5/03/2010

eMPIA Technology

EM28281
All-in-one Video Audio Capture Device

Datasheet
Revision 1.0

Introduction

The EM28281 is a multi-function device that provides audio and video capture solutions to systems with USB architectures. The chip can not only support Audio/Video capture, but also perform hybrid function of broadcast television on personal computers with external tuner and demodulator. EM28281 decodes the variable video source including composite and S-Video, perform auto-detect video standard NTSC, PAL, SECAM with VBI decoding support. The audio stream can be sampling by on-chip 16-bit sigma-delta ADCs, directly passed through isochronous or bulk endpoint, and compliant to USB Audio Class. The chip uses an embedded microcontroller 8051 to decode USB requests and control various I/O's. Microcode is stored off chip and downloaded to on-chip cache at power up. Video stream, audio stream, and transport stream are directly transferred, bypassing the microcontroller.

With removing the external A/V decoder, the EM28281 reduces the overall bill of materials (BOM) without compromising audio and video performance. In order for the transport stream to fit in the limited bandwidth of USB, a transport stream PID filter is built in to cut out unnecessary traffic on USB. For added value, an infrared protocol decoder is integrated on chip that supports NEC, RC5 and RC6 remote control protocols.

Features

Analog Video Capture

- Dedicated composite video port, S-Video port.
- Decodes NTSC, PAL or SECAM composite video, S-Video.
- Decodes all variations of NTSC standard
- Decodes all variations of PAL standard (I,B,G,H,D,N,M)
- Excellent quality Y/C separation - minimizes cross luma, cross color effects
- Superior frequency response preserves fine detail
- Digital automatic gain control (AGC) supported
- Adaptive 2D Comb Filter provides high quality video
- Auto-detects video standard (NTSC, PAL or SECAM)
- Auto-detects and locks to VCR trick modes
- Decodes weak and noisy off-air signals
- Auto-detects and decodes Macrovision copy protection
- Auto-detects and decodes CGMS copy protection
- VBI decoding supported
- Brightness, contrast, Hue and Saturation adjustment
- Sharpness enhancement
- Random ratio down scaler
- Video endpoint type can be isochornous or bulk

Analog Audio Capture

- Stereo 16-bit sigma-delta ADCs
- ADC sample rate 48 Khz
- Volume and mute control
- Audio endpoint type can be isochornous or bulk

