

Product Description:

The TQ7M35 is a 2.7VDC SiGe HBT transmitter designed for use in CDMA mobile phones. Its RF performance meets the requirements for products designed to IS-95/98 standards. It incorporates the complete transmitter chain for dual-band triple-mode CDMA phones. The device integrates an I/Q modulator, variable gain amplifier (VGA), two single side-band up-conversion mixers with fully integrated LO phase shifters, and a voltage controlled oscillator. It also includes a complete PLL with dividers, phase-frequency detector (PFD), and a charge pump.

The TQ7M35 provides programmable output power in cellular and PCS bands. The IC is available in a small 5x5mm, lead-less 32pin quad flat package.

Electrical Specifications:

Parameter	Min	Typ	Max	Units
Frequency Ranges-Cell Band	824		849	MHz
Frequency Ranges-PCS Band	1750		1910	MHz
CDMA mode/Cell Band Pout ¹		8		dBm
CDMA Mode/Cell Band ACPR ¹		54		dBc
CDMA Mode/PCS Band Pout ²		8		dBm
CDMA Mode/PCS Band ACPR ²		54		dBc
Current consumption		103		mA

Note 1: Test Conditions CDMA Mode/Cell Band: V_{CC} = 3.00VDC, T_c = 25°C

Note 2: Test Conditions CDMA Mode/PCS Band: V_{CC} = 3.00VDC, T_c = 25°C

For additional information and latest specifications, see our website: www.triquint.com

TQ7M35

DATA SHEET

3V HBT SiGe CDMA Transmitter

Features

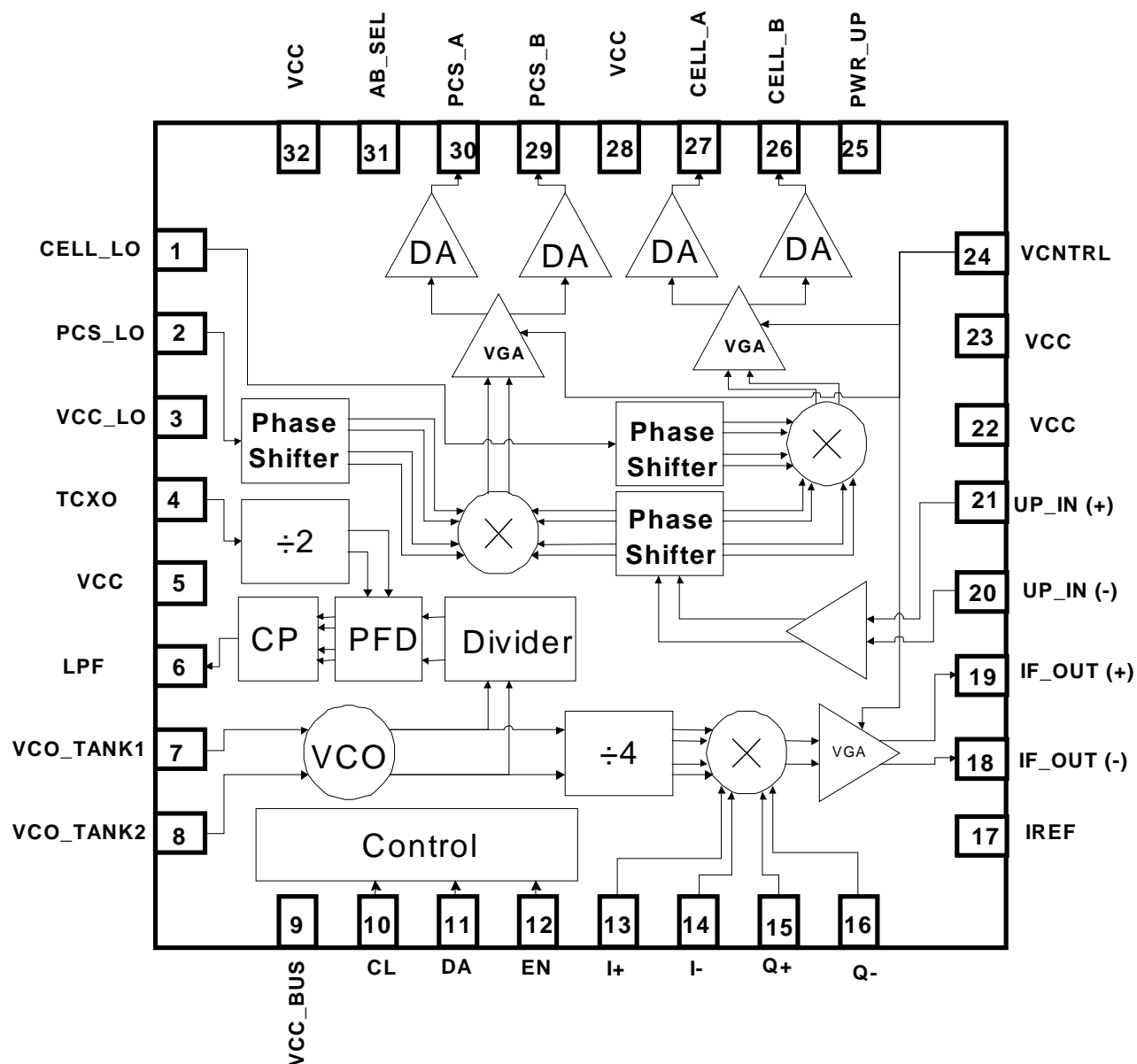
- Low 2.7VDC Operation
- Single Side-band Up-converters
- 100dB of Dynamic Range
- Low Current Consumption
- Individual Block Power Down Capability
- On-chip PLL
- 3-wire bus, 4 bit programming
- Full ESD Protection

