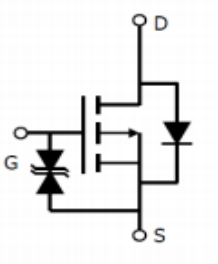
EFMICRO
Semiconductor Limited Company

# EFM3415

**P-Channel Advanced Power MOSFET**

## • Product Summary

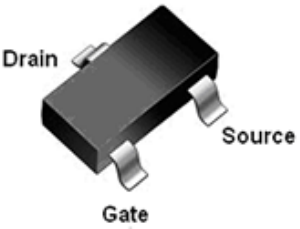
| Part # | $V_{DS}$ | $R_{DS(on).typ}$ ($@V_{GS}$=4.5V) | $R_{DS(on).typ}$ ($@V_{GS}$=2.5V) | $I_D$ |
|---|---|---|---|---|
| EFM3415 | -20V | 35mΩ | 45mΩ | -4.2A |




**P-Channel MOSFET**

## • Features

- *Low $R_{DS(on)}$ @$V_{GS}$=-4.5V*
- *-2.5V Logic Level Control*
- *P Channel SOT23 Package*
- *Pb−Free, RoHS Compliant*
- *HMB ESD Protection 4KV*




**SOT - 23**

RoHS

HF

## •Application

- High-side Load Switch
- *Switching Circuits*
- *High Speed line Driver*
- Power Management Functions

## •Ordering Information:

| | |
|---|---|
| Part NO. | EFM3415 |
| Marking | 3415 |
| Packing Information | REEL TAPE |
| Basic ordering unit (pcs) | 3000 |

## •Absolute Maximum Ratings ($T_C$=25℃)

| Parameter | Symbol | Limit | Unit |
|---|---|---|---|
| Drain-Source Voltage | $V_{DS}$ | -20 | V |
| Gate-Source Voltage | $V_{GS}$ | ±12 | V |
| Drain Current-Continuous | $I_D$ | -4.2 | A |
| Drain Current-Pulsed (Note 1) | $I_{DM}$ | -30 | A |
| Maximum Power Dissipation | $P_D$ | 1.5 | W |
| Operating Junction and Storage Temperature Range | $T_J$,$T_{STG}$ | -55 To 150 | ℃ |

## •Thermal Characteristic

| | | | |
|---|---|---|---|
| Thermal Resistance,Junction-to-Ambient (Note 2) | $R_{\theta JA}$ | 80 | ℃/W |

## ● Static Electrical Characteristics @ $T_J$ = 25°C (unless otherwise stated)

| Parameter | Symbol | Condition | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| **Off Characteristics** | | | | | | |
| Drain-Source Breakdown Voltage | $BV_{DSS}$ | $V_{GS}$=0V $I_D$=-250uA | -20 | -- | -- | V |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$=-20V $V_{GS}$=0V | -- | -- | -1 | uA |
| Gate-Body Leakage Current | $I_{GSS}$ | $V_{GS}$=±12V $V_{DS}$=0V | -- | -- | ±10 | uA |
| **On Characteristics** (Note 3) | | | | | | |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$=$V_{GS}$ $I_D$=-250uA | -0.4 | -0.7 | -1.2 | V |
| Drain-Source On-State Resistance | $R_{DS(ON)}$ | $V_{GS}$=-4.5V $I_D$=-4.2A | -- | 35 | 45 | mΩ |
| | | $V_{GS}$=-2.5V $I_D$=-3A | -- | 45 | 55 | mΩ |
| **Dynamic Characteristics** (Note4) | | | | | | |
| Input Capacitance | $C_{lss}$ | $V_{DS}$=-10V $V_{GS}$=0V F=1.0MHz | -- | 675 | -- | PF |
| Output Capacitance | $C_{oss}$ | | -- | 120 | -- | PF |
| Reverse Transfer Capacitance | $C_{rss}$ | | -- | 85 | -- | PF |
| **Switching Characteristics** (Note 4) | | | | | | |
| Turn-on Delay Time | $t_{d(on)}$ | $V_{DD}$=-10V $I_D$=-2A $V_{GS}$=-4.5V $R_G$=3.3Ω, | -- | 15 | -- | nS |
| Turn-on Rise Time | $t_r$ | | -- | 11 | -- | nS |
| Turn-Off Delay Time | $t_{d(off)}$ | | -- | 22 | -- | nS |
| Turn-Off Fall Time | $t_f$ | | -- | 35 | -- | nS |
| Total Gate Charge | $Q_g$ | $V_{DS}$=-10V $I_D$=-4A $V_{GS}$=-4.5V | -- | 14.2 | -- | nC |
| Gate-Source Charge | $Q_{gs}$ | | -- | 3.2 | -- | nC |
| Gate-Drain Charge | $Q_{gd}$ | | -- | 5.8 | -- | nC |
| **Drain-Source Diode Characteristics** | | | | | | |
| Diode Forward Voltage (Note 3) | $V_{SD}$ | $V_{GS}$=0V $I_S$=-2A | -- | -0.83 | -1.2 | V |
| Diode Forward Current (Note 2) | $I_S$ | | -- | -- | -2 | A |

