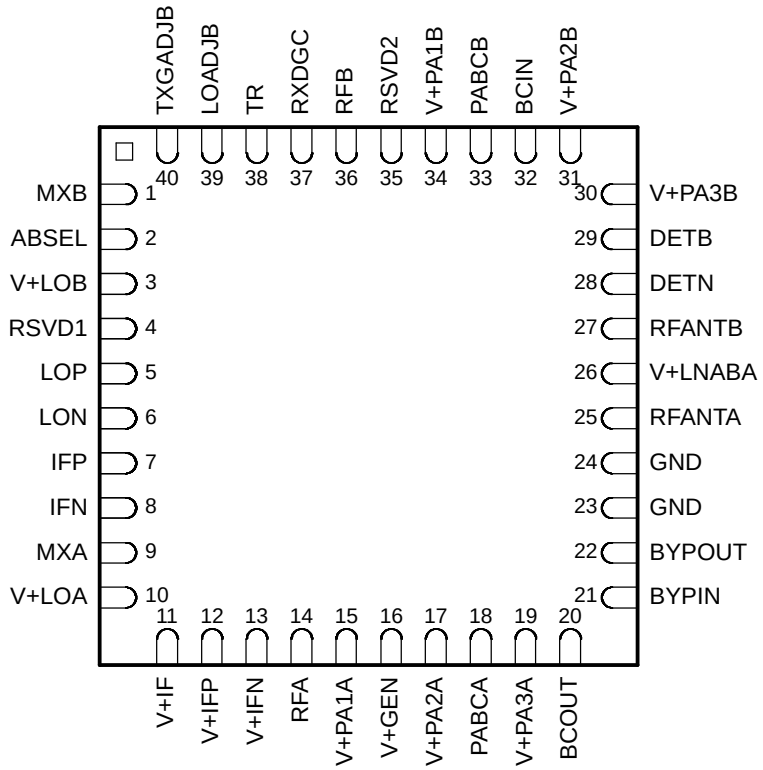
High-Power Dual-Band (2.4-GHz to 2.5-GHz and 4.9-GHz to 5.9-GHz) RF Front-End

FEATURES

- Highly Integrated 802.11 a/b/g Radio Frequency Front End ASIC
- Fully Integrated Up/Down Converters, LNAs, PAs and T/R Switches
- Super Heterodyne Architecture for Superior Adjacent Channel Rejection Performance
- Differential LO and IF Interface for Enhanced Spurious/EMI Performance
- Common Frequency Plan uses a Single LO and Common IF for Single IF Filter for Both Bands
- Integrated Temperature Compensated TX Power Detectors
- PA Bias Control Function
- Lead Free Package (TBD)
- Antenna Port OP_{1dB} = +23 dBm Typical
- Antenna Port OIP3 = +33 dBm, Typical
- Frequency Range: 2.4 to 2.5 and 4.9 to 5.9 GHz
- Noise Figure: 4 dB ISM Band, 6 dB 5 GHz Bands Typical
- Typical Gain: 38 dB TX, 20dB RX
- IF = 374 MHz

TBD PACKAGE
(TOP VIEW)



