

EPC2204 – Enhancement Mode Power Transistor

 $V_{DS}, 100\text{ V}$
 $R_{DS(on)}, 6\text{ m}\Omega$
 $I_D, 29\text{ A}$


Gallium Nitride's exceptionally high electron mobility and low temperature coefficient allows very low $R_{DS(on)}$, while its lateral device structure and majority carrier diode provide exceptionally low Q_G and zero Q_{RR} . The end result is a device that can handle tasks where very high switching frequency, and low on-time are beneficial as well as those where on-state losses dominate.

Maximum Ratings

PARAMETER		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	100	V
V_{DS}	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150 °C)	120	
I_D	Continuous ($T_A = 25^\circ\text{C}$)	29	A
	Pulsed (25°C , $T_{PULSE} = 300\ \mu\text{s}$)	125	
V_{GS}	Gate-to-Source Voltage	6	V
	Gate-to-Source Voltage	-4	
T_J	Operating Temperature	-40 to 150	°C
T_{STG}	Storage Temperature	-40 to 150	

Thermal Characteristics

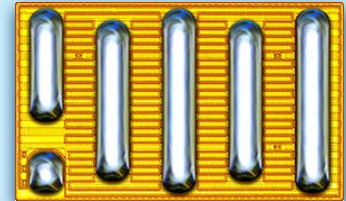
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	2.5	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	64	

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. See https://epc-co.com/epc/documents/product-training/Appnote_Thermal_Performance_of_eGaN_FETs.pdf for details.

Static Characteristics ($T_J = 25^\circ\text{C}$ unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}$, $I_D = 0.25\text{ mA}$	100			V
I_{DSS}	Drain-Source Leakage	$V_{GS} = 0\text{ V}$, $V_{DS} = 80\text{ V}$		0.04	0.2	mA
I_{GSS}	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}$		0.01	1.3	
	Gate-to-Source Forward Leakage [#]	$V_{GS} = 5\text{ V}$, $T_J = 125^\circ\text{C}$		0.3	6.7	
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		0.03	0.2	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 4\text{ mA}$	0.8	1.1	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}$, $I_D = 16\text{ A}$		4.4	6	mΩ
V_{SD}	Source-Drain Forward Voltage [#]	$I_S = 0.5\text{ A}$, $V_{GS} = 0\text{ V}$		1.6		V

[#] Defined by design. Not subject to production test.



EPC2204 eGaN® FETs are supplied only in passivated die form with solder bars. Die Size: 2.5 x 1.5 mm

Applications

- DC-DC Converters
- Isolated DC-DC Converters
- Lidar
- Sync rectification for AC-DC and DC-DC
- Point of Load Converters
- USB-C
- Class-D Audio
- LED Lighting
- E-Mobility

Benefits

- Ultra High Efficiency
- No Reverse Recovery
- Ultra Low Q_G
- Small Footprint



Dynamic Characteristics# ($T_j = 25^\circ\text{C}$ unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		644	851	pF
C_{RSS}	Reverse Transfer Capacitance			2.3		
C_{OSS}	Output Capacitance			304	456	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0\text{ V}$		401		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			501		
R_G	Gate Resistance			0.4		Ω
Q_G	Total Gate Charge	$V_{DS} = 50\text{ V}, V_{GS} = 5\text{ V}, I_D = 16\text{ A}$		5.7	7.4	nC
Q_{GS}	Gate-to-Source Charge	$V_{DS} = 50\text{ V}, I_D = 16\text{ A}$		1.8		
Q_{GD}	Gate-to-Drain Charge			0.8		
$Q_{G(TH)}$	Gate Charge at Threshold			1		
Q_{OSS}	Output Charge	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		25	38	
Q_{RR}	Source-Drain Recovery Charge			0		

Defined by design. Not subject to production test.

All measurements were done with substrate connected to source.

Note 2: $C_{OSS(ER)}$ is a fixed capacitance that gives the same stored energy as C_{OSS} while V_{DS} is rising from 0 to 50% BV_{DSS} .

Note 3: $C_{OSS(TR)}$ is a fixed capacitance that gives the same charging time as C_{OSS} while V_{DS} is rising from 0 to 50% BV_{DSS} .

