

# KM3x – Metrology MCUs based on Arm® Cortex®-M0+ Core

Up to 512 KB Flash and 64 KB SRAM

## 1. KM MCU Series

KM metering MCUs expand the successful line of NXP MCUs portfolio based on the Arm® Cortex™-M0+ core. The KM series supports low-cost, highly integrated solutions for one-, two-, and three- phase meters with a high accuracy sigma-delta ADC metering front end.

KM metering MCUs address specific regional needs including neutral disconnect or split phase for North America and Japan. Full metrology software, including time or filter based, is provided as well as fast Fourier transform. These devices include high electrostatic discharge immunity with high accuracy RTC with less than 5 ppm drift over temperature.

Standard Tower System boards and regional reference designs with complete software libraries are available for design evaluation.

## 2. KM3x MCU Family

The KM3x MCU family adds a segment LCD controller in addition to the KM1x series. The KM3x MCU family includes KM33 and KM34 and KM35 with the key difference of 24 bit sigma- delta model number to address metering requirement from different region.

- KM33 – With up to 50 MHz Cortex M0+ core, up to 128 KB flash and 16 KB SRAM, featuring 3x 24-

## Contents

1. KM MCU Series.....	1
2. KM3x MCU Family .....	1
3. KM3x MCU Family Key Features.....	2
4. KM3x MCU Family Feature Summary .....	4
5. KM3x MCU Family Block Diagram .....	5
6. KM3x MCU Family Common Features .....	5
7. KM3x MCU Family Differences .....	6
8. Comprehensive enablement solutions.....	7
8.1. Integrated development environments.....	7
8.2. Development hardware.....	7
9. Part identification.....	9
9.1. Description .....	9
9.2. Format .....	9
9.3. Fields .....	9
10. Orderable part numbers .....	10
11. Revision history.....	10



bit sigma-delta ADC models, 16-bit SAR ADC, and high accuracy internal VREF. Up to 100 pins package offering 36x8/40x4 segment LCD

- KM34 – With up to 75MHz Cortex M0+ core, up to 256 KB Flash and 32 KB SRAM, featuring 4x 24-bit sigma-delta ADC models, 16-bit SAR ADC, and high accuracy internal VREF. Up to 144 pins package offering 56x8/ 58x6/ 60x4 segment LCD
- KM35 – With up to 75MHz Cortex M0+ core, up to 512 KB Flash and 64 KB SRAM, featuring 4x 24-bit sigma-delta ADC models, 16-bit SAR ADC, and high accuracy internal VREF. Up to 144 pins package offering 56x8/ 58x6/ 60x4 segment LCD

### **3. KM3x MCU Family Key Features**

- Core
  - Arm® Cortex®-M0+ core up to 75 MHz
  - Memory-mapped Arithmetic Unit (MMAU)
  - Memory Mapped Cryptographic Acceleration Unit(MMCAU)
- Memories
  - 128 KB to 512 KB program flash memory
  - 16 KB to 64 KB SRAM
- Clocks
  - FLL and PLL
  - 4 MHz internal reference clock
  - 32 kHz internal reference clock
  - 1 kHz LPO clock
  - 32.768 kHz crystal oscillator in iRTC power domain
  - 1 MHz to 32 MHz crystal oscillator
- Low power features
  - 13 power modes to provide power optimization based on application requirements
  - 8.82 mA @ 75 MHz run current
  - Less than 124.4  $\mu$ A/MHz very low power run current
  - 6.05  $\mu$ A very low power stop current
  - Down to 357 nA deep sleep current
  - VBAT domain current < 1  $\mu$ A with iRTC operational
  - Low-power boot with less than 2.33 mA peak current
- System peripherals
  - Memory Protection Unit (MPU)

