

# ELECTRONIC DESIGN AND THE POST-PANDEMIC SUPPLY CHAIN

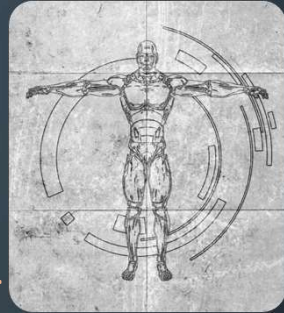
2022 CASE STUDY:

ROBOTICS INERTIAL MEASUREMENT UNIT (IMU)

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# CASE STUDY



TDK INVENSENSE ICM-20948, 9-AXIS INERTIAL MEASUREMENT UNIT

APPLICATION: ROBOTIC EXOSKELETON

CUSTOMER: “Manufacturer rep states component is not recommended for new design and CM says there are no parts available”

TDK: MEMS Sensors, San Jose CA, part introduced in 2017,  
5 years to EOL, average cost \$4.00



## ELECTRONIC COMPONENTS ARE A GLOBAL RESOURCE

- Locally made PC boards depend on globally sourced components
- Component manufacturers are dependent on global resources
- Electronic components are a global commodity and subject to global market pressures

# TDK ICM-20948 MARKET AVAILABILITY – JANUARY 2022

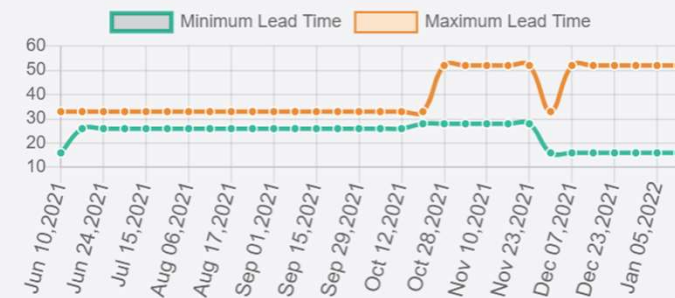
Distributor	SKU	Quantity
Digi-Key	1428-1123-2-ND	0
Farnell	2911498	0
Farnell	2911498RL	0
Newark	69AC5939	0
Mouser Electronics	410-ICM-20948	0
Element14	2911498	0



Price (\$)



Lead Time (Weeks)



# WHAT'S GOING ON?

## THE GLOBAL SUPPLY CHAIN

- TDK manufactures the IC in Taiwan and buys the magnetic IMU sensor from AKM (Japan)
- As a result of the pandemic, AKM shifted to automotive parts and discontinued the magnetic sensor
- TDK bought remaining sensor dies -but when they are gone the IMU can no longer be supported



# WHERE HAVE THE PARTS GONE?

## GLOBAL 'DISTRIBUTION'


- Global distribution includes a broker market with billions of dollars in investment power
- Non-authorized distributors are buying technologically significant components and selling at a higher price




# TDK ICM-20948

## BROKER MARKET—FEBRUARY 2022


### THE NEW STOCK MARKET (SMALL SAMPLE)

 Shenzhen Hansi Information & Technology Co. LTD				
Part #	Manufacturer	Description	Stock	Price
ICM-20948	TDK InvenSense	IMU ACCEL/GYRO/COMPI2C/SPI 24QFN	5,000	\$7.31

 Jigo Technology (HK) limited.				
Part #	Manufacturer	Description	Stock	Price
ICM-20948	INVENSENSE	New and original Rohs ; DC:1918+ ; QFN24	53000	
ICM-20948	INVENSENSE	New and original Rohs ; DC:1848+ ; QFN24	53000	

 Easev semiconductor Limited <span style="color: green;">Certificates</span>				
Part #	Manufacturer	Description	Stock	Price
ICM-20948	INVENSENSE	QFN24 ; DC:20+	1	
ICM-20948 ICM20948 ICM-42688-P	INVENSENSETDK	LGA ; DC:2020+	25600	
ICM-42605 ICM-20948 ICM-40607 AS5600	TDK INVENSENSE	LGA14 ; DC:2020+	36000	

