



**THE DATASHEET OF
PLL1708DBQ**





3.3-V DUAL PLL MULTICLOCK GENERATOR

FEATURES

- 27-MHz Master Clock Input
- Generated Audio System Clock (PLL1707):
 - SCKO0: $768 f_S$ ($f_S = 44.1$ kHz)
 - SCKO1: $768 f_S$, $512 f_S$ ($f_S = 48$ kHz)
 - SCKO2: $256 f_S$ ($f_S = 32, 44.1, 48, 64, 88.2, 96$ kHz)
 - SCKO3: $384 f_S$ ($f_S = 32, 44.1, 48, 64, 88.2, 96$ kHz)
- Generated Audio System Clock (PLL1708):
 - SCKO0: $768 f_S$ ($f_S = 44.1$ kHz)
 - SCKO1: $768 f_S$, $512 f_S$, $384 f_S$, $256 f_S$ ($f_S = 48$ kHz)
 - SCKO2: $256 f_S$ ($f_S = 16, 22.05, 24, 32, 44.1, 48, 64, 88.2, 96$ kHz)
 - SCKO3: $384 f_S$ ($f_S = 16, 22.05, 24, 32, 44.1, 48, 64, 88.2, 96$ kHz)
- Zero PPM Error Output Clocks
- Low Clock Jitter: 50 ps (Typical)
- Multiple Sampling Frequencies (PLL1707):
 - $f_S = 32, 44.1, 48, 64, 88.2, 96$ kHz
- Multiple Sampling Frequencies (PLL1708):
 - $f_S = 16, 22.05, 24, 32, 44.1, 48, 64, 88.2, 96$ kHz
- 3.3-V Single Power Supply
- PLL1707: Parallel Control
PLL1708: Serial Control
- Package: 20-Pin SSOP (150 mil), Lead-Free Product

APPLICATIONS

- HDD + DVD Recorders
- DVD Recorders
- HDD Recorders
- DVD Players
- DVD Add-On Cards for Multimedia PCs
- Digital HDTV Systems
- Set-Top Boxes

DESCRIPTION

The PLL1707[†] and PLL1708[†] are low cost, phase-locked loop (PLL) multiclock generators. The PLL1707 and PLL1708 can generate four system clocks from a 27-MHz reference input frequency. The clock outputs of the PLL1707 can be controlled by sampling frequency-control pins and those of the PLL1708 can be controlled through serial-mode control pins. The device gives customers both cost and space savings by eliminating external components and enables customers to achieve the very low-jitter performance needed for high performance audio DACs and/or ADCs. The PLL1707 and PLL1708 are ideal for MPEG-2 applications which use a 27-MHz master clock such as DVD recorders, HDD recorders, DVD add-on cards for multimedia PCs, digital HDTV systems, and set-top boxes.



This integrated circuit can be damaged by ESD. Texas Instruments recommends that all integrated circuits be handled with appropriate precautions. Failure to observe proper handling and installation procedures can cause damage.

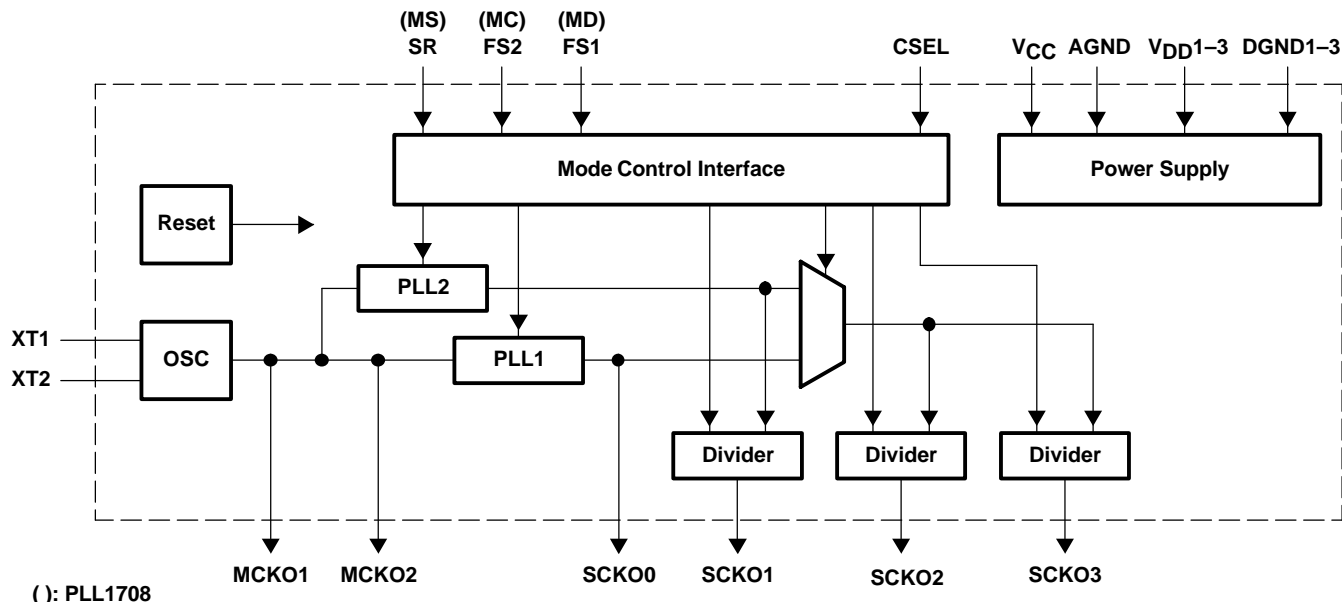
ESD damage can range from subtle performance degradation to complete device failure. Precision integrated circuits may be more susceptible to damage because very small parametric changes could cause the device not to meet its published specifications.



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

[†]The PLL1707 and PLL1708 use the same die and they are electrically identical except for mode control.

FUNCTIONAL BLOCK DIAGRAM



PACKAGE/ORDERING INFORMATION

| PRODUCT | PACKAGE | PACKAGE CODE | OPERATION TEMPERATURE RANGE | PACKAGE MARKING | ORDERING NUMBER | TRANSPORT MEDIA |
|------------|---------|--------------|-----------------------------|-----------------|-----------------|-----------------|
| PLL1707DBQ | SSOP 20 | 20DBQ | -25°C to 85°C | PLL1707 | PLL1707DBQ | Tube |
| | | | | | PLL1707DBQR | Tape and reel |
| PLL1708DBQ | SSOP 20 | 20DBQ | -25°C to 85°C | PLL1708 | PLL1708DBQ | Tube |
| | | | | | PLL1708DBQR | Tape and reel |

ABSOLUTE MAXIMUM RATINGS

over operating free-air temperature range unless otherwise noted⁽¹⁾

| | PLL1705 AND PLL1706 |
|--|---------------------------------|
| Supply voltage: V_{CC} , V_{DD1} - V_{DD3} | 4 V |
| Supply voltage differences: V_{CC} , V_{DD1} - V_{DD3} | ± 0.1 V |
| Ground voltage differences: AGND, DGND1-DGND3 | ± 0.1 V |
| Digital input voltage: FS1 (MD), FS2 (MC), SR (MS), CSEL | - 0.3 V to ($V_{DD} + 0.3$) V |
| Analog input voltage, XT1, XT2 | - 0.3 V to ($V_{CC} + 0.3$) V |
| Input current (any pins except supplies) | ± 10 mA |
| Ambient temperature under bias | -40°C to 125°C |
| Storage temperature | -55°C to 150°C |
| Junction temperature | 150°C |
| Lead temperature (soldering) | 260°C, 5 s |
| Package temperature (IR reflow, peak) | 260°C |

