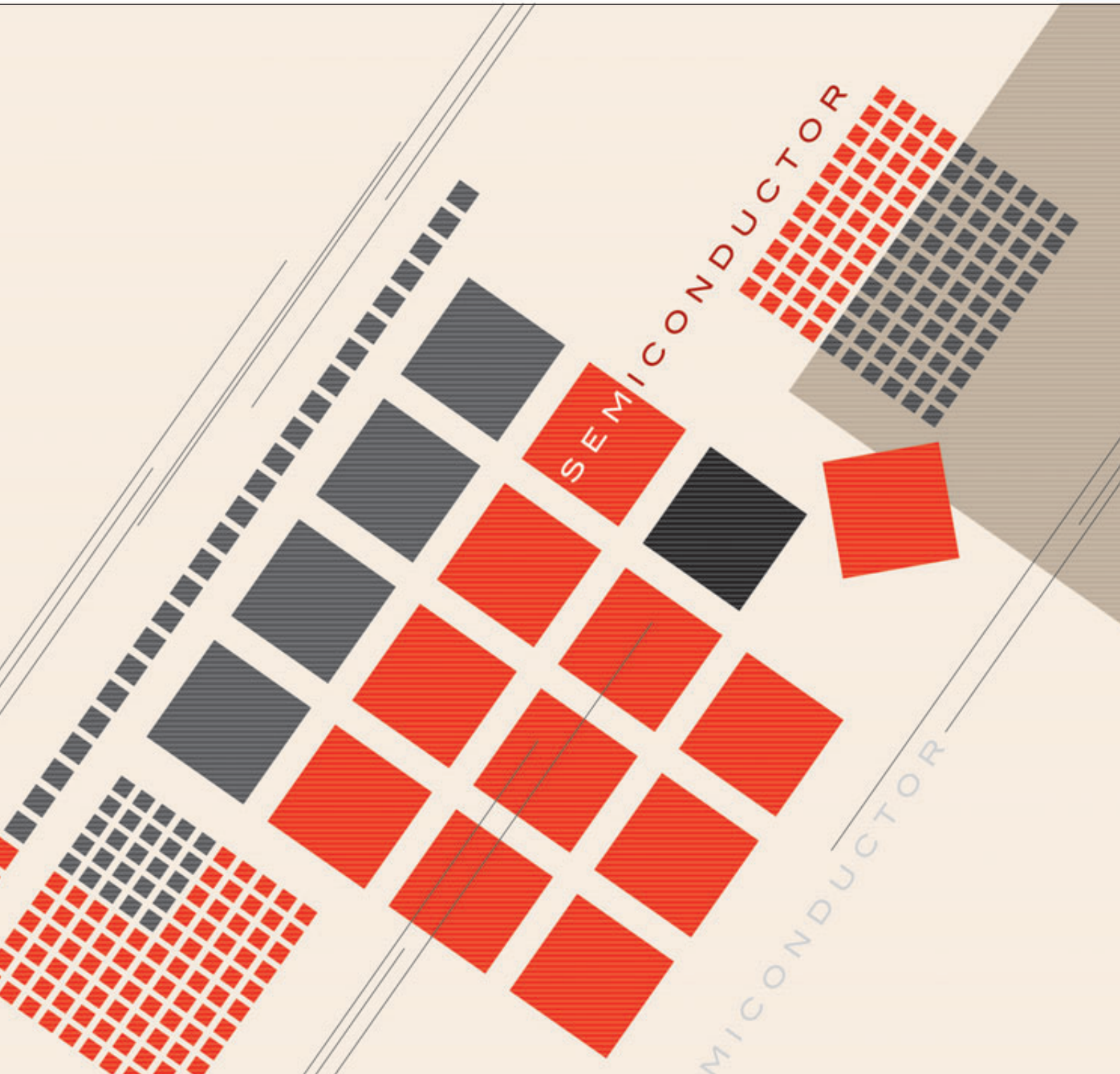


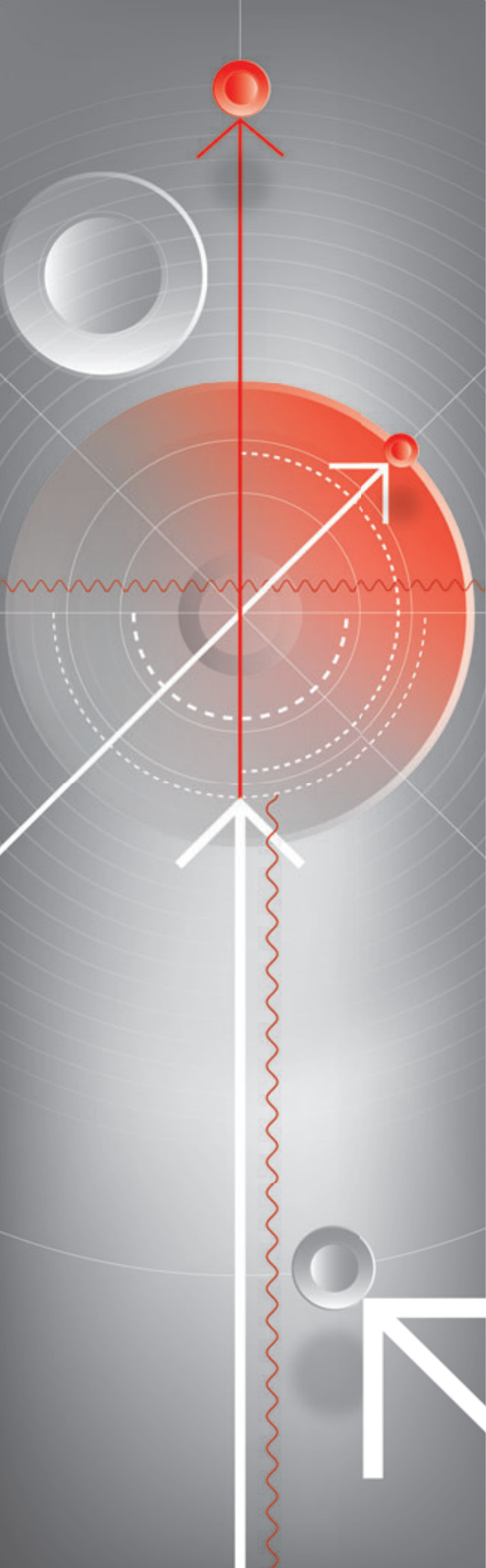
PRODUCT GUIDE

# Radio-Frequency Semiconductors



• SEMICONDUCTOR •

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



# C O N T E N T S

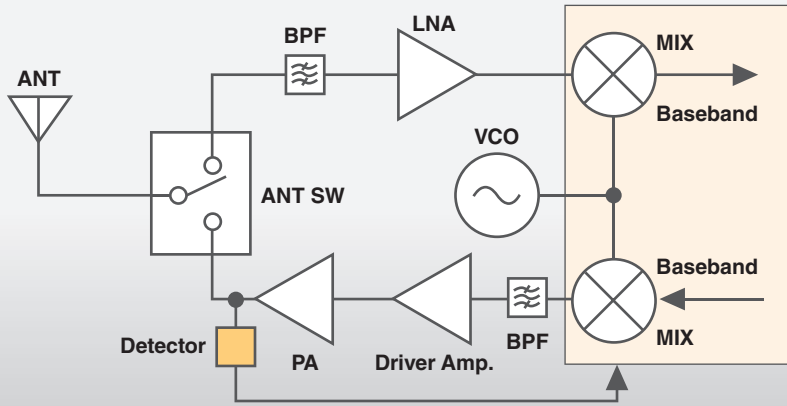
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# 1

# Recommended Products by Application

## 1.1 Cell Phones

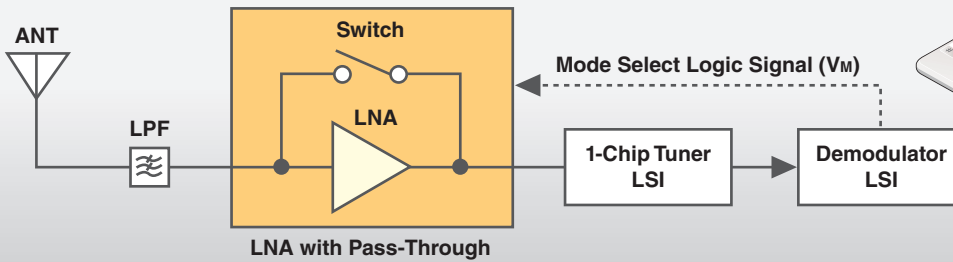
### 800 MHz/2 GHz



Application		Part Number	Package	Feature
Detector	Discrete	JDH2S04FS	fSC	Single Schottky barrier diode
		JDH3D01FV	VESM	Dual Schottky barrier diode
	IC	TCX4A02WBG	WCSP4	-

: New product

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



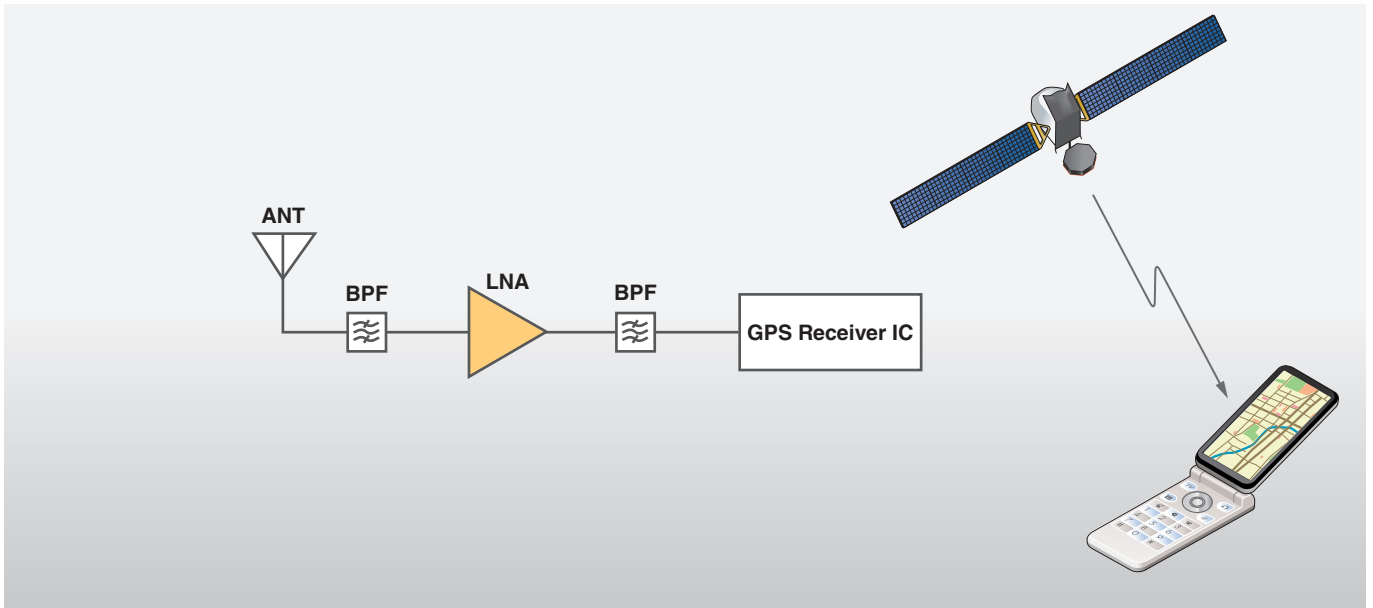
Application	Part Number	Package	Feature
LNAs with Pass-Through	TA4029CTC	CST6C	
	TB7600CTC		Matching circuit; low current
	TB7601CTC		Matching circuit
	TB7602CTC		Matching circuit; low distortion
	TB7603CTC		Variant of the TB7600CTC with modified logic functions
	TB7604CTC		Variant of the TB7601CTC with modified logic functions
	TB7605CTC		Variant of the TB7602CTC with modified logic functions
	TA4029TU	UF6	
	TB7600TU		Matching circuit; low current
	TB7601TU		Matching circuit
	TB7602TU		Matching circuit; low distortion
	TB7603TU		Variant of the TB7600TU with modified logic functions
	TB7604TU		Variant of the TB7601TU with modified logic functions
	TB7605TU		Variant of the TB7602TU with modified logic functions