Notes:

① Pulse width limited by maximum allowable junction temperature

②Pulse test ; Pulse width≤300μs, duty cycle≤2%.

## • Typical Characteristics

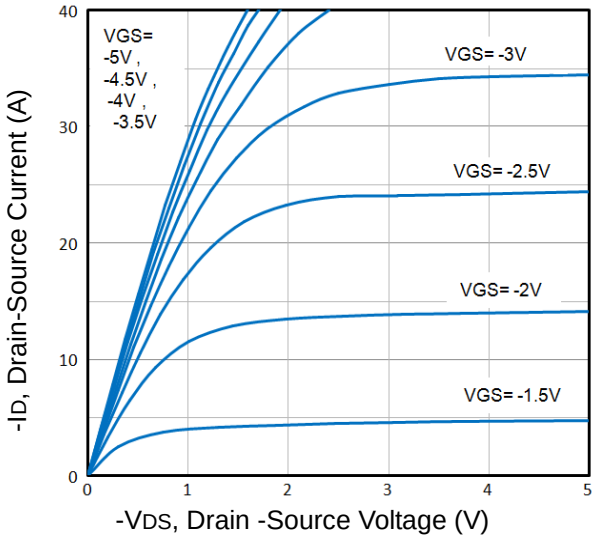



**Fig1.** Typical Output Characteristics

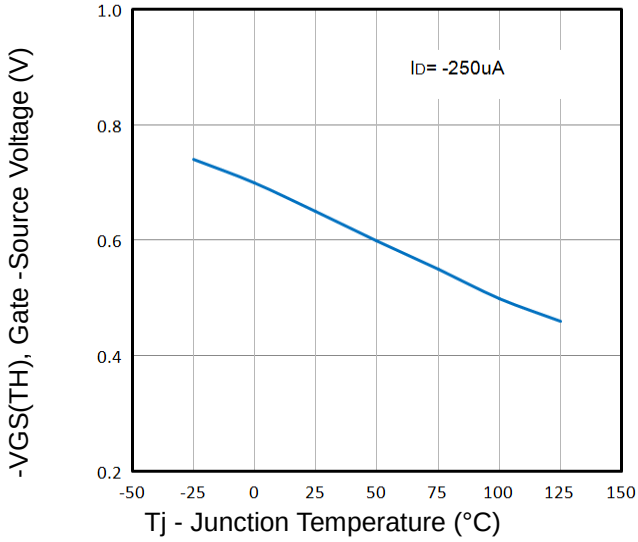



**Fig2.** Normalized Threshold Voltage Vs. Temperature

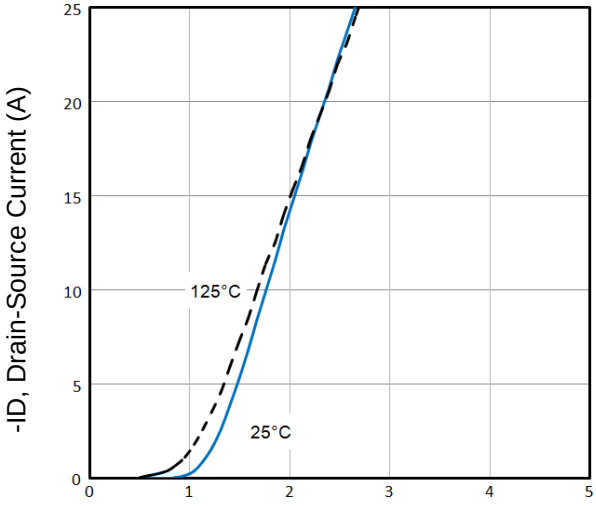



**Fig3.** Typical Transfer Characteristics

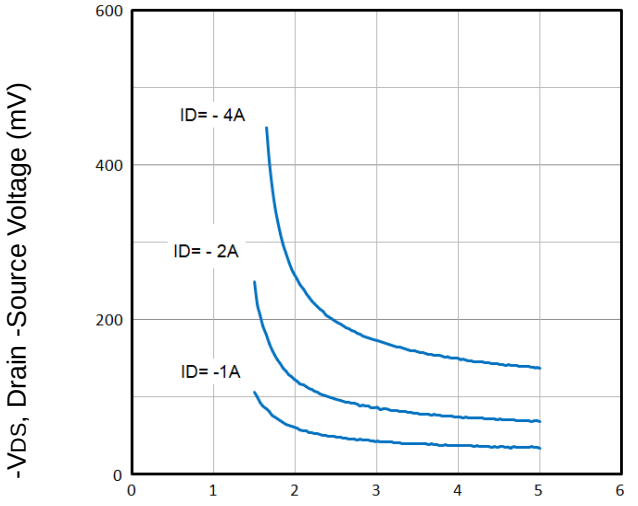



