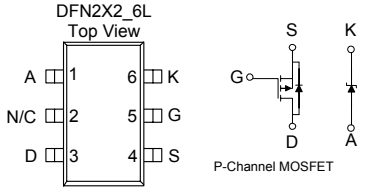
# P-Channel 20-V (D-S) MOSFET With Schottky Diode

These miniature surface mount MOSFETs utilize a high cell density trench process to provide low $r_{DS(on)}$ and to ensure minimal power loss and heat dissipation. Typical applications are DC-DC converters and power management in portable and battery-powered products such as computers, printers, PCMCIA cards, cellular and cordless telephones.

- Low $r_{DS(on)}$ provides higher efficiency and extends battery life
- Low thermal impedance copper leadframe DFN2X2_6L saves board space
- Fast switching speed
- High performance trench technology

| MOSFET PRODUCT SUMMARY | | |
|---|---|---|
| $V_{DS}$ (V) | $r_{DS(on)}$ (OHM) | $I_D$ (A) |
| -20 | 0.090 @ $V_{GS}$ = -4.5V | -4.5 |
| | 0.120 @ $V_{GS}$ = -2.5V | -4.5 |

| SCHOTTKY PRODUCT SUMMARY | | |
|---|---|---|
| $V_{KA}$ (V) | $V_f$ (V) Diode Forward Voltage | $I_F$ (A) |
| 20 | 0.46V @ 0.5A | 1 |




| ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C UNLESS OTHERWISE NOTED) | | | | |
|---|---|---|---|---|
| Parameter | | Symbol | Maximum | Units |
| Drain-Source Voltage (MOSFET) | | $V_{DS}$ | -20 | V |
| Reverse Voltage (Schottky) | | $V_{KA}$ | 20 | |
| Gate-Source Voltage (MOSFET) | | $V_{GS}$ | ±8 | |
| Continuous Drain Current ($T_J$=150°C) (MOSFET)[a] | $T_A$=25°C | $I_D$ | -4.5 | A |
| | $T_A$=70°C | | -4.5 | |
| Pulsed Drain Current (MOSFET)[b] | | $I_{DM}$ | -8 | |
| Continuous Source Current (MOSFET Diode Conduction)[a] | | $I_S$ | -4.5 | |
| Average Forward Current (Schottky) | | $I_F$ | 1 | |
| Pulsed Forward Current (Schottky) | | $I_{FM}$ | 2 | |
| Maximum Power Dissipation (MOSFET)[a] | $T_A$=25°C | $P_D$ | 6.5 | W |
| | $T_A$=70°C | | 5 | |
| Maximum Power Dissipation (Schottky)[a] | $T_A$=25°C | | 7.3 | |
| | $T_A$=70°C | | 4.7 | |
| Operating Junction and Storage Temperature Range | | $T_J$, $T_{stg}$ | -55 to 150 | °C |

| THERMAL RESISTANCE RATINGS | | | | | |
|---|---|---|---|---|---|
| Parameter | | Symbol | Typ | Max | |
| Maximum Junction-to-Ambient[a] | t <= 5 sec | $R_{thJA}$ | 52 | 65 | °C/W |
| | Steady State | | 12.5 | 16 | |

Notes

a. Surface Mounted on 1" x 1" FR4 Board.

b. Pulse width limited by maximum junction temperature

| MOSFET SPECIFICATIONS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Test Conditions | Limits | | | Unit |
| | | | Min | Typ | Max | |
| **Static** | | | | | | |
| Gate-Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = -250 uA | -0.4 | | | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0 V, $V_{GS}$ = +/-8 V | | | ±100 | nA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = -16 V, $V_{GS}$ = 0 V | | | -1 | uA |
| | | $V_{DS}$ = -16 V, $V_{GS}$ = 0 V, $T_J$ = 55°C | | | -10 | |
| On-State Drain Current[A] | $I_{D(on)}$ | $V_{DS}$ = -5 V, $V_{GS}$ = -4.5 V | -8 | | | A |
| Drain-Source On-State Resistance[A] | $r_{DS(on)}$ | $V_{GS}$ = -4.5 V, $I_D$ = -1 A | | | 0.090 | Ω |
| | | $V_{GS}$ = -2.5 V, $I_D$ = -1 A | | | 0.120 | |
| Forward Tranconductance[A] | $g_{fs}$ | $V_{DS}$ = -5 V, $I_D$ = -1 A | | 3 | | S |
| Diode Forward Voltage | $V_{SD}$ | $I_S$ = -1.6 A, $V_{GS}$ = 0 V | | -0.70 | | V |
| **Dynamic[b]** | | | | | | |
| Total Gate Charge | $Q_g$ | $V_{DS}$ = -5 V, $V_{GS}$ = -4.5 V, $I_D$ = -3.6 A | | 6.0 | | nC |
| Gate-Source Charge | $Q_{gs}$ | | | 0.80 | | |
| Gate-Drain Charge | $Q_{gd}$ | | | 1.30 | | |
| Turn-On Delay Time | $t_{d(on)}$ | $V_{DD}$ = -5 V, $R_L$ = 5 OHM, $V_{GEN}$ = -4.5 V, $R_G$ = 6 OHM | | 6.5 | | ns |
| Rise Time | $t_r$ | | | 20 | | |
| Turn-Off Delay Time | $t_{d(off)}$ | | | 31 | | |
| Fall-Time | $t_f$ | | | 21 | | |

