

# FSAV433

## High-Bandwidth (550MHz) Three-Channel 3:1 Video Switch

### Features

- Ground between channels to optimize isolation and reduce hostile crosstalk
- -70dB non-adjacent channel crosstalk at 30MHz
- 6.5Ω typical On Resistance ( $R_{ON}$ )
- -3dB bandwidth: 550MHz
- Low power consumption (1μA max)

### Applications

- RGB Video Switch in LCD, Plasma, and Projection displays
- DVD-RW, notebook

### Description

The FSAV433 is an ultra-low power, high-bandwidth video switch specially designed for switching three analog video signals, including computer RGB and high-definition YPbPr signals. The wide bandwidth (550MHz) of the switch allows signal passage with minimum edge and phase distortion, while -70dB non-adjacent channel crosstalk generates negligible image noise between active channels. Optimized differential gain and phases maintain the image integrity of video applications, while low On Resistance offers low signal insertion loss.

The Fairchild switch family derives from and embodies Fairchild's proven switch technology used for years in its 74LVX3L384 (FST3384) bus switch product.

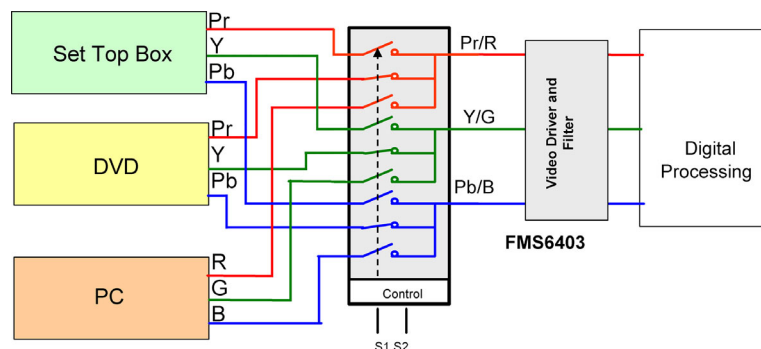
### Ordering Information

| Order Number | Package Number | Pb-Free <sup>(1)</sup> | Package Description                                                                         | Packing Method |
|--------------|----------------|------------------------|---------------------------------------------------------------------------------------------|----------------|
| FSAV433BQX   | MLP020B        | Yes                    | 20-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 4.5mm | Tape & Reel    |
| FSAV433MTC   | MTC20          | Yes                    | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide                 | Tube           |
| FSAV433MTCX  | MTC20          | Yes                    | 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide                 | Tape & Reel    |

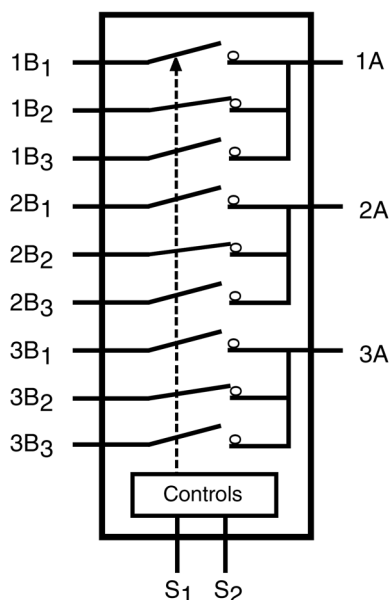
#### Notes:

1. Pb-Free package per JEDEC J-STD-020B.

### Application Diagram



## Analog Symbol



## Pin Descriptions

| Pin Name   | Description  |
|------------|--------------|
| $S_1, S_2$ | Select Input |
| A          | Bus A        |
| $B_1-B_3$  | Bus B        |

## Truth Table

| $S_1$ | $S_2$ | Function   |
|-------|-------|------------|
| Low   | Low   | Disconnect |
| Low   | High  | $A = B_1$  |
| High  | Low   | $A = B_2$  |
| High  | High  | $A = B_3$  |

## Connection Diagrams

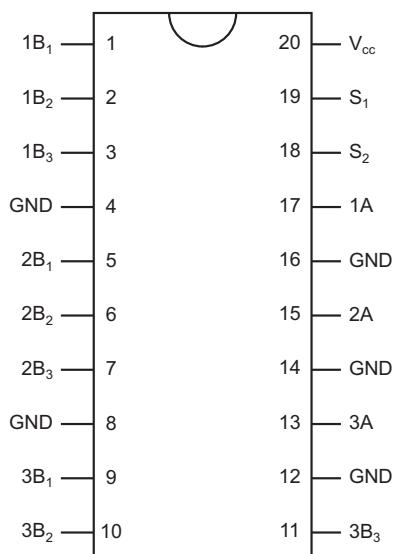


Figure 1. Pin Assignments for TSSOP  
(Top Through View)

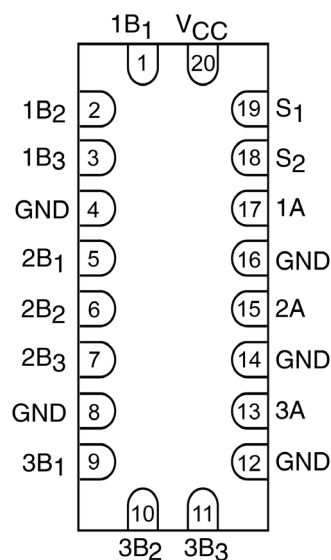


Figure 2. Pad Assignments for DQFN  
(Top Through View)

