

Diodes

Tuner Applications



UFP	URP	MPAK

Varicap

Diode Samples in this Kit:

- HVU 202B
- HVC 202B
- HVU 300B
- HVC 300B
- HVU 306B
- HVC 306B
- HVU 363B
- HVC 363B
- HVU 12
- HVC 316
- HNC 317B
- HVM 15

PIN

Diode Samples in this Kit:

- HSU 277
- HSC 277
- HSM 2692
- HSM 2693A
- HSM 2694
- HVM 187WS
- HVU 187
- HVM 14S
- HVB 14S
- HVM 14

Tune your Circuits

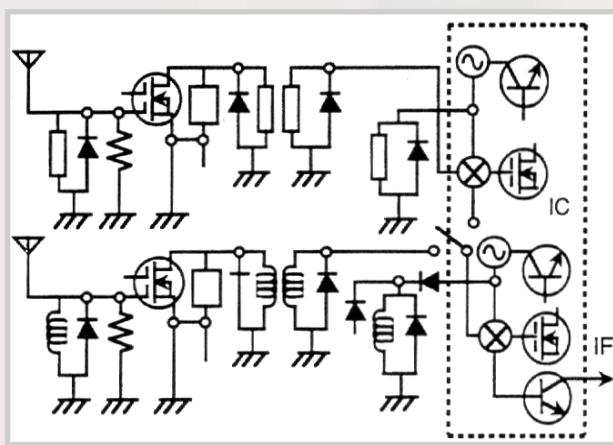
Hitachi's range of Varicap and PIN Diodes addresses the needs of today's tuner development engineers. A unique process and a special taping system have made our Varicap and PIN Diodes one of the most popular choices for European VCO tuner designs.

Varicap Diode's Key Features:

- ◊ Small Industry Standard Packages SOD 323 / SOD 523
- ◊ Low Temperature Process (LT) :
 - ◆ Wide Tuning Range
 - ◆ Improved Linearity
 - ◆ Higher $\Delta C/C$
 - ◆ Low Noise
- ◊ Continuous Connected Taping System (C.C.)
 - ◆ Save Manufacturing Time
 - ◆ Excellent Tuner Tracking Characteristics
 - ◆ Easy Grouping in Tuners

PIN Diode's Key Features:

- ◊ Single and Dual Diode Configuration
- ◊ Small Industry Standard Packages
- ◊ Low Noise
- ◊ Low Current for Longer Battery Life
- ◊ Low Loss
- ◊ High Isolation
- ◊ Fast Switching





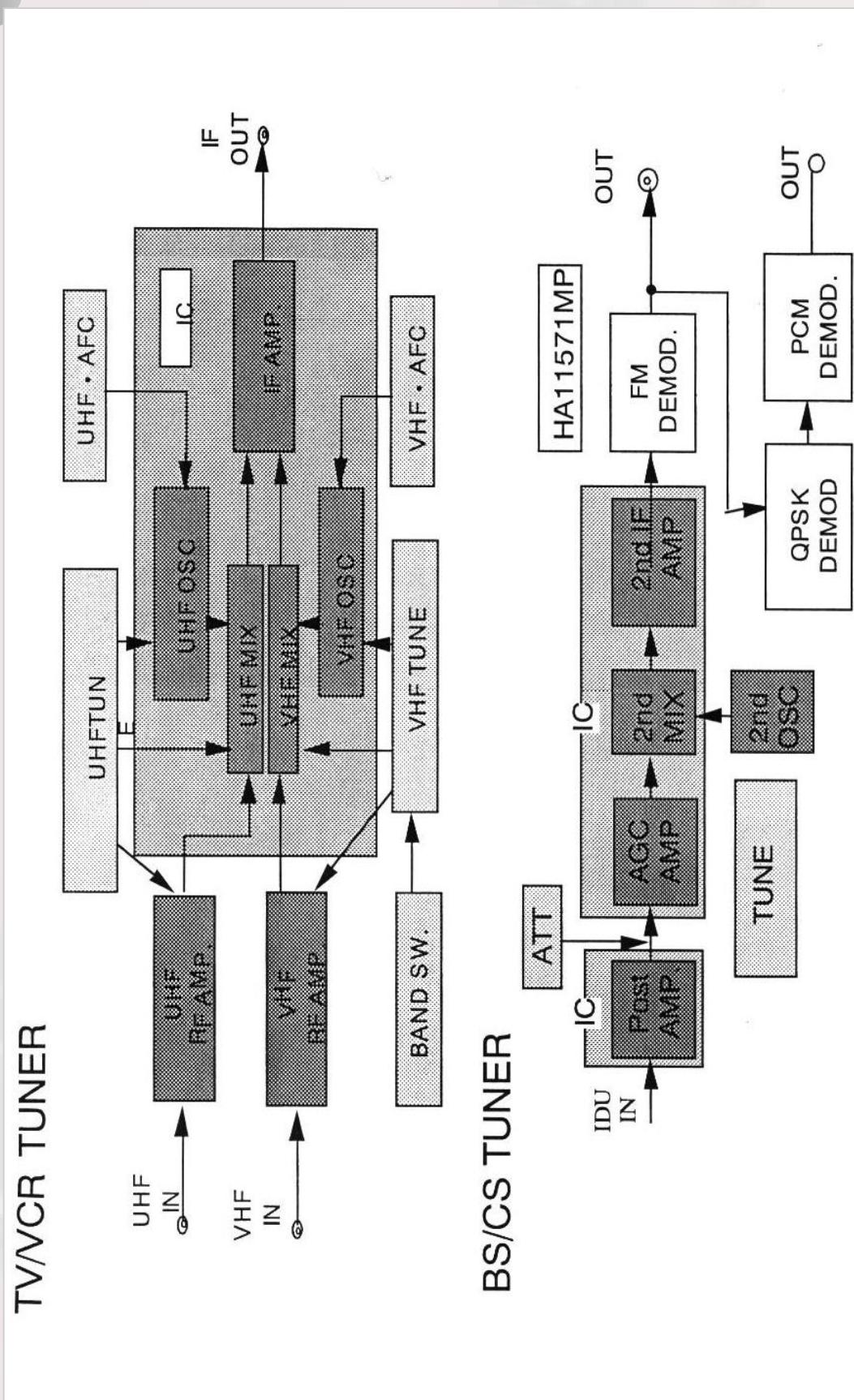
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Additionally:

