$$\underline{\Sigma} = \sigma^2 \underline{I}$$

Multivariate Gaussian P.D.F.

$$p(w) = \frac{1}{(2\pi)^{\frac{D}{2}} |\underline{\Sigma}|^{\frac{1}{2}}} \exp\left\{-\frac{1}{2}(\underline{w}-\underline{\mu})^T \underline{\Sigma}^{-1} (\underline{w}-\underline{\mu})\right\}$$

$$p(w) = \frac{1}{(2\pi)^{\frac{D}{2}} |\sigma^2 \underline{I}|^{\frac{1}{2}}} \exp\left\{-\frac{1}{2\sigma^2}(\underline{w}-\underline{\mu})^T \underline{I}^{-1} (\underline{w}-\underline{\mu})\right\}$$

$$= \frac{1}{(2\pi)^{\frac{D}{2}} (\sigma^2)^{\frac{D}{2}}} \exp\left\{-\frac{1}{2\sigma^2} \sum_{d=1}^{D} (w_d - \mu_d)^2\right\}$$

$$= \frac{1}{(2\pi)^{\frac{D}{2}} (\sigma^2)} \prod_{d=1}^{D} \exp\left\{-\frac{1}{2\sigma^2}(w_d - \mu_d)^2\right\}$$

$$= \prod_{d=1}^{D} \frac{1}{\sqrt{2\pi}\sigma} \exp\left\{-\frac{1}{2\sigma}(w-\mu)^2\right\}$$

$$= \prod_{d=1}^{D} p(w_d \mid \mu_d, \sigma^2)$$