⁽¹⁾ Stresses beyond those listed under "absolute maximum ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

all specifications at $T_A = 25^\circ\text{C}$, $V_{DD1}-V_{DD3} (= V_{DD}) = V_{CC} = 3.3\text{ V}$, $f_M = 27\text{ MHz}$, crystal oscillation, $f_S = 48\text{ kHz}$ (unless otherwise noted)

| PARAMETER | | TEST CONDITIONS | | MIN | TYP | MAX | UNIT |
|--|-------------------------------|-------------------------|-----------------------|-------------------------|--------|-------------|---------------|
| DIGITAL INPUT/OUTPUT | | | | | | | |
| Logic input | | | | CMOS compatible | | | |
| $V_{IH}^{(1)}$ | Input logic level | | | $0.7V_{DD}$ | | 3.6 | Vdc |
| $V_{IL}^{(1)}$ | | | | | | $0.3V_{DD}$ | |
| $I_{IH}^{(1)}$ | Input logic current | $V_{IN} = V_{DD}$ | | | 65 | 100 | μA |
| $I_{IL}^{(1)}$ | | $V_{IN} = 0\text{ V}$ | | | | ± 10 | |
| Logic output | | | | CMOS | | | |
| $V_{OH}^{(2)}$ | Output logic level | $I_{OH} = -4\text{ mA}$ | | $V_{DD} - 0.4\text{ V}$ | | | Vdc |
| $V_{OL}^{(2)}$ | | $I_{OL} = 4\text{ mA}$ | | | | 0.4 | Vdc |
| Sampling frequency | | PLL1707 | Standard f_S | 32 | 44.1 | 48 | kHz |
| | | | Double f_S | 64 | 88.2 | 96 | |
| | | PLL1708 | Half f_S | 16 | 22.05 | 24 | |
| | | | Standard f_S | 32 | 44.1 | 48 | |
| | | | Double f_S | 64 | 88.2 | 96 | |
| MASTER CLOCK (MCKO1, MCKO2) CHARACTERISTICS ($f_M = 27\text{ MHz}$, $C_1 = C_2 = 15\text{ pF}$, $C_L = 20\text{ pF}$ on measurement pin) | | | | | | | |
| Master clock frequency | | | | 26.73 | 27 | 27.27 | MHz |
| V_{IH} | Input level(3) | | | $0.7V_{CC}$ | | | V |
| V_{IL} | | | | $0.3V_{CC}$ | | | |
| I_{IH} | Input current(3) | $V_{IN} = V_{CC}$ | | | | ± 10 | μA |
| I_{IL} | | $V_{IN} = 0\text{ V}$ | | | | ± 10 | |
| Output voltage (4) | | | | 3.5 | | | Vp-p |
| Output rise time | | 20% to 80% of V_{DD} | | 2.0 | | | ns |
| Output fall time | | 80% to 20% of V_{DD} | | 2.0 | | | ns |
| Duty cycle | | For crystal oscillation | | 45% | 51% | 55% | |
| | | For external clock | | 50% | | | |
| Clock jitter (5) | | | | 50 | | | ps |
| Power-up time (6) | | | | 0.5 | | 1.5 | ms |
| PLL AC CHARACTERISTICS (SCKO0-SCKO3) ($f_M = 27\text{ MHz}$, $C_L = 20\text{ pF}$ on measurement pin) | | | | | | | |
| SCKO0 | Output system clock frequency | PLL1707 | Fixed | 33.8688 | | | MHz |
| SCKO1 | | | Selectable for 48 kHz | 24.576 | | 36.864 | |
| SCKO2 | | | 256 f_S | 8.192 | 12.288 | 24.576 | |
| SCKO3 | | | 384 f_S | 12.288 | 18.432 | 36.864 | |
| SCKO0 | | PLL1708 | Fixed | 33.8688 | | | |
| SCKO1 | | | Selectable for 48 kHz | 12.288 | 24.576 | 36.864 | |
| SCKO2 | | | 256 f_S | 4.096 | 12.288 | 24.576 | |
| SCKO3 | | | 384 f_S | 6.144 | 18.432 | 36.864 | |
| Output rise time | | 20% to 80% of V_{DD} | | 2.0 | | | ns |
| Output fall time | | 80% to 20% of V_{DD} | | 2.0 | | | ns |
| Output duty cycle | | | | 45 | 50 | 55 | % |

(1) Pins 5, 6, 7, 12: FS1/MD, FS2/MC, SR/MS, CSEL (Schmitt-trigger input with internal pulldown, 3.3-V tolerant)

(2) Pins 2, 3, 14, 15, 18, 19: SCKO2, SCKO3, MCKO1, MCKO2, SCKO0, SCKO1

(3) Pin 10: XT1

(4) Pin 11: XT2

(5) Jitter performance is specified as standard deviation of jitter for 27-MHz crystal oscillation and default SCKO frequency setting. Jitter performance varies with master clock mode, SCKO frequency setting and load capacitance on each clock output.

(6) The delay time from power on to oscillation

(7) The settling time when the sampling frequency is changed

(8) The delay time from power on to lockup

(9) $f_M = 27\text{-MHz}$ crystal oscillation, no load on MCKO1, MCKO2, SCKO0, SCKO1, SCKO2, SCKO3. Power supply current varies with sampling frequency selection and load condition.

(10) While all bits of CE[6:1] are 0, the PLL1708 goes into power-down mode.

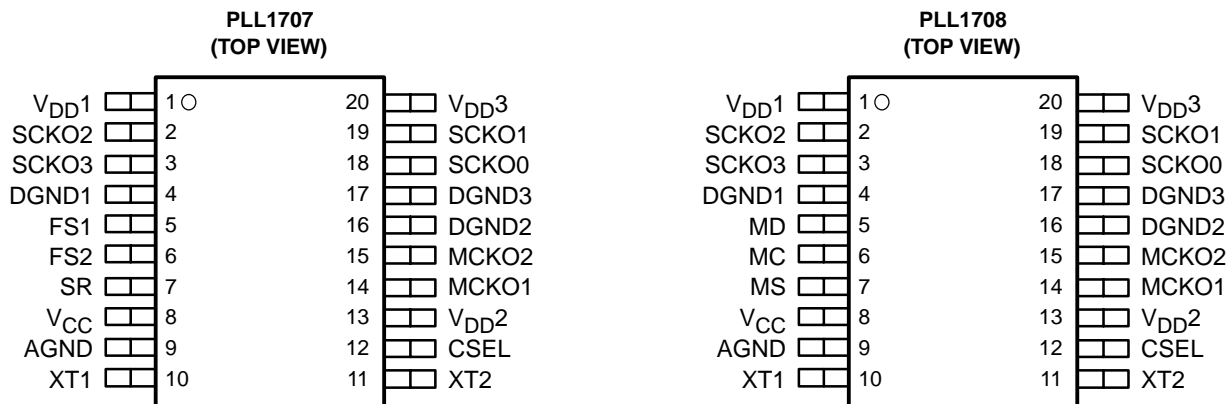
ELECTRICAL CHARACTERISTICS (continued)

all specifications at $T_A = 25^\circ\text{C}$, $V_{DD1}\text{--}V_{DD3} (= V_{DD}) = V_{CC} = 3.3\text{ V}$, $f_M = 27\text{ MHz}$, crystal oscillation, $f_S = 48\text{ kHz}$ (unless otherwise noted)

| PARAMETER | TEST CONDITIONS | MIN | TYP | MAX | UNIT | |
|----------------------------------|-------------------------------------|---|-----|-----|------------------|--------------------|
| Output clock jitter (5) | SCKO0, SCKO1 | | 58 | 100 | ps | |
| | SCKO2, SCKO3 | | 50 | 100 | ps | |
| Frequency Settling Time(7) | PLL1707, to stated output frequency | | 50 | 150 | ns | |
| | PLL1708, to stated output frequency | | 80 | 300 | | |
| Power-up time (8) | To stated output frequency | | 3 | 6 | ms | |
| POWER SUPPLY REQUIREMENTS | | | | | | |
| V_{CC}, V_{DD} | Supply voltage range | 2.7 | 3.3 | 3.6 | Vdc | |
| $I_{DD} + I_{CC}$ | Supply current (9) | $V_{DD} = V_{CC} = 3.3\text{ V}, f_S = 48\text{ kHz}$ | | 19 | 25 | mA |
| | | Power down(10) | | 350 | 550 | μA |
| | Power dissipation | $V_{DD} = V_{CC} = 3.3\text{ V}, f_S = 48\text{ kHz}$ | | 63 | 90 | mW |
| TEMPERATURE RANGE | | | | | | |
| | Operating temperature | -25 | | 85 | $^\circ\text{C}$ | |
| θ_{JA} | Thermal resistance | PLL1707/8DBQ: 20-pin SSOP (150 mil) | | | 150 | $^\circ\text{C/W}$ |

- (1) Pins 5, 6, 7, 12: FS1/MD, FS2/MC, SR/MS, CSEL (Schmitt-trigger input with internal pulldown, 3.3-V tolerant)
- (2) Pins 2, 3, 14, 15, 18, 19: SCKO2, SCKO3, MCKO1, MCKO2, SCKO0, SCKO1
- (3) Pin 10: XT1
- (4) Pin 11: XT2
- (5) Jitter performance is specified as standard deviation of jitter for 27-MHz crystal oscillation and default SCKO frequency setting. Jitter performance varies with master clock mode, SCKO frequency setting and load capacitance on each clock output.
- (6) The delay time from power on to oscillation
- (7) The settling time when the sampling frequency is changed
- (8) The delay time from power on to lockup
- (9) $f_M = 27\text{-MHz}$ crystal oscillation, no load on MCKO1, MCKO2, SCKO0, SCKO1, SCKO2, SCKO3. Power supply current varies with sampling frequency selection and load condition.
- (10) While all bits of CE[6:1] are 0, the PLL1708 goes into power-down mode.