: New product

# 1

# Recommended Products by Application

## LNAs for GPS Receiver Applications: 1.575 GHz



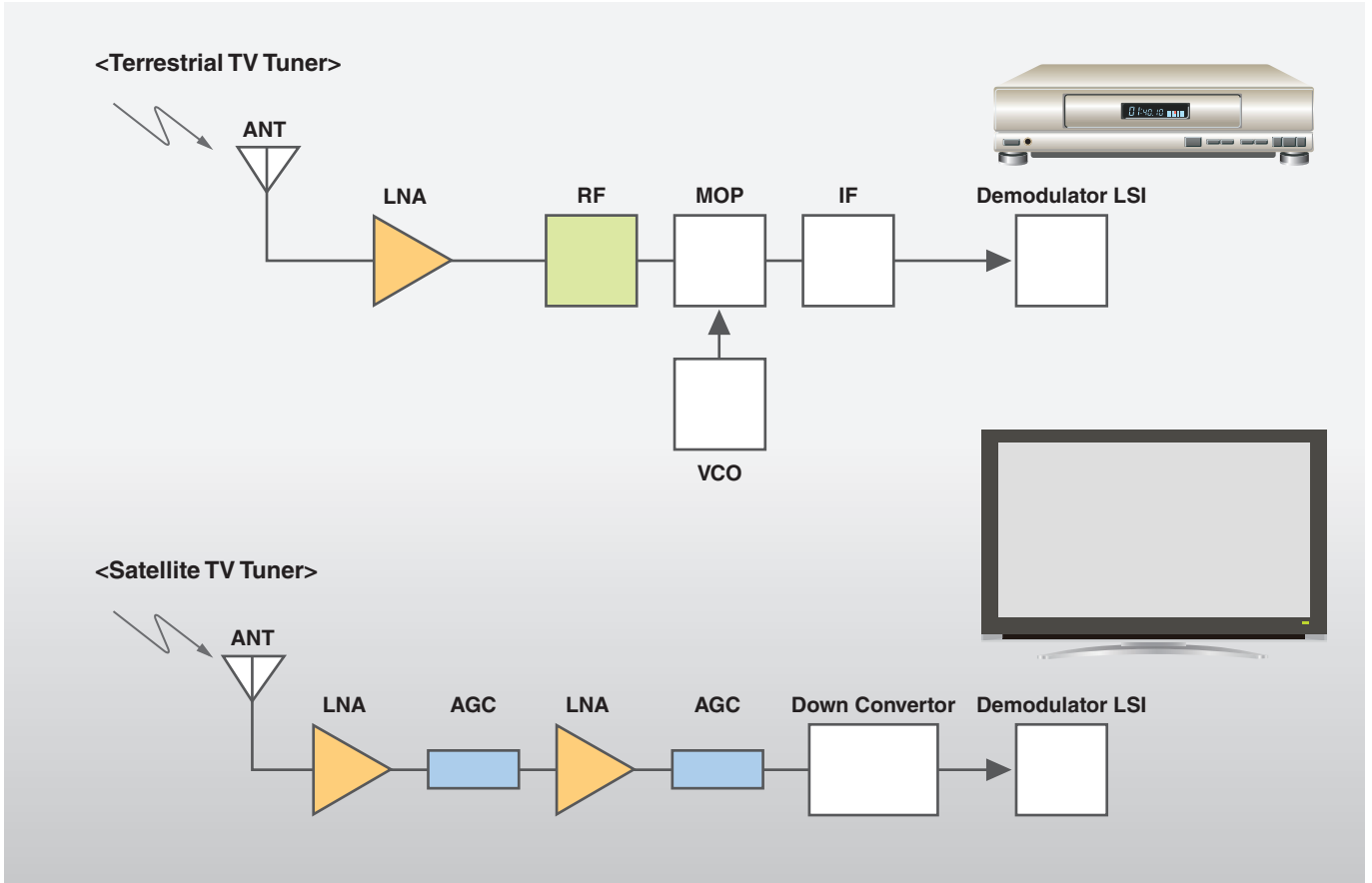
Application		Part Number	Package	Feature
LNA	Discrete	<b>MT4S300T</b>	TESQ	Low NF (0.75 dB); low distortion (OIP3 = 8.7 dBm) @ V <sub>CC</sub> = 1.8 V, I <sub>CC</sub> = 6.2 mA; circuit evaluation
		<b>MT4S300U</b>	USQ	
		<b>MT4S301T</b>	TESQ	Low NF (0.76 dB) @ V <sub>CC</sub> = 1.8 V, I <sub>CC</sub> = 5.2 mA; circuit evaluation
		<b>MT4S301U</b>	USQ	
	MMIC	<b>TA4032FT</b>	TESQ	Low NF (1 dB) @ V <sub>CC</sub> = 3 V, I <sub>CC</sub> = 5 mA
		<b>TA4032CTC</b>	CST6C	Small package

  : New product



## 1.2 TV Tuners

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

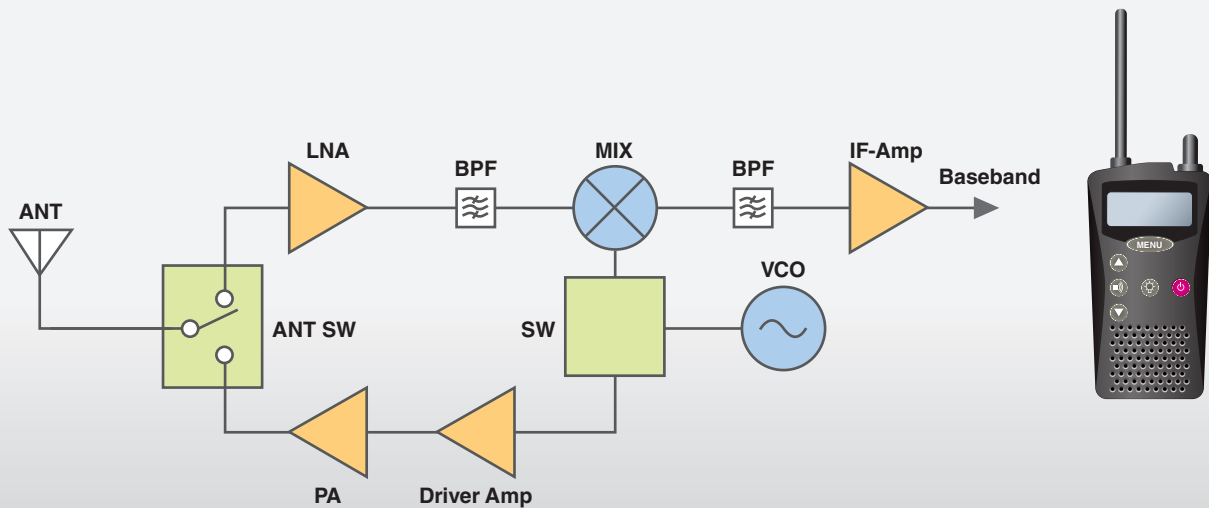


Application	Part Number	Package	Feature	
Terrestrial	MT3S111	S-Mini	Ultra-low NF; low distortion	
	MT3S111TU	UFM	Ultra-low NF; low distortion	
	MT3S111P	PW-Mini	Ultra-low NF; low distortion; high Pc	
	MT3S113	S-Mini	Low NF; ultra-low distortion	
	MT3S113TU	UFM	Low NF; ultra-low distortion	
	MT3S113P	PW-Mini	Low NF; ultra-low distortion; high Pc	
	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 Pc	
	MT3S20TU	UFM	High V <sub>CEO</sub> ; low distortion	
	MT3S20R	SOT-23F	High V <sub>CEO</sub> ; low distortion; high Pc	
	MT3S20P	PW-Mini	High V <sub>CEO</sub> ; low distortion; high Pc	
	MT3S21P	PW-Mini	Low distortion; high Pc	
	MT3S22P	PW-Mini	Low distortion; high Pc	
	Terrestrial	2SC5087	SMQ	High V <sub>CEO</sub> ; high gain; low distortion
2SC5087R		SMR(R)	High V <sub>CEO</sub> ; high gain; low distortion	
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		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	
	JDP2S02AFS	fSC	Low capacitance; high isolation	

: New product

## 1.3 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	RFM08U9X	2SK3074	5.0	9.6
	RFM12U7X	RFM01U7P	5.0-10.0	7.2
	2SK3476		5.0	
GMRS	RFM04U6P	RFM00U7U	3.0	6.0
	2SK3756		1.5-2.0	4.5
FRS	2SK3078A		1.0	
GMRS	RFM03U3CT		0.5	
FRS	RFM04U6P		1.0-2.0	
			0.5	

■ : New product

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

V <sub>CE0</sub> (V)	PW-Mini	SOT-23F	S-Mini	UFM	USQ	SSM	fSM
12	MT3S20P	MT3S20R	2SC5084	MT3S20TU	2SC5088	2SC5086	2SC5086FT
5-6	MT3S21P MT3S22P	MT3S19R	MT3S19	MT3S15TU MT3S19TU	MT4S03BU MT4S23U MT4S24U	-	-

■ : New product

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

Application	SMQ	USQ
VHF	3SK292	3SK294
UHF	3SK291	3SK293

#### ● Diodes

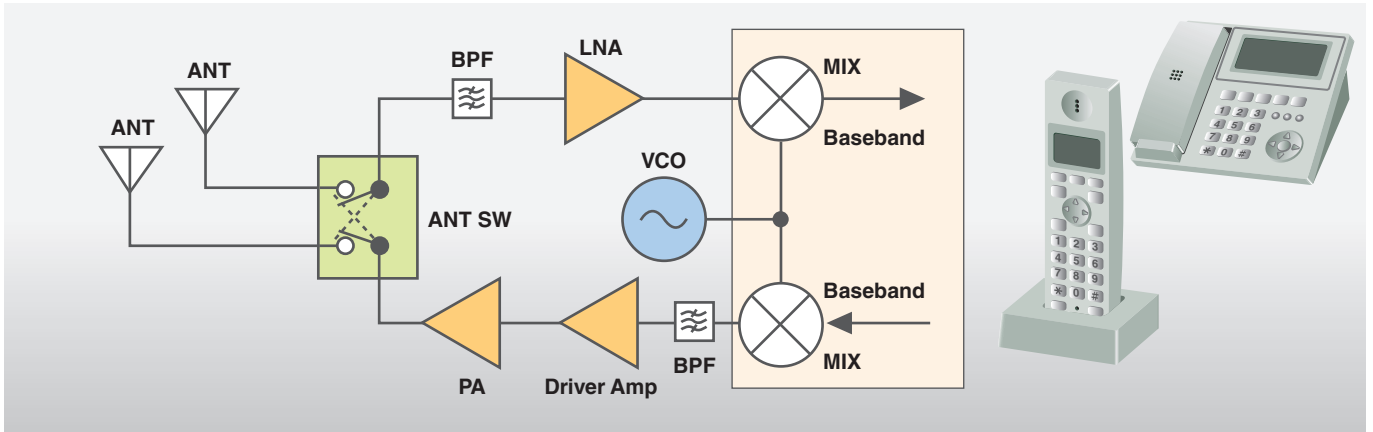
Application	S-FLAT	USC	ESC	fSC
PIN	JDP2S12CR	1SV307	1SV308	JDP2S02AFS
Band SW	-	1SS314	1SS381	-
Varicap	-	1SV214	JDV2S36E	JDV2S41FS

■ : New product



## 1.4 Cordless Phones

900 MHz/1.9 GHz/2.4 GHz/5.8 GHz

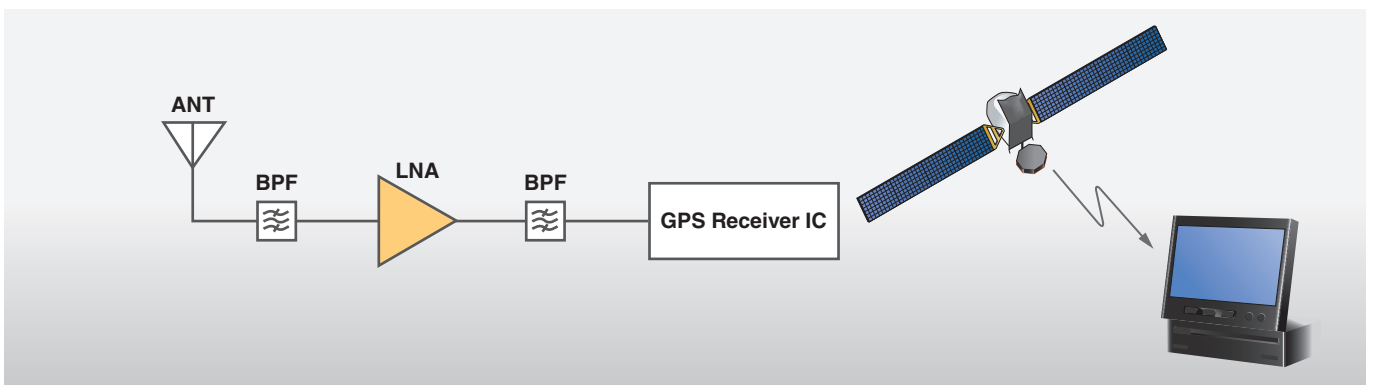


Application	Part Number	Package	Feature
ANT-SW	JDP2S02AFS	fSC	Single
	JDP3C02AU	USM	Dual
PA	MT4S301T	TESQ	High gain; 5.8 GHz capability
	MT4S301U	USQ	
Driver Amp, LNA	MT4S301T	TESQ	High gain; low NF; 5.8-GHz capability
	MT4S301U	USQ	
	MT4S300T	TESQ	Low distortion; low NF
	MT4S300U	USQ	
	MT3S37T	TESM	
	MT3S06S	SSM	Low current
VCO	2SC5086	SSM	High current
	2SC5066		Low current
	JDV2S41FS	fSC	Low resistance