| SCHOTTKY SPECIFICATIONS ($T_A$ = 25°C UNLESS OTHERWISE NOTED) | | | | | | |
|---|---|---|---|---|---|---|
| Parameter | Symbol | Test Conditions | Limits | | | Unit |
| | | | Min | Typ | Max | |
| Forward Voltage Drop | $V_F$ | $I_F$ = 0.5 A | | | 0.46 | V |
| | | $I_F$ = 0.5 A, $T_J$ = 125°C | | | 0.53 | V |
| Maximum Reverse Leakage Current | $I_{rm}$ | $V_r$ = 5 V | | | 0.041 | mA |
| | | $V_r$ = 30 V, $T_J$ = 75°C | | | 4 | |
| | | $V_r$ = 30 V, $T_J$ = 125°C | | | 28 | |
| Junction Capacitance | $C_T$ | $V_r$ = 10 V | | 30 | | pF |

Notes

a. Pulse test: PW <= 300us duty cycle <= 2%.

b. Guaranteed by design, not subject to production testing.

# Typical Electrical Characteristics

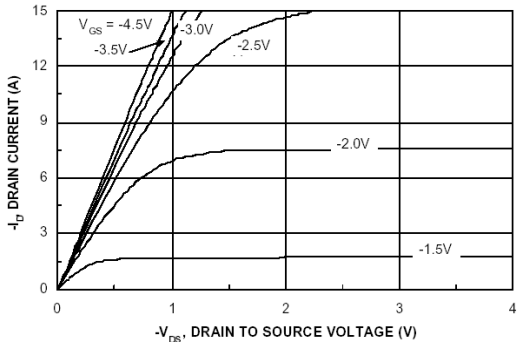



**Figure 1. On-Region Characteristics**

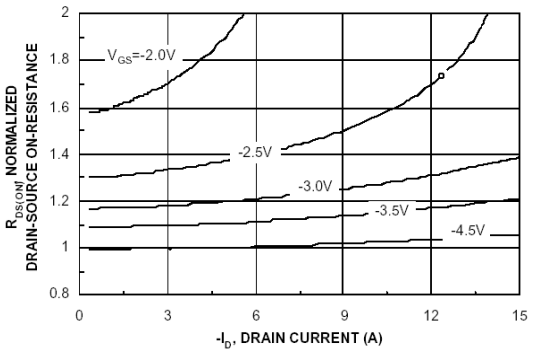



**Figure 2. On-Resistance Variation with Drain Current and Gate Voltage**

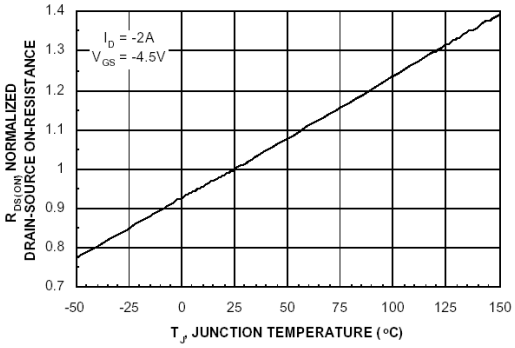