Figure 1: Typical Output Characteristics at 25°C

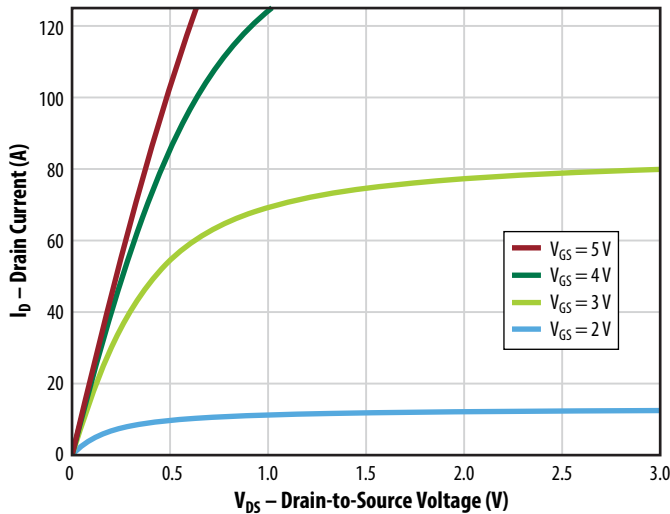


Figure 2: Typical Transfer Characteristics

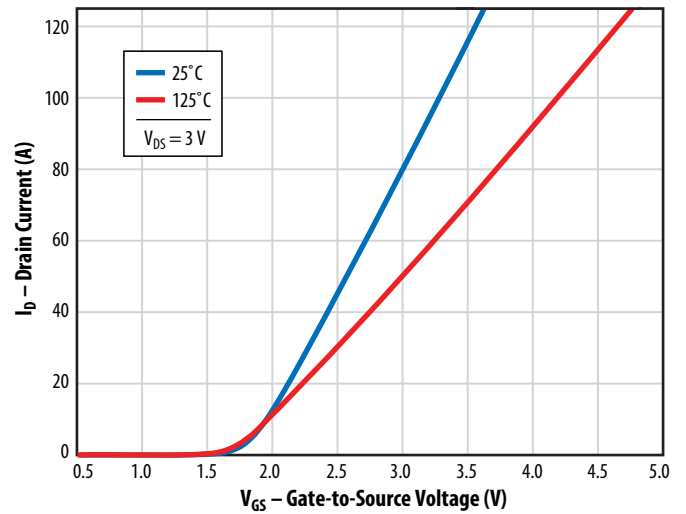


Figure 3: $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

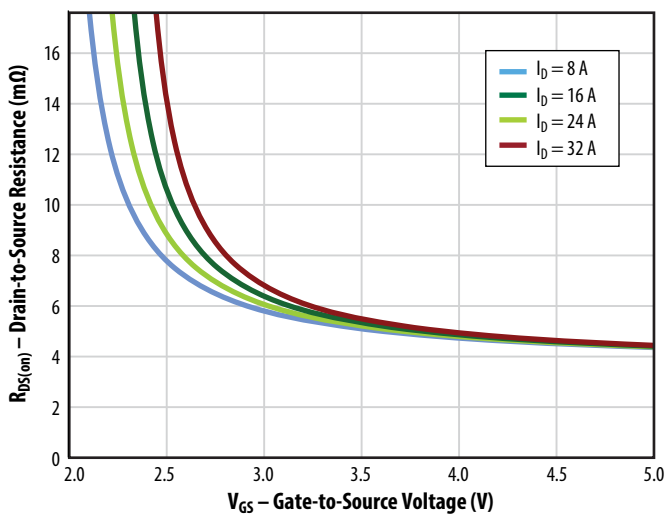


Figure 4: Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

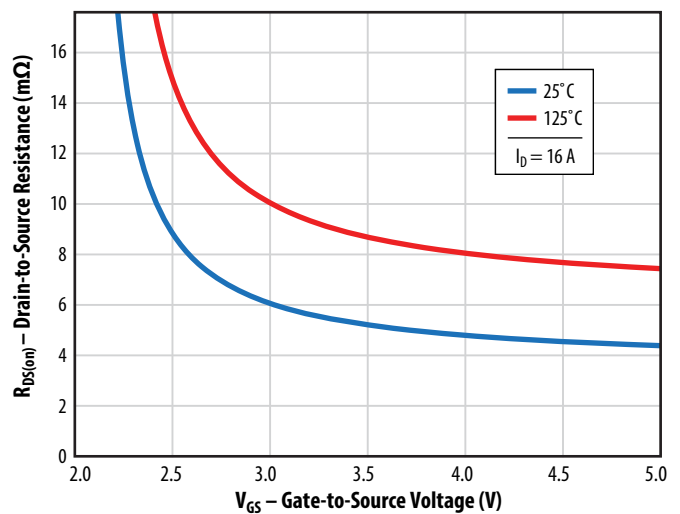


Figure 5a: Typical Capacitance (Linear Scale)