: New product

## 1.5 GPS: Car Navigation, PND

1.575 GHz



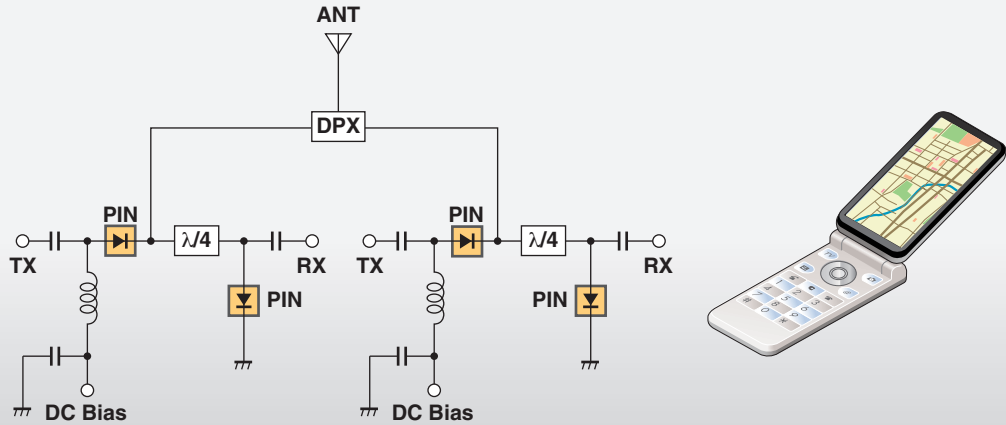
Application	Part Number	Package	Feature	
LNA	MT4S300T	TESQ	Low distortion; low NF	
	MT4S300U	USQ		
	MT4S301T	TESQ	High gain; low NF	
	MT4S301U	USQ		
	MMIC	TA4032FT	TESQ	Low NF (1 dB)@V <sub>cc</sub> = 3 V, I <sub>cc</sub> = 5 mA
		TA4032CTC	CST6C	Small package

: New product

## 1.6 Antenna Switch Modules (ASM)

0.9-2 GHz

<Switch Circuit of Dual-Band ASM>



Application	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, f = 1 MHz	1.0	I <sub>F</sub> = 10 mA, f = 100 MHz
	JDP2S02ACT	CST2					
	JDP2S08SC	SC2	Low resistance	0.32	V <sub>R</sub> = 1 V, f = 1 MHz	1.5	I <sub>F</sub> = 1 mA, f = 100 MHz
	JDP2S05FS	fSC					
	JDP2S05CT	CST2	Low capacitance	0.30	V <sub>R</sub> = 1 V, f = 1 MHz	1.0	I <sub>F</sub> = 10 mA, f = 100 MHz
	JDP2S05SC	SC2					
	JDP4P02AT	TESQ	Low capacitance	0.21	V <sub>R</sub> = 1 V, f = 1 MHz	1.0	I <sub>F</sub> = 10 mA, f = 100 MHz
	JDP4P08CTC	CST4C					
JDP4L08CTC							

  : New product

Toshiba also offers ASMs with four and six 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.

Helps push the limits of circuit performance thanks to excellent characteristics, such as low distortion, low NF and high ESD protection.

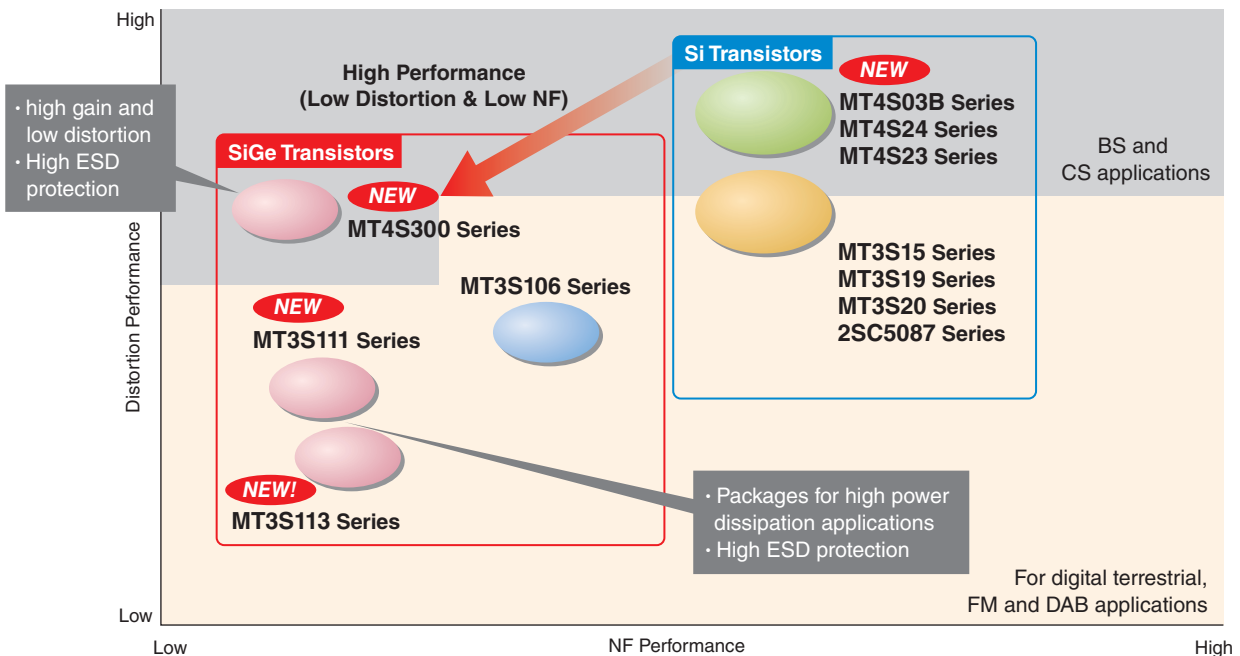
#### 2. Facilitates system design.

Provides great flexibility in circuit design according to the system needs and thus shortens development times.

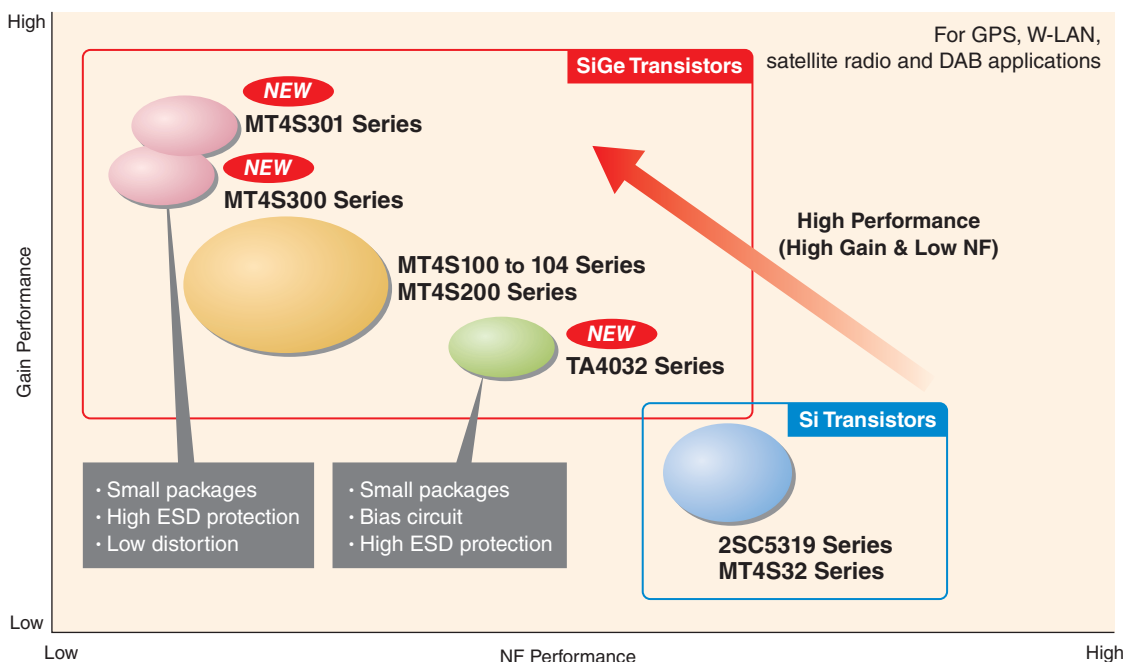
#### 3. Excellent cost performance

Helps reduce system costs, compared to using ICs.

#### ● Distortion Performance vs. NF Performance



#### ● Gain Performance vs. NF Performance



# 2 Transistors

## 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 V <sub>CC</sub> = Up to 10 V	Low distortion, high P <sub>C</sub> and high ESD protection	MT3S20P
			Low distortion, high P <sub>C</sub> and high ESD protection	MT3S20TU
	6 V	V <sub>CC</sub> = 5 V	Low distortion, high P <sub>C</sub> and high ESD protection	MT3S20R
			High P <sub>C</sub>	MT3S20R
			High gain, low distortion and high ESD protection	MT3S21P / MT3S22P
		High P <sub>C</sub>	High gain, low distortion and high ESD protection	MT3S15TU / MT3S19 / MT3S19TU
			High P <sub>C</sub>	MT3S19R
			High P <sub>C</sub>	MT3S19R
SiGe	6 V	V <sub>CC</sub> = 5 V	Low distortion, ultra-low NF, high P <sub>C</sub> and high ESD protection	MT3S111P
			High gain	MT3S111 / MT3S111TU
	5.3 V	V <sub>CC</sub> = 3.3 V V <sub>CC</sub> = 5 V	Ultra-low distortion, low NF, high P <sub>C</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

### Transistors for Low-Noise Amplifier Applications

Applications: GPS systems, cordless phones, W-LAN, satellite radios, DAB systems

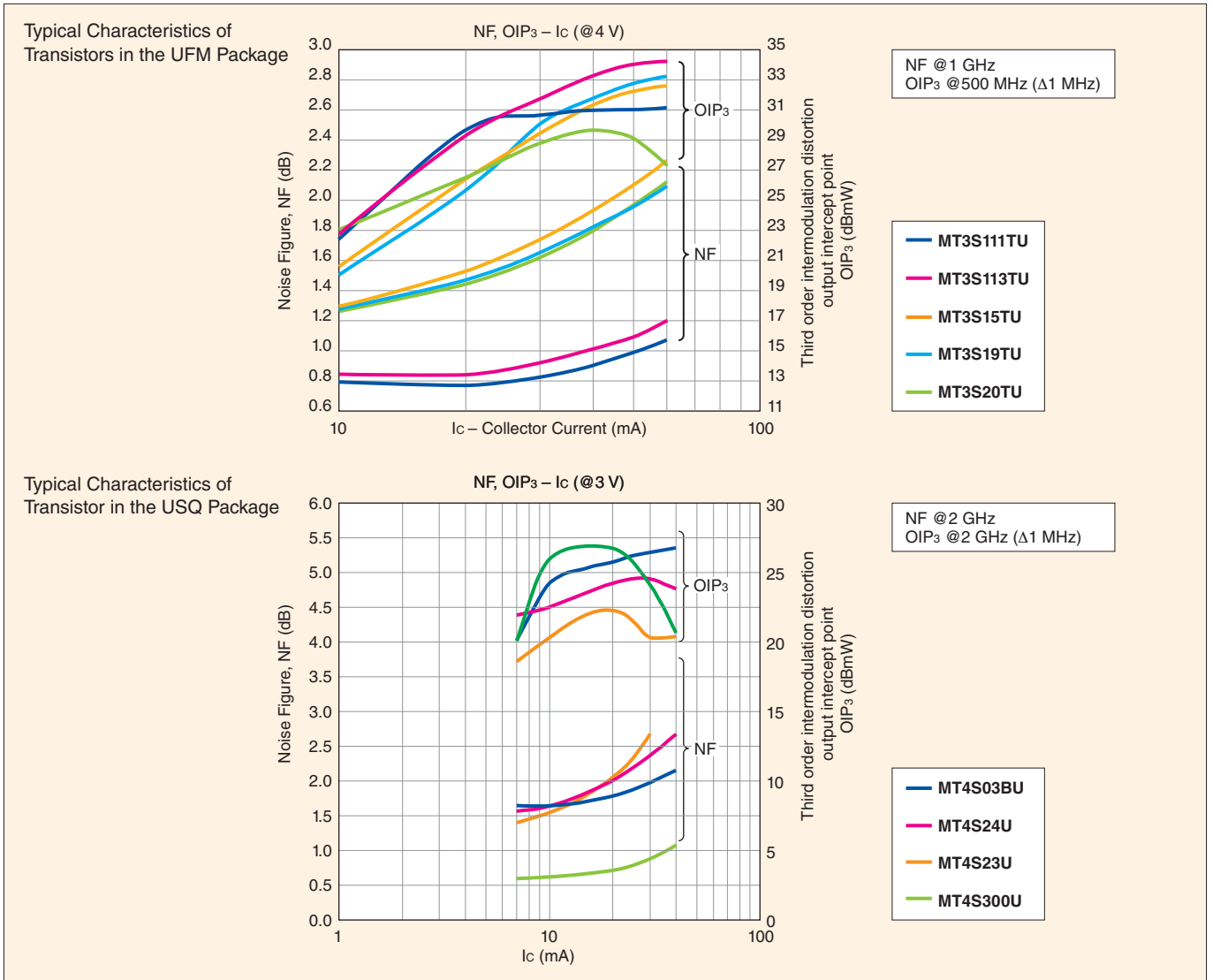
Process	V <sub>CEO</sub>	Supply Voltage	Feature	Recommended Products
SiGe	3 V	V <sub>CC</sub> = Up to 2 V	High gain	MT4S101U / MT4S101T
			High gain, low NF and RF capability	MT4S104U / MT4S104T
			High gain, low NF	MT4S100U / MT4S100T
			Ultra-low NF	MT4S102U / MT4S102T
	4 V	V <sub>CC</sub> = Up to 3 V	High gain and RF capability	MT4S200U / MT4S200T
			High gain, ultra-low NF, RF capability and high ESD protection	MT4S301U / MT4S301T
			High gain, ultra-low NF, low distortion and high ESD protection	MT4S300U / MT4S300T

