CDMA DATA TERMINAL

DTG2000-Dual Reference Manual
Application Information

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01-DTG2000-Dual-1 X5

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It is advised for the customers to contact our engineers for more information with respect to Keypad, audio interface, RF interface and input power supply before they start an actual design.

OEM integrators and installers are instructed that the phrase 'This device contains transmitter FCC ID: P4M-DTG2000' must be placed on the outside of the host.

⚠	**Warning: Exposure to Radio Frequency Radiation** The radiated output power of this device is far below the FCC radio frequency exposure limits. Nevertheless, the device should be used in such a manner that the potential for human contact during normal operation is minimized. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna should not be less than 20cm during normal operation and the gain of the antenna must not exceed 1dBi

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1. Introduction

1.1 Purpose

This manual provides hardware interface and programming information for the DTG2000-Dual CDMA Wireless Data Module.

1.2 Organization

This manual will discuss the interface and operation of the module and is divided into the following subsections:

- Section 2 – Introduces users to the DTG2000-Dual CDMA Wireless Data Module's basic features and general specifications.
- Section 3 – Lists each DTG2000-Dual pin and its function within the device. The pinout for the module is listed in numeric sequence.
- Section 4 – Specifies the recommended operating conditions, DC voltage characteristics, I/O timing, and power estimations for the module. Timing diagrams are also included.
- Section 5 – Details each subsystem or block within the module and shows how the subsystem or block interfaces with external peripherals.
- Section 6 – Provides package dimensions for the module.

1.3 Revision History

The revision history for this document is shown in Table 1-1.

Table 1-1 Revision History

Version	Date	Description
V1_X1	Dec. 2002	Initial Release
V1_X2	Feb. 2003	1st Revision
V1_X3	Mar. 2003	2nd Revision - 100 pin map - RF connector
V1_X5	May. 2004	3rd Revision - 100 pin map - Metal case drawing - Added Application schematic

1.4 References

1. QUALCOMM Incorporated. MSM6050 Mobile Station Modem™: Component Supply Specification. 80-V2466-1, April 13, 2002.
2. QUALCOMM Incorporated. MSM6050™ Mobile Station Modem: Device Specification (Preliminary Information). 93-V3185-1, March 29, 2002.
3. QUALCOMM Incorporated. SURF6050 User Manual. 80-V2551-40, March 29, 2002.

1.5 Acronym List

Term	Definition
CDMA	Code-Division Multiple Access
CODEC	Coder-Decoder
GPIO	General-purpose Input/Output
JTAG	Joint Test Action Group (ANSI/ICEEE Std. 1149.1-1990)
LCD	Liquid Crystal Display
LDO	Voltage Regulator
LED	Light Emitting Diode
PCB	Printed Circuit Board
PCM	Pulse Coded Modulation
PCS	Personal Communications Service
RF	Radio Frequency
Rx	Receive
TCXO	Temperature-Controlled Crystal Oscillator
Tx	Transmit
UART	Universal Asynchronous Receiver Transmitter

2. Overview

2.1 Application Descriptions

The CDMA Wireless Data Module is a complex consumer communications instrument that relies heavily on both digital signal and embedded processor technologies. The Wireless Data Modules manufactured by AnyDATA.NET support Code-Division Multiple Access (CDMA). This operates in both the cellular and PCS spectrum band.

In a continuing effort to simplify the design and to reduce the size and production cost of the Wireless Data Module, AnyDATA.NET has successfully developed the DTG series. The DTG2000-Dual is AnyDATA.NET's latest compact Wireless Data Module operating in the Cellular and PCS spectrum band. The DTG2000-Dual contains not only a complete digital modulation and demodulation system for CDMA standards as specified in IS-95 A/B and IS-2000, but also GPSOne position location solution which offers wireless callers their location wherever and whenever they need it.

GPSOne is QUALCOMM CDMA Technologies' position location solution. It offers the availability of position location determination in hostile environments (such as indoors) where conventional GPS receivers do not work well.

GPSOne uses a hybrid approach that utilizes signals from the GPS satellite constellation and from CDMA cell sites to determine location. Using the hybrid approach, GPSOne enhances location services availability, accelerates the location determination process, and provides improved accuracy.

The hybrid mode approach for position location uses signals from CDMA cell stations and GPS satellites to compute the user's location. This approach basically takes advantage of an accurate knowledge of GPS system timing on a CDMA mobile station. The knowledge of system timing allows the GPSOne solution to use both the CDMA signal measurements and GPS signal measurements collectively to compute the user's location. It also allows for a central entity, named Position Determination Entity (PDE), to send estimated signal phases to the mobile. This knowledge reduces the time to search the satellite pseudo ranges on the mobile, thus improving the time taken to determine the user's position.

The subsystem in the DTG2000-Dual includes a CDMA processor (MSM6050), an integrated CODEC with an ear piece and microphone amplifiers, and an RS-232 serial interface supporting forward link data communications at a rate of 153kbps.

The DTG2000-Dual provides an external interface that includes the standard RS-232, Digital Audio, External reset control, parallel LCD Display, Keypad, Ringer extension ports and R-UIM for China

market.

The DTG2000-Dual has the capability to power down unused circuits in order to dynamically minimize power consumption.

2.2 Technical Specifications

2.2.1 General Specifications

Parameters	Descriptions
External Access	Code-Division-Multiple-Access (CDMA)
CDMA Protocol	IS-95 A/B, IS-98A, IS-126, IS-637A, IS-707A, IS-2000
Data Rate	153.6Kbps max
Transmit/Receive Frequency Interval	45MHz for Cellular and 80MHz for PCS
Vocoder	EVRC, 13kQCELP
RF technology	Zero Intermediate Frequency
Number of Channel	832 for Cellular and 42 for PCS
Operating Voltage	DC +3.4V ~ +4.3V BATT_INT (Pin88 and 90) DC +4.0V to +5.0V +VEXT_DC (Pin87 and 89)
Current Consumption	1. VCC applied to +VEXT_DC (Pin87 and Pin89) Stand by mode: Idle (110mA), Sleep (less than 9mA) Busy mode: 900mA (Max) 2. VCC applied to BATT_INT (Pin88 and Pin90) Stand by mode: Idle (110mA), Sleep (less than 1mA) Busy mode: 900mA (Max) See section 4.5.1 for detail
Operating Temperature	-30ºC ~ +60ºC
Frequency Stability	±300Hz for Cellular and ±150Hz for PCS
Antenna	GSC Connector, 50ohm
Size	38 X 38 X 5.8mm with case
Weight	About 15g
External Interface	RS-232s, Digital/Analog Audios, LCD, Keypad, Ringer External Reset Control, R-UIM, MP3, MIDI, GPIOs
User Interface Software	BREW support
Additional Function	GPSOne position location solution

