    | 3.3 V             | SM8 (SOT-505) |                | TA4031F              |
|          |                   | CST8          |                | TA4031CT             |

\* The gain is programmable via an external resistor.

\*\* The gain is programmable via an applied external voltage.

## Selection Table

Typical, Ta = 25°C

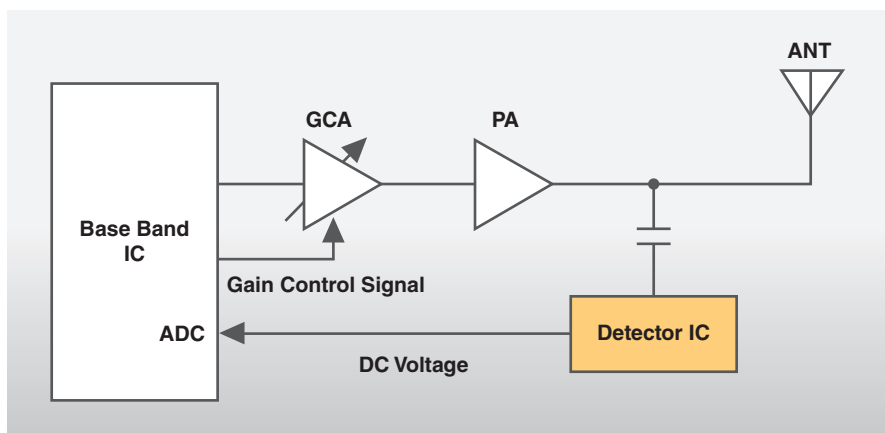
| Applications                 | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | Gain (1) (dB) | Gain (2) (dB) | I <sub>cc</sub> (mA) | IM3 (dBc) | Conditions  |                     | Package       |
|------------------------------|---------------------------|-------------|-----------------------|---------------|---------------|----------------------|-----------|-------------|---------------------|---------------|
|                              |                           |             |                       |               |               |                      |           | Freq. (MHz) | V <sub>cc</sub> (V) |               |
| VHF amps<br>TV tuner IF amps | 10 to 100                 | TA4022F     | 5                     | 19.0          | 10.0          | 35                   | 58        | 45          | 5                   | SM8 (SOT-505) |
|                              |                           | TA4023F     | 5                     | 28.0          | 9.0           | 28                   | 51        | 45          | 5                   | SM8 (SOT-505) |
|                              |                           | TA4031F     | 3.3                   | 49.0          | -4.0          | 35                   | 54        | 45          | 3.3                 | SM8 (SOT-505) |
|                              |                           | TA4031CT    | 3.3                   | 49.0          | -4.0          | 35                   | 54        | 45          | 3.3                 | CST8          |

## 4.2 Detector ICs

Toshiba's detector IC converts RF power into a DC voltage so that the transmitter power from telecommunication devices such as cell phones can be accurately controlled. It is ideal for power detector applications for a modulated signal with a high peak-to-average power ratio (PAPR).

The detector IC is housed in a small WCSP package, making it the ideal solution for space-critical applications such as cell phones.

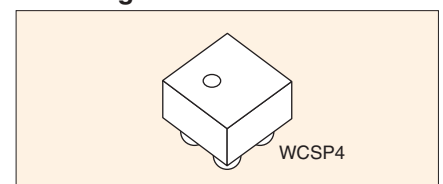
### Block Diagram of a Cell Phone Transmitter



### Features

- Effective detector voltage output
- Operating frequency: 700-2000 MHz
- Low standby power: 0.95 mW typ.
- Small WCSP: 0.79 x 0.79 x 0.5 mm
- On-chip ESD protection elements