PIN ASSIGNMENTS



PLL1707 Terminal Functions

| TERMINAL NAME | NO. | I/O | DESCRIPTION |
|------------------|-----|-----|---|
| AGND | 9 | – | Analog ground |
| CSEL | 12 | I | SCKO1 frequency selection control ⁽¹⁾ |
| DGND1 | 4 | – | Digital ground 1 |
| DGND2 | 16 | – | Digital ground 2 |
| DGND3 | 17 | – | Digital ground 3 |
| FS1 | 5 | I | Sampling frequency group control 1 ⁽¹⁾ |
| FS2 | 6 | I | Sampling frequency group control 2 ⁽¹⁾ |
| MCKO1 | 14 | O | 27-MHz master clock output 1 |
| MCKO2 | 15 | O | 27-MHz master clock output 2 |
| SCKO0 | 18 | O | System clock output 0 (33.8688 MHz fixed) |
| SCKO1 | 19 | O | System clock output 1 (selectable for 48 kHz) |
| SCKO2 | 2 | O | System clock output 2 (256 f _S selectable) |
| SCKO3 | 3 | O | System clock output 3 (384 f _S selectable) |
| SR | 7 | I | Sampling rate control ⁽¹⁾ |
| V _{CC} | 8 | – | Analog power supply, 3.3 V |
| V _{DD1} | 1 | – | Digital power supply 1, 3.3 V |
| V _{DD2} | 13 | – | Digital power supply 2, 3.3 V |
| V _{DD3} | 20 | – | Digital power supply 3, 3.3 V |
| XT1 | 10 | I | 27-MHz crystal oscillator, or external clock input |
| XT2 | 11 | O | 27-MHz crystal oscillator, must be OPEN for external clock input mode |

(1) Schmitt-trigger input with internal pulldown.

PLL1708 Terminal Functions

| TERMINAL NAME | NO. | I/O | DESCRIPTION |
|------------------|-----|-----|---|
| AGND | 9 | – | Analog ground |
| CSEL | 12 | I | SCKO1 frequency selection control ⁽¹⁾ |
| DGND1 | 4 | – | Digital ground 1 |
| DGND2 | 16 | – | Digital ground 2 |
| DGND3 | 17 | – | Digital ground 3 |
| MC | 6 | I | Bit clock input for serial control ⁽¹⁾ |
| MCKO1 | 14 | O | 27-MHz master clock output 1 |
| MCKO2 | 15 | O | 27-MHz master clock output 2 |
| MD | 5 | I | Data input for serial control ⁽¹⁾ |
| MS | 7 | I | Chip select input for serial control ⁽¹⁾ |
| SCKO0 | 18 | O | System clock output 0 (33.8688 MHz fixed) |
| SCKO1 | 19 | O | System clock output 1 (selectable for 48 kHz) |
| SCKO2 | 2 | O | System clock output 2 (256 f _S selectable) |
| SCKO3 | 3 | O | System clock output 3 (384 f _S selectable) |
| VCC | 8 | – | Analog power supply, 3.3 V |
| VDD1 | 1 | – | Digital power supply 1, 3.3 V |
| VDD2 | 13 | – | Digital power supply 2, 3.3 V |
| VDD3 | 20 | – | Digital power supply 3, 3.3 V |
| XT1 | 10 | I | 27-MHz crystal oscillator, or external clock input |
| XT2 | 11 | O | 27-MHz crystal oscillator, must be OPEN for external clock input mode |

⁽¹⁾ Schmitt-trigger input with internal pulldown.

TYPICAL PERFORMANCE CURVES

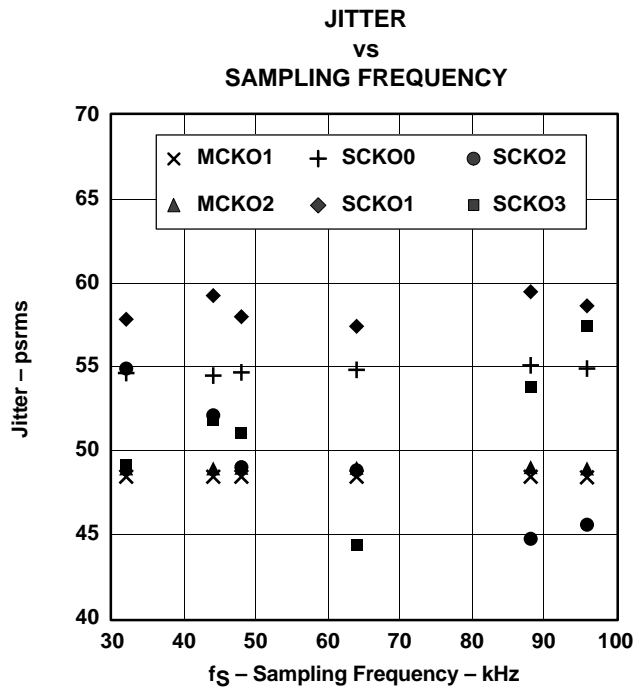


Figure 1

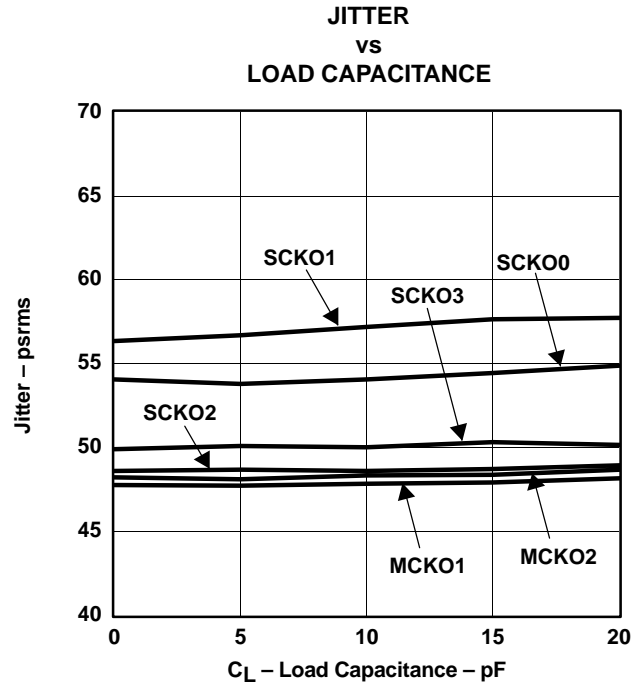


Figure 2

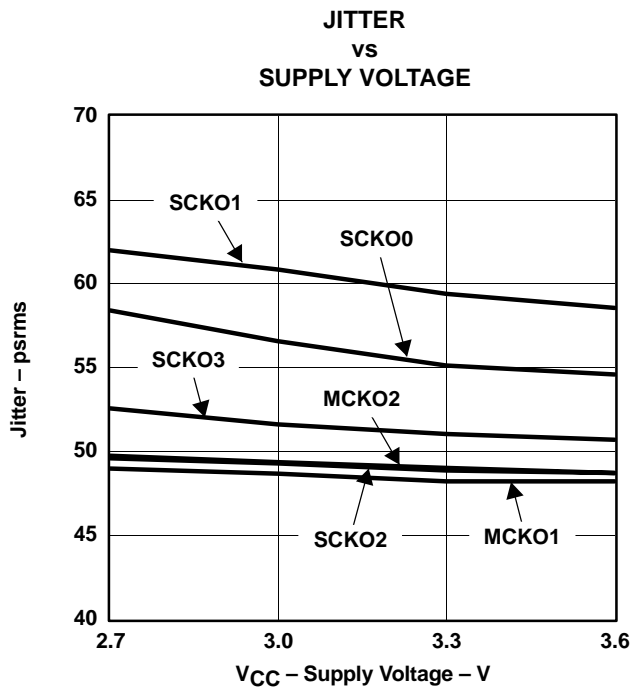


Figure 3

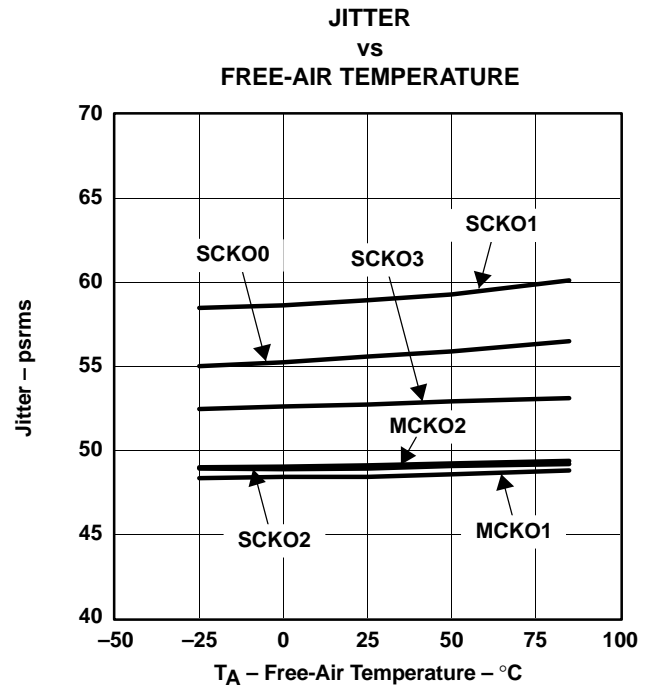


Figure 4

NOTE: All specifications at $T_A = 25^\circ\text{C}$, $V_{DD1-3} (= V_{DD}) = V_{CC} = +3.3\text{ V}$, $f_M = 27\text{ MHz}$, crystal oscillation, $C_1, C_2 = 15\text{ pF}$, default frequency (33.8688 MHz for SCKO0, 36.864 MHz for SCKO1, 256 f_s and 384 f_s of 48 kHz for SCKO2 and SCKO3), $C_L = 20\text{ pF}$ on measurement pin, unless otherwise noted.

