

GT4221

USB2.0 Hi-Speed Switches

1 Features	2 Application
- V_{CC} Operating Range: 2.3V to 5.5V - Analog Signal Range: 0 to 3.6V - -3dB Bandwidth: 1.8GHz - Off Isolation: -38dB@250MHZ - Crosstalk Rejection: -45dB@250MHZ - ON-Resistance: 2Ω Typical - Extended Temperature Range: -40 to 85 - Green QFN2.0x1.5-10L, QFN1.8x1.4-10L packages	- Cell Phones - Hi-Fi Audio Switching - USB 2.0 High Speed Data Switching - USB 3.x Type C Switching

3 Description	Circuit Diagram
The GT4221 is a high bandwidth, fast double-pole double-throw (DPDT) analog switch. Its wide bandwidth and low bit-to-bit skew allow it to pass high-speed differential signals with good signal integrity. Each switch is bidirectional and offers little or no attenuation of the high-speed signals at the outputs. Industry-leading advantages include a propagation delay of less than 250ps, resulting from its low channel resistance and low I/O capacitance. Its high channel-to-channel crosstalk rejection results in minimal noise interference. The GT4221 is available in Green QFN2.0X1.5-10L, QFN1.8x1.4-10L packages. It operates over an ambient temperature range of 40°C to +85°C.	The circuit diagram illustrates the GT4221 chip's connections. The chip is a square component with four pins on the left (1D+, 1D-, 2D+, 2D-) and two pins on the right (S, /OE). The top pin is VCC, connected to a 0.1uF capacitor. The bottom pin is GND, connected to ground. The 1D+ and 1D- pins are connected to a USB 2.0 Controller. The 2D+ and 2D- pins are connected to another USB 2.0 Controller. The S pin is connected to a signal source, and the /OE pin is connected to a signal source.

4 Device Summary, Pin and Packages

Table 4-1. Device Summary ⁽¹⁾

Serial Name	Part Name	Package	Body Size (Nom)	Marking ⁽²⁾	MSL ⁽³⁾	Package Qty
GT4221	GT4221QGA	QFN2.0X1.5-10L	2.0mm×1.5mm×0.55mm	4221 XXXX	3	3000
GT4221	GT4221QA	QFN1.8x1.4-10L	1.8mm×1.4mm×0.55mm	4221 XXXX	3	3000

(1) For all available packages, please contact product sales

(2) There may be additional marking, which relates to the lot trace code information (data code and vendor code), the logo or the environmental category on the device.

(3) MSL, The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications.

(4) "XXXX" in Marking will be appeared as the batch code.