PRODUCT PREVIEW

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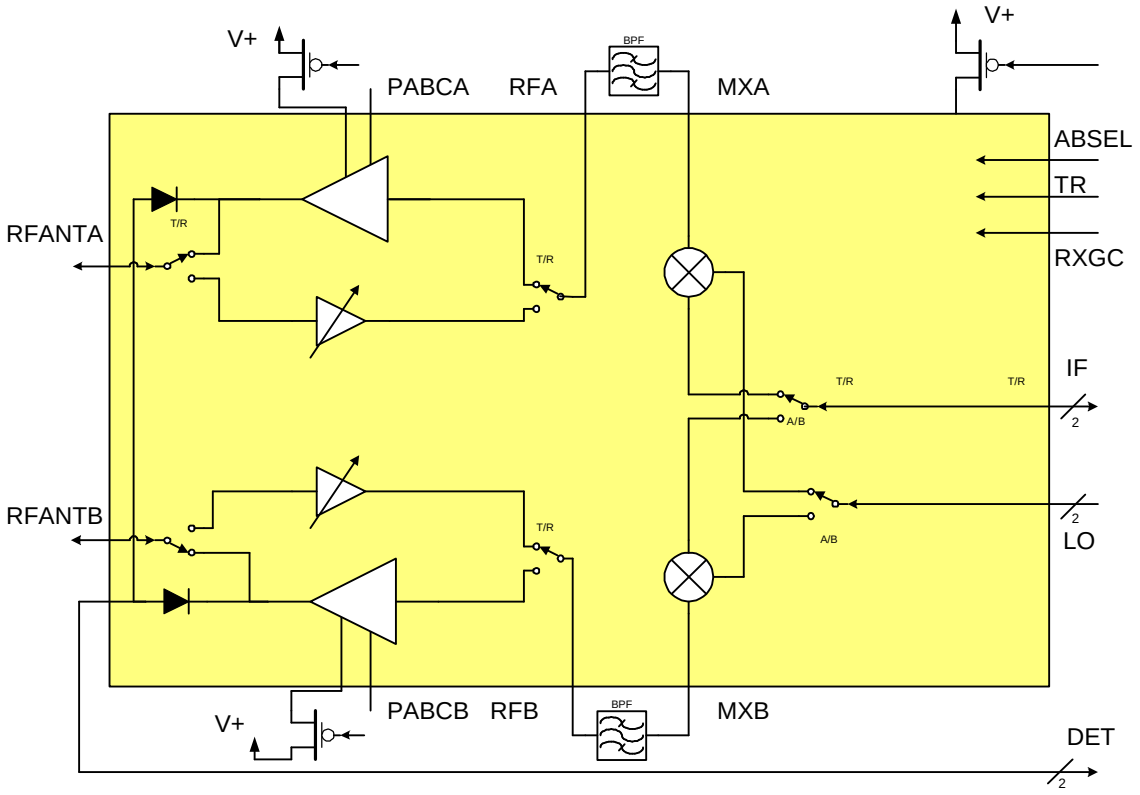
DESCRIPTION

The TRF2436 is a fully integrated Dual Band Tri Mode Radio Frequency Front End (RFFE) designed specifically for use in 802.11 a/b/g applications. The TRF2436 is designed to perform RF up and down conversions in the unlicensed ISM and 4.9-5.9 GHz bands. The TRF2436 uses a common IF frequency for both bands, eliminating the need for additional IF filtering. Combined with the TI TRF2432 IF/IQ Transceiver/Synthesizer, the TRF2436 completes the TI WLAN two-chip radio.

The TRF2436 incorporates all of the RF blocks for both the “b/g” and “a” bands except for low cost ceramic filters. The ASIC includes LNAs, PAs, mixers, bias circuitry, RX gain control, transmit coupler detectors, and T/R switches. High integration and internal RF matching enhances performance and greatly reduce external part count. The only external components needed (other than simple passives) for operation are RF filters and external low power DC switching FETs.

Functional Block Diagram



DEVICE INFORMATION

TERMINAL FUNCTIONS

TERMINAL		I/O	TYPE	DESCRIPTION
NAME	NO.			
MXB	1	I/O	RF SE	B band RF Input/Output to mixer. 50-Ω single ended. Do not apply DC.
ABSEL	2	I	Digital	Band select pin. HIGH = A-band. LOW = B-band.
V+LOB	3	I	Power	B band LO amplifier bias +3.3V
RSVD1	4	-	-	Not connected for normal operation. Leave Open.
LOP	5	I	RF Dif.	LO input (differential) Positive, AC coupled
LON	6	I	RF Dif.	LO input (differential) Negative, AC coupled
IFP	7	I/O	RF Dif.	IF input/output (differential) Positive, DC coupled, typical DC Voltage is 2.6V
IFN	8	I/O	RF Dif.	IF input/output(differential) Negative, DC coupled, typical DC Voltage is 2.6V
MXA	9	I/O	RF SE	A band RF Input/Output to mixer. 50-Ω single ended. Do not apply DC.