- 4-channel DMA controller
- Watchdog and EWM
- Low-leakage Wakeup Unit (LLWU)
- SWD debug interface and Micro Trace Buffer (MTB)
- Bit Manipulation Engine (BME)
- Inter-peripheral Crossbar Switch (XBAR)
- Analog
  - Up to 4 AFE channels (4× 24-bit Sigma Delta ADCs with PGA)
  - 16-channel 16-bit SAR ADC with 4 result registers
  - High-speed analog comparator containing a 6-bit DAC and programmable reference input
  - Internal 1.2 V reference voltage 10–15 ppm/C°
- Communication interfaces
  - 16-bit SPI modules
  - Low power UART module
  - UART module complying with ISO7816-3
  - Basic UART module
  - I2C with SMBus
- Timers
  - Quad Timer
  - Periodic Interrupt Timer (PIT)
  - Low Power Timer (LPTMR)
  - Programmable Delay Block (PDB)
  - Watchdog Timer
  - External Watchdog Monitor (EWM)
  - Independent Real Time Clock (iRTC)
- Human machine interface
  - Up to 4×60 (8×56, 6×58) segment LCD controller operating in all low-power modes
  - General purpose input/output (GPIO)
- Security and integrity modules
  - Memory Mapped Cryptographic Acceleration Unit (MMCAU) for AES encryption
  - Random Number Generator (RNGA), complying with NIST: SP800-90
  - Cyclic Redundancy Check (PCRC)

- 80-bit unique identification number per chip
- Operating conditions
  - Voltage range: 1.71 to 3.6 V (without AFE)
  - Voltage range: 2.8 to 3.6 V (with AFE)
  - iRTC battery supply voltage range: 1.71 to 3.6 V
  - Temperature range: –40 to 105 °C
- Packages
  - 144-pin LQFP 20×20 mm 0.5 mm pitch
  - 100-pin LQFP 14×14 mm 0.5 mm pitch

## 4. KM3x MCU Family Feature Summary

Sub-Family	KM33	KM34Z128	KM34Z256	KM35Z256	KM35Z512
CPU Frequency	50MHz	50MHz	75MHz	75MHz	75MHz
Memory-mapped Arithmetic Unit (MMAU)	-	-	Yes	Yes	Yes
Flash Memory	64-128 KB	128 KB	256 KB	256 KB	512 KB
SRAM	16 KB	16 KB	32 KB	64 KB	64 KB
Memory Mapped Cryptographic Acceleration Unit (MMCAU)	-	-	Yes	Yes	Yes
Inter Peripheral Crossbar In/Out Pin	5/5 - 9/9	9/9	9/9 - 11/11	9/9 - 11/11	9/9 - 11/11
Segment LCD	20x8/ 22x6/ 24x4 – 36x8/38x6/40x4	36x8/ 38x6/ 40x4	36x8/ 38x6/ 40x4 – 56x8/58x6/60x4	36x8/ 38x6/ 40x4 – 56x8/58x6/ 60x4	36x8/ 38x6/ 40x4 – 56x8/ 58x6/ 60x4
Analog	24bit ADC, 16bit ADC,PGA, CMP w/ 6bit DAC, VREF	24bit ADC, 16bit ADC,PGA, CMP w/ 6bit DAC, VREF	24bit ADC, 16bit ADC,PGA, CMP w/ 6bit DAC, VREF	24bit ADC, 16bit ADC,PGA, CMP w/ 6bit DAC, VREF	24bit ADC, 16bit ADC,PGA, CMP w/ 6bit DAC, VREF

Connectivity	UART w/ ISO7816, SPI, I2C	UART w/ ISO7816, SPI, I2C	UART w/ ISO7816, LPUART, SPI, I2C	UART w/ ISO7816, LPUART, SPI, I2C	UART w/ ISO7816, LPUART, SPI, I2C
Package	64LQFP, 100LQFP	100LQFP	100LQFP, 144LQFP	100LQFP, 144LQFP	100LQFP, 144LQFP

