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EZ-PD™ CMG1 Datasheet

USB Type-C EMCA Controller

General Description

EZ-PD™ CMG1 is a dedicated USB Type-C EMCA controller that complies with the USB Type-C and Power Delivery (PD) standards for Electronically Marked Type-C Thunderbolt and non-Thunderbolt passive cable applications. EZ-PD CMG1 integrates a complete Type-C transceiver including the R_A termination resistors on the VCONN pins and VBUS short circuit protection on both VCONN and CC pins. CMG1 also includes 40 bytes of storage for configuration of vendor-, device-, and cable-specific configuration data. EZ-PD CMG1 is targeted for passive EMCA implementations with either one or two e-marker chips on the cable.

Features

Type-C Support and USB-PD Support

- Supports USB PD3.0 spec and USB Type-C spec version 1.3 (Including support for the revised minimum VCONN operating voltage of 3 V)
- Integrated high-voltage protection on CC, VCONN1, and VCONN2 pins to protect against accidental shorts to the VBUS pin on the Type-C connector
- 40-byte storage programmable over Type-C interface for storing vendor-, device-, and cable-specific configuration data
- Termination resistor R_A on VCONN1 and VCONN2
- Supports R_A weakening to reduce power consumption
- Supports electronically marked passive cable implementations with one or two controllers

Clocks and Oscillators

- Integrated oscillator eliminating the need for external clock

Power

- 2.7 V to 5.5 V operation
- Sleep: 1.7 mA

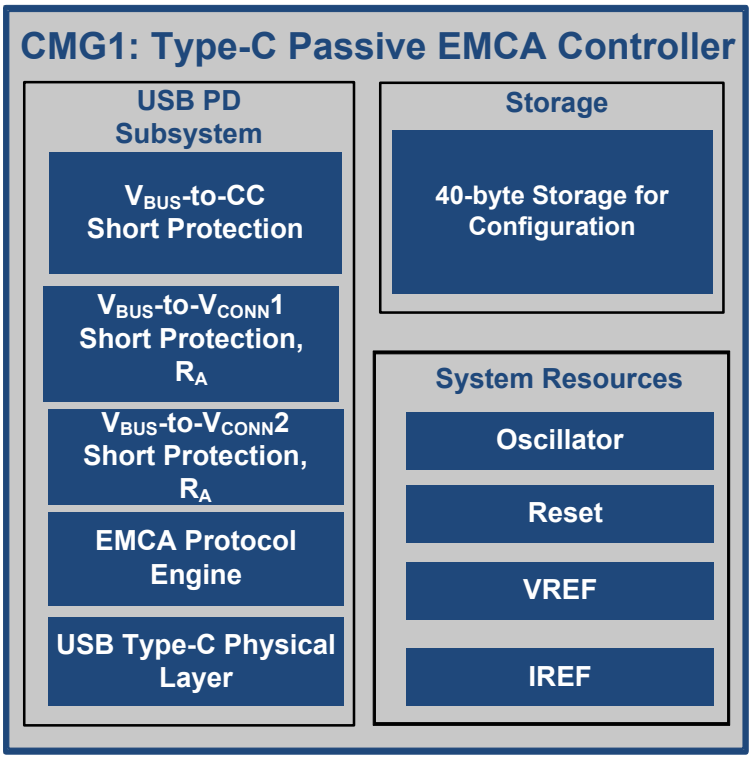
System-Level ESD Protection

- On CC, VCONN1, and VCONN2 pins
- ± 8 kV Contact Discharge and ±15 kV Air Gap Discharge based on IEC61000-4-2 level 4C

Package

- 9-ball WLCSP
- Supports industrial temperature range (–40 °C to +85 °C)

