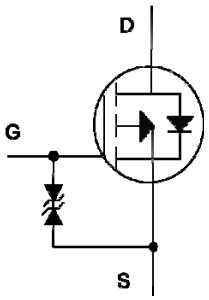
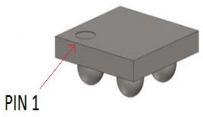
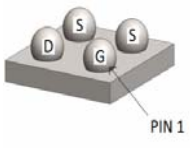
**P-Channel Logic Level Enhancement Mode Field Effect Transistor**

Product Summary:

| | |
|---|---|
| $BV_{DSS}$ | -30V |
| $R_{DSON\ (MAX.)}$ | 110mΩ |
| $I_D$ | -2.4A |




Pb-Free Lead Plating & Halogen Free

ESD Protection

**ABSOLUTE MAXIMUM RATINGS ($T_A$ = 25 °C Unless Otherwise Noted)**

| PARAMETERS/TEST CONDITIONS | | SYMBOL | LIMITS | UNIT |
|---|---|---|---|---|
| Gate-Source Voltage | | $V_{GS}$ | ±12 | V |
| Continuous Drain Current | $T_A$ = 25 °C | $I_D$ | -2.4 | A |
| | $T_A$ = 70 °C | | -1.8 | |
| Pulsed Drain Current[1] | | $I_{DM}$ | -9.6 | |
| Power Dissipation | $T_A$ = 25 °C | $P_D$ | 1.3 | W |
| | $T_A$ = 70 °C | | 0.84 | |
| Operating Junction & Storage Temperature Range | | $T_j$, $T_{stg}$ | -55 to 150 | °C |

**THERMAL RESISTANCE RATINGS**

| THERMAL RESISTANCE | SYMBOL | TYPICAL | MAXIMUM | UNIT |
|---|---|---|---|---|
| Junction-to-Ambient[3] | $R_{\theta JA}$ | | 95 | °C / W |

[1]Pulse width limited by maximum junction temperature.

[2]Duty cycle ≤ 1%

[3]95°C / W when mounted on a 1 $in^2$ pad of 2 oz copper.

**ELECTRICAL CHARACTERISTICS ($T_J$ = 25 °C, Unless Otherwise Noted)**

| PARAMETER | SYMBOL | TEST CONDITIONS | LIMITS | | | UNIT |
|---|---|---|---|---|---|---|
| | | | MIN | TYP | MAX | |
| **STATIC** | | | | | | |
| Drain-Source Breakdown Voltage | $V_{(BR)DSS}$ | $V_{GS}$ = 0V, $I_D$ = -250μA | -30 | | | V |
| Gate Threshold Voltage | $V_{GS(th)}$ | $V_{DS}$ = $V_{GS}$, $I_D$ = -250μA | -0.4 | -0.8 | -1.2 | |
| Gate-Body Leakage | $I_{GSS}$ | $V_{DS}$ = 0V, $V_{GS}$ = ±12V | | | ±5 | μA |
| Zero Gate Voltage Drain Current | $I_{DSS}$ | $V_{DS}$ = -24V, $V_{GS}$ = 0V | | | -1 | μA |
| | | $V_{DS}$ = -20V, $V_{GS}$ = 0V, $T_J$ = 125 °C | | | -10 | |
| On-State Drain Current[1] | $I_{D(ON)}$ | $V_{DS}$ = -5V, $V_{GS}$ = -4.5V | -2.4 | | | A |
| Drain-Source On-State Resistance[1] | $R_{DS(ON)}$ | $V_{GS}$ = -4.5V, $I_D$ = -1A | | 90 | 110 | mΩ |
| | | $V_{GS}$ = -3.7V, $I_D$ = -1A | | 100 | 125 | |
| | | $V_{GS}$ = -2.5V, $I_D$ = -0.5A | | 115 | 150 | |
| Forward Transconductance[1] | $g_{fs}$ | $V_{DS}$ = -5V, $I_D$ = -1A | | 5 | | S |
| **DYNAMIC** | | | | | | |
| Input Capacitance | $C_{iss}$ | $V_{GS}$ = 0V, $V_{DS}$ = -15V, f = 1MHz | | 525 | | pF |
| Output Capacitance | $C_{oss}$ | | | 92 | | |
| Reverse Transfer Capacitance | $C_{rss}$ | | | 80 | | |
| Total Gate Charge[1,2] | $Q_g$ | $V_{DS}$ = -15V, $V_{GS}$ = -4.5V, $I_D$ = -1A | | 8.6 | | nC |
| Gate-Source Charge[1,2] | $Q_{gs}$ | | | 1.0 | | |
| Gate-Drain Charge[1,2] | $Q_{gd}$ | | | 2.9 | | |
| Turn-On Delay Time[1,2] | $t_{d(on)}$ | $V_{DS}$ = -15V, $I_D$ = -1A, $V_{GS}$ = -4.5V, $R_{GEN}$ = 6Ω | | 25 | | nS |
| Rise Time[1,2] | $t_r$ | | | 15 | | |
| Turn-Off Delay Time[1,2] | $t_{d(off)}$ | | | 40 | | |
| Fall Time[1,2] | $t_f$ | | | 20 | | |
| **SOURCE-DRAIN DIODE RATINGS AND CHARACTERISTICS ($T_C$ = 25 °C)** | | | | | | |
| Continuous Current | $I_S$ | | | | -2.4 | A |
| Pulsed Current[3] | $I_{SM}$ | | | | -9.6 | |
| Forward Voltage[1] | $V_{SD}$ | $I_F$ = $I_S$, $V_{GS}$ = 0V | | | -1.2 | V |

