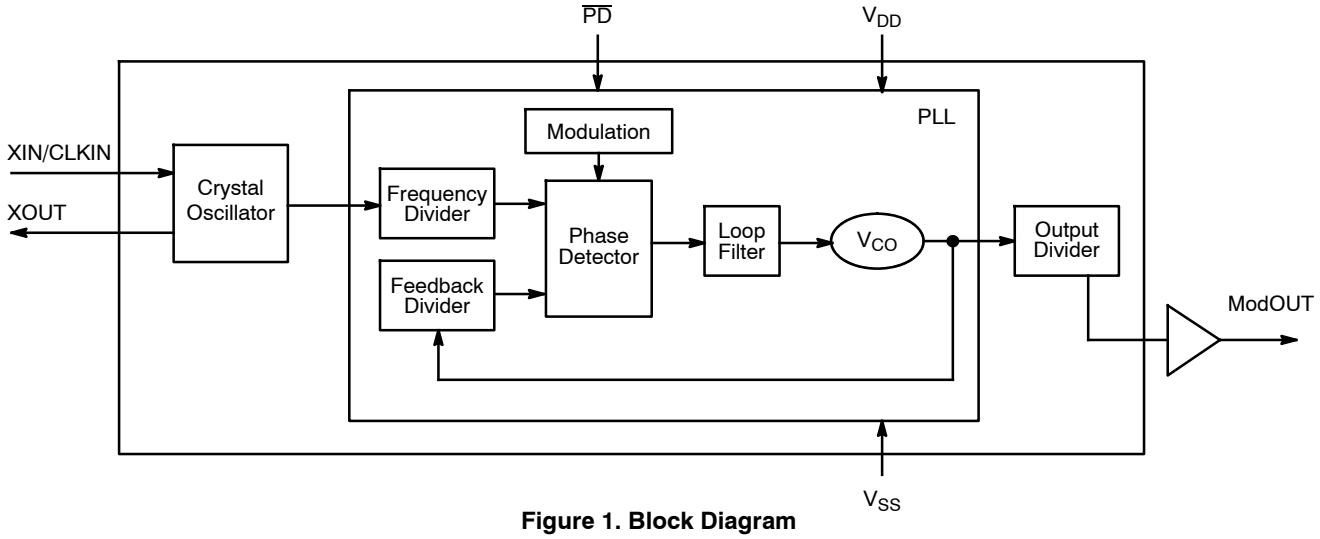


Figure 1. Block Diagram

Table 1. KEY SPECIFICATIONS

Description	Specification
Supply Voltages	V_{DD} = 3.3 V / 2.5 V
Frequency Range	30 MHz < CLKIN < 50 MHz
Cycle−to−Cycle Jitter	200 ps (maximum)
Output Duty Cycle	45/55% (worst case)
Modulation Rate Equation	F_{IN}/1280
Frequency Deviation	±0.75% (TYP) @ 46 MHz

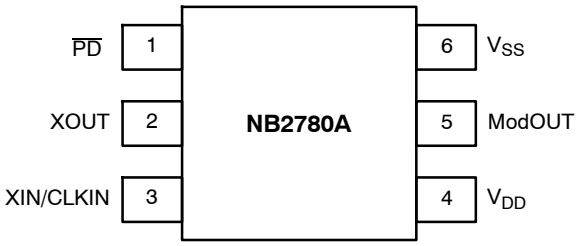


Figure 2. Pin Configuration

Table 2. PIN DESCRIPTION

Pin #	Pin Name	Type	Description
1	$\overline{PD}$	I	Powerdown control pin. Pull low to enable Powerdown mode. Connect to V_{DD} if not used.
2	XOUT	O	Crystal connection. If using an external reference, this pin must be left unconnected.
3	XIN/CLKIN	I	Crystal connection or external reference frequency input. This pin has dual functions. It can be connected either to an external crystal or an external reference clock
4	V_{DD}	P	Power supply for the entire chip.
5	ModOUT	O	Spread spectrum clock output.
6	V_{SS}	P	Ground connection.

