

CMOS Very Small 1 bit Control SPDT Switch for 0.01~10.6GHz

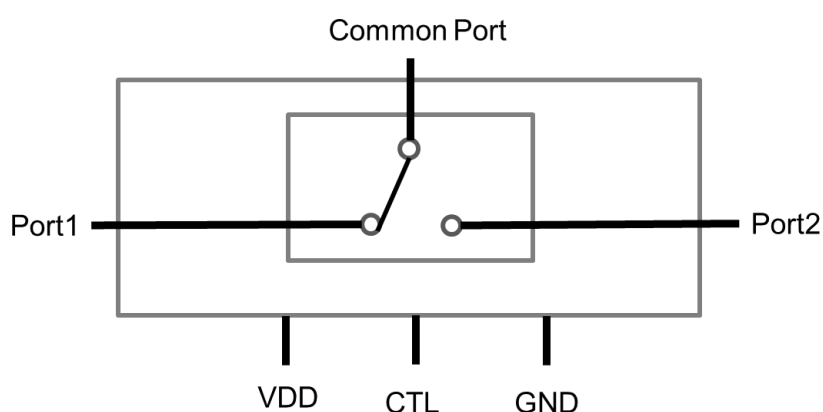
■ Applications

UWB/WiFi for Consumer Application

■ Features

- Low Insertion Loss1.4dB @ 10.6GHz
- Supply Voltage.....1.6 to 3.6V
- Small Package6 pin QFN Package
(0.7mm×1.1mm×0.60mm max)
- MSL1
- ESD.....HBM JEDEC JS-001-2017 Class 1C
- RoHS Compliant

■ Functional Block Diagram



■ Pin Description

| Pin # | Symbol | Description |
|-------|-------------|------------------------|
| 1 | Port2 | Single Ended RF port |
| 2 | GND | Ground |
| 3 | Port1 | Single Ended RF port |
| 4 | VDD | Voltage Supply |
| 5 | Common Port | Single Ended RF port |
| 6 | CTL | SW Logic Control Input |

■ SW Control Logic

| Mode | Port1 | Port2 |
|---------|-------|-------|
| CTL (L) | ON | OFF |
| CTL (H) | OFF | ON |

■ Absolute Maximum Ratings

| Symbol | Parameter | Conditions | Rating | Unit |
|--------|-----------------------|---|------------|------|
| Vdd | Supply Voltage | Ta = 25°C | 4.0 | V |
| CTL | Control Voltage | Ta = 25°C | 4.0 | V |
| Pin | RF Input Power | Ta = 25°C, Vdd=1.8V, CW, 50ohm, CTL(H) =1.8V,CTL(L) =0V Correspond RF path is ON | 30 | dBm |
| Top | Operating Temperature | - | -40 to 90 | °C |
| Tstg | Storage Temperature | - | -55 to 150 | °C |

Remark: Exceeding any of the rating limits may cause fatal damage to the device and result in permanent failure.

■ Recommended Operating Conditions

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------|------------------------|---------------|------|------|------|------|
| Top | Operating Temperature | | -40 | | 90 | |
| Vdd | Supply Voltage | Ta = -40~90°C | 1.6 | 1.8 | 3.6 | V |
| CTL(H) | Control Voltage (High) | Ta = -40~90°C | 1.2 | 1.8 | 3.6 | V |
| CTL(L) | Control Voltage (Low) | Ta = -40~90°C | 0 | 0 | 0.5 | V |

■ DC Electrical Specifications

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------|-----------------|--|------|------|------|------|
| Idd | Supply Current | Ta = 25°C, Vdd = 1.8V CTL(H) =1.8V,CTL(L) =0V | - | 8 | 20 | uA |
| Ictl | Control Current | Ta = 25°C, Vdd = 1.8V CTL(H) =1.8V,CTL(L) =0V | - | 0.01 | 5 | uA |