- CD ROM with electronic file of:
 - This presentation
 - PDF datasheets for all devices in this kit
 - Package overview
 - Technology overview
 - **Cross reference list for Hitachi diodes**
 - **SPICE parameters for all kit diodes**
 - **Application examples**
- Data sheet hardcopy of all Hitachi kit diodes
- Sample kit of diodes and transistors for tuners

BS/CS & TV/VCR Tuner Block Diagram





BS/CS Diode & Transistor Sample Line-up

Function	Device	Parts Name	Main SPEC.	Out Line	Features
1st IF AMP.	Bipolar Transistor	2SC5049	fT=10GHz typ. NF=1.2dB typ.	MPAK	Low Noise
		2SC4791		MPAK-4	High fT
		2SC4784		CMPAK	
		2SC5050	fT=11GHz typ. NF=CP.CPdB typ.	MPAK	Low Noise
Post AMP.		2SC4926		MPAK-4	High fT
		2SC5051		CMPAK	
		2SC4995		CMPAK-4	
		2SC5080	fT=11GHz typ. NF=dB typ.	MPAK-4	Low Noise
ATT.	PIN Diode	2SC5081		CMPAK-4	High fT
		HVM187WS	C=2.4pF Max.(@VR=0V) rf=5.6ohm Max.(@IF=10mA)	MPAK	Low rf
		HVI187		URP	
		HVM14S	C=0.25pF(@VR=50V) rf=7ohm Max.(@IF=10mA)	MPAK	Low Capacitance
Tune	VARI-CAP. Diode	HVB14S		CMPAK	
		HVM14		MPAK	
		HVIU12	C1=3.6~5.3pF	URP	
		HVIU316	C1=5.16~7.22pF	URP	Low Rs
		HNC317B	C1=9.0~11.52pF	UFP	High Cap.Ratio
		HVM15	C1=3.6~5.3pF	MPAK	Twin Diode



TV/VCR Diode Sample Line-up

Function	Device	Parts Name	Main SPEC.	Out Line	Features
UHF Tune	Vari-Cap. Diode	HVU202B HVC202B	C2/C25=6.3min rs=0.57ohm max.	URP UFP	Low Rs
VHF Tune		HVU300B HVC300B	C2/C25=17.0 min.(for ref.) Rs=1.1 ohm max.	URP UFP	High Cap. Ratio
		HVU306B HVC306B	C2/C25=11.0 min.(for ref.) Rs=0.78ohm max.	URP UFP	Low Rs High Cap. Ratio
		HVC363B HVC363B	C2/C25=13.5 MIN Rs=0.78ohm max.	URP UFP	Low Rs High Cap. Ratio
Band SW.	PIN Diode	HSU277	Rf=0.7ohm max.	URP	
		HSC277		UFP	
		HSM2692 HSM2693A HSM2694	Rf=0.9ohm max.	MPAK MPAK MPAK	



TV/VCR Transistor Sample Line-up

Function	Device	Parts Name	Main Spec	Out Line	Features
VHF RF AMP.	BB FET (Dual-Gate MOSFET with Bias Circuit)	BB301M	PG=26.0dB typ. NF=1.3dB typ.(@200MHz)	MPAK-4	Low Voltage Operation(5V)
		BB301C		CMPAK-4	
		BB401M		MPAK-4R	
		BB302M	PG=26.0dB typ. NF=1.7dB typ.(@200MHz)	MPAK-4	Low Voltage Operation(9V)
		BB302C		CMPAK-4	
		BB402M		MPAK-4R	
		BB303M	PG=32.0dB typ. NF=1.0dB typ.(@200MHz)	MPAK-4	Low Voltage Operation(5V)
		BB303C		CMPAK-4	
		BB403M		MPAK-4R	
		BB304M	PG=29.0dB typ. NF=1.2dB typ.(@200MHz)	MPAK-4	5-9V Operation
		BB304C		CMPAK-4	
		BB404M		MPAK-4R	
		BB305M	PG=28.0dB typ. NF=1.5dB typ.(@200MHz)	MPAK-4	Better Cross- Moduration
		BB305C		CMPAK-4	
		BB405M		MPAK-4R	