Applications

- Dual Mode and Tri Mode CDMA/AMPS phones

TQ7M35 - Preliminary Data Sheet

Package Pinout:



Pin Descriptions:

Pin Name	Pin #	Description and Usage (Equivalent Circuit)
CELL_LO	1	Local oscillator CELL band input
PCS_LO	2	Local oscillator PCS band input
V _{CC}	3	Regulated power supply
TCXO	4	Reference oscillator input
V _{CC}	5	Regulated power supply
LPF	6	Charge-pump loop filter
VCO_TANK1	7	Voltage controlled oscillator external tank circuit
VCO_TANK2	8	Voltage controlled oscillator external tank circuit
V _{CC_BUS}	9	Serial bus interface regulated power supply
CL	10	Serial bus interface clock input
DA	11	Serial bus interface data input
EN	12	Serial bus interface enable strobe input
I+	13	I+ data differential signal input
I-	14	I- data differential signal input
Q+	15	Q+ data differential signal input
Q-	16	Q- data differential signal input
I _{ref}	17	Constant current sink
IF_OUT(-)	18	IF section differential output
IF_OUT(+)	19	IF section differential output
UP_IN(+)	20	Up-converter input
UP_IN(-1)	21	Up-converter input
V _{CC}	22	Regulated power supply
V _{CC}	23	Regulated power supply
V _{CNTRL}	24	Gain control analog voltage input
PWR_UP	25	Power-up logic control signal input. Logic high will power up the integrated circuit except the phase lock loop circuitry and logic low will power down the integrated circuit except the phase lock loop circuitry.
CELL_B	26	CELL band driver amplifier B open collector power output
CELL_A	27	CELL band driver amplifier A open collector power output
V _{CC}	28	Regulated power supply
PCS_B	29	PCS band driver amplifier B open collector power output
PCS_A	30	PCS band driver amplifier A open collector power output
AB_Sel	31	Channel select logic control. Logic low will turn-on the A driver output and logic high will enable the B driver output.
V _{CC}	32	Regulated power supply
GND	Paddle	Ground. TriQuint recommends use of several via holes to the backside ground under the Paddle.

TQ7M35 - Preliminary Data Sheet

Output Electrical Characteristics^{1,2}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Cell Band RF Output (CELL_A, pin #27 and CELL_B, pin #26)					
Cell Band RF Output Frequency Range		824		849	MHz
Cell Band RF Output Power	High Power (Pout=7.7dBm)		7.7		dBm
Cell Band RF Output Adjacent Channel Power	High Power Power (Pout=7.7dBm)		-54		dBc
Cell Band RF Output Receive Band Noise	High Power Power (Pout=7.7dBm)		-130		dBm/Hz
PCS Band RF Output (PCS_A, pin #30 and PCS_B, pin #29)					
PCS Band RF Output Frequency Range		1750		1910	MHz
PCS Band RF Output Power	High Power (Pout=8.2dBm)		8.2		dBm
PCS Band RF Output Adjacent Channel Power	High Power (Pout=8.2dBm)		-54		dBc
PCS Band RF Output Receive Band Noise	High Power (Pout=8.2dBm)		-132		dBm/Hz
IF Section Outputs (IF_OUT(+), pin #19 and IF_OUT(-), pin #18)					
IF Section Frequency Range			130.38		MHz
IF Section Output Power			-13		dBm
IF Section Adjacent Channel Power	400 Ohm differential load		-63		dBc
IF Section Carrier Suppression	I/Q input: Differential Sin and Cos signals with 200 mV amplitude (400 mVpp) and 100kHz frequency from a low ohmic source (<1kOhm)		-35		dBc
IF Section Sideband Suppression	I/Q input: Differential Sin and Cos signals with 200 mV amplitude (400 mVpp) and 100kHz frequency from a low ohmic source (<1kOhm)		-50		dBc

Output Electrical Characteristics^{1,2} (cont'd)

IF Section spurious	I/Q input: Differential Sin and Cos signals with 200 mV amplitude (400 mVpp) and 100kHz frequency from low ohmic source (<1kOhm)	-60			dBc
IF Section Modulator Noise	@5MHz off carrier	142			dBm/Hz

Note 1: Test Conditions: $V_{CC}=3.00VDC$, TriQuint Test Board, $T_c=25^{\circ}C$ unless otherwise specified.