DUTY CYCLE
VS
SUPPLY VOLTAGE

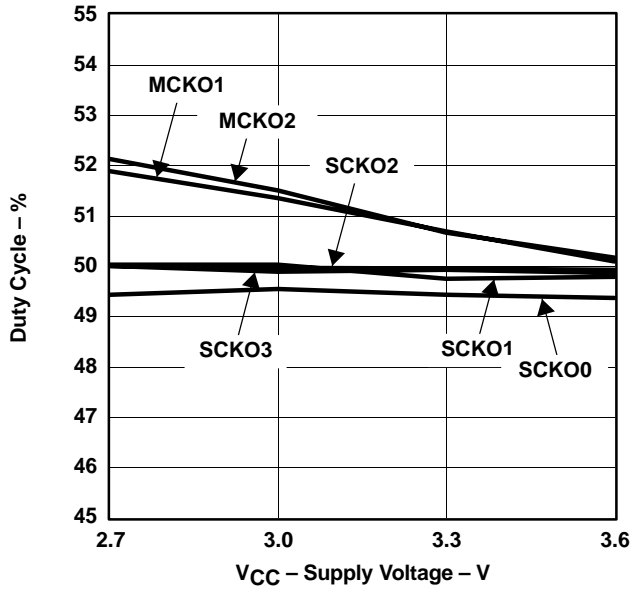


Figure 5

DUTY CYCLE
VS
FREE-AIR TEMPERATURE

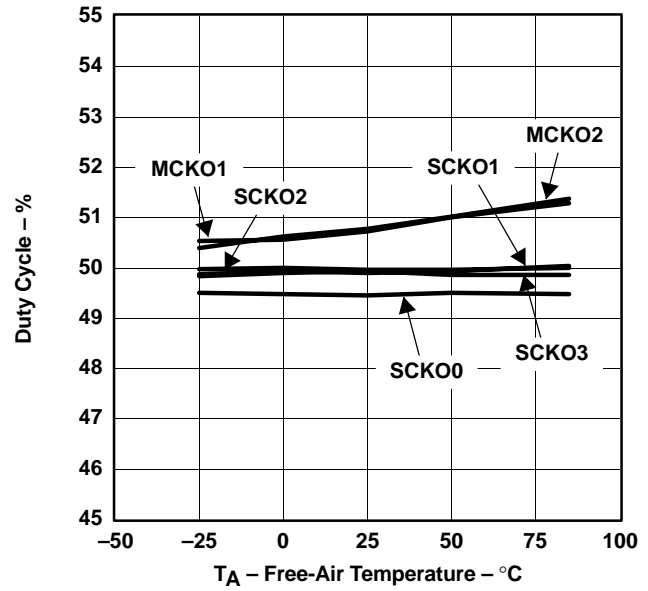


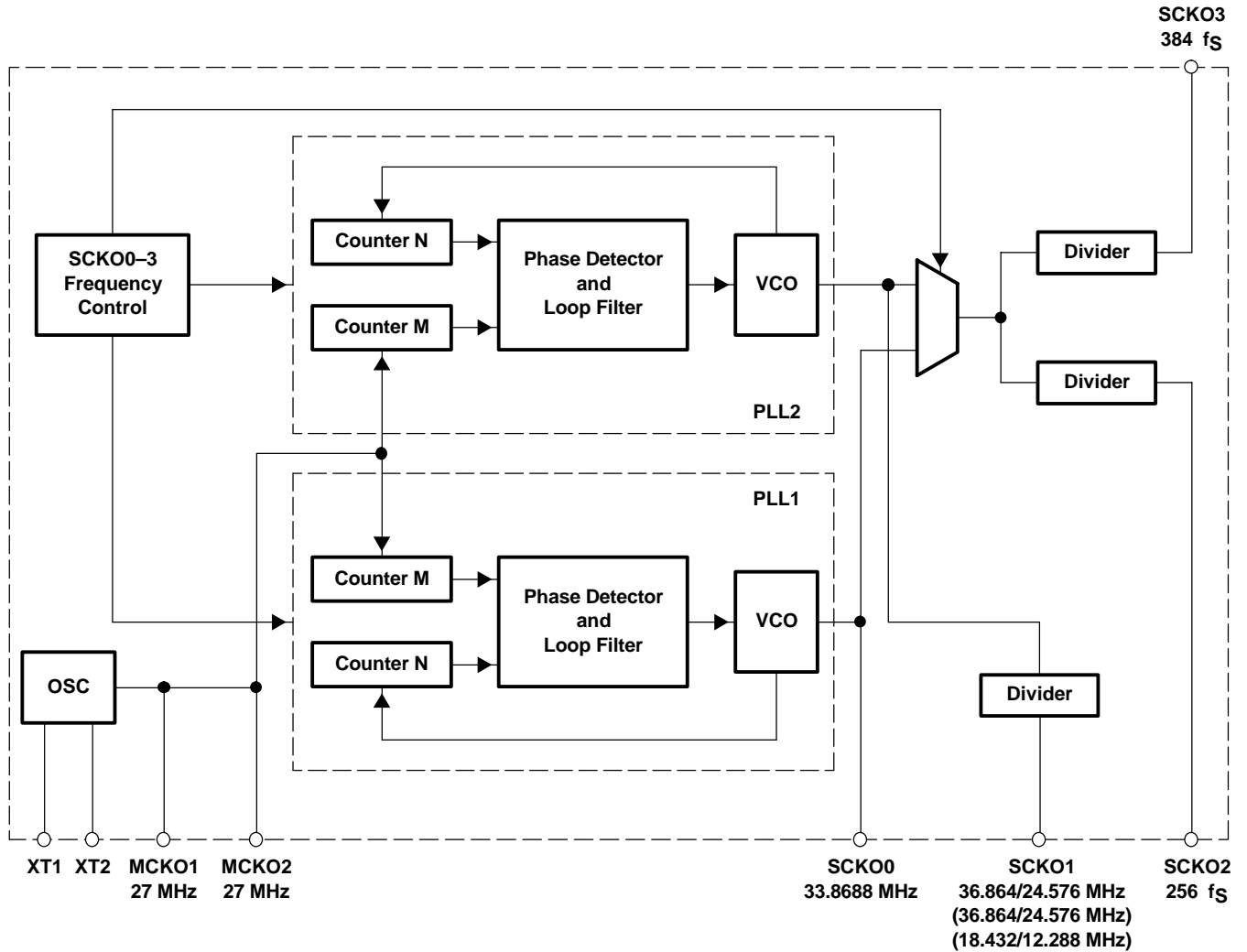
Figure 6

NOTE: All specifications at T_A = 25°C, V_{DD1-3} (= V_{DD}) = V_{CC} = +3.3 V, f_M = 27 MHz, crystal oscillation, C₁, C₂ = 15 pF, default frequency (33.8688 MHz for SCKO0, 36.864 MHz for SCKO1, 256 f_S and 384 f_S of 48 kHz for SCKO2 and SCKO3), C_L = 20 pF on measurement pin, unless otherwise noted.

THEORY OF OPERATION

MASTER CLOCK AND SYSTEM CLOCK OUTPUT

The PLL1707/8 consists of a dual PLL clock and master clock generator which generates four system clocks and two buffered 27-MHz clocks from a 27-MHz master clock. Figure 7 shows the block diagram of the PLL1707/8. The PLL is designed to accept a 27-MHz master clock.



(): PLL1708

Figure 7. Block Diagram

Table 2. Sampling Frequencies

| SAMPLING RATE | SAMPLING FREQUENCY (kHz) | | |
|-------------------------------|--------------------------|-------|----|
| Half sampling frequencies† | 16 | 22.05 | 24 |
| Standard sampling frequencies | 32 | 44.1 | 48 |
| Double sampling frequencies | 64 | 88.2 | 96 |

† PLL1708 only

Table 3. Sampling Frequencies and System Clock Output Frequencies

| SAMPLING FREQUENCY (kHz) | SAMPLING RATE | 256 fs SCKO2 (MHZ) | 384 fs SCKO3 (MHZ) |
|--------------------------|---------------|-----------------------|-----------------------|
| 16† | Half | 4.096 | 6.144 |
| 22.05† | Half | 5.6448 | 8.4672 |
| 24† | Half | 6.144 | 9.216 |
| 32 | Standard | 8.192 | 12.288 |
| 44.1 | Standard | 11.2896 | 16.9344 |
| 48 | Standard | 12.288 | 18.432 |
| 64 | Double | 16.384 | 24.576 |
| 88.2 | Double | 22.5792 | 33.8688 |
| 96 | Double | 24.576 | 36.864 |

† PLL1708 only

Response time from power on (or applying the clock to XT1) to SCKO settling time is typically 3 ms. Delay time from sampling frequency change to SCKO settling is 300 ns maximum. Figure 10 illustrates SCKO transient timing in the PLL1708.