TV/VCR Transistor Sample Line-up

Function	Device	Parts Name	Main Spec	Out Line	Features
UHF RF AMP.	BB FET (Dual-Gate MOSFET with Bias Circuit)	BB101M BB101C BB201M BB102M BB102C BB202M BB501M BIC701M	PG=20.0dB typ. NF=2.1dB typ.(@900MHz) PG=20.0dB typ. NF=2.1dB typ.(@900MHz) PG=21.5dB typ. NF=1.8dB typ.(@900MHz) PG=21.5dB typ. NF=1.7dB typ.(@900MHz)	MPAK-4 CMPAK-4 MPAK-4R MPAK-4 CMPAK-4 MPAK-4R MPAK-4 MPAK-4	Low Voltage Operation(5V)
Dual-Gate MOSFET	3SK295 3SK296 3SK321 3SK318 3SK319		PG=19.5dB typ. NF=2.0dB typ.(@900MHz) PG=21.5dB typ. NF=1.6dB typ.(@900MHz)	MPAK-4 CMPAK-4 MPAK-4R MPAK-4	Low Noise Low Voltage
VHF/UHF AMP.	Dual-Gate MOSFET	3SK297 3SK298 3SK322	PG=25.0dB typ. NF=1.0dB typ.(@2000MHz)	MPAK-4 CMPAK-4 MPAK-4R	Better Cross-modulation



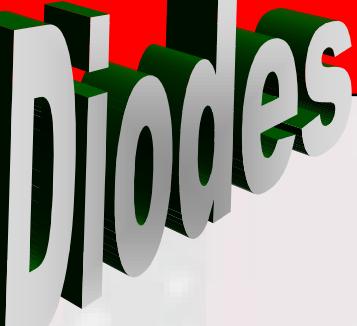
Varicap Diode Line-up for Tuner

Application		Package code	Type No.	Ratings	Characteristics			
				VR (V)	C (pF)	n	CVR/CVR	rs (Ω) max
BS/CS Tuner	Tuning	MPAK	HVM15	35	$C_1 = 3.6 - 5.6, C_{30} = 0.5 - 0.9$	4.0 min	1/30	1.50
			HVU12	35	$C_1 = 3.6 - 5.6, C_{30} = 0.45 - 0.85$	4.0 min	1/30	1.50
		URP	HVU314	32	$C_1 = 4.4 - 6.4, C_{25} = 0.47 - 0.77$	7.2 min	1/25	1.05
			HVU316	30	$C_1 = 5.16 - 7.22, C_{25} = 0.48 - 0.76$	9.0 min	1/25	1.20
	VCO	UFP	HVC317B	30	$C_1 = 9.0 - 11.5, C_{25} = 0.6 - 0.8$	13.0 min	1/25	1.60
			HVU356	15	$C_2 = 27.7 - 31.8, C_3 = 21.6 - 25.6, C_4 = 17.1 - 19.0$	1.45 min	2/4	0.60
TV Tuner	LHF Tuning	URP	HVU202A	34	$C_2 = 14.11 - 16.47, C_{25} = 2.06 - 2.35$	6.2 min	2/25	0.57
			HVU202B	35	$C_2 = 14.15 - 15.75, C_{25} = 2.06 - 2.35$	6.3 min	2/25	0.57
		UFP	HVC202A	34	$C_2 = 14.11 - 16.47, C_{25} = 2.06 - 2.35$	6.2 min	2/25	0.57
			HVC202B	35	$C_2 = 14.15 - 15.75, C_{25} = 2.06 - 2.35$	6.3 min	2/25	0.57
	VHF Tuning	URP	HVU200A	32	$C_2 = 27.7 - 31.8, C_{25} = 2.67 - 3.03$	10.0 min	2/25	0.70
			HVU300A	32	$C_2 = 39.5 - 47.4, C_{25} = 2.6 - 3.03$	14.5 min	2/25	1.10
			HVU300B	34	$C_2 = 47.0 - 53.0, C_{25} = 2.65 - 3.0$	17.0 min	2/25	1.10
			HVU306A	32	$C_2 = 29.3 - 34.2, C_{25} = 2.57 - 2.92$	11.0 min	2/25	0.75
			HVU306B	34	$C_2 = 29.5 - 33.5, C_{25} = 2.6 - 2.9$	11.0 min	2/25	0.75
			HVU307	32	$C_2 = 32.2 - 37.5, C_{25} = 2.57 - 3.0$	12.0 min	2/25	0.85
			HVU363A	32	$C_1 = 34.65 - 42.35, C_{28} = 2.361 - 2.754$	13.5 min	1/28	0.75
			HVU363B	32	$C_1 = 36.0 - 42.0, C_{28} = 2.36 - 2.75$	13.7 min	1/28	0.75
		UFP	HVC200A	32	$C_2 = 27.7 - 31.8, C_{25} = 2.67 - 3.03$	10.0 min	2/25	0.70
			HVC300A	32	$C_2 = 39.5 - 47.4, C_{25} = 2.6 - 3.03$	14.5 min	2/25	1.10
	AFC	URP	HVC300B	34	$C_2 = 47.0 - 53.0, C_{25} = 2.65 - 3.0$	17.0 min	2/25	1.10
			HVC306A	32	$C_2 = 29.3 - 34.2, C_{25} = 2.57 - 2.92$	11.0 min	2/25	0.75
			HVC306B	34	$C_2 = 29.5 - 33.5, C_{25} = 2.6 - 2.9$	11.0 min	2/25	0.75
			HVC321B	15	$C_1 = 29.0 - 33.0, C_{10} = 2.55 - 2.90$	10.5 min	1/10	1.00
		UFP	HVC322B	15	$C_2 = 14.22 - 15.473, C_{25} = 2.132 - 2.321$	6.22 min	2/25	0.60
			HVC363A	32	$C_1 = 34.65 - 42.35, C_{28} = 2.361 - 2.754$	13.5 min	1/28	0.75
			HVC363B	32	$C_1 = 36.0 - 42.0, C_{28} = 2.36 - 2.75$	13.7 min	1/28	0.75
			HVU89	32	$C_2 = 10.5 - 16.0, C_{10} = 3.3 - 5.7$	2.5 - 3.4	2/10	1.20
	FM Tuner	MPAK	HVU308A	35	$C_2 = 13.7 - 15.9, C_{20} = 1.65 - 2.06$	7.12 min	2/20	0.95
			HVC308A	35	$C_2 = 13.7 - 15.9, C_{20} = 1.65 - 2.06$	7.12 min	2/20	0.95
			HVM16	14	$C_2 = 43.0 - 48.1$	1.23 - 1.33	2/4	-
		CMPAK	HVM25	16	$C_3 = 36.0 - 45.0, C_8 = 12.0 - 17.0$	2.5 min	3/8	-
			HVM27WK	20	$C_1 = 52.0 - 62.0, C_2 = 43.0 - 48.1, C_8 = 24.0 - 27.0$	1.8 min	1/8	0.4
AM Tuner	Tuning	SRP	HVB27WK	15	$C_1 = 52.0 - 62.0, C_2 = 43.0 - 48.0, C_8 = 24.0 - 27.0$	1.7 min	2/8	-
			HVR100	15	$C_1 = 421.5 - 524.6, C_8 = 20.4 - 28.2$	1.8 min	1/8	0.4
		MPAK	HVM100	15	$C_1 = 421.5 - 524.6, C_5 = 73.2 - 121.4, C_8 = 73.2 - 121.4$	1.7 min	2/8	-