### Package



## Selection Table


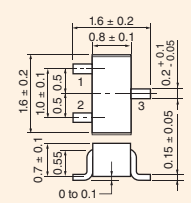
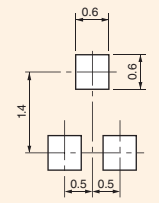
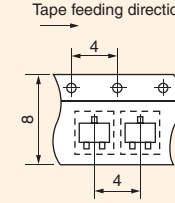
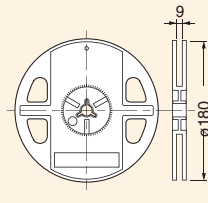

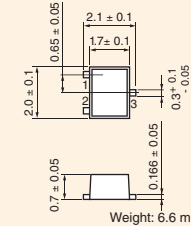
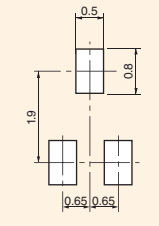
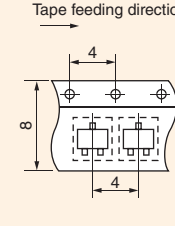
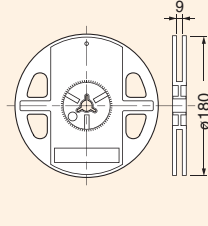

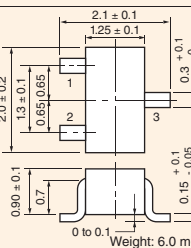
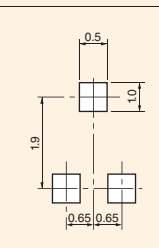
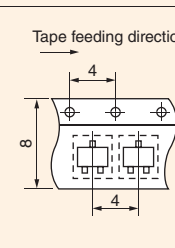
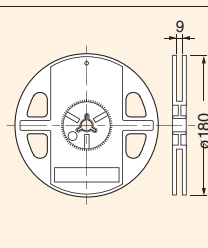

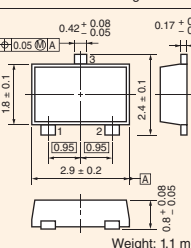
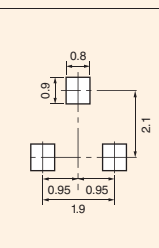
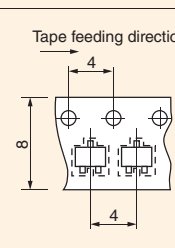
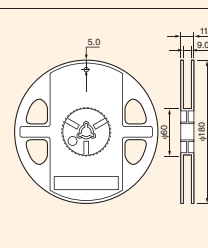

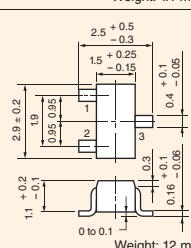
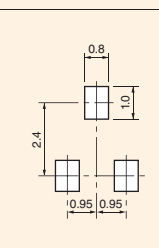
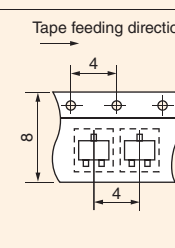
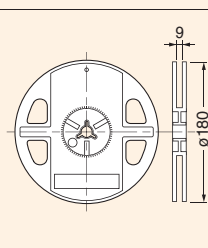
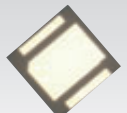
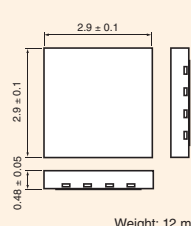
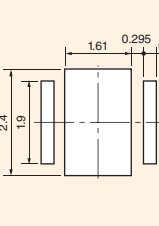
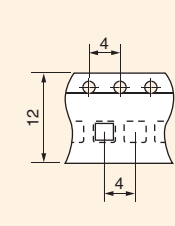
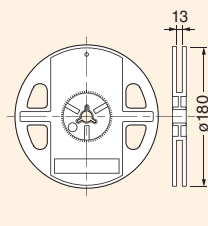