2.2.2 Receiver Specifications

Parameters	Descriptions
Frequency Range	869.04 ~ 893.97 MHz for Cellular and 1931.25 ~ 1988.75MHz for PCS
Sensitivity	Below –104 dBm
Interference Rejection	Single tone (-30dBm @900KHz): Below –101dBm Two tone (-43 dBm @900KHz and 1700KHz): Below –101dBm Two tone (-32 dBm @900KHz and 1700KHz): Below –90dBm Two tone (-21 dBm @900KHz and 1700KHz): Below –79dBm
Spurious Wave Suppression	Below –80dBc
Input Dynamic Range	-25 dBm ~ -104dBm

2.2.3 Transmitter Specifications

Parameters	Descriptions
Frequency Range	824.04 ~ 848.97 MHz for Cellular and 1851.25 ~ 1908.75MHz for PCS
Nominal Max Power	0.32 W (24.7dBm)
Peak Power in Operation Mode	0.35W (25.5dBm)
Minimum Controlled Output Power	Below –50dBm
Max Power Spurious	900KHz: Below –42dBc/30KHz 1.98MHz: Below –54dBc/30KHz

2.2.4 gpsOne Receiver Specifications

Parameters	Descriptions
Frequency Range	L1, 1575.42MHz
C/A Code	1.023MHz Chip Rate
Receiver Sensitivity	-152dBm

2.2.5 Standards

IS-95 A/B: Protocol Between MS & BTS

IS-96A: Voice Signal Coding

IS-98A: Base MS Function

IS-126: Voice Loop-Back

IS-637: Short Message Service

IS-707: Data Service

Built-in TCP/IP : AnyDATA proprietary software

IS-657 : packet data

2.3 Interface Diagram

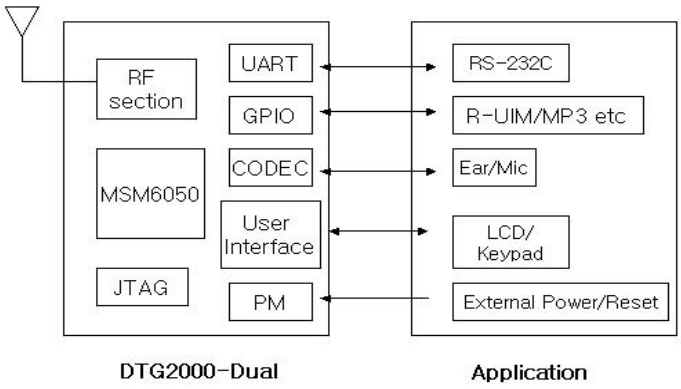


Figure 2-1 Interface Block Diagram

3. PIN Description

3.1 I/O Description Parameters

Symbol	Description
I	CMOS Input
O	Output
B	Bi-directional
N	Voltage or Current Level
IS	Input with Schmitt Trigger
BS	Bi-directional Schmitt Trigger
PU	Internal Pull-Up
PD	Internal Pull-Down

3.2 PIN Names and Pinouts

3.2.1 100-Pin Connector

PIN	NAME	TYPE	DESCRIPTION
1	D15	B-K3	Data line
2	AGND	AGND	Analog Ground
3	D14	B-K3	Data line
4	AGND	AGND	Analog Ground
5	D12	B-K3	Data line
6	D13	B-K3	Data line
7	D10	B-K3	Data line
8	D11	B-K3	Data line
9	D08	B-K3	Data line
10	D09	B-K3	Data line
711	GND	GND	Signal ground
12	GND	GND	Signal ground
13	MSM_DP_DCD/ (GPIO_INIT44)	BS-PD	Data carrier detect (UART1)
14	MSM_DP_RI/ (GPIO_INIT54)	BS-PD	Ring indicator (UART1)
15	MSM_DP_RFR/	O	Ready for Receive (UART1)
16	MSM_DP_TXD	O	Transmit data (UART1)
17	MSM_DP_DTR/ (GPIO_INIT50)	BS-PU	Data terminal ready (UART1)
18	MSM_DP_RXD	IS-PD	Receive data (UART1)
19	MSM_DP_CTS/	IS-PD	Clear to send (UART1)
20	MSM_DP_RXD2(UIM_PWR_EN)	BS_PD3	General purpose input output, Receive data (UART2)
21	MSM_DP_TXD2 (UIM_DATA)	BS_PD3	General purpose input output,Transmit data (UART2)
22	MSM_DP_CTS2/ (UIM_RESET)	BS_PD3	General purpose input output, Clear to send (UART2)
23	MSM_DP_RFR2/ (UIM_CLK)	BS_PD3	General purpose input Output, Ready for Receive(UART2)
24	GPIO_INT15	BS_PU3	General purpose input output