: New product

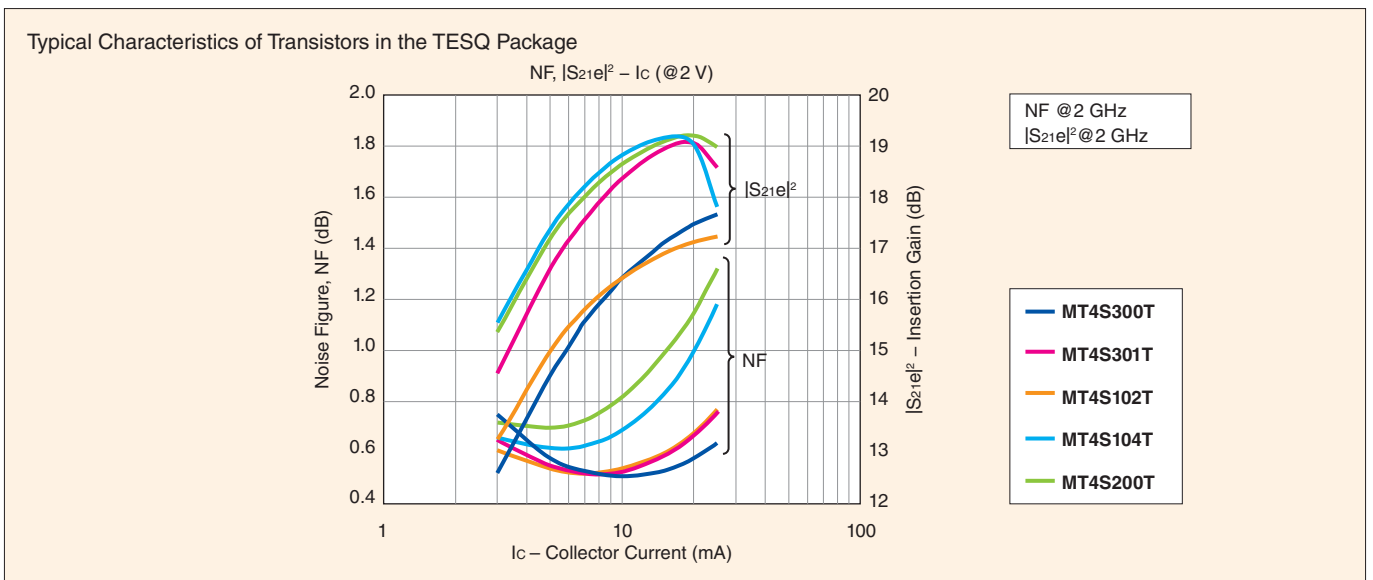


## Performance Characteristics Curves

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



### Transistors for Low-Noise Amplifier Applications





# 2 Transistors

## 2.2 RF-MOSFET

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

### Features

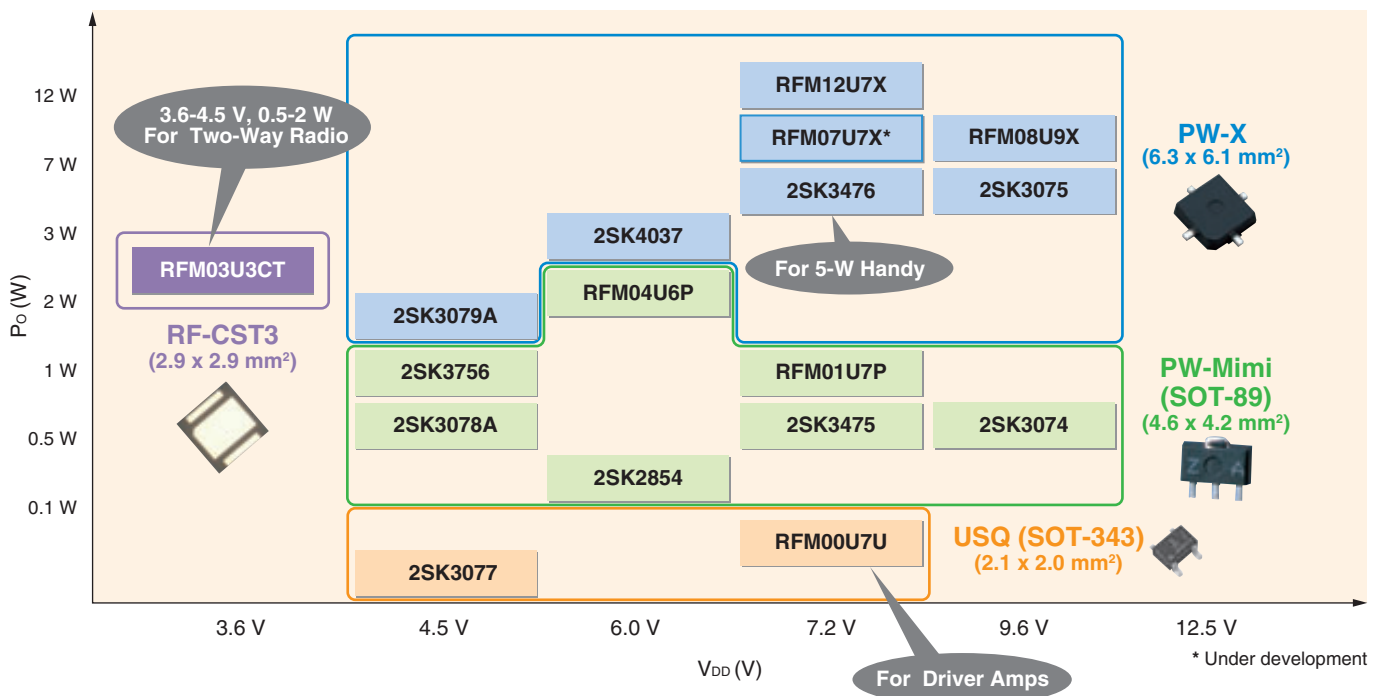
1. Available with output power up to 12 W and supply voltage from 3.6 V to 12.5 V.

All RF-MOSFETs are offered in combination with a driver amp.

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

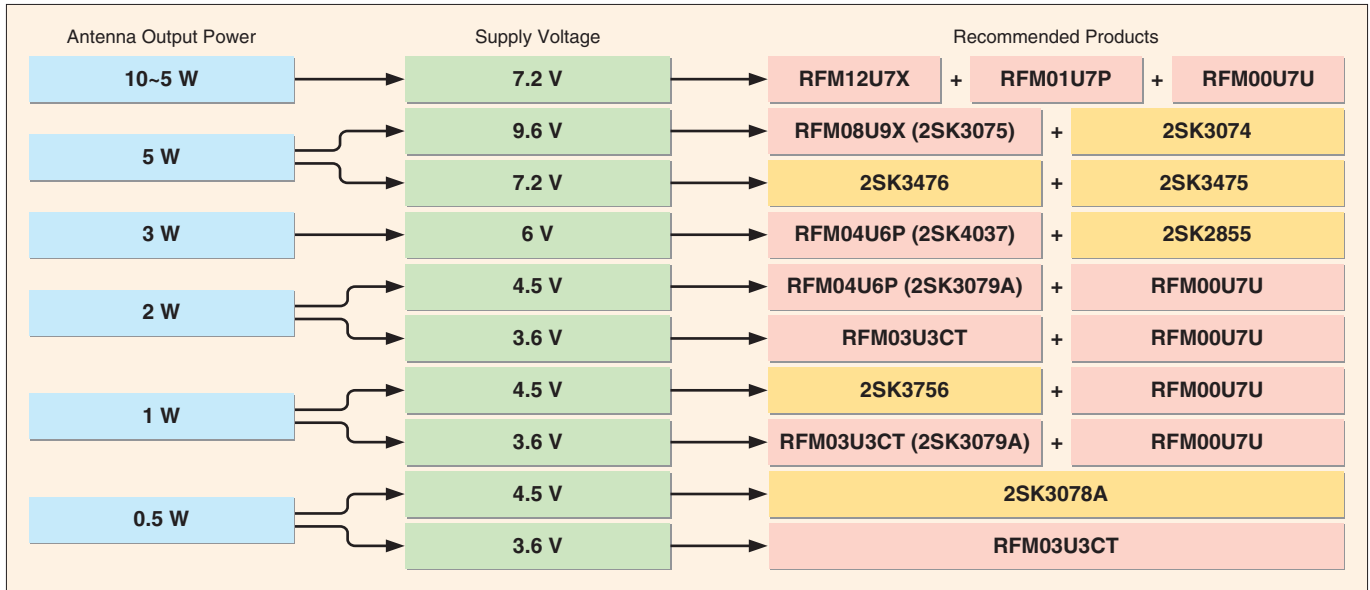
Toshiba's RF-MOSFETs can be used as the final amplifier without damage being a concern.

### RF-MOSFET Lineup





## Selection Guide



## Selection Table

Applications	Part Number	Absolute Maximum Ratings (Tc = 25°C)			Po (W)				Package
		V <sub>BSS</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 Professional radios 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
Driver	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				Y <sub>f</sub> s  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)	(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

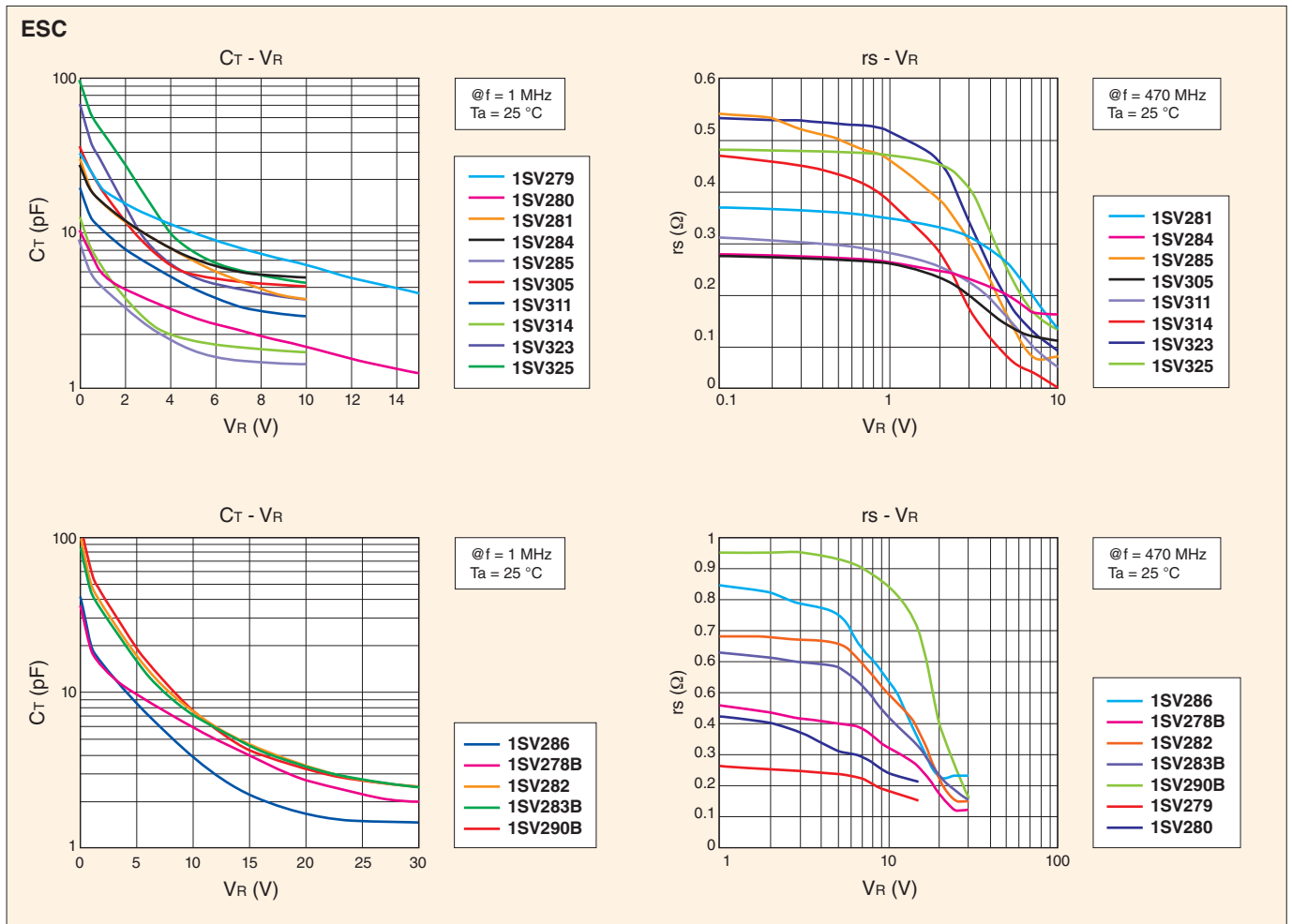
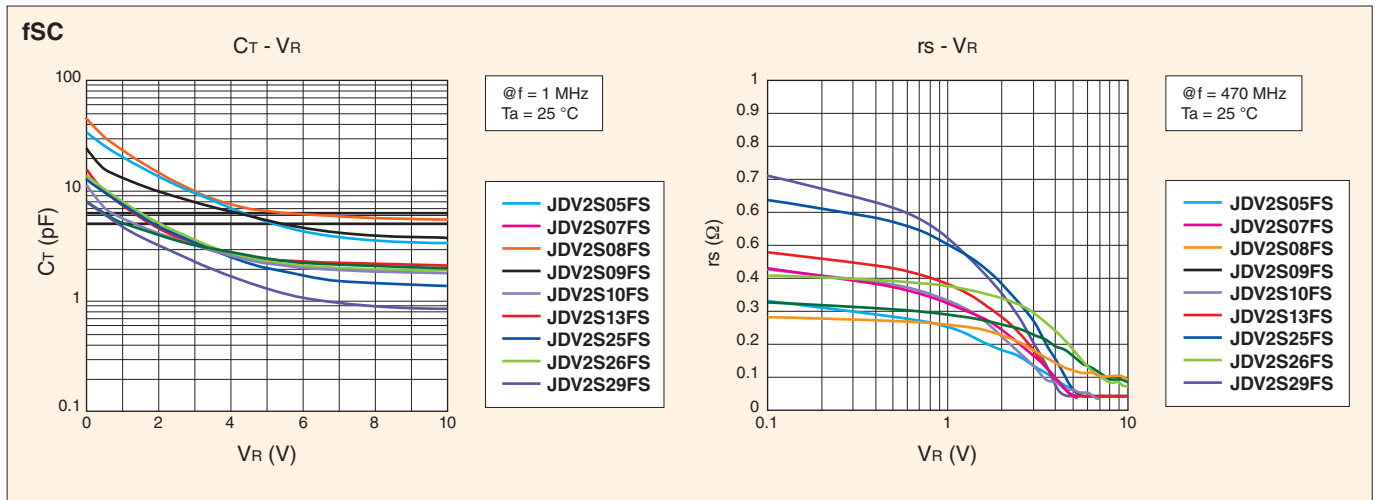
## 3.1 Variable Capacitance Diodes (VCD)

### 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 ultra-small SC2 package (measuring 0.62 mm x 0.32 mm), as well as industry-standard packages such as USC (SOD-323), ESC (SOD-523) and fSC (SOD-923) to meet diverse customer needs.