Varicap Diode Line-up for VCO

Application	Package code	Type No.	Ratings	Characteristics			
			VR (V)	C (pF)	n	CVR/CVR	rs (Ω) max
VCO	URP	HVU17	15	$C_1 = 50 - 85, C_3 = 16.1 - 27.3, C_{4,5} = 5.23 - 8.84$	5.6 min	1/4.5	-
		HVU350	15	$C_1 = 15 - 17.5, C_4 = 5.3 - 6.3$	2.8 min	1/4	0.50
		HVU350B	15	$C_1 = 15.5 - 17.0, C_4 = 5.0 - 6.0$	2.8 min	1/4	0.50
		HVU351	10	$C_2 = 14.0 - 16.0, C_{10} = 5.0 - 6.5$	2.0 min	2/10	0.35
		HVU355	15	$C_1 = 6.4 - 7.4, C_4 = 2.75 - 3.25$	2.0 min	1/4	0.60
		HVU355B	15	$C_1 = 6.4 - 7.2, C_4 = 2.55 - 2.95$	2.2 min	1/4	0.60
		HVU357	10	$C_1 = 19.5 - 23.5, C_2 = 14.3 - 17.6$	1.3 min	1/2	0.35
		HVU358	15	$C_1 = 19.0 - 21.0, C_4 = 8.5 - 10.0$	2.0 min	1/4	0.40
		HVU359	15	$C_1 = 24.8 - 29.8, C_4 = 6.0 - 8.3$	3.0 min	1/4	1.50
		HVU362	15	$C_1 = 41.6 - 49.9, C_4 = 10.1 - 14.8$	3.0 min	1/4	2.00
VCO	UFP	HVU365	15	$C_1 = 27.05 - 28.55, C_4 = 6.05 - 7.55$	3.0 min	1/4	1.50
		HVC350B	15	$C_1 = 15.5 - 17.0, C_4 = 5.0 - 6.0$	2.8 min	1/4	0.50
		HVC351	10	$C_2 = 14.0 - 16.0, C_{10} = 5.0 - 6.5$	2.0 min	2/10	0.35
		HVC355B	15	$C_1 = 6.4 - 7.2, C_4 = 2.55 - 2.95$	2.2 min	1/4	0.60
		HVC357	10	$C_1 = 19.5 - 23.5, C_2 = 14.3 - 17.6$	1.3 min	1/2	0.35
		HVC358B	15	$C_1 = 19.5 - 21.0, C_4 = 8.0 - 9.3$	2.2 min	1/4	0.40
		HVC359	15	$C_1 = 24.8 - 29.8, C_4 = 6.0 - 8.3$	3.0 min	1/4	1.50
		HVC362	15	$C_1 = 41.6 - 49.9, C_4 = 10.1 - 14.8$	3.0 min	1/4	2.00
		HVC365	15	$C_1 = 27.05 - 28.55, C_4 = 6.05 - 7.55$	3.0 min	1/4	1.50
		HVC366	15	$C_1 = 6.3 - 6.8, C_2 = 4.35 - 4.95$	1.39 min	1/2	0.60
		HVC368B	15	$C_1 = 15.0 - 17.0, C_3 = 5.0 - 7.0$	2.2 min	1/3	1.00
		HVC369B	15	$C_1 = 4.65 - 5.15, C_4 = 1.85 - 2.15$	2.3 min	1/4	0.50
		HVC372B	15	$C_1 = 15.0 - 17.0, C_4 = 7.0 - 8.5$	2.0 min	1/4	0.40
		HVC374B	10	$C_1 = 21.5 - 24.0, C_2 = 12.5 - 14.5$	1.68 - 1.75	1/2	1.00
		HVC375B	10	$C_1 = 15.5 - 17.0, C_4 = 3.0 - 5.0$	4.0 min	1/4	0.80
		HVC376B	15	$C_1 = 25.0 - 28.5, C_4 = 4.8 - 6.8$	4.3 min	1/4	0.80
MPAK	HVM17	15	$C_1 = 50 - 85, C_3 = 16.1 - 27.3, C_{4,5} = 5.23 - 8.84$	5.6 min	1/4.5	-	-