PIN	NAME	TYPE	DESCRIPTION
25	AUX_PCM_CLK	BS_PD3	External CODEC PCM clock
26	AUX_PCM_DOUT	BS_PU3	External CODEC PCM data output
27	AUX_PCM_SYNC	BS_PD3	External CODEC PCM data strobe
28	AUX_PCM_DIN	IS-PD	External CODEC PCM data input
29	GPIO_INT49	BS_HK2	General purpose input output
30	POWER_ON	I	POWER ON used only when to use 3.6V 1cell battery External pulled up required
31	EX_RESET	I	External Reset (Low Enable)
32	GPIO_INT18	BS_PD3	General purpose input output
33	GPIO_INT45	BS_PD3	General purpose input output
34	GPIO_INT33 (IDLE LED)	BS_PD3	General purpose input output, Idle LED Enable
35	GPIO_INT47 (BUSY LED	BS_PU3	General purpose input output, Busy LED Enable
36	GND	GND	Signal ground
37	GND	GND	Signal ground
38	D00	B-K3	Data line
39	D01	B-K3	Data line
40	D02	B-K3	Data line
41	D03	B-K3	Data line
42	D04	B-K3	Data line
43	D05	B-K3	Data line
44	D06	B-K3	Data line
45	D07	B-K3	Data line
46	A02	B-K3	Address line
47	A01	B_K3	Address line
48	RESET_OUT/	O	Reset Out
49	GPIO_INT37(LCS_CS/)	BS_PU3	General purpose input output
50	GPIO_INT36(LCD_EN)	BS_PU3	General purpose input output
51	OE/	O-3	Output Enable Signal
52	WE/	O-3	Write Enable Signal
53	KEYSENSE0/ (GPIO_INT62)	IS_PU3	Key sense input
54	KEYSENSE1/ (GPIO_INT63)	IS_PU3	Key sense input
55	KEYSENSE2/ (GPIO_INT64)	IS_PU3	Key sense input
56	KEYSENSE3/ (GPIO_INT65)	IS_PU3	Key sense input
57	KEYSENSE4/ (GPIO_INT66)	IS_PU3	Key sense input
58	GPIO_INT61 (KEYPAD00)	BS_PD3	General purpose input output, Keypad input
59	GPIO_INT60 (KEYPAD01)	BS_PD3	General purpose input output, Keypad input
60	GPIO_INT59 (KEYPAD02)	BS_PD3	General purpose input output, Keypad input
61	GPIO_INT58 (KEYPAD03)	BS_PD3	General purpose input output, Keypad input
62	GPIO_INT57 (KEYPAD04)	BS_PD3	General purpose input output, Keypad input
63	GPIO_INT56 (KEYPAD05)	BS_PD3	General purpose input output, Keypad input
64	GPIO_INT48(ON_SW_SENSE)	BS_PU3	General purpose input output
65	GPIO_INT09	BS_HK2	General purpose input output
66	GPIO_INT10	BS_HK2	General purpose input output
67	SMS LED	O	SMS LED Enable
68	GPIO_INT17	BS_PU3	General purpose input output
69	GPIO_INT04	BS_PD3	General purpose input output
70	GPIO_INT16	BS_PU3	General purpose input output
71	VIBRATOR_DRV	O	VIBRATOR_DRV output
72	PS_HOLD	O	PS_HOLD output, POWER LED Enable
73	AUXON	OA	Auxiliary output (-)
74	RINGER	O	Ringer Enable output

PIN	NAME	TYPE	DESCRIPTION
75	AUXOP	OA	Auxiliary output (+)

PIN	NAME	TYPE	DESCRIPTION
76	GND	GND	Signal ground
77	GND	GND	Signal ground
78	GPIO_INT19(EAR_DET1)	BS_PD3	General purpose input output, EAR Jack Detect
79	EAR2O	OA	Ear Jack speaker output
80	EAR1O_P	OA	External speaker (+) output
81	EAR1O_N	OA	External speaker (-) output
82	MIC1P	IA	External Mic (+) input
83	MIC2P	IA	Ear Jack Mic (+) input
84	GND	GND	Signal Ground
85	GND	GND	Signal ground
86	+VBATT	IA	Battery Gauge input
87	+VEXT_DC	V	External DC input
88	VATT_INT	V	Battery input
89	+VEXT_DC	V	External DC input
90	VATT_INT	V	Battery input
91	GPIO_INT11(RXD3)	BS_PD3	General purpose input output (UART3)
92	GPIO_INT12(TXD3)	BS_PD3	General purpose input output (UART3)
93	GPIO_INT13(CTS/3)	BS_PD3	General purpose input output (UART3)
94	GPIO_INT14(RFR/3)	BS_PD3	General purpose input output (UART3)
95	GPIO_INT02	BS_PU3	General purpose input output
96	GP_ADC_DET	BS_PD3	General purpose ADC input
97	GPIO_INT34	BS_PU3	General purpose input output
98	GPIO_INT35	BS_PU3	General purpose input output
99	GND	GND	Signal ground
100	GND	GND	Signal ground

3.3 100-PIN Connect Pinouts (Topview)

Table 3-1 100-PIN Connector Pinouts

1	D15	2	AGND
3	D14	4	AGND
5	D12	6	D13
7	D10	8	D11
9	D08	10	D09
11	GND	12	GND
13	MSM_DP_DCD/ (GPIO_INT44)	14	MSM_DP_RI/ (GPIO_INT54)
15	MSM_DP_RFR/	16	MSM_DP_TXD
17	MSM_DP_DTR/ (GPIO_INT50)	18	MSM_DP_RXD
19	MSM_DP_CTS/	20	MSM_DP_RXD2 (UIM_PWR_EN)
21	MSM_DP_TXD2 (UIM_DATA)	22	MSM_DP_CTS2/ (UIM_RESET)
23	MSM_DP_RFR2/ (UIM_CLK)	24	UART_EN
25	AUX_PCM_CLK	26	AUX_PCM_DOUT
27	AUX_PCM_SYNC	28	AUX_PCM_DIN
29	GPIO_INT49	30	POWER_ON
31	EX_RESET	32	GPIO_INT18
33	GPIO_INT45	34	IDLE LED
35	BUSY LED	36	GND
37	GND	38	D00
39	D01	40	D02
41	D03	42	D04
43	D05	44	D06
45	D07	46	A02
47	A01	48	RESET_OUT
49	LCD_CS/ (GPIO_INT37)	50	LCD_EN (GPIO_INT36)
51	OE/	52	WE/
53	KEYSENSE0/ (GPIO_INT62)	54	KEYSENSE1/ (GPIO_INT63)
55	KEYSENSE2/ (GPIO_INT64)	56	KEYSENSE3/ (GPIO_INT65)
57	KEYSENSE4/ (GPIO_INT66)	58	KEYPAD00 (GPIO_INT61)
59	KEYPAD01 (GPIO_INT60)	60	KEYPAD02 (GPIO_INT59)
61	KEYPAD03 (GPIO_INT58)	62	KEYPAD04 (GPIO_INT57)
63	KEYPAD05 (GPIO_INT56)	64	GPIO_INT48 (ON_SW_SENSE/)
65	GPIO_INT09	66	GPIO_INT10
67	SMS LED	68	GPIO_INT17
69	GPIO_INT04	70	GPIO_INT16
71	VIBRATOR_DRV	72	PS_HOLD, Power On LED
73	AUXON	74	RINGER
75	AUXOP	76	GND
77	GND	78	GPIO_INT19 (EAR_DET1)
79	EAR2O	80	EAR1O_P

81	EAR1O_N	82	MIC1P
83	MIC2P	84	GND
85	GND	86	+VBATT
87	+VEXT_DC	88	VATT_INT
89	+VEXT_DC	90	VATT_INT
91	GPIO_INT11 (MSM_DP_RXD3) *	92	GPIO_INT12 (MSM_DP_TXD3) *
93	GPIO_INT13 (MSM_DP_CTS3/)	94	GPIO_INT14 (MSM_DP_RFR3)
95	GPIO_INT02	96	GP_ADC_DET
97	GPIO_INT34 (GP_CS0/)	98	GPIO_INT35 (GP_CS1/)
99	GND	100	GND

Notes:

*** Pin 91 and Pin 92 can be used as the third UART for debugging. We strongly recommend that the user have a 3-pin connector or 3 test points on their board, so that one can easily monitor and diagnose their module.**

4. Interface Descriptions

4.1 Overview

This chapter covers information required to convert the DTG2000-Dual into a subscriber unit application. In addition, some of the internal blocks of the device are described. Understanding these internal blocks is necessary for one to completely grasp the functions of the various interfaces.

