

mSATA

3SE3 Series

Customer: _____
Customer
Part
Number: _____
Innodisk
Part
Number: _____
Innodisk
Model Name: _____
Date: _____

Innodisk Approver	Customer Approver

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REVISION HISTORY

Revision	Description	Date
Preliminary	First Released	Aug,2016
1.0	Official released	Sep., 2016
1.1	Add 4/8/16GB Model with Kioxia 24nm SLC NAND	Jan., 2020

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1. Product Overview

1.1 Introduction of Innodisk mSATA 3SE3

Innodisk mSATA 3SE3 is designed with mSATA form factor by MO-300/MO-300B which established by JEDEC, and supports SATA III standard (6.0 Gb/s) with excellent performance. Regarding of mechanical interference, Innodisk mSATA 3SE3 absolutely replaces the traditional hard disk and makes personal computer, in any field, smaller and easier.

Innodisk offers SLC series of product with SLC-based flash, boasting faster write speeds and lower consumption, is more reliable and suitable of critical applications.

Innodisk mSATA 3SE3 effectively reduces the booting time of operation system and the power consumption is less than hard disk drive (HDD), and complies with ATA protocol, no additional drives are required, and can be configured as a boot device or data storage device

1.2 Product View and Models

Innodisk mSATA 3SE3 is available in follow capacities within SLC flash ICs.

mSATA 3SE3 04GB	mSATA 3SE3 08GB	mSATA 3SE3 16GB
mSATA 3SE3 32GB	mSATA 3SE3 64GB	mSATA 3SE3 128GB

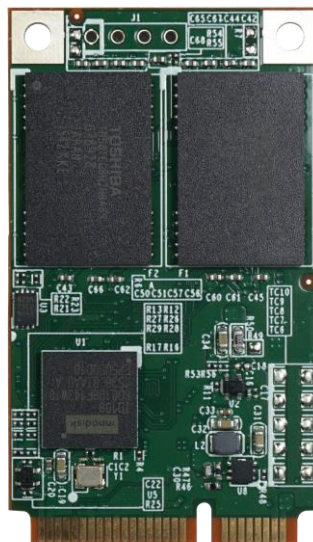


Figure 1: Innodisk mSATA 3SE3

1.3 SATA Interface

Innodisk mSATA 3SE3 supports SATA III interface, and compliant with SATA I and SATA II. SATA III interface can work with Serial Attached SCSI (SAS) host system, which is used in server computer. Innodisk mSATA 3SE3 is compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps /3.0Gbps/6.0Gbps data rate).

2. Product Specifications

2.1 Capacity and Device Parameters

mSATA 3SE3 device parameters are shown in Table 1.

Table 1: Device parameters

Capacity	Cylinders	Heads	Sectors	LBA	User Capacity(MB)
04GB	7773	16	63	7835184	3,826
08GB	15525	16	63	15649200	7,641
16GB	16383	16	63	31277232	15,272
32GB	16383	16	63	62533296	30,533
64GB	16383	16	63	125045424	61,057
128GB	16383	16	63	250069680	122,104

2.2 Performance

Burst Transfer Rate: 6.0Gbps

Table 2: Performance

Capacity	04GB	04GB 24nm	08GB	08GB 24nm	16GB	16GB 24nm	32GB	64GB	128GB
Sequential Read (max.)	120 MB/sec	31 MB/sec	220 MB/sec	62 MB/sec	385 MB/sec	123 MB/sec	380 MB/sec	385 MB/sec	385 MB/sec
Sequential Write (max.)	55 MB/sec	26 MB/sec	110 MB/sec	50 MB/sec	170 MB/sec	96 MB/sec	210 MB/sec	225 MB/sec	220 MB/sec
4KB Random** Read (QD32)	6,100 IOPS	3,500 IOPS	9,900 IOPS	5,500 IOPS	13,000 IOPS	8,500 IOPS	13,000 IOPS	12,000 IOPS	12,000 IOPS
4KB Random** Write (QD32)	10,000 IOPS	6,000 IOPS	15,000 IOPS	8,500 IOPS	18,000 IOPS	10,500 IOPS	20,000 IOPS	20,000 IOPS	20,000 IOPS

Note: the information is based on CrystalDiskMark 5.1.2 with file size 1000MB test patent

2.3 Electrical Specifications

2.3.1 Power Requirement

Table 3: Innodisk mSATA 3SE3 Power Requirement

Item	Symbol	Rating	Unit
Input voltage	V _{IN}	+3.3 DC +- 5%	V

2.3.2 Power Consumption

Table 4: Power Consumption

Mode	Power Consumption (mA)
Read	174 (max.)
Write	180 (max.)
Idle	134 (max.)

