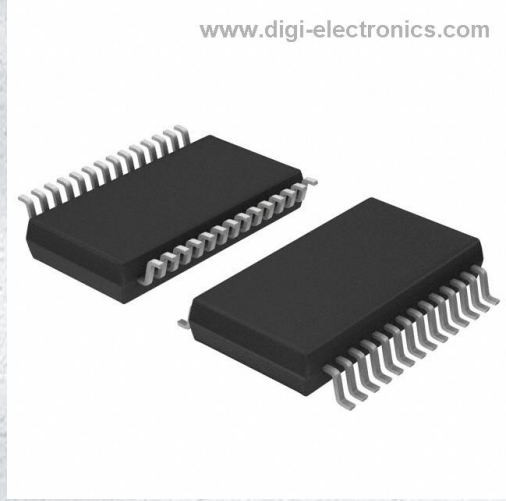
525R-02LFT Datasheet



https://www.DiGi-Electronics.com

DiGi Electronics Part Number	525R-02LFT-DG
Manufacturer	Renesas Electronics Corporation
Manufacturer Product Number	525R-02LFT
Description	IC CLOCK GENERATOR 28QSOP
Detailed Description	Clock Generator, Fanout Distribution IC 250MHz 1 2 8-SSOP (0.154", 3.90mm Width)

Tel: +00 852-30501935

RFQ Email: Info@DiGi-Electronics.com

Purchase and inquiry

Manufacturer Product Number:	Manufacturer:
525R-02LFT	Renesas Electronics Corporation
Series:	Product Status:
OSCaR™	Obsolete
DiGi-Electronics Programmable:	Type:
Not Verified	Clock Generator, Fanout Distribution
PLL:	Input:
Yes with Bypass	Clock, Crystal
Output:	Number of Circuits:
CMOS	1
Ratio - Input:Output:	Differential - Input:Output:
1:2	No/No
Frequency - Max:	Divider/Multiplier:
250MHz	Yes/Yes
Voltage - Supply:	Operating Temperature:
3V ~ 5.5V	0°C ~ 70°C
Mounting Type:	Package / Case:
Surface Mount	28-SSOP (0.154", 3.90mm Width)
Supplier Device Package:	Base Product Number:
28-QSOP	525R

Environmental & Export classification

Moisture Sensitivity Level (MSL):	REACH Status:
1 (Unlimited)	REACH Unaffected
ECCN:	HTSUS:
EAR99	8542.39.0001

USER CONFIGURABLE CLOCK 525-01/02

Description

The ICS525-01/02 are the most flexible way to generate a high-quality, high-accuracy, high-frequency clock output from an inexpensive crystal or clock input. The user can configure the device to produce nearly any output frequency from any input frequency by grounding or floating the select pins. Neither microcontroller, software, nor device programmer are needed to set the frequency. Using Phase-Locked Loop (PLL) techniques, the device accepts a standard fundamental mode, inexpensive crystal to produce output clocks up to 250MHz. It can also produce a highly accurate output clock from a given input clock, keeping them frequency locked together.

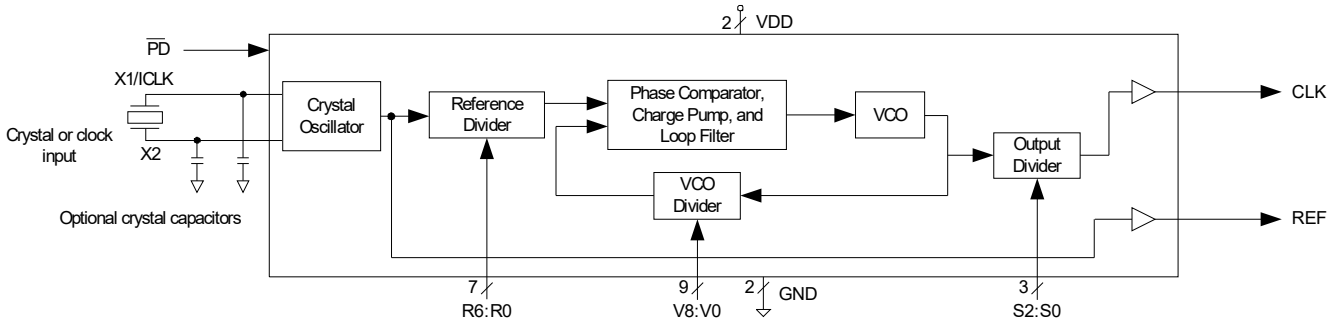
For similar capability with a serial interface, use the 307. For simple multipliers to produce common frequencies, refer to the 50x family of parts, which are smaller and more cost effective.

