EFFICIENT POWER CONVERSION

# EPC2108 – Enhancement-Mode GaN Power Transistor Half Bridge With Integrated Synchronous Bootstrap Preliminary Specification Sheet

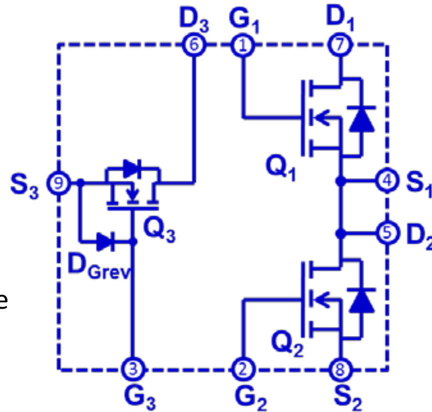
**Status: Engineering**

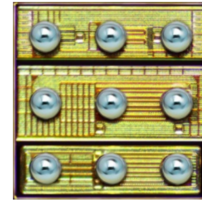
**Features:**

- $V_{DS}$, 60 V
- High Frequency Operation
- High Density Footprint
- Low Inductance Package
- Pb-Free (RoHS Compliant), Halogen Free

**Applications:**

- High Frequency DC-DC Conversion
- Class-D Audio
- Wireless Power (Highly Resonant and Inductive)

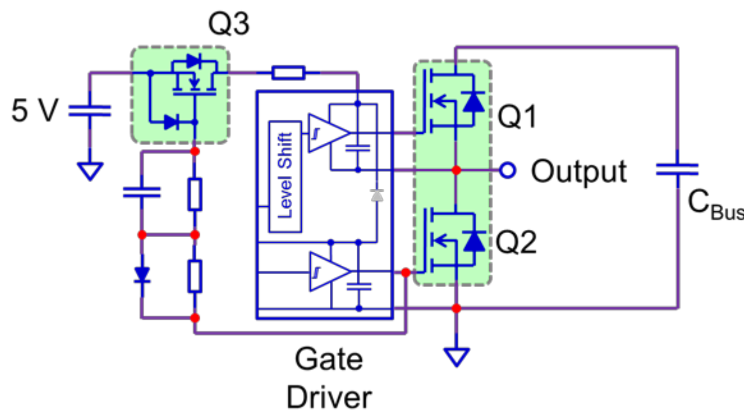


EPC2108 devices are supplied only in passivated die form with solder balls

Die Size: 1.35 mm x 1.35 mm

**Typical Circuit**




**MAXIMUM RATINGS**

| Parameter | Device | Value |
|---|---|---|
| Maximum Drain – Source Voltage | Q1 & Q2 | 60 V |
| | Q3 | 100 V |
| Maximum Gate – Source Voltage Range | Q1 & Q2 | -4 V < $V_{GS}$ < 6 V |
| | Q3 | -2 V < $V_{GS}$ < 6 V |
| Continuous Drain Current, 25 °C | Q1 & Q2 , $R_{θJA}$ = 124 °C/W | 1.7 A |
| | Q3 , $R_{θJA}$ = 95 °C/W | 0.5 A |
| Maximum Pulsed Drain Current, 25 °C, $T_{pulse}$ = 300 µs | Q1 & Q2 | 5.5 A |
| | Q3 | 0.5 A |
| Operating Temperature Range | -40 °C < $T_J$ < 150 °C | |

### STATIC CHARACTERISTICS

| Parameter | Conditions | Q1 & Q2 | Q3 |
|---|---|---|---|
| Maximum Drain – Source Voltage ($BV_{DSS}$) | $V_{GS}$ = 0 V, $I_D$ = 0.3 mA | 60 V | 100 V |
| Maximum Drain – Source Leakage | Q1/Q2: $V_{DS}$ = 48 V, $V_{GS}$ = 0 V<br>Q3: $V_{DS}$ = 80 V, $V_{GS}$ = 0 V | 0.25 mA | 0.1 mA |
| Maximum $R_{DS(on)}$ | Q1/Q2: $V_{GS}$ = 5 V, $I_D$ = 2.5 A<br>Q3: $V_{GS}$ = 5 V, $I_D$ = 0.05 A | 190 mΩ | 2.8 Ω |
| Typical $R_{DS(on)}$ | | 150 mΩ | 2.1 Ω |
| Gate – Source Threshold Voltage | Q1/Q2: $I_D$ = 0.2 mA, $V_{DS}$ = $V_{GS}$<br>Q3: $I_D$ = 0.02 mA, $V_{DS}$ = $V_{GS}$ | $0.8\ V < V_{GS(TH)} < 2.5\ V$ | |
| Gate – Source Maximum Positive Leakage | $V_{GS}$ = 5 V | 1 mA | 1 mA |
| Gate – Source Maximum Negative Leakage | Q1/Q2: $V_{GS}$ = -4 V<br>Q3: $V_{GS}$ = -1 V | -0.25 mA | -0.1 mA |
| Source-Gate Maximum Forward Voltage | Q3: $I_{SG}$ = 0.2 mA, $V_{DS}$ = 0 V | | -2 V |

