

Universal Land Patterns for LMK6D, LMK6P, and LMK6H BAW Oscillators



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ABSTRACT

As demand for integrated circuits has increased, the need for multi-source designs has become much more important. To address this, TI developed universal land patterns for 6-pin, 3.2mm × 2.5mm (DLE) and 6-pin, 2.5mm × 2.0mm (DLF) oscillators that can accommodate our LMK6H, LMK6P, and LMK6D oscillators as well as all other HCSL, LVPECL, and LVDS oscillators.

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1 Introduction

Designing systems around integrated circuits requires careful consideration of their physical formats and dimensions. Devices often come in standardized package sizes, but their pin layouts and footprints often vary between models and manufacturers. *Land patterns*, which are the dimensions of the metal pads that component leads are soldered to, are subject to even more variation. A given land pattern is not always compatible with other products of the same package size and pin functionality. This makes it more difficult to adapt the system for alternative parts when conducting tests or adapting to supply shortages. TI designed universal land patterns for oscillators with 6-pin, 3.2-mm × 2.5-mm and 2.5-mm × 2.0-mm packages that can fit all such devices on the market and are readily compatible with the new LMK6H, LMK6P, and LMK6D (hereafter, LMK6D/P/H) bulk acoustic wave (BAW) oscillators. PCB designers are strongly recommended to use the universal land patterns to increase the flexibility of their systems at no additional cost.

2 DLE, DLF Packages for TI LMK6x Oscillators

TI's LMK6x family of BAW oscillators are designed to offer high performance in compact design sizes. All variants are available in two package sizes, the larger 3.2mm × 2.5mm DLE and the smaller 2.5mm × 2.0mm DLF.

The LMK6C variant supports only the single-ended LVCMOS output format and thus has four pins. The device is fully compatible with the land patterns of other 4-pin DLE and DLF oscillators on the market and does not need special design considerations – any existing project using such oscillators can accept the LMK6C without modifications. [Figure 2-1](#) shows the DLE package and [Figure 2-2](#) shows the DLF package for this device.