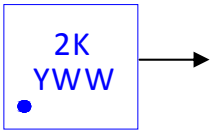
[1]Pulse test : Pulse Width ≤ 300 μsec, Duty Cycle ≤ 2%.

[2]Independent of operating temperature.

[3]Pulse width limited by maximum junction temperature.

## Ordering & Marking Information:

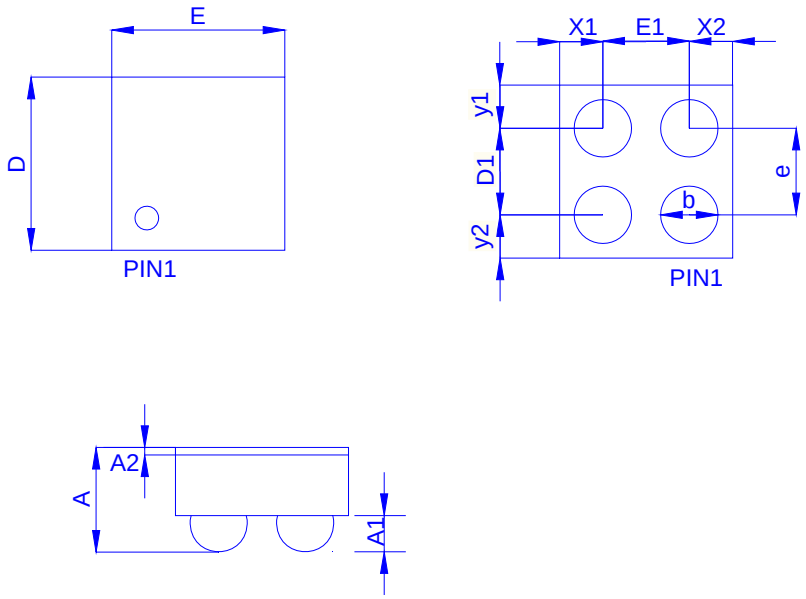
Device Name: EMZFA1P03Z for WLCSP




2K Device Code, 2K for EMZFA1P03Z

YWW: Date Code

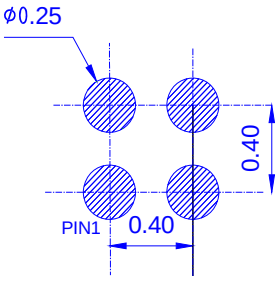
## Outline Drawing



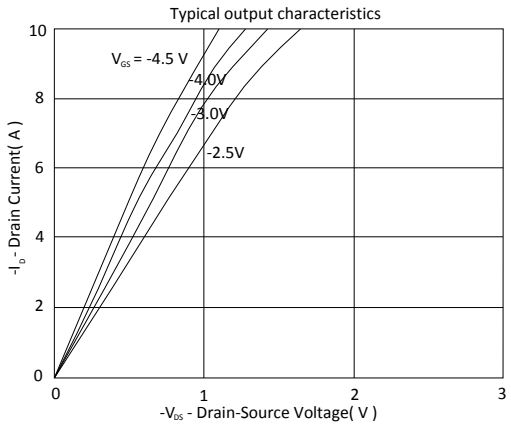

Dimension in mm

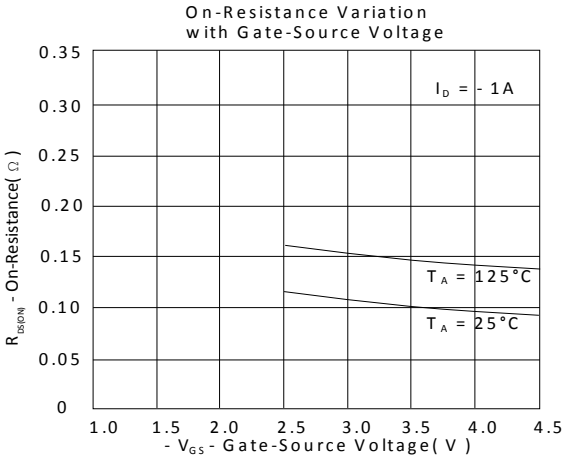
| Dimension | A | A1 | A2 | D | D1 | E | E1 | b | e | X1 | X2 | y1 | y2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Min. | 0.463 | 0.168 | 0.020 | 0.770 | 0.400 (BSC) | 0.770 | 0.400 (BSC) | 0.265 | 0.400 (BSC) | 0.200 (REF) | 0.200 (REF) | 0.200 (REF) | 0.200 (REF) |
| Max. | 0.503 | 0.228 | 0.050 | 0.830 | | 0.830 | | | | | | | |