Note 2: Min./Max. limits are at $+25^{\circ}C$ case temperature unless otherwise specified.

Up-converter Electrical Characteristics^{1,2}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Cellular Band Up-Converter					
Cellular Up-Converter output frequency		824		849	MHz
Cellular Up-Converter IF input power at UP_IN(+) and UP_IN(-)	$f_{IF}=130.38MHz$		-16		dBm
Cellular Up-Converter Mixer LO Input Power at Cell_LO	$f_{LO}=954MHz$ to 979MHz	-10	-3		dBm
Cellular Up-converter LO-Leakage at Cell_A or Cell_B	$P_{LO}=-3dBm$		-25	-20	dBm
Cellular Up-converter Image Rejection at Cell_A or Cell_B	$P_{RF_OUT}=+7.7dBm$		-35	-30	dBc
PCS Band Up-Converter					
PCS Up-Converter output frequency		1750		1910	MHz
PCS Up-Converter IF input power at UP_IN(+) and UP_IN(-)	$f_{IF}=130.38MHz$		-16		dBm
PCS Up-Converter Mixer LO Input Power at PCS_LO	$f_{LO}=1620MHz$ to 1780MHz	-10	-3		dBm
PCS Up-converter LO-Leakage at PCS_A or PCS_B	$P_{LO}=-3dBm$		-25	-20	dBm
PCS Up-converter Image Rejection at PCS_A or PCS_B	$P_{RF_OUT}=+8.2Bm$		-35	-30	dBc

Note 1: Test Conditions: $V_{CC}=3.00VDC$, TriQuint Test Board, $T_c=25^{\circ}C$ unless otherwise specified.

Note 2: Min./Max. limits are at $+25^{\circ}C$ case temperature unless otherwise specified.

TQ7M35 - Preliminary Data Sheet

Absolute Maximum Ratings

Parameter	Absolute Maximum Value	Units
Supply Voltages (All Vcc pins)	4.0	VDC
Current at any input/output pin	40	mA
Case Temperature, Survival	-30 to +85	°C
Storage Temperature	-40 to +150	°C

Note: The part may not survive all maximums applied simultaneously.

Operating Range

Parameter	Range	Units
Supply Voltages (All Vcc pins)	2.7 to 3.3	VDC
Case Temperature	-30 to 85	°C

DC Supply Electrical Characteristics^{1,2,3}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Supply Voltages (All Vcc pins)		2.7		3.3	VDC
Cell Band Mode Current Consumption (Driver A or Driver B activated)	High Power ($P_{wr_up}=1$, $Bit1=0$, $Bit2=0$, $AB_SEL=high$ or low, $P_{out}=7.7dBm$)		103		mA
	Low Power ($P_{wr_up}=1$, $Bit1=0$, $Bit2=0$, $AB_SEL=high$ or low, $P_{out}=-90dBm$)		90		mA
PCS Band Mode Current Consumption (Driver A or Driver B activated)	High Power ($P_{wr_up}=1$, $Bit1=1$, $Bit2=0$, $AB_SEL=high$ or low, $P_{out}=8.2dBm$)		103		mA
	Low Power ($P_{wr_up}=1$, $Bit1=1$, $Bit2=1$, $AB_SEL=high$ or low, $P_{out}=-90$)		90		mA

DC Supply Electrical Characteristics^{1,2,3} (Cont'd)

Cell Band Mode Current Consumption (Driver A and Driver B activated)	High Power ($P_{wr_up}=1$, $Bit1=0$, $Bit2=1$, $P_{out}=10.7dBm$)	120	mA
	Low Power ($P_{wr_up}=1$, $Bit1=0$, $Bit2=1$, $P_{out}=-87dBm$)	90	mA
PCS Band Mode Current Consumption (Driver A and Driver B activated)	High Power ($P_{wr_up}=1$, $Bit1=1$, $Bit2=1$, $P_{out}=11dBm$)	120	mA
	Low Power ($P_{wr_up}=1$, $Bit1=1$, $Bit2=1$, $P_{out}=-87dBm$)	90	mA
Standby Mode Current Consumption (PLL circuitry, partial IQ modulator circuitry, and Serial Bus Interface activated)	$P_{wr_Up}=low$, $Bit3=1$	12	mA
Serial Bus Current Consumption (Serial Bus Interface activated)	$V_{cc_bus}=High$ (powered on)	0.7	mA
Powered Off	$P_{wr_up}=low$, $bit3=0$, $V_{cc_bus}=low$ (powered off)	<10	μA

Note 1: Test Conditions: $V_{CC}=3.00VDC$, $T_c=25^{\circ}C$ unless otherwise specified.