$T_J$ = 25 °C unless otherwise stated

### DYNAMIC CHARACTERISTICS

| Parameter | Conditions | Typical Value | | | |
|---|---|---|---|---|---|
| | | Q1 | Q2 | Q3 | Unit |
| $C_{ISS}$ (Input Capacitance) | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V | 22 | | 7 | pF |
| $C_{OSS}$ (Output Capacitance) | | 13 | 23 | 2.5 | |
| $C_{RSS}$ (Reverse Transfer Capacitance) | | 0.5 | | 0.05 | |
| $Q_G$ (Total Gate Charge) | Q1 & Q2: $V_{DS}$ = 30 V, $V_{GS}$ = 5 V, $I_D$ = 2.5 A | 220 | | | pC |
| | Q3: $V_{DS}$ = 30 V, $V_{GS}$ = 5 V, $I_D$ = 0.05 A | | | 44 | |
| $Q_{GS}$ (Gate to Source Charge) | $V_{DS}$ = 30 V<br>Q1 & Q2: $I_D$ = 2.5 A<br>Q3: $I_D$ = 0.05 A | 85 | | 16 | |
| $Q_{GD}$ (Gate to Drain Charge) | | 45 | | 4.5 | |
| $Q_{G(TH)}$ (Gate Charge at Threshold) | | 48 | | 14 | |
| $Q_{OSS}$ (Output Charge) | $V_{DS}$ = 30 V, $V_{GS}$ = 0 V | 650 | 1000 | 100 | |
| $Q_{RR}$ (Source-Drain Recovery Charge) | | 0 | | | |

$T_J$ = 25 °C unless otherwise stated

## THERMAL CHARACTERISTICS

| | | TYPICAL | |
|---|---|---|---|
| $R_{\theta JC}$ | Thermal Resistance, Junction to Case | 6 | °C/W |
| $R_{\theta JB}$ | Thermal Resistance, Junction to Board (Note 2) | 33 | °C/W |
| $R_{\theta JA}$ | Thermal Resistance, Junction to Ambient (Note 1) | 81 | °C/W |

Note 1: $R_{\theta JA}$ is determined with the device mounted on one square inch of copper pad, single layer 2 oz copper on FR4 board.

Thermal models for EPC devices available at http://epc-co.com/epc/DesignSupport/DeviceModels.aspx