Logic Block Diagram



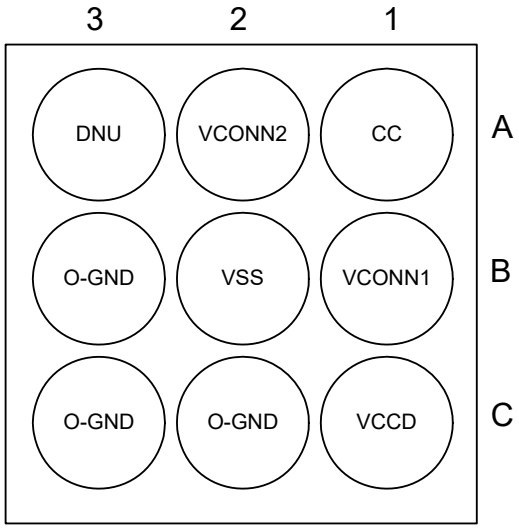
Contents

Pinout

Table 1. 9-Ball CSP Pin Description

9-Ball CSP	Pin Name	Description
A1	CC	Communication Channel (VBUS short protected)/IEC
A2	VCONN2	VCONN2 supply with R_A termination (2.7 V to 5.5 V) (VBUS Short protected)/IEC
A3	DNU[1]	Do not use[1]
B1	VCONN1	VCONN1 supply with R_A termination (2.7 V to 5.5 V) (VBUS Short protected)/IEC
B2	VSS	Ground pin. Mandatory to connect to system GND
B3	O-GND[2]	Optional GND pin. This pin can be connected to the system GND for better board layout routability.
C1	VCCD	1.8-V Core Voltage Out. Connect to 1-µF capacitor
C2	O-GND[2]	Optional GND pin. This pin can be connected to system GND for better board layout routability.
C3	O-GND[2]	Optional GND pin. This pin can be connected to system GND for better board layout routability.

Figure 1. Pinout of 9-WLCSP Bottom (Balls Up) View

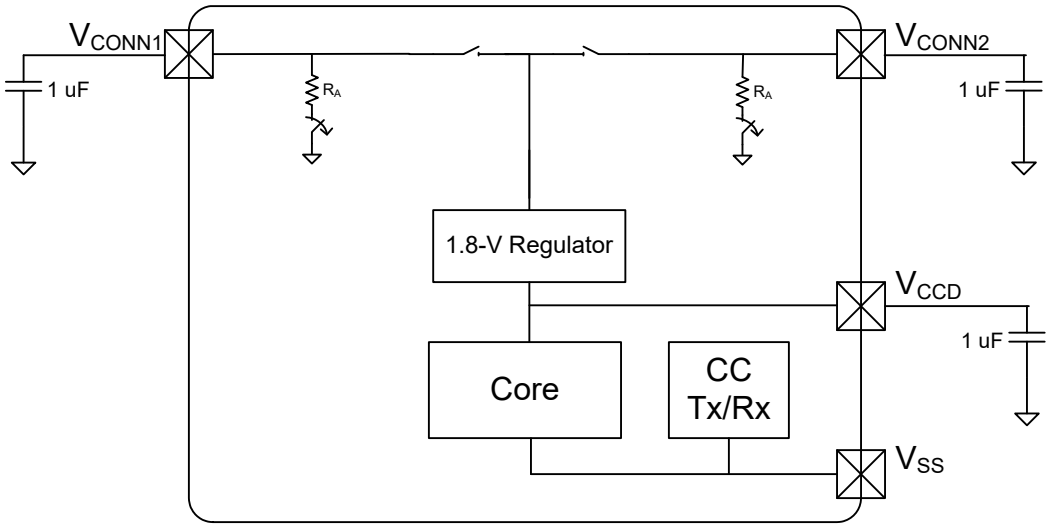


Notes
1. Keep pin A3 floating for all passive EMCA applications. See Figure 4 and Figure 5 for more details.
2. Any of the optional GND pins B3, C2, and C3 can be connected to system GND for better board layout routability. If connected to GND, ensure that the selected pin/s are shorted with the VSS pin (B2) of the CMG1 device in their board layout. If users are not planning to connect these optional GND pins to system GND, then it is mandatory to leave them unconnected in their board designs.