4 Device Summary, Pin and Packages (Continued)

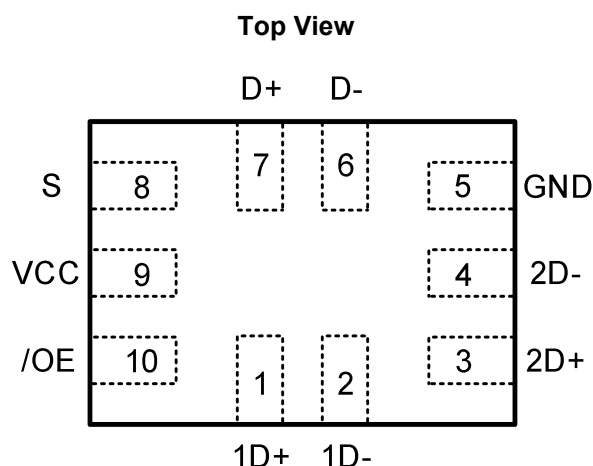


Fig.4-1. GT4221 QA Package

QFN1.8×1.4-10L

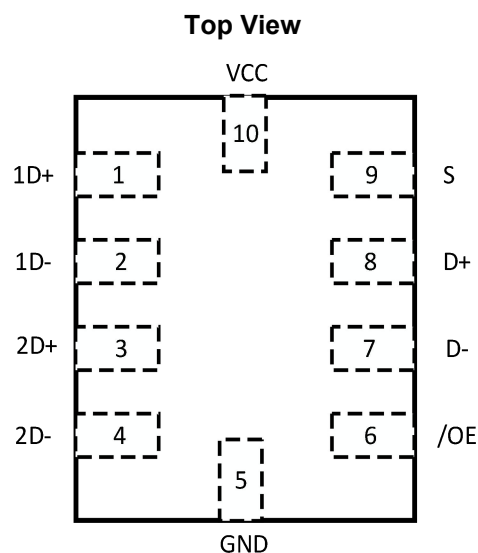


Fig.4-2. GT4221 QGA Package

QFN2×1.5-10L

Table 4-2 Pin Definition

Name	Pin		I/O	Description
	QGA	QA		
1D+	1	1	I/O	USB port 1 DATA+
1D-	2	2	I/O	USB Port 1 DATA-
2D+	3	3	I/O	USB port 2 DATA+
2D-	4	4	I/O	USB Port 2 DATA-
GND	5	5	G	Power Ground
/OE	6	10	I	Outputs enable input, active low.
D-	7	6	I/O	USB data bus DATA-
D+	8	7	I/O	USB data bus DATA+
S	9	8	I	Logic Control, 0 select Port 1, 1 select Port 2
V _{CC}	10	9	P	Power Supply

* It is suggested to leave the unconnected pins floating

Table 4-3 Truth Table

S	/OE	PORT 1	PORT 2
0	0	ON	OFF
1	0	OFF	ON
X	1	OFF	OFF

5 Voltage, Temperature, ESD and Thermal Ratings

5.1 Absolute Maximum Ratings

Parameters	Min.	Max.	Unit
Supply Voltage	-0.5	6.0	V
All Other Pins to GND	-0.5	VCC+0.3	
Continuous Current(D+/-, 1D+/-, 2D+/-)	-120	120	mA
Continuous Power Dissipation		0.4W	
Continuous Power Dissipation	-40	85	°C
Junction Temperature		150	
Storage temperature	-65	150	
Continuous Power Dissipation		260	

5.2 ESD Ratings

ESD			Value	Unit
V(ESD) ⁽¹⁾⁽²⁾	Electrostatic Discharge	Human-Body Model (HBM)	± 5500	V
		Machine Model (MM)	± 200	V

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

5.3 Recommended Operating Conditions

Over operating free-air temperature range (unless otherwise noted)

Symbol	Parameters	Min	Max	Unit
V _{CC}	Single-Supply, V _S =(V ₊) - (V ₋)	2.3	5.5	V
T _A	Operating Temperature	-40	85	°C

6 Electrical Specifications

$V_{CC} = 2.3V$ or $3.6V$, FULL = $-40^{\circ}C$ to $+85^{\circ}C$, Typical values are at $T_A = +25^{\circ}C$. (unless otherwise noted)

DC Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Unit
I_{OFF}	Source, Drain OFF Leakage Current	$V_{CC}=0V$, $V_{SW} = 0$ to $3.6V$			1	μA
I_{OZ}	Channel ON Leakage Current	Switch off, $V_{SW} = 0$ to $3.6V$			1	μA
I_{IN}	Control Input Leakage	$V_{IN} = GND$ or V_{IO}	-1		1	μA
I_{CC}	Quiescent Supply Current	$V_{CC}=3.6V$, $S = 0$ or V_{CC} , $D+/-$, $nD+/-$ = floating		37		μA
V_{IH}	Input Voltage High	$V_{CC} = 2.3V$ to $3.6V$	1.5			V
V_{IL}	Input Voltage Low	$V_{CC} = 2.3V$ to $3.6V$			0.4	V
R_{ON}	On-Resistance	$I_{SW}=30mA$, V_{D+} , $V_{D-} = 0V$		2.0	3.0	Ω
		$I_{SW}=30mA$, V_{D+} , $V_{D-} = 2.4V$		3.3	6.0	
ΔR_{ON}	Delta R_{ON}	$I_{SW}=30mA$, V_{D+} , $V_{D-} = 0V$		0.2		Ω
		$I_{SW}=30mA$, V_{D+} , $V_{D-} = 2.4V$		0.2		
$R_{FLAT(ON)}$	On-Resistance Flatness	$I_{SW}=30mA$, V_{D+} , $V_{D-} = 2.4V$		1.3		Ω

6 Electrical Specifications (Continued)

$V_{CC} = 2.3V$ or $3.6V$, FULL = $-40^{\circ}C$ to $+85^{\circ}C$, Typical values are at $T_A = +25^{\circ}C$. (unless otherwise noted)

