DESCRIPTION

The A4732 is a Low-Power, Two-Port, High-Speed, USB2.0 (480Mbps) double – pole double-throw (DPDT) Analog Switch featuring an On-Resistance of 6 ohm at V_{CC}=3V and a Low On Capacitance 7pf Typical.

The A4732 is compatible with the requirements of USB2.0 and the wide bandwidth needed to pass the third harmonic, resulting in signals with minimum edge and phase distortion. Superior channel-to channel crosstalk also minimizes interference. Break-before-make function for both parts eliminates signal disruption during switching from preventing both switches being enabled simultaneously.

The A4732 contains special circuitry on the switch I/O pins for applications where the V_{CC} supply is powered-off (V_{CC}=0), which allows the device to withstand an over-voltage condition. This device is designed to minimize current consumption even when the control voltage applied to the Sel pin is lower than the supply voltage (V_{CC}). This feature is especially valuable to ultra-portable applications, such as cell phones, allowing for direct interface with the general purpose I/Os of the baseband processor. Other applications include switching and connector sharing in portable cell phones, PDAs, digital cameras, printers, and notebook computers.

The A4732 is available in TQFN10(1.4x1.8) and MSOP10 packages.

ORDERING INFORMATION

Package Type	Part Number	
TQFN10 SPQ: 4,000pcs/Reel	TQ10	A4732TQ10R
		A4732TQ10VR
MSOP10 SPQ: 4,000pcs/Reel	MS10	A4732MS10R
		A4732MS10VR
Note	V: Halogen free Package R: Tape & Reel	
AiT provides all RoHS products		

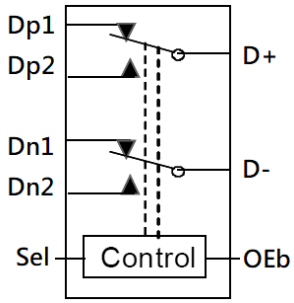
FEATURES

- Wide Power Supply Range: 1.8V to 5.5V
- Low On Capacitance 7pF (typ.)
- Low On Resistance 6Ω (typ.)
- High Bandwidth (-3db): 550MHz
- Low Power Consumption: 1uA Maximum
- ESD: pass 3KV HBM test
- Over voltage tolerance (OVT) on all USB ports up to 5.25V without external components
- TTL/CMOS Compatible
- Break-Before-Make Switching
- Operation Temperature Range: -40℃ to 85℃
- Available in TQFN10(1.4x1.8) and MSOP10 Packages

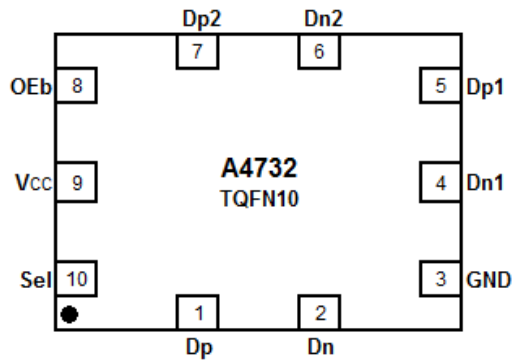
APPLICATION

- Cell phone
- PDAs
- Digital camera
- Notebook
- LCD Monitor
- TV
- SET-TOP BOX

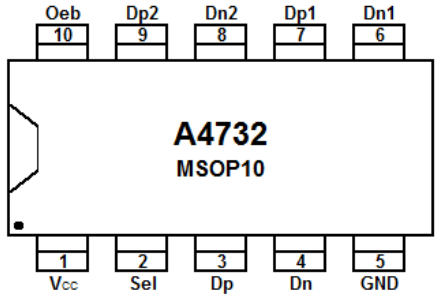
TYPICAL APPLICATION



PIN DESCRIPTION



Top View



Top View

Pin #		Symbol	Type	Function
TQFN10	MSOP10			
1	3	Dp	Input / Output	USB Data BUS
2	4	Dn	Input / Output	USB Data BUS
3	5	GND	Ground	Ground
4	6	Dn1	Input / Output	Data Port
5	7	Dp1	Input / Output	Data Port
6	8	Dn2	Input / Output	Data Port
7	9	Dp2	Input / Output	Data Port
8	10	OEb	Input	Switch enable
9	1	V_{CC}	PWR	Power Supply
10	2	Sel	Input	Switch select