**Figure 3. On-Resistance Variation with Temperature**

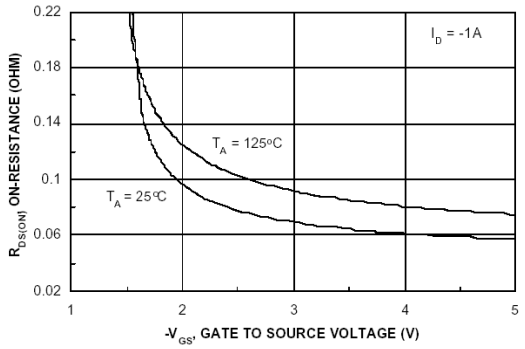



**Figure 4. On-Resistance Variation with Gate to Source Voltage**

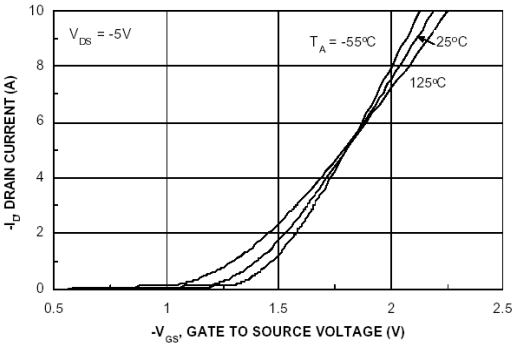



**Figure 5. Transfer Characteristics**

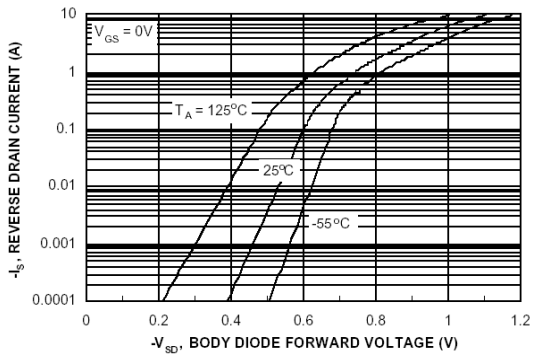



**Figure 6. Body Diode Forward Voltage Variation with Source Current and Temperature**

# Typical Electrical Characteristics

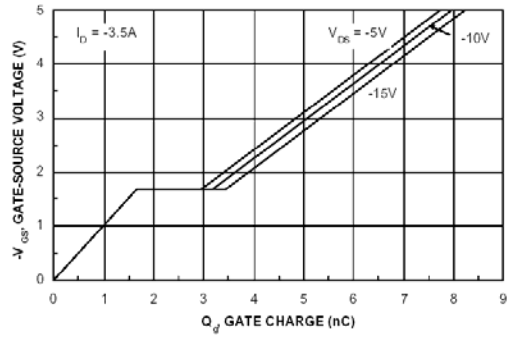



**Figure 7. Gate Charge Characteristic**

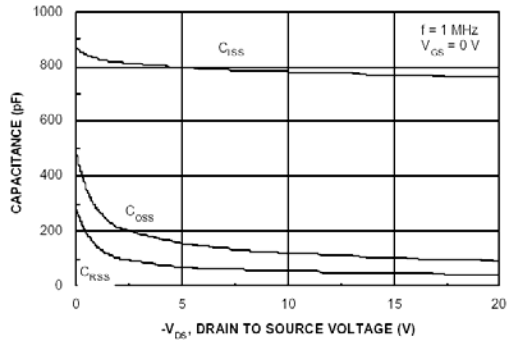



**Figure 8. Capacitance Characteristic**

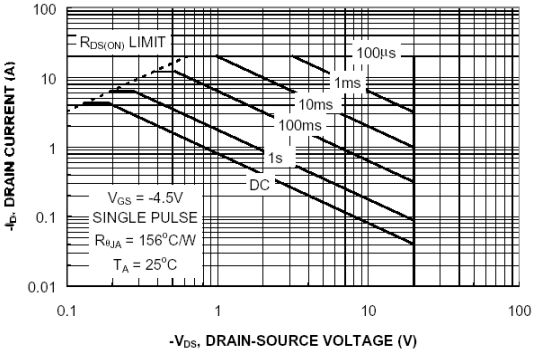



**Figure 9. Maximum Safe Operating Area**

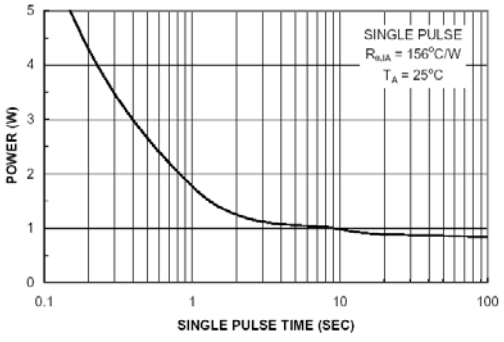



**Figure 10. Single Pulse Maximum Power Dissipation**

**Normalized Thermal Transient Junction to Ambient**

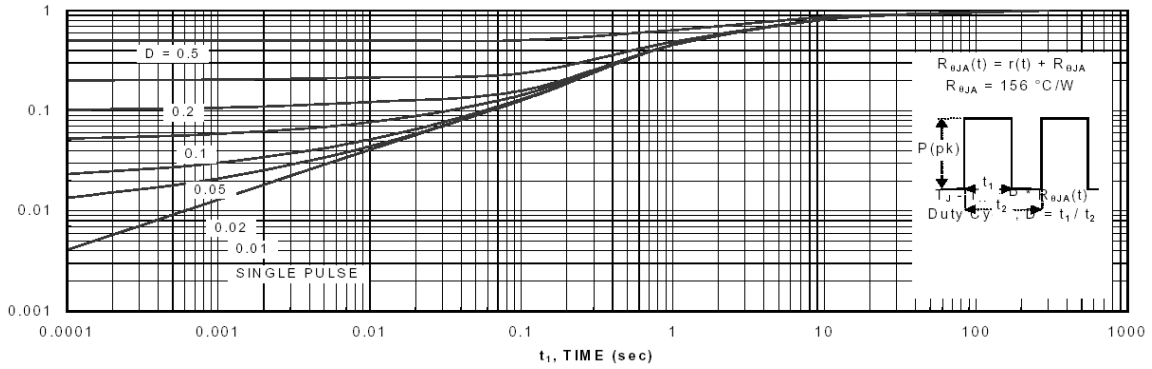
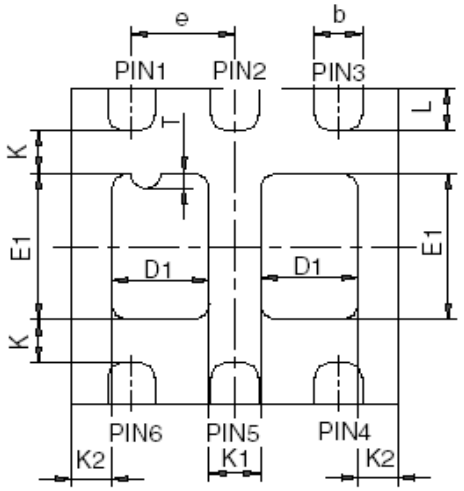