## Absolute Maximum Ratings

The “Absolute Maximum Ratings” are those values beyond which the safety of the device cannot be guaranteed. The device should not be operated at these limits. The parametric values defined in the Electrical Characteristics tables are not guaranteed at the absolute maximum ratings. The “Recommended Operating Conditions” table defines the conditions for actual device operation

| Symbol           | Parameter                            | Min.              | Max.  | Units |
|------------------|--------------------------------------|-------------------|-------|-------|
| $V_{CC}$         | Supply Voltage                       | -0.5              | +4.6  | V     |
| $V_S$            | DC Switch Voltage                    | -0.5V to $V_{CC}$ | +0.05 |       |
| $V_{IN}$         | DC Input Voltage <sup>(2)</sup>      | -0.5 to           | +4.6  | V     |
| $I_{IK}$         | DC Input Diode Current $V_{IN} < 0V$ |                   | -50   | mA    |
| $I_{OUT}$        | DC Output Sink Current               |                   | 100   | mA    |
| $I_{CC}/I_{GND}$ | DC $V_{CC}/GND$ Current              |                   | ±100  | mA    |
| $T_{STG}$        | Storage Temperature Range            | -65               | +150  | °C    |
| ESD              | Human Body Model                     |                   | 7     | kV    |

### Notes:

- The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

## Recommended Operating Conditions<sup>(3)</sup>

| Symbol   | Parameter                      | Min. | Max.     | Units |
|----------|--------------------------------|------|----------|-------|
| $V_{CC}$ | Power Supply Operating         | 2.3  | 3.6      | V     |
| $V_{IN}$ | Input Voltage                  | 0V   | $V_{CC}$ |       |
| $T_A$    | Free Air Operating Temperature | -40  | +85      | °C    |

### Notes:

- Unused control inputs must be held HIGH or LOW. They may not float.

## DC Electrical Characteristics

Typical values are at  $T_A = +25^\circ\text{C}$  unless otherwise specified.

| Symbol    | Parameter                              | Conditions                                                   | $V_{CC}$<br>(V) | $T_A = -40^\circ\text{C to } +85^\circ\text{C}$ |      |           | Units         |
|-----------|----------------------------------------|--------------------------------------------------------------|-----------------|-------------------------------------------------|------|-----------|---------------|
|           |                                        |                                                              |                 | Min.                                            | Typ. | Max.      |               |
|           | Analog Signal Range                    |                                                              |                 | 0                                               |      | 2.0       | V             |
| $V_{IK}$  | Clamp Diode Voltage                    | $I_{IN} = -18\text{ mA}$                                     | 3.0             |                                                 |      | -1.2      | V             |
| $V_{IH}$  | HIGH Level Input Voltage               |                                                              | 2.3             | 1.8                                             |      |           | V             |
|           |                                        |                                                              | 3.0 - 3.6       | 2.0                                             |      |           |               |
| $V_{IL}$  | LOW Level Input Voltage                |                                                              | 2.3             |                                                 |      | 0.7       | V             |
|           |                                        |                                                              | 3.0 - 3.6       |                                                 |      | 0.8       |               |
| $I_I$     | Input Leakage Current                  | $0 \leq V_{IN} \leq 3.6\text{V}$                             | 3.6             |                                                 |      | $\pm 1.0$ | $\mu\text{A}$ |
| $I_{OFF}$ | OFF-STATE Leakage Current              | $0 \leq A, B \leq V_{CC}$ , See Figure 7                     | 3.6             |                                                 |      | $\pm 1.0$ | $\mu\text{A}$ |
| $R_{ON}$  | Switch On Resistance <sup>(4)</sup>    | $V_{IN} = 1.0\text{V}$                                       | 2.3             |                                                 | 9.0  | 13.0      | $\Omega$      |
|           |                                        | $I_{ON} = 13\text{ mA}$ , See Figure 6                       | 3.0             |                                                 | 6.5  | 9.0       | $\Omega$      |
|           |                                        | $V_{IN} = 2.0\text{V}$                                       | 2.3             |                                                 | 10.0 | 15.0      | $\Omega$      |
|           |                                        | $I_{ON} = 26\text{ mA}$ , See Figure 6                       | 3.0             |                                                 | 6.5  | 9.0       | $\Omega$      |
| $I_{CC}$  | Quiescent Supply Current               | $V_{IN} = V_{CC}$ or GND, $I_{OUT} = 0$                      | 3.6             |                                                 |      | 1.0       | $\mu\text{A}$ |
| $I_{CCT}$ | Increase in $I_{CC}$ per Control Input | One Control Input at 3.0V<br>Other Inputs at $V_{CC}$ or GND | 3.6             |                                                 |      | 10.0      | $\mu\text{A}$ |

### Notes:

- Measured by the voltage drop between A and B pins at the indicated current through the switch. On resistance is determined by the lower of the voltages on the two (A or B) pins.

## AC Electrical Characteristics

Typical values are at  $V_{CC} = 3.3V$  and  $T_A = +25^\circ C$  unless otherwise specified.

