BCT646
2:1 MIPI D-PHY(2.5Gbps) 4-Data Lane Switch

GENERAL DESCRIPTION

The BCT646 is a four-data-lane, MIPI, D-PHY switch. This single-pole, double-throw (SPDT) switch is optimized for switching between two high-speed or low-power MIPI sources. The BCT646 is designed for the MIPI specification and allows connection to a CSI or DSI module.

APPLICATIONS

Cellular Phones, Smart Phones
Displays
Tablets
Laptops

FEATURES

Switch Type: SPDT(10x)
Signal Types: MIPI, D-PHY
V_{CC}:1.5 to 5.0V
Input Signals: 0 to 1.3V
R_{ON}: 7 HS MIPI
7 LP MIPI
R_{ON}: 0.15 Typical HS &LP MIPI
R_{ON_FLAT}: 0.2
I_{CCZ}: 1uA Maximum
I_{CC}: 35uA Maximum
O_{IRR}:-25dB Typical
X_{TALK}:-30dB Typical
Bandwidth:2.5 GHz Typical
Channel-to-Channel Skew: 6ps Typical
C_{ON}:1.5pF
36-Ball WLCSP Package

ABSOLUTE MAXIMUM RATINGS

Supply Voltage (V_{CC}) .....-0.5V to +6.0V
DC Input Voltage (SEL, /OE)[1].....-0.5V to V_{CC}V
DC Switch I/O Voltage.....-0.5V to 1.8V
DC Input Diode Current.....-50mA
DC Output Current 25mA
Storage Temperature Range.....-65 to +150
Junction Temperature.....150
Operating Temperature Range.....-40 to +85
Lead Temperature (Soldering, 10 sec).....260
ESD Susceptibility
HBM All Pins.....2.0KV
CDM.....1KV
IEC 61000-4-2 System (Contact).....8KV
IEC 61000-4-2 System (Air Gap).....15KV

CAUTION

pay attention to ESD protection. Broadchip recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage. ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.

Broadchip reserves the right to make any change in circuit design, specification or other related things if necessary without notice at any time. Please contact Broadchip sales office to get the latest datasheet.

RECOMMENDED OPERATING CONDTIONS

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications.

Symbol	Parameter		Min.	Max.	Unit
V_{CC}	Supply Voltage		1.5	5.0	V
V_{CTRL}	Control Input Voltage(SEL, /OE)[2]		0	V_{CC}	V
V_{SW}	Switch I/O Voltage (CLKn, CLKAn, CLKBn, Dn, DAn, DBn)	HS Mode	0	0.3	V
		LP Mode	0	1.3	
T_A	Operating Temperature		-40	+85	

Notes
1. The input and output negative ratings maybe exceed if the input and output diode current ratings are observed.
2. The control input must be held HIGH or LOW; it must not float.