Power

Figure 2 shows an overview of the CMG1 power system requirement. CMG1 operates from two possible external supply sources, VCONN1 and VCONN2. The VCONN supplies support operation over 2.7 V–5.5 V. CMG1 has two different power modes: Active and Sleep, transitions between which are managed by the Power System. The VCCD pin, the output of the core regulator (1.8 V), is brought out for connecting a 1-µF capacitor for regulator stability only. This pin is not supported as a power supply.

Figure 2. Power System



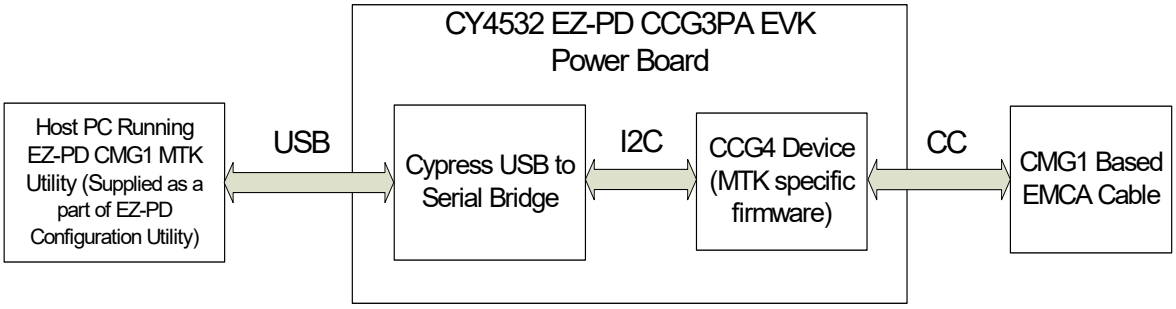
CMG1 Application Configuration Update Over CC Interface

The CMG1 Manufacturing Test Kit (MTK) Utility is used for updating the configuration parameters of the CMG1 devices over the CC interface. The CMG1 MTK Utility is integrated as a part of the EZ-PD Configuration Utility and is supported by its version 1.1 Beta (or later). Vendor-specific and cable-specific parameters can be set using the EZ-PD Configuration Utility. Once the parameters are set, the CMG1 MTK Utility is used for configuration and testing of CMG1-based passive EMCA cables.

To use the CMG1 MTK Utility, you must use the CY4532 EZ-PD CCG3PA EVK as shown in a high-level block diagram in Figure 3. The CMG1 MTK Utility is accompanied with a CMG1 MTK-specific firmware solution, which is intended for the CCG4 device present on the CY4532 EZ-PD CCG3PA EVK's Power Board. If customers are using the CY4532 EZ-PD CCG3PA EVK for the first time to update the configuration parameters of CMG1 devices, then the CCG4 device's firmware needs to be updated to this MTK-specific firmware (detailed instructions are provided in Getting Started with EZ-PD CMG1 Application Note).

The EZ-PD Configuration Utility 1.1 Beta (or later), which integrates and supports the CMG1 MTK Utility, can be downloaded here. For further details, follow the instructions provided in Getting Started with EZ-PD CMG1 Application Note for hardware setup and step-by-step instructions. Also, see Chapter 4 of the EZ-PD Configuration Utility User Manual for more details on how to configure and test CMG1-based passive EMCA cables.

Figure 3. CMG1 Application Configuration Update Over CC Interface



Application Diagrams

Figure 4 and Figure 5 show the application diagrams of a Passive EMCA application using CMG1 devices. Figure 4 shows the application using a single CMG1 device per cable present at one of the two plugs, whereas Figure 5 shows the same with two CMG1 devices per cable present at each plug. The VBUS signal, the SuperSpeed lines, Hi-Speed lines, and CC lines are connected directly from one end to another. The application diagram shown in Figure 4 requires a single VCONN wire to run through the cable so that the CMG1 device can be powered irrespective of which plug is connected to the host (DFP). However, in the application diagram shown in Figure 5, the VCONN signal does not run through the entire cable, but only runs to the respective VCONN pin of the CMG1 device at each end of the plug. Also, only one CMG1 device is powered at any given instance, depending on which one is nearer to the DFP that supplies VCONN.