These products are intended for clock generation. They have low output jitter (variation in the output period), but input to output skew and jitter are not defined nor guaranteed. For applications which require defined input to output timing, use the 527-01.

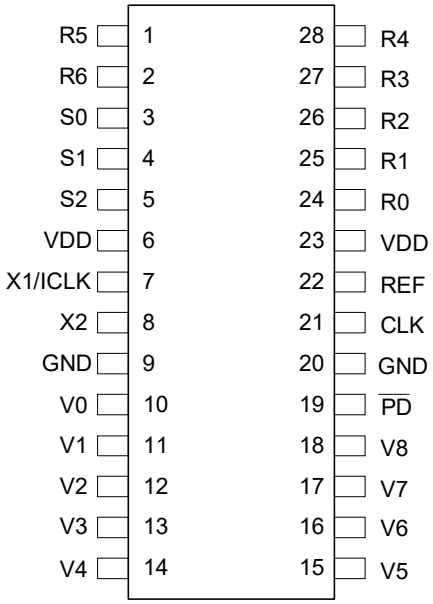
Features

- Packaged in 28-pin SSOP (150 mil body) or 28-pin VFQFPN (4x4mm body)
- Industrial and commercial versions available in Pb (lead) free package
- User determines the output frequency by setting all internal dividers
- Eliminates need for custom oscillators
- No software needed
- Online calculator determines register settings
- Pull-ups on all select inputs
- Input crystal frequency of 5 – 27 MHz
- Input clock frequency of 2 – 50 MHz
- Very low jitter
- Duty cycle of 45/55 up to 200MHz
- Operating voltage of 3.0V or 5.5V
- Ideal for oscillator replacement
- Industrial temperature version available
- For Zero Delay, refer to the 527