■ RF Electrical Specifications (Ta=25°C, VDD=1.8V, VCTL(H)=1.8V, VCTL(L)=0V, Pin=0dBm)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------|---|--|------|------|------|------|
| IL | Insertion Loss: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | - | 0.40 | 0.65 | dB |
| | | 1000-2500MHz | - | 0.45 | 0.75 | dB |
| | | 2500-5925MHz | | 0.70 | 0.95 | dB |
| | | 5925-7125MHz | - | 0.80 | 1.10 | dB |
| | | 7125-8250MHz | - | 0.95 | 1.35 | dB |
| | | 8250-9000MHz | - | 1.05 | 1.45 | dB |
| | | 9000-10600MHz | - | 1.40 | 1.80 | dB |
| ISO | Isolation: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | 50.5 | 56 | - | dB |
| | | 1000-2500MHz | 46.5 | 52 | - | dB |
| | | 2500-5925MHz | 34.5 | 40 | - | dB |
| | | 5925-7125MHz | 28.5 | 35 | - | dB |
| | | 7125-8250MHz | 22.5 | 31 | - | dB |
| | | 8250-9000MHz | 21.5 | 28 | - | dB |
| | | 9000-10600MHz | 18.5 | 24 | - | dB |
| Tsw | Switching Time | Vctl 50% ~ RF 90% or Vctl 50% ~ RF 10% | - | 70 | 280 | ns |
| 2f0 | Harmonics | 2.45GHz Pin=23dBm | 82 | 93 | | dBc |
| 3f0 | | | 80 | 89 | | dBc |
| 2f0 | | 5.5GHz Pin=23dBm | 53 | 65 | | dBc |
| 3f0 | | | 61 | 75 | | dBc |

(Ta=-40~90°C, VDD=1.8V, VCTL(H)=1.8V, VCTL(L)=0V, Pin=0dBm)

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|--------|---|--|------|------|------|------|
| IL | Insertion Loss: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | - | 0.40 | 0.75 | dB |
| | | 1000-2500MHz | - | 0.45 | 0.85 | dB |
| | | 2500-5925MHz | | 0.70 | 1.05 | dB |
| | | 5925-7125MHz | - | 0.80 | 1.2 | dB |
| | | 7125-8250MHz | - | 0.95 | 1.45 | dB |
| | | 8250-9000MHz | - | 1.05 | 1.55 | dB |
| | | 9000-10600MHz | - | 1.40 | 1.90 | dB |
| ISO | Isolation: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | 47.5 | 56 | - | dB |
| | | 1000-2500MHz | 44.5 | 52 | - | dB |
| | | 2500-5925MHz | 33.5 | 40 | - | dB |
| | | 5925-7125MHz | 27.5 | 35 | - | dB |
| | | 7125-8250MHz | 21.5 | 31 | - | dB |
| | | 8250-9000MHz | 20.5 | 28 | - | dB |
| | | 9000-10600MHz | 17.5 | 24 | - | dB |
| Tsw | Switching Time | Vctl 50% ~ RF 90% or Vctl 50% ~ RF 10% | - | 70 | 300 | ns |
| 2f0 | Harmonics | 2.45GHz Pin=23dBm | 77 | 93 | | dBc |
| 3f0 | | | 78 | 89 | | dBc |
| 2f0 | | 5.5GHz Pin=23dBm | 51 | 65 | | dBc |
| 3f0 | | | 59 | 75 | | dBc |

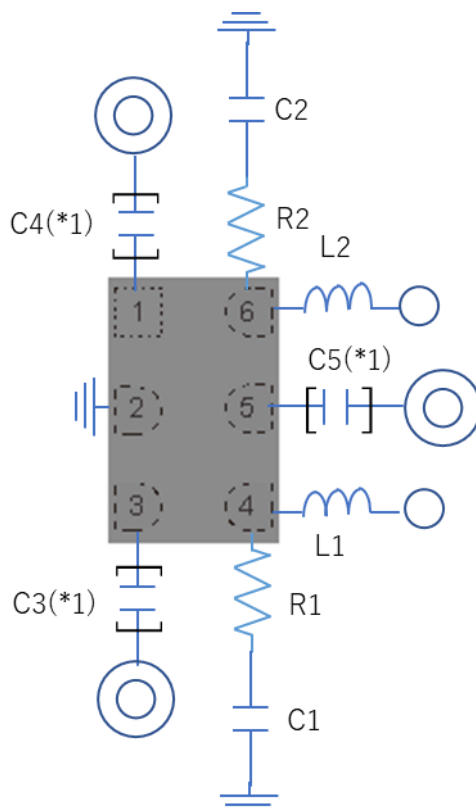
■ Reference : RF Performance RL/ IIP3 /P0.5dB/ HD for WiFi expansion
(Ta=25°C, Vdd=1.8 V, CTL=0 / 1.8 V)