Figure 4. Passive EMCA Application - Single CMG1 Chip Per Cable

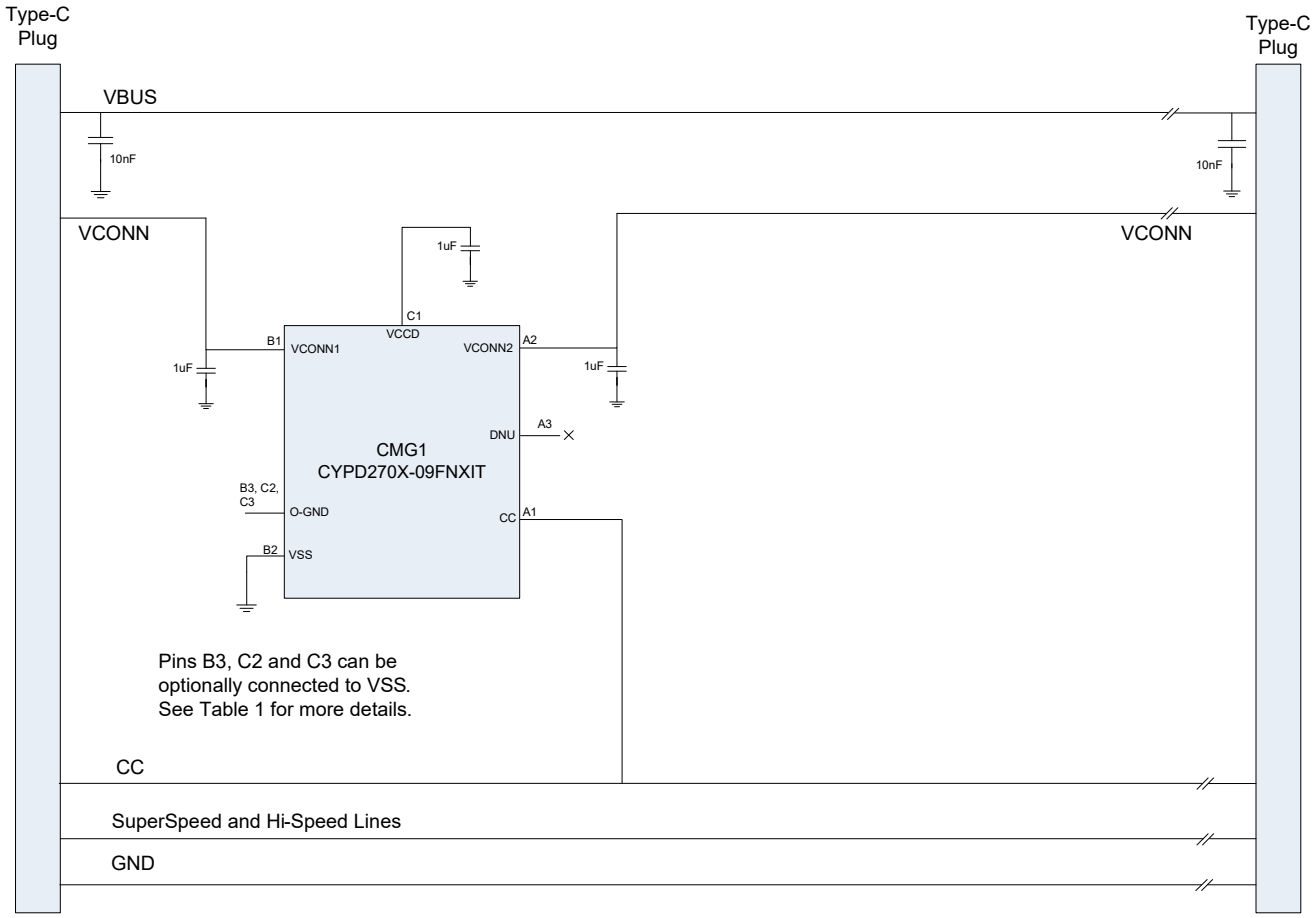
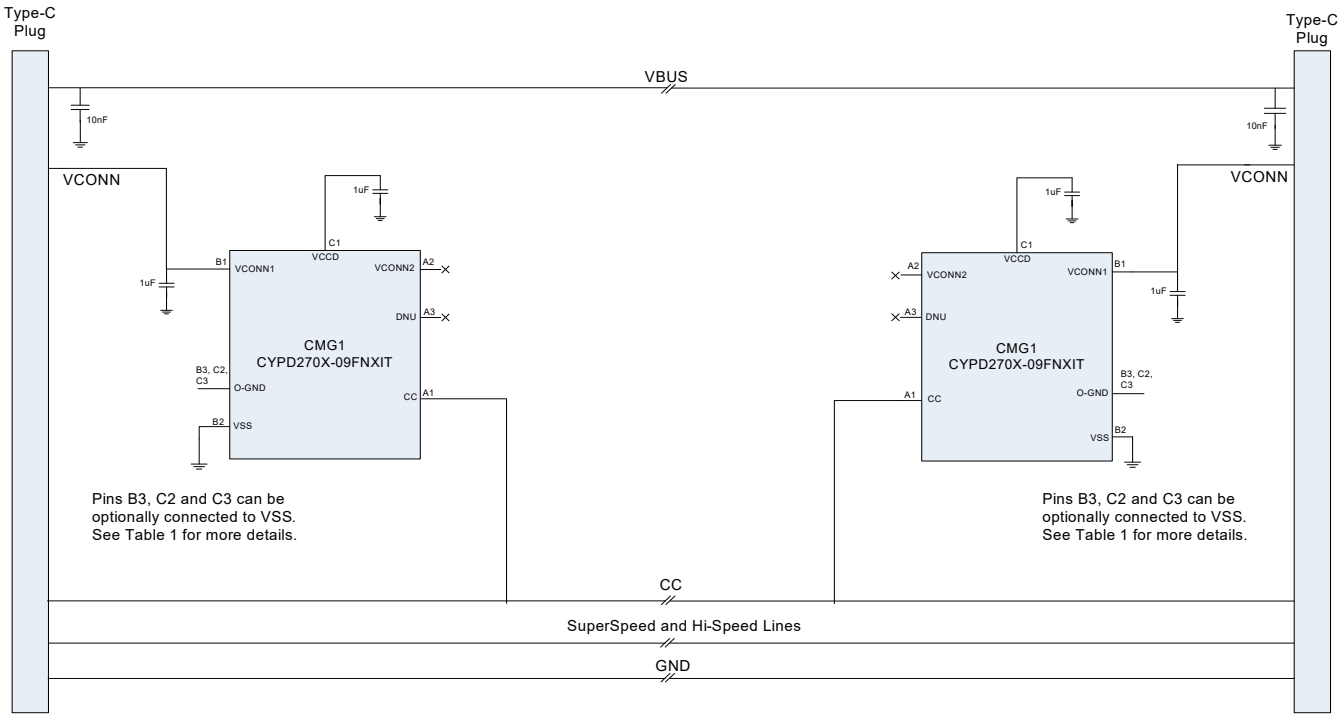