FUNCTION TABLE

OEb	Sel	Function
1	X	Disconnect
0	0	Dp, Dn=Dp1, Dn1
0	1	Dp, Dn=Dp2, Dn2

X =Don't care

ABSOLUTE MAXIMUM RATINGS

V_{CC}, DC Supply Voltage		-0.5V ~ 5.5V
Dpn/Dnn/Dp/Dn, DC Switch Voltage		-0.5V ~ 5.25V
V_{OEb} / V_{Sel}, DC Input Voltage		-0.5V ~ V_{CC}
$I_{(Dpn/Dnn/Dp/Dn)}$, Continuous Current		-100mA
$I_{PEAK(Dpn/Dnn/Dp/Dn)}$, Peak Current[NOTE1]		+150mA
T_A, Operating Temperature Range		-40℃~ +85℃
T_{STG}, Storage Temperature		-65℃~ +150℃
ESD, Human Body Model, JEDEC: JESD22-A114	I/O to GND	3kV

Stress beyond above listed “Absolute Maximum Ratings” may lead permanent damage to the device. These are stress ratings only and operations of the device at these or any other conditions beyond those indicated in the operational sections of the specifications are not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.
NOTE1: Pulsed at 1ms, 50% duty circle

RECOMMENDED OPERATING CONDITIONS

Parameter	Symbol	Min.	Max.	Unit
Supply Voltage	V_{CC}	1.8	5.5	V
Control Input Voltage (Sel, OEb)[NOTE2]	V_{CNTRL}	0	V_{CC}	V
Operating Temperature	T_A	-40	+85	°C

NOTE2: The control input must be held HIGH or LOW and it must not float.

ELECTRICAL CHARACTERISTICS

All typical value are for 1.8 to 5.5V at T_A=25°C unless otherwise specified.

Parameter	Symbol	Conditions	V_{CC} (V)	Min.	Typ.(2)	Max.	Unit
Analog Switch							
Analog Signal Range	$V_{Pn}/V_{Nn}/V_p/V_n$	-40°C to +85°C		0	-	Vcc	V
On-Resistance NOTE3	R_{ON}	V_{SW}=0.4V, I_{ON}=-8mA Test Circuit 1	3.0	-	6	10	Ω
On-Resistance Match Between Channels NOTE4	ΔR_{ON}	V_{SW}=0.4V, I_{ON}=-8mA Test Circuit 1	3.0	-	0.15	0.6	Ω
Current							
Source Off Leakage Current	I_{Pn} / $N_{n\ (OFF)}$	V_{CC}=3.6V,V_p/Vn = 3.3V/0.3V V_{Pn}/ V_{Nn} =0.3V/3.3V		-1	-	1	uA
Channel on Leakage Current	I_{Pn} / $N_{n\ (ON)}$	V_{CC}=3.6V, V_p/V_n =3.3V/0.3V V_{Pn}/ V_{Nn} =3.3V/0.3V		-1	-	1	uA
POWER OFF Leakage Current	I_{OFF}	V_{SW}=0V to 3.6V -40°C to +85°C	0	-1	-	1	uA
Quiescent Supply Current	I_{CC}	Vcontrol=0 or V_{CC}, I_{OUT}=0	3.0	-	-	1	uA
Increase in I_{CC} Current Per Control Voltage and V_{CC}	I_{CCT}	Vcontrol=2.6V -40°C to +85°C	4.3	-	-	40	uA
Input Leakage Current	I_{OEb} /$_{Sel}$	V_{SW}=0V to V_{CC} -40°C to +85°C	3.0	-	-	1	uA
Digital I/O							
Input Voltage High	V_{IH}	-40°C to +85°C	1.8 to 5.5	1.6	-	-	V
Input Voltage Low	V_{IL}	-40°C to +85°C	1.8 to 5.5	-	-	0.5	V

NOTE2: Typical characteristics are at +25°C

NOTE3: Measured by the voltage drop between Dpn/Dnn and Dp/Dn pins at the indicated current through the switch. On resistance is determined by the lower of the voltage on the two (Dpn/Dnn and Dp/Dn ports).