## 5. KM3x MCU Family Block Diagram

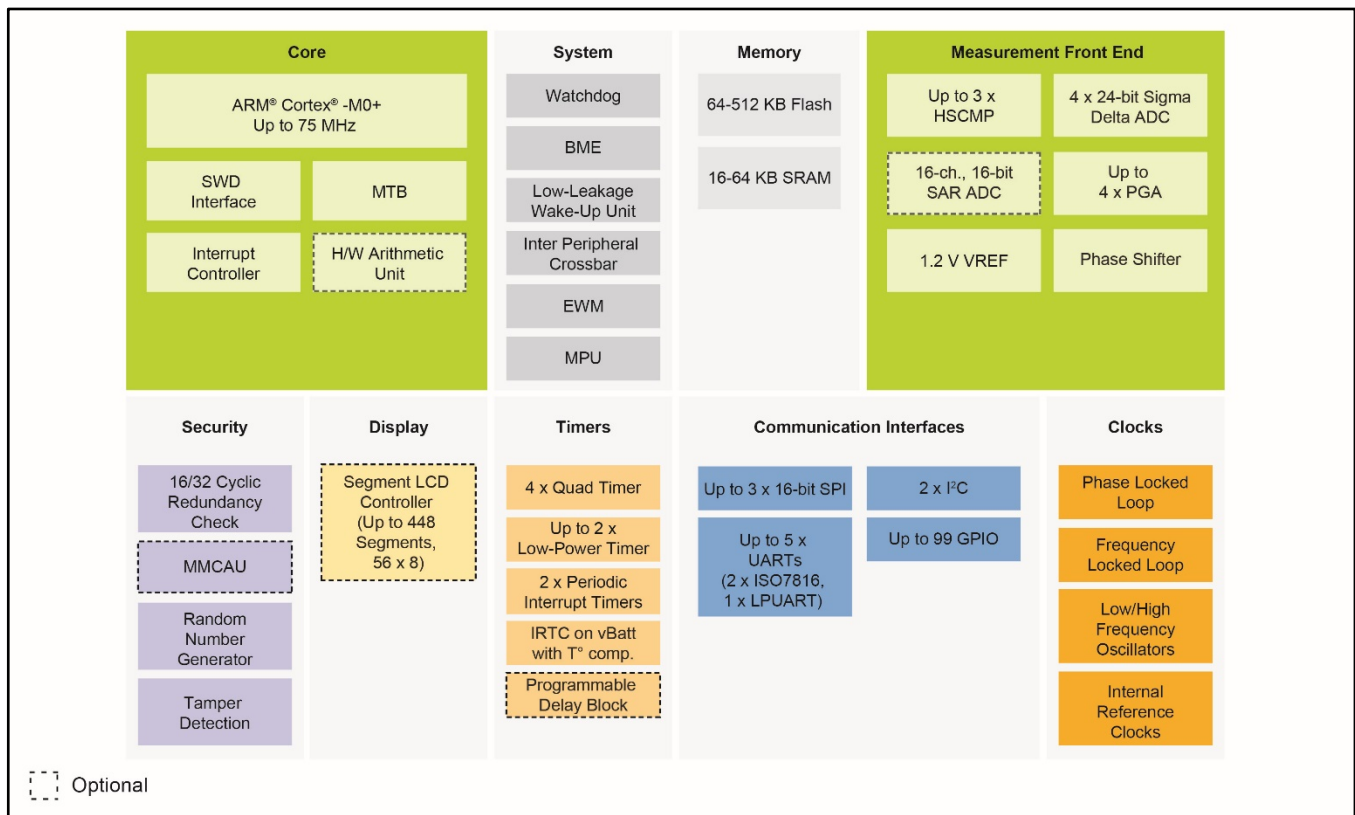


Figure 1 KM3x MCU Family Block Diagram

## 6. KM3x MCU Family Common Features

The following features are present on all KM3x MCUs:

- 2-pin serial wire debug (SWD), micro trace buffer (MTB)
- 4-channel DMA controller
- Integrated bit manipulation engine (BME)

- Random number generator
- Low- and high-frequency OSC
- iRTC, with 32KHz OSC, tamper detection and temperature compensation
- 4ch Quad Timer, 2 PIT, LPTMR
- High-speed analog comparator containing a 6-bit DAC for programmable reference input
- Power management controller (PMC) with nine power modes
- Non-maskable interrupt (NMI)
- Software and COP watchdog
- 80-bit unique identification number per chip
- Voltage range 1.71 V – 3.6 V
- Temperature range (TA) -40°C – 105°C