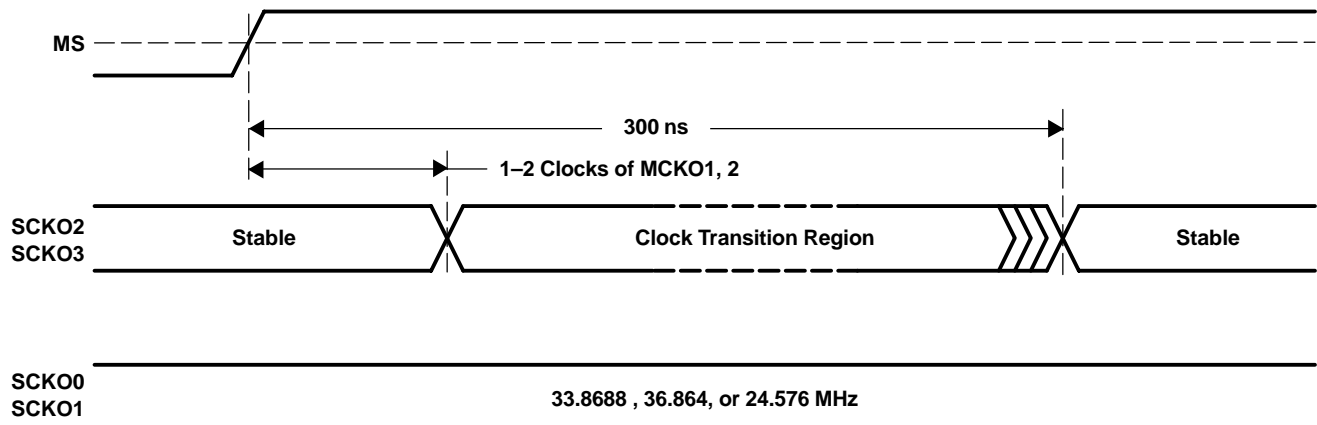


Figure 10. System Clock Transient Timing

The delay time for hardware control to use SR, FS2, FS1, or CSEL is 150 ns maximum. Figure 11 illustrates SCKO transient timing in the PLL1707. Clock transient timing is not synchronized with the SCKOs. External buffers are recommended on all output clocks in order to avoid degrading the jitter performance of the PLL1707/8.

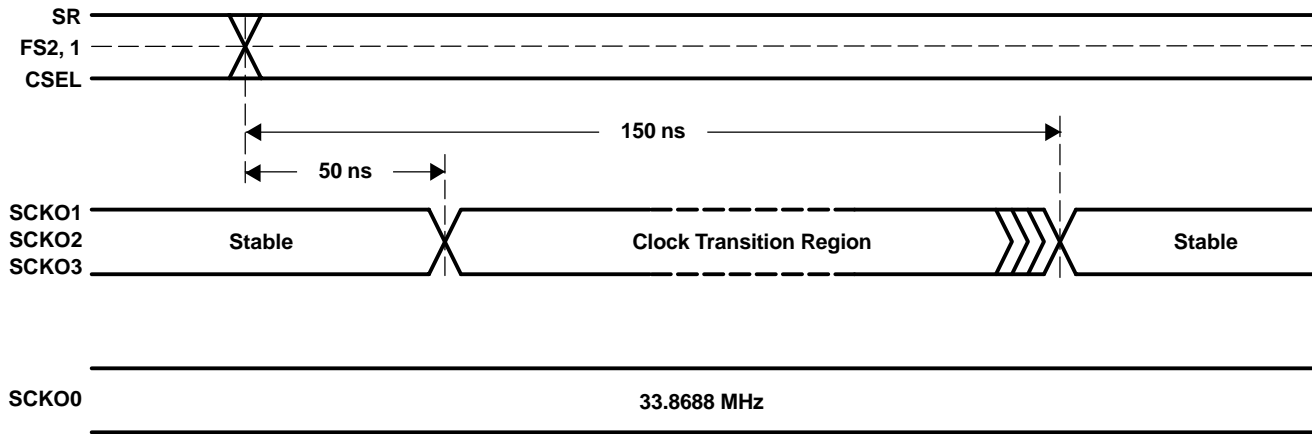


Figure 11. SCKO Transient Timing

POWER-ON RESET

The PLL1707/8 has an internal power-on reset circuit. The mode register of the PLL1708 is initialized with default settings by power-on reset. Throughout the reset period, all clock outputs are enabled with the default settings after power-up time. Initialization by internal power-on reset is done automatically during 1024 master clocks at $V_{DD} > 2.0$ V (TYP). Power-on reset timing is shown in Figure 12.

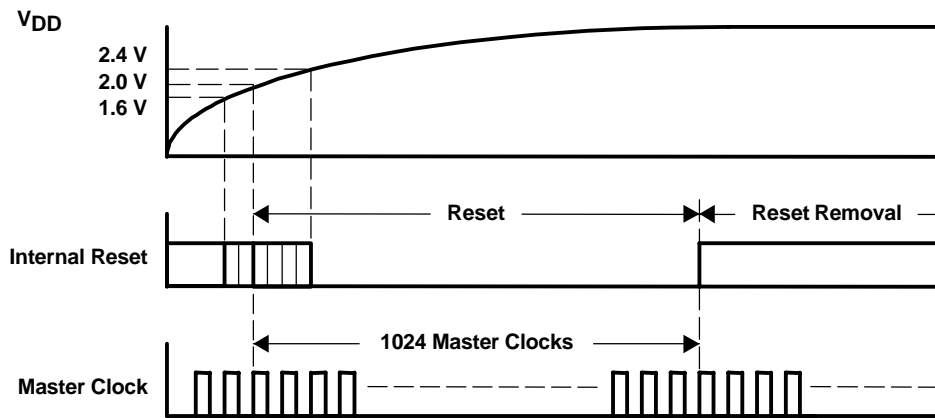


Figure 12. Power-On Reset Timing

FUNCTION CONTROL

The built-in functions of the PLL1707 can be controlled in the parallel mode (hardware mode), which uses SR (pin 7), FS1 (pin 5) and FS2 (pin 6). The PLL1708 can be controlled in the serial mode (software mode), which has a three-wire interface using MS (pin 7), MC (pin 6), and MD (pin 5). The selectable functions are shown in Table 4.

Table 4. Selectable Functions

| SELECTABLE FUNCTION | PARALLEL MODE | SERIAL MODE |
|--|---------------|-------------|
| Sampling frequency select (32 kHz, 44.1 kHz, 48 kHz) | Yes | Yes |
| Sampling rate select (standard/double) | Yes | Yes |
| Sampling rate select (half) | No | Yes |
| Each clock output enable/disable | No | Yes |
| Power down | No | Yes |
| SCKO1 configuration | No | Yes |

PLL1707 (Parallel Mode)

In the parallel mode, the following functions can be selected:

Sampling Frequency Group Select

The sampling frequency group can be selected by FS1 (pin 5) and FS2 (pin 6).

| FS2 (PIN 6) | FS1 (PIN 5) | SAMPLING FREQUENCY |
|-------------|-------------|--------------------|
| LOW | LOW | 48 kHz |
| LOW | HIGH | 44.1 kHz |
| HIGH | LOW | 32 kHz |
| HIGH | HIGH | Reserved |

Sampling Rate Select

The sampling rate can be selected by SR (pin 7)

| SR (PIN 7) | SAMPLING RATE |
|------------|---------------|
| LOW | Standard |
| HIGH | Double |

System Clock SCKO1 Frequency Select

System clock SCKO1 frequency can be selected by CSEL (pin 12).

| CSEL (PIN 12) | SCKO1 FREQUENCY |
|---------------|-----------------|
| LOW | 36.864 MHz |
| HIGH | 24.576 MHz |

PLL1708 (Serial Mode)

The built-in functions of the PLL1708 are shown in Table 5. These functions are controlled using the MS, MC, and MD serial control signals.

Table 5. Selectable Functions

| SELECTABLE FUNCTION | DEFAULT |
|--|------------------------|
| Sampling frequency select (32 kHz, 44.1 kHz, 48 kHz) | 48-kHz group |
| Sampling rate select (half, standard, double) | Standard |
| Each clock output enable/disable | Enabled |
| Power down | Disabled |
| SCKO1 configuration | 36.864 MHz, 24.576 MHz |

Program-Register Bit Mapping

The built-in functions of the PLL1708 are controlled through a 16-bit program register. This register is loaded using MD, MC and MS. After the 16 data bits are clocked in using the rising edge of MC, MS is used to latch the data into the register. Table 6 shows the bit mapping of the register. The serial mode control format and control data input timing are shown in Figure 13 and Figure 14, respectively.

