Disadvantages of FETs

1 Linearity is very poor by comparison with a BJT degenerated to give the same transconductance. The Class-B conduction characteristics do not cross over smoothly, and there is no equivalent to the optimal Class-B bias condition that is very obvious with a BJT output stage.
2 The Vgs required for conduction is usually of the order of 4–6 V, which is much greater than the 0.6–0.8 V required by a BJT for base drive. This greatly reduces the voltage efficiency of the output stage unless the preceding small-signal stages are run from separate and higher-voltage supply rails.
3 The minimum channel resistance of the FET, known as Rds(on), is high and gives a further reduction in efficiency compared with BJT outputs.
4 Power FETs are liable to parasitic oscillation. In severe cases a plastic-package device will literally explode. This is normally controllable in the simple complementary FET output stage by adding gate-stopper resistors, but is a serious disincentive to trying radical experiments in output stage circuit design.
5 Some commentators claim that FET parameters are predictable; I find this hard to understand as they are notorious for being anything but. From one manufacturer's data (Harris), the Vgs for the IRF240 FET varies between 2.0 and 4.0 V for an Id of 250 μA; this is a range of two to one. In contrast the Vbe/Ic relation in bipolars is fixed by a mathematical equation for a given transistor type, and is much more reliable. Nobody uses FETs in log converters.
6 Since the Vgs spreads are high, this will complicate putting devices in parallel for greater power capability. Paralleled BJT stages rarely require current-sharing resistors of greater than 0.1 Ω, but for the FET case they may need to be a good deal larger, reducing efficiency further.
7 At the time of writing, there is a significant economic penalty in using FETs. Taking an amplifier of given power output, the cost of the output semiconductors is increased by between 1.5 and 2 times with FETs.

IGBTs

Insulated-Gate Bipolar Transistors represent a relatively new option for the amplifier designer. They have been held up as combining the best features of FETs and BJTs. In my view this is a dubious proposition as I find the advantages of FETs for audio to be heavily outweighed by the drawbacks, and if IGBTs have any special advantages they have not so far emerged. According to the Toshiba application notes[1], IGBTs consist of an FET controlling a bipolar power transistor; I have no information on the linearity of these devices, but the combination does not sound promising.

The most discouraging aspect of IGBTs is the presence of a parasitic BJT that turns the device hard on above a critical current threshold. This inbuilt