PIN Diode Line-up

Application	Package Code	Type No.	Ratings								rf (Ω) max	IF (mA)	f (MHz)
			VR (V)	IF (mA)	Pd (mW)	VF (V) max	IF (mA)	C (pF) max	VR (V)	f (MHz)			
Antenna switching	URP	HUV131	60	100	150	1,0	10	0,8	1	1	1,0	10	100
		HUV132	60	100	150	1,0	10	0,5	1	1	2,0	10	100
		HUV133	30	-	150	0,85	2	1	1	1	0,7	2	100
	UFP	HVC131 <small>NEW</small>	60	100	150	1,0	10	0,8	1	1	1,0	10	100
		HVC132 <small>NEW</small>	60	100	150	1,0	10	0,5	1	1	2,0	10	100
		HVC133 <small>NEW</small>	30	-	150	0,85	2	1	1	1	0,7	2	100
		HVC134 <small>NEW</small>	60	100	150	1,0	10	0,4	1	1	2,0	10	100
	MPAK	HVM131S	60	100	150	1,0	10	0,8	1	1	1,0	10	100
		HVM131SR	60	100	150	1,0	10	0,8	1	1	1,0	10	100
		HVM132	60	100	150	1,0	10	0,5	1	1	2,0	10	100
		HVM132WK	60	100	150	1,0	10	0,5	1	1	2,0	10	100
Attenuator	MPAK	HVM14	50	50	100	1	50	0.25 typ	50	1	7	10	100
		HVM14S	50	50	100	1	50	0.25 typ	50	1	7	10	100
		HVM14SR	50	50	100	1	50	0.25 typ	50	1	7	10	100
		HVM187S	60	50	100	1	10	2,4	0	1	5,5	10	100
		HVM187WK	60	50	100	1	10	2,4	0	1	5,5	10	100
	URP	HVU187	60	50	100	1	10	2,4	0	1	5,5	10	100
	CMPAK	HVB14S	60	50	100	1	50	0.25 typ	50	1	7	10	100

Key Features of V-C Diodes for Tuner Applications

- **Continuous Connected Taping System (C.C.)**

Features:

- Small Capacitance Deviation ($\Delta C/C$)
 - > Easy Grouping in Tuners
- High Degree of Parallelism in the C-V Curves
 - > Excellent Tuner Tracking Characteristics
- Small Number of Groups per Reel
 - > Saves Time in Production:
Faster Mounting of Diodes
Fewer Stops for Group Changes

- **Low Temperature Process (LT)**

Features:

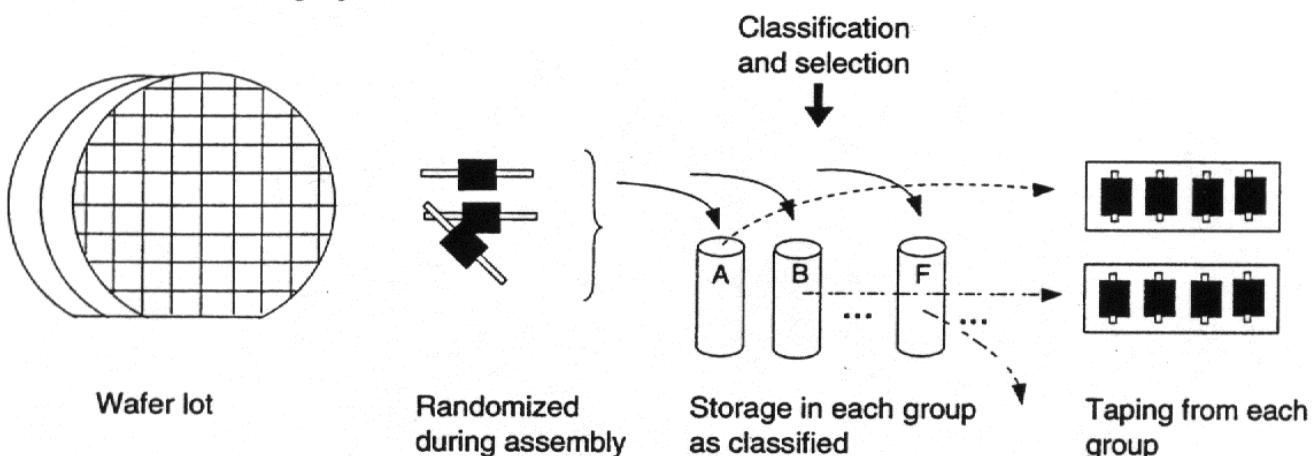
- High Capacitance Variation Ratio
 - > Better for Low Supply Voltage Applications
 - > Increased Number of Channels
- Reduced Intra-Set Capacitance Deviation
 - > Lower Tracking Error
 - > Improved Linearity in the Capacitance Characteristics
- Reduced High-Frequency Series Resistance
 - > Lower Noise Figure
 - > Increased System Performance
- Reduced Variance in the Inter-Pin Capacitance
 - > Lower Tracking Error
 - > Increased Stability in the Overtuning Range

Continuous Connected Taping System (C.C.)

