Preliminary

Toshiba Multi-Chip Module

TB7005FL

For high current and low voltage applications Synchronous buck converter module

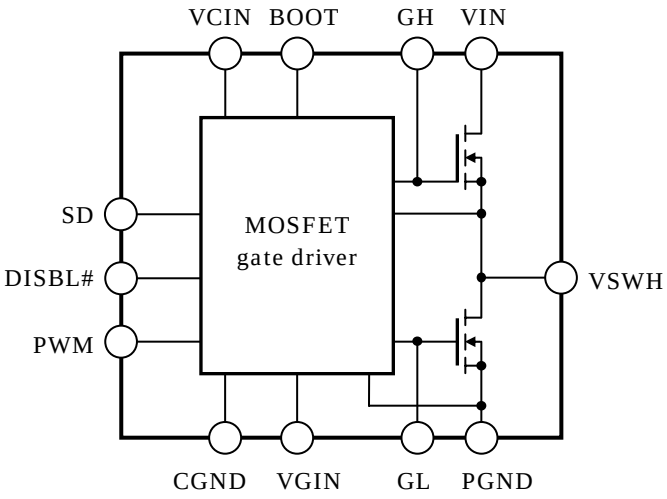
This product is a synchronous buck switching converter module. The additional components for DC-DC converter are a PWM control IC, an external inductor, and input and output capacitors.

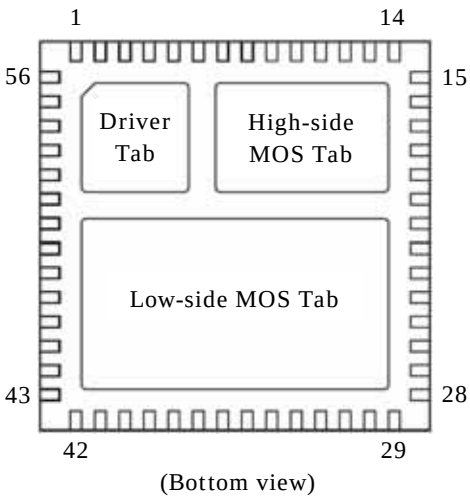
Features

- Operation frequency : 1MHz
- Built-in under voltage lockout about VCIN
  While under voltage lockout is operating, GH=L, GL=L
- Low-side MOSFET drive voltage : 4.5 to 5.5V
  External supply at VGIN
- DISBL# : Input "H" → the internal circuit is enabled
  Input "L" → the internal circuit is disabled
  The low-side MOSFET and the high-side MOSFET are turned off (GH=L, GL=L).
- Dead time between the high-side MOSFET switching and the low-side MOSFET switching :
  3ns (typ.)(@I_{OUT}=30A)
- Built-in BOOT-SWITCH
  Switch for charge up the bootstrap capacitor (same operation of SBD)