**Fig4.** Drain -Source Voltage vs Gate -Source Voltage

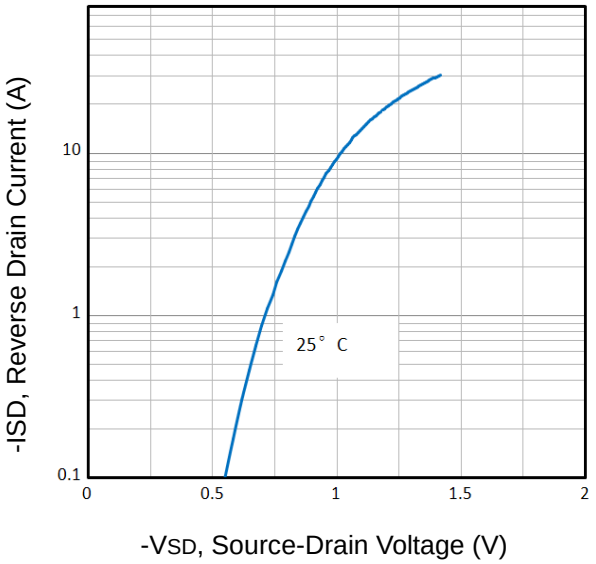



**Fig5.** Typical Source-Drain Diode Forward Voltage

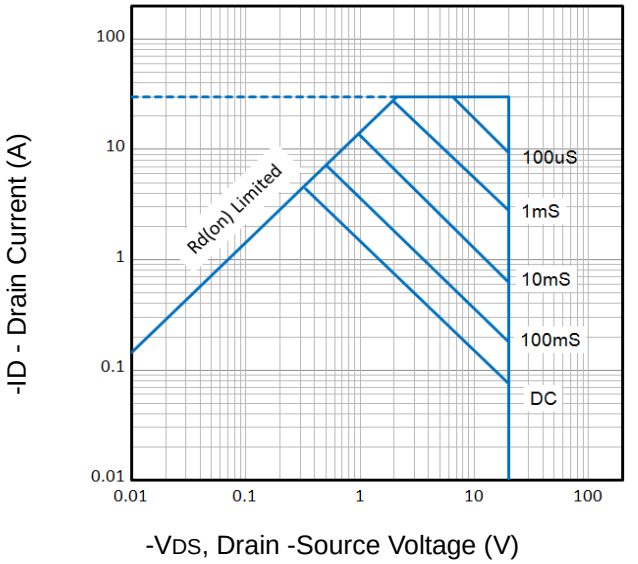



**Fig6.** Maximum Safe Operating Area

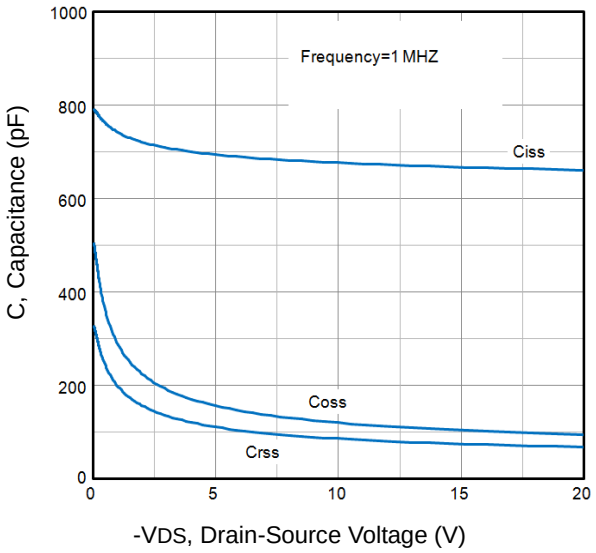



**Fig7.** Typical Capacitance Vs. Drain-Source Voltage

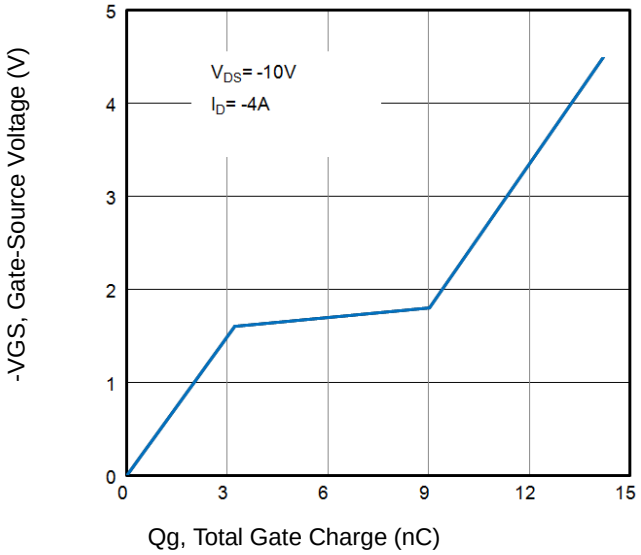



**Fig8.** Typical Gate Charge Vs. Gate-Source Voltage

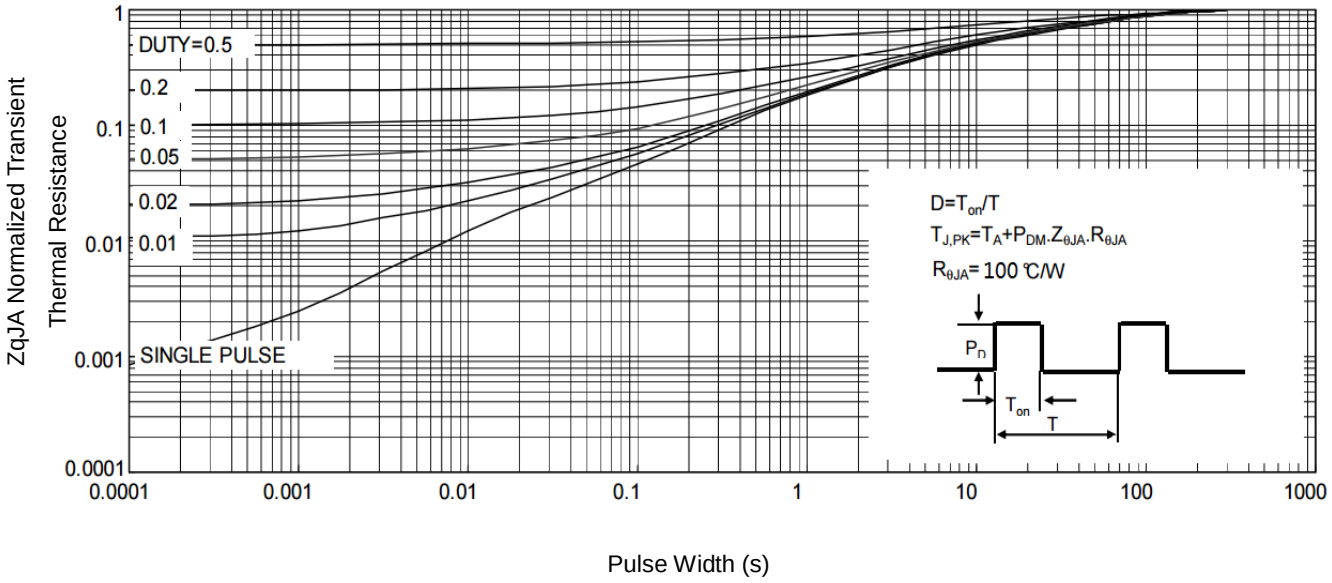