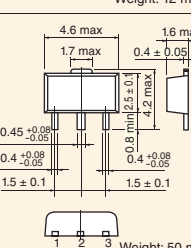
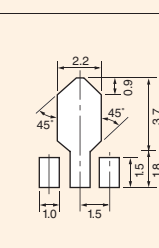
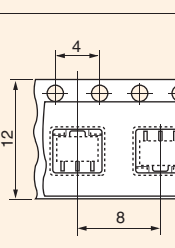
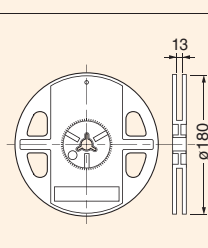
Ta = 25°C

| Applications       | Operating Frequency (MHz) | Part Number | Operating Voltage (V) | Typical Conv. Gain (mV/dB) | I <sub>cc</sub> Typ. (mA) | Input Return Loss (dB) | Conditions  |                     | Package |
|--------------------|---------------------------|-------------|-----------------------|----------------------------|---------------------------|------------------------|-------------|---------------------|---------|
|                    |                           |             |                       |                            |                           |                        | Freq. (MHz) | V <sub>cc</sub> (V) |         |
| RF power detection | 700 to 2000               | TCX4A01WBG  | 2.8                   | 85                         | 0.34                      | 14                     | 900         | 2.8                 | WCSP4   |

TCX4A01WBG : New product



# 5 Package Lineup

| Toshiba Package Name                  | Package   |   | Land Pattern* Dimensions<br>Unit: mm  | Standard Tape Packing Specifications |   |   |
|---------------------------------------|---|---|---|--------------------------------------|---|---|
|                                       | Appearance  | Dimensions<br>Unit: mm  |   | Tape Type                            | Tape Dimensions<br>Unit: mm   | Reel Dimensions<br>Unit: mm   |
| <b>SSM</b><br>(SOT-416)<br>(SC-75)    |    | <br>Weight: 2.4 mg   |    | <b>TE85L</b>                         |    |    |
| Packing quantity<br>3000/reel         |   |   |   |                                      |   |   |
| <b>UFM</b>                            |    | <br>Weight: 6.6 mg   |    | <b>TE85L</b>                         |    |    |
| Packing quantity<br>3000/reel         |   |   |   |                                      |   |   |
| <b>USM</b><br>(SOT-323)<br>(SC-70)    |   | <br>Weight: 6.0 mg  |   | <b>TE85L</b>                         |   |   |
| Packing quantity<br>3000/reel         |   |   |   |                                      |   |   |
| <b>SOT-23F</b>                        |  | <br>Weight: 1.1 mg |  | <b>TE85L</b>                         |  |  |
| Packing quantity<br>3000/reel         |   |   |   |                                      |   |   |
| <b>S-Mini</b><br>(SOT-346)<br>(SC-59) |  | <br>Weight: 12 mg  |  | <b>TE85L</b>                         |  |  |
| Packing quantity<br>3000/reel         |   |   |   |                                      |   |   |
| <b>RF-CST3</b>                        |  | <br>Weight: 12 mg  |  | <b>TE12L</b>                         |  |  |
| Packing quantity<br>1000/reel         |   |   |   |                                      |   |   |
| <b>PW-Mini</b>                        |  | <br>Weight: 50 mg  |  | <b>TE12L</b>                         |  |  |
| Packing quantity<br>1000/reel         |   |   |   |                                      |   |   |

\* For reference only. Land pattern dimensions should be determined empirically.