This chapter discusses the interface to the major blocks of the DTGD2000-Dual as shown in the following figure. These blocks include:

- Power Up
- CODEC Interface
- UART Interface
- General Purpose Interface
- External Hardware Reset
- User Interface

4.2 Powering Up the Module

There are two ways to power up the module and customers may choose one of the two ways to power up DTG2000.

4.2.1 Supply input to +VEXT_DC (Pin 87 and Pin 89)

If the customers don't need to save current in sleep mode, which is around 15mA, supplying the voltage input to +VEXT_DC (Pin 87 and 89) is recommended.

When the input voltage from +4V to +5.0V is supplied, DTG2000 will automatically start its power-on process and finish it within 2 seconds. In this case, using a regulator with an enable pin is highly recommended so that the customer can reset the module using the enable pin if software lock-up symptoms are found.

If a customer needs to use charging circuit built in the module, apply **+4.5V DC** to +VEXT_DC (Pin87 and 89) and connect the 3.6V 1cell lithium-ion battery to BATT_INT (Pin86 and 88).

4.2.2 Supply Input to BATT_INT (Pin 86 and Pin 88)

If the customers need to get their device to operate in a very low sleep current mode, supplying the voltage input to BATT_INT (Pin 86 and 88) is recommended.

When the input voltage from +3.4V to +4.3V is supplied to BATT_INT(Pin86 and 88), DTG2000 won't automatically start its power-on process without low assertion of POWER_ON (Pin 67). To power the module on, first apply VCC to BATT_INT and have POWER_ON (Pin 67) stay low for more than 500 msec and less than 2 sec.

POWER_ON (Pin 67) needs to be externally pulled up to 3V to 3.6V thru 100kohm resistor.

To power off the module, have POWER_ON(Pin 67) stay low for more than 2sec and less than 4sec and then the voltage in BATT_INT may or may not be removed.

If Vcc is supplied thru a regulator to BATT_INT(Pin86 and 88), using a regulator with an enable pin is highly recommended so that the customer can shut off the power to the module using the enable pin if software lock-up symptoms are found. If the modem is locked up, low assertion of POWER_ON(Pin 67) won't power on or off the module.

If Vcc is supplied directly from a battery, having a FET between the output of a battery and input of DTG2000 is recommended that the customer can shut off the Vcc to DTG2000 using the FET.

4.3 CODEC Interface

With the integrated microphone and earpiece amplifier including CODEC, the DTG2000-Dual module interfaces directly, either differential or single-ended, to the microphone and earpiece.

The audio features in the module are

- Two microphone inputs
- Two earphone outputs and one auxiliary audio output.

4.3.1 Internal CODEC Interface

The module contains analog audio interface circuitry. The contained audio interface supports all of the required conversation and amplification stages for the audio front end.

The audio interface includes the amplification stages for both the microphone and earphone.

The EAR10 and MIC1P are typically used for the handset microphone,

The EAR_JACK+ and MIC2P are typically used for the ear-jack.

Table 4-1 Analog Audio Pinouts

NAME	DESCRIPTION	CHARACTERISTIC
MIC2P	Mic Jack Input	Analog Input (Pin No. 83, for Ear-Mic Jack) *
EAR_DET1	EAR/MIC Set Detect	Logic Input (Pin No. 78) **
EAR_JACK+	Earphone Output	Analog Output (Pin No. 79 for Ear-Mic Jack)
GND_A	Audio Ground	Audio Ground (Pin No. 2, 4)

NAME	DESCRIPTION	CHARACTERISTIC
EAR10_N	Speaker Output -	Analog Output (Pin No. 81)
EAR10_P	Speaker Output +	Analog Output (Pin No. 80)
MIC1P	Mic Input	Analog Input (Pin No. 82), Mic bias is supplied from this pin.
AUXON	Auxiliary Output -	Analog Output (Pin No. 73)
AUXOP	Auxiliary Output +	Analog Output (Pin No. 75)

Note:

* MIC2, along with being a microphone input, checks to see if the user has pressed the headset key, which allows the user to connect to or disconnect from a call. This pin is internally pulled high and is therefore normally in the high state. To activate this input and connect to or disconnect from a call, the user must set the MIC2 pin to a low state for 100ms to 200ms.

** EAR_DET1 checks to see if a headset has been connected to the ear-jack. When there is no headset connected to the ear-jack, the audio path thru an ear jack is disconnected. When a headset is connected to the ear-jack, audio path is opened. To simulate a headset connected to the ear-jack, the user must apply a low signal to the EAR_DET1 pin for as long as the user wants the audio path to be kept open.

4.3.2 Extended CODEC Interface

The PCM CODEC interface is used for the car-kit audio system. This interface is optional.

External CODEC interface signals are listed below:

Table 4-2 Digital CODEC Pinouts

NAME	DESCRIPTION	PINOUTS
AUX_PCM_CLK	PCM Clock	Pin No. 25
AUX_PCM_DIN	PCM Data Input	Pin No. 28
AUX_PCM_DOUT	PCM Data Output	Pin No. 26
AUX_PCM_SYNC	PCM Sync.	Pin No. 27

4.4 UART Interface

The Universal Asynchronous Receiver Transmitter (UART) communicates with serial data that conforms to the RS-232 Interface protocol. The module has 3 UARTs which provides 3.0V CMOS level outputs and 3.0V CMOS input levels. All the control signals of the RS-232 are active low, however the data signals, RXD and TXD, are active high.

UART1 which has 512 bytes for Tx and Rx FIFO, supports high speed data communication up to 230.4kbps, program download and diagnostic monitor function.

UART2 and 3 which 64 bytes for T/Rx FIFO, support low speed data communication up to 115.2kbps, program download and diagnostic monitor function.

The UART features hardware handshaking, programmable data sizes, programmable stop bits, and odd, even, no parity.