| Symbol | Parameter | Conditions | Typ. | Unit |
|--------|---|--------------------------------------|------|------|
| RL | Return Loss: Common Port | 10-1000MHz | -25 | dB |
| | | 1000-2500MHz | -24 | dB |
| | | 2500-5925MHz | -18 | dB |
| | | 5925-7125MHz | -16 | dB |
| | | 7125-8250MHz | -14 | dB |
| | | 8250-9000MHz | -13 | dB |
| | | 9000-10600MHz | -10 | dB |
| IIP3 | 3 rd order input intercept point | 2.45GHz Pin=17dBm 20MHz offset | 63 | dBm |
| | | 5.80GHz Pin=17dBm 20MHz offset | 53 | dBm |
| P0.5dB | Input Power for 0.5dB compression | 2.45GHz | 30 | dBm |
| | | 5.5GHz | 29 | dBm |
| | | 6.175GHz | 29 | dBm |
| 2f0 | Harmonics | 6.175GHz Pin=23dBm | 61 | dBc |
| 3f0 | | | 73 | dBc |

■ Evaluation Board (EVB)

Electrical Performance of XMSSJK8GPA-246 is characterized under the condition where the device is mounted on the EVB.

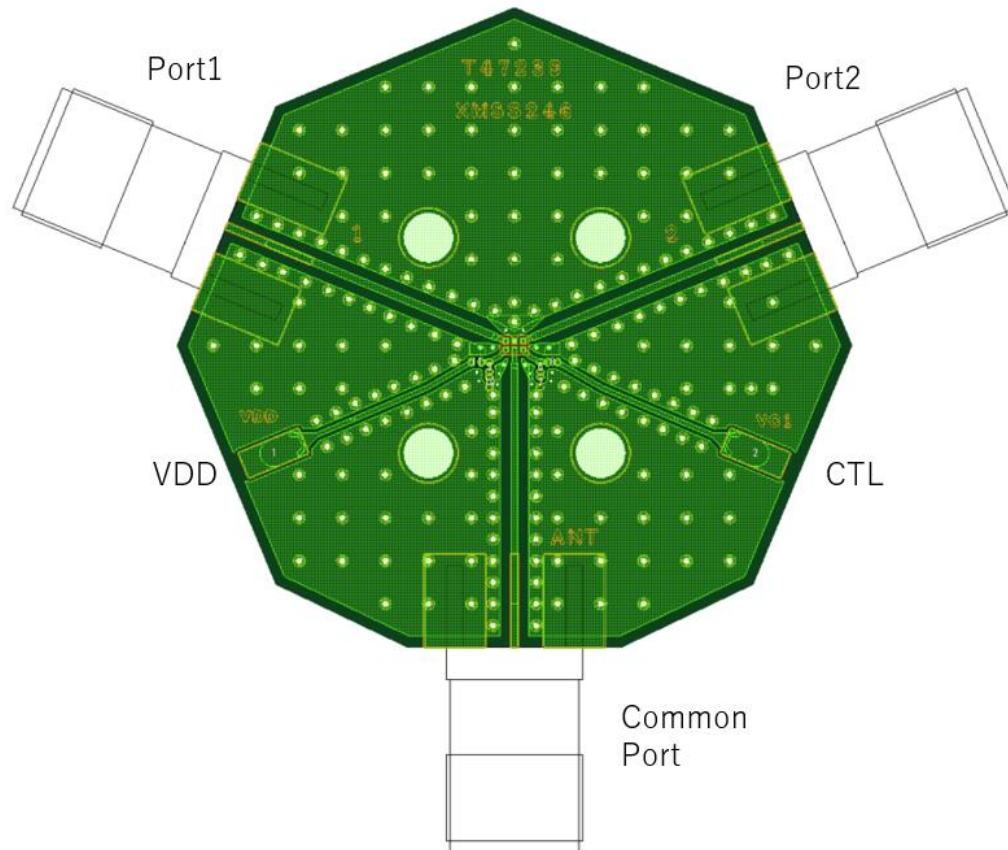
EVB Schematic



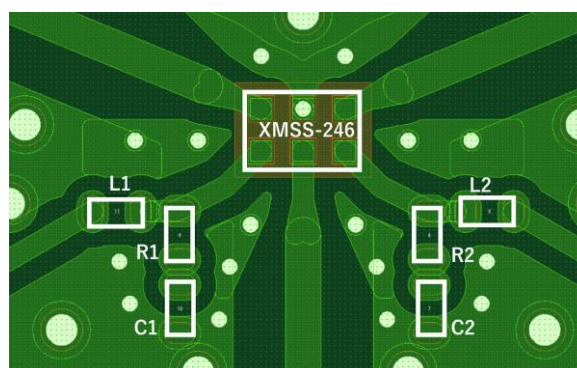
| Reference# | Parts Series | Constant | Purpose |
|-----------------|--------------|----------|-----------------------|
| C1,C2 | GRM033 | 1pF | RF GND over 8GHz |
| L1,L2 | LQP03HQ | 20nH | RF block over 8GHz |
| R1,R2 | ERJ1R | 51ohm | termination over 8GHz |
| [C3,C4,C5] (*1) | [GRM033] | [10pF] | [DC block] |

(*1) Remark: DC blocking capacitors on RF ports are necessary when DC voltages are applied from external circuits.

EVB Layout



Overall View



Enlarged around the device

Substrate

Transmission Line: 50Ω

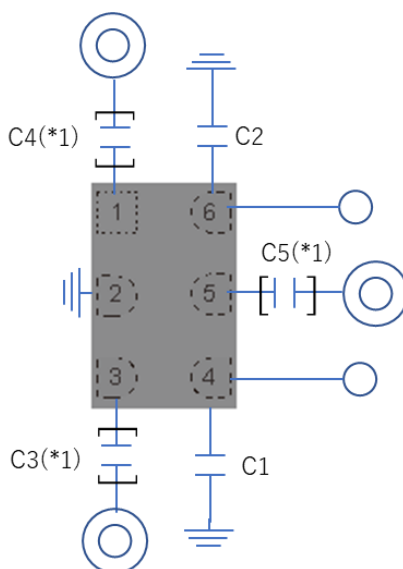
Material: Low Permittivity Glass Fiber Cloth Substrate ($\epsilon_r 3.4$)

Size: 31mm x 30mm

Thickness: 0.2mm+ (Dummy) 0.8mm

■ Reference : RF Performance with minimal external parts for WiFi Application (Ta=25°C, Vdd=1.8 V, CTL=0 / 1.8 V)