Figure 1a: EPC2108 - Q1 & Q2: Typical Output Characteristics at 25°C

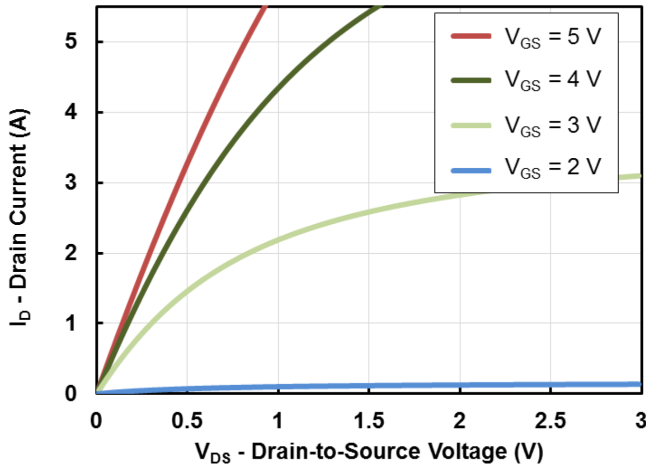



Figure 1b: EPC2108-Q3: Typical Output Characteristics at 25°C

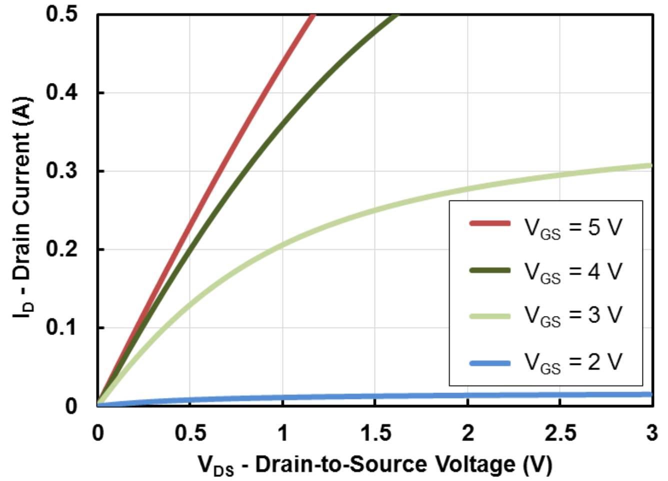



Figure 2a: EPC2108 - Q1 & Q2: Transfer Characteristics

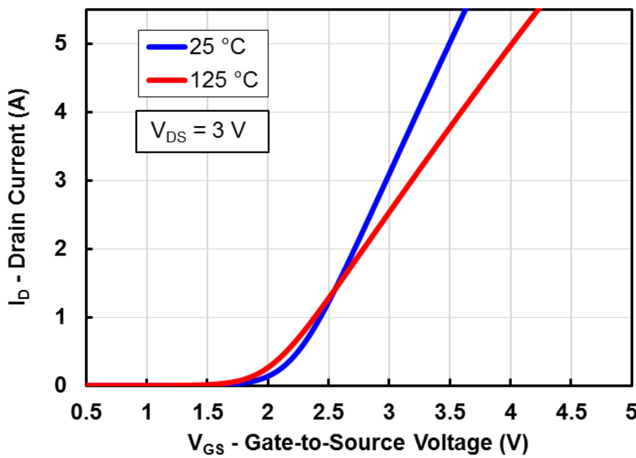



Figure 2b: EPC2108 - Q3: Transfer Characteristics

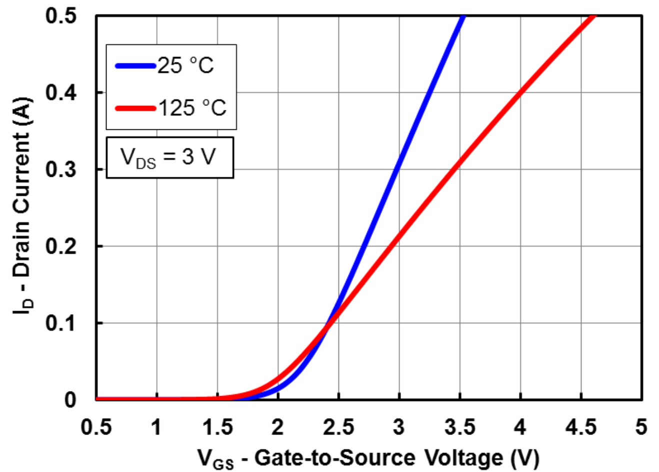



Figure 3a: EPC2108-Q1&Q2: $R_{DS(on)}$ vs. $V_{GS}$ for Various Drain Currents

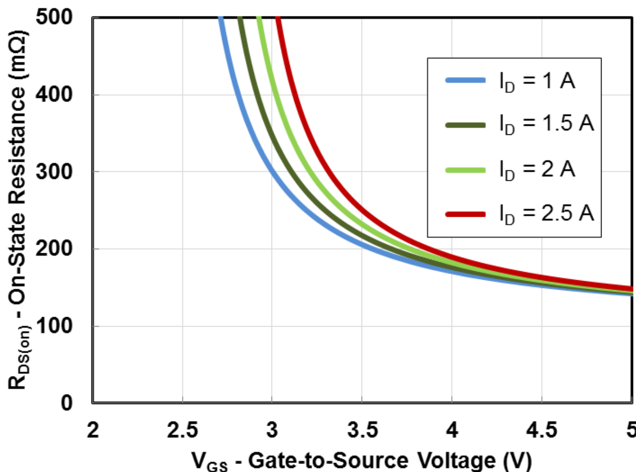