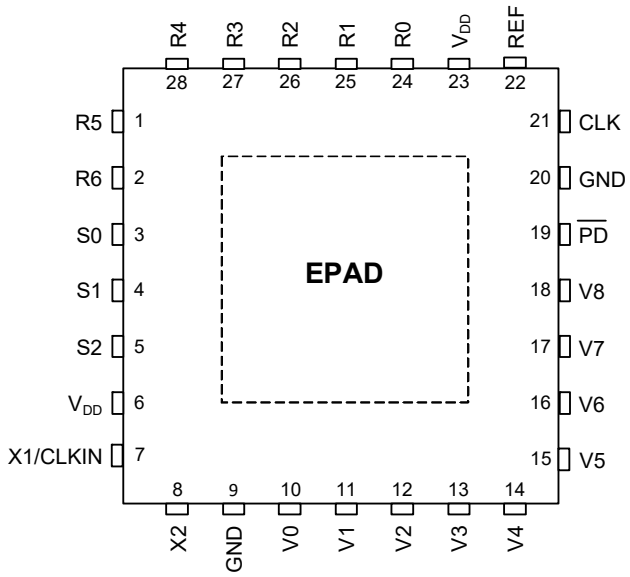
Block Diagram



Pin Assignments



28-pin SSOP



28-pin VFQFPN

Pin Descriptions

Pin Number	Pin Name	Pin Type	Pin Description
1, 2, 24-28	R5, R6, R0-R4	I(PU)	Reference divider word input pins determined by user. Forms a binary number from 0 to 127.
3, 4, 5	S0, S1, S2	I(PU)	Select pins for output divider determined by user. See table on page 3.
6, 23	VDD	Power	Connect to VDD.
7	X1/ICLK	X1	Crystal connection. Connect to a parallel resonant fundamental crystal or input clock.
8	X2	X2	Crystal connection. Connect to a crystal or leave unconnected for clock.
9, 20	GND	Power	Connect to ground.
10 - 18	V0 - V8	I(PU)	VCO divider word input pins determined by user. Forms a binary number from 0 to 511.
19	$\overline{PD}$	Input	Power-down. Active low. Turns off entire chip when low. Clock outputs tri-stated.
21	CLK	Output	Output clock determined by status of R0-R6, V-V8, S0-S2, and input frequency.
22	REF	Output	Reference output. Buffered crystal oscillator (or clock) output.

KEY: I(PU) = Input with internal pull-up resistor; X1, X2 = crystal connections

525-01 Output Frequency and Output Divider Table

S2 Pin 5	S1 Pin 4	S0 Pin 3	CLK Output Divider	Output Frequency Range (MHz)			
				VDD = 5 V		VDD = 3.3 V	
				0 - 70°C	-40 to +85°C	0 - 70°C	-40 to +85°C
0	0	0	10	3–26	3–23	3–18	3–16
0	0	1	2	15–160	15–140	15–100	15–90
0	1	0	8	3.75–40	3.75–36	3.75–25	3.75–22
0	1	1	4	7.5–80	7.5–72	7.5–50	7.5–45
1	0	0	5	6–50	6–45	6–34	6–30
1	0	1	7	4–40	4–36	4–26	4–23
1	1	0	9	3.3–33.3	3.3–30	3.3–20	3.3–18
1	1	1	6	5–53	5–47	5–27	5–24

525-02 Output Frequency and Output Divider Table

S2 Pin 5	S1 Pin 4	S0 Pin 3	CLK Output Divider	Output Frequency Range (MHz)	
				VDD = 5 V	VDD = 3.3 V
				-40 to +85°C	-40 to +85°C
0	0	0	6	5–67	5–40
0	0	1	2	15–200	15–120
0	1	0	8	3.75–50	3.75–30
0	1	1	4	7.5–100	7.5–60
1	0	0	5	6–80	6–48
1	0	1	7	4–57	4–34
1	1	0	1	30–250	30–200
1	1	1	3	10–133	10–80

External Components/Crystal Selection

Decoupling Capacitors

The ICS525-01/02 requries two 0.01µF decoupling capacitors to be connected between VDD and GND, one on each side of the chip. The capacitor must be connected close to the device to minimize lead inductance.

External Resistors

A 33Ω series termination resistor should be used on the CLK and REF pins.

Crystal Load Capacitors

The approximate total on-chip capacitance for a crystal is 16 pF, so a parallel resonant, fundamental mode crystal with this value of load (correlation) capacitance should be used. For crystals with a specified load capacitance greater than 16 pF, crystal capacitors may be connected from each of the pins X1 and X2 to Ground as shown in the block diagram. The value (in pF) of these crystal caps should be (CL -16)*2, where CL is the crystal load capacitance in pF. These external capacitors are only required for applications where the exact frequency is critical. For a clock input, connect to X1 and leave X2 unconnected (no capacitors on either).

Determining the Output Frequency

Users have full control in setting the desired output frequency over the range shown in the tables on pages 3-4. To replace a standard oscillator, users should connect the divider select input pins directly to ground (or VDD, although this is not required because of internal pull-ups) during Printed Circuit Board layout. The 525 will automatically produce the correct frequency when all components are soldered. It is also possible to connect the inputs to parallel I/O ports to switch frequencies. By choosing divides carefully, the number of inputs which need to be changed can be minimized. Observe the restrictions on allowed values of VDW and RDW.

Configuration Pin Settings

The output of the 525 can be determined by the following simple equation:

$$\text{CLK Frequency} = \text{Input Frequency} \times 2x\frac{(VDW+8)}{(RDW+2)\bullet OD}$$

Where:

Reference Divider Word (RDW) = 0 to 127 (0 not permitted for 525-01)

VCO Divider Word (VDW) = 0 to 511 (0, 1, 2, 3 not permitted for 525-01)

Output Divider (OD) = values on pages 3-4

Also, the following operating ranges should be observed:

1. The output frequency must be in the ranges listed on pages 3-4.

2. The phase detector frequency must be above 200 kHz.

$$200\text{kHz} < \frac{\text{InputFrequency}}{(RDW+2)}$$

Since all of the inputs have pull-up resistors, it is only necessary to ground the pins that need to be set to zero.

