

Descriptions

The TPGY320YU/TPGY321YU is a high performance, Double-Pole, Double Throw (DPDT) multiplexer that combines a low-distortion audio and a USB2.0 High-Speed (HS) switch path. This configuration enables audio and USB data to share a common connector port. The architecture is designed to allow audio signals to swing below ground. This means analog audio over USB-C connector can be used for personal media players and portable peripheral devices.

With Max. 18V high voltage range of VBUS pin, TPGY320YU/TPGY321YU can be configured for automatic USB communication with VBUS tie to VBUS directly. The TPGY320YU/TPGY321YU includes an over voltage protection of D+/R & D-/L pin to protect internal port. Typical applications involve switching in portables and consumer applications such as mobile phone, tablet, laptop, portable media players.

The TPGY320YU/TPGY321YU is available in QFN1418 package. Standard products are Pb-Free and halogen-Free.

Features

- Single Supply Range : 2.5V to 4.5V
- VBUS Pin Voltage : 18V
- D+/R & D-/L Pin OVP Threshold : 4.75V
- Audio Path On-Resistance : 2.5Ω
- THD+N@ 32Ω load & 0.7Vrms : -105dB
- Signal-to-Noise (SNR) Ratio : 115dBA
- USB Path -3dB Bandwidth : 1000MHz
- USB Path On-Resistance : 6.5Ω
- Audio Swing Range ($R_L = 1K\Omega$) : 2.5Vrms