Figure 3b: EPC2108-Q3: $R_{DS(on)}$ vs. $V_{GS}$ for Various Drain Currents

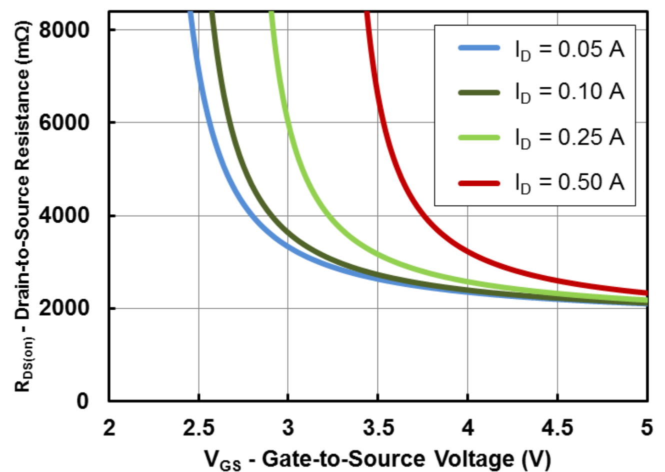


Figure 4a: EPC2108-Q1&Q2: $R_{DS(on)}$ vs. $V_{GS}$ for Various Temperatures

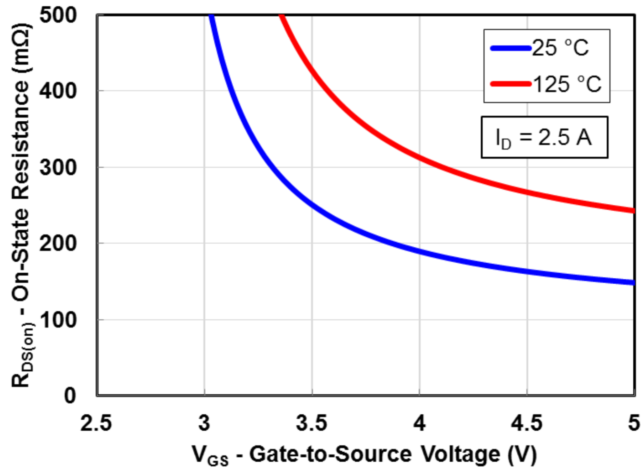



Figure 4b: EPC2108-Q3: $R_{DS(on)}$ vs. $V_{GS}$ for Various Temperatures

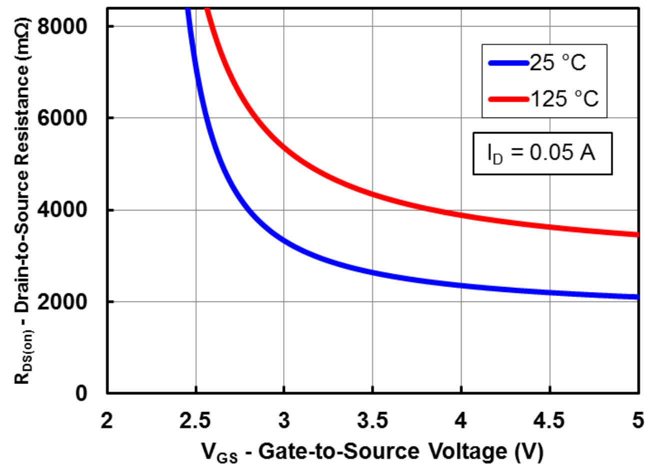



Figure 5a: EPC2108-Q1&Q2: Capacitance (Linear Scale)

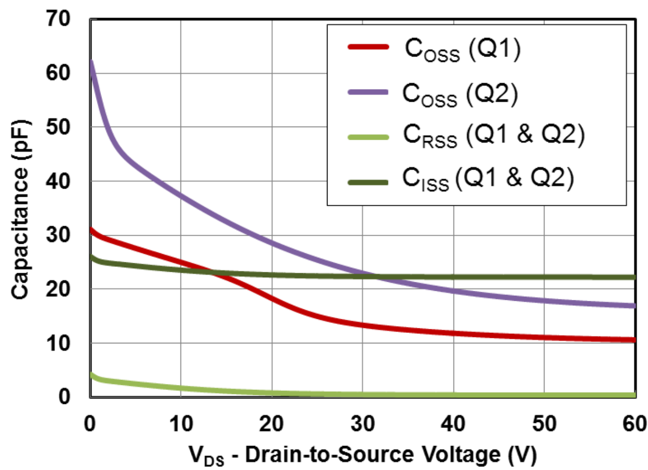



Figure 5b: EPC2108-Q3: Capacitance (Linear Scale)