PIN CONFIGURATION

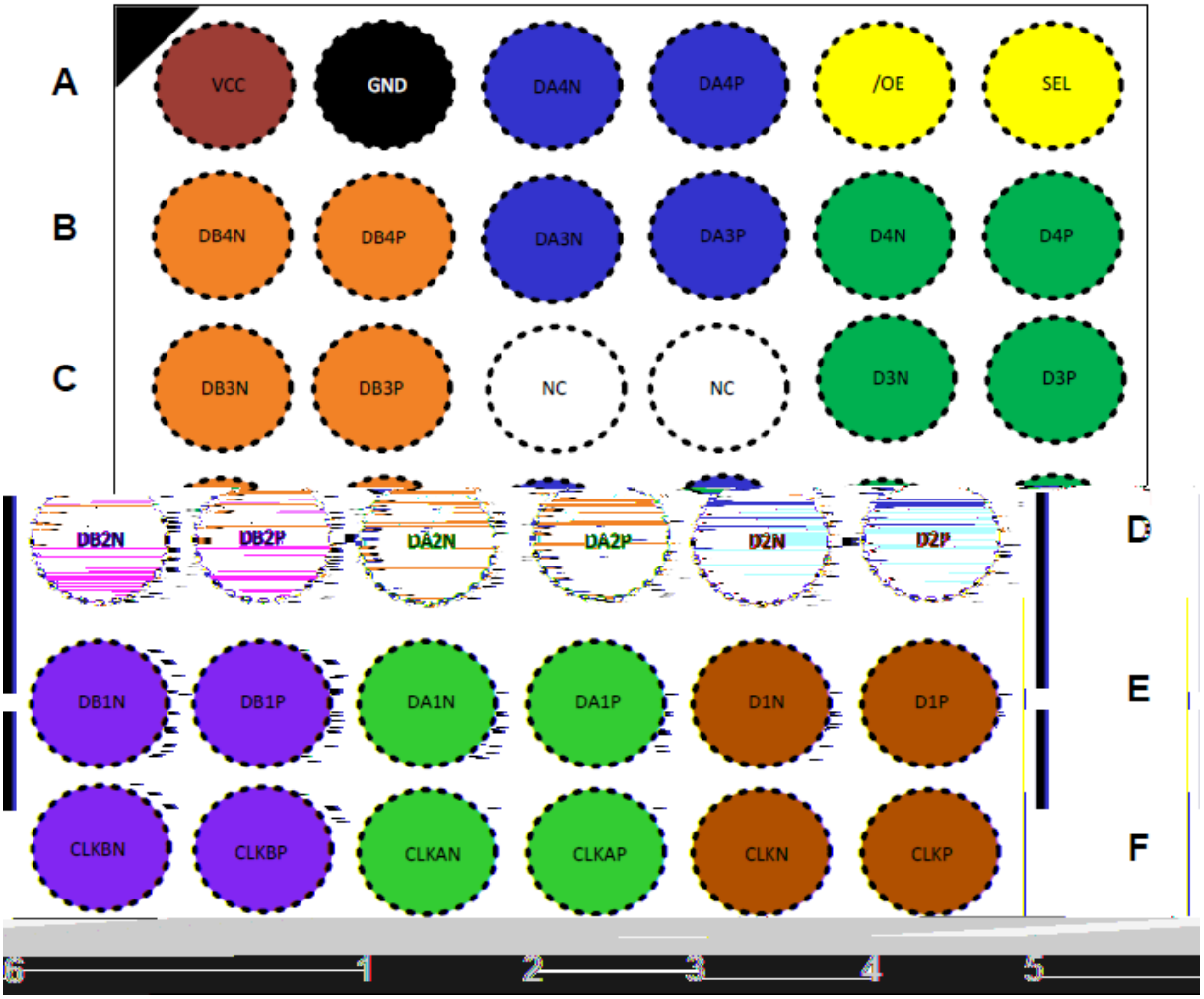


Figure2. Pin Configuration(Top Through View)