* Target: 128GB mSATA 3SE3

2.4 Environmental Specifications

2.4.1 Temperature Ranges

Table 5: Temperature range for mSATA 3SE3

Temperature	Range
Operating	Standard Grade: 0°C to +70°C
	Industrial Grade: -40°C to +85°C
Storage	-55°C to +95°C

2.4.2 Humidity

Relative Humidity: 10-95%, non-condensing

2.4.3 Shock and Vibration

Table 6: Shock/Vibration Testing for mSATA 3SE3

Reliability	Test Conditions	Reference Standards
Vibration	7 Hz to 2K Hz, 20G, 3 axes	IEC 68-2-6
Mechanical Shock	Duration: 0.5ms, 1500 G, 3 axes	IEC 68-2-27

2.4.4 Mean Time between Failures (MTBF)

Table 7 summarizes the MTBF prediction results for various mSATA 3SE3 configurations. The analysis was performed using a RAM Commander™ failure rate prediction.

- **Failure Rate:** The total number of failures within an item population, divided by the total number of life units expended by that population, during a particular measurement interval under stated condition.
- **Mean Time between Failures (MTBF):** A basic measure of reliability for repairable items: The mean number of life units during which all parts of the item perform within their specified limits, during a particular measurement interval under stated conditions.

Table 7: mSATA 3SE3 MTBF

Product	Condition	MTBF (Hours)
Innodisk mSATA 3SE3	Telcordia SR-332 GB, 25°C	>3,000,000

2.5 CE and FCC Compatibility

mSATA 3SE3 conforms to CE and FCC requirements.

2.6 RoHS Compliance

mSATA 3SE3 is fully compliant with RoHS directive.

2.7 Reliability

Parameter	Value
Read Cycles	Unlimited Read Cycles
Flash endurance	60,000 P/E cycles
Wear-Leveling Algorithm	Support
Bad Blocks Management	Support
Error Correct Code	Support
TBW* (Total Bytes Written) Unit:TB	
04GB	24
08GB	48
16GB	96
32GB	192
64GB	384
128GB	768
* Total bytes written is based on JEDEC 218 (Solid-State Drive Requirements and Endurance Test Method)	

2.8 Transfer Mode

mSATA 3SE3 support following transfer mode:

Serial ATA III 6.0Gbps

Serial ATA II 3.0Gbps

Serial ATA I 1.5Gbps

2.9 Pin Assignment

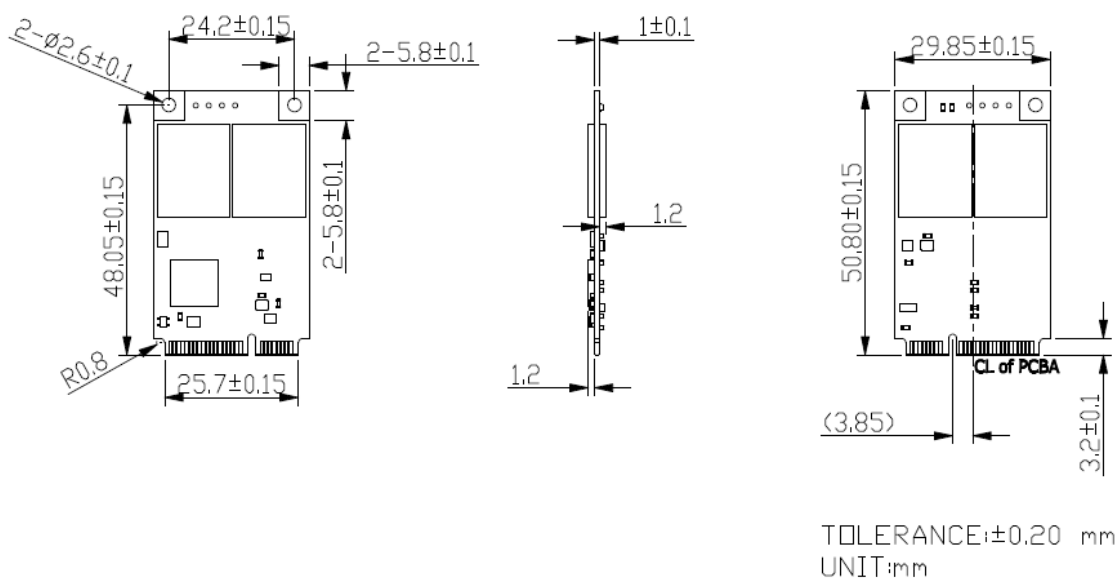
Innodisk mSATA 3SE3 uses a standard SATA pin-out. See Table 8 for mSATA 3SE3 pin assignment.