| Symbol     | Parameter                                                    | Conditions                    | $V_{CC}$<br>(V) | $T_A = -40^\circ C$ to $+85^\circ C$ |       |      | Units | Figure Number |
|------------|--------------------------------------------------------------|-------------------------------|-----------------|--------------------------------------|-------|------|-------|---------------|
|            |                                                              |                               |                 | Min.                                 | Typ.  | Max. |       |               |
| $t_{ON}$   | Turn ON Time S-to-Bus A                                      | $V_B = 2.0V$                  | 3.0 to 3.6      |                                      |       | 5.5  | ns    | Figures 9,10  |
|            |                                                              |                               | 2.3 to 2.7      |                                      |       | 7.0  |       |               |
| $t_{OFF}$  | Turn OFF Time S-to-Bus A                                     | $V_B = 2.0V$                  | 3.0 to 3.6      |                                      |       | 4.0  | ns    | Figures 9,10  |
|            |                                                              |                               | 2.3 to 2.7      |                                      |       | 5.0  |       |               |
| DG         | Differential Gain                                            | $R_L = 75\Omega, f = 3.58MHz$ | 3.0 to 3.6      |                                      | 0.2   |      | %     |               |
| DP         | Differential Phase                                           | $R_L = 75\Omega, f = 3.58MHz$ | 3.0 to 3.6      |                                      | 0.1   |      | °     |               |
| $O_{IRR}$  | Non-Adjacent OFF-Isolation<br>Adjacent OFF-Isolation         | $f = 30MHz, R_L = 75\Omega$   | 3.0 to 3.6      |                                      | -45.0 |      | dB    | Figure 12     |
|            |                                                              |                               | 2.3 to 2.7      |                                      | -45.0 |      |       |               |
| $X_{TALK}$ | Non-Adjacent Channel Crosstalk<br>Adjacent Channel Crosstalk | $R_L = 75\Omega, f = 30MHz$   | 3.0 to 3.6      |                                      | -70.0 |      | dB    | Figures 13,14 |
|            |                                                              |                               | 2.3 to 2.7      |                                      | -70.0 |      |       |               |
| BW         | -3dB Bandwidth                                               | $R_L = 50\Omega$              | 3.0 to 3.6      |                                      | 550   |      | MHz   | Figure 11     |
|            |                                                              | $R_L = 75\Omega$              | 3.0 to 3.6      |                                      | 300   |      |       |               |

## Capacitance

Typical values are at  $V_{CC} = 3.3V$  and  $T_A = +25^\circ C$  unless otherwise specified.

| Symbol    | Parameter                     | Conditions           | $T_A = -40^\circ C$ to $+85^\circ C$ | Units | Figure Number |
|-----------|-------------------------------|----------------------|--------------------------------------|-------|---------------|
| $C_{IN}$  | Control Pin Input Capacitance | $V_{CC} = 0V$        | 3.0                                  | pF    |               |
| $C_{ON}$  | A/B ON Capacitance            | $V_{CC} = 3.0V = 0V$ | 15.0                                 | pF    | Figure 16     |
| $C_{OFF}$ | Port B OFF Capacitance        | $V_{CC} = 3.0V$      | 4.0                                  | pF    | Figure 15     |