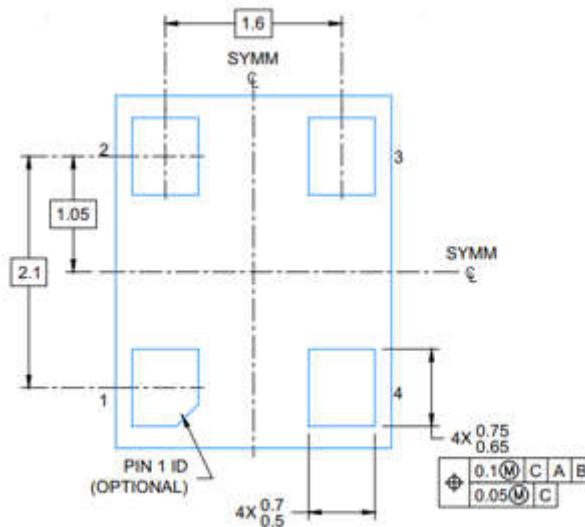


Figure 2-1. LMK6C Oscillator in 4-Pin, 3.2mm × 2.5mm DLE Package

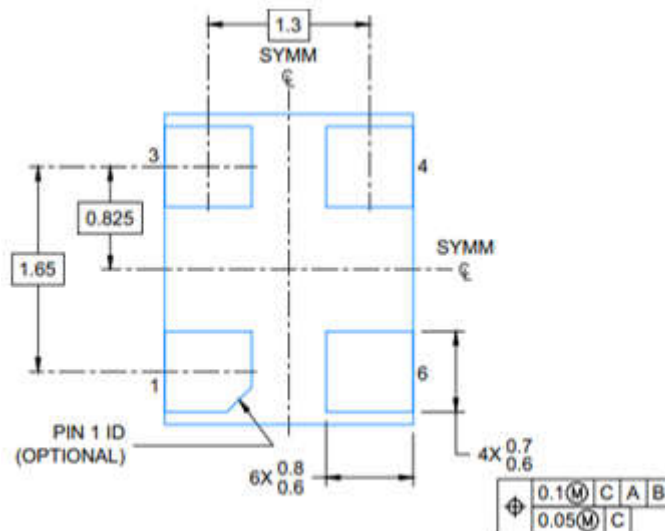


Figure 2-2. LMK6C Oscillator in 4-Pin, 2.5mm × 2.0mm DLF Package

The LMK6D, LMK6P, and LMK6H variants support differential output formats of LVDS, LVPECL, and HCSSL, respectively. These variants are available in DLE and DLF package sizes, but have six pins instead of the four-pin design of the LMK6C devices. Figure 2-3 shows the DLE package and Figure 2-4 shows the DLF package for these devices.

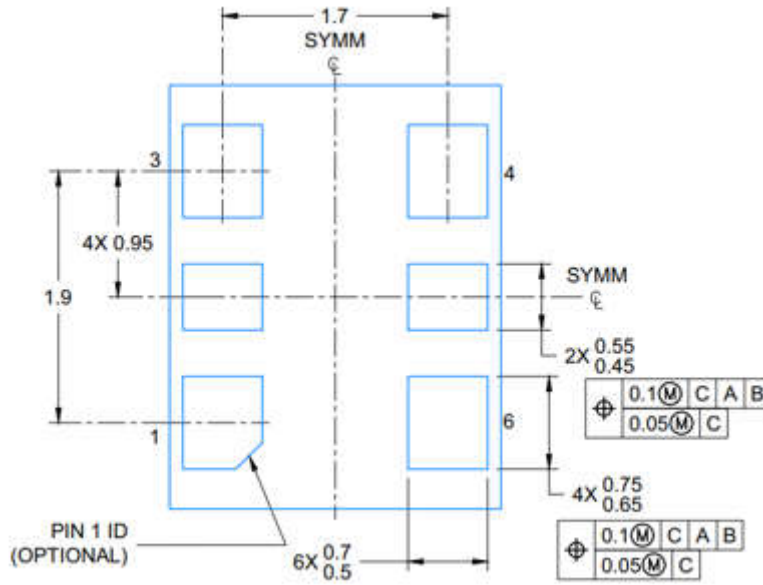


Figure 2-3. LMK6D/P/H Oscillator in 6-Pin, 3.2mm × 2.5mm DLE Package

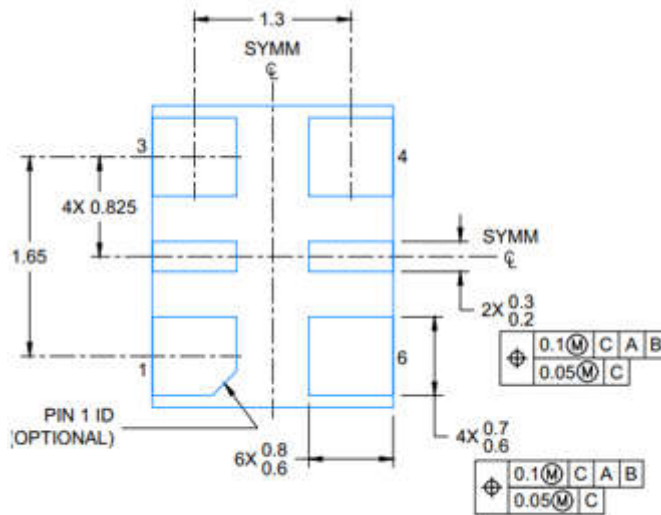


Figure 2-4. LMK6D/P/H Oscillator in 6-Pin, 2.5mm × 2.0mm DLF Package

3 Universal Land Patterns for 6-pin DLE and DLF Packages

Six-pin DLE and DLF oscillators currently on the market tend to have varying placements of the corner pins, which leads to different footprints and land patterns that are often incompatible with each other. Installing an oscillator on an unsuitable land pattern results in overhangs that can potentially affect performance. TI's universal land patterns in DLE and DLF sizes are one-size-fits-all designs that feature more generously-sized corner pads.