DEVICE INFORMATION (continued)

TERMINAL FUNCTIONS (continued)

TERMINAL		I/O	TYPE	DESCRIPTION
NAME	NO.			
V+LOA	10	I	Power	A band LO amplifier bias +3.3V
V+IF	11	I	Power	IF amplifier bias +3.3V.
V+IFP	12	I	Power	IFP amplifier bias +3.3V.
V+IFN	13	I	Power	IFN amplifier bias +3.3V.
RFA	14	I/O	RF SE	A Band RF Input/Output to PA/LNA. 50-Ω single ended. AC coupled.
V+PA1A	15	I	Power	A band Power amplifier bias +3.3V.
V+GEN	16	I	Power	DC Bias Control Bias +3.3V.
V+PA2A	17	I	Power	A band Power amplifier bias +3.3V.
PABCA	18	-	-	A band PA Bias Control Input
V+PA3A	19	-	-	A band Power amplifier bias +3.3V.
BCOUT	20	O	Analog	Bias Control Output.
BYPIN	21	I	Analog	DC Bias Bypass Input
BYPOUT	22	O	Analog	DC Bias Bypass Output
GND	23, 24	-	-	Connect to ground
RFANTA	25	I/O	RF SE	A band RF in/out to antennas. AC coupled.
V+LNABA	26	I	Power	A and B Band LNA bias +3.3V.
RFANTB	27	I/O	RF SE	B band RF in/out to antennas. AC coupled.
DETN	28	O	Analog	Negative RF power detector output
DETP	29	O	Analog	Positive RF power detector output.
V+PA3B	30	I	Power	B band Power amplifier bias +3.3V.
V+PA2B	31	I	Power	B band Power amplifier bias +3.3V.
BCIN	32	I	Analog	Bias control input
PABCB	33	-	-	B band PA Bias Control Input
V+PA1B	34	I	Power	B band Power amplifier bias +3.3V.
RSVD2	35	-	-	Not Connected for normal operation. Leave Open.
RFB	36	I/O	RF SE	B band RF Input/Output to PA/LNA. 50-Ω single ended. AC coupled.
RXDGC	37	I	Digital	Rx Gain Control. HIGH = minimum gain. LOW = maximum gain
TR	38	I	Digital	Transmit/Receive mode control. HIGH = transmit. LOW = receive.
LOADJB	39	-	-	Not connected for normal operation. Leave Open. B band LO amp bias adjust.
TXGADJB	40	-	-	Not connected for normal operation. Leave open. PAB Amplifier bias adjust.

PRODUCT PREVIEW

ABSOLUTE MAXIMUM RATINGS

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

		UNIT
DC supply voltage, V_{CC}		0 to 6.9 V
DC supply current, I_{CC}		600 mA
RF input power	Any port and any mode	+10 dBm
Digital input voltage, V_{ID}		-0.3 V to 5 V
Junction temperature, T_{JC}		175°C
Thermal resistance junction-to-case, θ_{JC}		35°C/W
Operating temperature, T_A		-20°C to +85°C
Storage temperature, T_{stg}		-40°C to +105°C
Lead temperature	40 sec maximum	+220°C

DC CHARACTERISTICS

TYP ratings are at 25°C and V_{CC} = 3.3 V, MIN and MAX ratings are over operating free-air temperature and voltage ranges (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
V_{CC}	Supply votlage	Specification compliant	2.7	3.3	4.2	V
I_{CC}	Total supply current	B Band, RX Mode		65	105	mA
		A Band, RX Mode		80	120	mA
		B Band, TX Mode, Max PABC input		410	520	mA
		A Band, TX Mode, Max PABC input		450	550	mA
V_{IH}	High-level input voltage		1.7			V
V_{IL}	Low-level input voltage				0.5	V
I_{IH}	High-level input current			100	300	µA
I_{IL}	Low-level input current				-50	µA