## Typical Characteristics

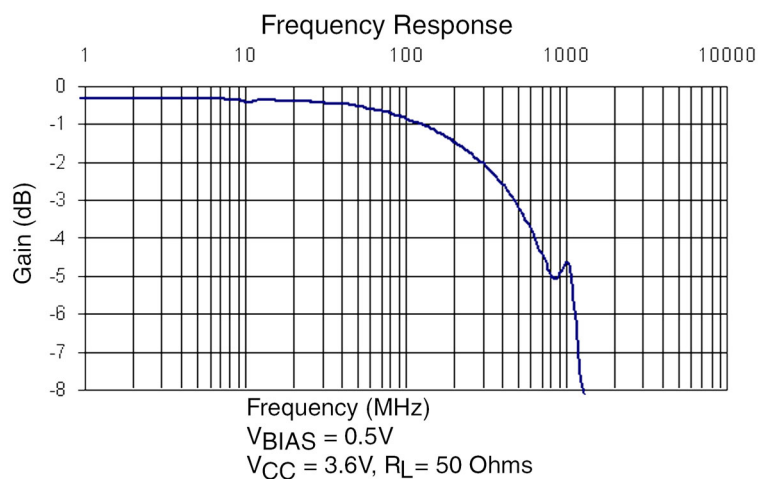


Figure 3. Gain vs. Frequency

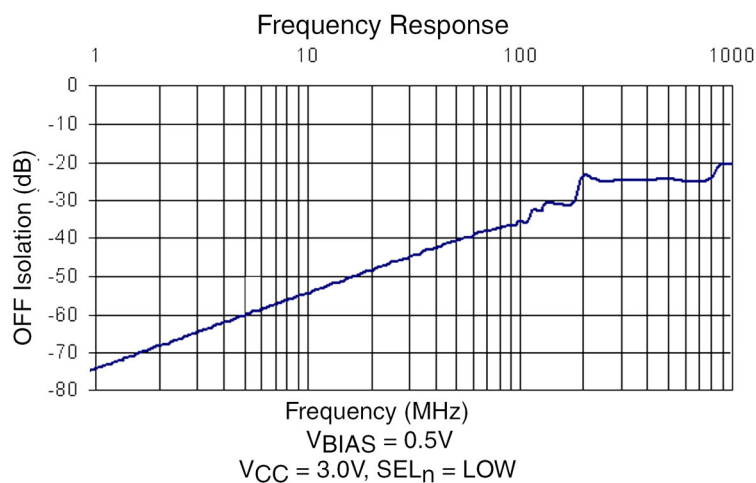


Figure 4. OFF Isolation

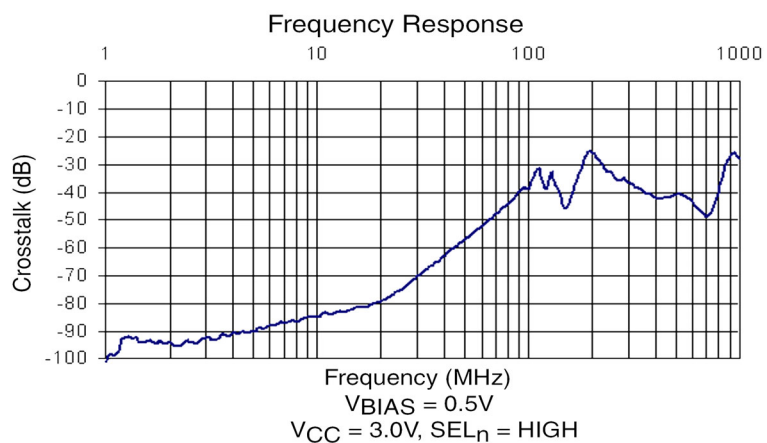


Figure 5. Crosstalk

## Test Diagrams

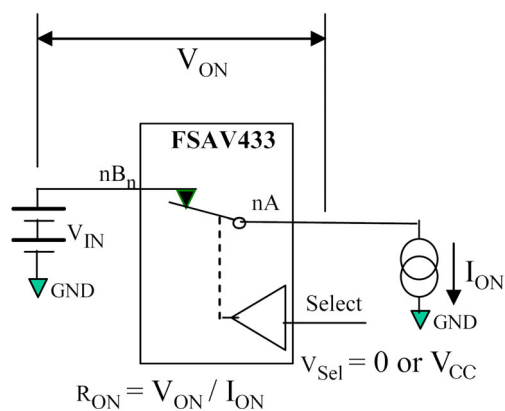
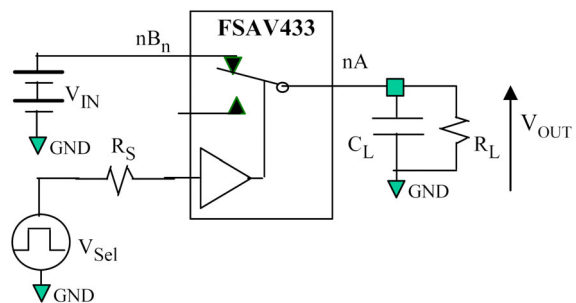


Figure 6. On Resistance



$R_L$  and  $C_L$  are functions of application environment (50, 75, or 100 $\Omega$ )  $C_L$  includes test fixture and stray capacitance

Figure 9. Test Circuit Load

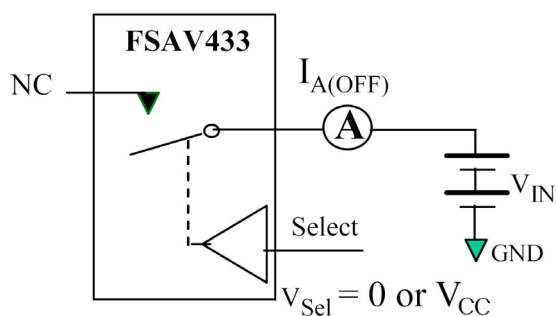


Figure 7. OFF Leakage

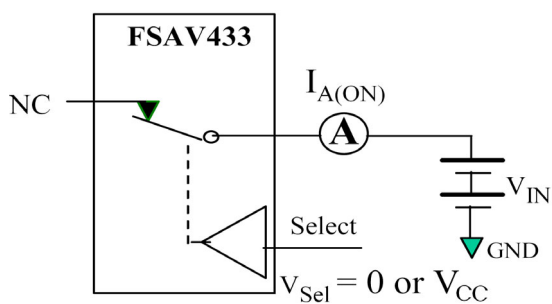


Figure 8. ON Leakage

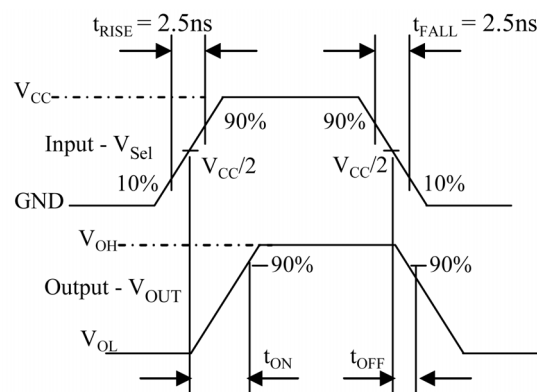
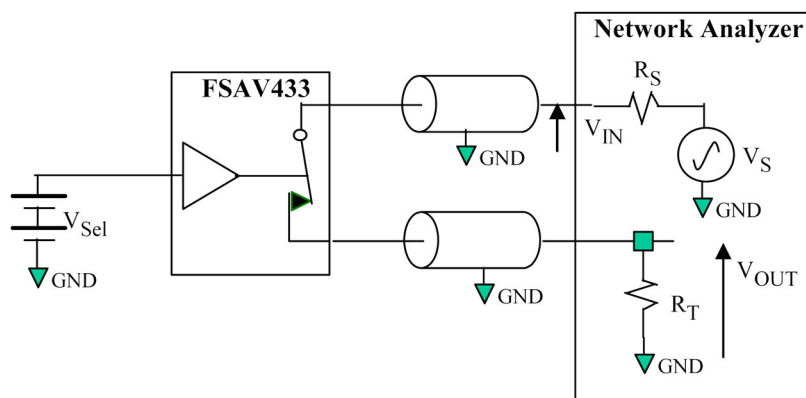