Table 8: Innodisk mSATA 3SE3 Pin Assignment

Signal Name	Pin #	Pin #	Signal Name
GND	51	52	+3.3V
DAS	49	50	GND
NC	47	48	NC
NC	45	46	NC
NC	43	44	NC
+3.3V	41	42	NC
+3.3V	39	40	GND
GND	37	38	NC

GND	35	36	NC
RX+	33	34	GND
RX-	31	32	NC
GND	29	30	NC
GND	27	28	NC
TX-	25	26	GND
TX+	23	24	+3.3V
GND	21	22	NC
NC	19	20	NC
NC	17	18	GND
GND	15	16	NC
NC	13	14	NC
NC	11	12	NC
GND	9	10	NC
NC	7	8	NC
NC	5	6	NC
NC	3	4	GND
NC	1	2	+3.3V

2.10 Mechanical Dimensions



2.11 Assembly Weight

An Innodisk mSATA 3SE3 within flash ICs, 32GB's weight is 8 grams approximately.

2.12 Seek Time

Innodisk mSATA 3SE3 is not a magnetic rotating design. There is no seek or rotational latency required.

2.13 NAND Flash Memory

Innodisk mSATA 3SE3 uses Multi Level Cell (SLC) NAND flash memory, which is non-volatility, high reliability and high speed memory storage. Each cell stores 2 bits or holds four states per cell. Read or Write data to flash memory for SSD is control by microprocessor.

3. Theory of Operation

3.1 Overview

Figure 2 shows the operation of Innodisk mSATA 3SE3 from the system level, including the major hardware blocks.