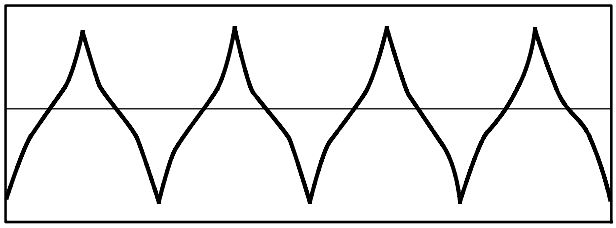


Figure 3. Modulation Profile

Table 3. MAXIMUM RATINGS

Symbol	Description	Rating	Unit
V_{DD}, V_{IN}	Voltage on any pin with respect to Ground	0.5 to + 7.0	V
T_{STG}	Storage Temperature	−65 to +125	°C
T_A	Operating Temperature	0 to 70	°C
T_s	Max. Soldering Temperature (10 sec)	260	°C
T_J	Junction Temperature	150	°C
T_{DV}	Static Discharge Voltage (As per MIL−STD−883, Method 3015)	2	kV

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

Table 4. DC ELECTRICAL CHARACTERISTICS FOR 2.5 V SUPPLY (Test Conditions: All parameters are measured at room temperature 25°C)

Symbol	Description	Min	Typ	Max	Unit
V_{IL}	Input LOW Voltage	GND − 0.3		0.8	V
V_{IH}	Input HIGH Voltage	2.0		V_{DD} + 0.3	V
I_{IL}	Input LOW Current			−35	μA
I_{IH}	Input HIGH Current			35	μA
I_{XOL}	XOUT Output LOW Current (@ 0.6 V, V_{DD} = 2.5 V)		3.0		mA
I_{XOH}	XOUT Output HIGH Current (@ 1.8 V, V_{DD} = 2.5 V)		3.0		mA
V_{OL}	Output LOW Voltage (V_{DD} = 2.5 V, I_{OL} = 8.0 mA)			0.6	V
V_{OH}	Output HIGH Voltage (V_{DD} = 2.5 V, I_{OH} = 8.0 mA)	1.8			V
I_{DD}	Static Supply Current (Note 1)			10	μA
I_{CC}	Dynamic Supply Current (2.5 V, 46 MHz, and No Load)		4.0		mA
V_{DD}	Operating Voltage	2.375	2.5	2.625	V
t_{ON}	Powerup Time (first locked cycle after powerup) (Note 2)			5.0	mS
Z_{OUT}	Clock Output Impedance		50		Ω

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

1. XIN/CLKIN pin and $\overline{PD}$ are pulled low.
2. V_{DD} and XIN/CLKIN input are stable, $\overline{PD}$ pin is made high from low.

Table 5. AC ELECTRICAL CHARACTERISTICS FOR 2.5 V SUPPLY

Symbol	Description	Min	Typ	Max	Unit
CLKIN	Input Frequency	30		50	MHz
ModOUT	Output Frequency	30		50	MHz
f_d	Frequency Deviation Input Frequency = 30 MHz Input Frequency = 50 MHz			±1.10 ±0.62	%
t_{LH} (Note 3)	Output Rise Time (measured at 0.7 V to 1.7 V)	0.7	1.3	1.6	ns
t_{HL} (Note 3)	Output Fall Time (measured at 1.7 V to 0.7 V)	0.4	0.8	1.0	ns
t_{JC}	Jitter (Cycle−to−Cycle)			200	ps
t_D	Output Duty Cycle	45	50	55	%

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

3. t_{LH} and t_{HL} are measured at capacitive load of 15 pF.

Table 6. DC ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY (Test Conditions: All parameters are measured at room temperature 25°C)

Symbol	Description	Min	Typ	Max	Unit
V_{IL}	Input LOW Voltage	GND − 0.3		0.8	V
V_{IH}	Input HIGH Voltage	2.0		V_{DD} + 0.3	V
I_{IL}	Input LOW Current			−35	μA
I_{IH}	Input HIGH Current			35	μA
I_{XOL}	XOUT Output LOW Current (@ 0.4 V, V_{DD} = 3.3 V)		3.0		mA
I_{XOH}	XOUT Output HIGH Current (@ 2.5 V, V_{DD} = 3.3 V)		3.0		mA
V_{OL}	Output LOW Voltage (V_{DD} = 3.3 V, I_{OL} = 8.0 mA)			0.4	V
V_{OH}	Output HIGH Voltage (V_{DD} = 3.3 V, I_{OH} = 8.0 mA)	2.5			V
I_{DD}	Static Supply Current (Note 4)			10	μA
I_{CC}	Dynamic Supply Current (3.3 V, 46 MHz, and No Load)		5.0		mA
V_{DD}	Operating Voltage	2.7	3.3	3.6	V
t_{ON}	Powerup Time (first locked cycle after powerup) (Note 5)			5.0	mS
Z_{OUT}	Clock Output Impedance		45		Ω

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

4. XIN/CLKIN pin and $\overline{PD}$ are pulled low.
5. V_{DD} and XIN/CLKIN input are stable, $\overline{PD}$ pin is made high from low.