Figure 10. Turn ON / Turn OFF Waveforms

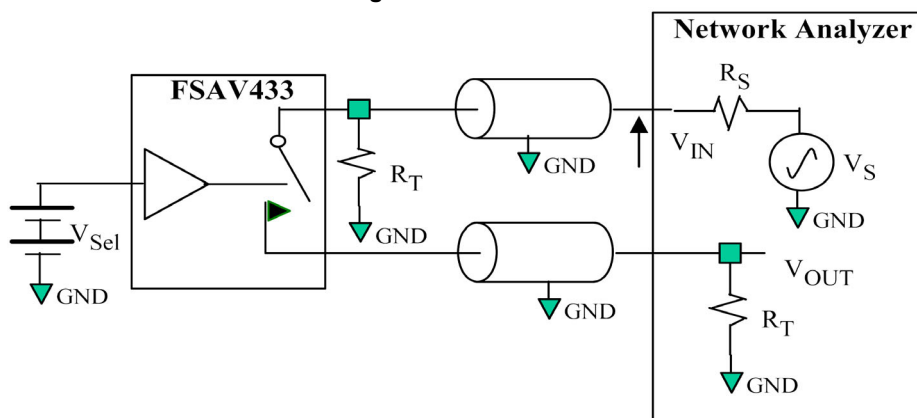
## Test Diagrams



$R_L$  and  $C_L$  are function of application environment (50, 75, or 100W)

$C_L$  includes test fixture and stray capacitance

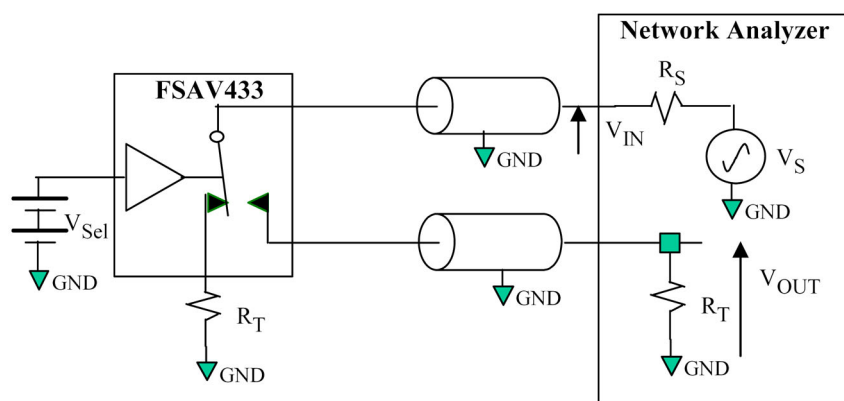
**Figure 11. Bandwidth**



$R_S$  and  $R_T$  are function of application environment (50, 75, or 100W)

$$\text{OFF Isolation} = 20 \log (V_{OUT} / V_{IN})$$

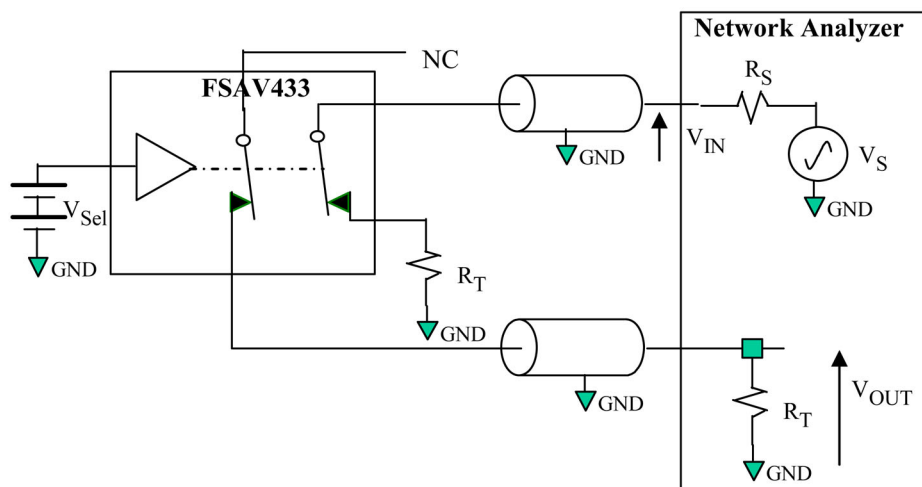
**Figure 12. Channel OFF Isolation**



$$\text{Crosstalk} = 20 \log (V_{OUT} / V_{IN})$$

**Figure 13. Adjacent Channel Crosstalk**

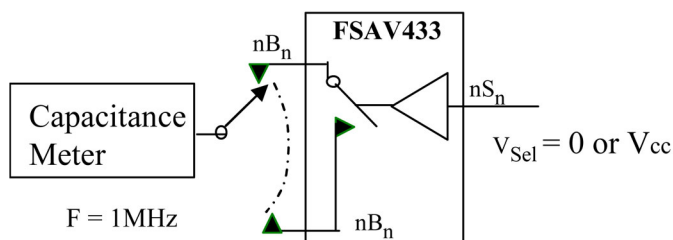
## Test Diagrams (Continued)



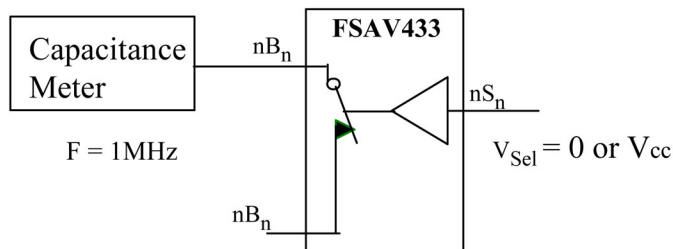
$R_S$  and  $R_T$  are function of application environment (50, 75, or 100 $\Omega$ )

Crosstalk = 20 Long ( $V_{OUT} / V_{IN}$ )