4.4.1 UART1 interface

Table 4-3 UART1 Interface Pinouts

NAME	DESCRIPTION	PIN NUNBER	CHARACTERISTIC
DP_DCD/	Data Carrier Detect	13	Network connected from the module
DP_RI/	Ring Indicator	14	Output to host indicating coming call
DP_RFR/	Ready for Receive	15	Ready for receive from host
DP_TXD	Transmit Data	16	Output data from the module
DP_DTR/	Data Terminal Ready	17	Host ready signal
DP_RXD	Receive Data	18	Input data to the module
DP_CTS/	Clear to Send	19	Clear to send to the host
GND	Signal Ground	11, 12	Signal ground

4.4.2 UART2 interface

The UART2 supports R-UIM interface.

Table 4-4 UART2 Interface Pinouts

NAME	DESCRIPTION	PIN NUMBER	CHARACTERISTIC
DP_RXD2	Receive Data	20	Input data to the module
DP_TXD2	Transmit Data	21	Output data from the module
DP_CTS2/	Clear to Send	22	Clear to send to the host
DP_RFR2/	Ready for Receive	23	Ready for receive from host
GND	Signal Ground	11, 12	Signal ground

If a customer wants to use R-UIM card, UART2 can't be used as UART.

4.4.3 UART3 interface

The UART3 is used to monitor and diagnose the status of the DTG2000-Dual. It is strongly recommended for the user to have the following UART3 pins connected to an extra connector or to test points, in order to easily troubleshoot any problems with the module.

Table 4-5 UART3 Interface Pinouts

NAME	DESCRIPTION	PIN NUMBER	CHARACTERISTIC
DP_RXD3	Receive Data	29	Input data to the module
DP_TXD3	Transmit Data	30	Output data from the module
DP_CTS3/	Clear to Send	34	Clear to send to the host
DP_RFR3/	Ready for Receive	32	Ready for receive from host
GND	Signal Ground	11, 12	Signal ground

4.5 General Purpose Interface

The general purpose interface consists of 11 user-definable bi-directional pins.

Each GPIO pin can be configured as an input interrupt source. In addition, some GPIO pins can be used as output control pins from the module. The user can define these pins properly as follows.

Table 4-6 General Purpose Interface Pinouts

NAME	PIN NUMBER	CHARACTERISTIC
GPIO_INT15	24	Configured as a pull-up, Bi-directional
GPIO_INT45	33	Configured as a pull-up, Bi-directional
GPIO_INT17	68	Configured as a pull-up, Bi-directional
GPIO_INT04	69	Configured as a pull-down, Bi-directional
GPIO_INT16	70	Configured as a pull-down, Bi-directional
GPIO_INT09	65	Configured as a pull-down, Bi-directional
GPIO_INT10	66	Configured as a pull-up, Bi-directional
GPIO_INT42	93	Configured as a pull-up, Bi-directional
GPIO_INT49	29	Configured as a pull-down, Bi-directional
GPIO_INT02	95	Configured as a pull-down, Bi-directional
GPIO_INT18	32	Configured as a pull-down, Bi-directional

4.6 External Hardware Reset and Power Down Registration

4.6.1 External Hardware Reset (Pin #31)

There are two types of resets that the user can employ to restart the module. The first type will reset the MSM and the memory and is performed when the user gives the AT command, AT+RESET, to the MSM. Another way to reset the module is by using the external hardware reset. This type of reset will reset the hardware as well as the MSM and the memory. The flash memory will be the only information that is kept. To perform an external hardware reset, make sure the module has powered on and is not in the initialization stage, and then **pull low** the external hardware reset pin (Pin #31) for 200ms to 500ms. Keep the external hardware reset pin high or floating when the module is initializing and booting up as well as during normal operation. This pin is **internally pulled up to +3.0V**.

4.6.2 Power Down Registration

Before DTG-2000 is powered off, it has to send power down registration message to the CDMA base station to help the base station to maximize its capacity. Depending on air interface environment, it may take 12 seconds at maximum according to CDMA technical standard.

4.6.2.1 Power Down Registration Protocol for CDMA device

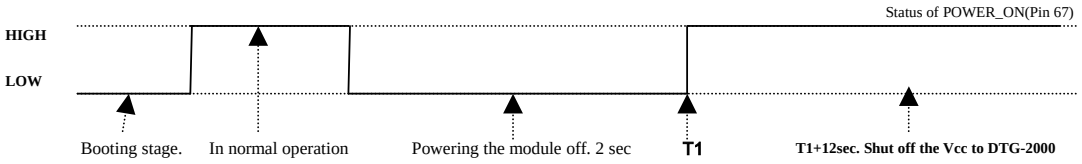
4.6.2.1.1 Using AT command (When Vcc is applied to +VEXT_DC)

Device connected to DTG-2000 DTG-2000

Before powering off DTG-2000, send “AT+POWEROFF” to DTG-2000.

After waiting for 12 seconds, the host device may shut down the power to DTG-2000.

4.6.2.1.2 Using POWER_ON (Pin 67) (Only when Vcc is applied to BATT_INT)



4.7 User Interface

4.7.1 Keypad

The keypad interface consists of a 5 X 6 matrix pattern. The 5-KEYSENSE/[4:0] pins are used to connect a matrix keypad to the module. The KEYSENSE/ pins are active low.

The 6-KEYPAD pins are necessary to construct the other side of the matrix. These KEYPAD pins must be active high in order for the keypad matrix to work properly. The general keypad matrix is shown below:

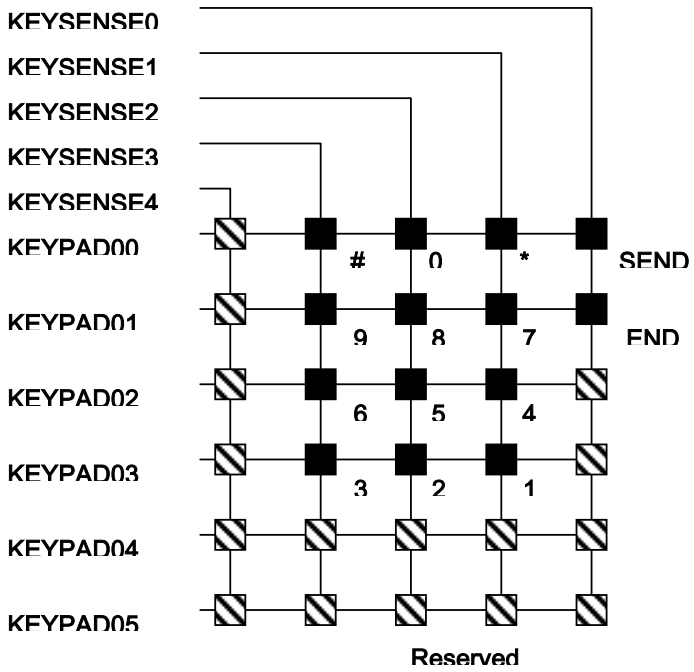


Figure 4-1 Keypad Matrix

DTMF

When key is pressed, CDMA Module generates standard DTMF tone and sends it to the local audio path (speaker). If the Mobile station is in traffic state, the CDMA Module sends DTMF Message to the Base Station and to the local audio path (speaker) at the same time. The network will deliver the analog DTMF tone or DTMF Message to its final destination.