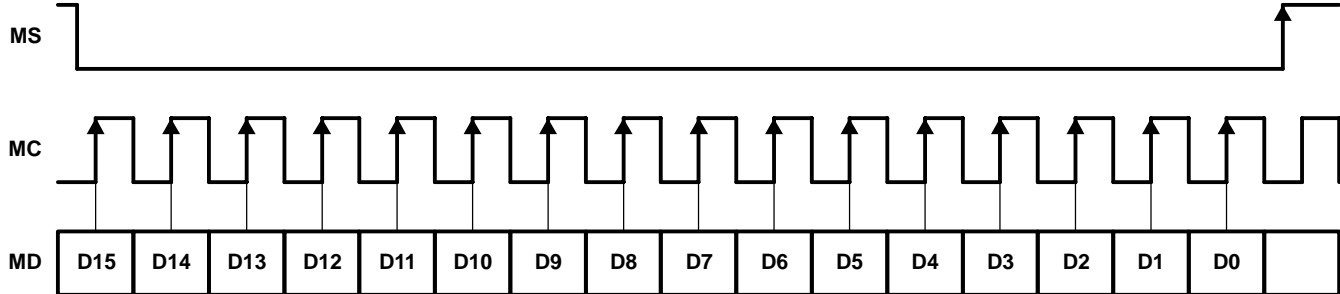
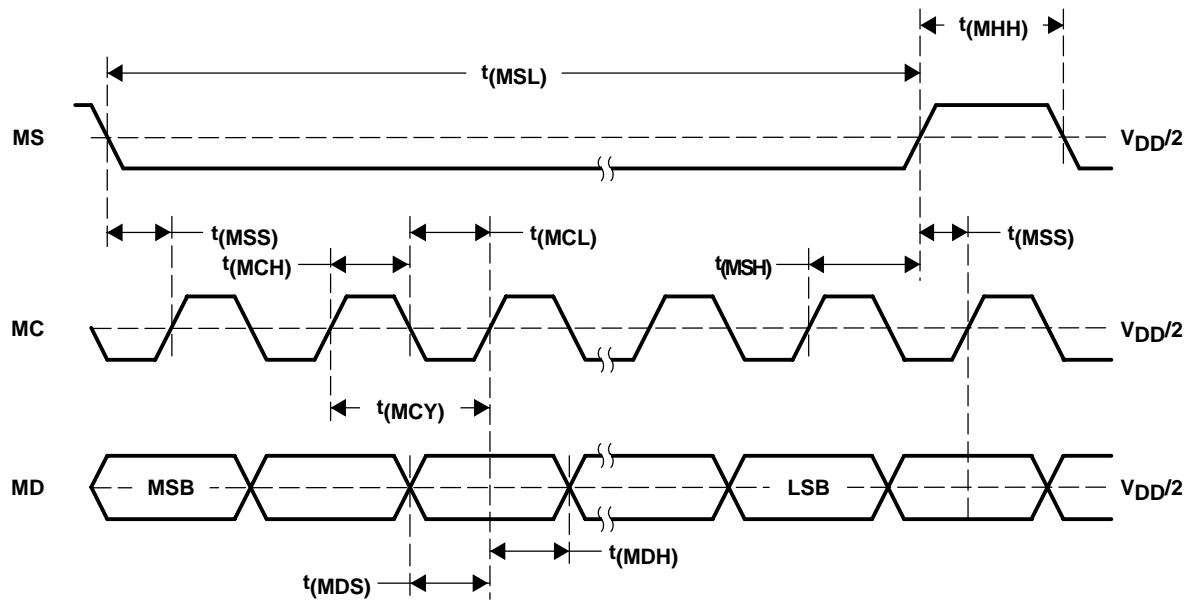


Figure 13. Serial Mode Control Format



| DESCRIPTION | SYMBOL | MIN | TYP | MAX | UNIT |
|------------------------------|--------|-----|-----|-----|--------------------------|
| MC pulse cycle time | t(MCY) | 100 | | | ns |
| MC pulse duration LOW | t(MCL) | 40 | | | ns |
| MC pulse duration HIGH | t(MCH) | 40 | | | ns |
| MD hold time | t(MDH) | 40 | | | ns |
| MD setup time | t(MDS) | 40 | | | ns |
| MS low-level time | t(MSL) | 16 | | | MC clocks ⁽¹⁾ |
| MS high-level time | t(MHH) | 200 | | | ns |
| MS hold time ⁽²⁾ | t(MSH) | 40 | | | ns |
| MS setup time ⁽³⁾ | t(MSS) | 40 | | | ns |

(1) MC clocks: MC clock period

(2) MC rising edge for LSB to MS rising edge

(3) MS rising edge to the next MC rising edge. If the MC clock is stopped after the LSB, any MS rise time is accepted.

Figure 14. Control Data Input Timing

Mode Register

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 0 | 1 | 1 | 1 | 0 | 0 | CE6 | CE5 | CE4 | CE3 | CE2 | CE1 | SR2 | SR1 | FS2 | FS1 |

Table 6. Mode Register Mapping

| REGISTER | BIT NAME | DESCRIPTION |
|--------------|----------|-----------------------------|
| Mode control | CE6 | MCKO2 output enable/disable |
| | CE5 | MCKO1 output enable/disable |
| | CE4 | SCKO1 output enable/disable |
| | CE3 | SCKO3 output enable/disable |
| | CE2 | SCKO2 output enable/disable |
| | CE1 | SCKO0 output enable/disable |
| | SR[2:1] | Sampling rate select |
| | FS[2:1] | Sampling frequency select |

FS[2:1]: Sampling Frequency Group Select

| FS2 | FS1 | SAMPLING FREQUENCY |
|-----|-----|--------------------|
| 0 | 0 | 48 kHz (default) |
| 0 | 1 | 44.1 kHz |
| 1 | 0 | 32 kHz |
| 1 | 1 | Reserved |

SR[2:1]: Sampling Rate Select

| SR2 | SR1 | SAMPLING RATE |
|-----|-----|--------------------|
| 0 | 0 | Standard (default) |
| 0 | 1 | Double |
| 1 | 0 | Half |
| 1 | 1 | Reserved |

CE [6:1]: Clock Output Control

| CE1–CE6 | CLOCK OUTPUT CONTROL |
|---------|-------------------------------|
| 0 | Clock output disable |
| 1 | Clock output enable (default) |

While all the bits of CE [6:1] are 0, the PLL1708 goes into the power-down mode, all dynamic operation including PLLs and the oscillator halts, but serial mode control is enabled for resumption.

Configuration Register

| | | | | | | | | | | | | | | | |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| D15 | D14 | D13 | D12 | D11 | D10 | D9 | D8 | D7 | D6 | D5 | D4 | D3 | D2 | D1 | D0 |
| 0 | 1 | 1 | 0 | 1 | 1 | RSV | RSV | RSV | RSV | RSV | CFG1 | RSV | RSV | RSV | RSV |

Table 7. Configuration Register Mapping

| REGISTER | BIT NAME | DESCRIPTION |
|---------------|----------|---------------------|
| Configuration | RSV | Reserved, must be 0 |
| | CFG1 | SCKO1 configuration |

CFG1: SCKO1 Configuration Control

| CFG1 | CONFIGURATION 1 |
|------|--|
| 0 | 36.864 MHz, 24.576 MHz for SCKO1 (default) |
| 1 | 18.432 MHz, 12.288 MHz for SCKO1 |

The system clock SCKO1 frequency can be selected by CSEL (pin 12) and CFG1 (register).