NOTE4: ΔR_{ON}= $R_{ON(MAX)}$ – $R_{ON(MIN)}$, between Dp and Dn .

All typical value are for V_{CC}=1.8 to 5.5V at T_A=25°C, unless otherwise specified.

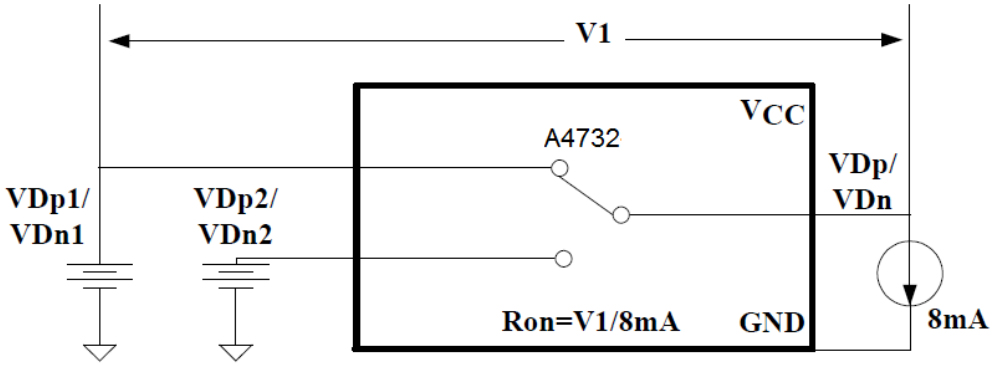
Parameter	Symbol	Conditions	V_{CC} (V)	Min.	Typ.(2)	Max.	Unit
DRIVER CHARACTERISTICS							
Turn-On Time	t_{ON}	R_L=50Ω, C_L=10pF, V_{SW}=0.8V Test Circuit 5	3.3	-	20		ns
Turn-Off Time	t_{OFF}	R_L=50Ω, C_L=10pF, V_{SW}=0.8V Test Circuit 5	3.3	-	15		ns
Break-Before-Make Time	t_{BBM}	R_L=50Ω, C_L=10pF, V_{SW}=0.8V Test Circuit 7	3.3		4		ns
Propagation Delay	t_{PD}	R_L=50Ω, C_L=10pF Test Circuit 8	3.3	-	0.35	-	ns
CAPACITANCE							
Charge Injection Select Input to Common I/O	Q	V_G=GND, C_L=1.0nF, R_G=0Ω $Q=C_L \times V_{OUT}$ Test Circuit 6		-	11	-	pC
ON Capacitance	C_{ON}	OEb=0V, f=250MHz		-	7	-	pF
APPLICATION CHARACTERISTICS							
-3dB Bandwidth	f_{3dB}	R_L=50Ω, C_L=pF Test Circuit 2	3.0 to 3.6	-	550	-	MHz
Off Isolation NOTE5	V_{ISO}	R_L=50Ω, C_L=10pF Test Circuit 3	3.3	-	-35	-	dB
Channel crosstalk	X_{TALK}	R_L=50Ω, f=250MHz Test Circuit 4	3.3	-	-40	-	dB