Figure 5. Passive EMCA Application - Single CMG1 Chip Per Plug



Electrical Specifications

Absolute Maximum Ratings

Table 2. Absolute Maximum Ratings

Parameter	Description	Min	Typ	Max	Units	Details/Conditions
V_{CONN_MAX}	Max supply voltage relative to V_{SS}	–	–	25	V	Absolute max
$V_{CC\_PIN\_ABS}$	Max voltage on the CC pin	–	–	25	V	
ESD_HBM	Electrostatic discharge human body model	2200	–	–	V	–
ESD_CDM	Electrostatic discharge charged device model	500	–	–	V	–
LU	Pin current for latch-up	–140	–	140	mA	–
ESD_IEC_CON	Electrostatic discharge IEC61000-4-2	8000	–	–	V	Contact discharge on CC and V_{CONN} pins
ESD_IEC_AIR	Electrostatic discharge IEC61000-4-2	15000	–	–	V	Air discharge for CC and V_{CONN} pins

Device-Level Specifications

See basic specifications in the following tables. More specifications will be added in a future version of this document.

Table 3. DC Specifications

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/Conditions
SID.PWR#1	V_{CONN1} or V_{CONN2}	Power supply input voltage	2.7	–	5.5	V	–
SID.PWR#5	V_{CCD}	Output voltage (for core logic)	–	1.8	–	V	–
SID.PWR#12	C_{EFC}	External regulator voltage bypass on V_{CCD}	0.8	1	1.2	µF	X5R ceramic or better
SID.PWR#13	C_{VCONN}	Power supply decoupling capacitor on V_{CONN1} and V_{CONN2}	0.8	1	–	µF	X5R ceramic or better
Active Mode, V_{CONN1} or V_{CONN2} = 2.7 V to 5.5 V. Typical values measured at V_{CONN1} or V_{CONN2} = 5 V							
SID.PWR#8	I_{DD_A}	Active current	–	5	7.5	mA	CC I/O in Transmit or Receive
Sleep Mode, Typical values measured at V_{CONN1} or V_{CONN2} = 5 V and T_A = 25 °C							
SID25A	I_{DD_S}	Sleep mode current	–	1.7	3.0	mA	CC as wakeup source. One VCONN supply is powered, the other is floating or grounded.

Table 4. PD DC Specifications

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/Conditions
SID.PD.6	R_A	Power cable termination	0.8	1	1.2	kΩ	All supplies force to 0 V and 0.2 V applied at V_{CONN1} or V_{CONN2}
SID.PD.7	R_{A_OFF}	Power cable termination - disabled	0.4	0.75	–	MΩ	2.7 V applied at V_{CONN1} or V_{CONN2} with R_A disabled
SID.PD.14	I_{LEAK}	Leaker on V_{CONN1} or V_{CONN2} for discharge upon cable detach	150	–	–	µA	–
SID.PD.15	$V_{GNDOFST}$	Ground offset tolerated by BMC receiver	–500	–	500	mV	Relative to remote BMC transmitter
SID.PD.16	Z_{OPEN_PD}	Impedance of CC pin with VCONN1 and VCONN2 un-powered	200	–	–	kΩ	0 V ≤ CC Voltage ≤ 5.5 V

Table 5. Storage Specifications

Spec ID	Parameter	Description	Min	Typ	Max	Units	Details/Conditions
SID.MEM#3	NVL_ERASE	NVL bulk erase time	25	–	100	ms	–40 °C ≤ T_A ≤ 85 °C
SID.MEM#4	NVL_WRITE	NVL program	2	–	10	ms	
SID.MEM#5	NVL_DR	NVL data retention	20	–	–	years	25 °C ≤ T_A ≤ 55 °C
SID.MEM#5A	NVL_DR	NVL data retention	10	–	–	years	55 °C ≤ T_A ≤ 85 °C
SID.MEM#6	NVL_ENPB	NVL write endurance	100	–	–	cycles	25 °C ≤ T_A ≤ 55 °C