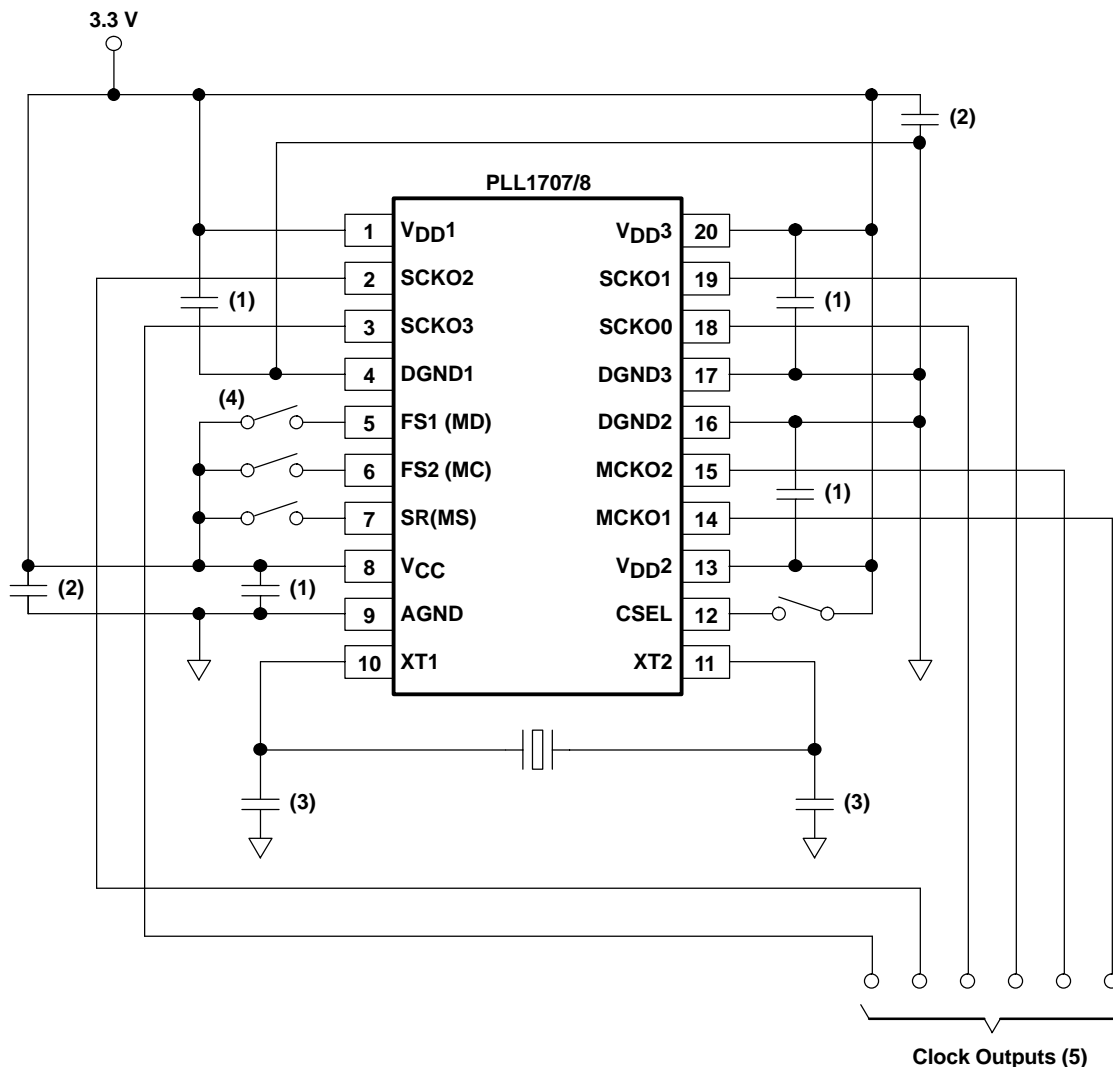
| CFG1 (REGISTER) | CSEL (PIN 12) | SCKO1 |
|-----------------|---------------|------------|
| 0 | LOW | 36.864 MHz |
| 0 | HIGH | 24.576 MHz |
| 1 | LOW | 18.432 MHz |
| 1 | HIGH | 12.288 MHz |

CONNECTION DIAGRAM

Figure 15 shows the typical connection circuit for the PLL1707. There are four grounds for digital and analog power supplies. However, the use of one common ground connection is recommended to avoid latch-up or other power-supply-related troubles. Power supplies should be bypassed as close as possible to the device.

MPEG-2 APPLICATIONS

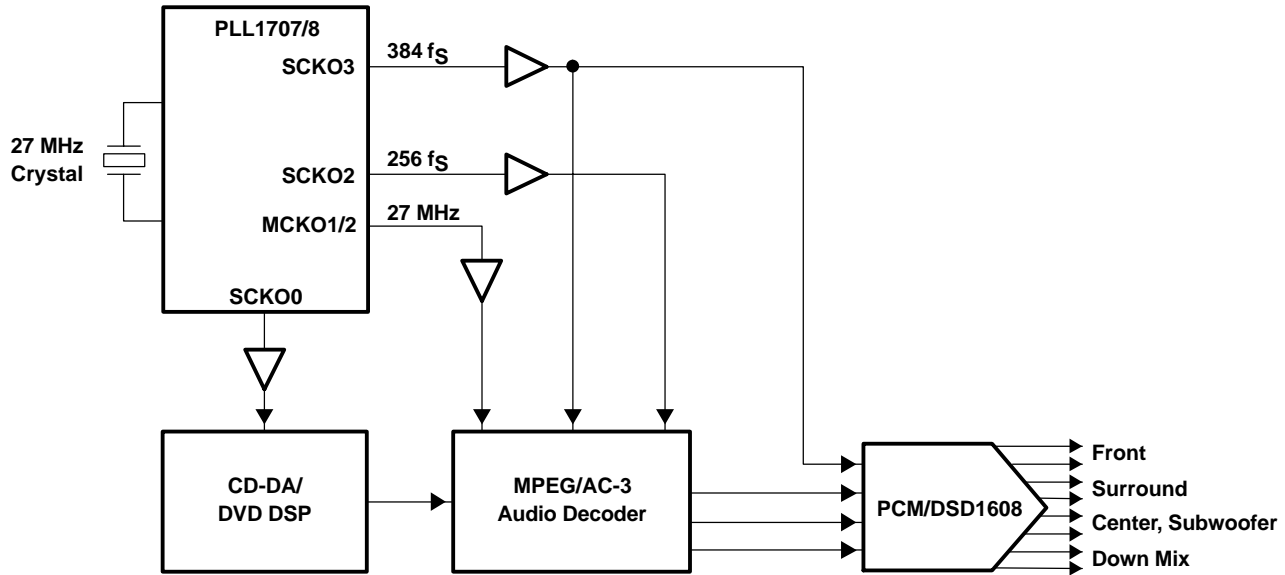
Typical applications for the PLL1707/8 are MPEG-2 based systems such as DVD recorders, HDD recorders, DVD players, DVD add-on cards for multimedia PCs, digital HDTV systems, and set-top boxes. The PLL1707/8 provides audio system clocks for a CD-DA DSP, DVD DSP, Karaoke DSP, ADC(s), and DAC(s) from a 27-MHz video clock.



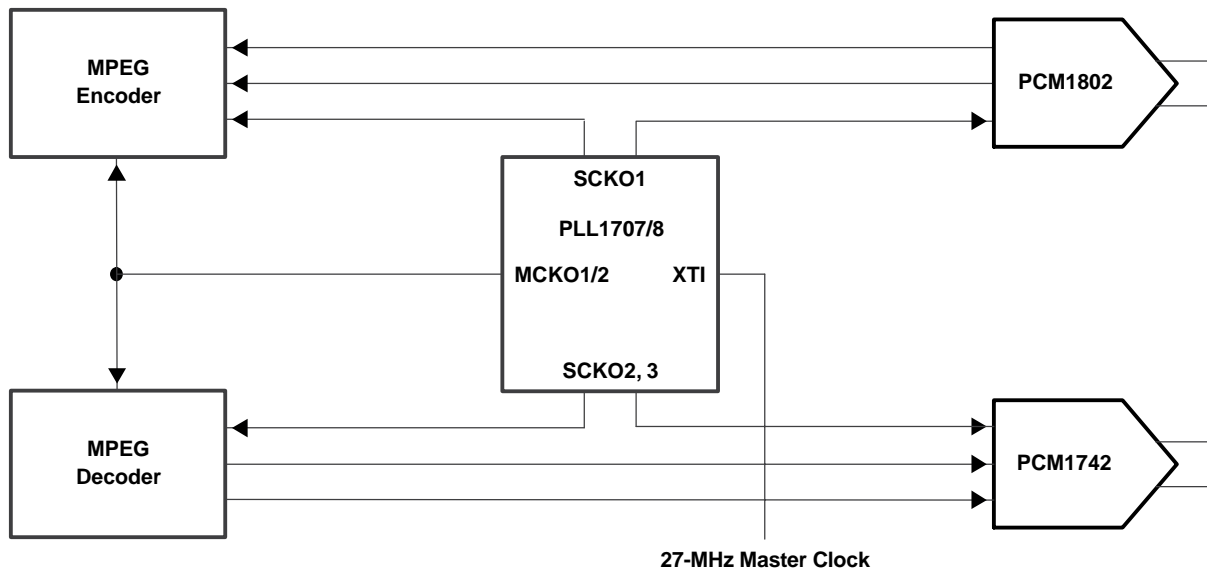
- (1) 0.1- μ F ceramic capacitor typical, depending on quality of power supply and pattern layout
- (2) 10- μ F aluminum electrolytic capacitor typical, depending on quality of power supply and pattern layout
- (3) 27-MHz quartz crystal and 10–33 pF \times 2 ceramic capacitors, which generate the appropriate amplitude of oscillation on XT1/XT2
- (4) This connection is for PLL1707 (parallel mode); when PLL1708 (serial mode) is to be used, control pins must be connected to serial interfaced controller.
- (5) For good jitter performance, minimize the load capacitance on the clock output. It is recommended to drive the clock outputs through buffers, especially if there are heavy loads on SCKO0 and SCKO1, and to minimize mutual interference by separating them or inserting a guard pattern between them.