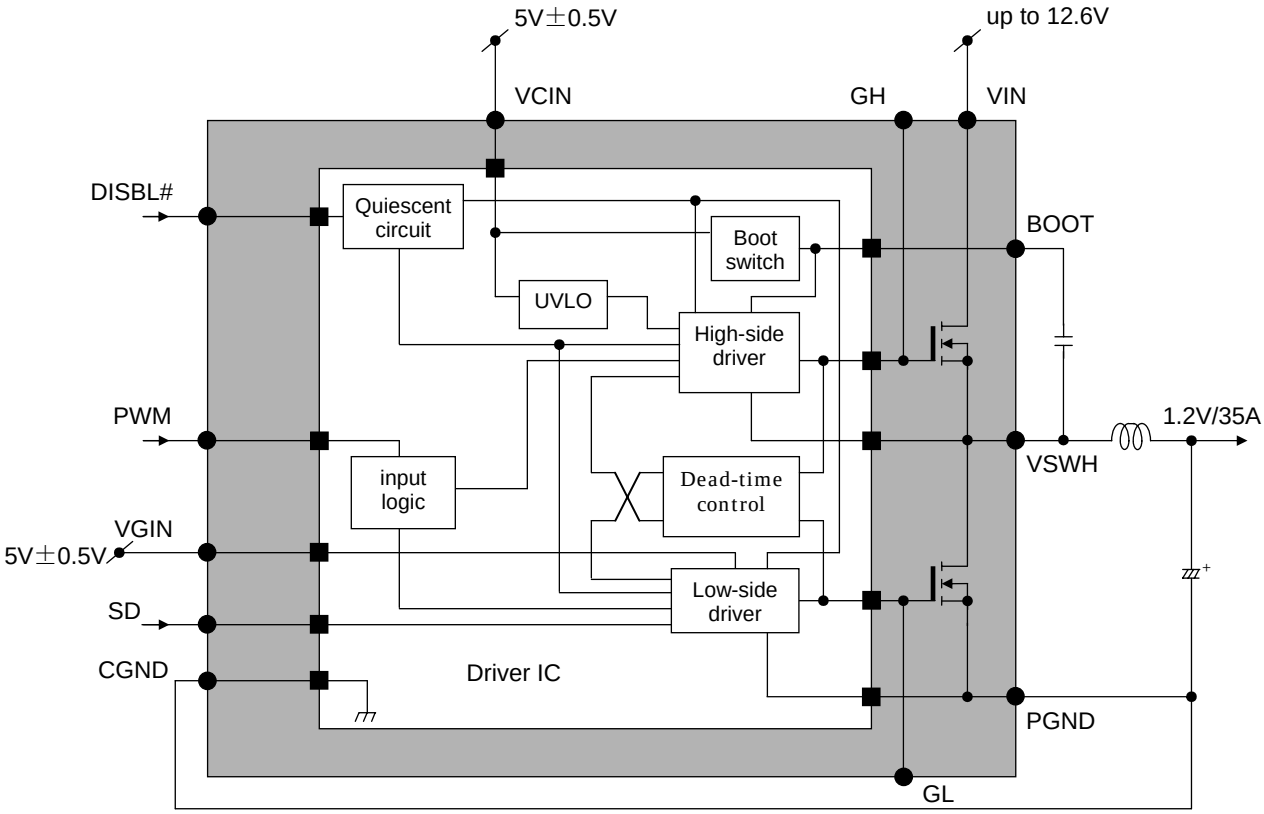
Due to its MOS structure, this product is sensitive to electrostatic discharge. Handle with care.