Which Part to Use?

The 525-01 is the original configurable clock.

The 525-02 has a higher maximum output frequency and a slightly different set of output dividers.

To determine the best combination of VCO, reference, and output divide, use the Calculator on our web site.

Absolute Maximum Ratings

Stresses above the ratings listed below can cause permanent damage to the ICS525-01/02. These ratings, which are standard values for IDT commercially rated parts, are stress ratings only. Functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods can affect product reliability. Electrical parameters are guaranteed only over the recommended operating temperature range.

Item	Rating
Supply Voltage, VDD	7 V
All Inputs and Outputs	-0.5 V to VDD+0.5 V
Ambient Operating Temperature, Commercial	0 to +70°C
Ambient Operating Temperature, Industrial	-40 to +85°C
Storage Temperature	-65°C to 150°C
Junction Temperature	125°C
Soldering Temperature	260°C (max. of 10 seconds)

DC Electrical Characteristics

Unless stated otherwise, **VDD = 3.3 V**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Operating Voltage	VDD		3.0		5.5	V
Operating Supply Current	IDD	60 MHz out, no load, 15 MHz crystal, 525-01/02 only		8		mA
Operating Supply Current, Power-down	IDD	Pin 19 = 0, Note 1		4		µA
Input High Voltage	V_{IH}		2			V
Input Low Voltage	V_{IL}				0.8	V
Input High Voltage, X1/ICLK only	V_{IH}	ICLK (pin7)	VDD/2+1	VDD/2		V
Input Low Voltage, X1/ICLK only	V_{IL}	ICLK (pin7)		VDD/2	VDD/2-1	V
Output High Voltage	V_{OH}	I_{OH} = -12 mA	VDD-0.4			V
Output Low Voltage	V_{OL}	I_{OL} = 12 mA			0.4	V
Short Circuit Current		CLK and REF outputs		±55		mA
Input Capacitance	C_{IN}	V, R, S pins and pin 19		4		pF
On-chip Pull-up Resistor	R_{PU}	V, R, S pins and pin 19		270		kΩ

AC Electrical Characteristics

Unless stated otherwise, **VDD = 3.3 V**

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Units
Input Frequency	F_{IN}	Crystal input	5		27	MHz
		Clock input	2		50	MHz
Output Clock Rise Time		0.8 to 2.0 V		1		ns
Output Clock Fall Time		2.0 to 0.8 V		1		ns
Output Clock Duty Cycle, OD = 2, 4, 6, 8, or 10		At VDD/2	45	49 to 51	55	%
Output Clock Duty Cycle, OD = 3, 5, 7, or 9		At VDD/2	40		60	%
Output Clock Duty Cycle, OD = 1 (-02 only)		At VDD/2	35		65	
Power-down Time, PD low to clocks stopped					50	ns
Power-up Time, PD high to clocks stable					10	ms
Absolute Clock Period Jitter, 525-01, Note 2	t_{ja}	Deviation from mean		±140		ps
One Sigma Clock Period Jitter, 525-01, Note 2	t_{js}	One Sigma		45		ps
Absolute Clock Period Jitter, 525-02, Note 2	t_{ja}	Deviation from mean		±85		ps
One Sigma Clock Period Jitter, 525-02, Note 2	t_{js}	One Sigma		30		ps

NOTE 1: Phase relationship between input and output can change at power-up. For a fixed phase relationship, see the 527.

NOTE 2: For 16 MHz, 100 MHz output. Use the -02 for lowest jitter.

Package Outline Drawings

The package outline drawings are located at the end of this document and are accessible from the Renesas website (see Ordering Information for POD links). The package information is the most current data available and is subject to change without revision of this document.