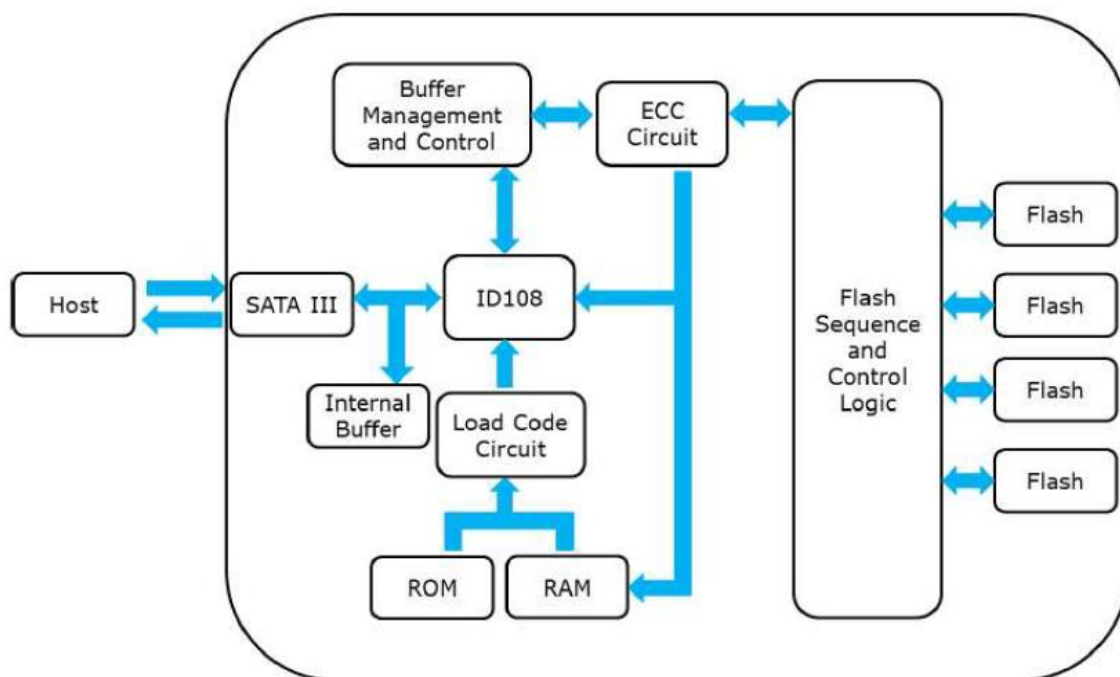


Figure 2: Innodisk mSATA 3SE3 Block Diagram

Innodisk mSATA 3SE3 integrates a SATA III controller and NAND flash memories. Communication with the host occurs through the host interface, using the standard ATA protocol. Communication with the flash device(s) occurs through the flash interface.

3.2 SATA III Controller

Innodisk mSATA 3SE3 is designed with ID108, a SATA III 6.0Gbps (Gen. 3) controller. The Serial ATA physical, link and transport layers are compliant with Serial ATA Gen 1, Gen 2 and Gen 3 specification (Gen 3 supports 1.5Gbps/3.0Gbps/6.0Gbps data rate). The controller has 4 channels for flash interface.

3.3 Error Detection and Correction

Highly sophisticated Error Correction Code algorithms are implemented. The ECC unit consists of the Parity Unit (parity-byte generation) and the Syndrome Unit (syndrome-byte computation). This unit implements an algorithm that can correct 40 bits per 1024 bytes in an ECC block. Code-byte generation during write operations, as well as error detection during read operation, is implemented on the fly without any speed penalties.

3.4 Wear-Leveling

Flash memory can be erased within a limited number of times. This number is called the **erase cycle limit** or **write endurance limit** and is defined by the flash array vendor. The erase cycle limit applies to each individual erase block in the flash device.

Innodisk mSATA 3SE3 uses a static wear-leveling algorithm to ensure that consecutive writes of a specific sector are not written physically to the same page/block in the flash. This spreads flash media usage evenly across all pages, thereby extending flash lifetime.

3.5 Bad Blocks Management

Bad Blocks are blocks that contain one or more invalid bits whose reliability are not guaranteed. The Bad Blocks may be presented while the SSD is shipped, or may develop during the life time of the SSD. When the Bad Blocks is detected, it will be flagged, and not be used anymore. The SSD implement Bad Blocks management, Bad Blocks replacement, Error Correct Code to avoid data error occurred. The functions will be enabled automatically to transfer data from Bad Blocks to spare blocks, and correct error bit.

3.6 Power Cycling

Innodisk's power cycling management is a comprehensive data protection mechanism that functions before and after a sudden power outage to SSD. Low-power detection terminates data writing before an abnormal power-off, while table-remapping after power-on deletes corrupt data and maintains data integrity. Innodisk's power cycling provides effective power cycling management, preventing data stored in flash from degrading with use.

3.7 Garbage Collection

Garbage collection is used to maintain data consistency and perform continual data cleansing on SSDs. It runs as a background process, freeing up valuable controller resources while sorting good data into available blocks, and deleting bad blocks. It also significantly reduces write operations to the drive, thereby increasing the SSD's speed and lifespan.

3.8 Trim

The Trim command is designed to enable the operating system to notify the SSD which pages no longer contain valid data due to erases either by the user or operating system itself. During a delete operation, the OS will mark the sectors as free for new data and send a Trim command to the SSD to mark them as not containing valid data. After that the SSD knows not to preserve the contents of the block when writing a page, resulting in less write amplification with fewer writes to the flash, higher write speed, and increased drive life.