### Performance Characteristics Curves





## Selection Table

Application	Electrical Characteristics (Ta = 25°C)										SC2	fSC (SOD-923)	ESC (SOD-523)	USC (SOD-323)	CST3	USQ (SOT-343)	S-Mini (SOT-346, SC-59)
	Absolute Maximum Ratings		C <sub>T1</sub> Typ.		C <sub>T2</sub> Typ.		C <sub>T1</sub> /C <sub>T2</sub> Typ.		rs Typ.								
	V <sub>R</sub> (V)		pF	V <sub>R</sub> (V)	pF	V <sub>R</sub> (V)	pF	(Ω)	V <sub>R</sub> (V)	f (MHz)							
VCO	10	44-49.5	1	9.2-12	4	4.3	0.4	4	100				<b>1SV325</b>	<b>1SV324</b>			
	10	44-49.5	1	5.4-7.3	6	7.5	0.4	4	100				<b>JDV2S36E</b>				
	10	26.5-29.5	1	6.0-7.1	4	4.3	0.4	4	100				<b>1SV323</b>	<b>1SV322</b>			
	10	17.3-19.3	1	5.3-6.6	4	3.0	0.27-0.35	1	470		JDV2S08FS	<b>1SV305</b>	<b>1SV304</b>			JDV4P08U	
	10	18	1	4.8	4	3.75	0.45	1	470				<b>1SV331</b>				
	10	16	1	8.0	4	2.0	0.28	1	470				<b>1SV270</b>	<b>1SV281</b>			
	10	16	1	8.0	4	2.0	0.22	1	470				<b>1SV276</b>	<b>1SV284</b>			
	10	15.33-16.31	1	5.25-5.6	4	2.82-3.01	0.36-0.40	1	470	JDV2S26SC	JDV2S26FS				JDV3S26CT		
	15	14-16	2	5.5-6.5	10	2.5	0.2	5	470		<b>JDV2S41FS</b>	<b>1SV279</b>	<b>1SV229</b>				
	10	9.88-10.77	1	4.32-4.93	4	2.13-2.33	0.23	1	470	JDV2S31SC					JDV3S31CT		
	10	9.7-11.1	1	4.45-5.45	4	2.1	0.28-0.33	1	470		JDV2S09FS	<b>1SV311</b>	<b>1SV310</b>				
	10	7.3-8.4	0.5	2.75-3.4	2.5	2.5-2.55	0.35	1	470		JDV2S10FS	<b>1SV314</b>					
	10	7.37	0.5	2.94	2.5	2.51	0.48	1	470	JDV2S38SC							
	10	5.7-6.7	1	1.85-2.45	4	2.8	0.55	1	470		JDV2S13FS	<b>1SV329</b>					
	10	5.57-5.99	1	1.88-2.12	4	2.77-3	0.47-0.49	1	470	JDV2S25SC	JDV2S25FS				JDV3S25CT		
	10	4.5	1	2.0	4	2.3	0.42	1	470		JDV2S07FS	<b>1SV285</b>					
	15	3.8-4.7	2	1.5-2.0	10	2.4	0.44	1	470		JDV2S40FS	<b>1SV280</b>	<b>1SV239</b>				
	10	3.85-4.55	1	1.94-2.48	4	1.9	0.3	1	470		JDV2S05FS	<b>JDV2S05E</b>					
	10	3.54-3.87	1	1.22-1.4	4	2.73-2.92	0.64-0.66	1	470	JDV2S29SC	JDV2S29FS				JDV3S29CT		
	10	3.15	1	1.57	4	2.0	0.5	1	470			<b>JDV2S01E</b>					
TV tuners	30	45.0	2	3.0	25	15	1.05	5	470					<b>1SV231</b>			
	30	45	2	2.8	25	16	0.92	5	470				<b>1SV290B</b>	<b>1SV288</b>			
	34	35.5	2	2.85	25	12.5	0.6	5	470				<b>1SV282</b>	<b>1SV262</b>			
	34	31.5	2	2.75	25	11.5	0.55	5	470				<b>1SV283B</b>	<b>1SV269</b>			
	30	30.3	2	2.9	25	10.5	0.55	5	470					<b>1SV232</b>			
	30	26-32	2	2.5-3.2	25	10.5	0.6	5	470					<b>1SV215</b>			
	30	14.16-16.25	2	2.01-2.43	25	6.5	0.4	5	470				<b>1SV278B</b>	<b>1SV214</b>			
	30	14.5-16.1	2	1.56-1.86	20	8.9	0.73	5	470				<b>1SV286</b>				
	30	6-7.2	1	0.49-0.64	25	11.5	1	5	470				<b>JDV2S71E</b>				
FM tuners	30	3.31-4.55	2	0.61-0.77	25	5.7	1.2	1	470				<b>1SV309</b>	<b>1SV245</b>			
	12	70	2	27	6	2.6	(0.3)	2	100								JDV3C34
	15	30.5	3	12.7	8	2.1-2.6	0.3	3	100								1SV228
	32	19.7	3	7.2	30	2.6-2.9	0.35	3	100								1SV225

: New product



# 3 Diodes

## Carrier Tape Specification for Diode Pairs

### Packing for Paired and Unpaired Diodes

Tape	Packing	Quantity	
		ESC	USC
TPL2	Paired	6400 to 8000	2400 to 3000
TPL3	Unpaired	8000	3000

### Paired Diode Packing Using TPL2

#### Specification

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

Figure 1 Paired Diode Packing Specification Based on Capacitances

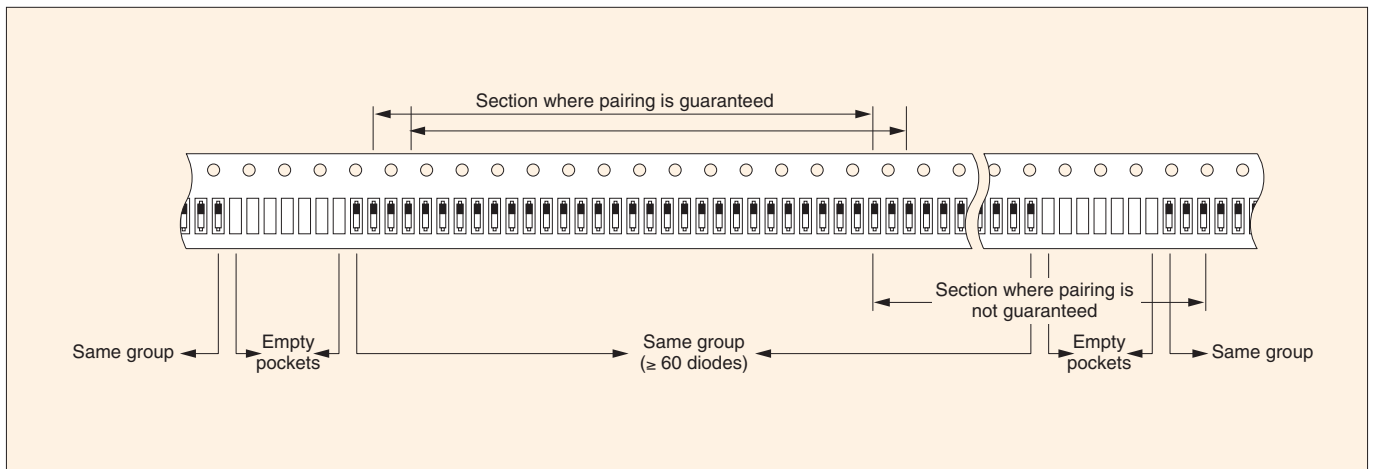


Table 1 Pairing Specification

Item	Tape
Section where pairing is guaranteed	Any 15 consecutive diodes in the same group
Number of diodes per group	$\geq 60$ diodes (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.

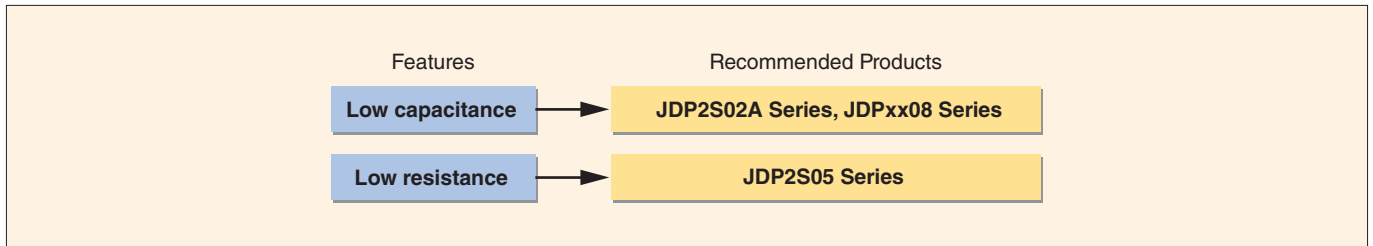


## 3.2 PIN Diodes

### Features

- Ideal for RF switching applications.
- Available in the ultra-small SC2 package (0.62 mm x 0.32 mm) and in single and dual versions to meet customer needs for space-critical applications. Toshiba's portfolio of PIN diodes includes the low-capacitance 08 Series and the low-resistance 05 Series.

### Selection Guide



### Selection Table

Application	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	CST4C	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)										
Low capacitance	30	50	1.00	50	0.21	1	100	1.5	1			1SV308 	1SV307 						
			0.94								JDP2S02ACT 	JDP2S02AFS 				JDP4P02AT 			
			0.98							0.28	1.0	10							JDP3C02AU 
			0.95										JDP2S08SC 				JDP4P08CTC 	JDP4L08CTC 	
Low resistance	20		0.94							JDP2S05CT 	JDP2S05FS 								
			0.95							0.24			JDP2S05SC 						
High power	180	1000	1.00										JDP2S12CR 						

: New product

# 3 Diodes

## 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

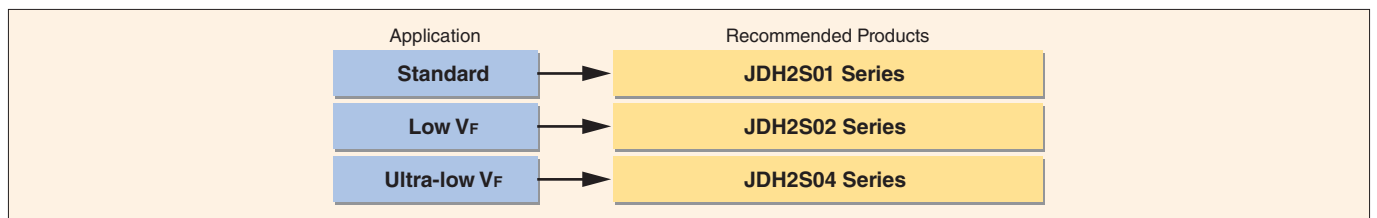
Application	Absolute Maximum Ratings		Electrical Characteristics ( $T_a = 25^\circ\text{C}$ )						ESC (SOD-523)	USC (SOD-323)	SSM (SOT-416,SC-75)	USM (SOT-323,SC-70)	S-Mini (SOT-346,SC-59)	
	$V_R$ (V)	$I_F$ (mA)	$V_F$ Max (V)	$C_T$ Typ. (pF)		$r_s$ Typ. ( $\Omega$ )		$I_F$ (mA)						f (MHz)
				$I_F$ (mA)	$V_R$ (V)	$I_F$ (mA)	f (MHz)							
Single		1.00		0.7		0.5-0.6								
Dual	30	50	0.85	2	0.80-0.85	6	0.6	2	100		1SS364	1SS312 1SS313	1SS268 1SS269	

## 3.4 Schottky Barrier Diodes (SBD)

### Features

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

### Selection Guide



### Selection Table

Application	Absolute Maximum Ratings		Electrical Characteristics ( $T_a=25^\circ\text{C}$ )				SC2	fSC (SOD-923)	USC (SOD-323)	VESM (SOT-723)	SSM (SOT-416,SC-75)	S-Mini (SOT-346,SC-59)
	$V_R$ (V)	$I_F$ (mA)	$V_F$ Max (V)	$C_T$ Typ. (pF)		$V_R$ (V)						
				$I_F$ (mA)	$V_R$ (V)							
Standard	6	30	0.5	10	0.8	0						1SS154 1SS271
	4-5	25-30	0.25	2	0.6	0.2	JDH2S01FS	1SS315	JDH3D01FV	JDH3D01S	1SS295	
Low $V_F$	10	10	0.24	1	0.4	0.2	JDH2S02SC	JDH2S02FS				
Ultra-low $V_F$			0.18				JDH2S04FS					

 : New product

## 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. Saves board space.

Toshiba's MMICs incorporate peripheral circuits such as bias and matching circuits on the same chip.