Schematic



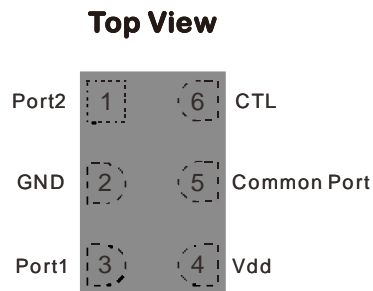
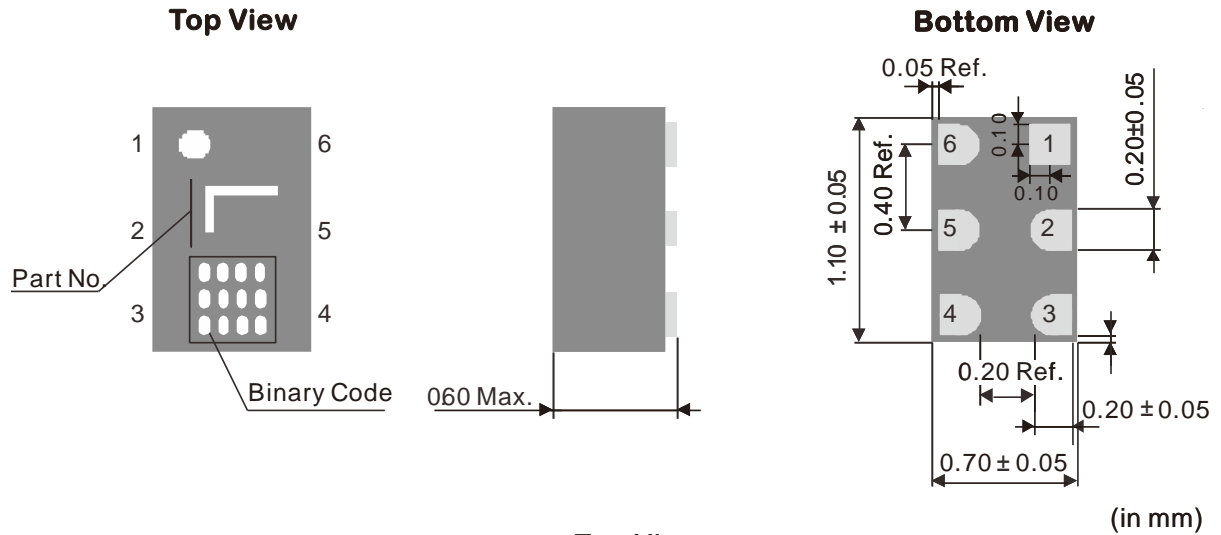
| Reference# | Parts Series | Constant |
|-----------------|--------------|----------|
| C1,C2 | GRM033 | 1pF |
| L1,L2 | - (ERJ1R) | - (0ohm) |
| R1,R2 | - (ERJ1R) | - (0ohm) |
| [C3,C4,C5] (*1) | [GRM033] | [10pF] |

(*1)Remark: DC blocking capacitors on RF ports are necessary when DC voltages are applied from external circuits.