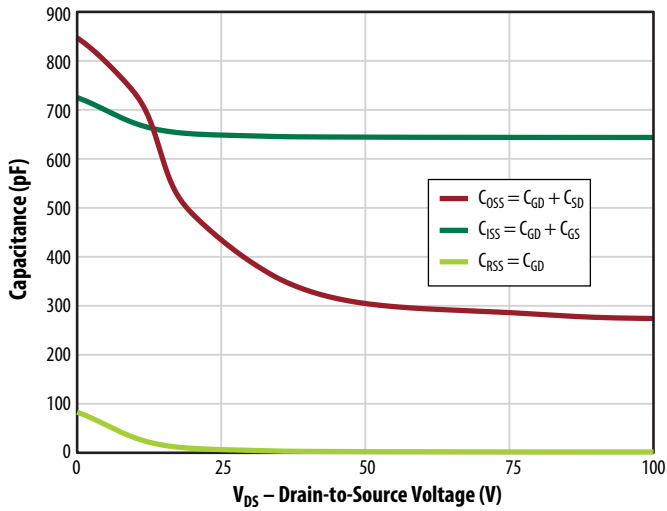


Figure 5b: Typical Capacitance (Log Scale)

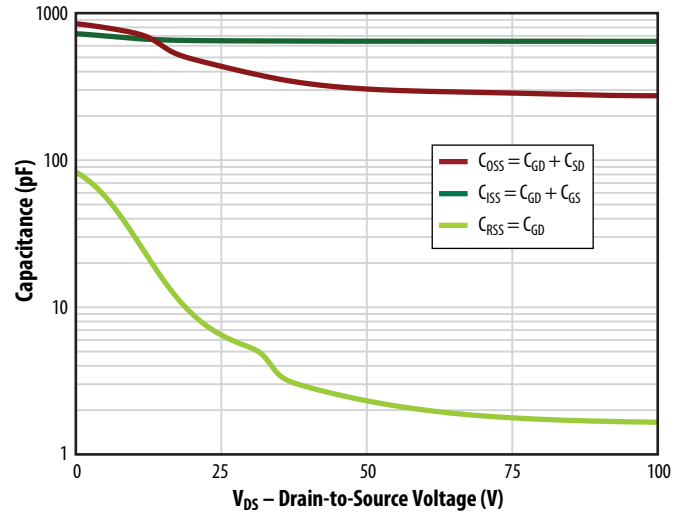


Figure 6: Typical Output Charge and C_OSS Stored Energy

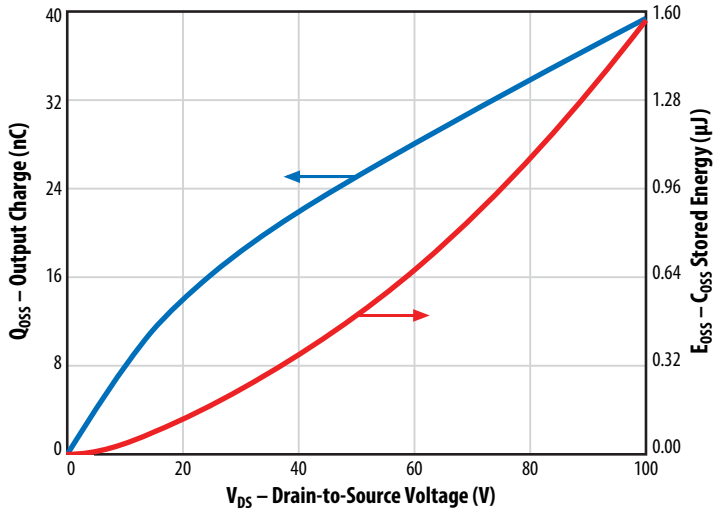


Figure 7: Typical Gate Charge

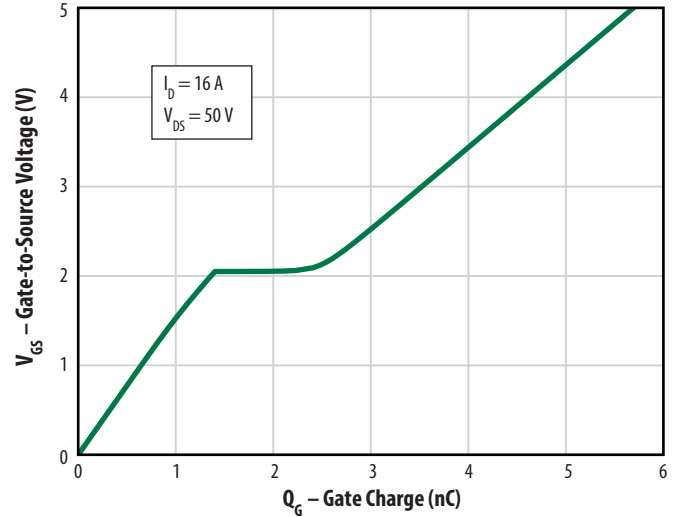