# ALTERNATIVE 9-AXIS PARTS

ONLY 3 MAJOR IMU SUPPLIERS

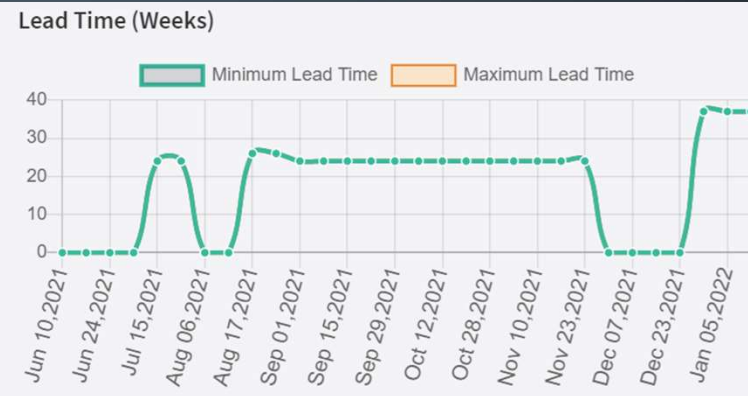
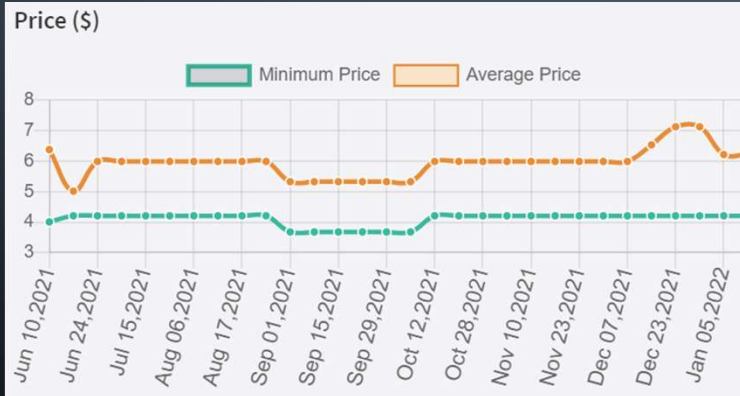
- TDK ICM-20948 9-Axis IMU
- Bosch BMX160 9-Axis IMU
- STMicroelectronics LSM9DS1TR 9-Axis IMU

Changing a critical design component requires extensive redesign



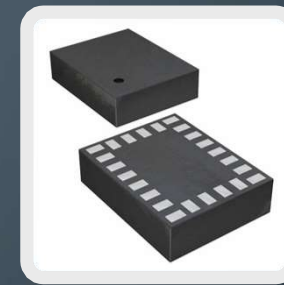
# BOSCH BMX160 9-AXIS IMU MARKET AVAILABILITY – JANUARY 2022

Distributor	SKU	Quantity
Digi-Key	828-1087-2-ND	0



# ST MICRO LSM9DS1TR 9-AXIS IMU MARKET AVAILABILITY – JANUARY 2022

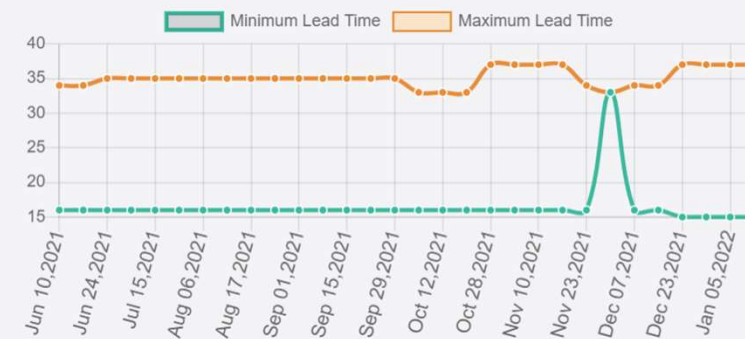
Distributor	Sku	Quantity
Newark	26V5658	0
Farnell	2532383	0
Farnell	2532383RL	0
Digi-Key	497-14946-2-ND	0
Newark	83V4306	0
Element14	2532383	0
Newark	29AC7702	0
Mouser Electronics	511-LSM9DS1TR	0



Price (\$)



Lead Time (Weeks)



# REDESIGN ALTERNATIVE 6-AXIS IMU WITH EXTERNAL MAGNETOMETER

- Redesign using more available 6-axis part with external magnetometer
- Purchase TDK parts from brokers to continue manufacture through redesign effort

Distributor	SKU	Quantity
Mouser Electronics	262-BMI270	0
Digi-Key	828-1091-2-ND	1528





# THE BEER GAME

- Small interruptions due to the pandemic have resulted in large supply chain disruptions
- Brokers are buying large quantities of parts to 'buy low, sell high'
- Companies are forced to hoard parts in order to keep manufacturing going
- Lead times greater than 52 weeks and unscheduled obsolescence are now common



# IMPORTANT POINTS

- Lead times continue to increase in 2022, indicating it will be several years before the supply chain normalizes
- Sustaining engineering, component engineering, and lifecycle management are now critical to the manufacture of electronic products
- Redesigns must include a BOM scrub for availability, not just compatibility
- Alternate components and assemblies are key to agile manufacturing