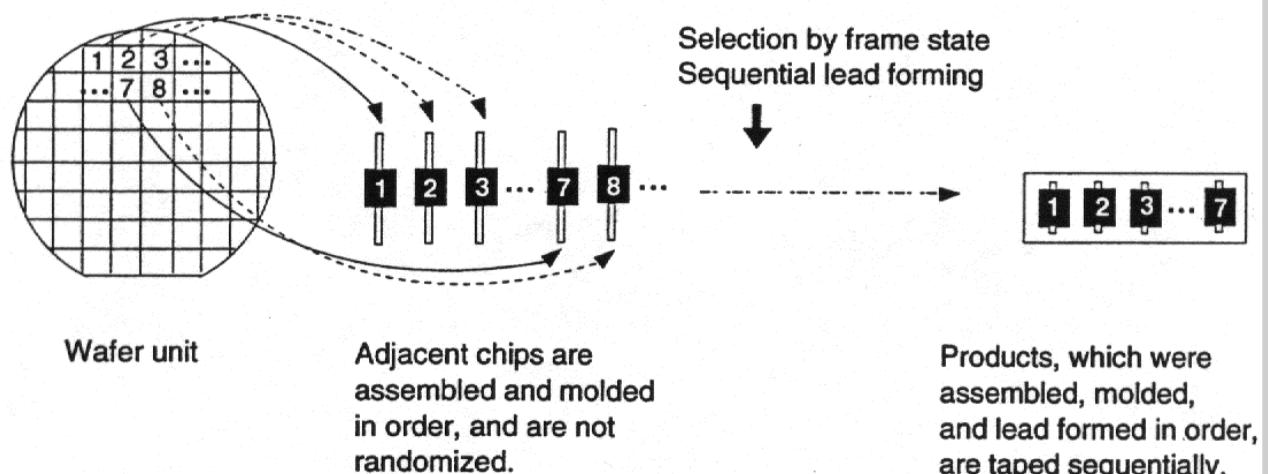
Variations in semiconductor device characteristics arise due to variations in the component materials and the manufacturing process. However, chips that are adjacent on the wafer exhibit essentially identical characteristics. Hitachi takes advantage of this and achieves continuous grouping in taping by assembling and taping chips that are adjacent on the wafer sequentially. This is called the *Continuous Connected Taping System*.

Manufacturing Comparison - Standard and C. C. Taping System

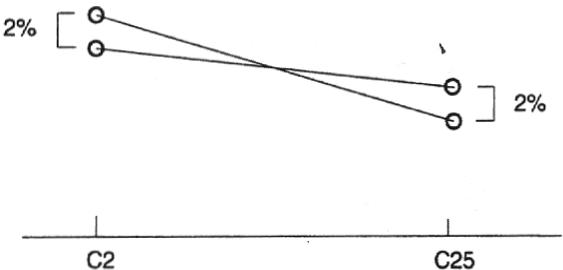
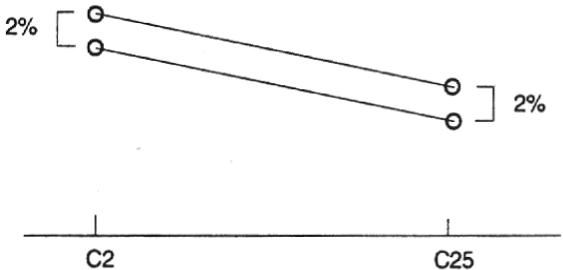
Earlier Manufacturing System



C.C. Method Manufacturing System



Features and Merits of the New C.C. Taping System

Earlier Method	C.C. Method
<p>Low degree of parallelism in the C-V curves</p>  <p>For example, for diodes with a $\Delta C/C$ of 2%, products whose curves cross as shown above may exist.</p>	<p>High degree of parallelism in the C-V curves</p>  <p>For example, even when $\Delta C/C$ is 2%, parallelism such as that shown in the figure above will be present. This provides excellent tuner tracking characteristics.</p>
<p>Large $\Delta C/C$ values</p> <p>Since a selection approach is taken, values will be distributed within the set selection value range.</p>	<p>Small $\Delta C/C$ values</p> <p>Variations are reduced since adjacent chips are taped consecutively.</p>
<p>Large number of groups (sequence interruptions) exist within a single reel</p> <p>Since a sorting and selecting scheme is used, the number of chips in a given group is relatively small. This means that the number of groups in a given reel is large.</p>	<p>Small number of groups (sequence interruptions) within a reel</p> <p>Since this system has continuity, the number of sequence interruptions within a reel is reduced. This can improve mounting efficiency in use, since the number of times the mounting equipment must be stopped is reduced.</p>

Low Temperature Process (L.T.)

Hitachi has developed a Low Temperature Process for manufacturing variable-capacitance diodes, allowing for even shorter pn junctions and a higher gradient in the doping / depth chart. The process improves the capacitance ratio and the linearity characteristics of the diode, which is particularly useful for low supply voltage applications/ wider tuning range and also offers better system performance due to lower tracking error. Due to the shorter pn junction, the high frequency series resistance of the diode is lowered, and thus the noise figure reduced.