RECEIVER CHARACTERISTICS

TR = Low, 2dB base band filter loss in RX band, MIN, TYP, and MAX rating are at 25°C and V_{CC} = 3.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{IRF}	RF input frequency	B band	2400		2500	MHz
		A band	4900		5900	MHz
f_{LO}	LO input frequency	B band	2774		2874	MHz
		A band	2637		3137	MHz
f_{IF}	IF input frequency			374		MHz
G	Gain	B Band High Gain Mode RXGC=LOW	17	19		dB
		A Band High Gain Mode RXGC=LOW	18	23		dB
ΔG	Gain step size	B Band Low Gain Mode RXGC=HIGH		25		dB
		A Band Low Gain Mode RXGC=HIGH		15		dB
	Noise figure	B Band. Max Gain		4	5	dB
		A Band. Max Gain		6	7.5	dB
	Input P_{-1dB}	B Band High Gain Mode RXGC=LOW	-16	-13		dBm
		B Band Low Gain Mode RXGC=HIGH				dBm
		A Band High Gain Mode RXGC=LOW	-22	-18		dBm
		A Band Low Gain Mode RXGC=HIGH	-16	-13		dBm
	Input 3rd order intercept point	B Band High Gain Mode RXGC=LOW	-6	-2		dBm
		B Band Low Gain Mode RXGC=HIGH	4	8		dBm
		A Band High Gain Mode RXGC=LOW	-12	-8		dBm
		A Band Low Gain Mode RXGC=HIGH	-6	-3		dBm
	RF input return loss	Z = 50 Ω Both Bands, Both Gain modes	8			dB
	LNA out return loss RF	Z = 50 Ω Both Bands, Both Gain modes	9			dB
	Mixer input MX return loss	Z = 50 Ω Both Bands	10			dB

PRODUCT PREVIEW

RECEIVER CHARACTERISTICS (continued)

TR = Low, 2dB base band filter loss in RX band, MIN, TYP, and MAX rating are at 25°C and V_{CC} = 3.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	Output return loss	Measured into 200 Ω differential	10			dB
	LO at MX leakage	B band		-30		dBm
		A Band (5274-6274MHz)		-30		dBm
	LO at IF leakage	Both bands		-40		dBm
	Gain flatness full band	B band		1		dB
		A band		2		dB
	Gain flatness / 22 MHz	Both bands				dB
	Gain settling time	Full range to within 0.5 dB final. All bands		0.3		µs
	RF to RFANT isolation	In Band: B Band High Gain Mode RXGC=LOW		30		dB
		In Band: B Band Low Gain Mode RXGC=HIGH		5		dB
		In Band: A Band High Gain Mode RXGC=LOW		25		dB
		In Band: A Band Low Gain Mode RXGC=HIGH		35		dB

TRANMITTER CHARACTERISTICS

TR = High, 2dB base band filter loss in RX band, MIN, TYP, and MAX rating are at 25°C and V_{CC} = 3.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
f_{IF}	IF input frequency			374		MHz
f_{ORF}	RF output frequency	B band	2400		2500	MHz
		A band	4900		5900	MHz
f_{LO}	LO input frequency	B band	2774		2874	MHz
		A band	2637		3137	MHz
G	Gain	B Band	37	40		dB
		A Band	40	43		dB
	Output 1 dB gain compression	B band. max PABC input	22	23.5		dBm
		A band. max PABC input	20.5	22.5		dBm
		5150 – 5350 MHz Max PABC input, V+PA = 2.9V min, Other V_{CC} = 2.7V min	20.5	22.5		dBm
	Output 3rd order intercept	B band	32	35		dBm
		A band	30	32.5		dBm
	Noise figure	Both bands		8		dB
	IF input return loss	Measured into 200 Ω differential	8			dB
	Mixer output return loss MX	Z = 50 Ω both bands	10			dB
	RF input return loss RF	Z = 50 Ω both bands	8			dB
	RFANT return loss	Z = 50 Ω both bands	6			dB
	LO leakage at MX	B band		-35		dBm
		A band (5274-6274MHz)		-35		dBm
	Gain flatness full band	B band		1		dB
		A band		2		dB
	Gain flatness / 22 MHz	Both bands				dB
	PA harminics	Both bands CW at P1dB			-20	dBc

PRODUCT PREVIEW

TRANMITTER CHARACTERISTICS (continued)

TR = High, 2dB base band filter loss in RX band, MIN, TYP, and MAX rating are at 25°C and V_{CC} = 3.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	RFANT to RF isolation	B band		50		dB
		A band		50		dB
	PA Off Isolation RF to RFANT	In band: both bands	50			dB
	PA Turn On Time	To within 0.5dB max power		0.2		µs
	PA Turn Off Time	To within -20dB max power		0.2		µs
	PA droop	From max power after turn-on time, Maximum on duration is 200 ms			0.5	dB
	PA Bias Control Input Range (PABC)	Max Current corresponds to max PA bias state				mA