## 7. KM3x MCU Family Differences

Table 1 KM3x MCU family differences

Subfamily		KM33	KM34Z128	KM34Z256	KM35Z256	KM35Z512
Core	Frequency	50MHz	50MHz	75MHz	75MHz	75MHz
	Memory Mapped Arithmetic Unit (MMAU)	–	–	Yes	Yes	Yes
Flash / SRAM Size		64 KB/16 KB - 128 KB/16 KB	128 KB/16 KB	256 KB/32 KB	256 KB/64 KB	512 KB/64 KB
Communication	LPUART	–	–	1	1	1
	UART	2	2	2	2	2
	UART w/ ISO7816	2	2	2	2	2
	SPI	2	2	2	3	3
	I2C	2	2	2	2	2
Analog Modules	24-bit Sigma Delta ADC (PGA number)	3(2)	4(2)	4(4)	4(4)	4(4)
	16-bit ADC (channels)	1(7 - 12)	1(12)	1(12 - 16)	1(12 - 16)	1(12 - 16)
	CMP w/ 6bit DAC	2	2	3	3	3
Other	Inter Peripheral Crossbar In/Out Pin	5/5 - 9/9	9/9	9/9 - 11/11	9/9 - 11/11	9/9 - 11/11
	MMCAU	–	–	Yes	Yes	Yes
	Segment LCD	20x8/ 22x6/ 24x4 – 36x8 /38x6 /40x4	36x8/ 38x6/ 40x4	36x8/ 38x6/ 40x4 - 56x8/ 58x6/ 60x4	36x8/ 38x6/ 40x4 - 56x8/ 58x6/ 60x4	36x8/ 38x6/ 40x4 - 56x8/ 58x6/ 60x4

	Total GPIOs	38/68	68	72/99	72/99	72/99
Package	64LQFP, 100LQFP	100LQFP	100LQFP, 144LQFP	100LQFP, 144LQFP	100LQFP, 144LQFP	100LQFP, 144LQFP

## 8. Comprehensive enablement solutions

### 8.1. Integrated development environments

- IAR Embedded Workbench® [iar.com/kinetis](http://iar.com/kinetis)
- Arm Keil® Microcontroller Development Kit [keil.com/nxp](http://keil.com/nxp)
- NXP MCUXpresso [nxp.com/mcuxpresso](http://nxp.com/mcuxpresso)
  - An open-source software development kit (SDK)
  - An easy-to-use integrated development environment (IDE)
  - A comprehensive suite of system configuration tools, including pins, clocks, SDK builder and more
  - Broad Arm ecosystem support through NXP Connect partners

### 8.2. Development hardware

NXP Tower System development board platform is a modular development platform for 8-bit, 16-bit, and 32-bit microcontrollers that enable advanced development through rapid prototyping. Featuring multiple development boards or modules, the Tower System development board platform provides designers with building blocks for entry-level to advanced microcontroller development.