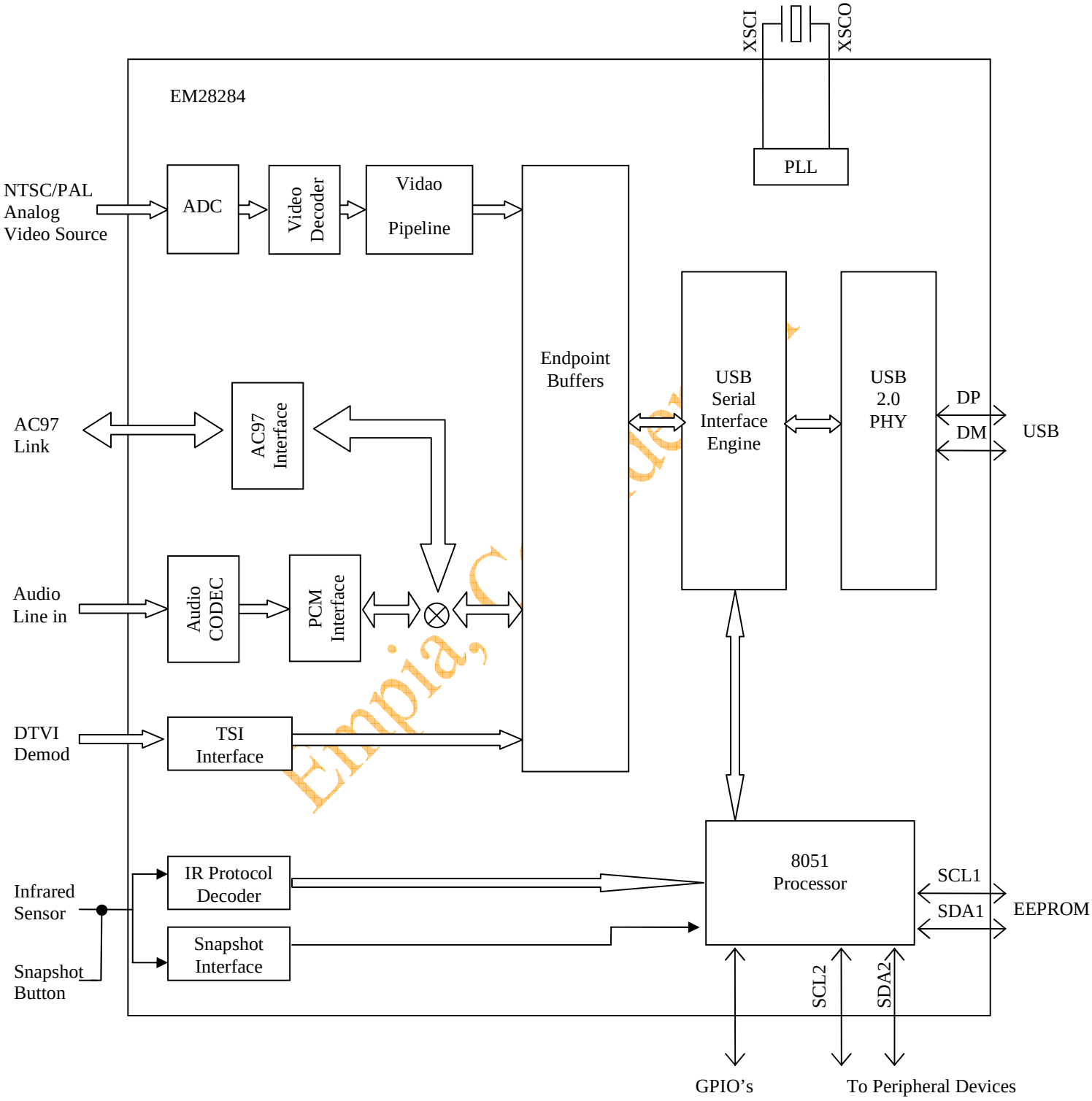
DTV Transport Stream Capture

- Support DVBT, ATSC, QAM, DVBS demodulators
- Receive serial form transport streams
- Null PID filter rejecting null packets
- Transport stream endpoint type can be isochornous or bulk
- Decode infrared remote control protocols NEC, RC5, and RC6