Applications

- USB Type-C Audio

Typical Application and Functional Diagram

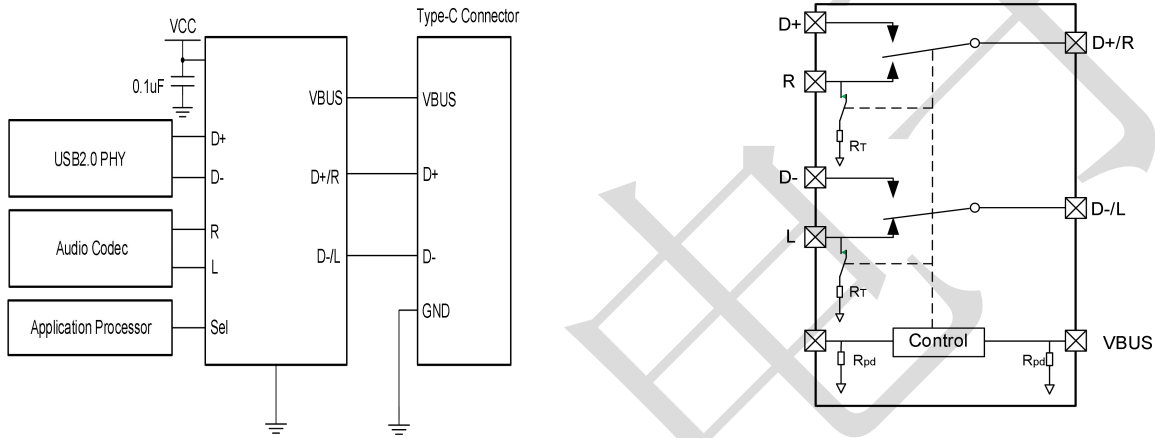


Fig.1 Typical Application and Functional Diagram

Pin Configuration

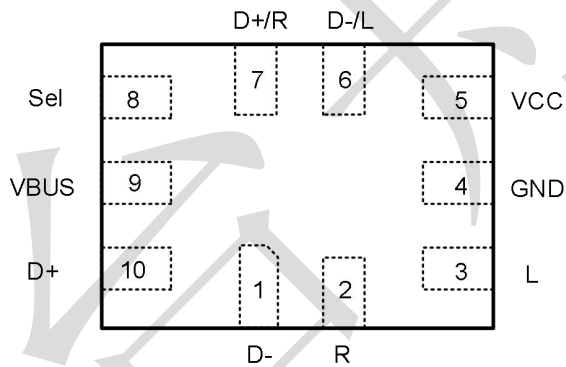


Fig.2 TPGY320YU PinConfiguration

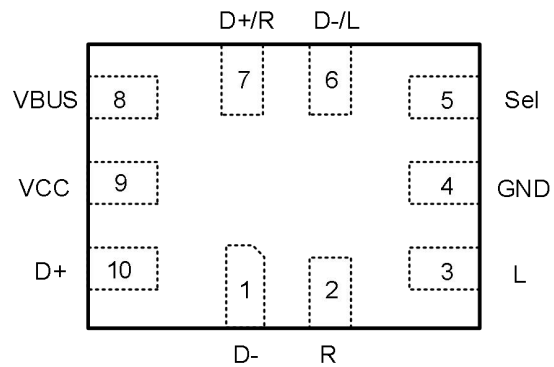


Fig.2 TPGY321YU PinConfiguration

Pin Descriptions

TPGY320YU Pin Number	TPGY321YU Pin Number	Symbol	Descriptions
1	1	D-	USB data (Negative) input sources
2	2	R	Audio Right input sources
3	3	L	Audio Left input sources
4	4	GND	Ground
5	9	VCC	Power supply
6	6	D-/L	USB data (Negative) and audio Left common connector ports
7	7	D+/R	USB data (Positive) and audio Right common connector ports
8	5	Sel	Audio Selection and Low-Power Mode Control
9	8	VBUS	USB Switch Selection
10	10	D+	USB data (Positive) input sources

Table-1 Pin Descriptions

Truth Table

VBUS	Sel	TPGY320YU		TPGY321YU	
		USB Mode	Audio Mode	USB Mode	Audio Mode
1	0	ON	OFF	ON	OFF
0	0	OFF	ON	OFF	ON
1	1	OFF	ON	OFF	ON
0	1	OFF	ON	OFF	OFF

Absolute Maximum Ratings ⁽¹⁾

Parameter	Symbol	Value	Unit
Supply voltage range	V_{CC}	-0.3 ~ 6.5	V
USB signal voltage range	V_{USB}	-0.3 ~ 4.0	V
Audio signal voltage range	V_{AUDIO}	-2.5 ~ V_{CC}	V
VBUS pin voltage range	V_{VBUS}	-0.3 ~ 18	V
Sel pin voltage range	V_{SEL}	-0.3 ~ 6.5	V
Continues output current (USB)	I_{OUT}	±100	mA
Continues output current (Audio)	I_{OUT}	±200	mA
Junction temperature range	T_J	150	°C
Lead temperature range	T_L	260	°C
Storage temperature range	T_{STG}	-65 ~ +150	°C
Thermal resistance	$R_{\theta JA}$	250	°C/W
ESD protection (HBM)	Sel, VBUS to GND	±4000	V
	V_{CC} to GND	±5000	V
	D+, D- to GND	±4000	V
	D+/R, D-/L to GND	±4000	V
	L, R to GND	±4000	V

Recommend operating ratings ⁽²⁾

Parameter	Symbol	Value	Unit
Supply voltage range	V_{CC}	2.5 ~ 4.5	V
USB signal voltage range	V_{USB}	0.0 ~ 3.3	V
Audio signal voltage range	V_{AUDIO}	-2.5 ~ +2.5	V
VBUS pin voltage range	V_{VBUS}	-0 ~ 18	V
Sel pin voltage range	V_{SEL}	-0 ~ 5.5	V
Operating temperature range	T_{OPR}	-40 ~ 85	°C

1. "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.
2. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