Table 7. AC ELECTRICAL CHARACTERISTICS FOR 3.3 V SUPPLY

Symbol	Description	Min	Typ	Max	Unit
CLKIN	Input Frequency	30		50	MHz
ModOUT	Output Frequency	30		50	MHz
f_d	Frequency Deviation Input Frequency = 30 MHz Input Frequency = 50 MHz			±1.10 ±0.62	%
t_{LH} (Note 6)	Output Rise Time (measured at 0.8 V to 2.0 V)	0.5	1.1	1.4	ns
t_{HL} (Note 6)	Output Fall Time (measured at 2.0 V to 0.8 V)	0.3	0.8	1.1	ns
t_{JC}	Jitter (Cycle−to−Cycle)			200	ps
t_D	Output Duty Cycle	45	50	55	%

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfpm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

6. t_{LH} and t_{HL} are measured at capacitive load of 15 pF.

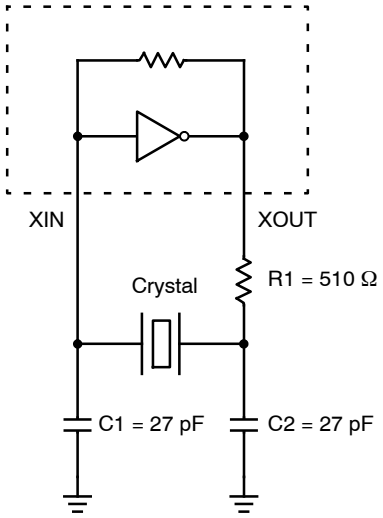


Figure 4. Typical Crystal Oscillator Circuit

Table 8. TYPICAL CRYSTAL SPECIFICATIONS

Fundamental AT Cut Parallel Resonant Crystal	
Nominal Frequency	33 MHz
Frequency Tolerance	±50 ppm or better at 25°C
Operating Temperature Range	−25°C to +85°C
Storage Temperature	−40°C to +85°C
Load Capacitance	18 pF
Shunt Capacitance	7 pF Maximum
ESR	25 Ω

ORDERING INFORMATION

Device	Marking	Temperature Range	Package	Shipping†	Availability
NB2780ASNR2	E07	0°C – 70°C	TSOP−6 (TSOT−23−6)	2500 Tape & Reel	*Now*
NB2780ASNR2G	E07	0°C – 70°C	TSOP−6 (TSOT−23−6) (Pb−Free)	2500 Tape & Reel	*Contact Sales Representative*

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

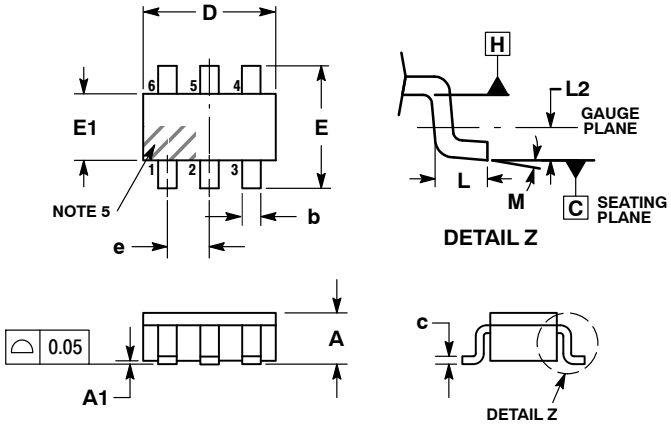
MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