Note 2: Min./Max. limits are at $+25^{\circ}C$ case temperature unless otherwise specified.

Note 3: TriQuint Test Board.

Analog/RF/IF Input Electrical Characteristics^{1,2,3}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
TCXO Input (TCXO, pin #4)					
TCXO Frequency Range			19.68		MHz
TCXO Input Voltage Range		100	250	600	mVp
Cell LO Input (CELL_LO, pin #1)					
Cell LO Frequency range		954		979	MHz
Cell LO Input Power Range	50 Ω Source	-10	-3		dBm
Cell LO Input Impedance ($Re\{Z_{CELL_LO}\}$)	Cell LO Input Frequency (f_{LOc}) = 966MHz, $P_{wr_Up}=0$ or 1		43		Ω
PCS LO Input (PCS_LO, pin #2)					
PCS LO Frequency range (f_{LOp})		1620		1780	MHz
PCS LO Input Power Range (P_{LOp})	50 Ω Source	-10	-3		dBm
PCS LO Input Impedance ($Re\{Z_{PCS_LO}\}$)	PCS LO Input Frequency (f_{LOp}) = 1750MHz, $P_{wr_Up}=0$ or 1		43		Ω

TQ7M35 - Preliminary Data Sheet

Analog/RF/IF Input Electrical Characteristics^{1,2,3} (cont'd)

Up-Converter Input

(UP_IN(+)--pin #21, UP_IN(-)--pin #20)

Up-converter frequency range (f_{VGA})	400 Ohm Source	130.38	MHz
Up-converter power	400 Ohm Source	-16	dBm
Up-converter input impedance		2000	Ohm

Control Voltage Input

(V_{CNTRL}, pin #24)

Control voltage input voltage range	0	2.5	VDC
Control voltage input impedance		5000	Ohm

I/Q Modulator base-band inputs

(I+, I-, Q+, Q-, pins #13, 14, 15, and 16)

DC Voltage	Referred to GND	1.35	V _{CC} /2	V _{CC} /2 + 0.1	VDC
Frequency Range		0		2MHz	MHz
AC Voltage	Referred to GND		130		mVpp
AC Voltage	Differential		260		mVpp

I/Q Modulator Local Oscillator Input

(VCO_Tank1, pin#7 and VCO_Tank2, pin #8))

Resonator Frequency Range		520	MHz
Resonator Q	Unloaded	40	None

Note 1: Test Conditions: V_{CC}=3.00VDC, T_C=25°C unless otherwise specified.

Note 2: Min./Max. limits are at +25°C case temperature unless otherwise specified.

Note 3: TriQuint Test Board

Logical Input Electrical Characteristics^{1,2,3}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
Logic Input Electrical Characteristics	Applicable to PWR_UP (pin #25), and AB_SEL (pin #31)				
Logical High Voltage Level		$V_{CC} - 0.3$	3	V_{CC}	VDC
Logical Low Voltage Level		0	0	0.3	VDC
Logical Low or High Current Consumption			50		μA

Note 1: Test Conditions: $V_{CC}=3.00VDC$, $T_c=25^{\circ}C$ unless otherwise specified.

Note 2: Min./Max. limits are at $+25^{\circ}C$ case temperature unless otherwise specified.

Note 3: TriQuint Test Board

Logical Input Function Selection Table¹

Logical Input	Logical Low	Description
PWR_UP	High	Transmit integrated circuit powered up
PWR_UP	Low	Transmit integrated circuit powered off (PLL with Bit 3 active)
DRV_SEL	High	Driver B active if Bit 2 is low, no effect if Bit 2 is high
DRV_SEL	Low	Driver A active if Bit 2 is low, no effect if Bit 2 is high

Note 1: A complete truth table is shown below in "Mode Programming Truth Table"

3-Wire Bus Signal Times^{1,2,3}

Parameter	Conditions	Min.	Typ/Nom	Max.	Units
3-Wire Bus	Applicable to CL (pin #10), DA (pin #25), and EN (pin #31)				
Clock Period (TPER)			100		ns
Rise Time (TR)			10		ns
Fall Time (TF)			10		ns
Set time data to clock (TS)			35		ns
Hold time data to clock (TH)			35		ns
Clock pulse width (TC)			50		ns
Set time enable to clock (TL)			40		ns
Set time data to neg. going clock edge (TSC)			10		ns

