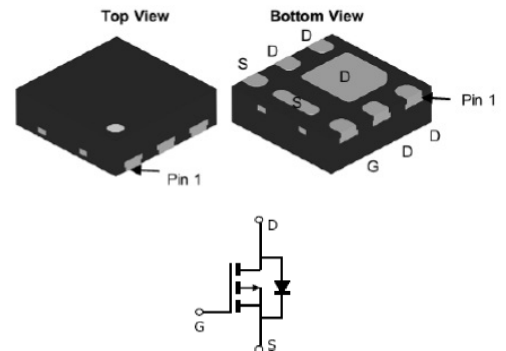


**P-Channel Enhancement Mode Power MOSFET**
**PRIMARY CHARACTERISTICS**

| BV <sub>DSS</sub> | R <sub>DS(on)</sub> Max.      | I <sub>D</sub> |
|-------------------|-------------------------------|----------------|
| -12V              | 10mΩ@V <sub>GS</sub> =-4.5V   | -20A           |
|                   | 13.5mΩ@V <sub>GS</sub> =-2.5V |                |

**DFN2x2**
**PACKAGE**

**FEATURES**

- High Power and Current Handling Capability
- Surface Mount Package

**APPLICATION**

- DC-DC Converters
- Power Management Functions
- Battery Management Application

**Absolute Maximum Ratings @T<sub>A</sub>=25°C unless otherwise noted**

| Parameter                                  |                      | Symbol                           | Ratings | Unit |
|--------------------------------------------|----------------------|----------------------------------|---------|------|
| Drain-Source Voltage                       |                      | V <sub>DSS</sub>                 | -12     | V    |
| Gate-Source Voltage                        |                      | V <sub>GSS</sub>                 | ± 12    | V    |
| Drain Current (Continuous) *AC             | T <sub>A</sub> =25°C | I <sub>D</sub>                   | -20     | A    |
|                                            | T <sub>A</sub> =70°C |                                  | -16     |      |
| Drain Current (Pulse) *B                   |                      | I <sub>DM</sub>                  | -80     | A    |
| Power Dissipation                          | T <sub>A</sub> =25°C | P <sub>D</sub>                   | 5       | W    |
| Operating Temperature/ Storage Temperature |                      | T <sub>J</sub> /T <sub>STG</sub> | -55~150 | °C   |

**Thermal Resistance Ratings**

| Parameter                   |         | Symbol            | Maximum | Unit |
|-----------------------------|---------|-------------------|---------|------|
| Maximum Junction-to-Ambient | t ≤ 10s | R <sub>thJA</sub> | 25      | °C/W |



## P-Channel Enhancement Mode Power MOSFET

**Electrical Characteristics @ $T_A=25^{\circ}\text{C}$  unless otherwise noted**

| Parameter                        | Symbol        | Test Conditions                                                    | Min  | Typ  | Max       | Unit       |
|----------------------------------|---------------|--------------------------------------------------------------------|------|------|-----------|------------|
| Static                           |               |                                                                    |      |      |           |            |
| Drain-Source Breakdown Voltage   | $V_{(BR)DSS}$ | $V_{GS} = 0V, I_D = -250\mu A$                                     | -12  | --   | --        | V          |
| Zero Gate Voltage Drain Current  | $I_{DSS}$     | $V_{DS} = -12V, V_{GS} = 0V$                                       | --   | --   | -1        | $\mu A$    |
| Gate Threshold Voltage           | $V_{GS(TH)}$  | $V_{GS} = V_{bs}, I_{DS} = -250\mu A$                              | -0.4 | -0.6 | -1        | V          |
| Gate Leakage Current             | $I_{GSS}$     | $V_{GS} = \pm 12V, V_{DS} = 0V$                                    | --   | --   | $\pm 100$ | $\mu A$    |
| Drain-Source On-state Resistance | $R_{DS(on)}$  | $V_{GS} = -4.5V, I_D = -15A$                                       | --   | 7    | 10        | m $\Omega$ |
|                                  | $R_{DS(on)}$  | $V_{GS} = -2.5V, I_D = -10A$                                       | --   | 9    | 13.5      | m $\Omega$ |
| Diode Forward Voltage            | $V_{SD}$      | $I_{SD} = -1A, V_{GS} = 0V$                                        | --   | --   | -1.2      | V          |
| Diode Forward Current     *AC    | $I_S$         | $T_A = 25^{\circ}C$                                                | --   | --   | -20       | A          |
| Switching                        |               |                                                                    |      |      |           |            |
| Total Gate Charge                | $Q_g$         | $V_{GS} = -4.5V, V_{DS} = -6V, I_D = -12A$                         | --   | 20   | --        | nC         |
| Gate-Source Charge               | $Q_{gs}$      |                                                                    | --   | 4    | --        | nC         |
| Gate-Drain Charge                | $Q_{gd}$      |                                                                    | --   | 5.5  | --        | nC         |
| Turn-on Delay Time               | $t_d (on)$    | $V_{GS} = -4.5V, V_{DS} = -6V, R_L = 0.5\Omega, R_{GEN} = 3\Omega$ | --   | 15   | --        | ns         |
| Turn-on Rise Time                | $t_r$         |                                                                    | --   | 45   | --        | ns         |
| Turn-off Delay Time              | $t_d (off)$   |                                                                    | --   | 135  | --        | ns         |
| Turn-Off Fall Time               | $t_f$         |                                                                    | --   | 185  | --        | ns         |
| Dynamic                          |               |                                                                    |      |      |           |            |
| Input Capacitance                | $C_{iss}$     | $V_{GS} = 0V, V_{DS} = -6V, f = 1MHz$                              | --   | 2180 | --        | pF         |
| Output Capacitance               | $C_{oss}$     |                                                                    | --   | 675  | --        | pF         |
| Reverse Transfer Capacitance     | $C_{rss}$     |                                                                    | --   | 425  | --        | pF         |