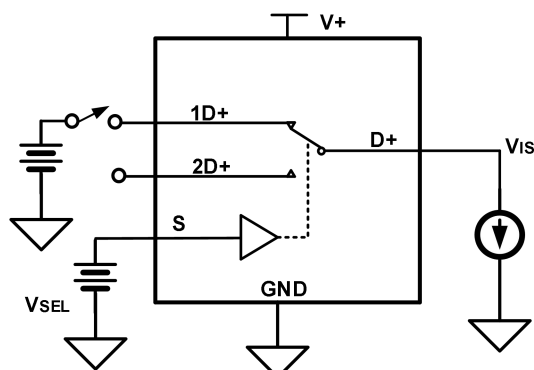
AC Electrical Characteristics

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
O_{IRR}	Off Isolation	$R_L = 50\Omega$, $f=250MHz$		-38		dB
BW	-3 db Bandwidth	$R_L=50\Omega$		1.8		GHz
T_{ON}	Turn-On Time	V_{nD+} and $V_{nD-} = 1.5V$ $R_L=50\Omega$, $C_L= 35pF$,		50	100	ns
T_{OFF}	Turn-Off Time	V_{nD+} and $V_{nD-} = 1.5V$ $R_L=50\Omega$, $C_L= 35pF$,		15	50	ns
T_{BBM}	Break-Before-Make Time	V_{nD+} and $V_{nD-} = 1.5V$ $R_L=50\Omega$, $C_L= 35pF$,	2	15		ns
X_{TALK}	Crosstalk	$R_L=50\Omega$, $f=250MHz$		-45		dB

Capacitance

Symbol	Parameter	Conditions	Min.	Typ.	Max.	Units
C_{ON}	D+,D- Off-Capacitance	$f= 1MHz$		3.5		pF
C_{OFF}	D+,D- On-Capacitance	$f= 1MHz$		2.5		pF

7 Measurement Information



Channel On
 $R_{ON} = (V_{HDS1n} \text{ or } V_{HSD2n} - V_{IS}) / I_D$
 $V_{SEL} = V_{IH} \text{ or } V_{IL}$

Fig.7-1. ON-State Resistance (R_{ON})

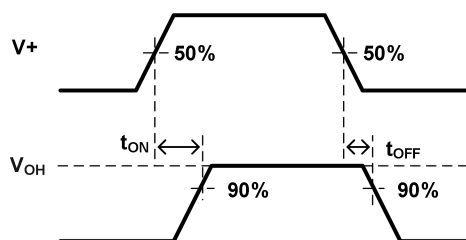
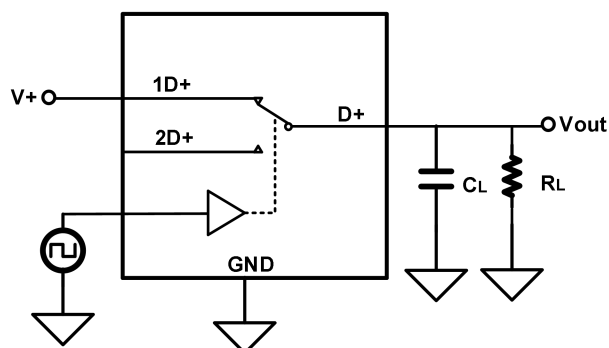


Fig.7-2. Turn-On (t_{ON}) and Turn-Off Time (t_{OFF})

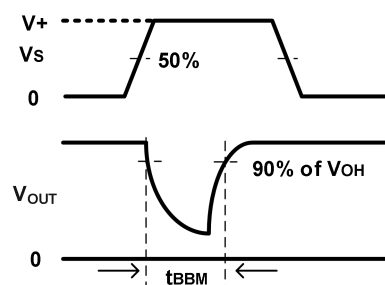
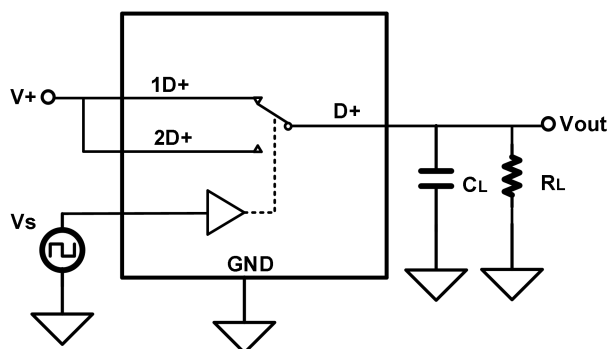