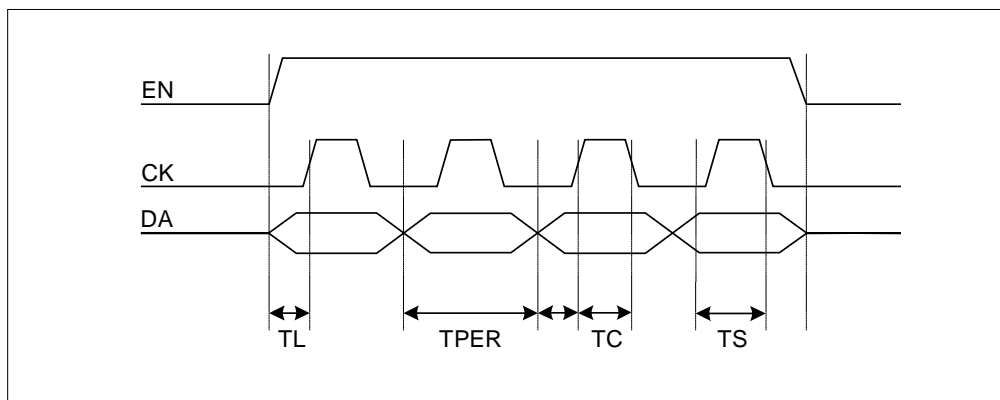
Note 1: Test Conditions: $V_{CC}=3.00VDC$, $T_c=25^{\circ}C$ unless otherwise specified.

Note 2: Min./Max. limits are at $+25^{\circ}C$ case temperature unless otherwise specified.

Note 3: TriQuint Test Board

TQ7M35 - Preliminary Data Sheet

3-Wire Bus Input Timing Diagram



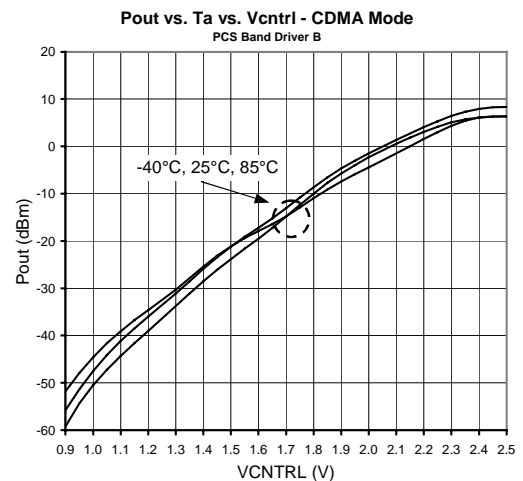
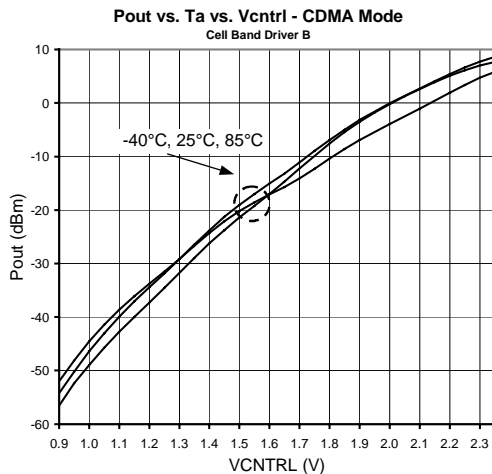
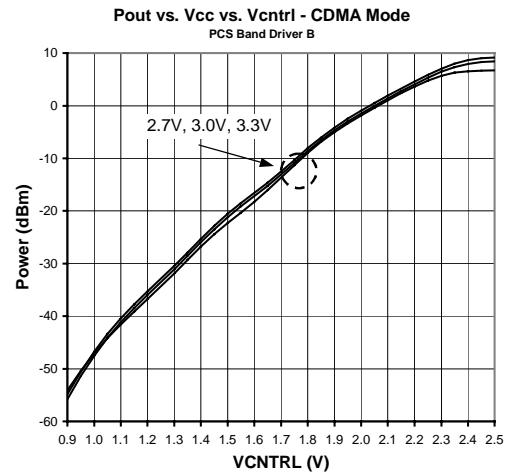
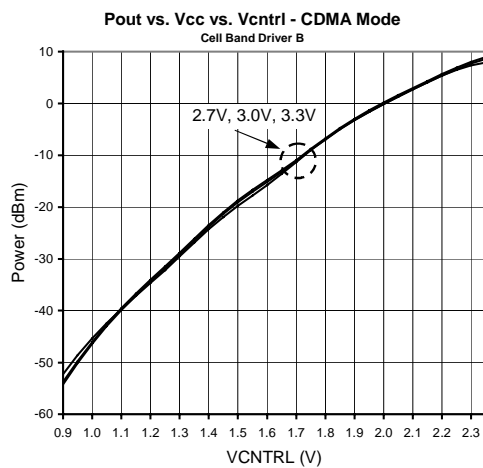
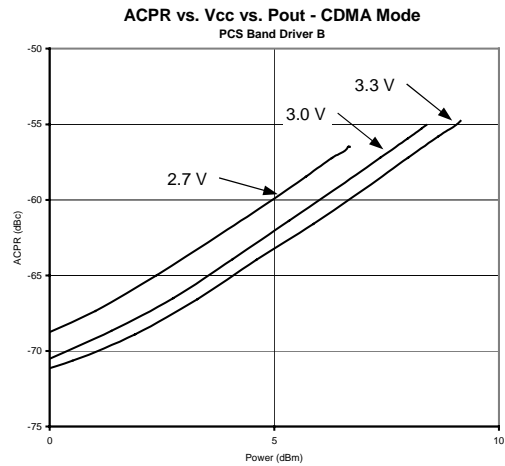
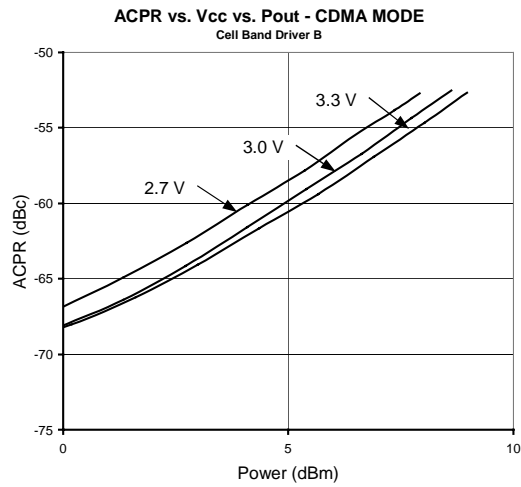
Mode Programming Truth Table¹