A: The value of  $R_{\theta JA}$  is measured with the device mounted on 1in<sup>2</sup> FR-4 board with 2oz. Copper, in a still air environment with  $T_A=25^{\circ}\text{C}$ . The value in any given application depends on the user's specific board design.

B: Repetitive rating, pulse width limited by junction temperature.

C: The current rating is based on the  $\leq 10\text{s}$  junction to ambient thermal resistance rating.

**P-Channel Enhancement Mode Power MOSFET**

Typical Performance Characteristics ( $T_J = 25^\circ\text{C}$ , unless otherwise noted)

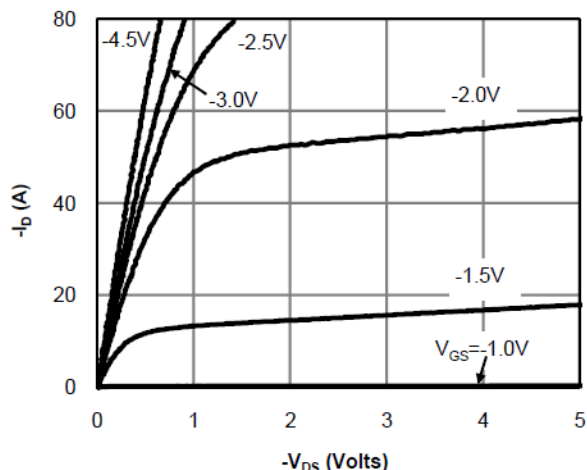


Figure 1: On-Region Characteristics

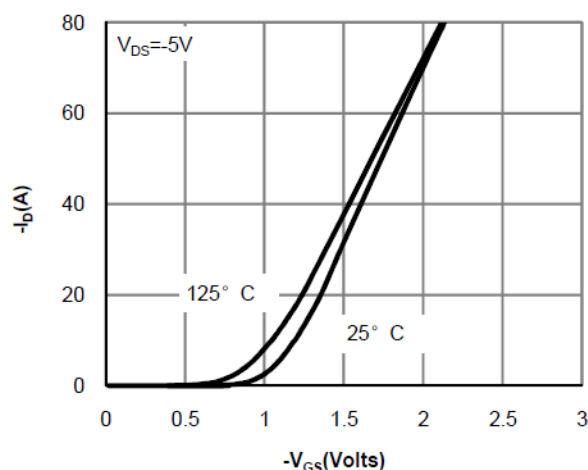


Figure 2: Transfer Characteristics

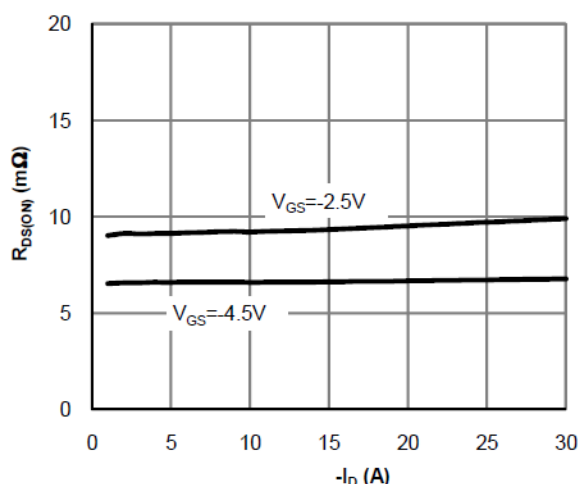


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