4.7.2 LCD

The module supports the 16 bits parallel LCD interface as well as the 8 bits. The LCD interface is composed of 23-signals. Direct access to the LCD driver is not applicable.

Table 4-7 LCD Interface Signals

NAME	TYPE	CHARACTERISTIC
LWR/	BS_PU	LCD RW pin out from the module
RD/	BS	LCD E pin out from the module
A01	B	LCD RS pin out from the module
LCD_CS/	O	LCD Chip Select pin out from the module
RES_OUT/	O	LCD Reset from the module
D00 ~ D015	O	LCD Data Lines from the module
VDD		LCD Power Supply
GND		LCD Signal Ground

4.7.3 Ringer (Pin74)

The Ringer pin provides the output to drive the sound transducer on the host. It alerts the user of a voice call event and outputs key tones if the keypad is connected.

The DTG2000-Dual module includes Ringer Driver and drives Buzzer directly.

Table 4-8 Ringer/Buzzer Driver Output Spec.

PARAMETER	TEST CONDITION	TYPICAL VALUE
Drive Frequency		Max 8kHz
Load Current	R_load=10 ohm	Min 300mA
Load Resistance		Typ 10 ohm

4.7.4 LED Interface

Table 4-9 LED interface

PIN NUMBER	USE	REMARK
34	Idle LED	High Enable, High indicates "The device is in CDMA service area"
35	Busy LED	High Enable, High indicates "The device is in CDMA Traffic state"
67	SMS LED	High Enable High indicates "The device has received SMS message
72	Power On LED	High Enable High indicates "The device is turned on"

Above pins can not drive LED directly. Must use driver ICs to drive LEDs

5. Electrical Specifications

5.1 DC Electrical Specifications

5.1.1 Absolute Maximum Ratings

Operating the module under conditions that exceed those listed in the Absolute Maximum Ratings table may result in damage to the module.

Absolute Maximum Ratings should be considered as limiting values. The module may not function properly and should not be operated if any one of the parameters is not within its specified operating range.

Table 5-1 Absolute Maximum Ratings

PARAMETER		MIN	MAX	UNITS
Storage Temperature		-50	+85	ºC
Voltage On Any Input or Output Pin		-0.8	+3.5	V
Supply Voltage	+VEXT_DC	-1.0	+5.0	V
	BATT_INT	-1.0	+4.4	V
Initializing Current		250		mA
Drop		No damages after 60-Inch drop over concrete floor		

5.1.2 Recommended Operating Conditions

PARAMETER		MIN	TYP	MAX	UNITS
Supply Voltage	+VEXT_DC	+4.0	**+4.5**	+5.0	V
	BATT_INT	+3.4	**+4.0**	+4.3	V
Operating Temperature		-30		+60	ºC
Operating Humidity		95% (50°C) Relative Humidity			

5.1.3 Power Consumption

CONVERSATION (Busy)	STANDBY	
	Idle	Sleep
900mA (MAX)	110mA	+VEXT_DC : 9mA BATT_INT : 1mA

5.1.4 Serial Interface Electrical Specifications

PARAMETER	MIN	TYP (NO LOAD)	MAX	UNITS
Input High Voltage	+2.0	+3	+3.3	V
Input Low Voltage	-0.5	0	+0.8	V
Output High Voltage	+2.4	+2.8	+3.0	V
Output Low Voltage		0	+0.4	V

5.2 Timing characteristics

5.2.1 External CODEC Timing

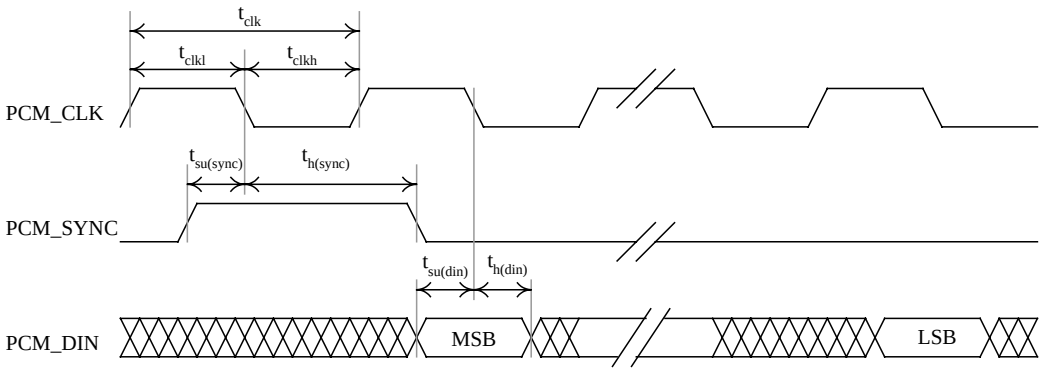


Figure 5-1 External PCM CODEC to Module timing

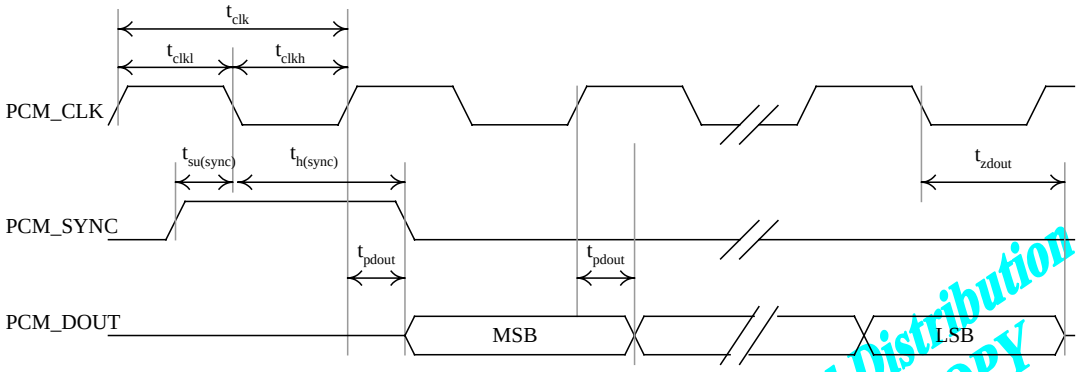


Figure 5-2 Module to External PCM CODEC timing

Table 5-2 External PCM CODEC Parameters

PARAMETER	DESCRIPTION	MIN	TYP.	MAX	UNIT
t_{clk}	PCM-CLK cycle time	400	500		ns
t_{clkl}	PCM-CLK low time	200	250		ns
t_{clkh}	PCM-CLK high time	200	250		ns
$t_{su(sync)}$	PCM_SYNC setup time to PCM_CLK falling		150		ns
$t_{h(sync)}$	PCM_SYNC hold time after PCM_CLK falling		350		ns
$t_{su(din)}$	PCM_DIN setup time to PCM_CLK falling	50			ns
$t_{h(din)}$	PCM_DIN hold time after PCM_CLK falling	10			ns
t_{pdout}	Delay from PCM_CLK falling to PCM_DOUT			50	ns