Diagrammatical View

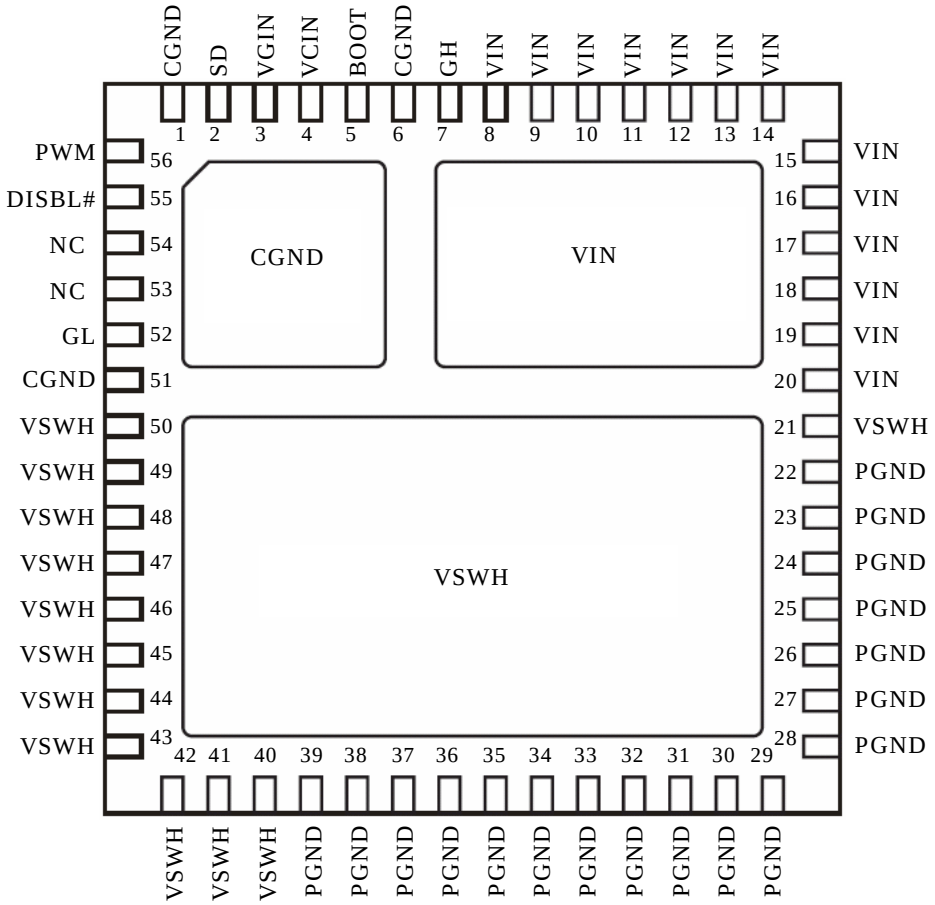




Block Diagram



Pin Configurations



Pin Descriptions

Name	No.	Functions	Notes
CGND	1,6,51,Tab	Internal driver-IC signal ground	Connect to the PGND
SD	2	Shut down signal for the low-side MOSFET. When set to low, the low-side MOSFET is turned off.	
VGIN	3	Supply voltage for driving the low-side MOSFET gate	
VCIN	4	Supply voltage for the internal driver-IC	
BOOT	5	Connect to the external boot strap capacitor	
GH	7	High-side MOSFET gate signal	For monitoring
VIN	9 to 20,Tab	Input voltage for the DC-DC converter	
VSWH	21,40 to 50,Tab	Switching node. Connect to the output inductor.	
PGND	22 to 39	Power ground	
GL	52	Low-side MOSFT gate signal	For monitoring
NC	53,54	No internal connection. Keep them open.	
DISBL#	55	Disabled signal for the internal control circuit. When set to high, the internal control circuit is enabled. When set to low, the Internal control circuit is disabled.	Both 5V logic level and 12V logic level are available
PWM	56	Input signal	