Ordering Information

Part / Order Number	Marking	Shipping Packaging	Package	Temperature
525-01RLF	ICS525-01RLF	Tubes	28-pin SSOP	0 to +70°C
525-01RLFT	ICS525-01RLF	Tape and Reel	28-pin SSOP	0 to +70°C
525-01RILF	ICS525-01RILF	Tubes	28-pin SSOP	-40 to +85°C
525-01RILFT	ICS525-01RILF	Tape and Reel	28-pin SSOP	-40 to +85°C
525R-02LF	ICS525R-02LF	Tubes	28-pin SSOP	0 to +70°C
525R-02LFT	ICS525R-02LF	Tape and Reel	28-pin SSOP	0 to +70°C
525R-02ILF	ICS525R-02ILF	Tubes	28-pin SSOP	-40 to +85°C
525R-02ILFT	ICS525R-02ILF	Tape and Reel	28-pin SSOP	-40 to +85°C
525NQG-01	525NQG-01	Tubes	28-pin VFQFPN	0 to +70°C
525NQG-01T	525NQG-01	Tape and Reel	28-pin VFQFPN	0 to +70°C
525NQG-01I	525NQG-01I	Tubes	28-pin VFQFPN	-40 to +85°C
525NQG-01IT	525NQG-01I	Tape and Reel	28-pin VFQFPN	-40 to +85°C
525NQG-02	525NQG-02	Tubes	28-pin VFQFPN	0 to +70°C
525NQG-02T	525NQG-02	Tape and Reel	28-pin VFQFPN	0 to +70°C
525NQG-02I	525NQG-02I	Tubes	28-pin VFQFPN	-40 to +85°C
525NQG-02IT	525NQG-02I	Tape and Reel	28-pin VFQFPN	-40 to +85°C

Revision History

Rev. March 30, 2015
1. removed -11 and -12 references/parts from datasheet. The devices are obsolete.
2. Added VFQFPN packaging note to Features.
3. Updated POD with latest drawing
4. Updated Ordering Information.

Rev. August 23, 2021
1. Rebranded to Renesas.
2. Updated “Which Part to Use?” section to include updated link to calculators page.
3. Updated Package Outline Drawings section and Ordering Information table.

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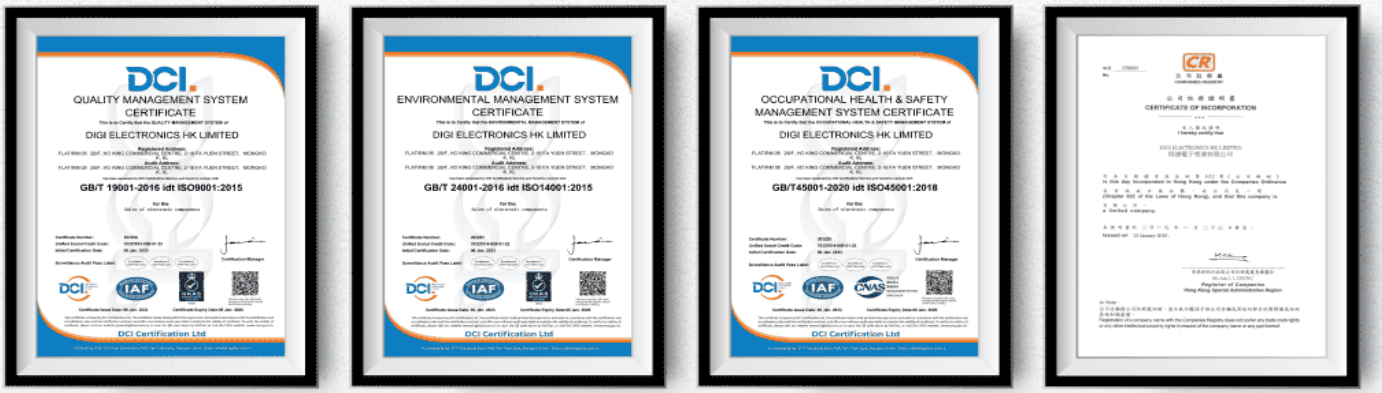

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