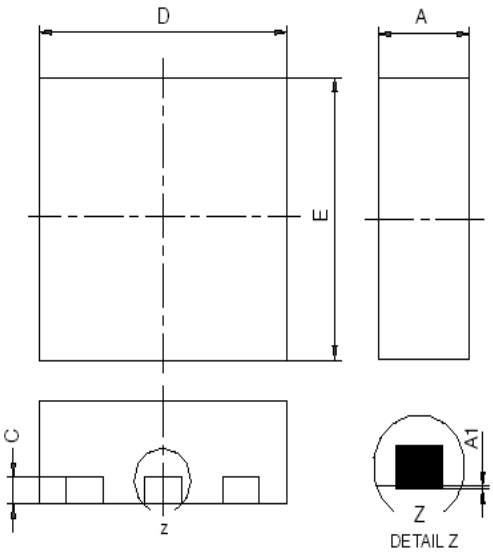

**Figure 11. Transient Thermal Response Curve.**

# Package Information




BACKSIDE VIEW OF DUAL

| DIM | DUAL PAD | | | | | |
|---|---|---|---|---|---|---|
| | MILLIMETERS | | | INCHES | | |
| | Min | Nom | Max | Min | Nom | Max |
| A | 0.675 | 0.75 | 0.80 | 0.027 | 0.030 | 0.032 |
| A1 | 0 | | 0.05 | 0 | | 0.002 |
| b | 0.23 | 0.30 | 0.38 | 0.009 | 0.012 | 0.015 |
| C | 0.15 | 0.20 | 0.25 | 0.006 | 0.008 | 0.010 |
| D | 2.00 BSC | | | 0.079 BSC | | |
| D1 | 0.600 | 0.650 | 0.700 | 0.024 | 0.026 | 0.028 |
| E | 2.00 BSC | | | 0.079 BSC | | |
| E1 | 0.81 | 0.86 | 0.91 | 0.032 | 0.034 | 0.036 |
| e | 0.65 BSC | | | 0.026 BSC | | |
| K1 | 0.25 | 0.30 | 0.35 | 0.010 | 0.012 | 0.014 |
| K2 | 0.65 BSC | | | 0.026 BSC | | |
| L | 0.250 | 0.300 | 0.350 | 0.01 | 0.012 | 0.014 |



# ECN History

| | |
|---|---|
| A: | New Product |
| A to B: | Add Typical Electrical Characteristics & Package |