Fig.7-3. Break-Before-Make Time Delay (t_{BBM})

7 Measurement Information (Continued)

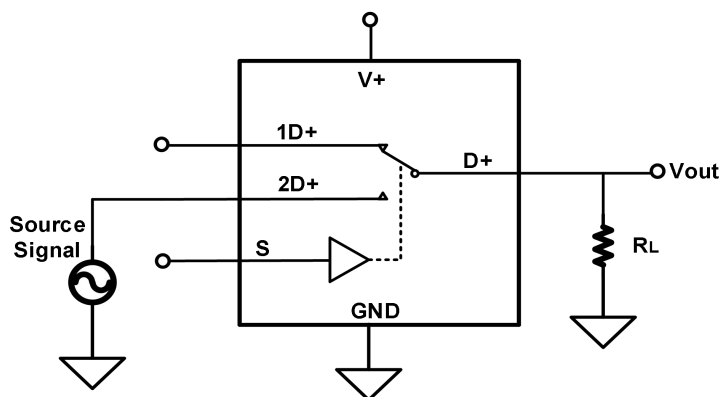


Fig.7-4. Off Isolation (OIRR)

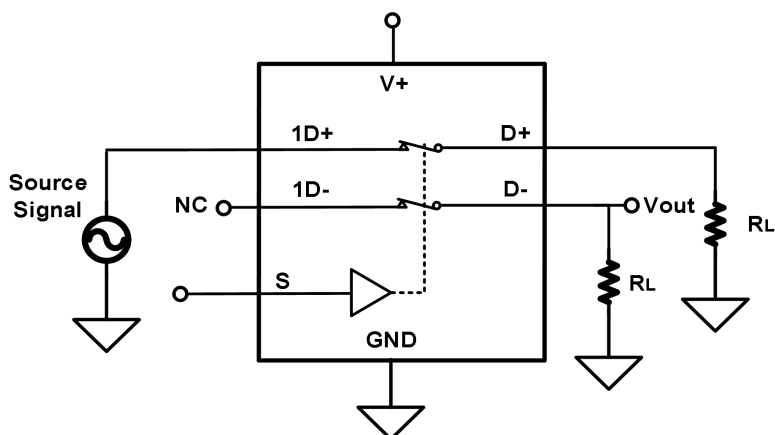


Fig.7-5. Channel-to-Channel Crosstalk

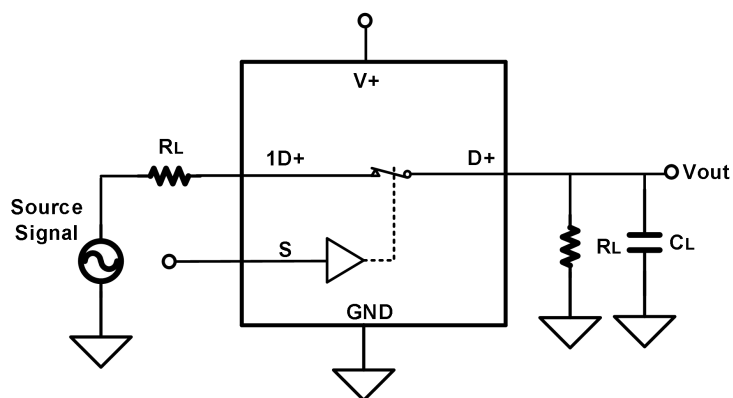
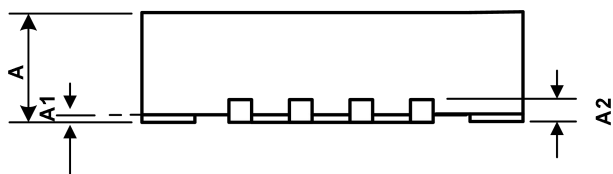
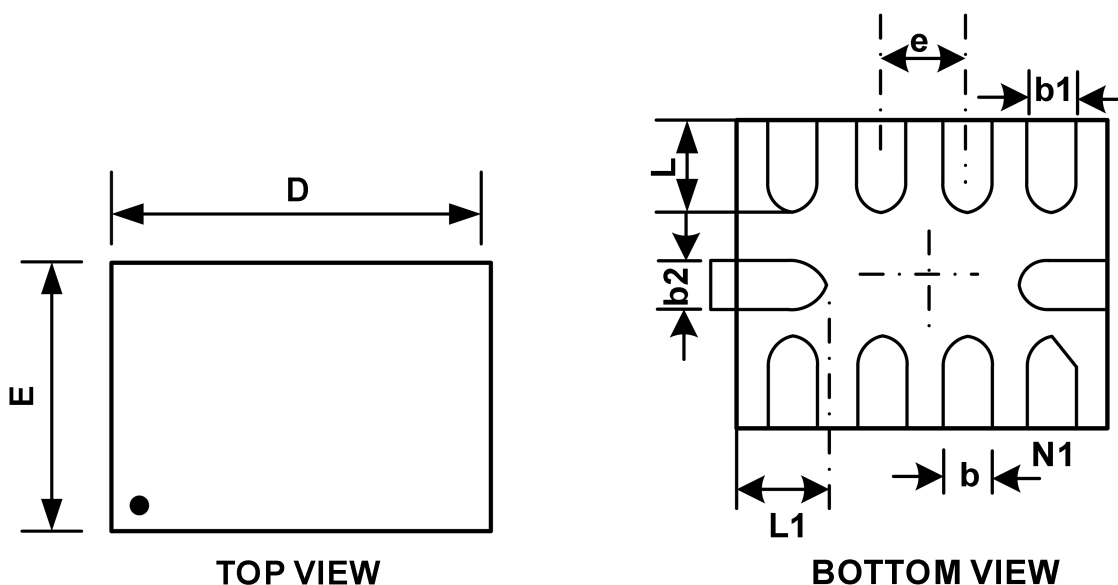


Fig.7-6. -3dB Bandwidth

8 Package Outline Dimension

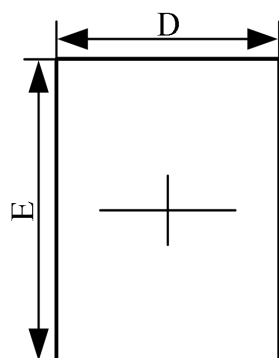
QFN2.0×1.5-10L



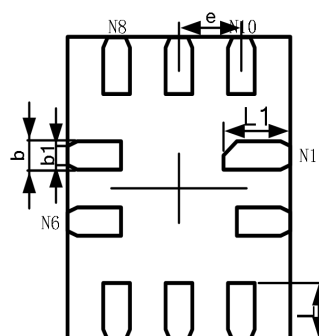
Symbol	Dimensions in Millimeters			Dimensions in Inches		
	Min.	Nom.	Max.	Min.	Nom.	Max.
A	0.5	0.55	0.6	0.020	0.022	0.024
A1	0	--	0.05	0		0.002
A3	0.15 REF			0.006 REF		
D	1.95	2	2.05	0.077	0.079	0.081
E	1.45	1.5	1.55	0.057	0.059	0.061
b	0.15	0.2	0.25	0.006	0.008	0.010
b1	0.2	0.25	0.3	0.008	0.010	0.012
b2	0.25	0.3	0.35	0.010	0.012	0.014
L	0.3	0.35	0.4	0.012	0.014	0.016
L1	0.35	0.4	0.45	0.014	0.016	0.018
e	0.50 BSC			0.020 BSC		
θ	0	—	8°	0	—	8°