Table 1. Ball-to-Pin Mappings

Ball	Pin Name
A1	V_{CC}
A2	GND
A3	DA4N
A4	DA4P
A5	/OE
A6	SEL
B1	DB4N
B2	DB4P
B3	DA3N
B4	DA3P

PIN DESCRIPTION

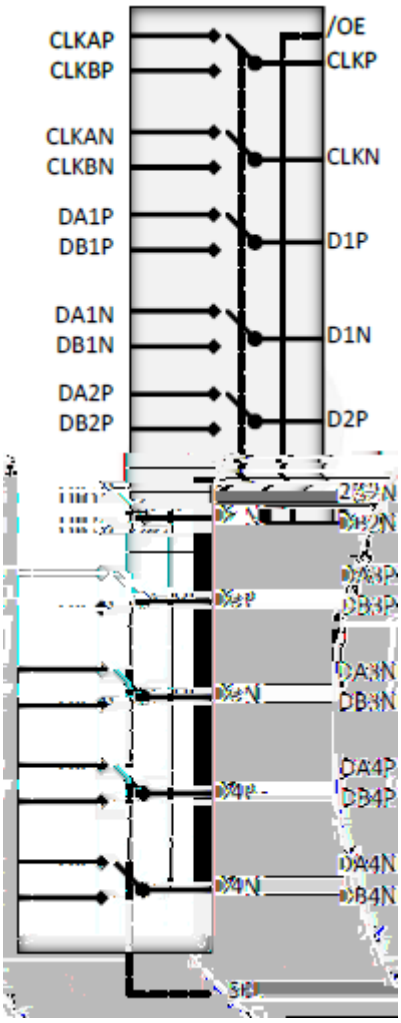


Figure 3. Analog Symbol

Pin Name	Description	
CLKP/N	Common Clock Path	
D1P/N	Common Data Path1	
D2P/N	Common Data Path2	
D3P/N	Common Data Path3	
D4P/N	Common Data Path4	
CLKAP/N	A-Side Clock Path	
DA1P/N	A-Side Data Path 1	
DA2P/N	A-Side Data Path 2	
DA3P/N	A-Side Data Path 3	
DA4P/N	A-Side Data Path 4	
CLKBP/N	B-Side Clock Path	
DB1P/N	B-Side Data Path 1	
DB2P/N	B-Side Data Path 2	
DB3P/N	B-Side Data Path 3	
DB4P/N	B-Side Data Path 4	
SEL	SEL=0	CLKP=CLKAP, CLKN=CLKAN, Dn(P/N)=DAn(P/N)
	SEL=1	CLKP=CLKBP, CLKN=CLKBN, Dn(P/N)=DBn(P/N)
/OE	Output Enable	
VCC	Power	
GND	Ground	
NC	No Connect	

DC ELECTRICAL CHARACTERISTICS

(All typical values are T_A = 25 , unless otherwise specified.)

PARAMETER	SYM	CONDITIONS	V_{CC} (V)	MIN	TYP	MAX	UNITS
Control Input Leakage(SEL, /OE)	I_{IN}	V_{CNTRL}=0 to V_{CC}	5	-1		1	uA
Input Voltage High	V_{IH}	SEL, /OE	1.5 to 5	1.4			V
Input Voltage Low	V_{IL}	SEL, /OE	1.5 to 5			0.4	V
Off leakage Current of Port CLKAn, DAn, CLKBn, DBn	$I_{NO(OFF)}$ $I_{NC(OFF)}$	V_{SW}=0 DATA 1.3V	5	-1		1	uA
On leakage Current of Common Ports(CLKn, Dn)	$I_{A(ON)}$	V_{SW}=0 DATA 1.3V	5	-1		1	uA
Power-Off Leakage Current (All I/O Ports)	I_{OFF}	V_{SW}=0 or 1.3V	0	-1		1	uA
Off-State Leakage	I_{OZ}	V_{SW}=0 DATA 1.3V, /OE=High	5	-1		1	uA
Switch On Resistance for HS MIPI Applications(3)	$R_{ON\_MIPI\_HS}$	I_{ON}=-8mA, /OE=0V, SEL=V_{CC} or 0V, CLKA, CLKB, DBn or DAn=0.3V	1.5 to 5		7		
Switch On Resistance for LP MIPI Applications(3)	$R_{ON\_MIPI\_LP}$	I_{ON}=-8mA, /OE=0V, SEL=V_{CC} or 0V, CLKA, CLKB, DBn or DAn=1.3V	1.5 to 5		7		
On Resistance Matching Between HS MIPI Channels(4)	$R_{ON\_MIPI\_HS}$	I_{ON}=-8mA, /OE=0V, SEL=V_{CC} or 0V, CLKA, CLKB, DBn or DAn=0.3V	1.5 to 5		0.15		

DC ELECTRICAL CHARACTERISTICS

(All typical values are T_A = 25 , unless otherwise specified.)

PARAMETER	SYM	CONDITIONS	V_{CC} (V)	MIN	TYP	MAX	UNITS
On Resistance Matching Between LP MIPI Channels(4)	$R_{ON\_MIPI\_LP}$	I_{ON}=-8mA, /OE=0V, SEL=V_{CC} or 0V, CLKA, CLKB, DBn or DAn=1.3V	1.5 to 5		0.15		
On Resistance Flatness for HS MIPI Signals(4)	$R_{ON\_FLAT\_MIPI\_HS}$	I_{ON}=-8mA, /OE=0V, SEL=V_{CC} or BT1 0 0 1 4(					

AC ELECTRICAL CHARACTERISTICS

(All values are for V_{CC}=3.3V at T_A=25 unless otherwise specified.)