COMMON ELECTRICAL CHARACTERISTICS

MIN, TYP, and MAX ratings are at 25°C and V_{CC} = 3.3 V (unless otherwise noted)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
	TR_SEL switch time	Gain within 0.5dB. Not Including PA ramp time		0.3	1	µs
	AB_SEL switch time				1	µs
	LO input power	Reference to 100 Ω differential	-1		5	dBm
	LO input return loss	Measured to 100 Ω differential at 25°C	6			
	IF port impedance	Differential		200		Ω
	LO port impedance			100		Ω

PRODUCT PREVIEW

TYPICAL CHARACTERISTICS

A Band Detector Output

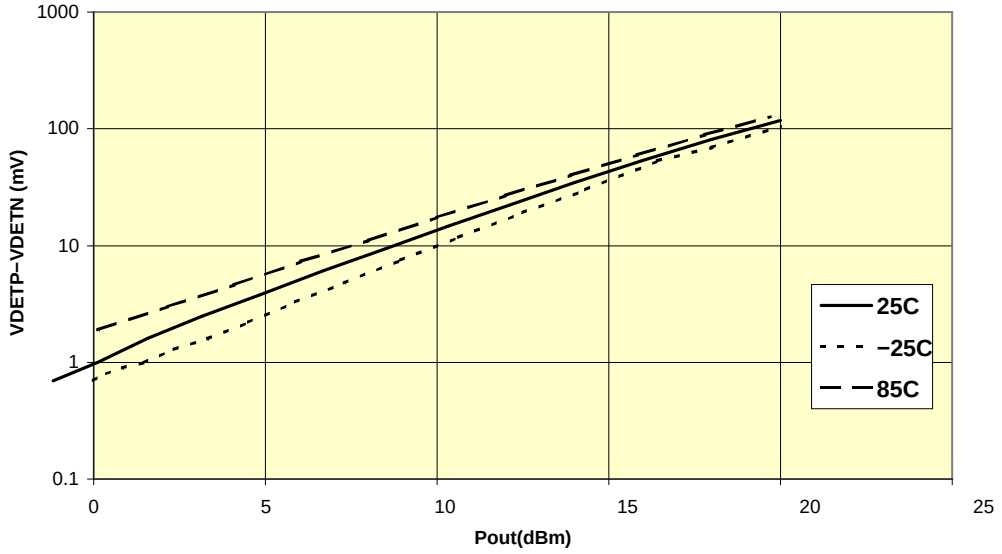


Figure 1. A Band Detector Output

TYPICAL CHARACTERISTICS (continued)