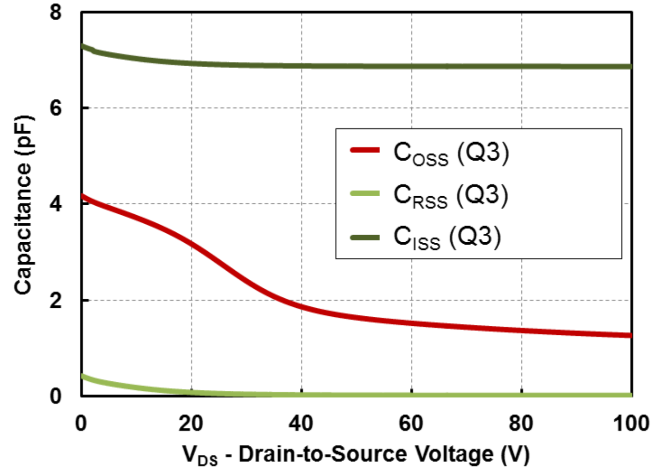



Figure 5c: EPC2108-Q1&Q2: Capacitance (Log Scale)

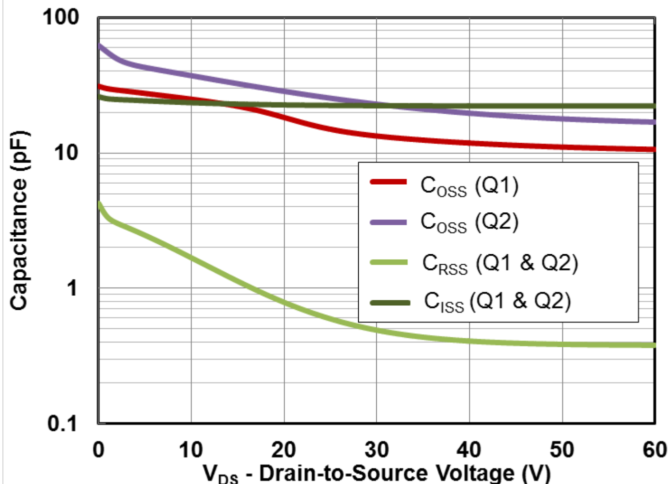



Figure 5d: EPC2108-Q3: Capacitance (Log Scale)