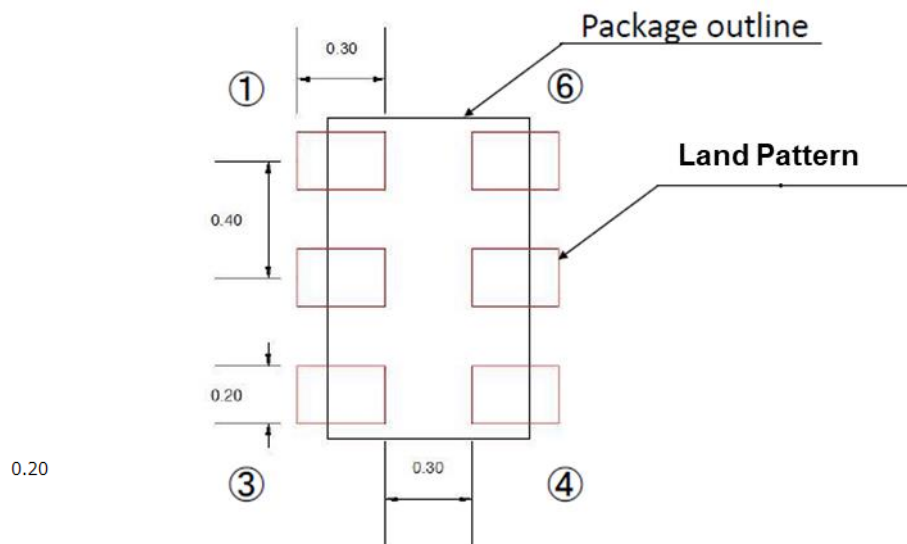
RF Performance IL/ISO/RL

| Symbol | Parameter | Conditions | Typ. | Unit |
|--------|---|--------------|------|------|
| IL | Insertion Loss: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | 0.40 | dB |
| | | 1000-2500MHz | 0.45 | dB |
| | | 2500-5925MHz | 0.70 | dB |
| | | 5925-7125MHz | 0.80 | dB |
| ISO | Isolation: Common port to RF Port1 Common port to RF Port2 | 10-1000MHz | 56 | dB |
| | | 1000-2500MHz | 52 | dB |
| | | 2500-5925MHz | 40 | dB |
| | | 5925-7125MHz | 35 | dB |