NOTE2: Typical characteristics are at 25°C

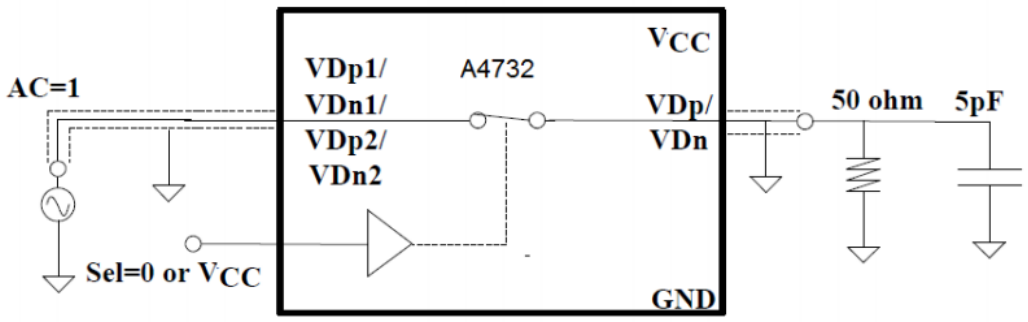
NOTE5: Off Channel Isolation = $20\log_{10}[(V_{P1\backslash P2})/V_P]$ or $20\log_{10}[(V_{N1\backslash N2})/V_N]$

TEST CIRCUIT

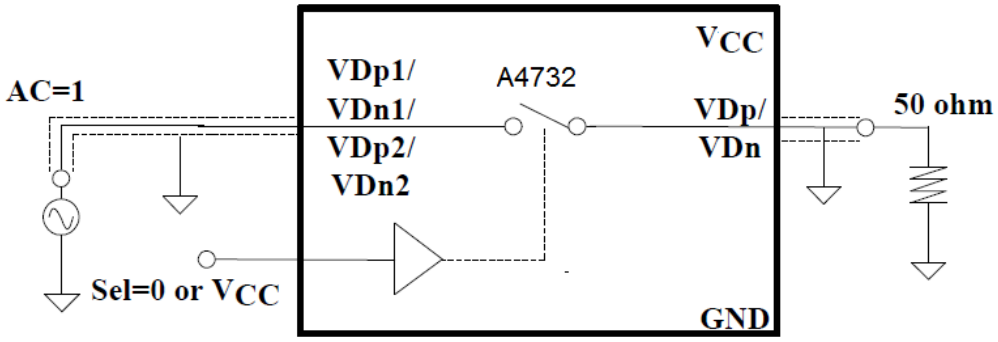
1. Test Circuit for On Resistance, R_{ON}