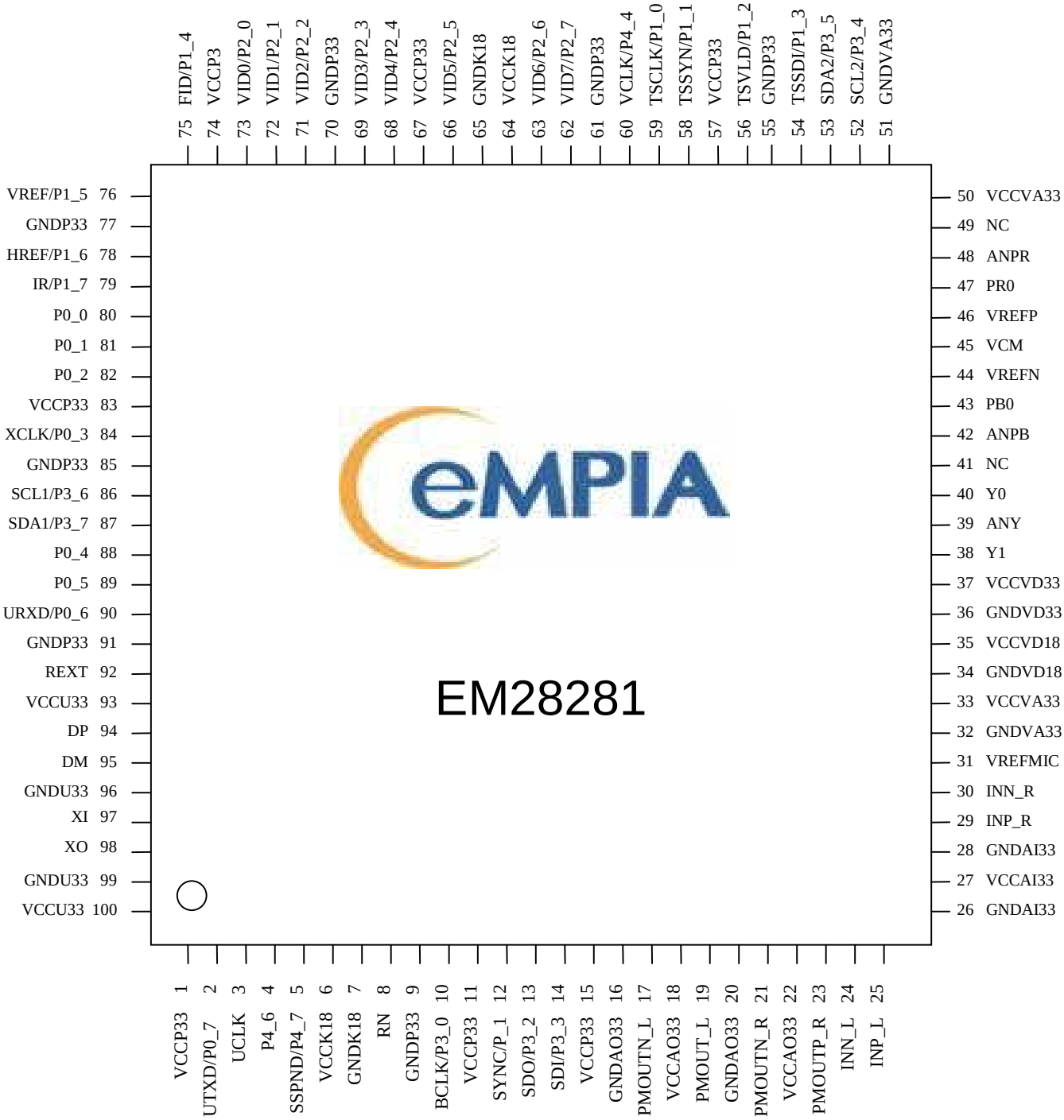
General

- USB 2.0 and 1.1 compliant
- Embedded 8051 microcontroller
- Many general I/O ports controlled by the 8051
- Support 2 timers in the 8051
- Support basic and extended interrupts in the 8051
- Support UART with programmable baud rates in the 8051
- Fully customizable microcode in external EEPROM, sized 4KB
- Customizable Vendor ID, Product ID, Vendor String, Product String
- 2 sets of 2-wire command serial bus to peripheral devices
- USB suspend output to peripheral devices
- 0.162 micron, 1.8V core, 3.3V I/O CMOS process
- 100 pin LQFP package