4. Installation Requirements

4.1 mSATA 3SE3 Pin Directions

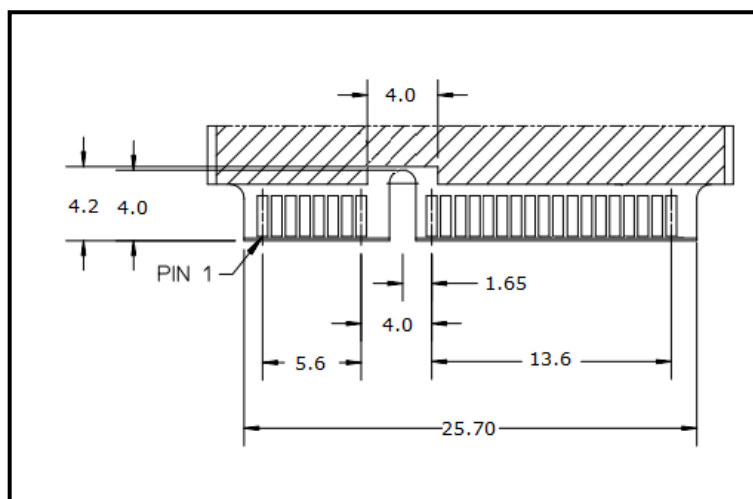


Figure 3: Signal Segment and Power Segment

4.2 Electrical Connections for mSATA 3SE3

A Serial ATA device may be either directly connected to a host or connected to a host through an adaptor card. The SATA interface has a separate connector for the power supply. Please refer to the pin description for further details.

4.3 Device Drive

No additional device drives are required. The Innodisk mSATA 3SE3 can be configured as a boot device.

5. Part Number Rule

CODE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
	D	E	M	S	R	-	3	2	G	D	0	8	S	C	A	D	B	-	X	X	X
Description	Disk	mSATA Regular					Capacity			Controller			Flash Mode	Operation Temp.	Internal Control	CH .	Flash Type	-	Customized Code		
Definition																					
Code 1 st (Disk)												Code 13 th (Flash Mode)									
D : Disk												S: Synchronous Flash									
Code 2 nd ~ 5 th (Form Factor)												Code 14 th (Operation Temperature)									
EMSR: mSATA Regular												C: Standard Grade (0℃ ~ +70℃)									
Code 7 th ~9 th (Capacity)												W: Industrial Grade (-40℃ ~ +85℃)									
04G: 04GB												Code 15 th (Internal control)									
08G: 08GB												A~Z: BGA PCB version									
16G: 16GB												Code 16 th (Channel of data transfer)									
32G: 32GB												S: Single Channel									
64G: 64GB												D: Dual Channels									
A28: 128GB												Q:Quad Channels									
Code 10 th ~12 th (Controller)												Code 17 th (Flash Type)									
D08: ID108												B: Toshiba SLC									
												Code 19 th ~21 th (Customized Code)									

宜鼎國際股份有限公司
Innodisk Corporation

Page 1/1

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RoHS 自我宣告書(RoHS Declaration of Conformity)

Manufacturer Product: All Innodisk EM Flash and Dram products

- 一、 宜鼎國際股份有限公司（以下稱本公司）特此保證售予新漢股份有限公司之所有產品，皆符合歐盟 2011/65/EU 關於 RoHS 之規範要求。

Innodisk Corporation declares that all products sold to Nexcom, are complied with European Union RoHS Directive (2011/65/EU) requirement.

- 二、 本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。

Innodisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

Name of hazardous substance	Limited of RoHS ppm (mg/kg)
鉛 (Pb)	< 1000 ppm
汞 (Hg)	< 1000 ppm
鎘 (Cd)	< 100 ppm
六價鉻 (Cr 6+)	< 1000 ppm
多溴聯苯 (PBBs)	< 1000 ppm
多溴二苯醚 (PBDEs)	< 1000 ppm

立保證書人 (Guarantor)