PARAMETER	SYM	CONDITIONS	V_{CC} (V)	MIN	TYP	MAX	UNITS
Turn-Off Time SEL to Output	t_{OFF}	R_L= , C_L=0pF, V_{SW}=0.6V	1.5 to 5		125	800	ns
Break-Before-Make Time	t_{BBM}	R_L= , C_L=0pF, V_{SW}=0.6V	1.5 to 5	50		450	ns
Propagation Delay(5)	t_{PD}	C_L=0pF, R_L=	1.5 to 5		0.25		ns
Off Isolation for MIPI(5)	O_{IRR}	f=1250MHz, R_L= , /OE=HIGH, V_{SW}=200mV_{PP}	1.5 to 5		-25		dB
Crosstalk for MIPI(5)	X_{TALK}	f=1250MHz, R_L= , /OE=High, V_{SW}=200mV_{PP}	1.5 to 5		-30		dB
		f=1250MHz, R_L= , /OE=Low, V_{SW}= 200mV_{PP}	1.5 to 5		-30		dB
-3db Bandwidth(5)	BW	C_L=0pF, R_L= , V_{SW}=200mV_{PP}	1.5 to 5		2.5		GHz

Note:
5. Guaranteed by characterization.

HIGH-SPEED-RELATED AC ELECTRICAL CHARACTERISTICS

PARAMETER	SYM	CONDITIONS	V_{CC} (V)	MIN	TYP	MAX	UNITS
HS Mode Skew of Opposite Transitions of the Same Output(6)	$t_{SK(P)}$	R_L= , C_L=0pF, V_{SW}=0.3V	1.5 to 5		6		ps

Note:
6. Guaranteed by characterization.

CAPACITANCE

PARAMETER	SYM	CONDITIONS	V_{CC} (V)	MIN	TYP	MAX	UNITS
Control Pin Input Capacitance(7)	C_{IN}	V_{CC}=0V, f=1MHz	0		2.1		pF
Output On Capacitance(7)	C_{ON}	V_{CC}=3.3V, /OE=0V, f=1250MHz(In HS common value)	3.3		1.5		
Output Off Capacitance(7)	C_{OFF}	V_{CC} and /OE=3.3V, f=1250MHz(Both sides in HS common value)	3.3		0.9		

Note:
7. Guaranteed by characterization.

TEST DIAGRAMS

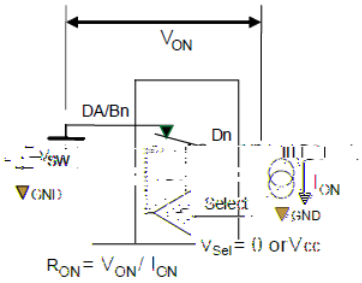
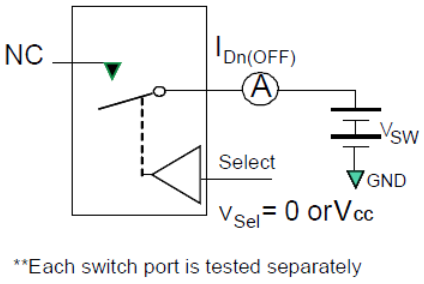


Figure 4. On Resistance



**Each switch port is tested separately

Figure 5. Off Leakage

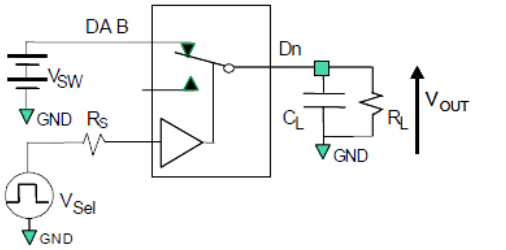


Figure 6. AC Test Circuit Board

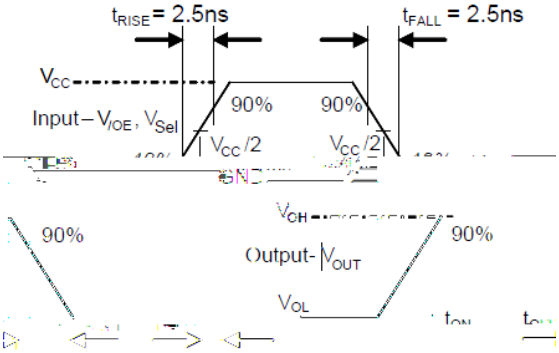


Figure 7. Turn-On/Turn-Off waveform

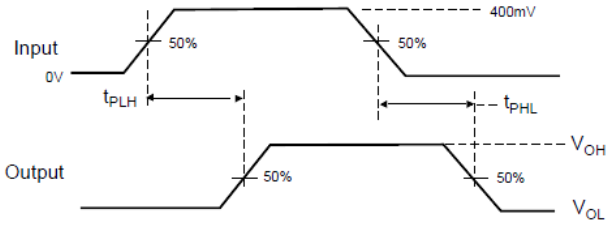


Figure 8. Propagation Delay($t_R$$t_F$-500ps)