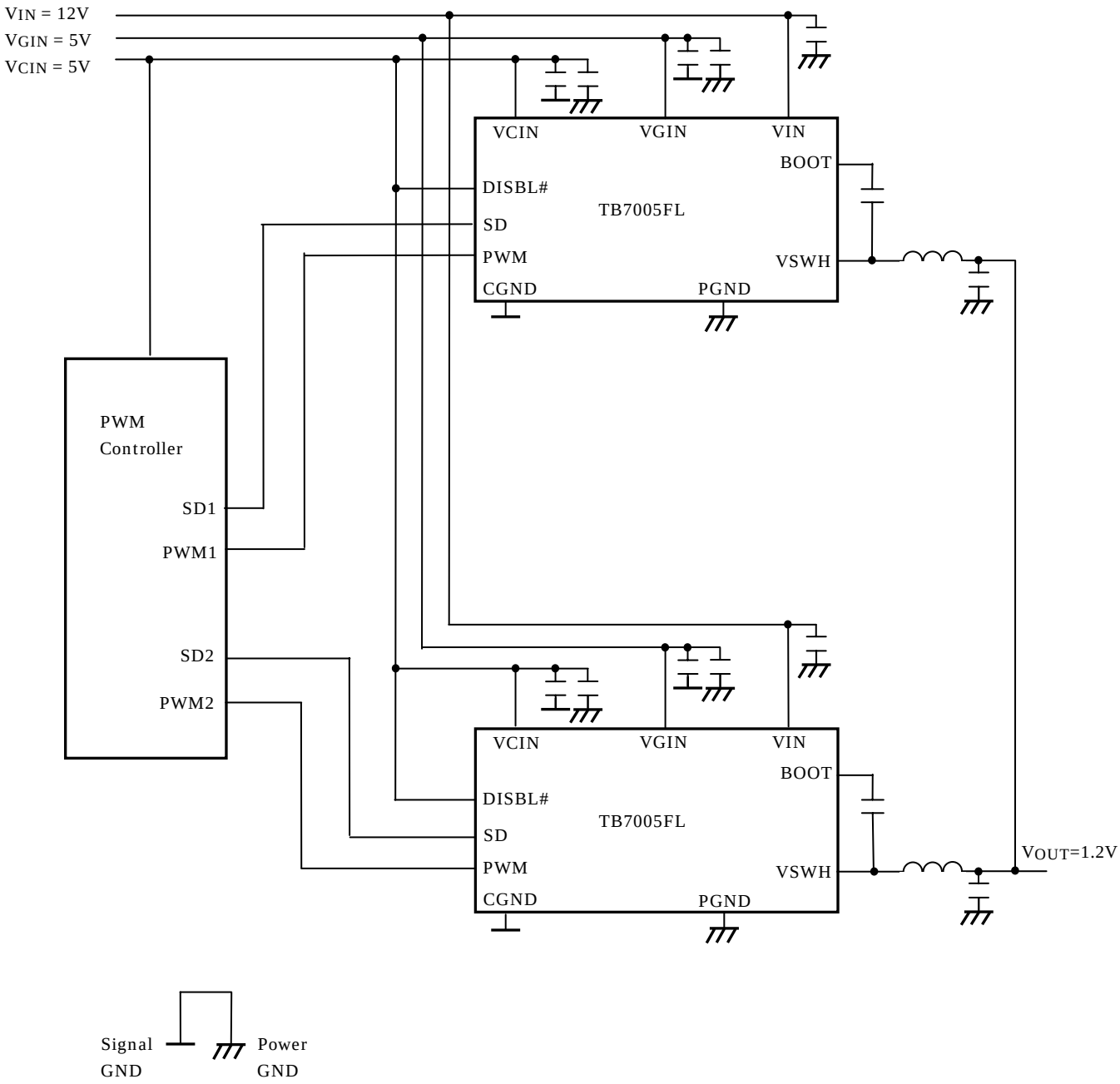
Maximum Ratings (Ta = 25°C)

Characteristics	Symbol	Ratings	Unit
VIN to PGND voltage	VIN	20	V
VCIN to CGND voltage	VCIN	-0.3 ~ 6	V
VSWH to PGND voltage	VSWH	-2 ~ 20	V
VGIN to CGND voltage	VGIN	-0.3 ~ 6	V
BOOT to VSWH voltage	$V_{BOOT-VSWH}$	-0.3 ~ VCIN + 0.3	V
BOOT to CGND voltage	V_{BOOT}	-0.3 ~ 26	V
PWM to CGND voltage	V_{PWM}	-0.3 ~ VCIN + 0.3	V
DISBL# to CGND voltage	$V_{DISBL\#}$	-0.3 ~ VCIN + 0.3	V
Output RMS current	I_{OUT}	35	A
Power dissipation	P_D	TBD	W
Operating channel temperature	T_{ch-opr}	-40 to 150	°C
Storage temperature	T_{stg}	-55 to 150	°C

Electrical Specifications (VCIN=5V , $V_{DISBL\#}$=5V , Ta=25°C , unless otherwise noted)

Characteristics	Symbol	Terminal	Conditions	Min.	Typ.	Max.	Unit
Power supply							
Operating input voltage	$V_{CIN(OPR)}$	VCIN	–	4.5	5	5.5	V
Quiescent current	$I_{CIN(OFF)}$	VCIN	$V_{DISBL\#}$ = 0, V_{PWM} = 0	–	–	TBD	μA
Operating VGIN current	$I_{GIN(OPR)}$	VGIN	f_C = 1MHz, Duty = 10%	–	–	TBD	mA
Under voltage lock out start threshold	V_{UVLO}	VCIN	–	2.6	2.8	3.1	V
Under voltage lock out Hysteresis	$V_{hys-UVLO}$	VCIN	–	–	0.7	–	V
PWM signal input							
PWM input rising threshold	$V_{H(PWM)}$	PWM	–	2.0	–	–	V
PWM input falling threshold	$V_{L(PWM)}$	PWM	–	–	–	0.8	V
DISBL# signal input							
DISBL# input rising threshold	$V_{H(DISBL\#)}$	DISBL#	–	2.0	–	–	V
DISBL# input falling threshold	$V_{L(DISBL\#)}$	DISBL#	–	–	–	0.8	V
SD signal input							
SD input rising threshold	$V_{H(SD)}$	SD	–	2.0	–	–	V
SD input falling threshold	$V_{L(SD)}$	SD	–	–	–	0.8	V