Mode		3-Wire Bus Bit Inputs				Logical Inputs	
		Bit 4	Bit 3	Bit 2	Bit 1	PWR_UP	AB_SEL
PLL Off	PLL circuitry and partial IQ modulator circuitry deactivated	X	0	X	X	X	X
PLL On	PLL circuitry and partial IQ modulator circuitry activated	X	1	X	X	X	X
Transmitter On	Complete IQ modulator circuitry, RF up-converters, and IF VGA activated	X	X	X	X	High	X
Transmitter Off	Complete IQ modulator circuitry, RF up-converters, and IF VGA deactivated	X	X	X	X	Low	X
Cell Mode	Driver A (Cell Band DA A activated)	X	X	0	0	High	Low
	Driver B (Cell Band DA B activated)	X	X	0	0	High	High
	Driver A and B (Cell Band DA A and B activated)	X	X	1	0	High	X
PCS Mode	Driver A (PCS Band DA A activated)	X	X	0	1	High	Low
	Driver B (Cell Band DA B activated)	X	X	0	1	High	High
	Driver A and B (Cell Band DA A and B activated)	X	X	1	1	High	X

¹The symbol X ("don't care") means a logic input does not affect an operating mode.

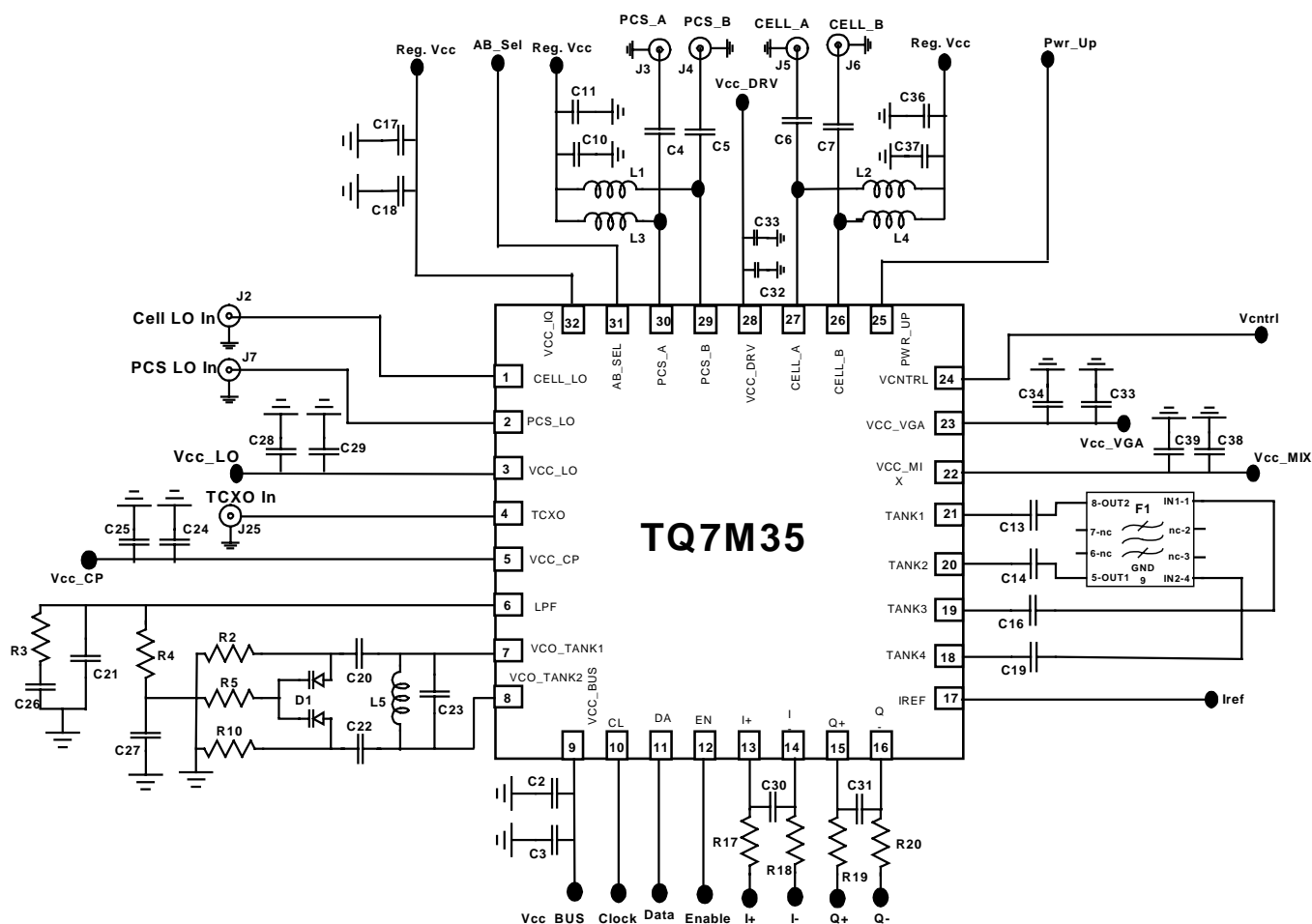
Measured Performance, CDMA Modulation:

Test Conditions (Unless Otherwise Specified): $V_{CC}=3.0VDC$, $T_C=+25^{\circ}C$, Cell Band freq=836MHz, PCS Band freq=1880MHz



TQ7M35-Preliminary Data Sheet

Application/Test Circuit:



Bill of Material for TQ7M35 CDMA Transmitter*

Component	Reference Designator	Part Number	Value	Size
CDMA Transmitter		TQ7M35		32pin/5mm square
RF Connectors	J2, J3, J4, J5, J6, J7, J25			
Capacitor	C23		1.2pF	0402
Capacitor	C21		6.8pF	0402
Capacitor	C20, C22, C27		8.2pF	0402
Capacitor	C4, C5		22pF	0402
Capacitor	C30, C31		68pF	0402

Bill of Material for TQ7M35 CDMA Transmitter* (cont'd)

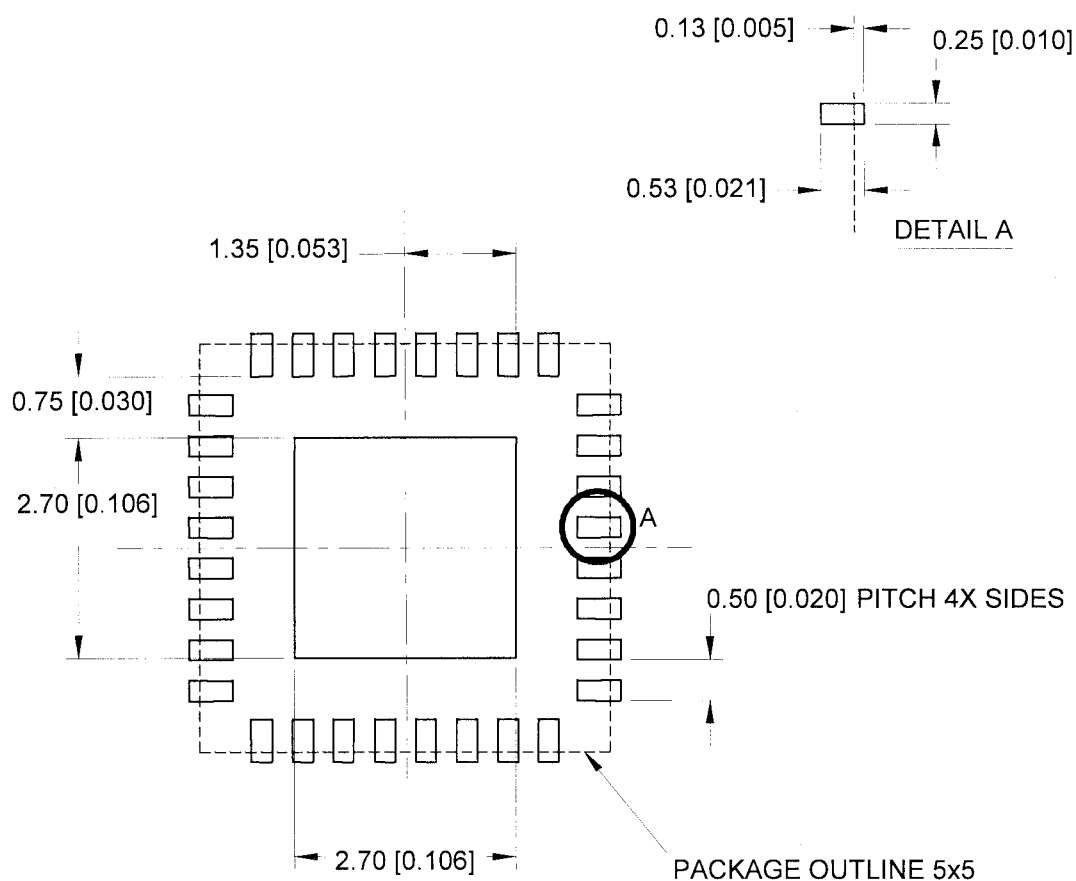
Component	Reference Designator	Part Number	Value	Size
Capacitor	C2, C6, C7, C8, C11, C18, C24, C29, C32, C34, C37, C39		100pF	0402
Capacitor	C26		120pF	0402
Capacitor	C13, C14, C16, C19		10nF	0402
Capacitor	C3, C9, C10, C17, C25, C28, C33, C35, C36, C38		100nF	0402
Resistor	R5, R17, R18, R19, R20		1K Ohm	0402
Resistor	R2, R10		2.7K Ohm	0402
Resistor	R4		3.3K Ohm	0402
Resistor	R3		27K Ohm	0402
Inductor	L1, L3		4.7nH	0402
Inductor	L2, L4		15nH	0402
Inductor	L5	0603CS-18NX Coilcraft	18nH	0603
Varactor-Diode	D1	Alpha SMV1235-074		
Filter	F1	LFSH30N/nc (Murata)	130.38MHz	LFSH30

