MOSFETs Take Top-Side Cooling A Step Further

Texas Instruments' family of DualCool NexFET power MOSFETs provide top-side cooling in packages with industry-standard footprints and pinouts. This enables designers who are currently using 25-V power MOSFETs in 5-mm x 6-mm S0-8 or QFN packages to replace those devices and achieve up to 80% higher power dissipation and 50% more current in their dc-dc converter designs (Fig. 1).

This new family of five NexFET devices in 5-mm x 6-mm SONs (also referred to as QFNs) allows computing and telecom system designers to use higher-current processors with expanded memory while saving board space. Target applications include desktop PCs, servers, telecommunications or networking equipment, basestations, and high-current industrial systems (see the table).

Although there are existing MOSFET packages that provide top-side cooling, these typically feature unique pinouts and require a change in pc-board layout for those who currently use S0-8 or QFN-packaged MOSFETs. In addition, DualCool NexFET devices allow for visual inspection after assembly on the customer's pc board.

The DualCool package design is a variation on the power QFN package (Fig. 2). Both the power QFN and the DualCool package use a metal clip to attach the source connection on top of the die to an I/O pad on the underside of the package. However, while the metal clip is covered by molding compound in the standard QFN, it is exposed in the DualCool design by placement of a metal heat slug on top of the clip. The top of the heat slug is flush with the package and accessible, so the customer can mount a heatsink to the device. Since this heat slug provides both a thermal and electrical connection to the drain, the customer will normally place an insulator between the package and any external heatsink.

The Dual Cool package offers a thermal impedance of 1.2°C per watt from the device junction to the topside of the package. The impact of this improved thermal performance on junction temperature versus power dissipation is shown in Fig. 3. According to the vendor, use of DualCool NexFET MOSFETs enables a single-phase synchronous buck converter to deliver 35 A of output, while using single MOSFETs for both the low-side and high-side switches.

DualCool NexFET devices are available now. Pricing for a representative device—the CSD16325Q5C—is $1.47 in 1,000-unit quantities. To order NexFET samples, see www.ti.com/mosfet-dcpr. For other information on this product family see www.ti.com/dualcool-pr.

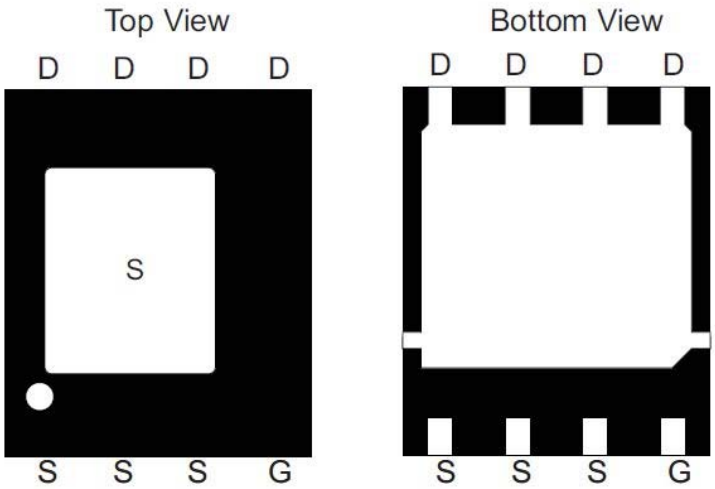
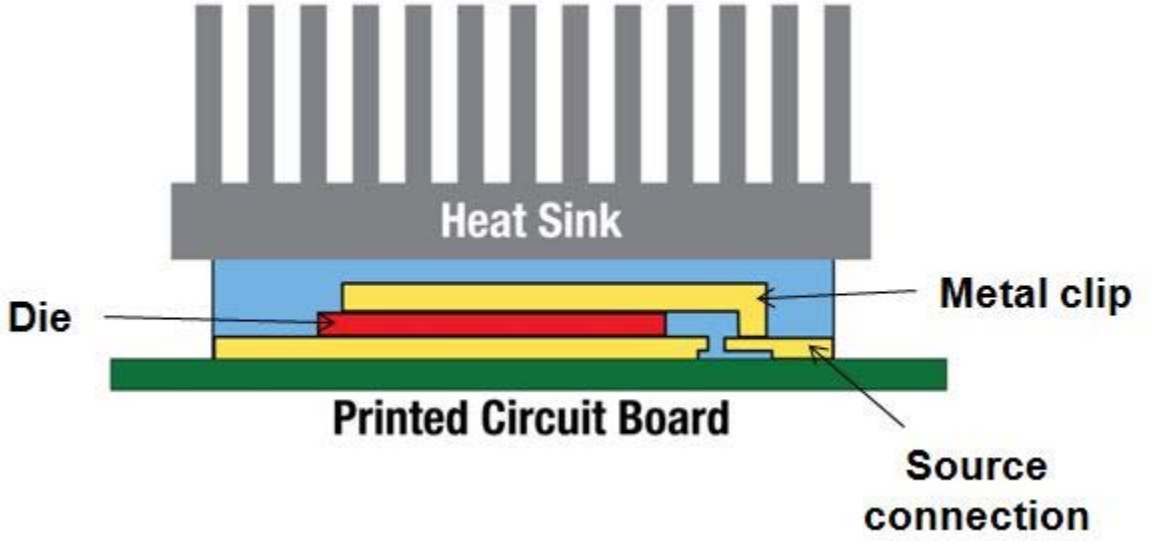