# 5 Package Lineup



| Toshiba Package Name               | Package    |                        | Land Pattern* Dimensions<br>Unit: mm | Standard Tape Packing Specifications |                             |                             |
|------------------------------------|------------|------------------------|--------------------------------------|--------------------------------------|-----------------------------|-----------------------------|
|                                    | Appearance | Dimensions<br>Unit: mm |                                      | Tape Type                            | Tape Dimensions<br>Unit: mm | Reel Dimensions<br>Unit: mm |
| <b>SMV</b><br>(SOT-25)<br>(SC-74A) |            |                        |                                      | <b>TE85L</b>                         |                             |                             |
| Packing quantity<br>3000/reel      |            | Weight: 14 mg          |                                      |                                      |                             |                             |
| <b>CST6C</b>                       |            |                        |                                      | <b>TE85L</b>                         |                             |                             |
| Packing quantity<br>10000/reel     |            | Weight: 2.0 mg         |                                      |                                      |                             |                             |
| <b>UF6</b>                         |            |                        |                                      | <b>TE85L</b>                         |                             |                             |
| Packing quantity<br>3000/reel      |            | Weight: 7.0 mg         |                                      |                                      |                             |                             |
| <b>SM6</b><br>(SOT-26)<br>(SC-74)  |            |                        |                                      | <b>TE85L</b>                         |                             |                             |
| Packing quantity<br>3000/reel      |            | Weight: 15 mg          |                                      |                                      |                             |                             |
| <b>CST8</b>                        |            |                        |                                      | <b>TE85L</b>                         |                             |                             |
| Packing quantity<br>5000/reel      |            | Weight: 2.0 mg         |                                      |                                      |                             |                             |
| <b>SM8</b><br>(SOT-505)            |            |                        |                                      | <b>TE12L</b>                         |                             |                             |
| Packing quantity<br>3000/reel      |            | Weight: 21 mg          |                                      |                                      |                             |                             |

\* For reference only. Land pattern dimensions should be determined empirically.

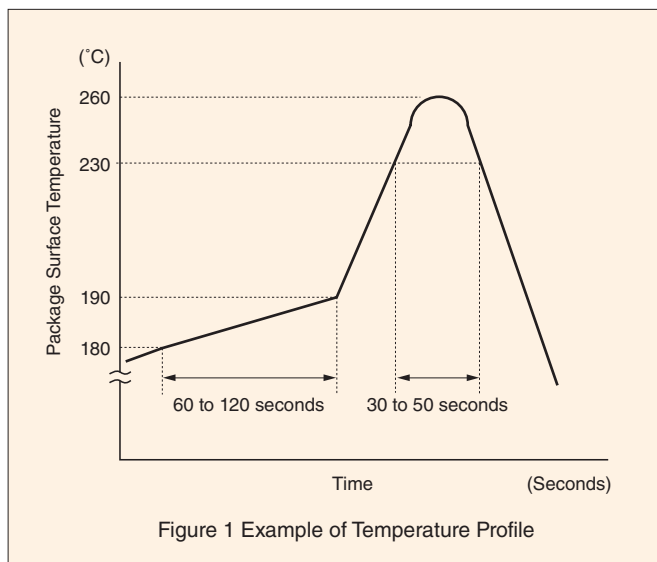
## Soldering Temperature Profile

Perform soldering following the methods and conditions described in the respective technical datasheets and databooks for the device used. The soldering method, temperature and time may be restricted, depending on the device. All soldering temperature profiles and conditions described in the mounting methods below are representative. The profiles and conditions vary from product to product. Therefore, mount the product after first confirming the information described in the respective technical datasheets and databooks with the customer.

Reflow soldering and flow soldering must not be combined when performed. For details regarding special soldering including lead(Pb) soldering, please contact your nearest Toshiba office or distributor.

### Using Infrared Reflow

1. It is recommended the top and bottom heating method with long or medium infrared rays.
2. Complete the infrared ray reflow process with a maximum package surface temperature of 260°C, within 30 to 50 seconds when a package surface temperature is 230°C or higher.
3. Refer to Figure 1 for an example of a temperature profile.



This profile is based on the device's maximum heat resistance guaranteed value.

Set the preheat temperature/heating temperature to the optimum temperature corresponding to the solder paste type used by the customer within the above-described profile.

### Using Hot Air Reflow

1. Complete hot air reflow with a maximum package surface temperature of 260°C, within 30 to 50 seconds when a package surface temperature is 230°C or higher.
2. For an example of a temperature profile, refer to Figure 1 above.