8 Package Outline Dimension (Continued)

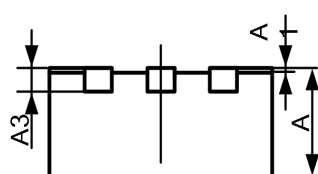
QFN1.8×1.4-10L



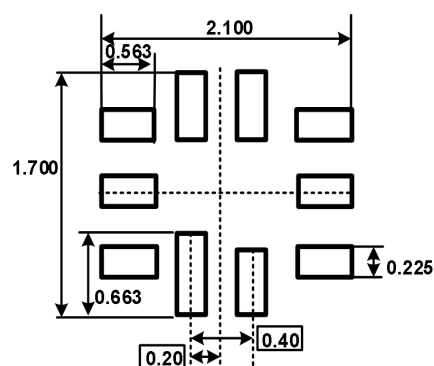
TOP VIEW



BOTTOM VIEW

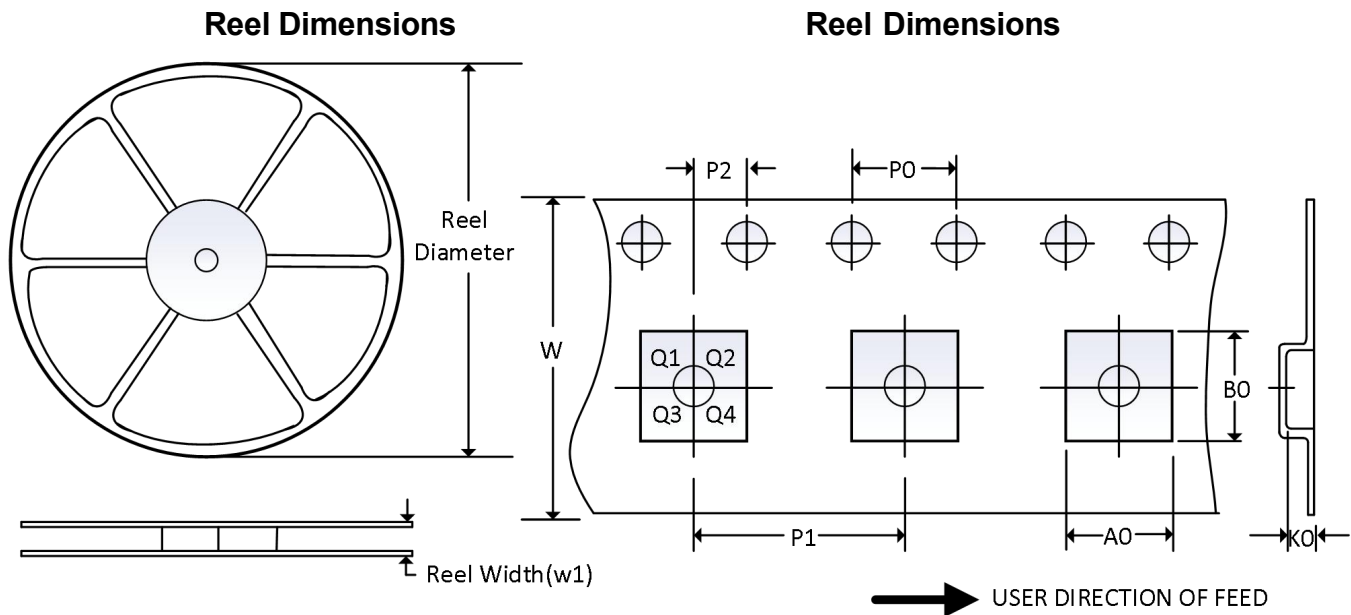


SIDE VIEW


Recommended Land
Pattern

Symbol	Dimensions in Millimeters		Dimensions in Inches	
	Min	Max	Min	Max
A	0.500	0.600	0.020	0.024
A1	0.000	0.050	0.000	0.002
A3	0.152REF		0.006REF	
D	1.350	1.450	0.053	0.057
E	1.750	1.850	0.069	0.073
D1	—	—	—	—
E1	—	—	—	—
k	—		—	
b	0.150	0.250	0.006	0.010
b1	0.100	0.200	0.004	0.008
e	0.400TYP		0.016TYP	
L	0.350	0.450	0.014	0.018
L1	0.450	0.550	0.018	0.022

9 Tape and Reel Information



NOTE: The picture is only for reference. Please make the object as the standard.

Key Parameter List of Tape and Reel

Package Type	Reel Diameter	Reel Width (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
QFN2.0*1.5-10L										
QFN1.4*1.8-10L	7"	9	1.6	2	0.85	4.0	4.0	2.0	8.0	Q1

NOTE:

1. All dimensions are nominal.
2. Plastic or metal protrusions of 0.15mm maximum per side are not included.