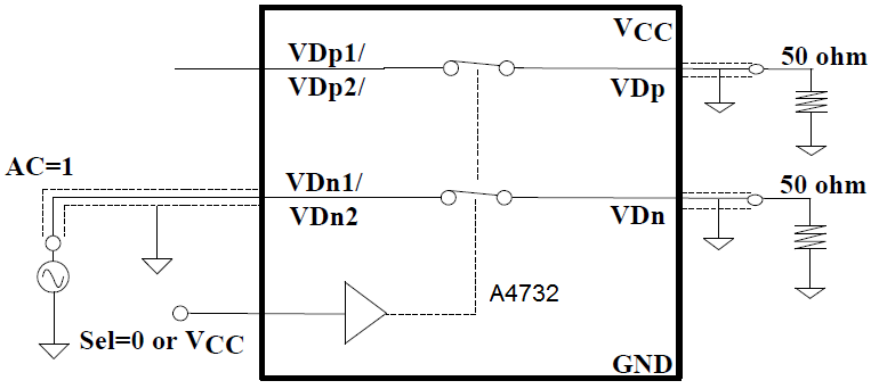
2. Test Circuit for Bandwidth, f_{3dB}



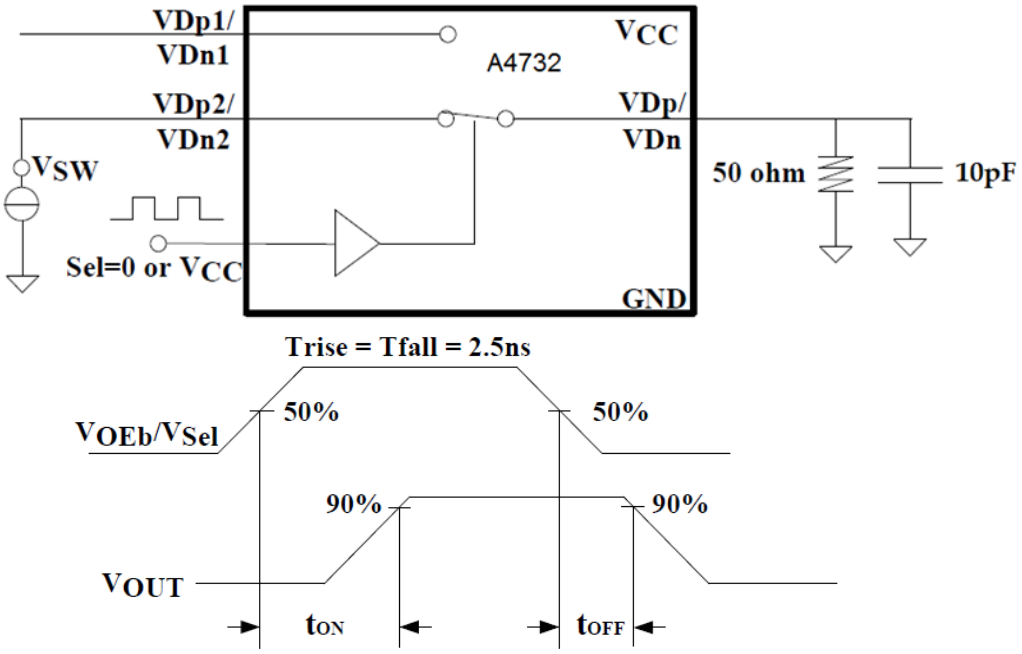
3. Test Circuit for Off Isolation, V_{ISO}