Figure 8: Reverse Drain-Source Characteristics

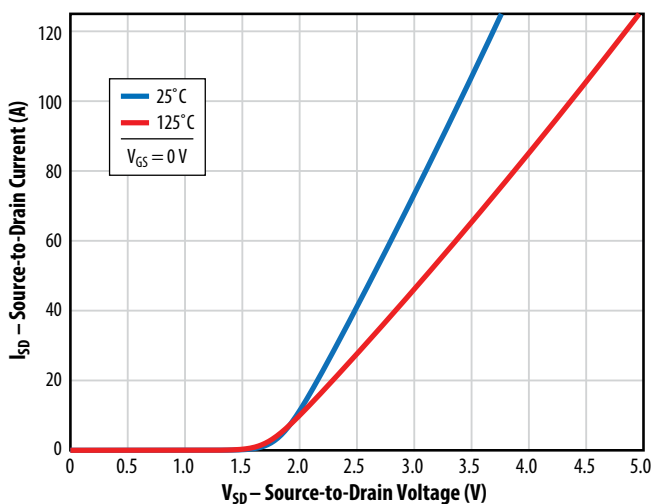
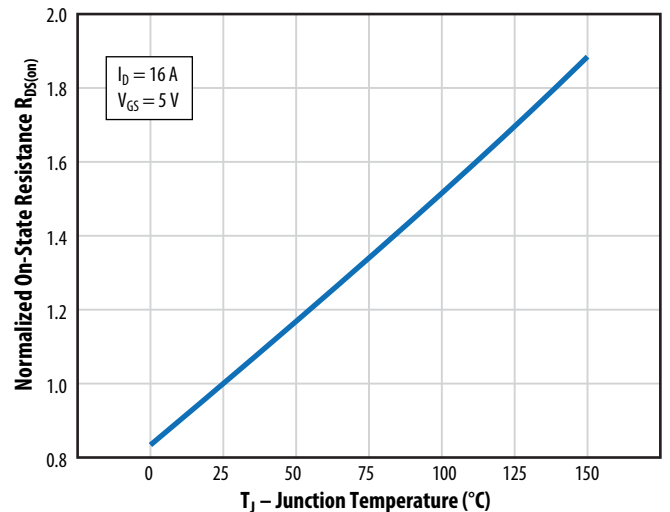


Figure 9: Normalized On-State Resistance vs. Temperature



Note: Negative gate drive voltage increases the reverse drain-source voltage. EPC recommends 0 V for OFF.