Electronics Characteristics (Ta=25°C, Vcc=3.3V, unless otherwise noted)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Control Input Voltage HIGH	V _{IH}	2.5V < V _{CC} < 3.0V	1.3			V
		3.0V < V _{CC} < 3.5V	1.5			V
Control Input Voltage LOW	V _{IL}	2.5V < V _{CC} < 3.0V			0.3	V
		3.0V < V _{CC} < 3.5V			0.5	V
Quiescent Supply Current	I _{CC}			20	35	uA
Sel Input Leakage Current	I _{IN}	0 < V _{IS} < V _{CC}			2	uA
VBUS Input Leakage Current	I _{IN}	0 < V _{IS} < 20V			2	uA
Off state leakage current	I _{OFF}				1	uA
Sel and VBUS Internal Pull-Down Resistors	R _{PD}			4		MΩ
Audio Path Termination Resistors	R _T			33		Ω
USB Switch On Resistance	R _{ONUSB}	V _{D+/D-} = 0V~0.4V, I _{ON} = 10mA		5.5	7	Ω
USB Switch Delta R _{ON}	ΔR _{ONUSB}	V _{D+/D-} = 0V~0.4V, I _{ON} = 10mA		0.5		Ω
Audio Switch On Resistance	R _{ONAudio}	V _{L/R} = -2V~+2V, I _{ON} = 60mA		2.5	2.7	Ω
Audio Switch Delta R _{ON}	ΔR _{ONAudio}	V _{L/R} = -2V~+2V, I _{ON} = 60mA		0.02		Ω
Audio Switch R _{ON} Flatness	R _{FLATAudio}	V _{L/R} = -2V~+2V, I _{ON} = 60mA		0.02		Ω
Quiescent Supply Current	I _{CC}			18	35	
Non-Adjacent Channel Crosstalk	Xtalk	Audio Mode f=1KHz R _T =32Ω		-80		dB
		USB Mode f=240MHz R _T =50Ω		-35		
Off Isolation	O _{IRR}	Audio Mode f=1KHz R _T =32Ω		-100		dB
		USB Mode f=240MHz R _T =50Ω		-40		
-3dB Bandwidth (USB Mode)	BW	R _T =50Ω, C _L =0pF Signal 0dBm		1000		MHz
Total Harmonic Distortion	THD	f = 20Hz to 20KHz,		-105		dB

(Audio Mode)		$R_L = 32\Omega, V_{IN} = 0.7V_{rms}$			
		$f = 20\text{Hz to } 20\text{kHz},$ $R_L = 1\text{k}\Omega, V_{IN} = 1.5V_{rms}$		-110	dB
Signal-to-Noise Ratio (Audio Mode)	SNR	$f = 20\text{Hz to } 20\text{kHz},$ $R_L = 32\Omega, V_{IN} = 2V_{rms}$		-115	dB
D+/R, D-/L On Capacitance	C_{ON}	$V_{Bias} = 0.2\text{V}, f = 1\text{MHz}$		5	pF
USB Path Off Capacitance	C_{OFF1}	$V_{Bias} = 0.2\text{V}, f = 1\text{MHz}$		3	pF
Audio Path Off Capacitance	C_{OFF2}	$V_{Bias} = 0.2\text{V}, f = 1\text{MHz}$		4	pF

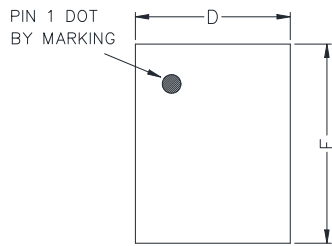
Table-4 Electrical Characteristics

Note:

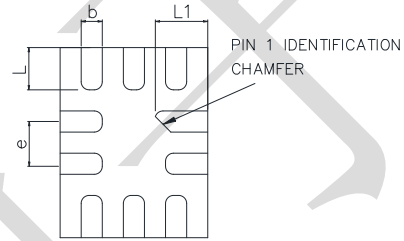
- (1) Flatness is defined as the difference between maximum and minimum value of ON-resistance at the specified analog signal voltage points.
- (2) R_{ON} matching between channels is calculated by subtracting the channel with the lowest max Ron value from the channel with the highest max Ron value.

Package Outline Dimensions

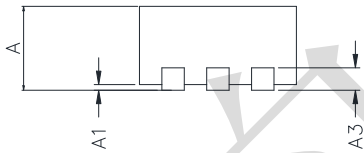
QFN1418-10L



TOP VIEW



BOTTOM VIEW



SIDE VIEW

Symbol	Dimensions in Millimeters		
	Min.	Typ.	Max.
A	0.50	0.55	0.60
A1	0.00	-	0.05
A3	0.15 Ref.		
D	1.35	1.40	1.45
E	1.75	1.80	1.85
b	0.15	0.20	0.25
L	0.30	0.40	0.50
L1	0.40	0.50	0.60
e	0.40 BSC		