Typical Application



Description of Operation

- Power supply

VGIN : supply voltage for driving the low-side MOSFET gate

It is available to supply the low-side MOSFET gate with drive voltage independent of VCIN supply.

supply voltage : 4.5 to 5.5V

VCIN : supply voltage for the internal driver IC

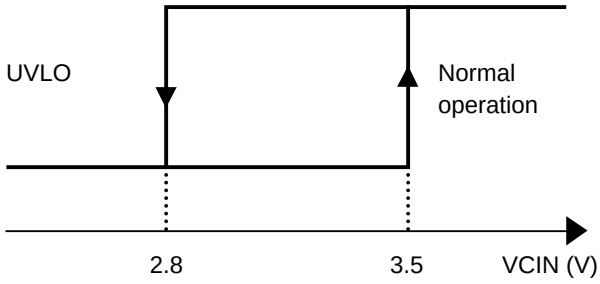
Built in under voltage lockout

operation voltage : 2.8V (typ.)

hysteresis voltage : 0.7V (typ.)

While under voltage lock out is operating,

the low-side MOSFET and the high-side MOSFET is kept OFF



- DISBL#

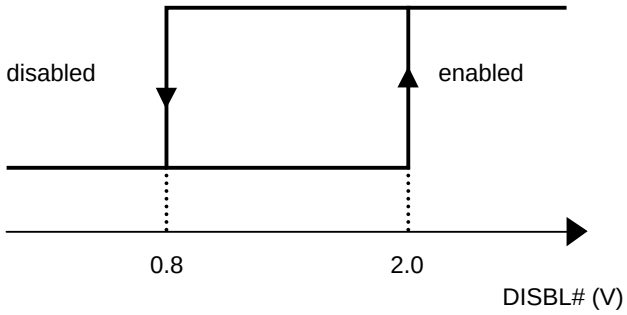
To decide the internal circuit to be enabled or to be disabled.

input “H” : normal operation

input “L” : the internal circuit is disabled (both side MOSFET are turned off)

threshold voltage of “H” : 2.0V (min.)

threshold voltage of “L” : 0.8V (max.)



- SD

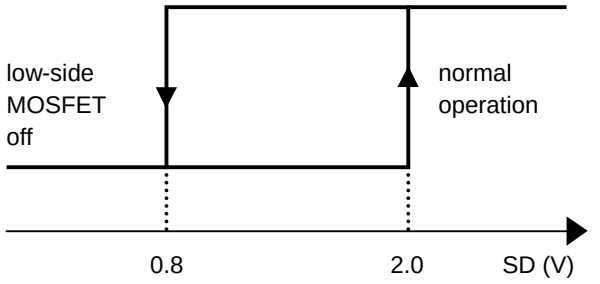
Input signal for the internal low-side MOSFET cut-off.

input “H” : normal operation

input “L” : the internal low-side MOSFET is kept off

threshold voltage of “H” : 2.0V (min.)

threshold voltage of “L” : 0.8V (max.)