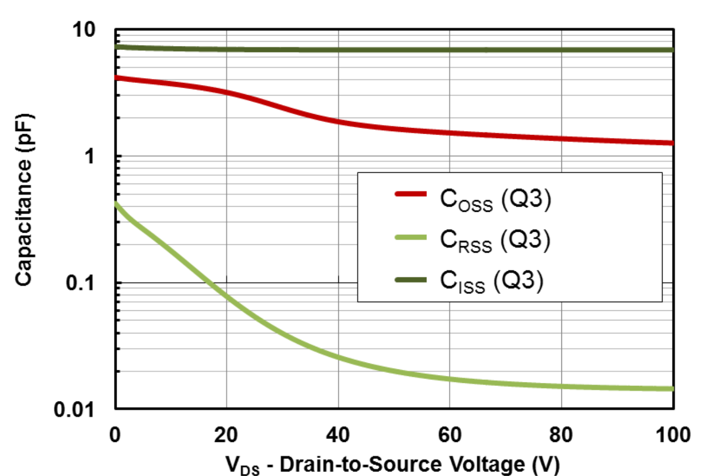


Figure 6a: EPC2108-Q1&Q2: Gate Charge

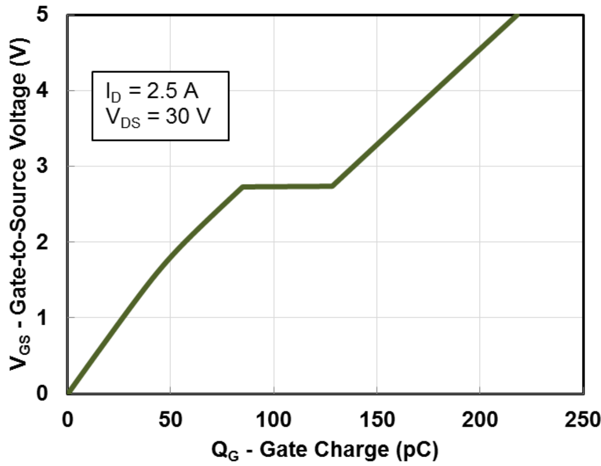



Figure 6b: EPC2108-Q3: Gate Charge

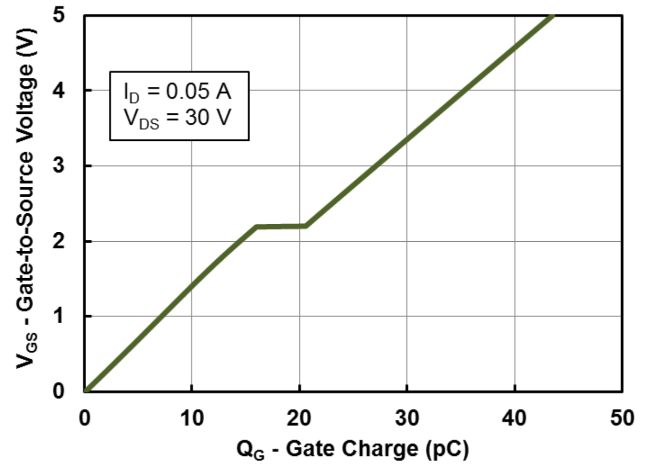



Figure 7a: EPC2108-Q1&Q2: Reverse Drain-Source Characteristics

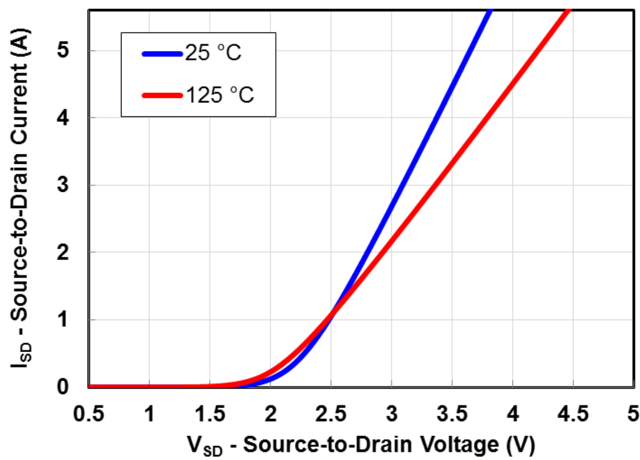



Figure 7b: EPC2108-Q3: Reverse Drain-Source Characteristics

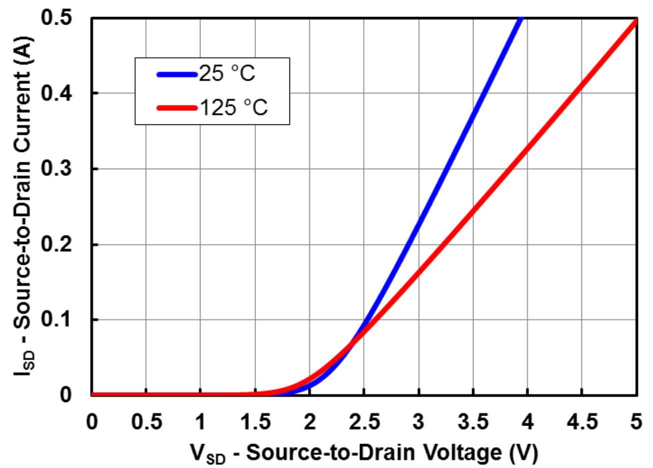



Figure 8a: EPC2108-Q1&Q2: Normalized On Resistance vs. Temperature

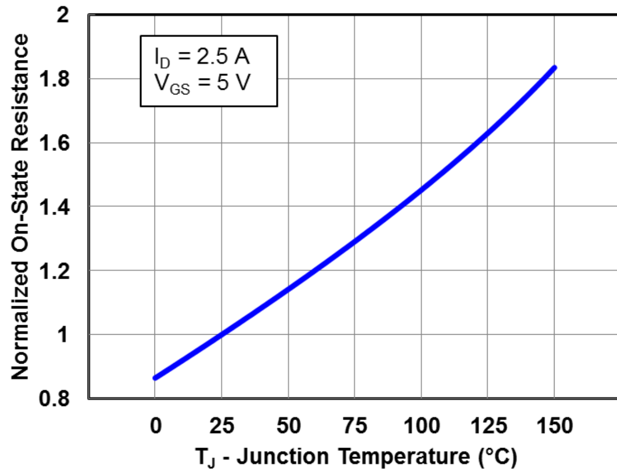



Figure 8b: EPC2108-Q3: Normalized On Resistance vs. Temperature