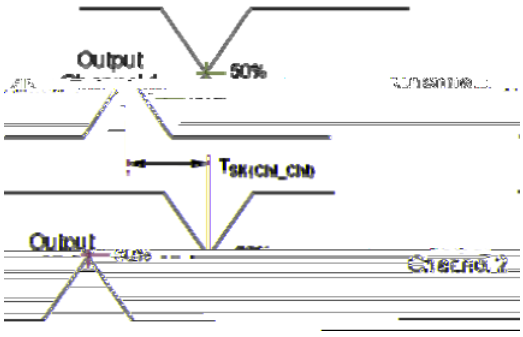


Figure 9. Channel to Channel Skew

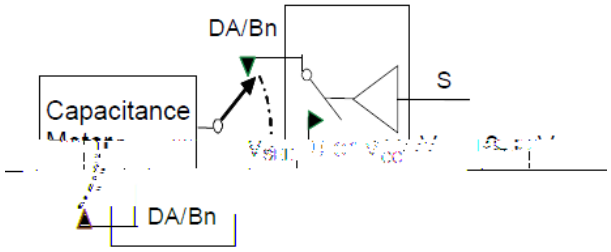


Figure 10. Channel Off Capacitance

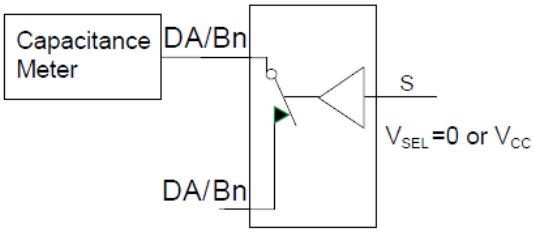


Figure 11. Channel On Capacitance

TEST DIAGRAMS(CONTINUED)