Increase of Capacitance Ratio due to L.T. Process

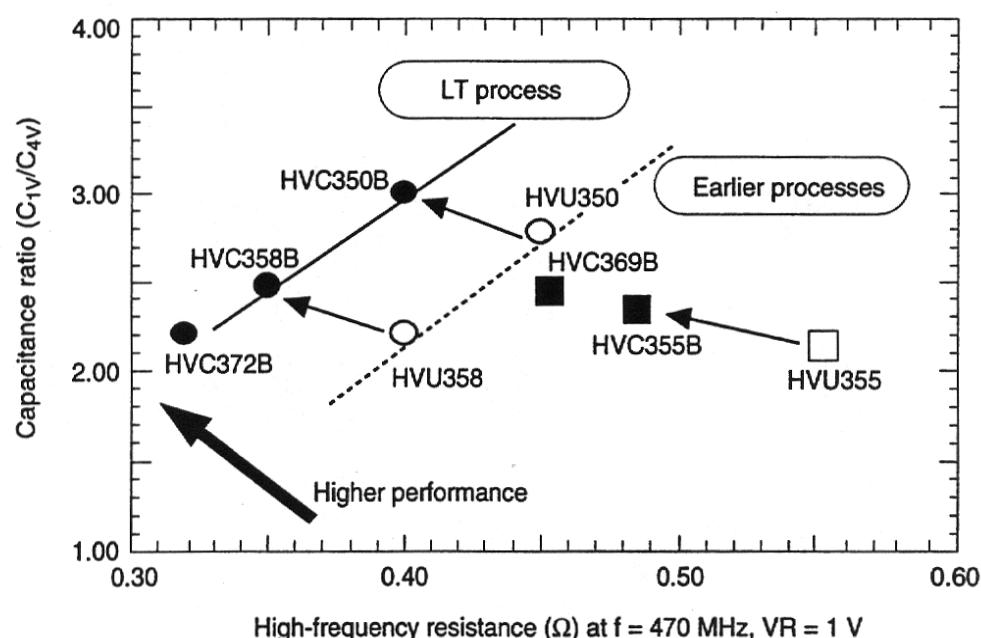


Figure 1.2.3 High-Frequency Resistance and Capacitance Ratio

Lower Series Resistance due to L.T. Process

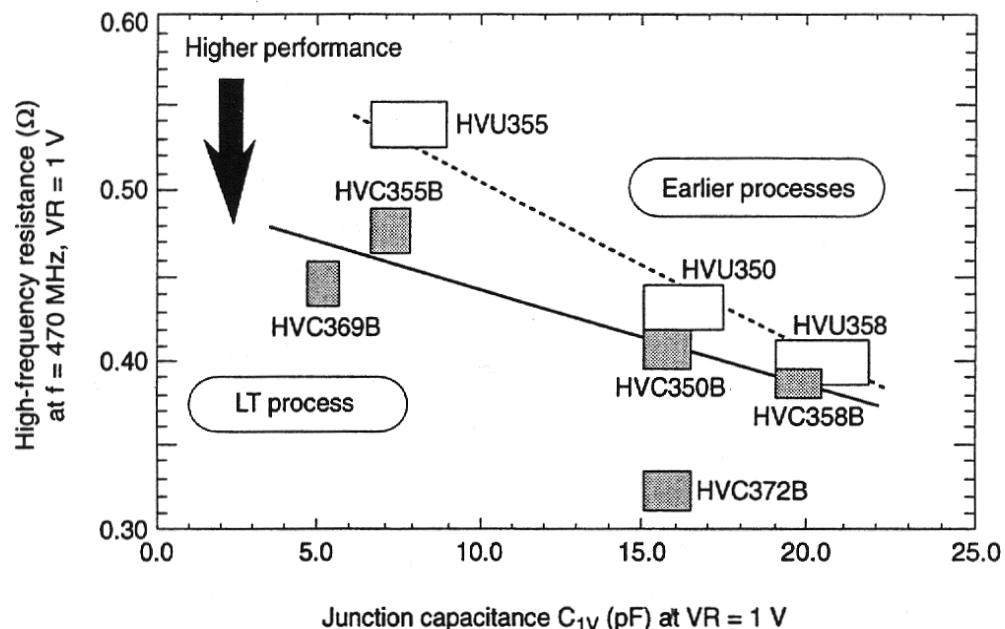
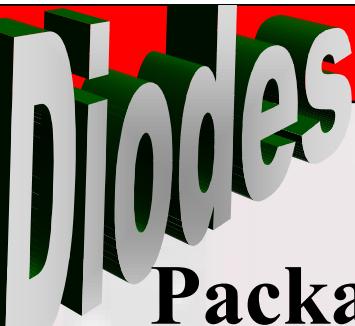


Figure 1.2.2 Junction Capacitance and High-Frequency Resistance



Packaging Overview for Diodes

Taping Code versus Packaging

e. Taping Symbols

Taping of URP package takes the following symbol according to quantity, group in 1 reel etc.

Taping code	Taping direction	Maximum category in 1 reel	Quantity in 1 reel	Group	End of Group	Note
TRF	TR	—	3000pcs	—	—	—
TRU		4n	3000pcs	20 + 1n	4 space	C.C system*
TRV					Non-reflection tape on 1 space	

Note: Continuous Connected taping system of variable capacitance diode.

Taping of UFP package takes the following symbols according to quantity, group in 1 reel etc.

Taping code	Taping direction	Maximum category in 1 reel	Quantity in 1 reel	Group	End of Group	Note
TRF	TR	—	4000pcs	—	—	—
TRU		5max		20 + 1n	9 space	C.C system*
TRV					1 space + Non- reflection tape on 1 space + 1 space	
KRF	KR	—	8000pcs	—	—	—
KRU		10max		20 + 1n	4 space	C.C system*
KRV					Non- reflection tape on 1 space	

Note: Continuous Connected taping system of variable capacitance diode.