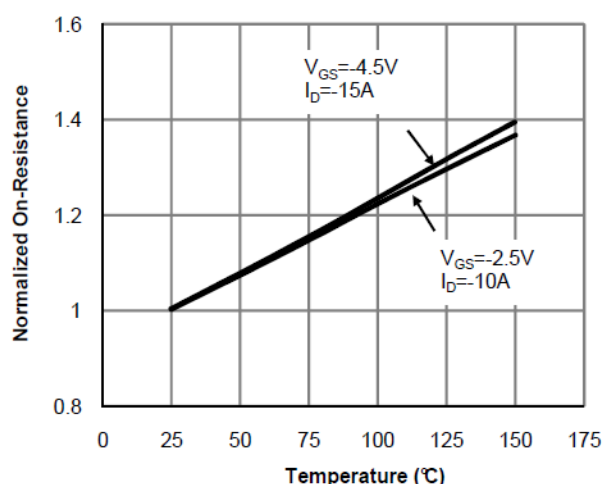


Figure 4: On-Resistance vs. Junction Temperature

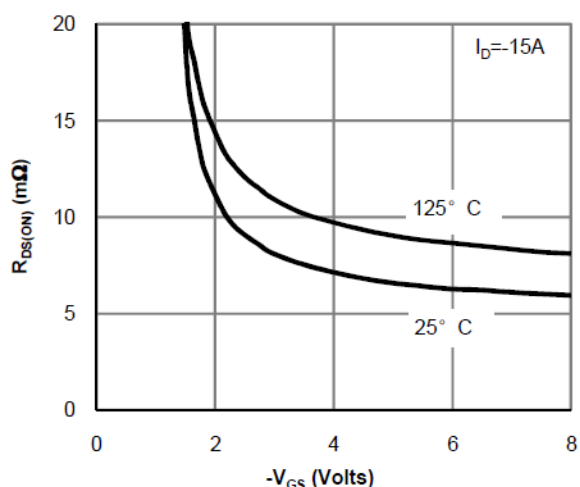


Figure 5: On-Resistance vs. Gate-Source Voltage

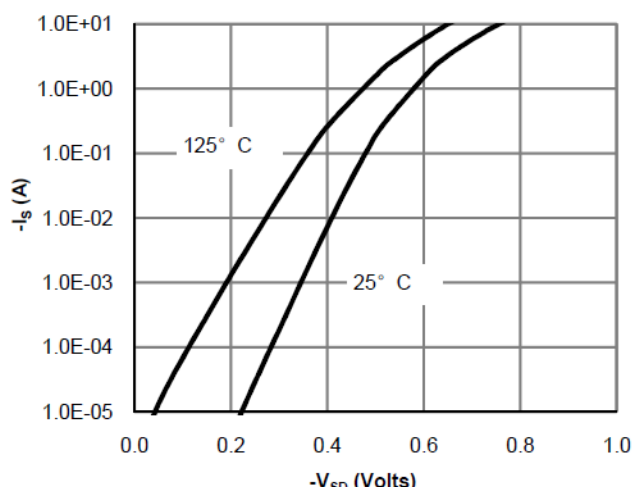
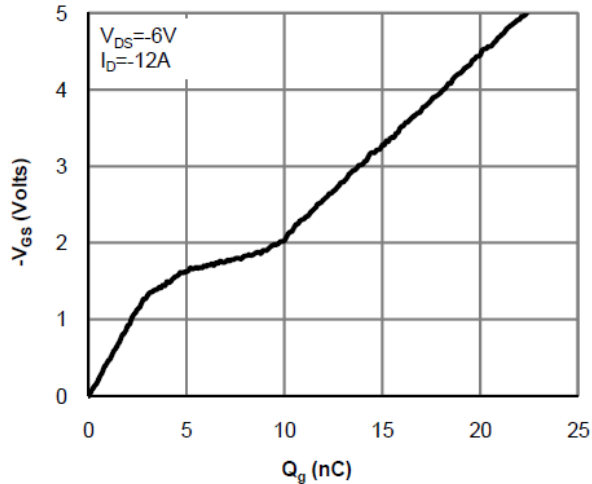
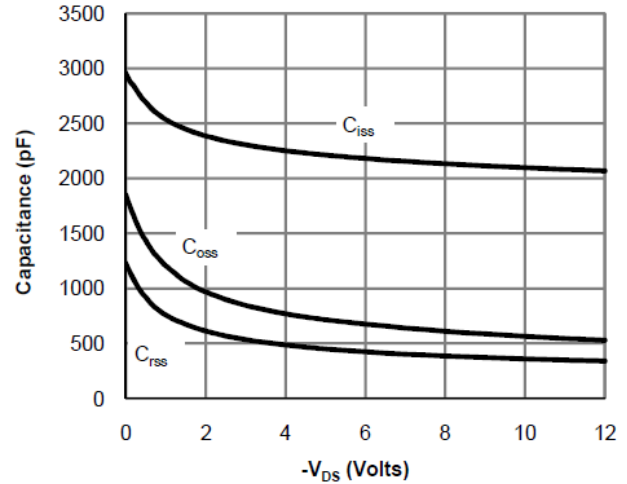
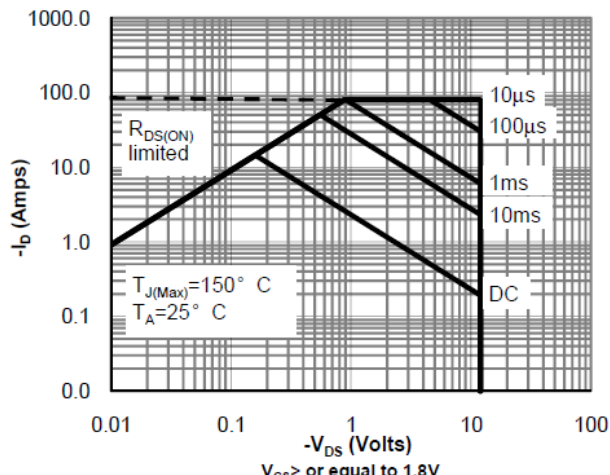
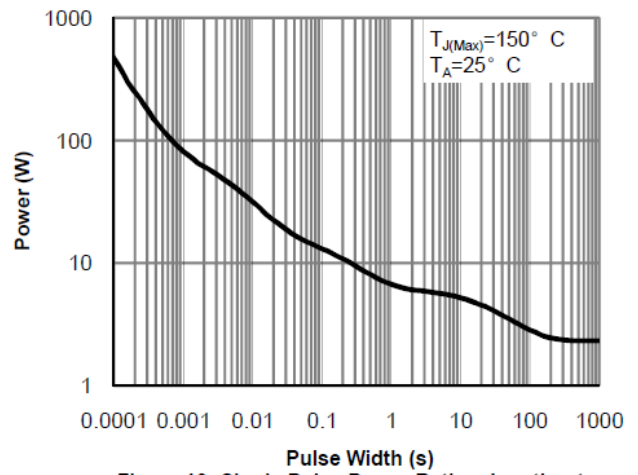
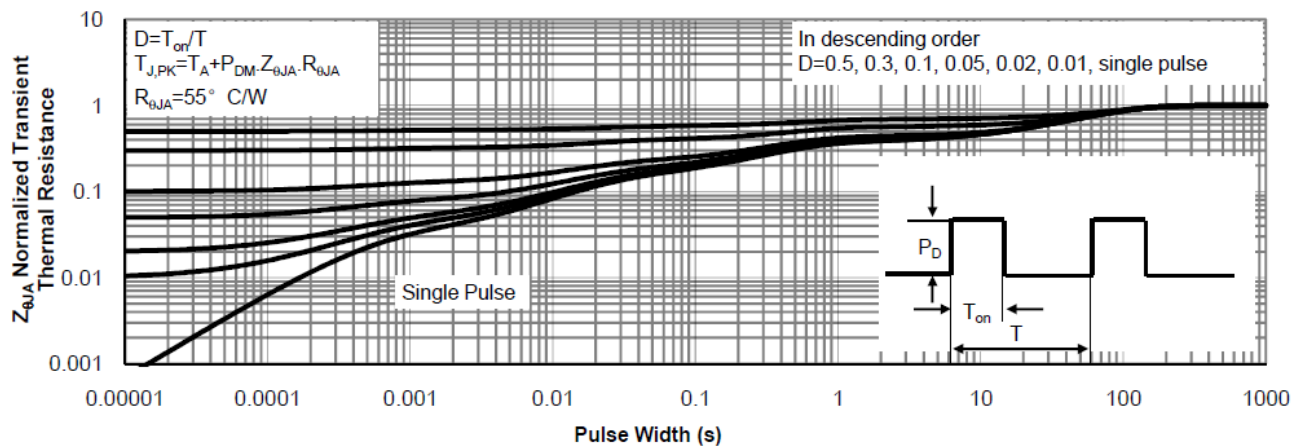