Functional Block Diagram



Pin Assignments



Pin Descriptions

Pin Num	Pin Name	I/O	Description
1	VCCP33		Digital I/O power of 3.3V
2	UTXD/P0_7	DIO	UART Transmit; GPIO0[7]
3	UCLK	DIO	Testing clock. Connect to digital ground for real application.
4	P4_6	DIO	GPIO4[6]
5	SSPND/P4_7	DO	USB suspend; GPIO4[7] output only
6	VCCK18		Digital core power of 1.8V
7	GNDK18		Digital core ground for 1.8V
8	RN	DI	Chip reset (when low)
9	GNDP33		Digital I/O ground for 3.3v
10	BCLK/P3_0	DIO	Audio bit clock ; GPIO3[0]
11	VCCP33		Digital I/O power of 3.3v
12	SYNC/P3_1	DIO	Audio sync ; GPIO3[1]
13	SDO/P3_2	DIO	Audio serial out ; GPIO3[2]
14	SDI/P3_3	DIO	Audio serial in ; GPIO3[3]
15	VCCP33		Digital I/O power of 3.3v
16	GNDAO33		Audio out analog ground for 3.3v
17	PMOUTN_L	AO	N-differential left channel audio analog out
18	VCCAO33		Audio out analog power of 3.3v
19	PMOUTP_L	AO	P-Differential left channel audio analog out
20	GNDAO33		Audio out analog ground for 3.3v
21	PMOUTN_R	AO	N-Differential right channel audio analog out
22	VCCAO33		Audio out analog power of 3.3v
23	PMOUTP_R	AO	P-Differential right channel audio analog out
24	INN_L	AI	N-Differential left channel audio analog out
25	INP_L	AI	P-Differential left channel audio analog in
26	GNDAI33		Audio in analog ground for 3.3v
27	VCCAI33		Audio in analog power of 3.3v
28	GNDAI33		Audio substrate analog ground for 3.3v
29	INP_R	AI	P-Differential right channel audio analog in
30	INN_R	AI	N-Differential right channel audio analog in
31	VREFMIC	AO	1.6v microphone reference voltage out
32	GNDVA33		Video AFE analog ground for 3.3v

33	VCCVA33		Video AFE analog power of 3.3v
34	GNDVD18		Video AFE digital ground for 1.8v
35	VCCVD18		Video AFE digital power of 1.8v
36	GNDVD33		Video AFE digital ground for 3.3v
37	VCCVD33		Video AFE digital power of 3.3v
38	Y1	AI	Analog video input for CVBS
39	ANY	AI	Video Y channel input reference
40	Y0	AI	Analog video input for Composite
41	NC		Reserve
42	ANPB	AI	Video Pb channel input reference
43	PB0	AI	Analog video input for S-Video Y
44	VREFN	AIO	Output for decoupling or input for bypass of Internal Negative Reference Voltage
45	VCM	AIO	Output for decoupling or input for bypass of Common Mode Voltage
46	VREFP	AIO	Output for decoupling or input for bypass or Internal Positive Reference Voltage
47	PR0	AI	Analog video input for S-Video C
48	ANPR	AI	Video Pr channel input reference
49	NC		Reserve
50	VCCVA33		Video AFE analog power of 3.3v
51	GNDVA33		Video AFE analog ground for 3.3v
52	SCL2/P3_4	DIO	Secondary Command Serial Bus (I2C) Clock ; GPIO3[4]
53	SDA2/P3_5	DIO	Secondary Command Serial Bus (I2C) Data ; GPIO3[5]
54	TSSDI/P1_3	DIO	Transport stream serial data ; GPIO1[3]
55	GNDP33		Digital I/O ground for 3.3v
56	TSVLD/P1_2	DIO	Transport stream data valid; GPIO1[2]
57	VCCP33		Digital I/O power of 3.3v
58	TSSYN/P1_1	DIO	Transport Stream sync ; GPIO1[1]
59	TSCLK/P1_0	DIO	Transport Stream clock ; GPIO1[0]
60	VCLK/P4_4	DIO	Video clock; GPIO4[4]
61	GNDP33		Digital I/O ground for 3.3V
62	VID7/P2_7	DIO	Video input data [7]; GPIO2[7]
63	VID6/P2_6	DIO	Video input data [6]; GPIO2[6]
64	VCCK18		Digital core power of 1.8V
65	GNDK18		Digital core ground for 1.8V
66	VID5/P2_5	DIO	Video input data [5]; GPIO2[5]
67	VCCP33		Digital I/O power of 3.3V
68	VID4/P2_4	DIO	Video input data [4]; GPIO2[4]