HITACHI

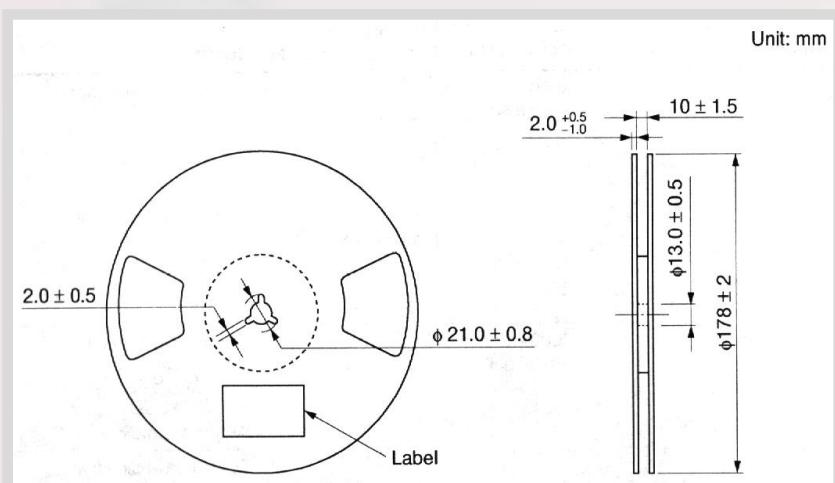


Packaging Overview for Diodes

Available Reel Packages

MPAK CMPAK	Taping	3000 (units/reel)	TR* ² (Taping to Right)	TR withdrawal direction (Marked surface up)
SRP URP	Taping	3000 (units/reel). Note that variable capacitance type is 2000 min (units/reel)	TL (Taping to Left)	TL withdrawal direction (Marked surface up)
UFP	Taping	4000 (units/reel)	TR* ² (Taping to Right)	TR withdrawal direction
		8000 (units/reel)	KR* ²	KR withdrawal direction

Reel Dimensions

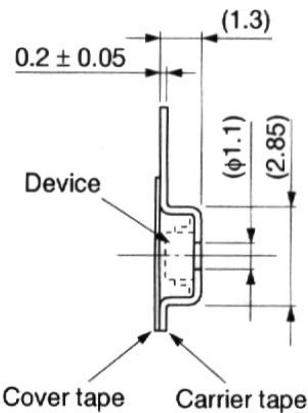
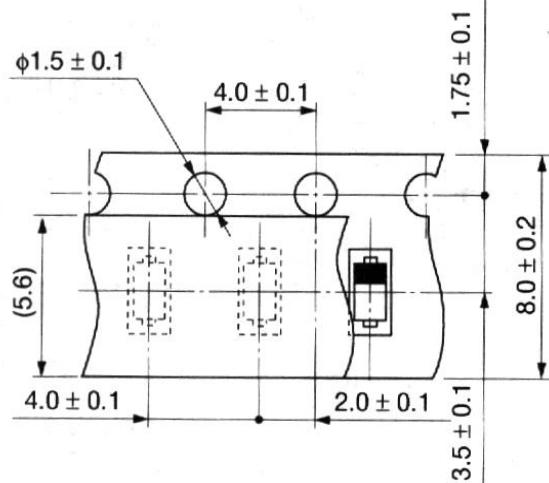




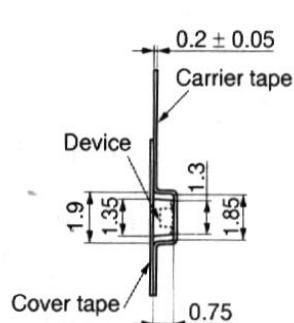
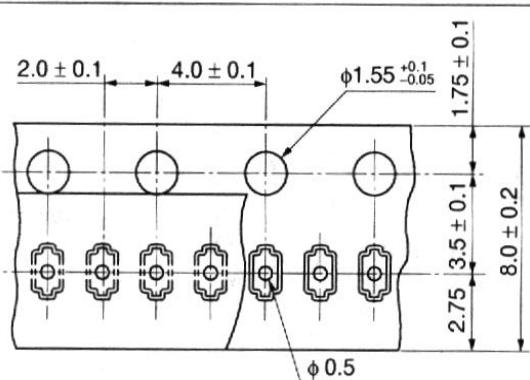
Packaging Overview for Diodes

Available Reel Packages

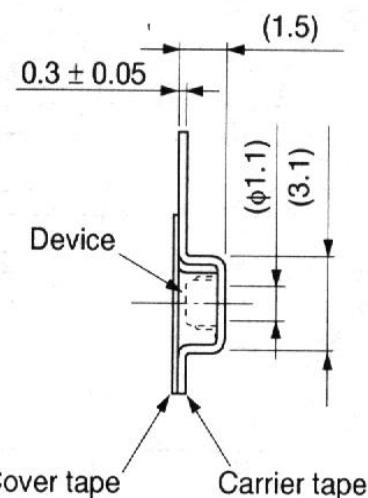
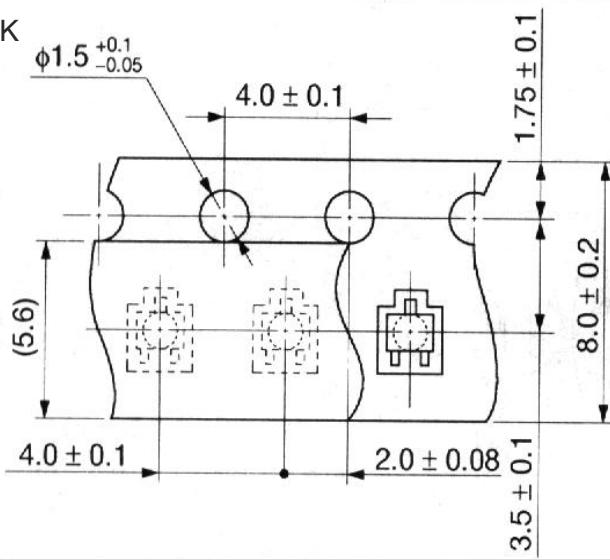
URP



UFP



CMPAK





Packaging Overview for Diodes

UFP / URP / MPAK Dimensions