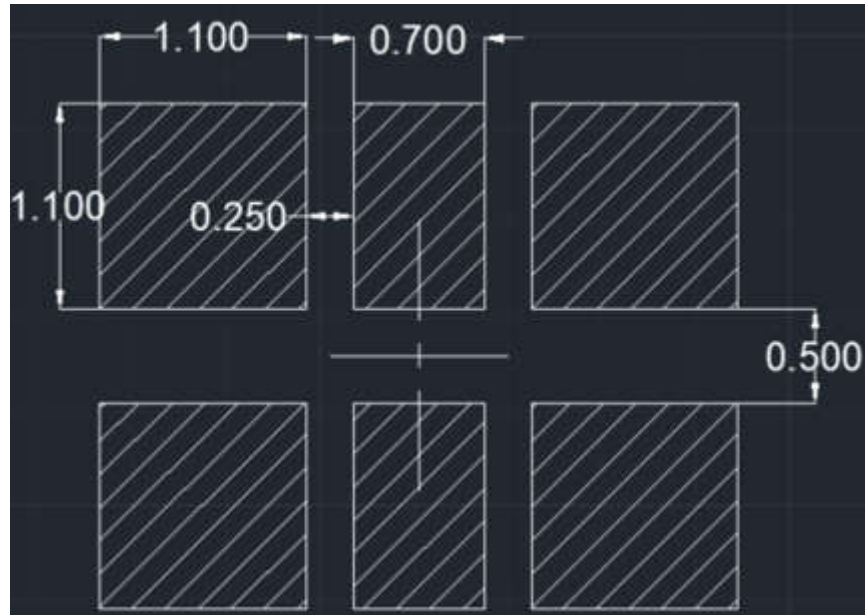


Figure 3-1. Universal Land Pattern for 6-Pin, 3.2mm × 2.5mm DLE Oscillators

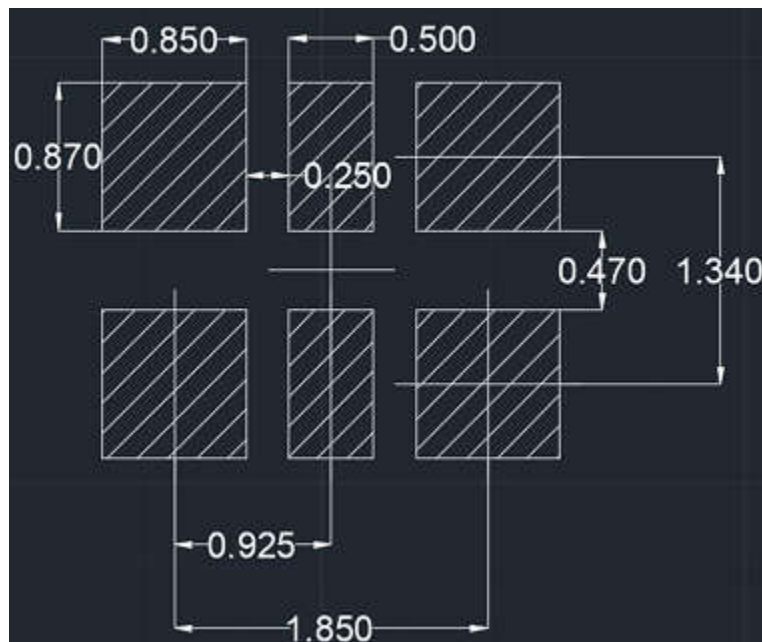


Figure 3-2. Universal Land Pattern for 6-Pin, 2.5mm × 2.0mm DLF Oscillators

The 6-pin DLE or DLF oscillators fit comfortably on the respective versions of the universal land pattern without overhangs. Figure 3-3 and Figure 3-4 show device footprints from both TI and many other vendors overlaid on the universal land patterns.