ON Semiconductor®

SCALE 2:1

TSOP−6
CASE 318G−02
ISSUE V

DATE 12 JUN 2012



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. MAXIMUM LEAD THICKNESS INCLUDES LEAD FINISH. MINIMUM LEAD THICKNESS IS THE MINIMUM THICKNESS OF BASE MATERIAL.
4. DIMENSIONS D AND E1 DO NOT INCLUDE MOLD FLASH, PROTRUSIONS, OR GATE BURRS. MOLD FLASH, PROTRUSIONS, OR GATE BURRS SHALL NOT EXCEED 0.15 PER SIDE. DIMENSIONS D AND E1 ARE DETERMINED AT DATUM H.
5. PIN ONE INDICATOR MUST BE LOCATED IN THE INDICATED ZONE.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.90	1.00	1.10
A1	0.01	0.06	0.10
b	0.25	0.38	0.50
c	0.10	0.18	0.26
D	2.90	3.00	3.10
E	2.50	2.75	3.00
E1	1.30	1.50	1.70
e	0.85	0.95	1.05
L	0.20	0.40	0.60
L2	0.25 BSC		
M	0°	–	10°

STYLE 1:
PIN 1. DRAIN
2. DRAIN
3. GATE
4. SOURCE
5. DRAIN
6. DRAIN

STYLE 2:
PIN 1. EMITTER 2
2. BASE 1
3. COLLECTOR 1
4. EMITTER 1
5. BASE 2
6. COLLECTOR 2

STYLE 3:
PIN 1. ENABLE
2. N/C
3. R BOOST
4. Vz
5. V in
6. V out

STYLE 4:
PIN 1. N/C
2. V in
3. NOT USED
4. GROUND
5. ENABLE
6. LOAD

STYLE 5:
PIN 1. EMITTER 2
2. BASE 2
3. COLLECTOR 1
4. EMITTER 1
5. BASE 1
6. COLLECTOR 2

STYLE 6:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. EMITTER
5. COLLECTOR
6. COLLECTOR

STYLE 7:
PIN 1. COLLECTOR
2. COLLECTOR
3. BASE
4. N/C
5. COLLECTOR
6. EMITTER

STYLE 8:
PIN 1. Vbus
2. D(in)
3. D(in)+
4. D(out)+
5. D(out)
6. GND

STYLE 9:
PIN 1. LOW VOLTAGE GATE
2. DRAIN
3. SOURCE
4. DRAIN
5. DRAIN
6. HIGH VOLTAGE GATE

STYLE 10:
PIN 1. D(OUT)+
2. GND
3. D(OUT)−
4. D(IN)−
5. VBUS
6. D(IN)+

STYLE 11:
PIN 1. SOURCE 1
2. DRAIN 2
3. DRAIN 2
4. SOURCE 2
5. GATE 1
6. DRAIN 1/GATE 2

STYLE 12:
PIN 1. I/O
2. GROUND
3. I/O
4. I/O
5. VCC
6. I/O

STYLE 13:
PIN 1. GATE 1
2. SOURCE 2
3. GATE 2
4. DRAIN 2
5. SOURCE 1
6. DRAIN 1

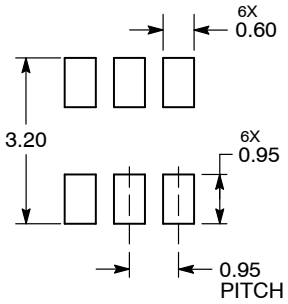
STYLE 14:
PIN 1. ANODE
2. SOURCE
3. GATE
4. CATHODE/DRAIN
5. CATHODE/DRAIN
6. CATHODE/DRAIN

STYLE 15:
PIN 1. ANODE
2. SOURCE
3. GATE
4. DRAIN
5. N/C
6. CATHODE

STYLE 16:
PIN 1. ANODE/CATHODE
2. BASE
3. EMITTER
4. COLLECTOR
5. ANODE
6. CATHODE

STYLE 17:
PIN 1. EMITTER
2. BASE
3. ANODE/CATHODE
4. ANODE
5. CATHODE
6. COLLECTOR

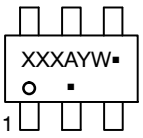
RECOMMENDED SOLDERING FOOTPRINT*



DIMENSIONS: MILLIMETERS

*For additional information on our Pb−Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

GENERIC MARKING DIAGRAM*



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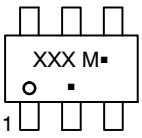

STANDARD

XXX = Specific Device Code
A = Assembly Location
Y = Year
W = Work Week
▪ = Pb−Free Package

XXX = Specific Device Code
M = Date Code
▪ = Pb−Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb−Free indicator, “G” or microdot “▪”, may or may not be present.

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