Figure 10: Normalized Threshold Voltage vs. Temperature

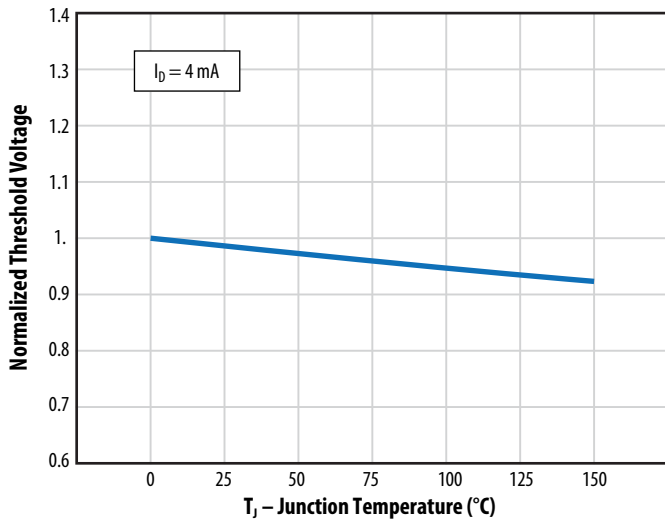


Figure 11: Safe Operating Area

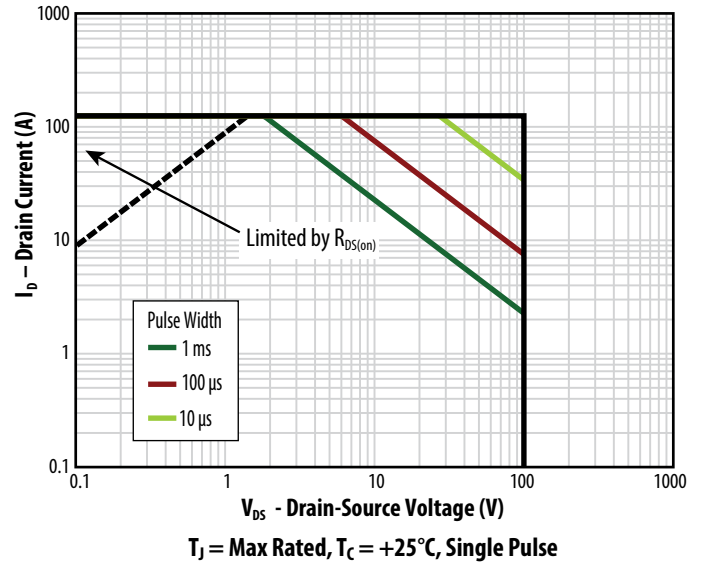
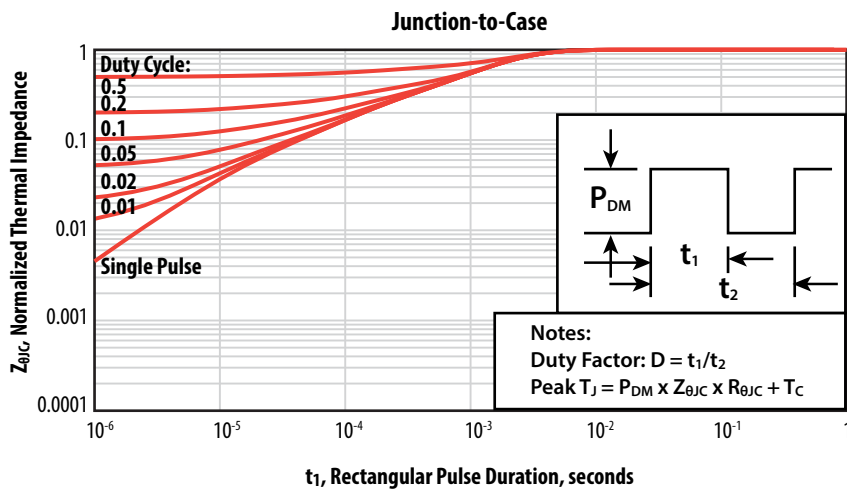
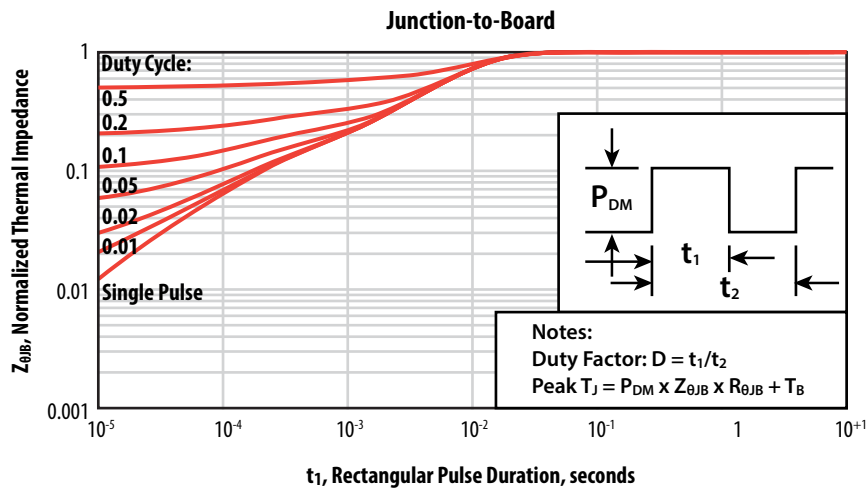
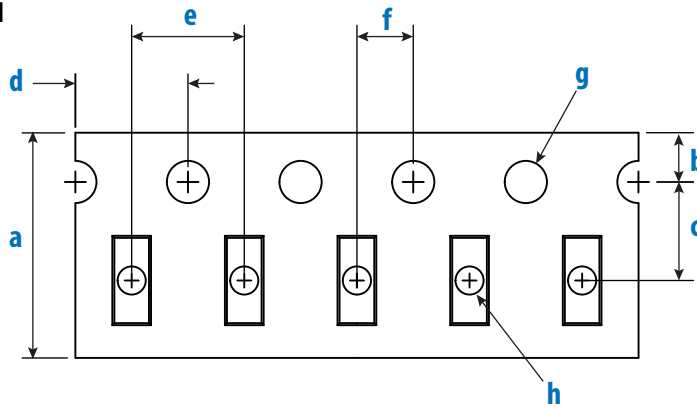
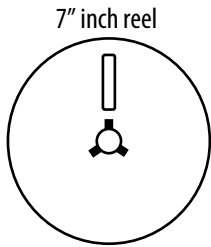