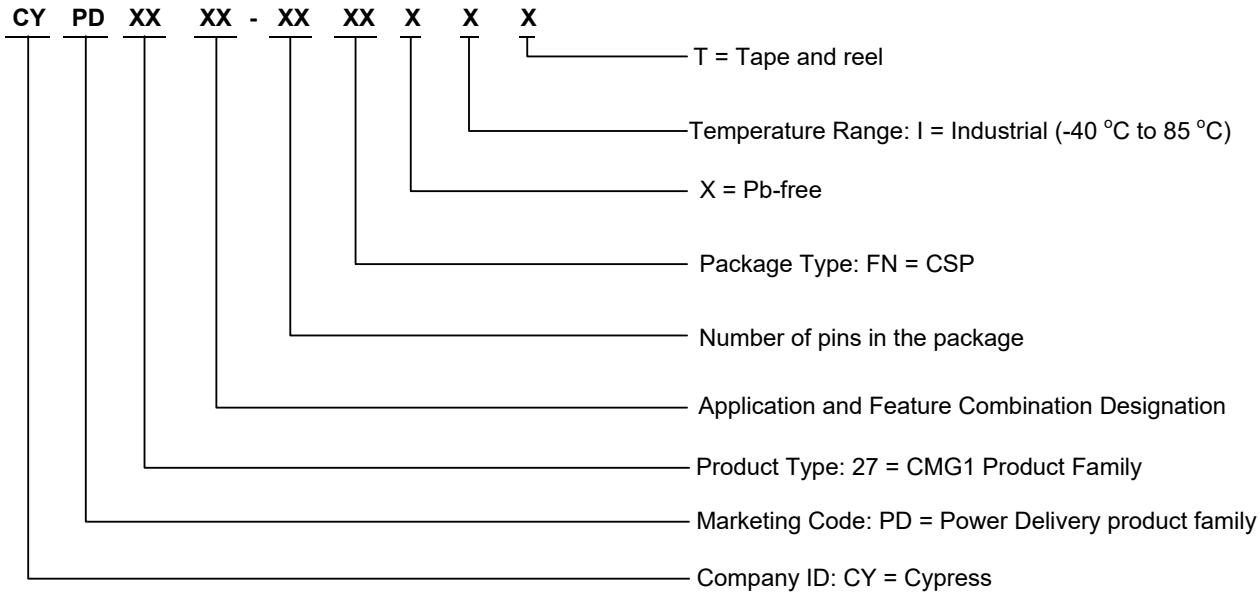
Ordering Information

Table 6 lists the EZ-PD CMG1 part numbers and features.

Table 6. CMG1 Ordering Information

MPN	Application	Type-C Ports	Role	Package Type	Si ID
CYPD2703-09FNXIT	Passive Cable	1	EMCA	9-ball CSP	2600
CYPD2704-09FNXIT	Thunderbolt Passive Cable	1	EMCA	9-ball CSP	2601

Ordering Code Definition



Packaging

Table 7. Package Characteristics

Parameter	Description	Conditions	Min	Typ	Max	Units
T_A	Operating ambient temperature	Industrial	–40	25	85	°C
T_J	Operating junction temperature	Industrial	–38.68	26.32	86.32	°C
T_{JA}	Package θ_{JA} (9-pin CSP)		–	–	31.9	°C/W
T_{JC}	Package θ_{JC} (9-pin CSP)		–	–	20.02	°C/W