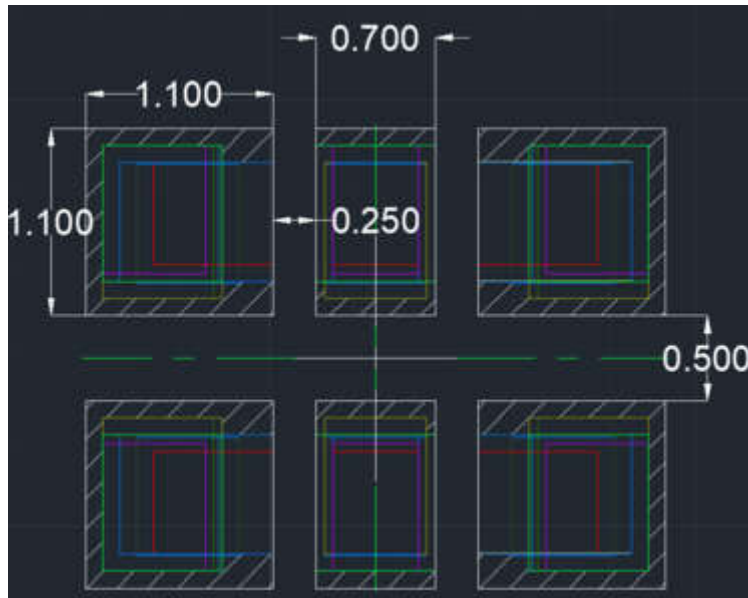


Figure 3-3. 6-Pin, 3.2mm × 2.5mm DLE Universal Land Pattern Overlaid With 11 Device Footprints

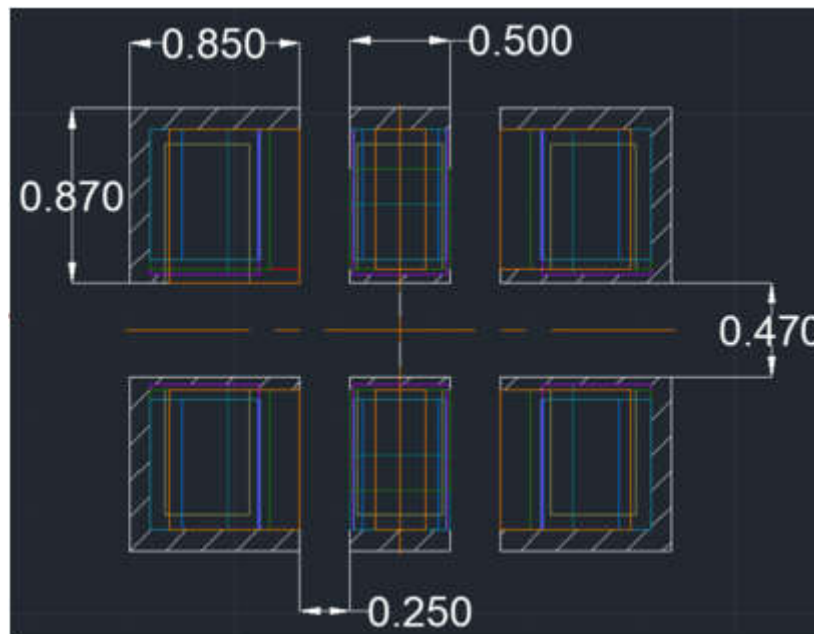


Figure 3-4. 6-Pin, 2.5mm × 2.0mm DLF Universal Land Pattern Overlaid With 11 Device Footprints

3.1 Reliability Tests

Figure 3-5 and Figure 3-6 show that there are no overhangs for TI's LMK6D/P/H BAW oscillators. The universal land patterns were extensively tested with TI LMK6D/P/H oscillators in both 3.2mm × 2.5mm DLE and 2.5mm × 2.0mm DLF sizes. Board level reliability (BLR) tests run with IPC9701 TC2 standards showed over 3,500 completed cycles with no failure. Thus, the universal land patterns are dependable, causing no issues in boards and systems.