| RL | Return Loss: Common Port | 10-1000MHz | 25 | dB |
| | | 1000-2500MHz | 24 | dB |
| | | 2500-5925MHz | 18 | dB |
| | | 5925-7125MHz | 16 | dB |

■ Package Outline, Pin Layout, Marking



■ Land Pattern

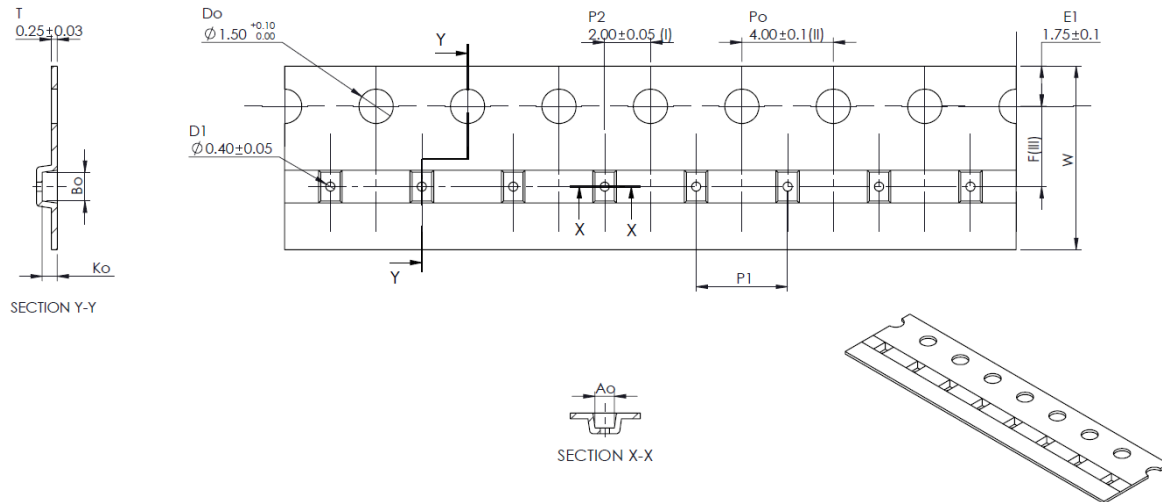


■ Solder Mounting Condition

260 degC max reflow

■ Tape and Reel

Tape



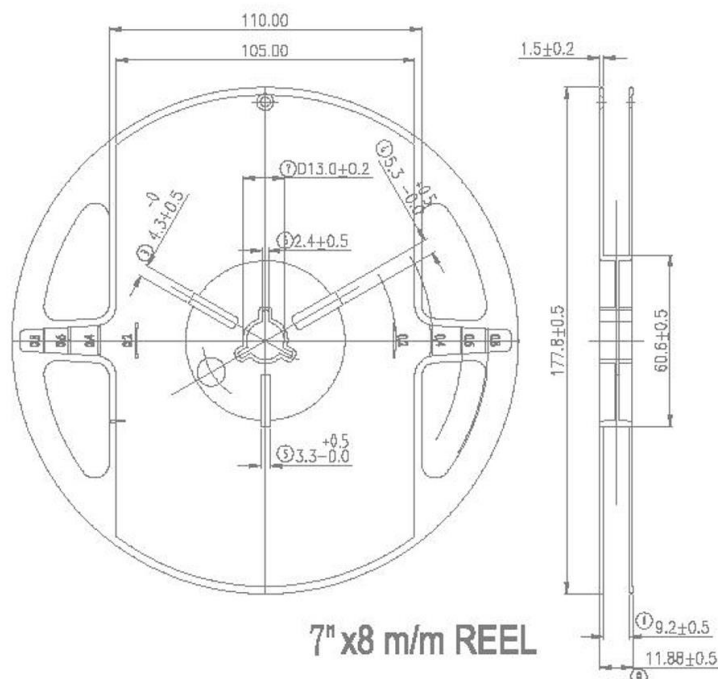
| | |
|----|-------------------|
| Ao | 0.85 +/- 0.05 |
| Bo | 1.25 +/- 0.05 |
| Ko | 0.65 +/- 0.03 (V) |
| F | 3.50 +/- 0.05 |
| P1 | 4.00 +/- 0.10 |
| W | 8.00 +/- 0.10 |