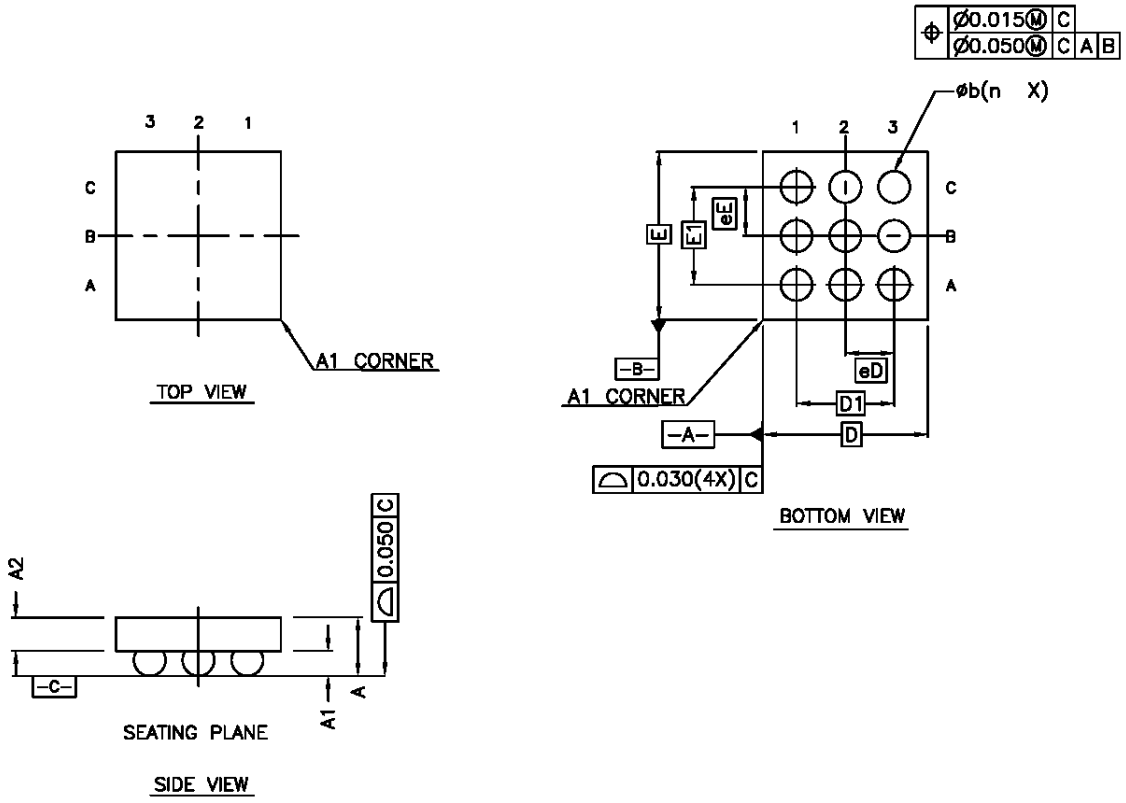
Table 8. Solder Reflow Peak Temperature

Package	Maximum Peak Temperature	Maximum Time within 5 °C of Peak Temperature
9-pin CSP	260 °C	30 seconds

Table 9. Package Moisture Sensitivity Level (MSL), IPC/JEDEC J-STD-2

Package	MSL
9-pin CSP	MSL 1

Figure 6. 9-ball CSP Package Outline



SYMBOL	DIMENSIONS		
	MIN.	NOM.	MAX.
A	-	-	0.520
A1	0.122	0.152	0.182
A2	0.250	0.275	0.300
D	1.351 BSC		
E	1.376 BSC		
D1	0.800 BSC		
E1	0.800 BSC		
n	9		
Øb	0.188	0.218	0.248
eD	0.400 BSC		
eE	0.400 BSC		

NOTES

1. ALL DIMENSIONS ARE IN MILLIMETERS.

002-21607 *B

Acronyms

Table 10. Acronyms Used in this Document

Acronym	Description
CC	configuration channel
CPU	central processing unit
DFP	downstream facing port
DRP	dual role port
EMCA	electronically marked cable assembly, a USB cable that includes an IC that reports cable characteristics (e.g., current rating) to the Type-C ports
ESD	electrostatic discharge
IC	integrated circuit
MCU	microcontroller unit
NC	no connect
NVL	non-volatile latch
PD	power delivery
PHY	physical layer
POR	power-on reset
PSoC®	Programmable System-on-Chip™
RX	receive
TX	transmit
Type-C	a new standard with a slimmer USB connector and a reversible cable, capable of sourcing up to 100 W of power
USB	Universal Serial Bus

Document Conventions

Units of Measure

Table 11. Units of Measure

Symbol	Unit of Measure
°C	degrees Celsius
Hz	hertz
KB	1024 bytes
kHz	kilohertz
kΩ	kilo ohm
Mbps	megabits per second
MHz	megahertz
MΩ	mega-ohm
Msps	megasamples per second
µA	microampere
µF	microfarad
µs	microsecond
µV	microvolt
µW	microwatt
mA	milliampere
ms	millisecond
mV	millivolt
nA	nanoampere
ns	nanosecond
Ω	ohm
pF	picofarad
ppm	parts per million
ps	picosecond
s	second
sps	samples per second
V	volt

Document History Page

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Revision	**ECN**	**Orig. of Change**	**Submission Date**	**Description of Change**
*H	6242326	VGT	07/13/2018	Changed datasheet status to Final.
*I	6554744	VGT	04/24/2019	Updated 9-ball CSP package diagram.

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