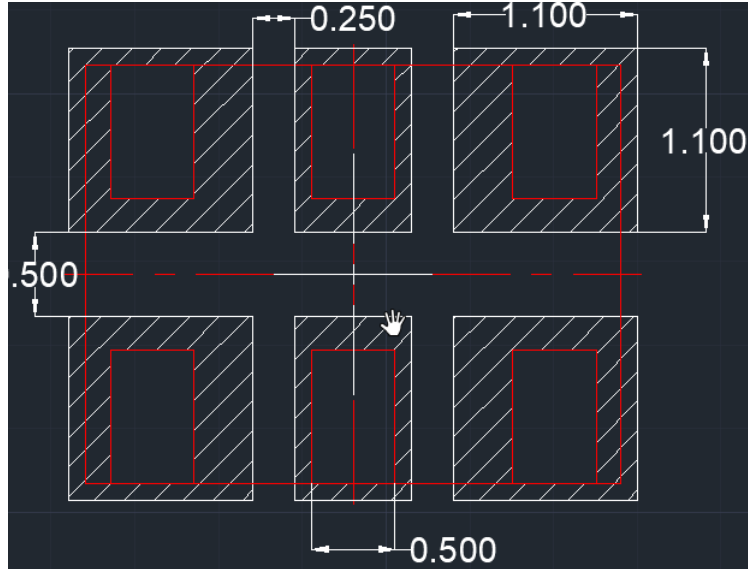


Figure 3-5. 6-Pin, 3.2mm × 2.5mm DLE Universal Land Pattern Overlaid With TI LMK6D/P/H DLE Device Lead Frames

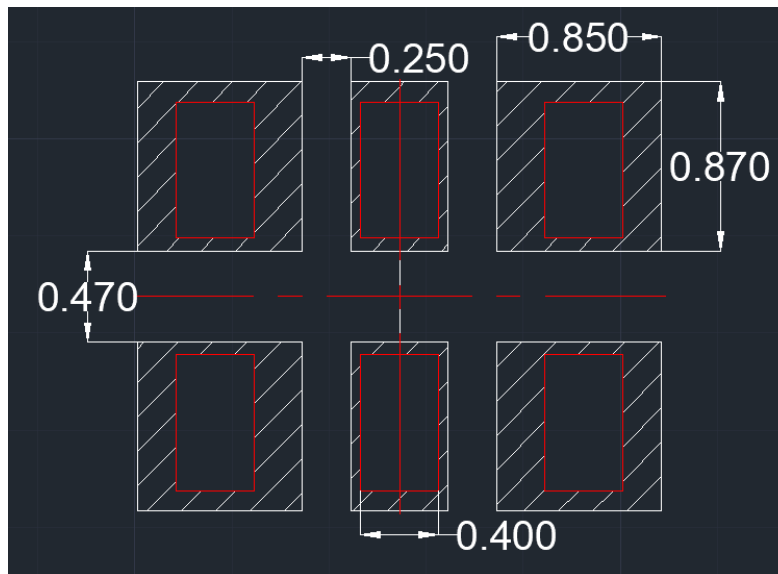


Figure 3-6. 6-Pin, 2.5mm × 2.0mm DLF Universal Land Pattern Overlaid With TI LMK6D/P/H DLF Device Lead Frames

4 Conclusion

In the best circumstances, fixed-frequency oscillators are simple to implement in a system due to their small sizes and limited pin counts. Land pattern compatibility issues can be frustrating as a result, as it can be necessary to create a new board design to fit a new oscillator, even if no other components need modification. The universal land patterns for 6-pin DLE and DLF packages help to mitigate this problem and maximize system flexibility — an oscillator change can potentially be as simple as a round of desoldering and resoldering. It is easier than ever to use oscillators such as the LMK6x family while reducing design risks.

For more information on the LMK6x oscillators and their applications, see the [oscillator webpage](#) on TI.com.

5 Revision History

Changes from Revision * (July 2023) to Revision A (September 2024)	Page
• Updated the numbering format for tables, figures, and cross-references throughout the document.....	1
• Updated images to show the lead frame.....	6

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