**Figure 14. Non-Adjacent Channel-to-Channel Crosstalk**



**Figure 15. Channel OFF Capacitance**



**Figure 16. Channel ON Capacitance**

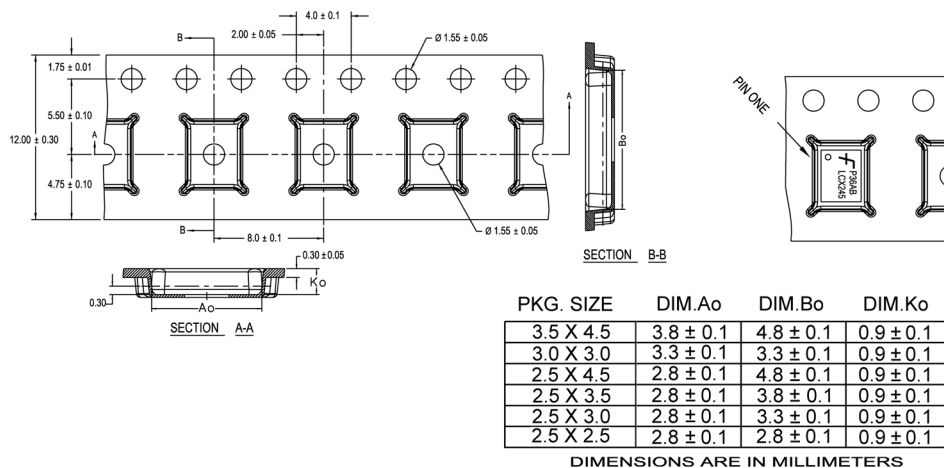
## Tape and Reel Specification

### Tape Format for DQFN

| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| BQX                | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 2500/3000       | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### Tape Dimensions

Dimensions are in millimeters unless otherwise noted.

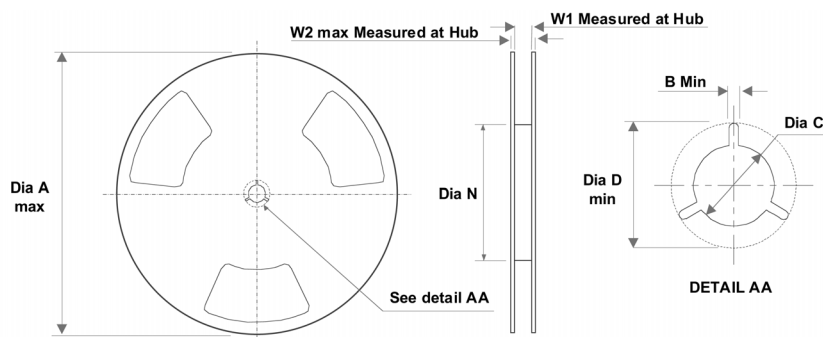


NOTES: unless otherwise specified

1. Cumulative pitch for feeding holes and cavities (chip pockets) not to exceed 0.008[0.20] over 10 pitch span.
2. Smallest allowable bending radius.
3. Thru hole inside cavity is centered within cavity.
4. Tolerance is ±0.002[0.05] for these dimensions on all 12mm tapes.
5. A<sub>o</sub> and B<sub>o</sub> measured on a plane 0.120[0.30] above the bottom of the pocket.
6. K<sub>o</sub> measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
7. Pocket position relative to sprocket hole measured as true position of pocket. Not pocket hole.
8. Controlling dimension is millimeter. Dimension in inches rounded.

### REEL DIMENSIONS

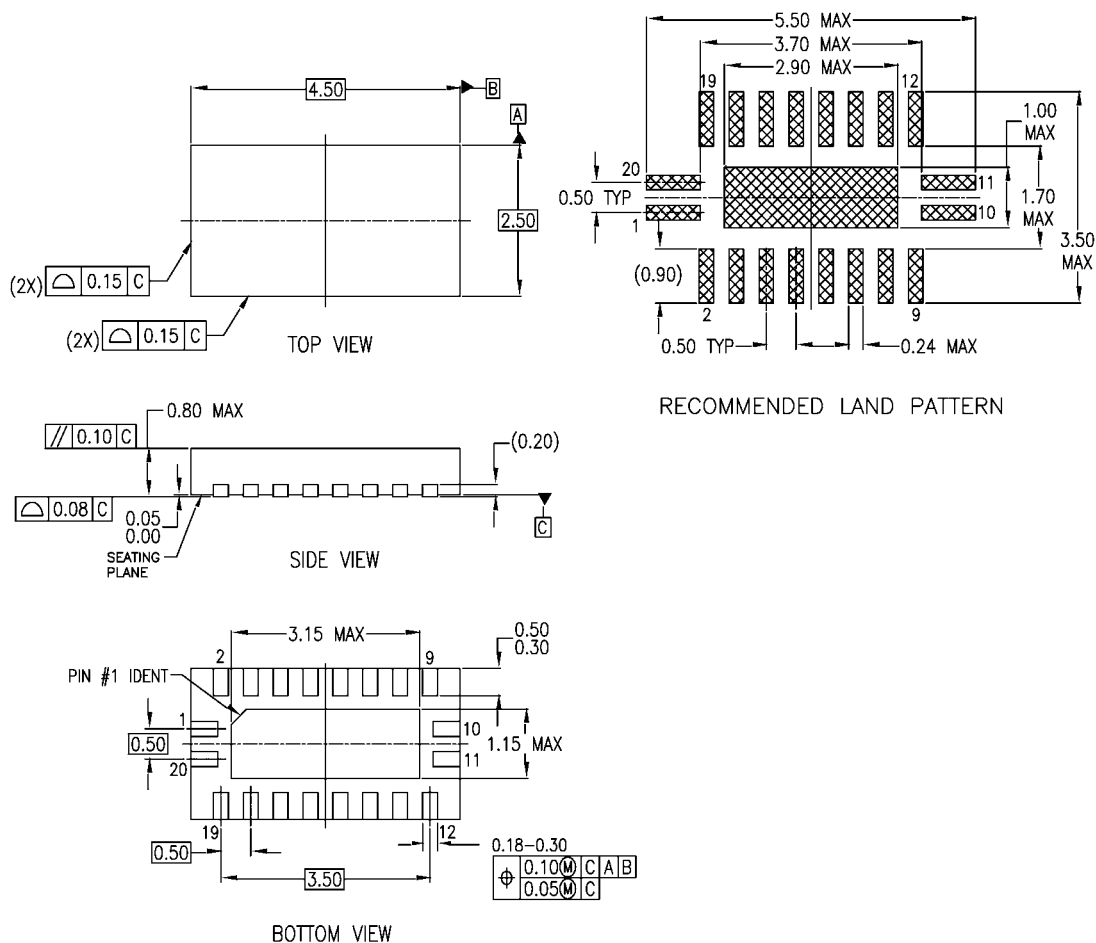
Dimensions are in millimeters unless otherwise noted.