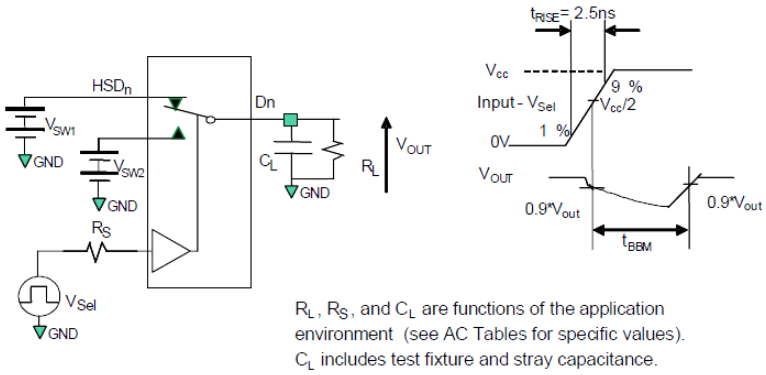


Figure 12. Break-Before-Make Interval Timing

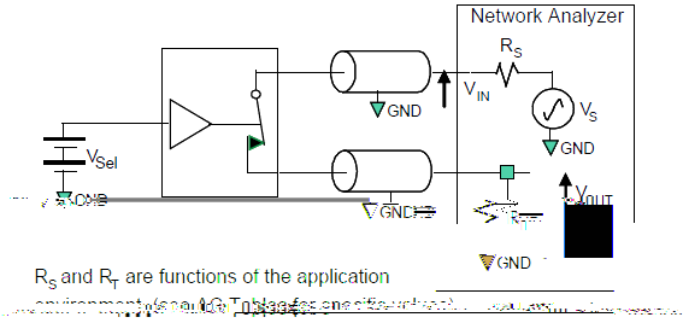


Figure 13. Bandwidth

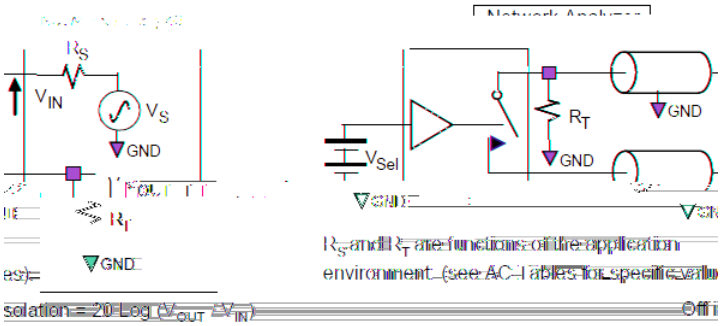
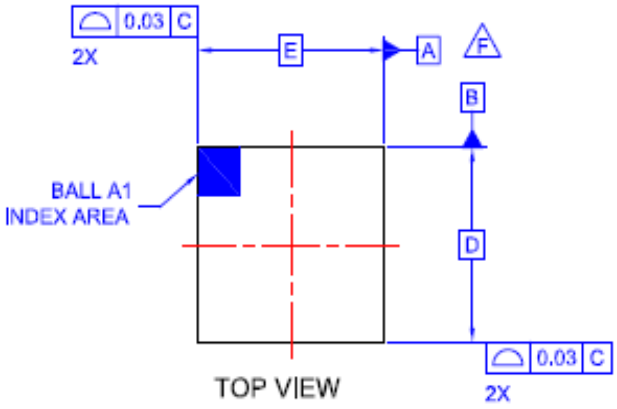


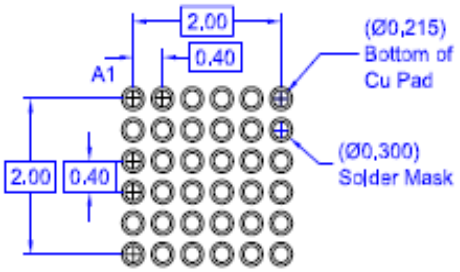
Figure 14. Channel Off Isolation

Figure 15. Non-Adjacent Channel-to-Channel Crosstalk

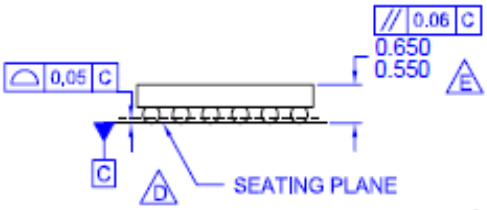
PACKAGE OUTLINE DIMENSIONS

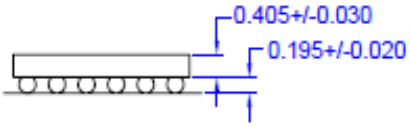


TOP VIEW

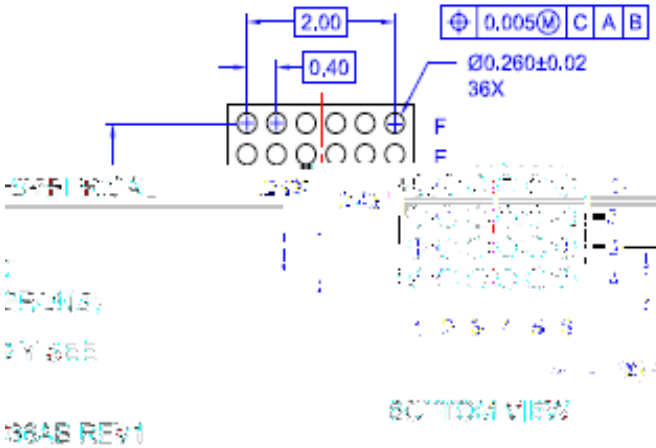


RECOMMENDED LAND PATTERN
(NSMD PAD TYPE)





SIDE VIEWS



NOTES

A. NO JEDEC REGISTRATION APPLIES.

B. DIMENSIONS ARE IN MILLIMETERS.

C. DIMENSIONS AND TOLERANCE
PER ASMEY14.5M, 2009.

Product-Specific Dimensions

Product	Package	D	E	X	Y
BCT646EWX-TR	36-Ball WLCSP, 2.43mm x 2.43 mm, 0.4mm Pitch	2.43mm	2.43mm	0.18mm	0.18mm