Figure 12: Transient Thermal Response Curves



TAPE AND REEL CONFIGURATION

4 mm pitch, 8 mm wide tape on 7" reel



Loaded Tape Feed Direction →



Die orientation dot
Gate solder bar is under this corner

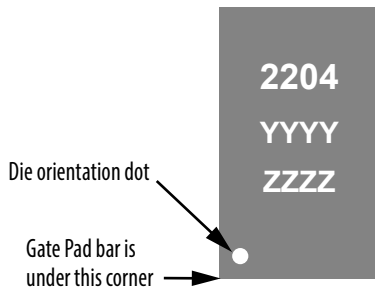
Die is placed into pocket solder bar side down (face side down)

EPC2204 (Note 1)	Dimension (mm)		
	Target	MIN	MAX
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (Note 2)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (Note 2)	2.00	1.95	2.05
g	1.50	1.50	1.60
h	0.50	0.45	0.55

Note 1: MSL 1 (moisture sensitivity level 1) classified according to IPC/JEDEC industry standard.

Note 2: Pocket position is relative to the sprocket hole measured as true position of the pocket, not the pocket hole.

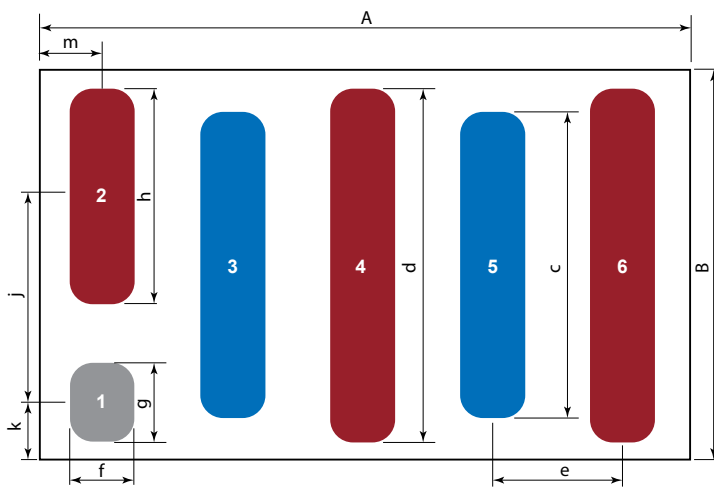
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot _Date Code Marking Line 2	Lot _Date Code Marking Line 3
EPC2204	2204	YYYY	ZZZZ