They are offered in small packages to save board space and thus help reduce the size of products such as mobile devices.

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

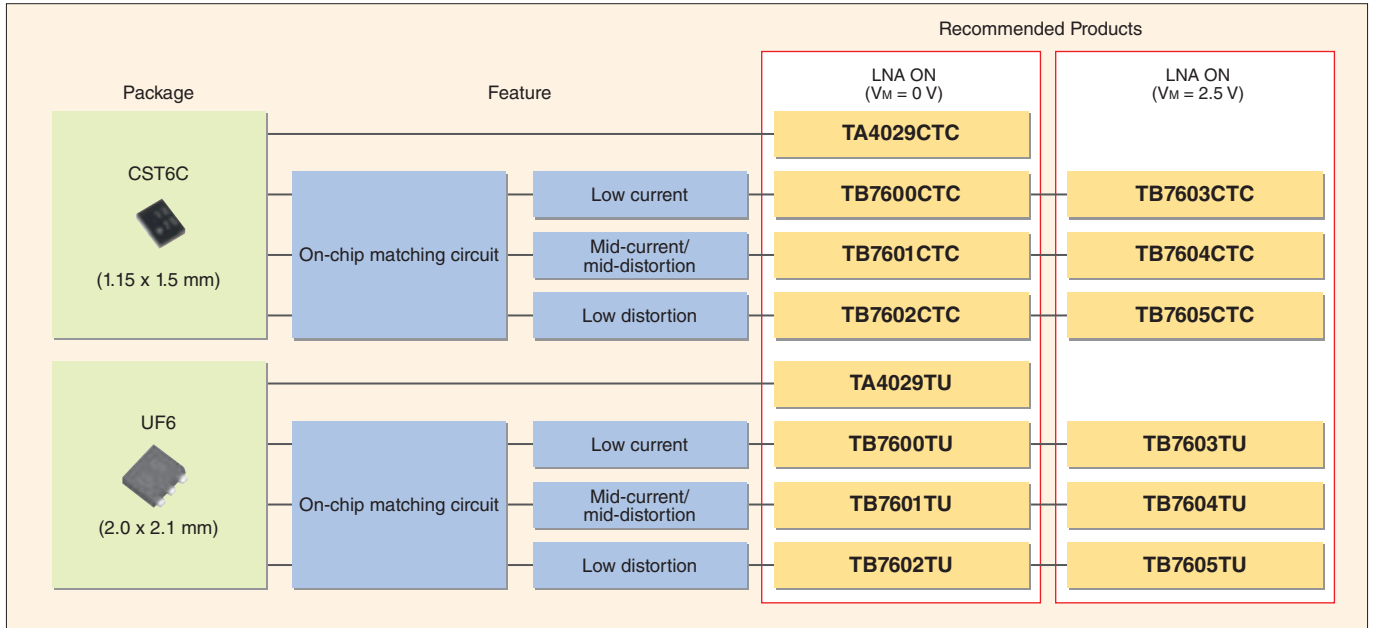
For optimum performance, bias conditions are preprogrammed, reducing the workload of system designers. Toshiba's MMICs provide excellent matching with upstream and downstream components.

#### 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)



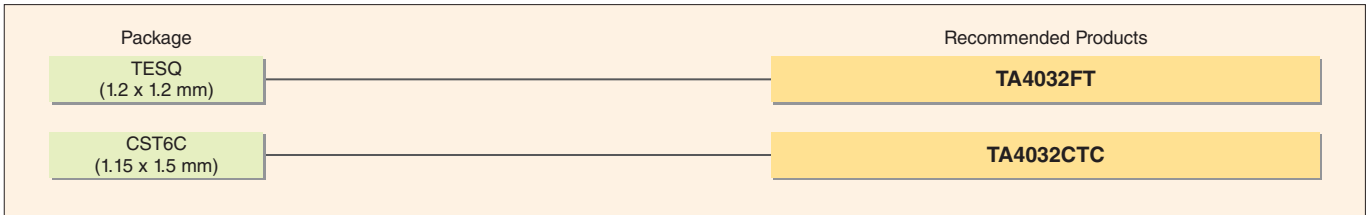
### Selection Table

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	Gain (1) (dB)	NF (dB)	Icc (mA)	Gain (2) (dB)	Condition		Package
								freq.(MHz)	Vcc (V)	
VHF/UHF amp TV tuner amp	50 to 1000	TA4029CTC	2.5	13.0	1.2	4.0	-2.0	1000	2.5	CST6C
		TA4029TU								UF6
		TB7600CTC	2.5	12.0	1.7	2.7	-2.5	1000	2.5	CST6C
		TB7600TU								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
		TB7603CTC	2.5	12.0	1.7	2.7	-2.5	1000	2.5	CST6C
		TB7603TU								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

: New product

## Selection Guide

### LNA (Up to 3 GHz)



## Selection Table

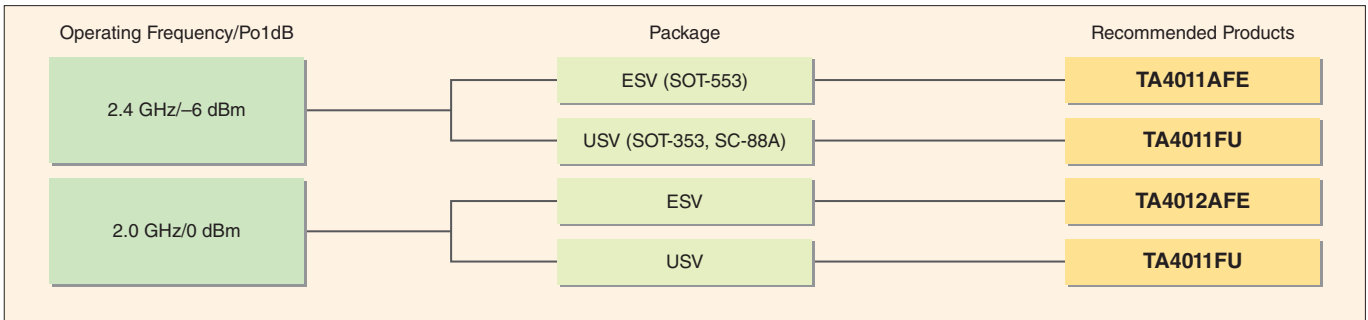
Typical, Ta = 25°C

Application	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, W-LAN amp	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

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	Bandwidth (GHz)	I <sub>cc</sub> Typ. (mA)	Po (dBmW)	Condition		Package	
							freq. (MHz)	V <sub>cc</sub> (V)		
VHF/UHF amp	Up to 1300	TA4000F	5	1.3	12	-2	400	5	SM6(SOT-26,SC-74)	
	Up to 2400	TA4001F	5	2.4	18	2	500	5	SMQ(SOT-24,SC-61)	
	Up to 1300	TA4002F	5	1.3	14	5	500	5	SMQ(SOT-24,SC-61)	
	Up to 1000	TA4004F	2	1.2	3.1	0	500	2	SMV(SOT-25,SC74A)	
			5	1	12.5	8	500	5		
	Up to 2400	TA4011AFE	2	2.4	3.5	-6@Po1dB	1500	1500	2	ESV(SOT-553)
		TA4011FU								USV(SOT-353,SC-88A)
	Up to 2000	TA4012AFE	2	2.0	6.5	0@Po1dB	1500	1500	2	ESV(SOT-553)
TA4012FU		USV(SOT-353,SC-88A)								

### Mixers

Typical, Ta = 25°C

Application	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)	Condition		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

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	C.Gain (dB)	NF (dB)	I <sub>cc</sub> (mA)	IIP <sub>3</sub> (dBmW)	Condition		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)



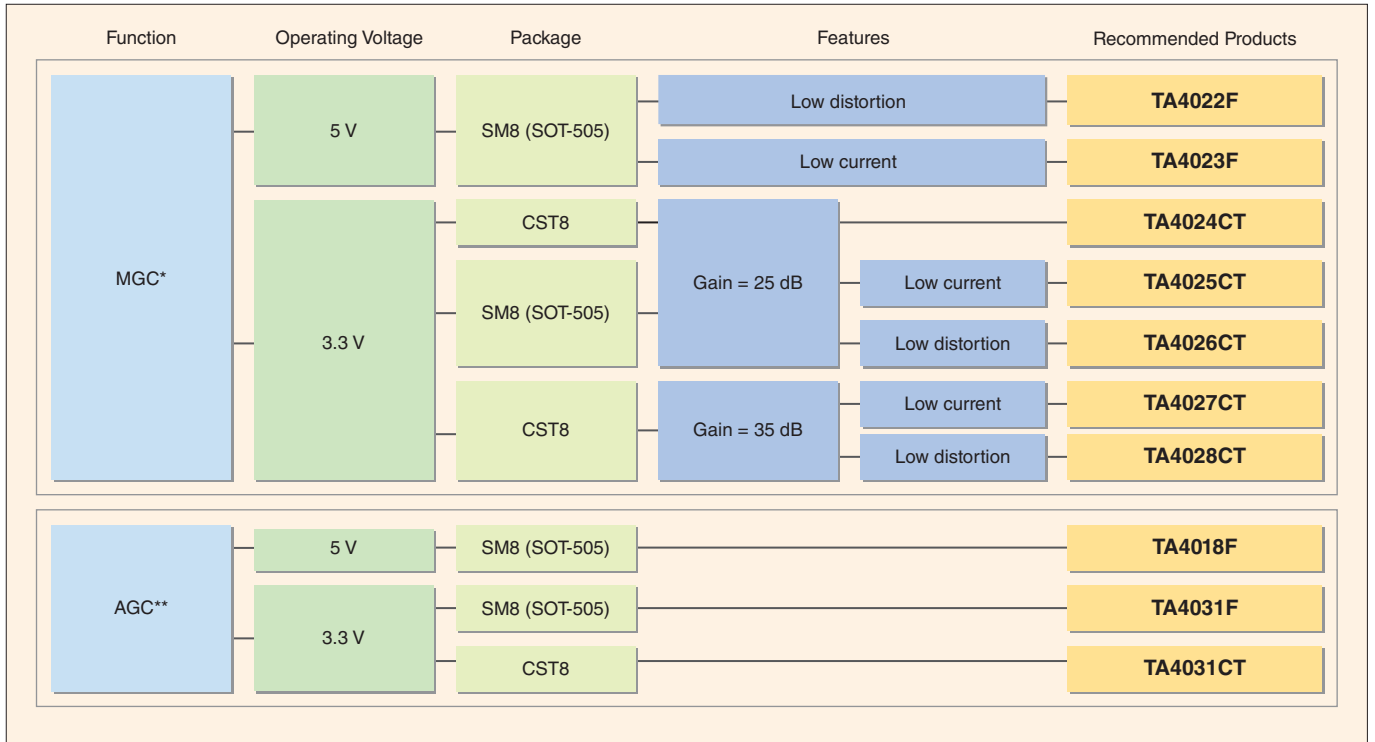
● TCXO, VCXO

Typical, Ta = 25°C

Application	Part Number	Operating Voltage (V)	I <sub>cc</sub> (mA)	V <sub>OSCB</sub> (V)	V <sub>OSCE</sub> (V)	V <sub>BUFFB</sub> (V)	V <sub>BUFFB</sub> (V)	Condition	Package
								V <sub>CC</sub> (V)	
TCXO, VCXO	<b>TA4014FE</b>	3	1.27	1.51	0.79	2.29	2.26	3	<b>ES6(SOT-563)</b>
	<b>TA4015FE</b>	3	1.32	1.71	0.99	2.28	2.02	3	<b>ES6(SOT-563)</b>

■ Selection Guide

● VHF Differential Amps (10 to 100 MHz)



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

■ Selection Table

Typical, Ta = 25°C

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	Gain (1) (dB)	Gain (2) (dB)	I <sub>cc</sub> (mA)	IM3 (dBc)	Condition		Package
								freq. (MHz)	V <sub>CC</sub> (V)	
VHF amp TV tuner IF amp	10 to 100	<b>TA4022F</b>	5	19.0	10.0	35	58	45	5	<b>SM8 (SOT-505)</b>
		<b>TA4023F</b>	5	28.0	9.0	28	51	45	5	<b>SM8 (SOT-505)</b>
		<b>TA4024CT</b>	3.3	26.0	16.0	26	53	45	3.3	<b>CST8</b>
		<b>TA4025CT</b>	3.3	25.0	15.0	21	52	45	3.3	<b>CST8</b>
		<b>TA4026CT</b>	3.3	26.0	16.0	35	54	45	3.3	<b>CST8</b>
		<b>TA4027CT</b>	3.3	34.5	25.0	23	55	45	3.3	<b>CST8</b>
		<b>TA4028CT</b>	3.3	34.5	25.0	14	55	45	3.3	<b>CST8</b>
		<b>TA4031F</b>	3.3	49.0	-4.0	35	54	45	3.3	<b>SM8 (SOT-505)</b>
		<b>TA4031CT</b>	3.3	49.0	-4.0	35	54	45	3.3	<b>CST8</b>