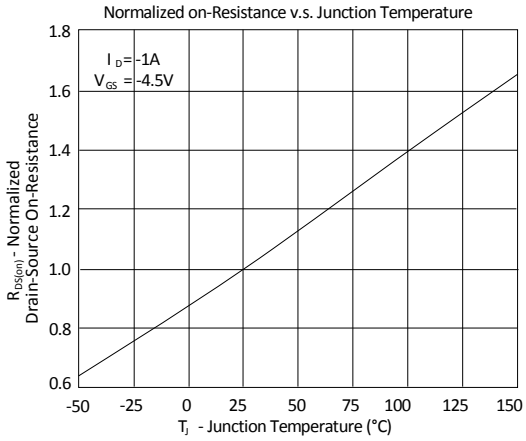
## Footprint

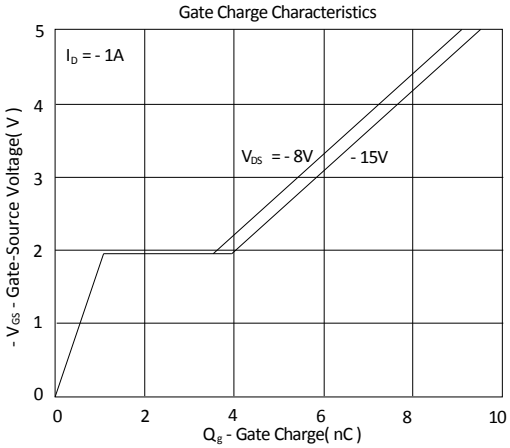


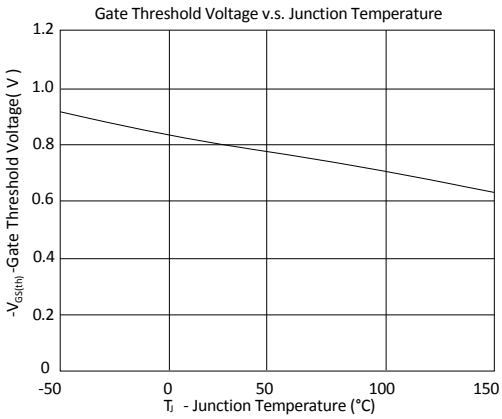
## TYPICAL CHARACTERISTICS

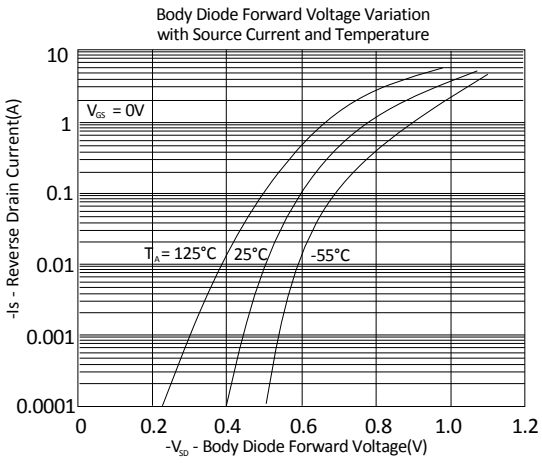


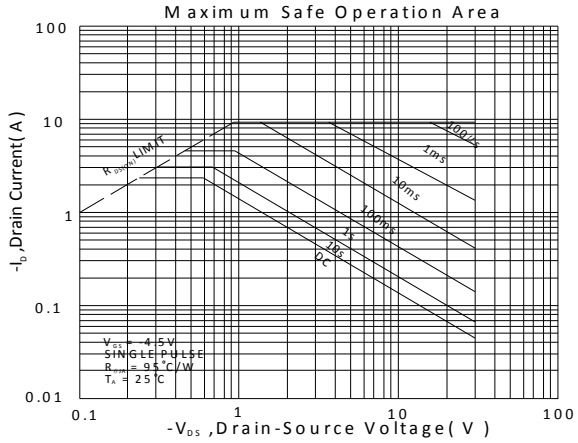



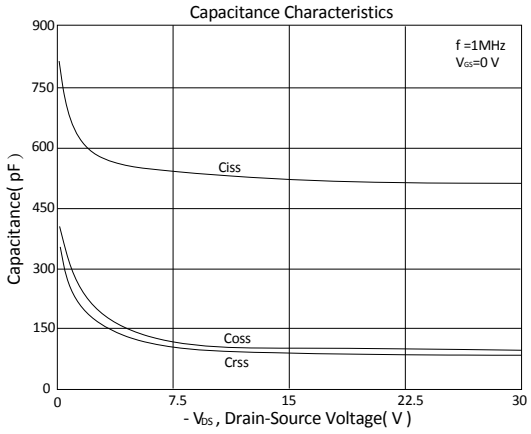



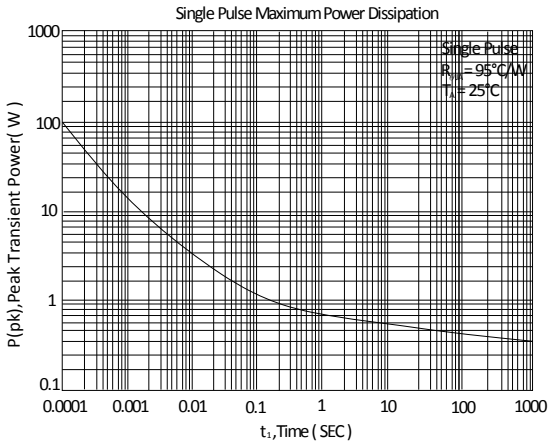



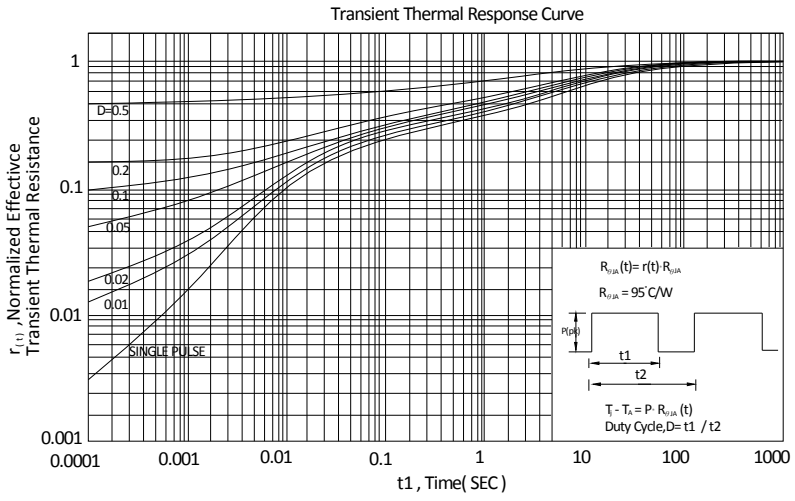




Maximum Safe Operation Area
-I_D ,Drain Current( A )
-V_DS ,Drain-Source Voltage( V )
100
10
1
0.1
0.01
0.1
1
10
100
R_DS(on) LIMIT
100μs
1ms
10ms
100ms
1s
10s
DC
V_GS = -4.5V
SINGLE PULSE
R_θJA = 95°C/W
T_A = 25°C


Capacitance Characteristics
Capacitance( pF )
- V_DS , Drain-Source Voltage( V )
f =1MHz
V_GS=0 V
900
750
600
450
300
150
0
0
7.5
15
22.5
30
Ciss
Coss
Crss


Single Pulse Maximum Power Dissipation
P(pk),Peak Transient Power( W )
t1,Time ( SEC )
1000
100
10
1
0.1
0.0001
0.001
0.01
0.1
1
10
100
1000
Single Pulse
R_θJA = 95°C/W
T_A = 25°C


Transient Thermal Response Curve
r(t) ,Normalized Effectivce
Transient Thermal Resistance
t1 , Time( SEC )
1
0.1
0.01
0.001
0.0001
0.001
0.01
0.1
1
10
100
1000
D=0.5
0.2
0.1
0.05
0.02
0.01
SINGLE PULSE
R_θJA(t)= r(t)·R_θJA
R_θJA = 95°C/W
P(pk)
t1
t2
T_j - T_A = P· R_θJA (t)
Duty Cycle,D= t1 / t2