Figure 15. Typical Connection Diagram

BLOCK DIAGRAM OF DVD PLAYER APPLICATION



BLOCK DIAGRAM OF HDD+DVD RECORDER APPLICATION



PACKAGING INFORMATION

| Orderable Device | Status (1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan (2) | Lead/Ball Finish (6) | MSL Peak Temp (3) | Op Temp (°C) | Device Marking (4/5) | Samples |
|------------------|---------------|--------------|-----------------|------|-------------|-------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| PLL1707DBQ | ACTIVE | SSOP | DBQ | 20 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | PLL1707 | Samples |
| PLL1707DBQR | ACTIVE | SSOP | DBQ | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | PLL1707 | Samples |
| PLL1708DBQ | ACTIVE | SSOP | DBQ | 20 | 50 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | PLL1708 | Samples |
| PLL1708DBQR | ACTIVE | SSOP | DBQ | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | PLL1708 | Samples |
| PLL1708DBQRG4 | ACTIVE | SSOP | DBQ | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM | -25 to 85 | PLL1708 | Samples |

(1) The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

(2) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

RoHS Exempt: TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

Green: TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

(3) MSL, Peak Temp. - The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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

(5) Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "-" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

(6) Lead/Ball Finish - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead/Ball Finish values may wrap to two lines if the finish value exceeds the maximum column width.

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OTHER QUALIFIED VERSIONS OF PLL1707 :

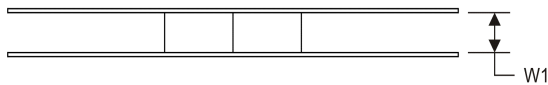
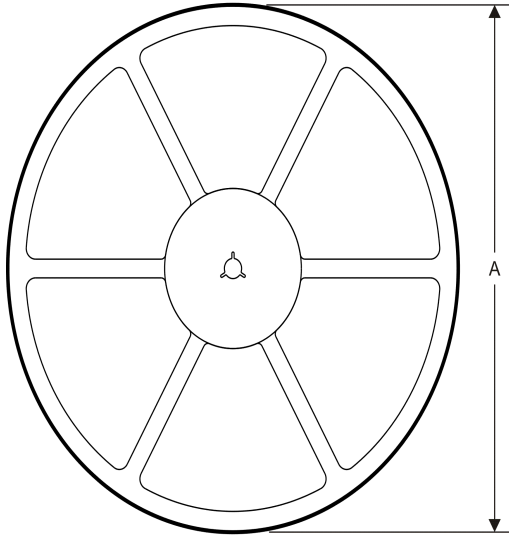
- Automotive: [PLL1707-Q1](#)

NOTE: Qualified Version Definitions:

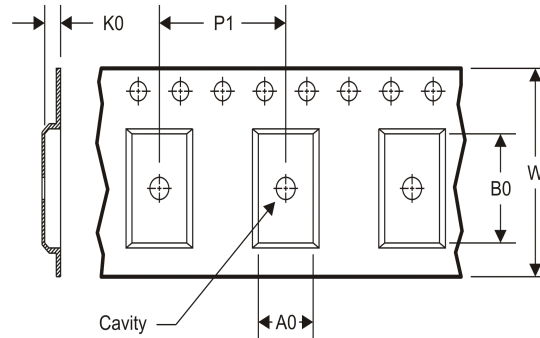
- Automotive - Q100 devices qualified for high-reliability automotive applications targeting zero defects

TAPE AND REEL INFORMATION

REEL DIMENSIONS



TAPE DIMENSIONS



| | |
|----|---|
| A0 | Dimension designed to accommodate the component width |
| B0 | Dimension designed to accommodate the component length |
| K0 | Dimension designed to accommodate the component thickness |
| W | Overall width of the carrier tape |
| P1 | Pitch between successive cavity centers |

TAPE AND REEL INFORMATION

*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| PLL1707DBQR | SSOP | DBQ | 20 | 2000 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |
| PLL1708DBQR | SSOP | DBQ | 20 | 2000 | 330.0 | 16.4 | 6.5 | 9.0 | 2.1 | 8.0 | 16.0 | Q1 |

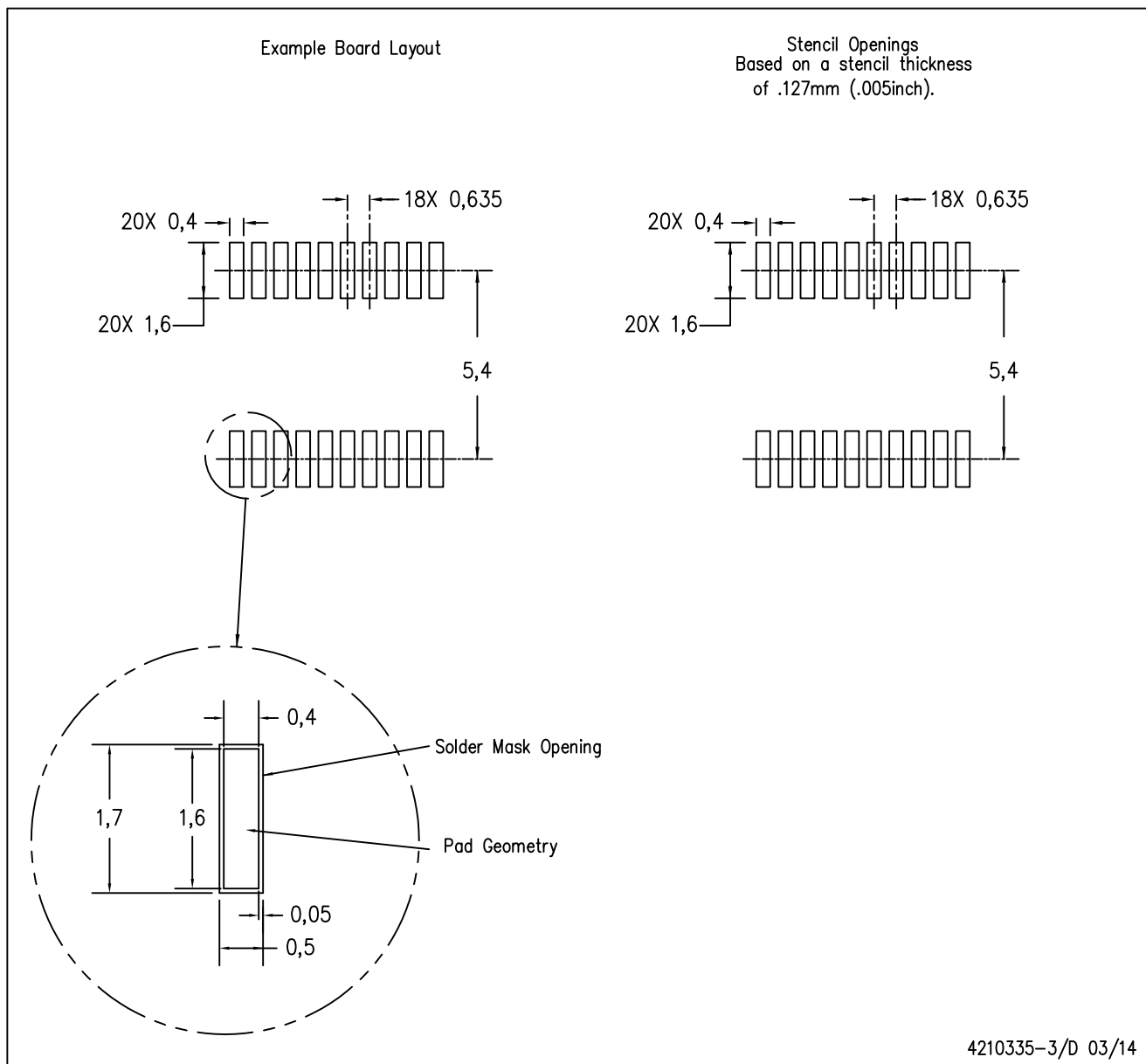
TAPE AND REEL BOX DIMENSIONS


*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-------------|--------------|-----------------|------|------|-------------|------------|-------------|
| PLL1707DBQR | SSOP | DBQ | 20 | 2000 | 367.0 | 367.0 | 38.0 |
| PLL1708DBQR | SSOP | DBQ | 20 | 2000 | 367.0 | 367.0 | 38.0 |

DBQ (R-PDSO-G20)

PLASTIC SMALL OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. Publication IPC-7351 is recommended for alternate designs.
 - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Example stencil design based on a 50% volumetric metal load solder paste. Refer to IPC-7525 for other stencil recommendations.

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