69	VID3/P2_3	DIO	Video input data [3]; GPIO2[3]
70	GNDP33		Digital I/O ground for 3.3V
71	VID2/P2_2	DIO	Video input data [2]; GPIO2[2]
72	VID1/P2_1	DIO	Video input data [1]; GPIO2[1]
73	VID0/P2_0	DIO	Video input data [0]; GPIO2[0]
74	VCCP33		Digital I/O power of 3.3V
75	FID/P1_4	DIO	Video field ID; GPIO1[4]
76	VREF/P1_5	DIO	Video vertical reference; GPIO1[5]
77	GNDP33		Digital I/O ground for 3.3V
78	HREF/P1_6	DIO	Video horizontal reference; GPIO1[6]
79	IR/P1_7	DIO	Infrared receive; Snap-shot button; GPIO1[7]
80	P0_0	DIO	GPIO0[0]
81	P0_1	DIO	GPIO0[1]
82	P0_2	DIO	GPIO0[2]
83	VCCP33		Digital I/O power of 3.3V
84	XCLK/P0_3	DIO	GPIO0[3]
85	GNDP33		Digital I/O ground for 3.3V
86	SCL1/P3_6	DIO	Primary Command Serial Bus Clock ; GPIO3[6]
87	SDA1/P3_7	DIO	Primary Command Serial Bus Data ; GPIO3[7]
88	P0_4	DIO	GPIO0[4]
89	P0_5	DIO	GPIO0[5]
90	URXD/P0_6	DIO	UART receive; GPIO0[6]
91	GNDP33		Digital I/O ground for 3.3V
92	REXT	AI	Connect with 270 ~ 390 ohm resistor to ground
93	VCCU33		USB analog power of 3.3V
94	DP	AIO	USB D+ line
95	DM	AIO	USB D- line
96	GNDU33		USB analog ground for 3.3V
97	XI	AI	12MHz crystal pad
98	XO	AO	12MHz crystal pad
99	GNDU33		USB analog ground for 3.3V
100	VCCU18		USB digital power of 1.8V

Electrical Specifications

Recommended Operating Conditions

Power Pin	Min	Typ	Max	Unit
VCCP33	3	3.3	3.6	V
VCCK18	1.62	1.8	1.98	V
VCCAO33	3	3.3	3.6	V
VCCAI33	3	3.3	3.6	V
VCCVD18	1.62	1.8	1.98	V
VCCVD33	3	3.3	3.6	V
VCCU33	3	3.3	3.6	V
VCCU18	1.62	1.8	1.98	V