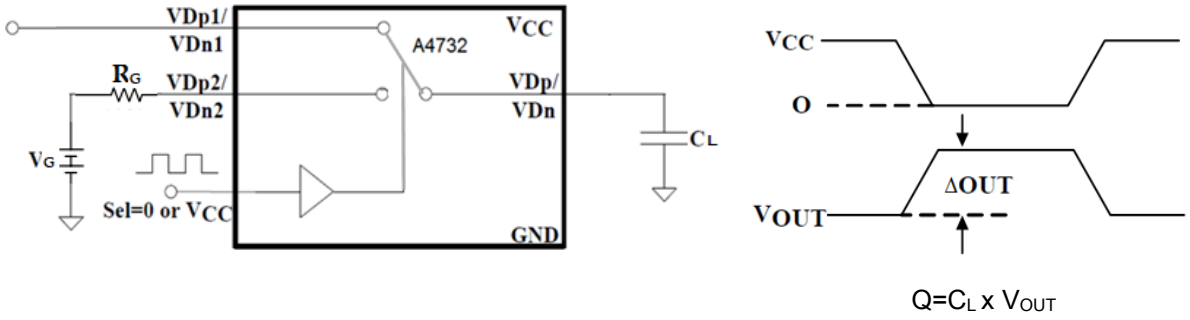
4. Test Circuit for Crosstalk, X_{TALK}



5. Test Circuit for Switch Times, t_{ON} , t_{OFF}

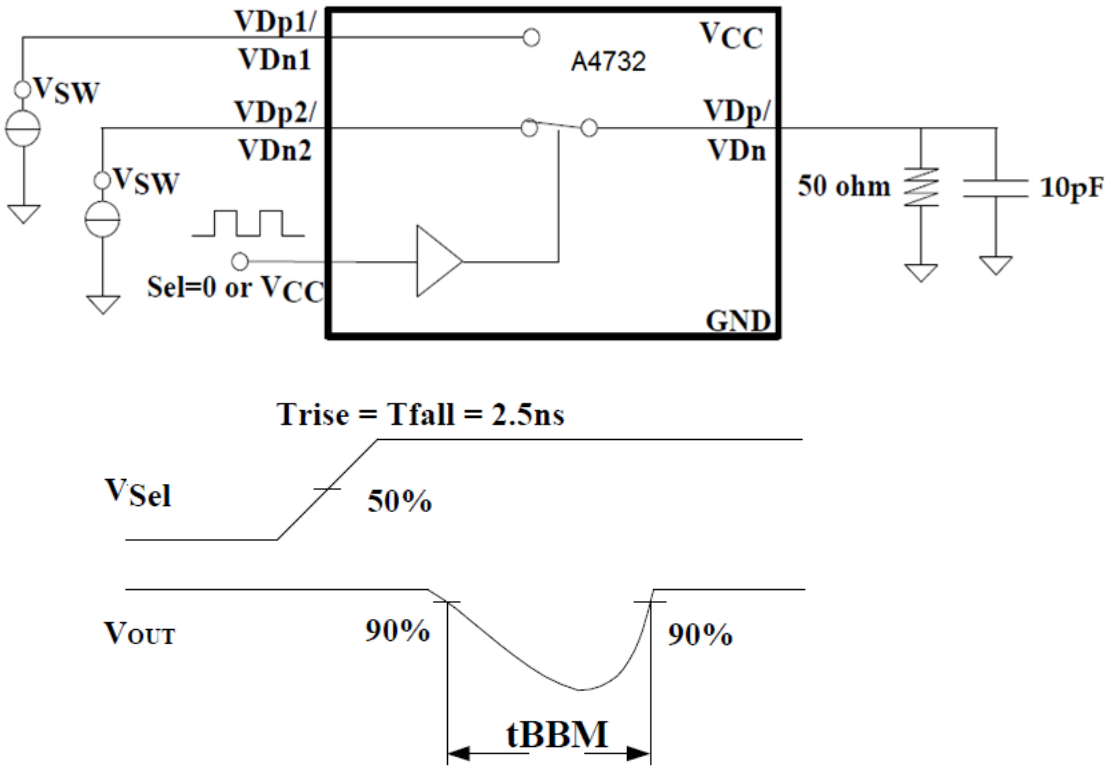


6. Test Circuit for Charge Injection, Q

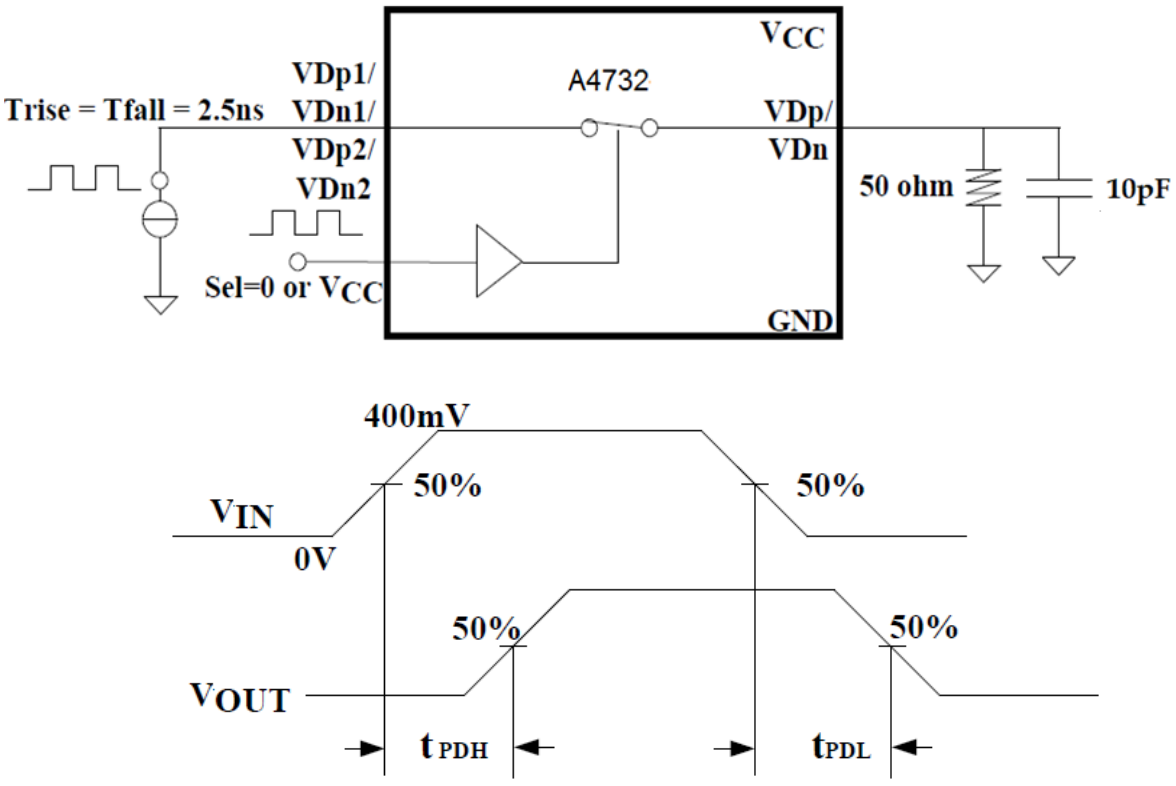


$Q=C_L \times V_{OUT}$

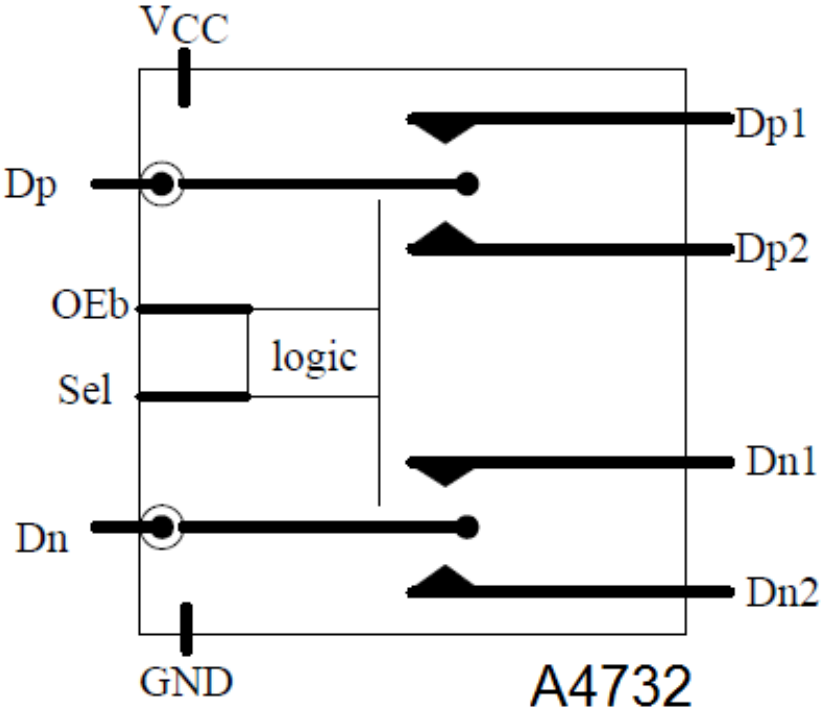
7. Test Circuit for Break-Before-Make Time Delay, t_{BBM}



8. Test Circuit for Propagation Delay, t_{PD}



BLOCK DIAGRAM



DETAILED INFORMATION

Meeting USB 2.0 V_{BUS} Short Requirements

(1) Power-Off Protection

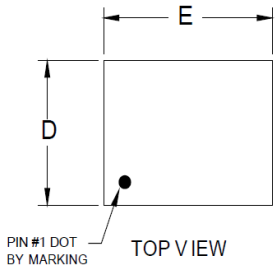
For a V_{BUS} short circuit the switch is expected to withstand such a condition for at least 24 hours. The A4732 has the specially designed circuit which prevents unintended signal bleed through as well as guaranteed system reliability during a power-down, over-voltage condition. The protection has been added to the common pins (Dp, Dn).