### Using Solder Flow/Dip

1. Apply preheating for 60 to 120 seconds at a temperature of 150°C.
2. Mount the device within 10 seconds of solder flow with a maximum temperature of 260°C.
3. For insertion-type packages, mount the device at the stopper or at a location more than 1.5 mm from the body.
4. Surface-mount packages are greatly affected by thermal stress compared with the insertion-type packages; therefore, mount the device lower temperature and shorter mounting time than the condition listed in the above 2. to avoid thermal stress.





## Transistors

### ● Microwave Transistor (MMTRs)

**MT 3 S 19 TU**  
 (1) (2) (3) (4) (5)

- |   |                             |
|---|-----------------------------|
| (1) Toshiba microwave transistor              | (5) Package                 |
| (2) Pin count                                 | TU: UFM                     |
| (3) Chip configuration                        | U: USM, USQ, US6            |
| S: Single                                     | S: SSM                      |
| C: Cascode                                    | T: TESM, TESQ               |
| P: Parallel-connected transistors             | E: ES6                      |
| L: Symmetrically connected transistors        | FS: fSM, fS6                |
| G: Combination with a general-purpose element | P: PW-Mini                  |
| (4) Number                                    | CT: CST3, CST6              |
|   | R: SOT-23F                  |
|   | No suffix: S-Mini, SMQ, SM6 |

### ● RF-MOSFET

**RFM 12 U 7 X**  
 (1) (2) (3) (4) (5)

- |                             |             |
|-----------------------------|-------------|
| (1) Toshiba RF-MOSFET       | (5) Package |
| (2) Output power (W)        | U: USQ      |
| (3) Frequency band          | P: PW-Mini  |
| U: UHF (300 MHz to 520 MHz) | X: PW-X     |
| (4) Operating voltage (V)   | CT: RF-CST3 |

### ● Conventional Series

**2SC\*\*\*\*\*** : Bipolar transistors  
**2SK\*\*\*\*\*** : Single-gate N-channel MOSFET  
**3SK\*\*\*\*\*** : Dual-gate N-channel MOSFET

## Diodes

### ● Diodes

**JD P 2 S 08 SC**  
 (1) (2) (3) (4) (5) (6)

- |  |                   |
|--|-------------------|
| (1) Toshiba RF diode                   | (6) Package       |
| (2) Diode type                         | SC: SC2           |
| P: PIN diode                           | CT: CST2, CST3    |
| V: Variable-capacitance diode          | CTC: CST4C        |
| H: Schottky barrier diode              | FS: fSC           |
| S: Switching diode                     | E: ESC            |
| (3) Pin count                          | U: USC, USM, USQ  |
| (4) Chip configuration                 | CR: S-FLAT        |
| S: Single                              | TU: UFM           |
| C: Multiple diodes with common cathode | T: TESQ           |
| P: Parallel-connected diodes           | No suffix: S-Mini |
| L: Symmetrically connected diodes      |                   |
| D: Series-connected diodes             |                   |
| (5) Number per diode type              |                   |

### ● Conventional Series

**1SV\*\*\*\*\*** : Variable-capacitance and PIN diodes  
**1SS\*\*\*\*\*** : Schottky barrier and switching diodes

## MMIC

### ● Radio-Frequency Cell Packs (Bipolar MMIC)

**TA 4029 TU**  
 (1) (2) (3)

**TB 7600 TU**  
 (1) (2) (3)

- |   |
|---|
| (1) Toshiba radio-frequency cell pack (bipolar) |
| (2) Number                                      |
| (3) Package                                     |
| CT: CST8  |
| CTC: CST6C                                      |
| F: SMQ, SMV, SM8                                |
| FE: ESV, ES6                                    |
| FU: USV   |
| TU: UF6   |

### ● Radio-Frequency Cell Packs (CMOS MMIC)

**TCX 4 A 01 WBG**  
 (1) (2) (3) (4) (5)

- |  |
|--|
| (1) Toshiba radio-frequency cell pack (CMOS) |
| (2) Pin count                                |
| (3) Product type                             |
| A: Detector                                  |
| B: Low-NF amp                                |
| (4) Number                                   |
| (5) Package                                  |
| WBG: WCSP4                                   |
| FU: USV                                      |

Right here and now! Toshiba Semiconductor

Web Search

<http://www.semicon.toshiba.co.jp/eng/>

► Web pages by product type



## Easy to Understand

You can search for parts, based on product types, specs, packages and so on.