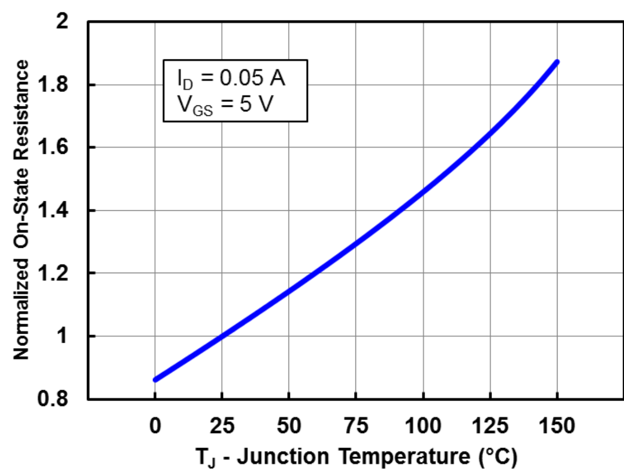


**Figure 9a:**
**EPC2108-Q1&Q2: Normalized Threshold Voltage vs. Temperature**

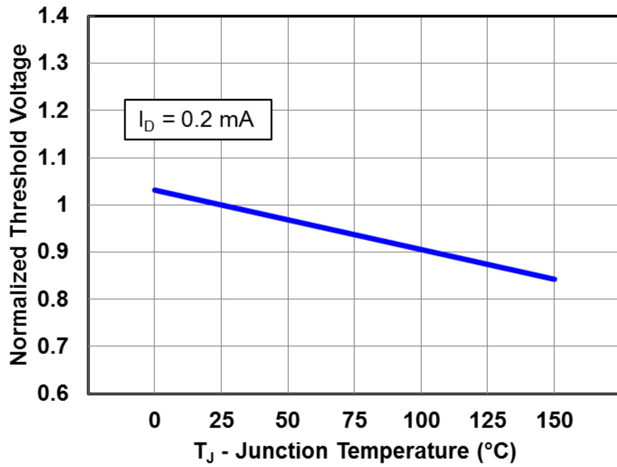
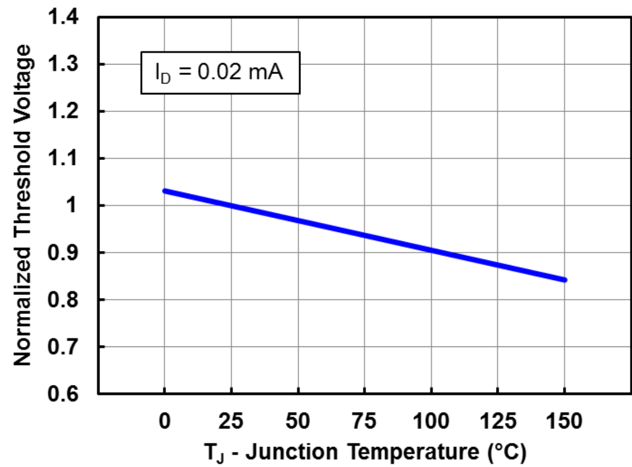
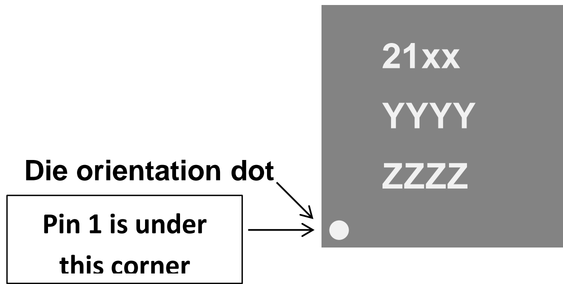



**Figure 9b:**
**EPC2108-Q3: Normalized Threshold Voltage vs. Temperature**



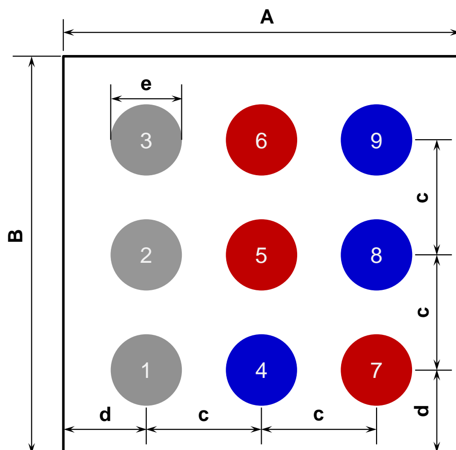
## DIE MARKINGS




| Part Number | Laser Marking | | |
|---|---|---|---|
| | Part # Marking Line 1 | Lot_Date Code Marking Line 2 | Lot_Date Code Marking Line 3 |
| EPC2108ENGR | 21XX | YYYY | ZZZZ |