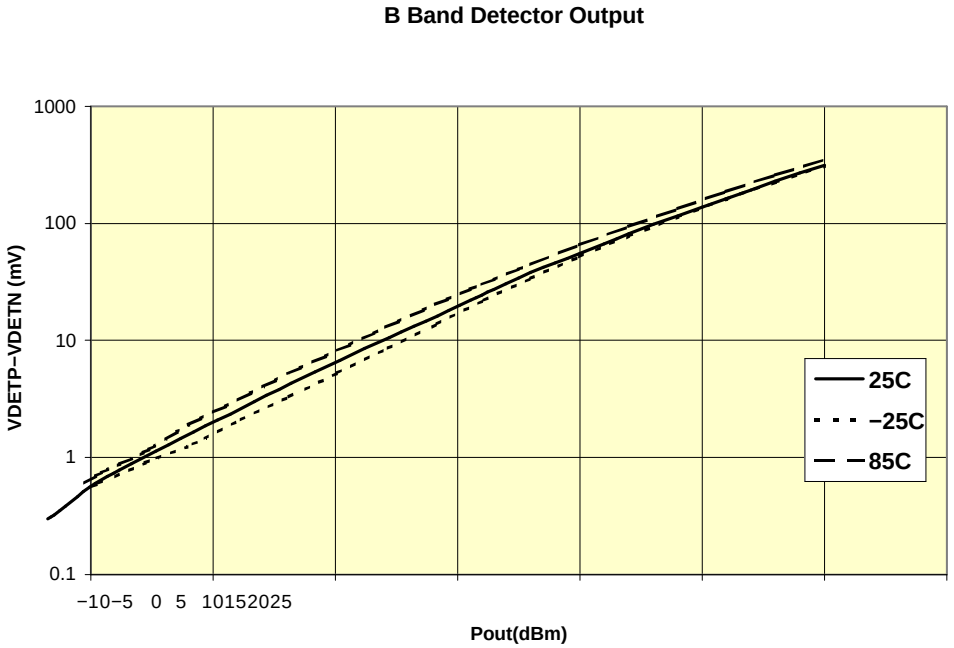


Figure 2. B Band Detector Output

APPLICATION INFORMATION

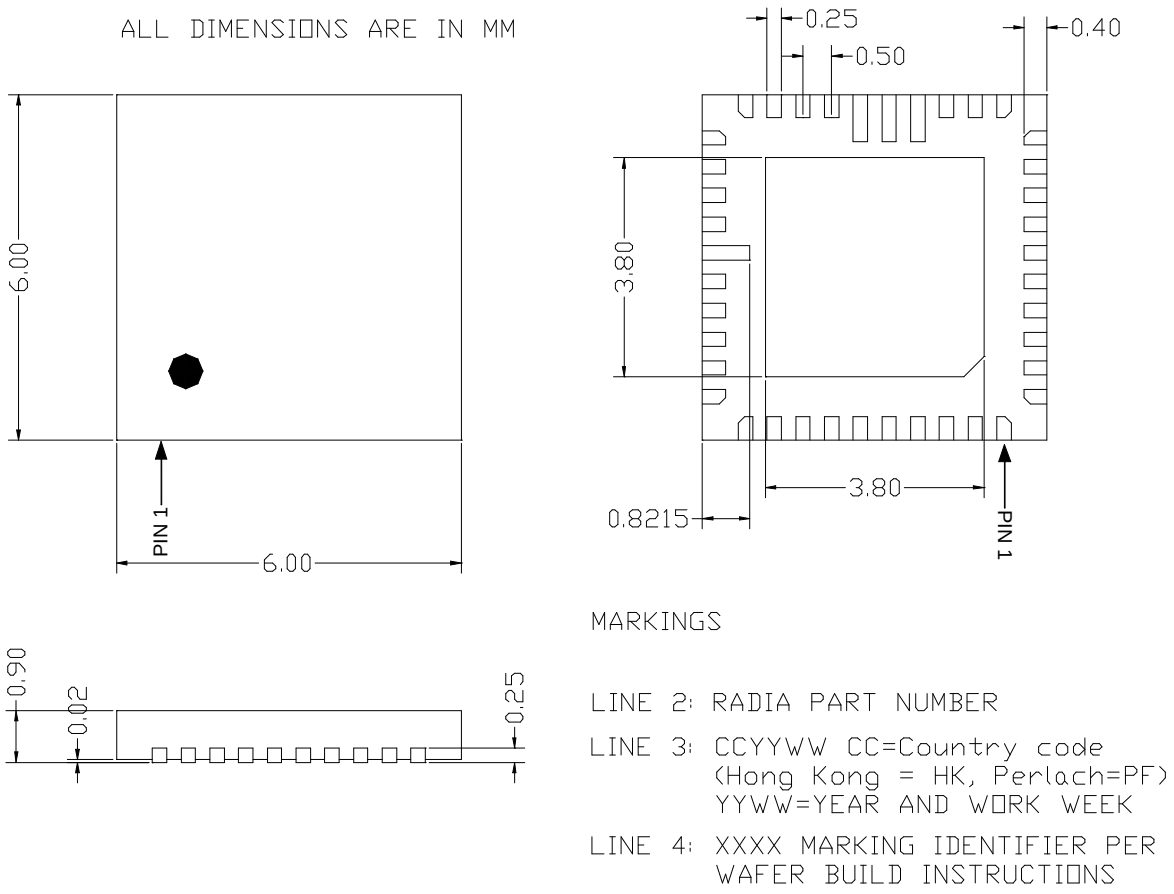
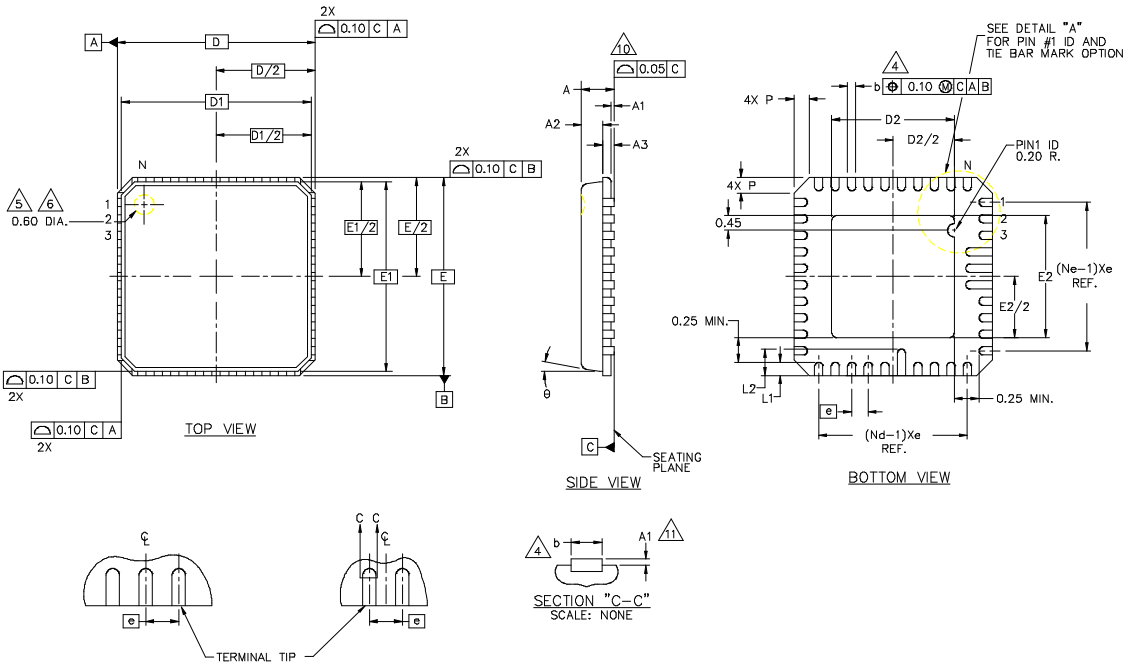