*May vary due to printed circuit board layout and material

TQ7M35-Preliminary

Data Sheet

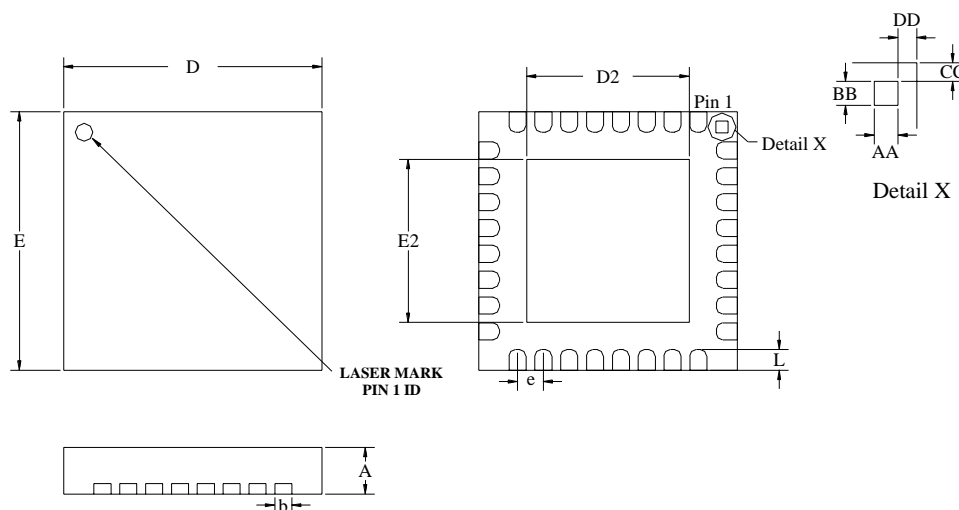
Recommended PC board layout to Accept 32 Pin Plastic Package:



Notes:

- 1 Only ground signal traces are allowed directly under the package
- 2 Primary dimensions are in millimeters alternate dimensions in brackets are in inches.

Package Type: 32 Pin Lead-less Plastic Package



JEDEC DESIGNATION	DESCRIPTION	METRIC	ENGLISH	NOTE
A	OVERALL HEIGHT	0.90 +/- .10 mm	.035 +/- .004 in	1
b	TERMINAL WIDTH	0.23 +/- .07 mm	.009 +/- .003 in	1
D	PACKAGE LENGTH	5.00 mm BSC	.197 in	1
D2	EXPOSED PAD LENGTH	3.45 +/- .10 mm	.136 +/- .004 in	1
e	TERMINAL PITCH	0.50 mm BSC	.020 in	1
E	PACKAGE WIDTH	5.00 mm BSC	.197 in	1
E2	EXPOSED PAD WIDTH	3.45 +/- .10 mm	.136 +/- .004 in	1
L	TERMINAL LENGTH	0.40 +/- .10 mm	.016 +/- .004 in	1
AA	PIN 1 ID LENGTH	0.23 mm BSC	.009 in	1
BB	PIN 1 ID WIDTH	0.23 mm BSC	.009 in	1
CC	PIN 1 ID TO EDGE	0.18 mm BSC	.007 in	1
DD	PIN 1 ID TO EDGE	0.18 mm BSC	.007 in	1

Notes: Primary dimensions are in metric millimeters. The English equivalents are calculated and subject to rounding error.

Additional Information

For latest specifications, additional product information, worldwide sales and distribution locations, and information about TriQuint:

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