Company name 公司名稱: Innodisk Corporation 宜鼎國際股份有限公司

Company Representative 公司代表人: Randy Chien 簡川勝

Company Representative Title 公司代表人職稱: Chairman 董事長

Date 日期: 2016 / 08 / 04



宜鼎國際股份有限公司 Innodisk Corporation

Tel:(02)7703-3000 Fax:(02) 7703-3555 Internet: <http://www.innodisk.com/>

REACH Declaration of Conformity

Manufacturer Product: All Innodisk EM Flash and Dram products

1.宜鼎國際股份有限公司（以下稱本公司）特此保證此售予貴公司之產品，皆符合歐盟化學品法案(Registration, Evaluation and Authorization of Chemicals: REACH)之規定
(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/05/2014)。所提供之產品包含：(1) 產品或產品所使用到的所有原物料；(2)包裝材料；(3)設計、生產及重工過程中所使用到的所有原物料。

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(<http://www.echa.europa.eu/de/candidate-list-table> last updated: 16/06/2014).

Products include: 1) Product and raw material used by the product; 2) Packaging material; 3) Raw material used in the process of design, production and rework

2.本公司同意因本保證書或與本保證書相關事宜有所爭議時，雙方宜友好協商，達成協議。

InnoDisk Corporation agrees that both parties shall settle any dispute arising from or in connection with this Declaration of Conformity by friendly negotiations.

立保證書人 (Guarantor)

Company name 公司名稱: InnoDisk Corporation 宜鼎國際股份有限公司

Company Representative 公司代表人: Richard Lee 李鍾亮

Company Representative Title 公司代表人職稱: CEO 執行長

Date 日期: 2014 / 07 / 29



Verification of Compliance

Product Name : mSATA
Model Number : mSATA 3\$*#-&
 \$:Flash type: (S:SLC,I:iSLC,M:MLC)
 *: Product line: (E:Embedded, G: EverGreen)
 #:controller:
 (empty:606/607/667/670, 2: SMI 2246XT/ 2246EN, 3:608/609)
 &: Product feature: (P: with DRAM, empty: without DRAM)
Applicant : Innodisk Corporation
Address : 5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221,
 Taiwan (R.O.C.)
Report Number : S3O22-U070-1307-314
Issue Date : December 10, 2014
Applicable Standards : EN 55022:2010+AC:2011 Class B ITE
 AS/NZS CISPR22:2009+A1:2010 Class B ITE
 EN 55024:2010
 EN 61000-4-2:2009
 EN 61000-4-3:2006+A1:2008+A2:2010
 EN 61000-4-4:2004+A1:2010

Based on the EMC Directive 2004/108/EC and the specifications of the customer, one sample of the designated product has been tested in our laboratory and found to be in compliance with the EMC standards cited above.



TAF 0905
 FCC CAB Code TW1053
 NVLAP Lab Code 200575-0
 IC Code 4699A
 VCCI Accep. No. R-1527, C-1609, T-1441, G-10,
 C-4400, T-1334, G-614



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(Tsun-Yu Shih/ General Manager)

Date: December 10, 2014

Verification of Compliance

Product Name : mSATA
 Model Number : mSATA 3\$*#-&
 \$:Flash type: (S:SLC,I:iSLC,M:MLC)
 *: Product line: (E:Embedded, G: EverGreen)
 #:controller:
 (empty:606/607/667/670, 2: SMI 2246XT/ 2246EN, 3:608/609)
 &: Product feature: (P: with DRAM, empty: without DRAM)
 Applicant : Innodisk Corporation
 Address : 5F.No.237, Sec. 1, Datong Rd., Xizhi Dist., New Taipei City 221,
 Taiwan (R.O.C.)
 Report Number : S3F-U070-1307-314
 Issue Date : December 10, 2014

Applicable Standards : FCC Part 15, Subpart B Class B ITE
 ANSI C63.4:2009
 Industry Canada ICES-003 Issue 5
 CAN/CSA-CISPR 22-10 Class B ITE

One sample of the designated product has been tested in our laboratory and found to be in compliance with the FCC rules cited above.



NVLAP LAB CODE 200573-0

TAF 0905

FCC CAB Code TW1053

IC Code 4699A

VCCI Accop. No. R-1527, C-1609, T-1441, G-10,
 C-4400, T-1334, G-614



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Tsun-Yu Shih

(Tsun-Yu Shih/ General Manager)

Date: December 10, 2014