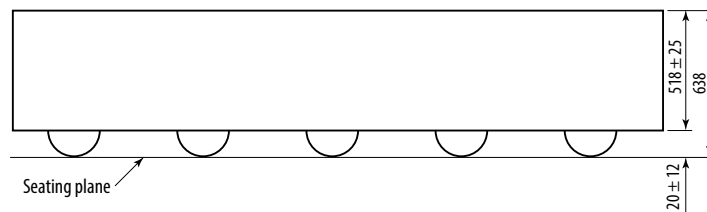
DIE OUTLINE

Solder Bump View



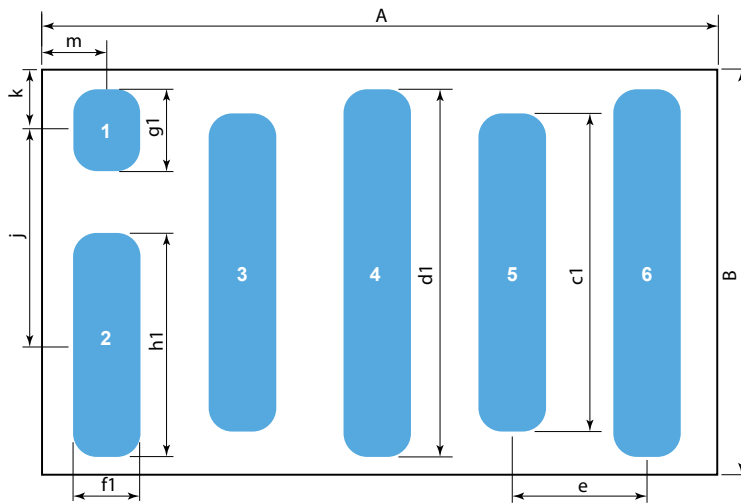
DIM	Micrometers		
	MIN	Nominal	MAX
A	2470	2500	2530
B	1470	1500	1530
c		1175	
d		1350	
e		500	
f		250	
g		300	
h		825	
j		787.5	
k		225	
m		250	

Side View



Pad 1 is Gate;
Pads 2, 4, 6 are Source;
Pads 3, 5 are Drain

RECOMMENDED LAND PATTERN
(units in μm)

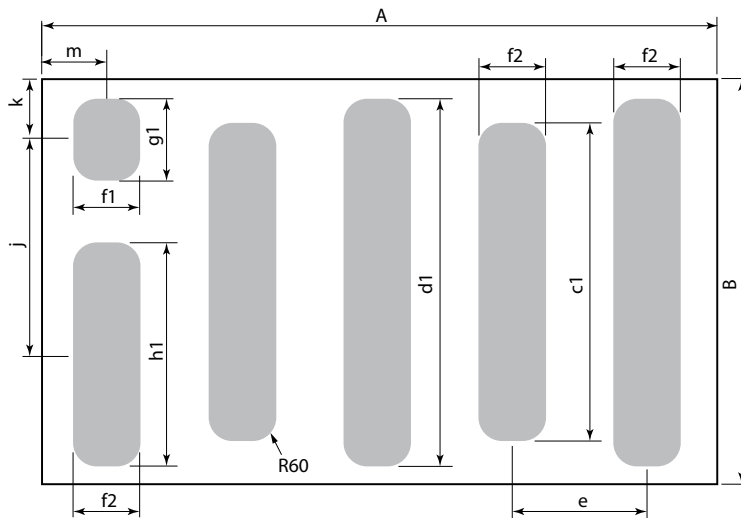


DIM	Nominal
A	2500
B	1500
c1	1155
d1	1330
e	500
f1	230
g1	280
h1	805
j	787.5
k	225
m	250

Land pattern is solder mask defined

Pad 1 is Gate;
Pads 2, 4, 6 are Source;
Pads 3, 5 are Drain

RECOMMENDED STENCIL DRAWING
(units in μm)



DIM	Nominal
A	2500
B	1500
c1	1155
d1	1330
e	500
f1	230
f2	210
g1	280
h1	805
j	787.5
k	225
m	250

Recommended stencil should be 4 mil (100 μm) thick, must be laser cut, openings per drawing.

The corner has a radius of R60.

Intended for use with SAC305 Type 4 solder, reference 88.5% metals content.

Split stencil design can be provided upon request, but EPC has tested this stencil design and not found any scooping issues.

Additional assembly resources available at <https://epc-co.com/epc/DesignSupport/AssemblyBasics.aspx>

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