Figure 3. Package Dimensions

PRODUCT PREVIEW

APPLICATION INFORMATION (continued)



SYMBOL	COMMON DIMENSIONS			NOTE
	MIN.	NOM.	MAX.	
A	–	0.85	0.90	
A1	0.00	0.01	0.05	11
A2	–	0.65	0.70	
A3		0.20 REF.		
D		6.00 BSC		
D1		5.75 BSC		
E		6.00 BSC		
E1		5.75 BSC		
θ	10°	–	12°	
e		0.50 BSC		
N		40		3
Nd		10		3
Ne		10		3
L1	0.30	0.40	0.50	
L2	0.70	0.80	0.90	
b	0.18	0.25	0.30	4
D2	3.60	3.70	3.80	
E2	3.60	3.70	3.80	

NOTES:

2. DIMENSIONING & TOLERANCES CONFORM TO ASME Y14.5M. – 1994.
3. N IS THE NUMBER OF TERMINALS.
   Nd IS THE NUMBER OF TERMINALS IN X–DIRECTION &
   Ne IS THE NUMBER OF TERMINALS IN Y–DIRECTION.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25mm FROM TERMINAL TIP.
5. PACKAGE BY USING INDENTATION MARK OR OTHER FEATURE OF PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. ALL DIMENSIONS ARE IN MILLIMETERS.
8. THE SHAPE SHOWN ON FOUR CORNERS ARE NOT ACTUAL I/O.
9. PACKAGE WARPAGE MAX 0.05mm.
10. APPLIED FOR EXPOSED PAD AND TERMINALS.
    EXCLUDE EMBEDDING PART OF EXPOSED PAD FROM MEASURING.
11. APPLIED ONLY FOR TERMINALS.