| Tape Size | A             | B               | C                | D                | N              | W1              | W2              |
|-----------|---------------|-----------------|------------------|------------------|----------------|-----------------|-----------------|
| 12 mm     | 13.0<br>(330) | 0.059<br>(1.50) | 0.512<br>(13.00) | 0.795<br>(20.20) | 7.008<br>(178) | 0.488<br>(12.4) | 0.724<br>(18.4) |

# Physical Dimensions

Dimensions are in millimeters unless otherwise noted.



## NOTES:

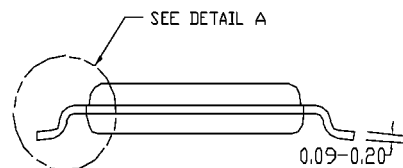
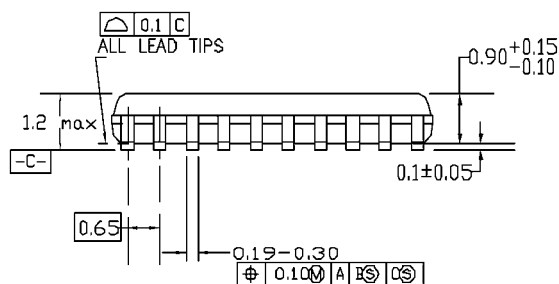
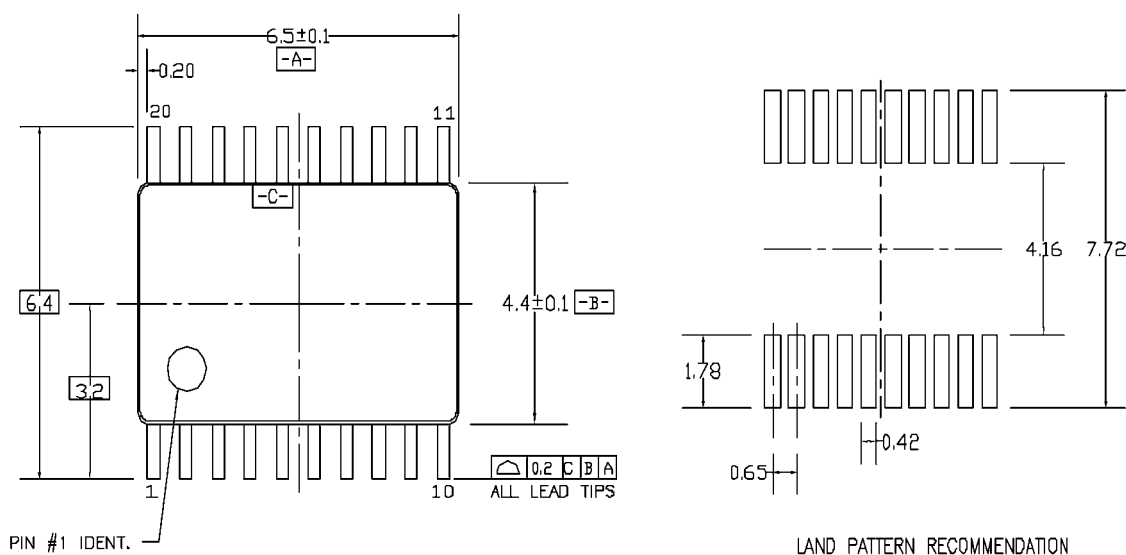
- A. CONFORMS TO JEDEC REGISTRATION MO-241, VARIATION AC
- B. DIMENSIONS ARE IN MILLIMETERS.
- C. DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994

MLP020BrevA

**Figure 17. 20-Terminal Depopulated Quad Very-Thin Flat Pack No Leads (DQFN), JEDEC MO-241, 2.5 x 4.5mm**

# Physical Dimensions (Continued)

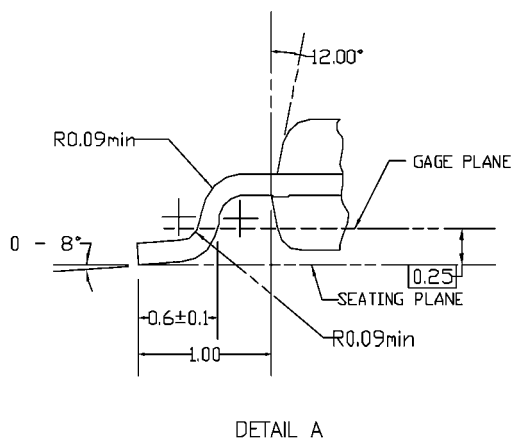
Dimensions are in millimeters unless otherwise noted.



DIMENSIONS ARE IN MILLIMETERS

## NOTES:

- CONFORMS TO JEDEC REGISTRATION MO-153, VARIATION AC, REF NOTE 6, DATE 7/93.
- DIMENSIONS ARE IN MILLIMETERS.
- DIMENSIONS ARE EXCLUSIVE OF BURRS, MOLDS FLASH, AND TIE BAR EXTRUSIONS.
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M, 1982.