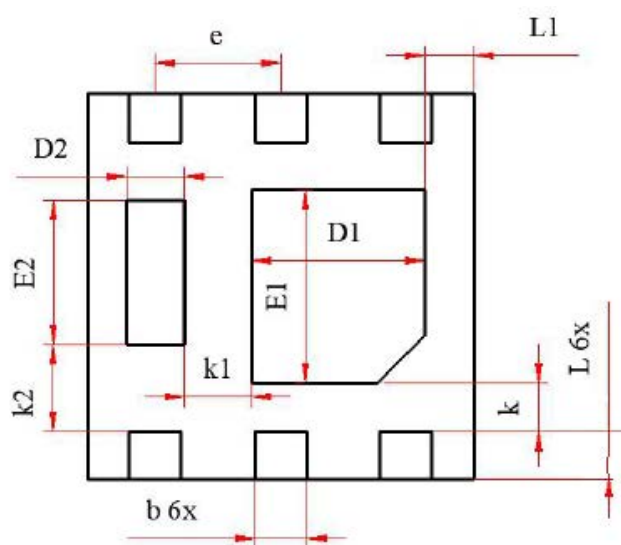
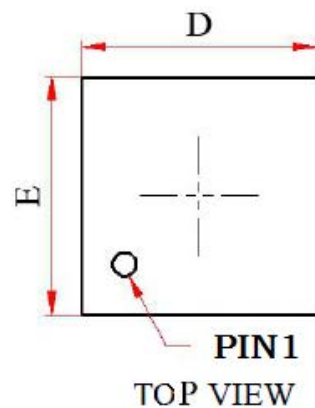
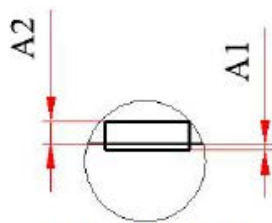
Figure 6: Body-Diode Characteristics

**P-Channel Enhancement Mode Power MOSFET****Figure 7: Gate-Charge Characteristics****Figure 8: Capacitance Characteristics****Figure 9: Maximum Forward Biased Safe Operating Area****Figure 10: Single Pulse Power Rating Junction-to-Ambient****Figure 11: Normalized Maximum Transient Thermal Impedance**



## Outline Drawing

## DFN2x2-6L(M)

**BOTTOM VIEW****PIN 1  
TOP VIEW****DETAIL "A"****Detail "A"  
SIDE VIEW**

| Symbol | Dimension In Millimeters |       |       | Dimension In Inches |       |       |
|--------|--------------------------|-------|-------|---------------------|-------|-------|
|        | Normal                   | Min   | Max   | Normal              | Min   | Max   |
|        | --                       | 0.500 | 0.600 | --                  | 0.020 | 0.024 |
| A1     | --                       | --    | 0.005 | --                  | --    | 0.000 |
| A2     | --                       | 0.050 | 0.150 | --                  | 0.002 | 0.006 |
| D      | 2.000                    | 1.950 | 2.070 | 0.079               | 0.077 | 0.081 |
| E      | 2.000                    | 1.950 | 2.070 | 0.079               | 0.077 | 0.081 |
| D1     | 0.900                    | 0.800 | 1.000 | 0.035               | 0.031 | 0.039 |
| E1     | 1.000                    | 0.900 | 1.100 | 0.039               | 0.035 | 0.043 |
| D2     | 0.300                    | 0.200 | 0.400 | 0.012               | 0.008 | 0.016 |
| E2     | 0.750                    | 0.650 | 0.850 | 0.030               | 0.026 | 0.033 |
| b      | 0.270                    | 0.200 | 0.340 | 0.011               | 0.008 | 0.013 |
| L      | 0.250                    | 0.200 | 0.350 | 0.010               | 0.008 | 0.014 |
| L1     | 0.250                    | 0.200 | 0.300 | 0.010               | 0.008 | 0.012 |
| e      | 0.650 BSC                |       |       | 0.026 BSC           |       |       |
| k      | 0.250 REF                |       |       | 0.010 REF           |       |       |
| k1     | 0.350 REF                |       |       | 0.014 REF           |       |       |
| k2     | 0.450 REF                |       |       | 0.018 REF           |       |       |

**Rev.B**

**Ordering Information:**

| Device PN                                                      | Packing                |
|----------------------------------------------------------------|------------------------|
| SEM12P20 -T <sup>(1)</sup> H <sup>(2)</sup> -WS <sup>(3)</sup> | Tape&Reel: 3 Kpcs/Reel |

Note: (1) Packing code, Tape & Reel Packing

(2) Halogen free product for packing code suffix "H"

(3) WS : Willas brand abbreviation, Label Type does not display

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