(2) Power-On Protection

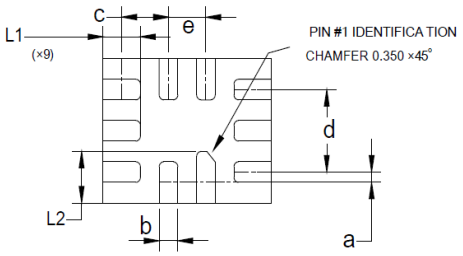
The USB 2.0 specification also notes that the USB device should be capable of withstanding a V_{BUS} short during transmission of data. This modification works by limiting current flow back into the V_{CC} rail during the over-voltage event so current remains within the safe operating range.

PACKAGE INFORMATION

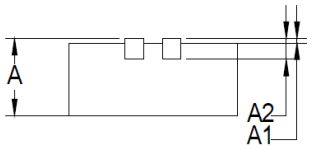
Dimension in TQFN10 (Unit: mm)



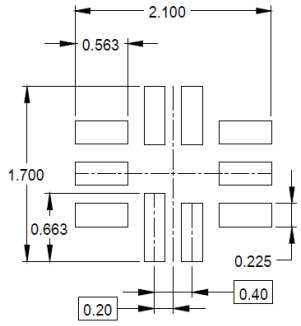
TOP VIEW



BOTTOM VIEW



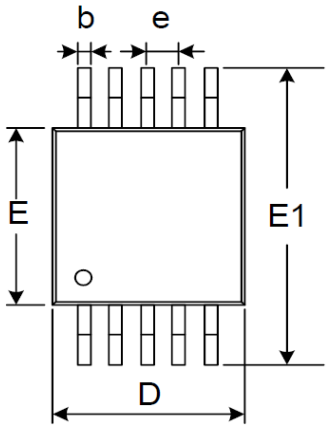
SIDE VIEW

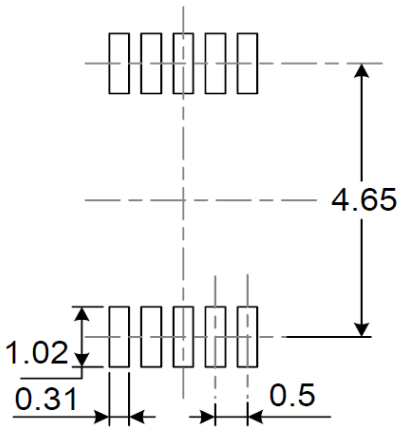


RECOMMENDED LAND PATTERN

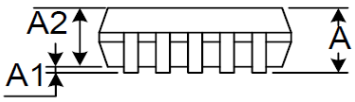
Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A2	0.203 REF		0.008 REF	
a	0.050	0.150	0.002	0.006
b	0.150	0.250	0.006	0.010
c	0.450	0.550	0.018	0.022
d	0.800 REF		0.031 REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
e	0.400 TYP		0.016 TYP	
L1	0.350	0.450	0.014	0.018
L2	0.450	0.550	0.018	0.022

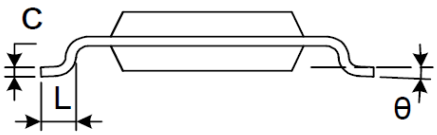
Dimension in MSOP10 (Unit: mm)





RECOMMENDED LAND PATTERN (Unit: mm)





Symbol	Millimeters		Inches	
	Min	Max	Min	Max
A	0.820	1.100	0.032	0.043
A1	0.020	0.150	0.001	0.006
A2	0.750	0.950	0.030	0.037
b	0.180	0.028	0.007	0.011
c	0.090	0.230	0.004	0.009
D	2.900	3.100	0.114	0.122
e	0.500 BSC		0.020 BSC	
E	2.900	3.100	0.114	0.122
E1	4.750	5.050	0.187	0.199
L	0.400	0.800	0.016	0.031
θ	0°	6°	0°	6°

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