  : New product

Typical, Ta = 25°C

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	S <sub>21</sub>   <sup>2</sup> (1) (dB)	S <sub>21</sub>   <sup>2</sup> (2) (dB)	I <sub>cc</sub> Typ. (mA)	IM3 (dB)	Condition		Package
								freq. (MHz)	V <sub>CC</sub> (V)	
CATV, IF amp	45	<b>TA4018F</b>	5	111.0	-26.0	28	42	45	5	<b>SM8(SOT-505)</b>
		<b>TA4019F</b>	5	30.0	10.5	35	53	45	5	<b>SM8(SOT-505)</b>

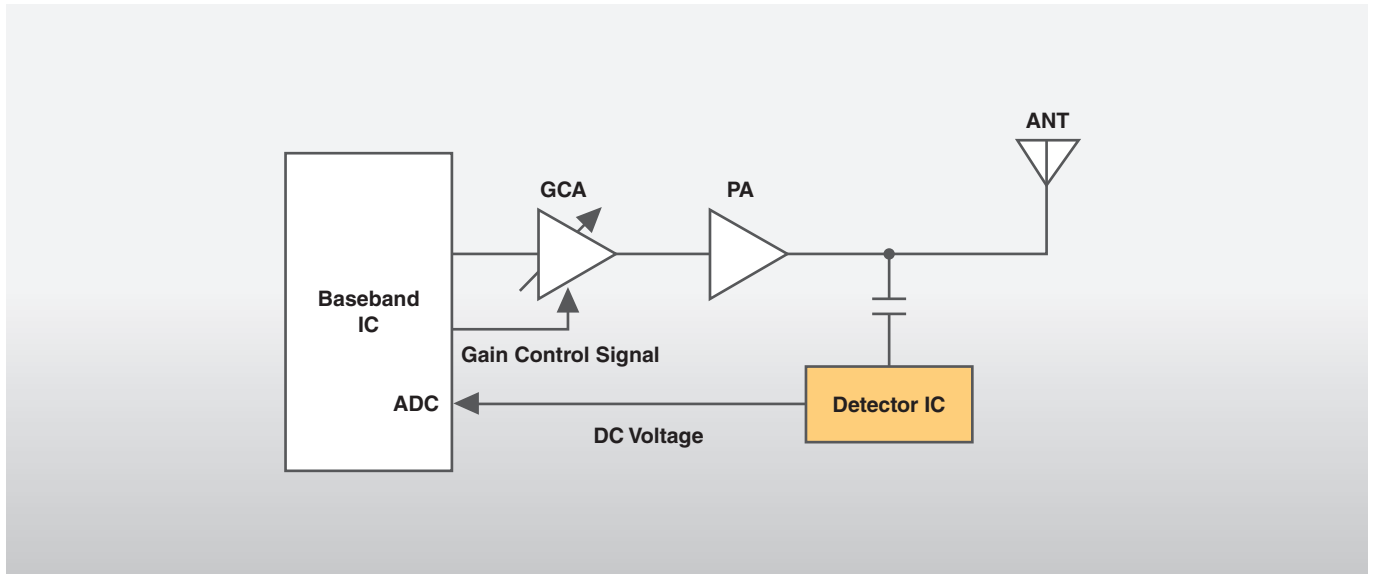


## 4.2 Detector IC

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.

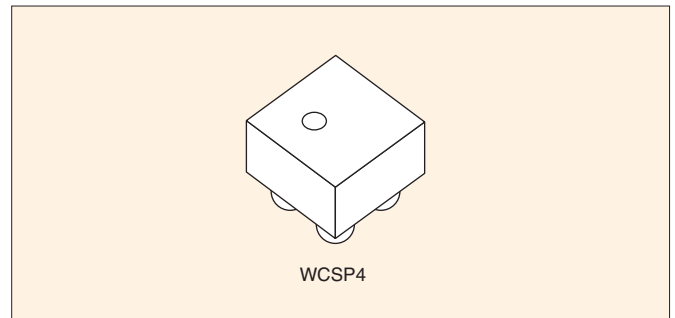
### ● Block Diagram of a Cell Phone Transmitter



### ■ 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

Application	Operating Frequency (MHz)	Part Number	Operating Voltage (V)	Typical Conv. Gain (mV/dB)	I <sub>cc</sub> Typ. (mA)	Input Return Loss (dB)	Condition		Package
							freq. (MHz)	V <sub>cc</sub> (V)	
RF power detection	700 to 2000	<b>TCX4A02WBG</b>	2.8	85	0.34	14	900	2.8	<b>WCSP4</b>

Ta = 25°C

: New product

# 5 Package Dimensions


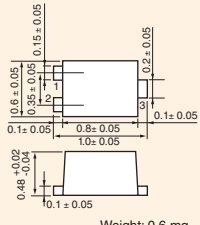
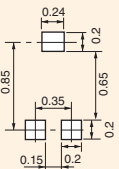
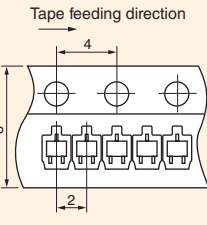
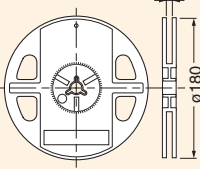

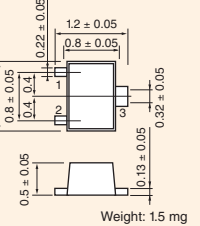
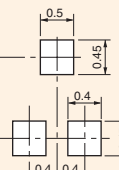
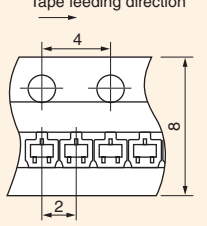
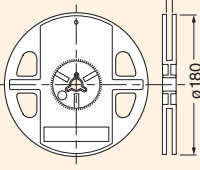

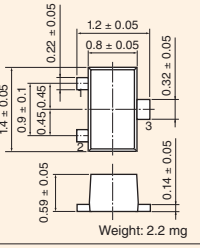
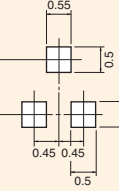
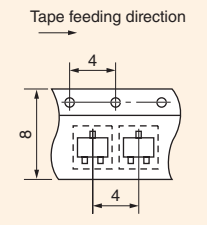
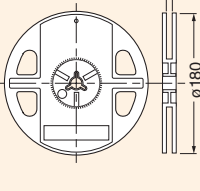

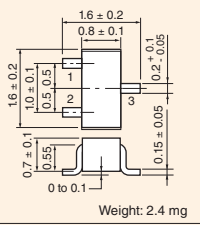
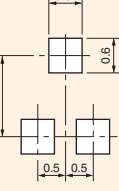
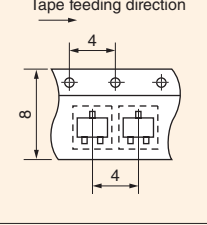
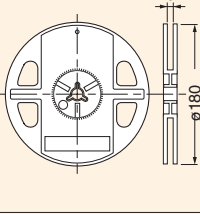

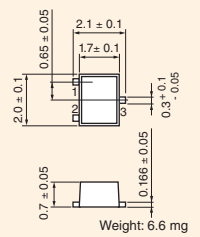
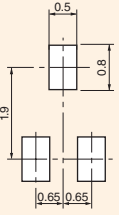
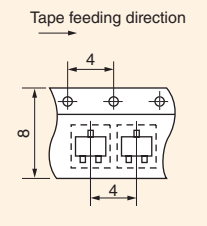
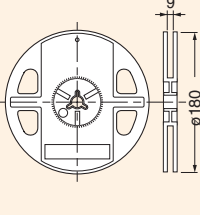

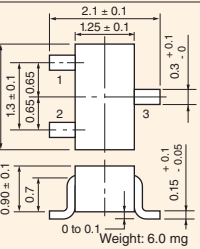
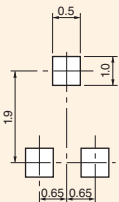
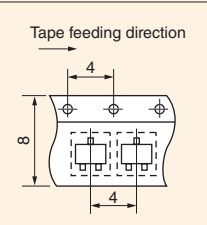
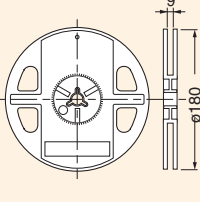

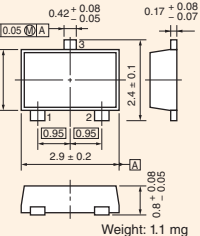
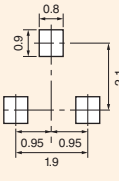
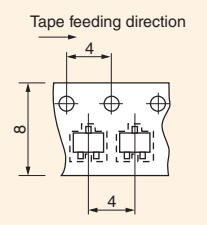
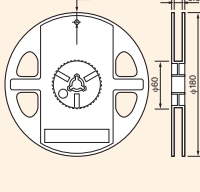


Toshiba Package Name	Package		Land Pattern* Dimensions Unit: mm	Standard Tape Packing Specifications		
	Appearance	Dimensions Unit: mm		Tape Type	Tape Dimensions Unit: mm	Reel Dimension Unit: mm
<b>SC2</b>		 0.32 ± 0.03 0.3 ± 0.03 0.62 ± 0.03 0.19 ± 0.02 0.27 ± 0.02 0.025 ± 0.015 0.19 ± 0.02 0.025 ± 0.015 0.338 0.025 ± 0.015 (Bottom View) Weight: 0.17 mg	 0.4 0.32 0.21 ± 0.02 0.21 ± 0.02	<b>TPL3</b>	 Tape feeding direction 8.0 3.5 ± 0.05 4.0 ± 0.05 2.0 ± 0.05	 9 ø180
Packing quantity 10000/reel						
<b>CST2 (SOD-882)</b>		 0.05 0.5 ± 0.05 0.4 ± 0.05 1.0 ± 0.05 0.25 ± 0.05 0.6 ± 0.05 (Bottom View) 0.38 ± 0.05 Weight: 0.7 mg	 0.65 0.6 0.35 ± 0.3 0.35 ± 0.3	<b>TPL3</b>	 Tape feeding direction 4 8 2	 9 ø180
Packing quantity 10000/reel						
<b>fSC (SOD-923)</b>		 0.6 ± 0.05 0.1 0.8 ± 0.05 1.0 ± 0.05 0.2 ± 0.05 0.1 ± 0.05 0.07 0.48 ± 0.05 Weight: 0.6 mg	 0.85 0.26 0.21	<b>TPL3</b>	 Tape feeding direction 4 8 2	 9 ø180
Packing quantity 10000/reel						
<b>ESC (SOD-523)</b>		 0.6 ± 0.1 0.2 1.2 ± 0.1 1.6 ± 0.1 0.3 ± 0.05 0.2 0.13 ± 0.05 0.8 ± 0.1 Weight: 1.4 mg	 1.7 0.8 0.6	<b>TPL3</b>	 Tape feeding direction 4 8 2	 9 ø180
Packing quantity 8000/reel						
<b>USC (SOD-323)</b>		 1.25 ± 0.2 0.1 1.7 ± 0.2 2.5 ± 0.2 0 ± 0.05 0.3 ± 0.1 0.15 ± 0.06 0.9 ± 0.2 0.9 ± 0.1 Weight: 4.5 mg	 2.3 0.9 0.8	<b>TPH3</b>	 Tape feeding direction 4 8 4	 9 ø180
Packing quantity 3000/reel						
<b>S-FLAT</b>		 1.6 ± 0.2 0.1 0.9 ± 0.1 2.6 ± 0.1 3.5 ± 0.2 0.65 ± 0.2 0.16 ± 0.05 0.99 ± 0.1 0.10 ± 0.1 Weight: 13 mg	 1.2 1.2 2.8	<b>TE85L</b>	 Tape feeding direction 4 8 4 19	 9 ø180
Packing quantity 3000/reel						
<b>CST3</b>		 0.6 ± 0.05 0.5 ± 0.03 1.0 ± 0.05 0.65 ± 0.02 0.35 ± 0.02 0.05 ± 0.03 0.15 ± 0.03 0.25 ± 0.03 0.25 ± 0.03 0.05 ± 0.03 (Bottom View) 0.38 ± 0.03 0.38 ± 0.03 Weight: 0.75 mg	 0.6 0.65 0.38 0.35 ± 0.3 0.35 ± 0.3 0.16 0.22	<b>TPL3</b>	 Tape feeding direction 4 8 2	 9 ø180
Packing quantity 10000/reel						

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



# 5 Package Dimensions

Toshiba Package Name	Package		Land Pattern* Dimensions Unit: mm	Standard Tape Packing Specifications		
	Appearance	Dimensions Unit: mm		Tape Type	Tape Dimensions Unit: mm	Tape Dimensions Unit: mm
<b>fSM</b>		 Weight: 0.6 mg		<b>TPL3</b>		
Packing quantity 10000/reel						
<b>VESM (SOT-723)</b>		 Weight: 1.5 mg		<b>TPL3</b>		
Packing quantity 8000/reel						
<b>TESM</b>		 Weight: 2.2 mg		<b>TE85L</b>		
Packing quantity 4000/reel						
<b>SSM (SOT-416) (SC-75)</b>		 Weight: 2.4 mg		<b>TE85L</b>		
Packing quantity 3000/reel						
<b>UFM</b>		 Weight: 6.6 mg		<b>TE85L</b>		
Packing quantity 3000/reel						
<b>USM (SOT-323) (SC-70)</b>		 Weight: 6.0 mg		<b>TE85L</b>		
Packing quantity 3000/reel						
<b>SOT-23F</b>		 Weight: 1.1 mg		<b>TE85L</b>		
Packing quantity 3000/reel						