## Easy to Search

You can find Toshiba's parts functionally equivalent to our competitors' by entering their part number.

## Easy to Use

You can narrow your search, based on functions, characteristics and so on.

**Visible LEDs: High-Brightness LED Lamps (option package) by package**

- Clicking on a part number jumps to the Product Detail page.
- You can also see a list of products by series code.
- You can also see a list of products by standard LED types.

| Series Code | Half value Angle (°) | Part Number | Series Code | Life (hr) | Dimension (mm) | Luminous Intensity (mcd) | Wavelength (nm) | Viewing Angle       |
|-------------|----------------------|-------------|-------------|-----------|----------------|--------------------------|-----------------|---------------------|
| SLV330000   | 60                   | SLV330000   | Yellow      | 500       | 4000           |                          |                 | Half value Angle 7° |
| SLV330000   | 60                   | SLV330000   | Green       | 500       | 4000           |                          |                 |                     |
| SLV330000   | 60                   | SLV330000   | Blue        | 500       | 4000           |                          |                 |                     |
| SLV330000   | 60                   | SLV330000   | Red         | 500       | 4000           |                          |                 |                     |
| SLV330000   | 60                   | SLV330000   | White       | 500       | 4000           |                          |                 |                     |
| SLV330000   | 60                   | SLV330000   | White       | 500       | 4000           |                          |                 |                     |

Product List

**Cross Reference Search: Transistors**

By entering a competitor's device part number, you can find an equivalent part from Toshiba.

► Products: M3T025, Bipolar Transistors, Base Resistor Built-in Transistors (BRT)

**Cross Reference Search:**

Manufacturer: All Manufacturers  
Part Number: NTK3

| Manufacturer     | Manufacturer Part Number | Toshiba Part Number | Category             | Package (Toshiba) | Package |
|------------------|--------------------------|---------------------|----------------------|-------------------|---------|
| ON Semiconductor | 2N3055                   | 2N3055              | Small signal NPN PNP | VS84              | TO18    |
| ON Semiconductor | 2N3055                   | 2N3055              | Small signal NPN PNP | VS84              | TO18    |
| ON Semiconductor | 2N3055                   | 2N3055              | Small signal NPN PNP | VS84              | TO18    |
| ON Semiconductor | 2N3055                   | 2N3055              | Small signal NPN PNP | VS84              | TO18    |
| ON Semiconductor | 2N3055                   | 2N3055              | Small signal NPN PNP | VS84              | TO18    |

Cross-Reference Search

**Parametric Search**

Search for products based on various parameters.

| Part Number | Manufacturer     | Category             | Package | Wavelength | Viewing Angle | Life | Luminous Intensity |
|-------------|------------------|----------------------|---------|------------|---------------|------|--------------------|
| SLV330000   | ON Semiconductor | Small signal NPN PNP | VS84    | Yellow     | 7°            | 500  | 4000               |
| SLV330000   | ON Semiconductor | Small signal NPN PNP | VS84    | Green      | 7°            | 500  | 4000               |
| SLV330000   | ON Semiconductor | Small signal NPN PNP | VS84    | Blue       | 7°            | 500  | 4000               |
| SLV330000   | ON Semiconductor | Small signal NPN PNP | VS84    | Red        | 7°            | 500  | 4000               |
| SLV330000   | ON Semiconductor | Small signal NPN PNP | VS84    | White      | 7°            | 500  | 4000               |

Parametric Search

## ► New and hot products

Our Web site quickly delivers information on new products.



Topics on new products



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