

Cirtec Neurostimulator ICs

PART #	CSI020	CSI021	CSI040	Saturn1	Saturn2
CHANNEL SPECIFICATIONS					
Number of independent channel outputs	32 ¹	4	16	26 ²	26 ²
Maximum single channel output current (mA)	12.7	6.12	25.4	15	15
Current amplitude resolution (µA)	100	3	25	15	15
Maximum compliance voltage (V)	18	18	18	18	23 ³
Typical electrode series capacitance (µF)	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0	0.1 – 1.0
Current digital-to-analog converter resolution (bits)	7	8	7	18 ⁴	18 ⁴
PULSE CAPABILITIES⁵					
Nominal system clock (kHz)	100	100	100	1000	1000
Maximum pulse frequency (kHz)	14.25	12.5	50	50	50
Pulse width range (µs)	20 – 1000	10 – 2550	2.5 – 1280	1 – 1500	1 – 1500
Pulse width resolution (µs)	10	10	2.5	1.0	1.0
Inter-phase delay between sink pulse and source pulse (µs)	20 – 65500	10 – 2550	2.5 – 1280	1 – 65535	1 – 65535
Inter-pulse between sink/source periods (ms)	0.02 – 655	0.01 – 20.4	0.0025 – 6400	2 – 131070	2 – 131070
Current sink to source amplitude ratio	1:8 – 8:1	4:1	1:1 – 8:1	Unrestricted	Unrestricted
Integrated clock	Yes	No	No	Yes	Yes
Integrated channel arbitration	Yes	No	No	No	No
Arbitrary waveform capability	No	No	No	Yes	Yes
Active charge balancing	Yes	Yes	Yes	Yes	Yes
Passive charge balancing	Yes	Yes	Yes	Yes	Yes
Charge balance correction	No	No	No	Yes	Yes
THERAPY CAPABILITIES					
Stimulation type	Bipolar	Monopolar	Monopolar or Bipolar	Monopolar or Bipolar	Monopolar or Bipolar
Integrated therapy control	Yes	Yes	Yes	Yes	Yes
Fully independent pulse timing	No	Yes	Yes	Yes	Yes
Burst stimulation	Yes	No	Yes	Yes	Yes
DC stimulation	No	No	Yes	Yes	Yes
Pulse skipping	No	No	Yes	Yes	Yes
Amplitude ramping – increasing	No	Yes	Yes	No	Yes
Amplitude ramping – decreasing	No	No	Yes	No	Yes
POWER, CONTROL, SIZE					
Minimum supply operating voltage (V)	3.5	2.4	2.4	2.4	2.4
HV boost voltage (V)	External	External	External	4 – 24	4 – 24
Sleep mode current consumption (µA)	15	< 1	< 1	< 2	< 2
Dynamic current consumption (µA) ⁶	40	150	600	500	100
Integrated battery charge controller	Yes	No	No	No	No
Multiple IC synchronization	No	Yes	No	No	No
SPI frequency (MHz)	1	1	1	8	8
Package (mm)	QFN72 (10x10)	QFN20 (4x4)	QFN72 (10x10)	TQFN100 (11.5x11.5)	
DEVELOPMENT SUPPORT					
Evaluation Kit Available	No	Yes	Yes	No	No
Complete IPG Available	Yes	No	No	Yes	No

¹Safety arbitration prevents channel overlapping
²Includes 2 "Enclosure" Channels

³Programmable from 4V to 23V
⁴Waveform DAC (8b) into Multiplier DAC (10b)

⁵Timing Parameters are based on Nominal clock and can be scaled
⁶Excluding HV supply currents

Cirtec Neural Sensing IC

CHANNEL SPECIFICATIONS	CSI080
Number of independent electrode inputs	8
Number of independent differential channels	4
Analog Input Dynamic Range (mV)	+/-2
Analog Input Referred Noise (nV _{rms})	300
Analog Input Impedance (MΩ)	3
Analog Signal Gain (V/V)	100 – 400
Analog Signal Bandwidth (Hz)	400
High-Pass Filter Corner (Hz)	3 – 30
ADC Sample Rate (sps)	500 – 2000
ADC Resolution (bits)	16
ADC Integral Non-Linearity (bits)	5
ADC Differential Non-Linearity (bits)	+/-0.5
Common Mode Rejection (dB)	70
Power Supply Rejection (dB)	100
POWER, CONTROL, SIZE	
Analog supply operating voltage (V)	1.7 – 1.9
Digital supply operating voltage (V)	1.7 – 1.10
Dynamic current consumption (μA)	900
Real-Time Stimulation Blanking	Yes
Blanking Fast-Recovery	Yes
SPI frequency (MHz)	1
Package (mm)	QFN40 (5x5)
DEVELOPMENT SUPPORT	
Evaluation Kit Available	TBD
Complete IPG Available	No

Cirtec Power Management IC

POWER MANAGEMENT FEATURES	Pluto
Battery supply voltage (V)	1.9 – 4.2
Primary battery protection	Yes
Battery recharge	Yes
Recharge output voltage (V)	4.7 – 5.5
Recharge fuel gauge	Yes
Rechargeable battery protection	Yes
Wireless power interface	Yes
Maximum wireless input voltage (V)	13.2
Voltage converter type	Buck/Boost
Converter output voltage (V)	2.65 – 2.85
Converter efficiency (typical)	88%
Regulated digital supply outputs	5
Digital supply voltage	2.4 – 2.6
Regulated analog supply outputs	1
Analog supply voltage	2.4 – 2.6
Brownout Detector	Yes
SUPPORT FEATURES	
Wireless communication monitor	Yes
Wireless monitor type	ASK
Thermistor interface	Yes
Magnetic switch interface	Yes
MCU interface	SPI
SPI frequency (MHz)	5
PACKAGING	
Package (mm)	QFN68 (8x8)