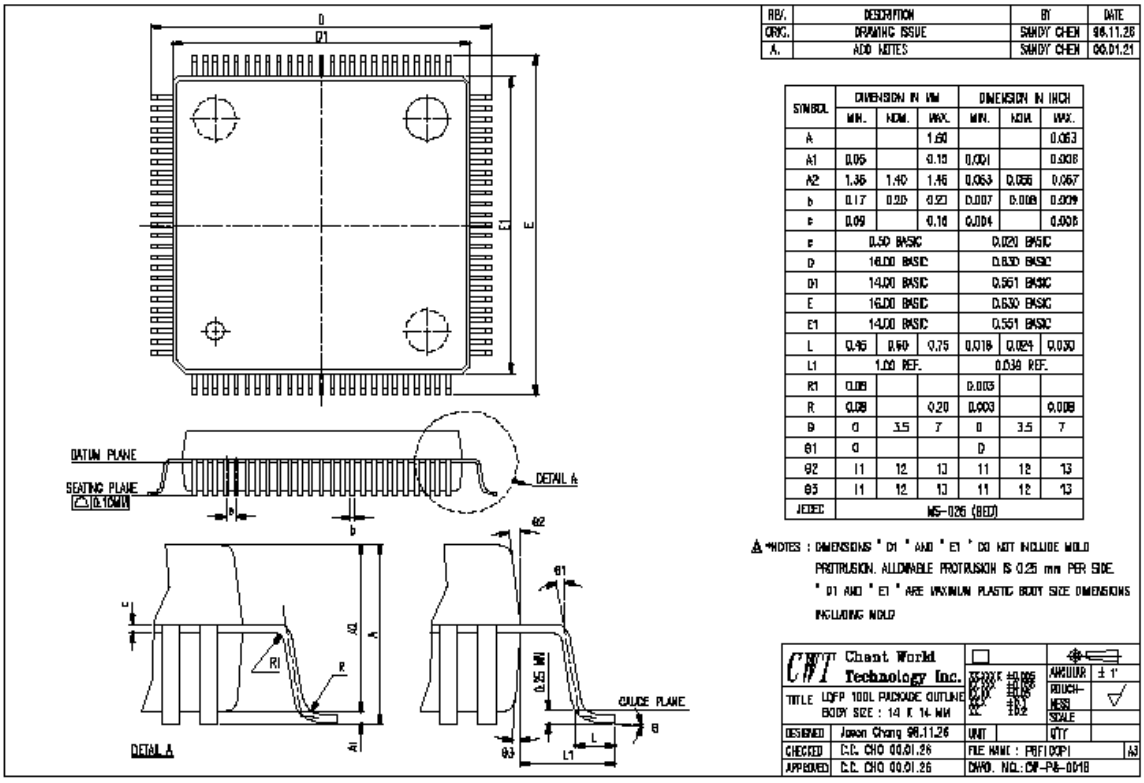
DC Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
VIH	Input High Voltage	2			V
VIL	Input Low Voltage			0.8	V
VOH	Output High Voltage	2.4			V
VOL	Output Low Voltage			0.4	V
ICC_{vcc33v} (Note1)	Operating Supply Current		65	85	mA
ICC_{vcc18v} (Note2)			55	75	mA
ICCS	Suspend Supply Current			310	uA
PD	Total power dissipation		376		mW

Note1: $ICC_{VCC33V}=ICC_{VCCP33}+ICC_{VCCAO33}+ICC_{VCCAI33}+ICC_{VCCVD33}$
Note2: $ICC_{VCC18V}=ICC_{VCCK18}+ICC_{VCCVD18}+ICC_{VCCU18}$

Packaging Information

100-pin (14x14)LQFP Mechanical Drawing



REV.	DESCRIPTION	BY	DATE
ORIG.	DRAWING ISSUE	SANDY CHEN	98.11.26
A.	ADD NOTES	SANDY CHEN	00.01.21

SYMBOL	DIMENSION IN MM			DIMENSION IN INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A			1.60			0.063
A1	0.05		0.15	0.002		0.006
A2	1.35	1.40	1.45	0.053	0.055	0.057
b	0.17	0.20	0.23	0.007	0.008	0.009
c	0.09		0.16	0.004		0.006
e	0.50 BASIC			0.020 BASIC		
D	16.00 BASIC			0.630 BASIC		
D1	14.00 BASIC			0.551 BASIC		
E	16.00 BASIC			0.630 BASIC		
E1	14.00 BASIC			0.551 BASIC		
L	0.45	0.60	0.75	0.018	0.024	0.030
L1	1.00 REF.			0.039 REF.		
R1	0.08			0.003		
R	0.08		0.20	0.003		0.008
θ	0	3.5	7	0	3.5	7
θ1	0			0		
θ2	11	12	13	11	12	13
θ3	11	12	13	11	12	13
JEDEC	MS-026 (BED)					

⚠ *NOTES : DIMENSIONS " D1 " AND " E1 " DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.25 mm PER SIDE. " D1 AND " E1 " ARE MAXIMUM PLASTIC BODY SIZE DIMENSIONS INCLUDING MOLD

CWT Chant World Technology Inc.			ANGULAR ± 1°
TITLE	LQFP 100L PACKAGE OUTLINE BODY SIZE : 14 X 14 MM		ROUGH-NESS
			SCALE
DESIGNED	Jason Chang 98.11.26	UNIT	QTY
CHECKED	C.C. CHO 00.01.26	FILE NAME : PBFLDQP1	A3
APPROVED	C.C. CHO 00.01.26	DWG. NO.: CW-PS-0018	