**Fig9.** Normalized Maximum Transient Thermal Impedance

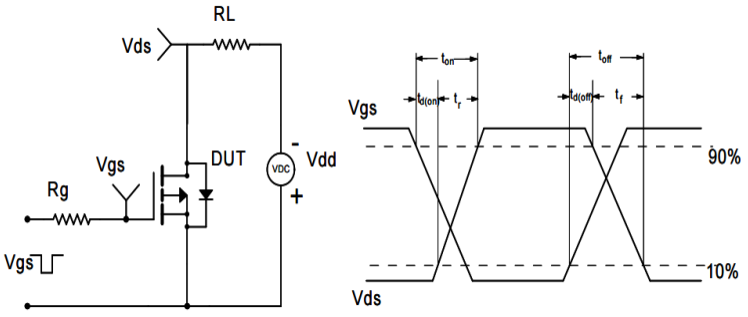
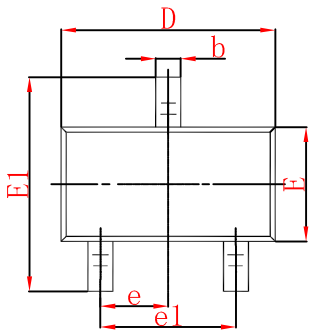
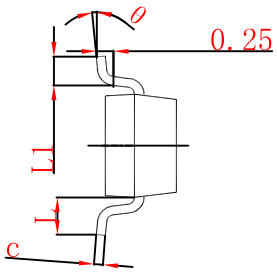
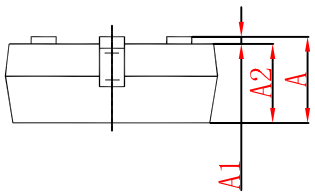



**Fig10.** Switching Time Test Circuit and waveforms

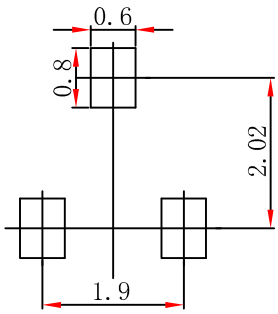
## SOT-23 Package Outline Dimensions




| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| A | 0.900 | 1.150 | 0.035 | 0.045 |
| A1 | 0.000 | 0.100 | 0.000 | 0.004 |
| A2 | 0.900 | 1.050 | 0.035 | 0.041 |
| b | 0.300 | 0.500 | 0.012 | 0.020 |
| c | 0.080 | 0.150 | 0.003 | 0.006 |
| D | 2.800 | 3.000 | 0.110 | 0.118 |
| E | 1.200 | 1.400 | 0.047 | 0.055 |
| E1 | 2.250 | 2.550 | 0.089 | 0.100 |
| e | 0.950 TYP | | 0.037 TYP | |
| e1 | 1.800 | 2.000 | 0.071 | 0.079 |
| L | 0.550 REF | | 0.022 REF | |
| L1 | 0.300 | 0.500 | 0.012 | 0.020 |
| θ | 0° | 8° | 0° | 8° |




Note:
1.Controlling dimension:in millimeters.
2.General tolerance:± 0.05mm.
3.The pad layout is for reference purposes only.