5.2.2 LCD Timing

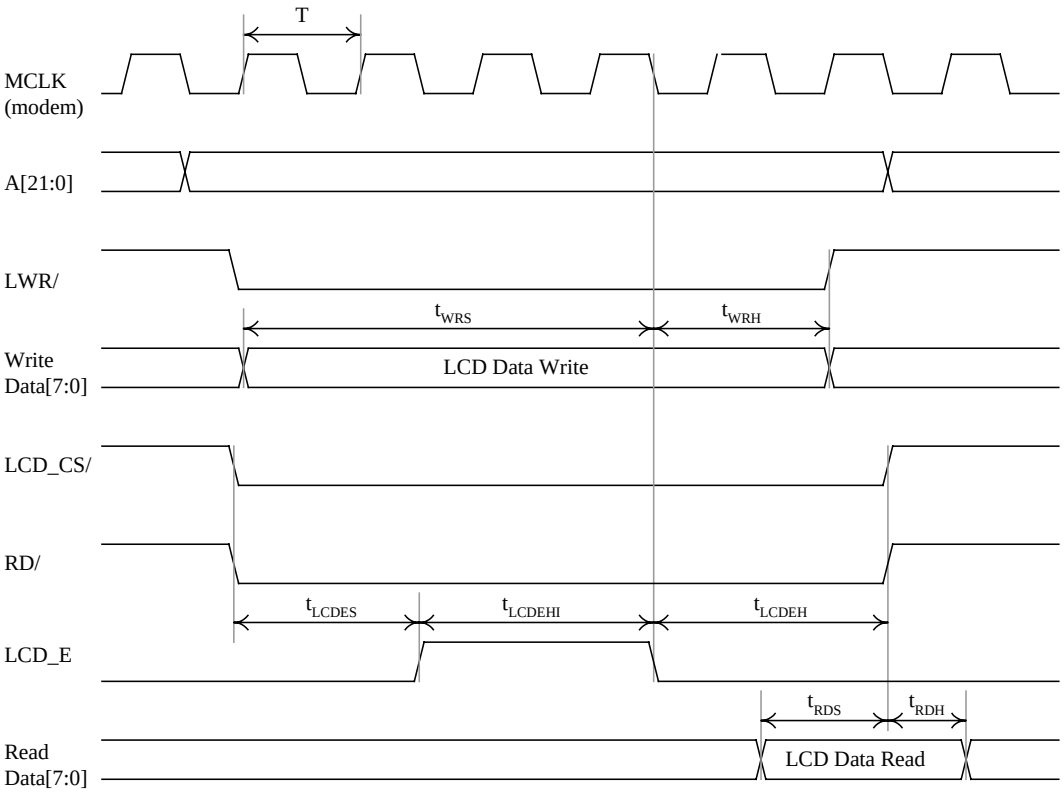


Figure 5-3 LCD Timing

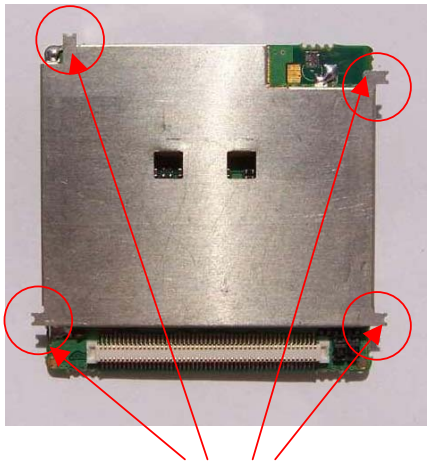
Table 5-3 LCD Timing Parameters

PARAMETER	DESCRIPTION	MIN	MAX	UNIT
t_{LCDES}	LCD_CS/ active to LCD_E active			ns
t_{LCDEHI}	Pulse width if LCD_E active			ns
t_{LCDEH}	LCD_E inactive to LCD_CS/ inactive (write)			ns
t_{LCDEHR}	LCD_E inactive to LCD_CS/ inactive (Read)			
t_{RDS}	Read data setup			ns
t_{RDH}	Read data hold			ns
t_{WRS}	Write data setup to LCD_E inactive			ns
t_{WRH}	Write data hold from LCD_E inactive			ns

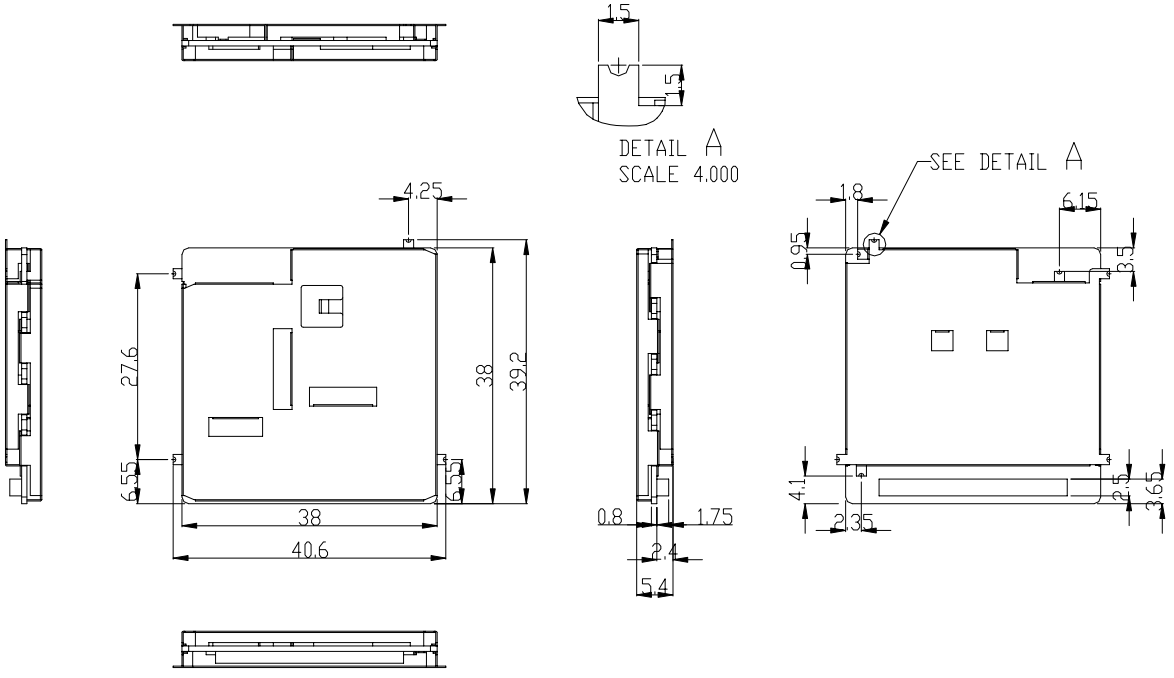
- k, I, n is integer lower than 16, MCLK is internal Clock of module