- PWM

  Input signal for the internal driver IC

  input “H” : the high-side MOSFET is turned on, the low-side MOSFET is turned off

  input “L” : the high-side MOSFET is turned off, the low-side MOSFET is turned on

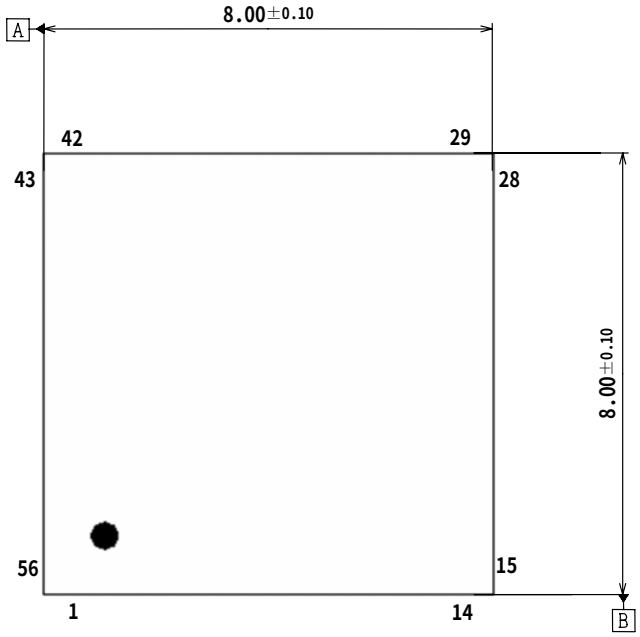
  threshold voltage of “H” : 2.0V (min.)

  threshold voltage of “L” : 0.8V (max.)

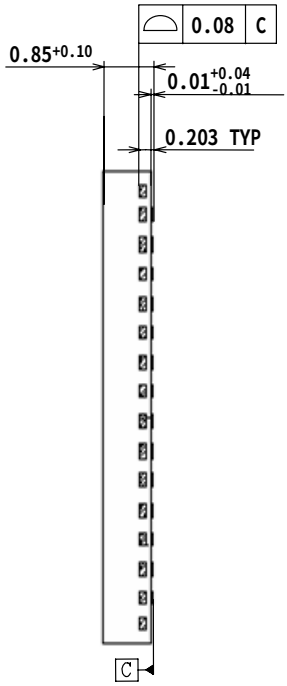
.

input				output	
VCIN	DISBL#	SD	PWM	high-side MOSFET	Low-side MOSFET
L	—	—	—	OFF	OFF
H	L	—	—	OFF	OFF
H	open	—	—	OFF	OFF
H	H	L	L	OFF	OFF
H	H	L	H	ON	OFF
H	H	H	L	OFF	ON
H	H	H	H	ON	OFF

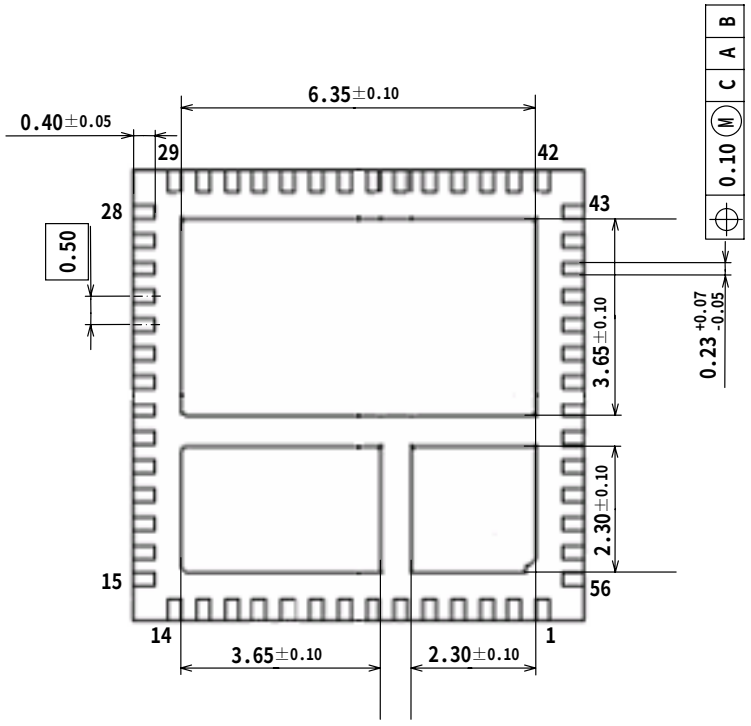
Package Outline



Top View



Side View



Bottom View