

Document Title: <b>Description, AN, Science of Grilling Meat</b>		Part # and Rev. <b>13901-01</b>	
		Release Date:	
Rev.	Description	Revision By	Date

**Production Filename:** 13901 (In Product Library)

**Path to Working Files:** DecaDoc\Application Notes\Master

**Dimensions:** 8.5 inch wide, 11 inch tall

**Material:** Paper, 92 Bright White or better, 75g/m<sup>2</sup> or heavier

**Colors:** Color Print on White

**Printer:** HP Color LaserJet 8550-PS

**Finish:** None

**Adhesive:** None

**Special Notes:** Illustrations are Ref Only \*\* Not to Scale \*\* (Shown page 1 of 2)



Application Note

### The Science of Grilling Meat

With summer coming on more of us will be spending time with the grill. Certainly the first concern when grilling meat is not to char the outside of the meat, but the second is to bring the inside to the desired temperature.

The following table tells us the temperature we are shooting for, given the preferences of ourselves or our guests. Our problem is to find the time it will take for the center of the steak to reach this temperature, starting say from refrigerator temperature, and having a grill that is at a known temperature. Table 1 shows the final temperatures commonly desired when grilling steak and ground beef.

The temperature distribution and heat flow in a steak or ground beef patty cooking on a grill is pretty complex. It could be modeled on a computer, but that's not what we want here.

We can approximate it with a solution to a highly idealized steak cooking situation.

Assume you have a thick slab of meat initially at temperature  $T_0$ . At time 0 one surface of the meat is placed in contact with the grill surface at temperature  $T_g$ . For this simple condition the temperature of the meat for any time,  $t$  and any depth,  $z$  beneath the heated surface can be computed from

$$\frac{T(z,t) - T_0}{T_g - T_0} = \operatorname{erfc}\left(\frac{z}{2\sqrt{Dt}}\right) \quad (1)$$

Here  $D$  is the thermal diffusivity of the meat and  $\operatorname{erfc}$  is the complementary error function which can be found in tables or approximated numerically (Press et al. 1989).

Table 1. Beef and Lamb Cooking Temperatures

Roasts, Steaks	Temperature	Description
Rare	120° to 125°F	Center is bright red, pinkish toward the exterior portion
Medium Rare	130° to 135°F	Center is very pink, slightly brown toward the exterior portion
Medium	140° to 145°F	Center is light pink, outer portion is brown
Medium Well	150° to 155°F	Not pink
Well Done	160°F and above	Steak is uniformly brown throughout
Ground Meat	160° to 165°F	No longer pink but uniformly brown throughout