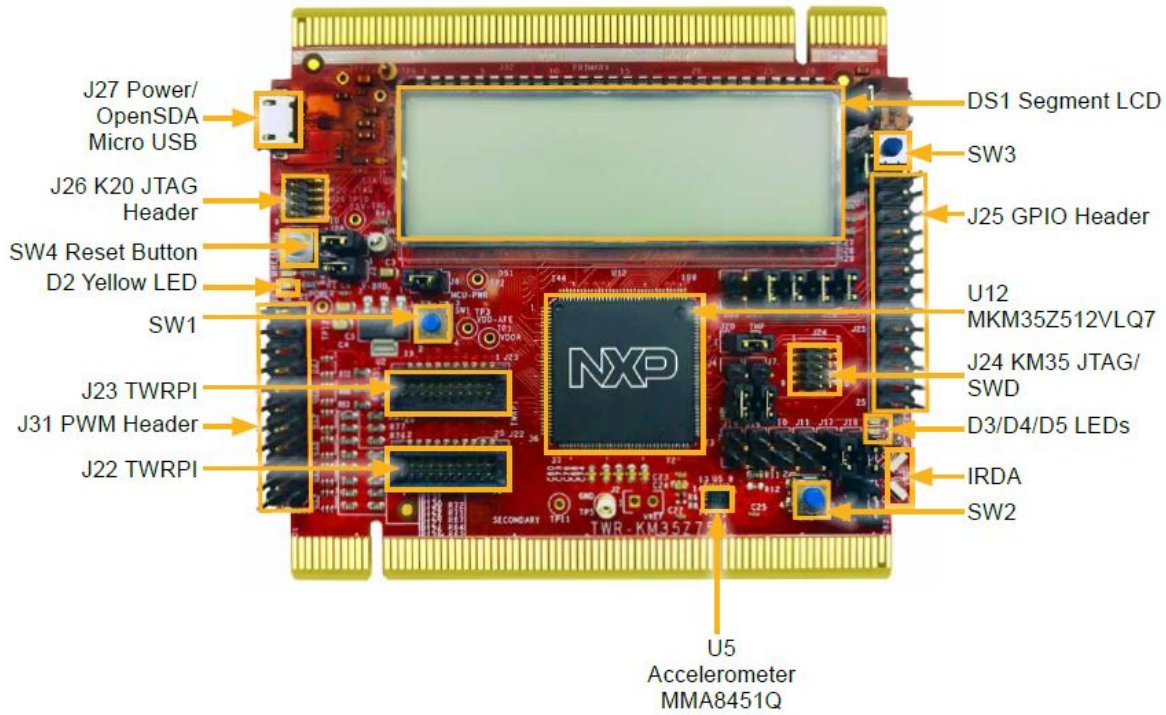


Figure 2 NXP Tower System development board platform



Tower-compatible microcontroller module

- USB interface with Mini-B/Micro-B USB connector
- Large 160-seg. glass LCD
- On-board debug circuit: open source SWD (OpenSDA) with virtual serial port
- Three-axis accelerometer/anti tamper tilt sensor (MMA8451Q)



- Four user-controllable LEDs
- Two user pushbutton switches for GPIO interrupts
- One user pushbutton switch for tamper detection
- One user pushbutton switch for MCU reset
- Potentiometer
- Headers for direct GPIO and ADC access
- External Tamper pins
- Independent, battery-operated power supply for Real Time Clock (RTC) and tamper detection modules
- IRDA support
- NTC temperature sensor
- General-purpose Tower Plug-in (TWRPI) socket

## 9. Part identification

### 9.1. Description

The chip part numbers have fields that identify the specific part. You can use the values of these fields to determine the specific part you have received.

### 9.2. Format

The device part numbers have the following format: Q KM## A FFF T PP CC (N)

### 9.3. Fields

The following table lists the possible values for each field in the part number. However, not all combinations are valid.

**Table 2 Part number field descriptions**

Field	Description	Values
Q	Qualification status	M = Fully-qualified, general market flow P = Prequalification
KM##	K family	KM33 KM34 KM35
A	Key attribute	Z = Cortex-M0+

## Revision history

FFF	Program Flash memory size	64 = 64 KB 128 = 128 KB 256 = 256 KB 512 = 512 KB
R	Silicon revision	(Blank) = Main A = Revision after main
T	Temperature range	C = -40°C – 85°C V = -40°C – 105°C
PP	Package identifier	LH = 64LQFP (10mm x 10mm x 1.4mm, Pitch 0.5mm) LL = 100LQFP (14mm x 14mm x 1.7mm, Pitch 0.5mm) LQ = 144LQFP (20mm x 20mm x 1.6mm, Pitch 0.5mm)
CC	Maximum CPU frequency (MHz)	5 = 50 MHz 7 = 75 MHz
N	Packaging type	R = Tape and reel (Blank) = Trays

## 10. Orderable part numbers

**Table 3 Ordering information**

Product	Core and Security			Memory		Package		Analog and HMI				
	MC Part number	Frequency	MMAU	MMCAU	Flash (KB)	SRAM (KB)	Pin Count	Package	24 bit Sigma Delta ADC (PGA number)	Comparator	LCD Segments	GPIOs
MKM33Z64ACLLH5	50MHz	-	-	-	64	16	64	LQFP	3(2)	2	20x8/22x6/24x4	38
MKM33Z64ACLL5	50MHz	-	-	-	64	16	100	LQFP	3(2)	2	36x8/38x6/40x4	68
MKM33Z128ACLLH5	50MHz	-	-	-	128	16	64	LQFP	3(2)	2	20x8/22x6/24x4	38
MKM33Z128ACLL5	50MHz	-	-	-	128	16	100	LQFP	3(2)	2	36x8/38x6/40x4	68
MKM34Z128ACLL5	50MHz	-	-	-	128	16	100	LQFP	4(2)	2	36x8/38x6/40x4	68
MKM34Z256VLL7	75MHz	Yes	Yes	-	256	32	100	LQFP	4(4)	3	36x8/ 38x6/ 40x4	72
MKM34Z256VLQ7	75MHz	Yes	Yes	-	256	32	144	LQFP	4(4)	3	56x8/ 58x6/ 60x4	99
MKM35Z512VLL7	75MHz	Yes	Yes	-	512	64	100	LQFP	4(4)	3	36x8/ 38x6/ 40x4	72
MKM35Z512VLQ7	75MHz	Yes	Yes	-	512	64	144	LQFP	4(4)	3	56x8/ 58x6/ 60x4	99
MKM35Z256VLL7	75MHz	Yes	Yes	-	256	64	100	LQFP	4(4)	3	36x8/ 38x6/ 40x4	72
MKM35Z256VLQ7	75MHz	Yes	Yes	-	256	64	144	LQFP	4(4)	3	56x8/ 58x6/ 60x4	99