| | |
|--|-----------------------------------|
| CONDITIONALLY COMPLY TO EIA - 481 - E | Customer confirmation for TOOL-UP |
| W = 8.00 +/- 0.10 D1 = 0.40 +/- 0.05 | Approved by: |
| Tool Code : ROTARY - 20 Estimated max. length : 500 meter/15X10CY-CORE 96 | Date: |

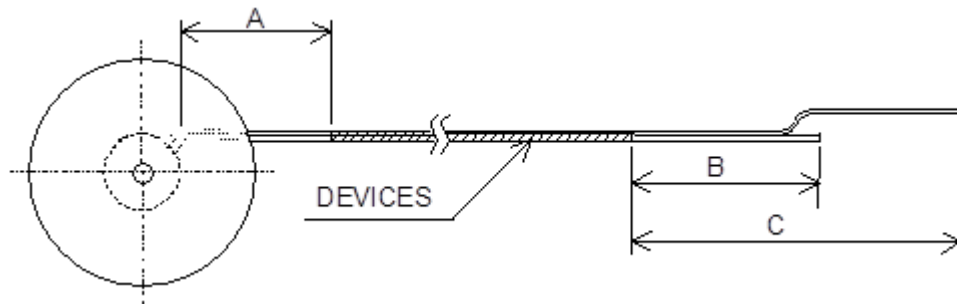
- (I) Measured from centreline of sprocket hole to centreline of pocket.
- (II) Cumulative tolerance of 10 sprocket holes is ± 0.20 .
- (III) Measured from centreline of sprocket hole to centreline of pocket.
- (IV) Other material available.
- (V) No CPK commitment for tolerance ± 0.03 .

ALL DIMENSIONS IN MILLIMETRES UNLESS OTHERWISE STATED.

Reel

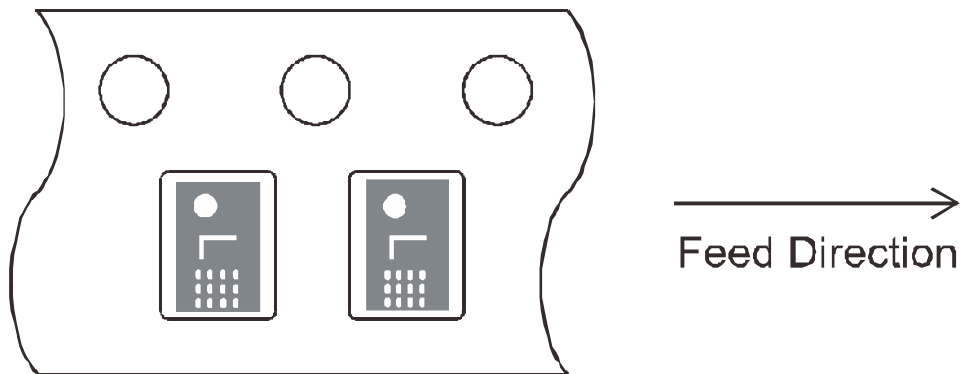


Leader and Trailer Dimensions



| Symbol | Items | Ratings (mm) |
|--------|----------------------------|--------------|
| A | Trailer | 160~ |
| B | Leader with empty cavities | 100~ |
| C | Leader | 400~ |

Device Direction



Packing Unit

5000pcs / reel



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| - Burning / explosion control equipment | |
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