MTC20REV D1

**Figure 18. 20-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide**

## TRADEMARKS

The following are registered and unregistered trademarks Fairchild Semiconductor owns or is authorized to use and is not intended to be an exhaustive list of all such trademarks.

|                                                  |                                 |                                 |                              |                       |
|--------------------------------------------------|---------------------------------|---------------------------------|------------------------------|-----------------------|
| ACE <sup>™</sup>                                 | FACT Quiet Series <sup>™</sup>  | OCX <sup>™</sup>                | SILENT SWITCHER <sup>®</sup> | UniFET <sup>™</sup>   |
| ActiveArray <sup>™</sup>                         | GlobalOptoisolator <sup>™</sup> | OCXPro <sup>™</sup>             | SMART START <sup>™</sup>     | UltraFET <sup>®</sup> |
| Bottomless <sup>™</sup>                          | GTO <sup>™</sup>                | OPTOLOGIC <sup>®</sup>          | SPM <sup>™</sup>             | VCX <sup>™</sup>      |
| Build it Now <sup>™</sup>                        | HiSeC <sup>™</sup>              | OPTOPLANAR <sup>™</sup>         | Stealth <sup>™</sup>         | Wire <sup>™</sup>     |
| CoolFET <sup>™</sup>                             | I <sup>2</sup> C <sup>™</sup>   | PACMAN <sup>™</sup>             | SuperFET <sup>™</sup>        |                       |
| CROSSVOLT <sup>™</sup>                           | i-Lo <sup>™</sup>               | POP <sup>™</sup>                | SuperSOT <sup>™</sup> -3     |                       |
| DOVE <sup>™</sup>                                | ImpliedDisconnect <sup>™</sup>  | Power247 <sup>™</sup>           | SuperSOT <sup>™</sup> -6     |                       |
| EcoSPARK <sup>™</sup>                            | IntelliMAX <sup>™</sup>         | PowerEdge <sup>™</sup>          | SuperSOT <sup>™</sup> -8     |                       |
| E <sup>2</sup> C MOS <sup>™</sup>                | ISOPPLANAR <sup>™</sup>         | PowerSaver <sup>™</sup>         | SyncFET <sup>™</sup>         |                       |
| EnSigna <sup>™</sup>                             | LittleFET <sup>™</sup>          | PowerTrench <sup>®</sup>        | TCM <sup>™</sup>             |                       |
| FACT <sup>™</sup>                                | MICROCOUPLER <sup>™</sup>       | QFET <sup>®</sup>               | TinyBoost <sup>™</sup>       |                       |
| FAST <sup>®</sup>                                | MicroFET <sup>™</sup>           | QS <sup>™</sup>                 | TinyBuck <sup>™</sup>        |                       |
| FASTr <sup>™</sup>                               | MicroPak <sup>™</sup>           | QT Optoelectronics <sup>™</sup> | TinyPWM <sup>™</sup>         |                       |
| FPS <sup>™</sup>                                 | MICROWIRE <sup>™</sup>          | Quiet Series <sup>™</sup>       | TinyPower <sup>™</sup>       |                       |
| FRFET <sup>™</sup>                               | MSX <sup>™</sup>                | RapidConfigure <sup>™</sup>     | TinyLogic <sup>®</sup>       |                       |
|                                                  | MSXPro <sup>™</sup>             | RapidConnect <sup>™</sup>       | TINYOPTO <sup>™</sup>        |                       |
| Across the board. Around the world. <sup>™</sup> |                                 | μSerDes <sup>™</sup>            | TruTranslation <sup>™</sup>  |                       |
| The Power Franchise <sup>®</sup>                 |                                 | ScalarPump <sup>™</sup>         | UHC <sup>™</sup>             |                       |
| Programmable Active Droop <sup>™</sup>           |                                 |                                 |                              |                       |

## DISCLAIMER

FAIRCHILD SEMICONDUCTOR RESERVES THE RIGHT TO MAKE CHANGES WITHOUT FURTHER NOTICE TO ANY PRODUCTS HEREIN TO IMPROVE RELIABILITY, FUNCTION, OR DESIGN. FAIRCHILD DOES NOT ASSUME ANY LIABILITY ARISING OUT OF THE APPLICATION OR USE OF ANY PRODUCT OR CIRCUIT DESCRIBED HEREIN; NEITHER DOES IT CONVEY ANY LICENSE UNDER ITS PATENT RIGHTS, NOR THE RIGHTS OF OTHERS. THESE SPECIFICATIONS DO NOT EXPAND THE TERMS OF FAIRCHILD'S WORLDWIDE TERMS AND CONDITIONS, SPECIFICALLY THE WARRANTY THEREIN, WHICH COVERS THESE PRODUCTS.

## LIFE SUPPORT POLICY

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF FAIRCHILD SEMICONDUCTOR CORPORATION.

As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, or (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in significant injury to the user.
2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

## PRODUCT STATUS DEFINITIONS

### Definition of Terms

| Datasheet Identification | Product Status         | Definition                                                                                                                                                                                                   |
|--------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Advance Information      | Formative or In Design | This datasheet contains the design specifications for product development. Specifications may change in any manner without notice.                                                                           |
| Preliminary              | First Production       | This datasheet contains preliminary data, and supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design. |
| No Identification Needed | Full Production        | This datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.                                                       |
| Obsolete                 | Not In Production      | This datasheet contains specifications on a product that has been discontinued by Fairchild semiconductor. The datasheet is printed for reference information only.                                          |

Rev. I20