6. Mechanical Dimensions

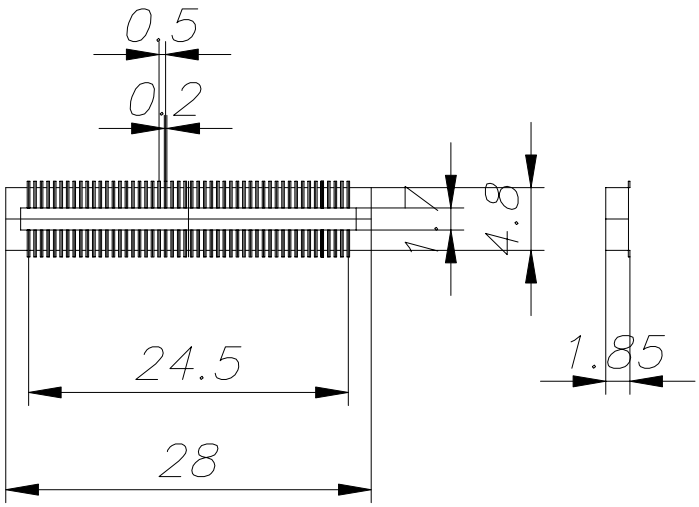
6.1 DTG2000-Dual Outline



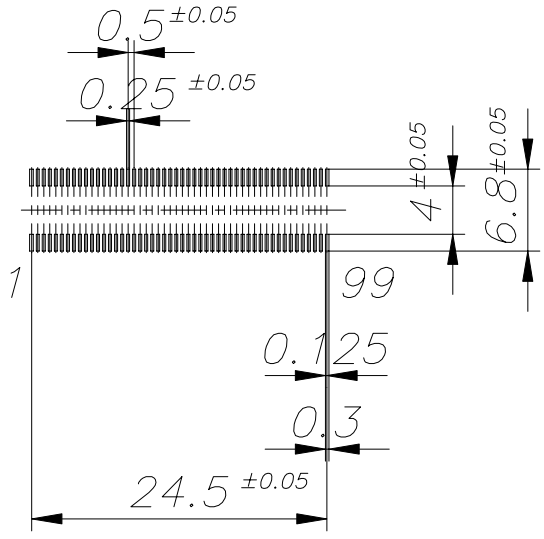
At least two of these 4 solder points in red circles MUST be soldered to PCB GND in the host device



6.2 100-Pin Connector Mechanical Dimension



Mechanical Dimension



PCB LAYOUT

Figure 6-1 100pins Connector (Units: mm)

Counter-Part (the 100-pins socket connector (not on the DTG2000-Dual)):

Part Name: Socket pin connector (0.5mm pitch, straight, dual row)

Part Number: AXK5F00545J

Manufacture : NAIS

Note: For more information on the 100-pins socket connector,

Please visit http://www.nais-e.com/ , click connector, and “NARROW PITCH(0.5mm) CONNECTORS P5 SERIES P5KF” .

6.3 RF Connector

Our part number : **MM9329-2700**.

Counter part number : MXTK92( )( )( )

Please, visit http://www.murata.com and search for MXTK92 in product search engine

● Part Numbering

Coaxial Connectors (Chip Type Receptacle)

(Part Number) MM | 7329 | -27 | 00 | R | A1

❶Product ID

Product ID	
MM	Microwave Coaxial Connectors (Chip Type Receptacle)

❷Series

Code	Series
3325	BFA Type Straight
3326	BFA Type Right Angle
7329	FSC Type
8430	SWD Type
9329	GSC Type

❸Individual Specification Code (1)

Code	Individual Specification Code (1)
-25	Discrete Terminal
-26	Switch Connector SMD Type
-27	Connector SMD Type

❹Individual Specification Code (2)

Code	Individual Specification Code (2)
00	Serial

❺Package Product ID

Code	Package Product ID
B	Bulk
R	Reel

❻Package Detail

Code	Package Detail
A1	FSC, SWD, GSC Type 1000pcs. /Reel (ø178mm)
B3	SWD Type, 3000pcs. /Reel (ø330mm)
B4	FSC Type, 4000pcs. /Reel (ø330mm)
B5	GSC Type, 5000pcs. /Reel (ø330mm)

Coaxial Connectors (with Cable)

(Part Number) MX | FG | 76 | □ | □ | □

❶Product ID

Product ID	
MX	Coaxial Connectors (with Cable)

❷Connector (1)

Code	Connector (1)
FG	FSC Type for 76 Cable
FK	FSC Type for 81 Cable
TK	GSC Type
YH	BFA Type

❸Cable

Code	Cable
62	0.8D, PE, Double Shield Line
63	0.8D, PE, Single Shield Line
75	0.8D, FEP, Double Shield Line
76	0.8D, FEP, Single Shield Line
81	0.4D, FEP, Single Shield Line
88	0.4D, PFA, Single Shield Line, Single Line
92	0.4D, PFA, Single Shield Line, Spiral

❹Connector (2)

Code	Connector (2)
FG	FSC Type for 76 Cable
FK	FSC Type for 81 Cable
TK	GSC Type
YH	BFA Type
XX	None Connector

❺Length

Expressed by four figures. The unit is mm. From first to third figures are significant, and the fourth figure expresses the number of zeros which follow the three figures.

Ex.)

Code	Length
5000	500mm = 500 x 10^0
1001	1000mm = 100 x 10^1

❻Individual Specification Code

Expressed by two figures.

7. Application Schematic