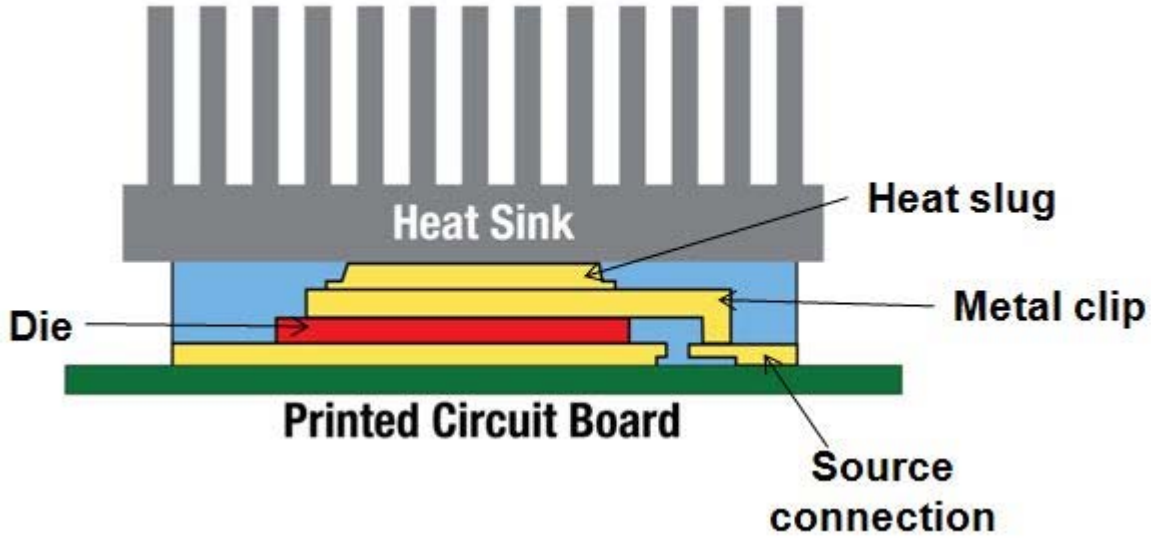
Fig. 1. With their industry-standard pinout, TI's DualCool NexFET MOSFETs serve as drop-in replacements for S0-8 and QFN-packaged MOSFETs.

Device	V_{DS}(V)	V_{GS}(V)	$R_{DS(ON)}$ (mΩ) at V_{GS}= 10 V	$R_{DS(ON)}$ (mΩ) at V_{GS}= 4.5 V	Q_G (nC)	Q_{GD} (nC)
CSD16407Q5C	25	16	1.8	2.5	13.3	3.5
CSD16408Q5C		16	3.7	5.4	6.5	1.9
CSD16325Q5C		10	—	1.7	18	2.9
CSD16321Q5C		10	—	2.1	14	2.5
CSD16322Q5C		10	—	4.5	6.5	1.2

Table. Key Specifications for DualCool NexFETs



(a)



(b)

Fig. 2. In a standard QFN package for power MOSFETs, the metal clip that provides the source connection is covered by molding material (a). In the Dual Cool NexFET package design, the metal clip is exposed through placement of a heat slug on top of the metal clip (b). (*Some QFNs use wirebonds instead of the metal clip.)*

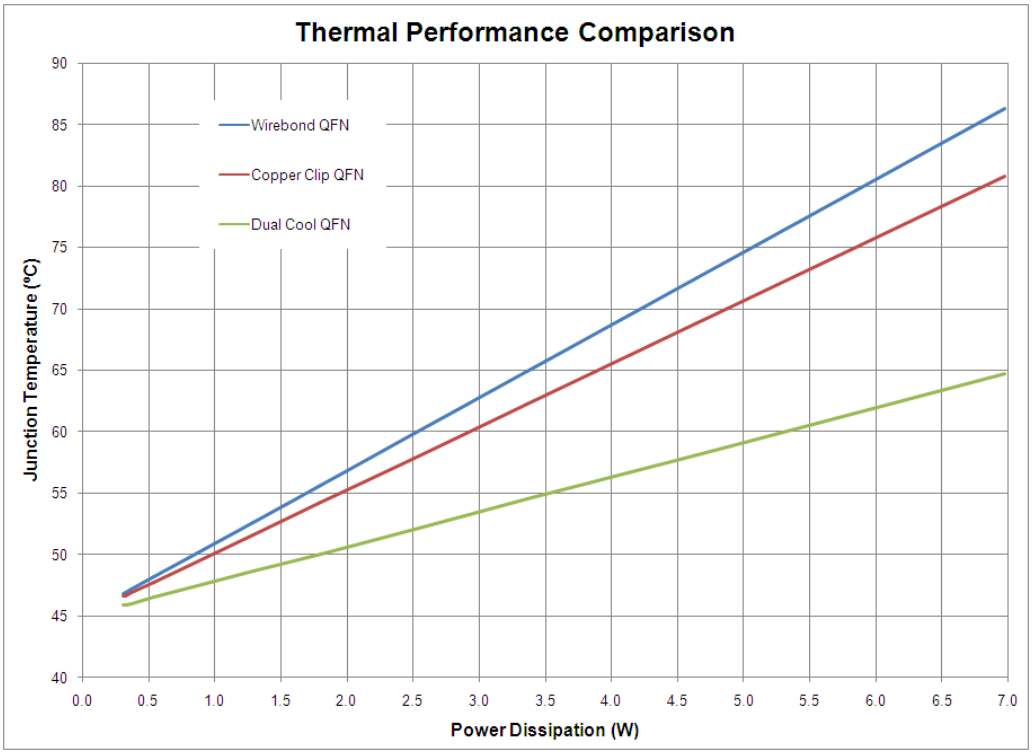


Fig. 3. The junction temperature of a DualCool NexFET device experiences a much lower temperature rise over a range of power dissipation levels than comparable MOSFETs in either the copper-clip QFN (pictured above in Fig. 2a) or the wirebond QFN.