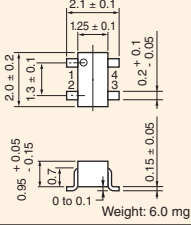
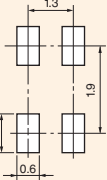
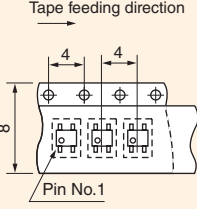
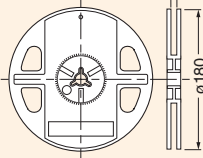

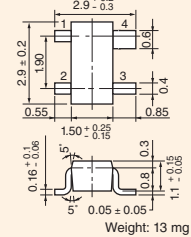
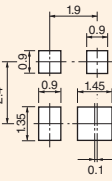
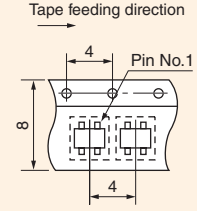
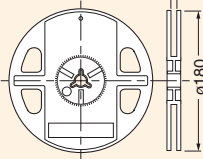

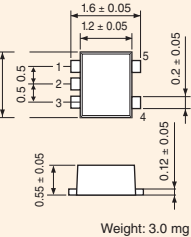
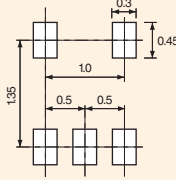
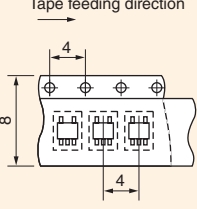
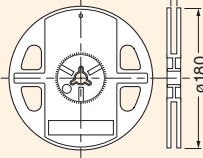

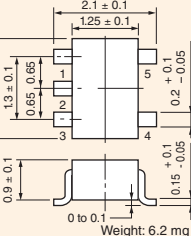
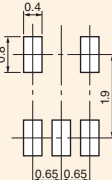
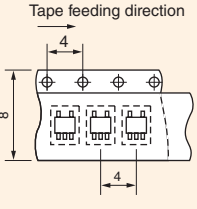
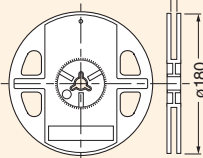

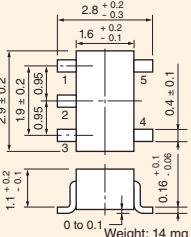
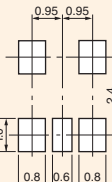
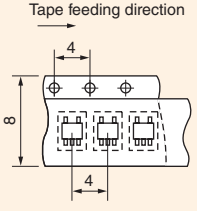
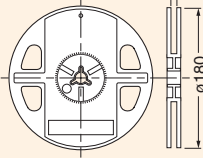

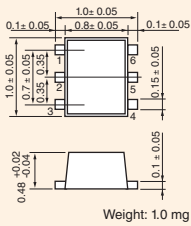
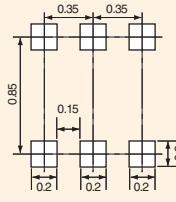
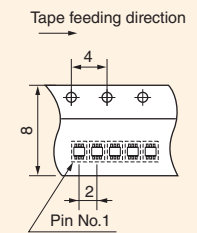
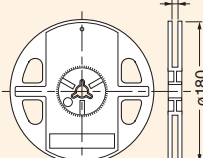

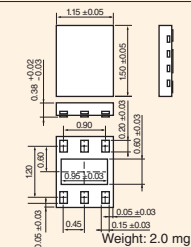
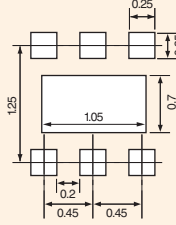
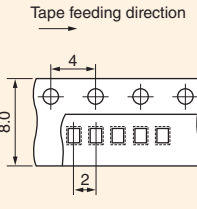
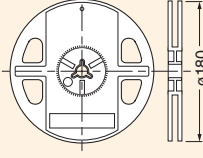
\* For reference only. Land pattern dimensions should be determined empirically.



Toshiba Package Name	Package		Land Pattern* Dimensions Unit: mm	Standard Tape Packing Specifications		
	Appearance	Dimensions Unit: mm		Tape Type	Tape Dimensions Unit: mm	Reel Dimension Unit: mm
<b>S-Mini</b> (SOT-346) (SC-59)		 2.5 +0.5/-0.3 1.5 +0.25/-0.16 2.9 ± 0.2 0.8 ± 0.1 0.4 ± 0.05 1.1 ± 0.2 0 to 0.1 Weight: 12 mg	 0.8 1.0 2.4 0.95 0.95	<b>TE85L</b>	 Tape feeding direction 4 8 4	 9 ø180
Packing quantity 3000/reel						
<b>RF-CST3</b>		 2.9 ± 0.1 2.9 ± 0.1 0.48 ± 0.05 Weight: 12 mg	 1.61 0.295 0.3 2.4 1.9	<b>TE12L</b>	 4 12 4	 13 ø180
Packing quantity 1000/reel						
<b>PW-Mini</b>		 4.6 max 1.7 max 0.4 ± 0.05 1.6 max 0.4 ± 0.05 4.2 max 0.8 min (2.5 ± 0.1) 0.45 ± 0.08 0.4 ± 0.08 1.5 ± 0.1 1.5 ± 0.1 Weight: 50 mg	 2.2 0.8 45° 3.7 1.5 1.8 1.0	<b>TE12L</b>	 4 12 8	 13 ø180
Packing quantity 1000/reel						
<b>PW-X</b>		 6.3 ± 0.2 4.7 ± 0.2 0.5 ± 0.1 1.2 ± 0.2 0.6 ± 0.2 4.5 ± 0.2 6.1 ± 0.2 1.04 ± 0.07 1.5 ± 0.2 Weight: 80 mg	 6.7 3.9 0.8 1.1 1.15 1.9	<b>TE12L</b>	 4 12 8	 13 ø180
Packing quantity 1000/reel						
<b>WCSP4</b>		 INDEX 0.03 S A 0.79 0.79 0.22 ± 0.03 0.195 0.25 ± 0.03 0.05 S 0.2 S 0.25 ± 0.03 0.03 S B 0.25 ± 0.03 0.195 0.25 ± 0.03 0.03 S A B Weight: 0.7 mg	 0.75 0.45 0.35 0.25	<b>TE85L</b>	 4 8	 9 ø180
Packing quantity 3000/reel						
<b>CST4C</b>		 1.20 ± 0.05 0.80 ± 0.05 0.38 ± 0.02 0.35 ± 0.02 0.45 ± 0.02 0.75 ± 0.02 0.25 ± 0.02 Weight: 1.1 mg	 0.45 0.75 0.25 0.35	<b>TPL3</b>	 Tape feeding direction 4 8 2	 9 ø180
Packing quantity 10000/reel						
<b>TESQ</b>		 1.2 ± 0.05 0.9 ± 0.05 0.8 ± 0.05 0.2 ± 0.05 0.52 ± 0.05 0.12 ± 0.05 Weight: 1.5 mg	 0.95 0.8 0.3 0.35	<b>TE85L</b>	 Tape feeding direction 4 8 Pin No.1	 9 ø180
Packing quantity 4000/reel						


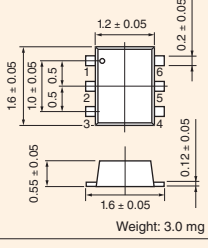
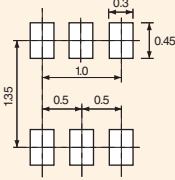
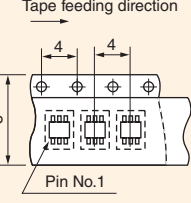
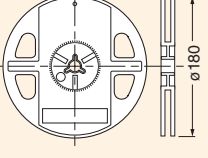

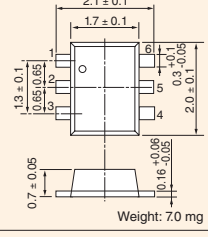
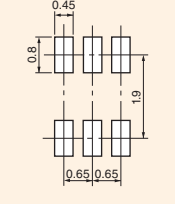
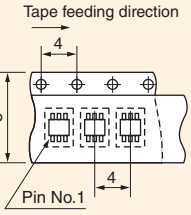
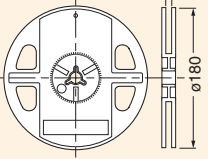

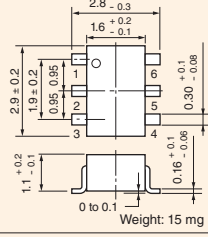
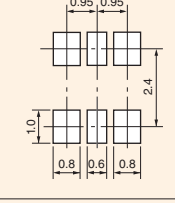
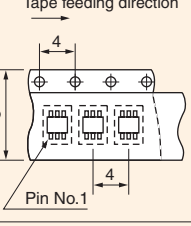
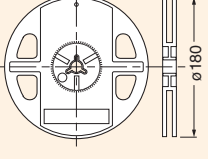

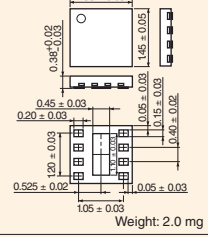
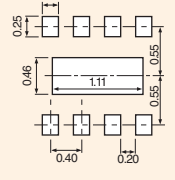
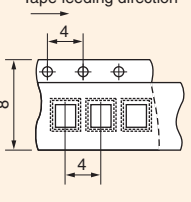
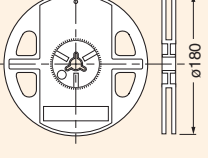

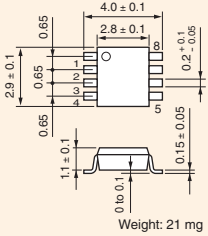
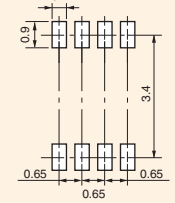
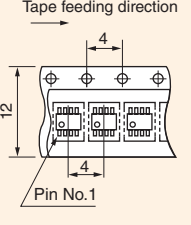
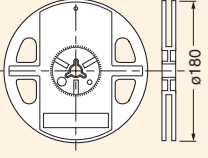
\* For reference only. Land pattern dimensions should be determined empirically.

# 5 Package Dimensions

Toshiba Package Name	Package		Land Pattern* Dimensions Unit: mm	Standard Tape Packing Specifications		
	Appearance	Dimensions Unit: mm		Tape Type	Tape Dimensions Unit: mm	Reel Dimension Unit: mm
<b>USQ</b> (SOT-343)		 Weight: 6.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>SMQ</b> (SOT-24) (SC-61)		 Weight: 13 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>ESV</b> (SOT-553)		 Weight: 3.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 4000/reel						
<b>USV</b> (SOT-353) (SC-88A)		 Weight: 6.2 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>SMV</b> (SOT-25) (SC-74A)		 Weight: 14 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>fS6</b> (SOT-963)		 Weight: 1.0 mg		<b>TPL3</b>	 Pin No.1	
Packing quantity 10000/reel						
<b>CST6C</b>		 Weight: 2.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 10000/reel						

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



Toshiba Package Name	Package		Land Pattern* Dimensions Unit: mm	Standard Tape Packing Specifications		
	Appearance	Dimensions Unit: mm		Tape Type	Tape Dimensions Unit: mm	Reel Dimension Unit: mm
<b>ES6</b> (SOT-563)		 Weight: 3.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 4000/reel						
<b>UF6</b>		 Weight: 7.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>SM6</b> (SOT-26) (SC-74)		 Weight: 15 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 3000/reel						
<b>CST8</b>		 Weight: 2.0 mg		<b>TE85L</b>	 Pin No.1	
Packing quantity 5000/reel						
<b>SM8</b> (SOT-505)		 Weight: 21 mg		<b>TE12L</b>	 Pin No.1	
Packing quantity 3000/reel						

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

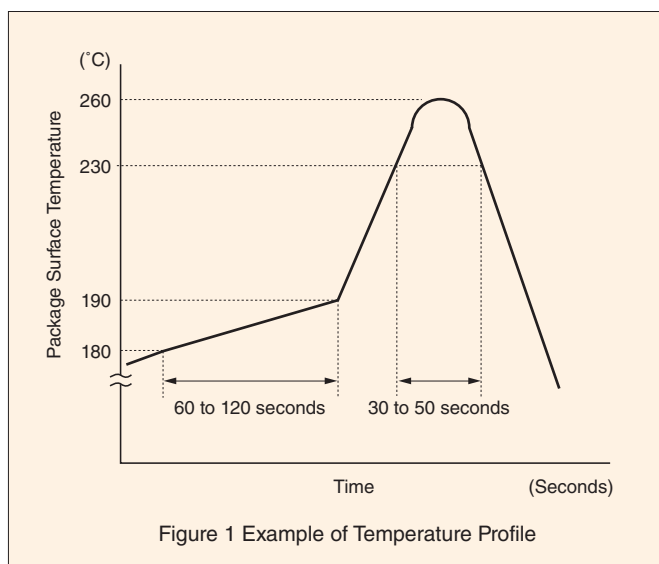
## Soldering Temperature Profile

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                  |
|   | CT: CST3, CST6              |
|   | R: SOT-23F                  |
| (4) Number                                    | 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 (MMIC bipolar)

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

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

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

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

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

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

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