Figure 4. Package Dimensions (Lead Free)

PRODUCT PREVIEW

APPLICATION INFORMATION (continued)

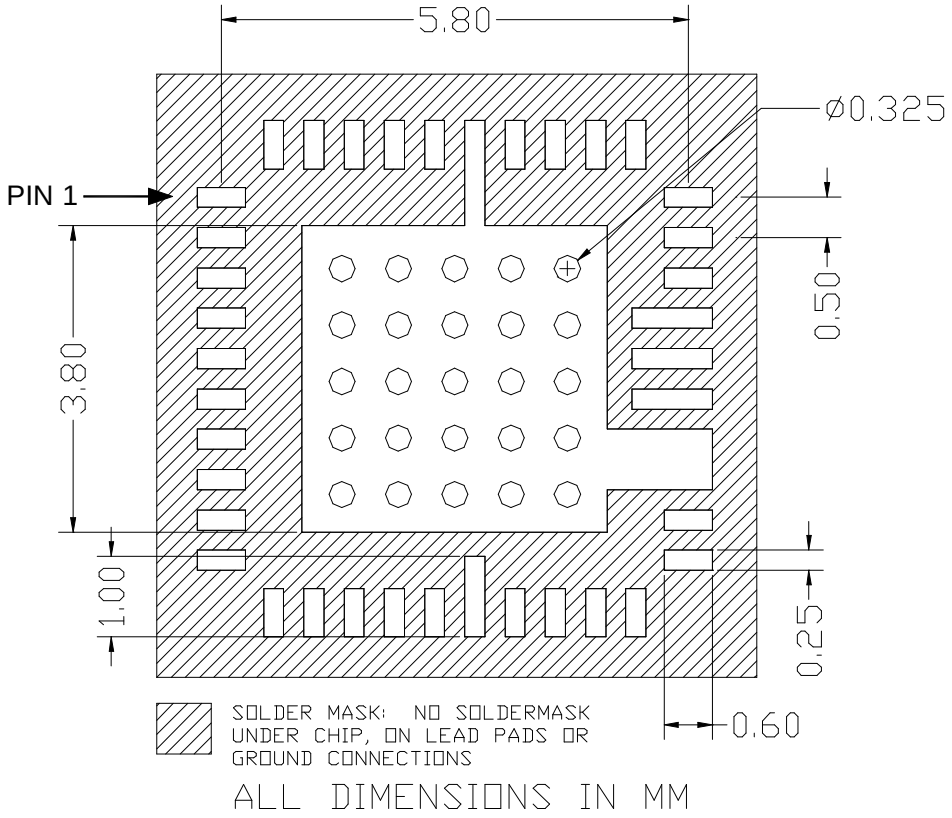
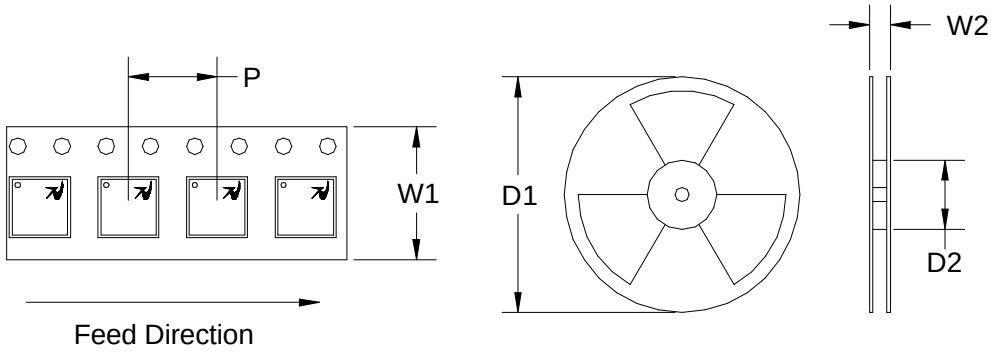


Figure 5. Recommended PCB Layout



Tape and Reel specifications defined per EIA−481−1A and EIA−481−2A.

Package Description	Parts per Reel	Pitch P (mm)	Tape Width W1 (mm)	Reel Size D (Inches)	Reel Width W2 (mm)	Hub Dia. D2 (mm)
6mm x 6mm LPCC40 Pin	3500	12	16	13	18.2	102

Figure 6. Tape and Reel Specifications

PRODUCT PREVIEW

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