## DIE OUTLINE

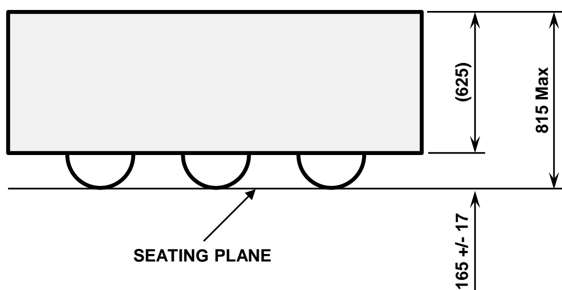
### Solder Bar View



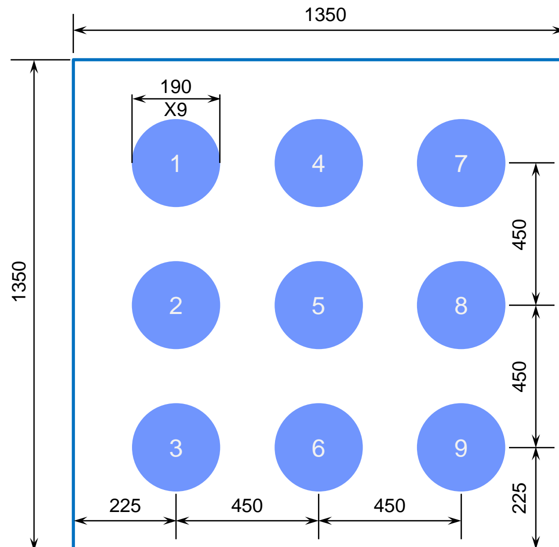

Pad 1 is Gate1 (Q1)
Pad 2 is Gate2 (Q2)
Pad 3 is Gate 3 (Q3)
Pad 7 is Drain1 (Q1)
Pad 5 is Drain2 (Q2)
Pad 6 is Drain3 (Q3)
Pad 4 is Source1 (Q1)
Pad 8 is Source2 (Q2)
Pad 9 is Source3 (Q3)

| DIM | MICROMETERS | | |
|---|---|---|---|
| | MIN | Nominal | MAX |
| A | 1320 | 1350 | 1380 |
| B | 1320 | 1350 | 1380 |
| c | 450 | 450 | 450 |
| d | 210 | 225 | 240 |
| e | 187 | 208 | 229 |

### Side View

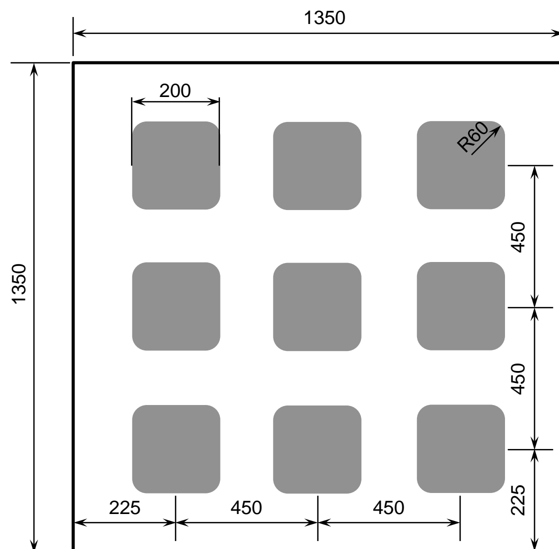


**RECOMMENDED LAND PATTERN**
**(*Units in µm*)**




**Pad 1 is Gate1 (Q1)**
**Pad 2 is Gate2 (Q2)**
**Pad 3 is Gate3 (Q3)**
**Pad 7 is Drain1 (Q1)**
**Pad 5 is Drain2 (Q2)**
**Pad 6 is Drain3 (Q3)**
**Pad 4 is Source1 (Q1)**
**Pad 8 is Source2 (Q2)**
**Pad 9 is Source3 (Q3)**

**RECOMMENDED STENCIL DESIGN**
**(*Units in µm*)**




**Recommended stencil should be 4mil (100µm) thick, must be laser cut, openings per drawing.**
**Intended for use with SAC305 Type 4 solder, reference 88.5% metals content**
**Additional assembly resources available at http://epc-co.com/epc/DesignSupport/AssemblyBasics.aspx**

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U.S. Patents 8,350,294; 8,404,508; 8,431,960; 8,436,398; 8,785,974; 8,890,168; 8,969,918; 8,853,749; 8,823,012
Revised July, 2016