## 11. Revision history

Revision number	Date	Substantive changes
0	06/2015	Initial release
1	04/2020	Added KM35

**How to Reach Us:**

**Home Page:**  
[nxp.com](http://nxp.com)

**Web Support:**  
[nxp.com/support](http://nxp.com/support)

Information in this document is provided solely to enable system and software implementers to use NXP products. There are no express or implied copyright licenses granted hereunder to design or fabricate any integrated circuits based on the information in this document. NXP reserves the right to make changes without further notice to any products herein.

NXP makes no warranty, representation, or guarantee regarding the suitability of its products for any particular purpose, nor does NXP assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters that may be provided in NXP data sheets and/or specifications can and do vary in different applications, and actual performance may vary over time. All operating parameters, including "typicals", must be validated for each customer application by customer's technical experts. NXP does not convey any license under its patent rights nor the rights of others. NXP sells products pursuant to standard terms and conditions of sale, which can be found at the following address: [nxp.com/SalesTermsandConditions](http://nxp.com/SalesTermsandConditions).

While NXP has implemented advanced security features, all products may be subject to unidentified vulnerabilities. Customers are responsible for the design and operation of their applications and products to reduce the effect of these vulnerabilities on customer's applications and products, and NXP accepts no liability for any vulnerability that is discovered. Customers should implement appropriate design and operating safeguards to minimize the risks associated with their applications and products.

NXP, the NXP logo, NXP SECURE CONNECTIONS FOR A SMARTER WORLD, COOLFLUX, EMBRACE, GREENCHIP, HITAG, I2C BUS, ICODE, JCOP, LIFE VIBES, MIFARE, MIFARE CLASSIC, MIFARE DESFire, MIFARE PLUS, MIFARE FLEX, MANTIS, MIFARE ULTRALIGHT, MIFARE4MOBILE, MIGLO, NTAG, ROADLINK, SMARTLX, SMARTMX, STARPLUG, TOPFET, TRENCHMOS, UCODE, Freescale, the Freescale logo, AltiVec, C-5, CodeTEST, CodeWarrior, ColdFire, ColdFire+, C-Ware, the Energy Efficient Solutions logo, Kinetis, Layerscape, MagniV, mobileGT, PEG, PowerQUICC, Processor Expert, QorIQ, QorIQ Qonverge, Ready Play, SafeAssure, the SafeAssure logo, StarCore, Symphony, VortiQa, Vybrid, Airfast, BeeKit, BeeStack, CoreNet, Flexis, MXC, Platform in a Package, QUICC Engine, SMARTMOS, Tower, TurboLink, and UMEMS are trademarks of NXP B.V. All other product or service names are the property of their respective owners. AMBA, Arm, Arm7, Arm7TDMI, Arm9, Arm11, Artisan, big.LITTLE, Cordio, CoreLink, CoreSight, Cortex, DesignStart, DynamiQ, Jazelle, Keil, Mali, Mbed, Mbed Enabled, NEON, POP, RealView, SecurCore, Socrates, Thumb, TrustZone, ULINK, ULINK2, ULINK-ME, ULINK-PLUS, ULINKpro, µVision, Versatile are trademarks or registered trademarks of Arm Limited (or its subsidiaries) in the US and/or elsewhere. The related technology may be protected by any or all of patents, copyrights, designs and trade secrets. All rights reserved. Oracle and Java are registered trademarks of Oracle and/or its affiliates. The Power Architecture and Power.org word marks and the Power and Power.org logos and related marks are trademarks and service marks licensed by Power.org.

Document Number: KM3XPB  
Rev. 1  
04/2020

