

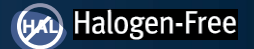
EPC2204A – Automotive 80 V (D-S) Enhancement Mode Power Transistor

 V_{DS} , 80 V

 $R_{DS(on)}$, 6 mΩ max

 I_D , 29 A

AEC-Q101



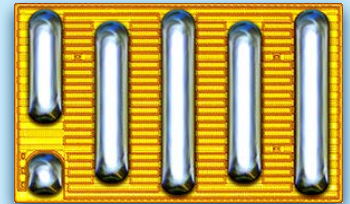
Revised November 27, 2024

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.

Application Notes:

- Easy-to-use and reliable gate, Gate Drive ON = 5 V typical, OFF = 0 V (negative voltage not needed)
- Top of FET is electrically connected to source

Questions:
Ask a GaN
Expert



Die Size: 2.5 x 1.5 mm

EPC2204A eGaN® FETs are supplied only in passivated die form with solder bars.

Maximum Ratings

PARAMETER		VALUE	UNIT
V_{DS}	Drain-to-Source Voltage (Continuous)	80	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150 °C)	96	
I_D	Continuous ($T_A = 25^\circ\text{C}$)	29	A
	Pulsed (25°C , $T_{PULSE} = 10 \mu\text{s}$)	167	
	Pulsed (125°C , $T_{PULSE} = 10 \mu\text{s}$)	134	
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	$V_{GS} = 0 \text{ V}$, $I_D = 0.2 \text{ mA}$	80			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	$V_{GS} = 6 \text{ V}$		0.01	1.3	
	Gate-to-Source Forward Leakage [#]	$V_{GS} = 6 \text{ V}$, $T_J = 125^\circ\text{C}$		0.3	6.7	
	Gate-to-Source Reverse Leakage	$V_{GS} = -4 \text{ V}$		0.03	0.2	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 4 \text{ mA}$	0.7	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.

Applications

- DC-DC converters
- Isolated DC-DC converters
- Automotive lidar/ToF
- Sync rectification for AC-DC and DC-DC
- Point of load converters
- USB-C
- Class-D audio
- LED lighting
- eMobility

Benefits

- Ultra high efficiency
- No reverse recovery
- Ultra low Q_G
- Small footprint

Scan QR code or click link below for more information including reliability reports, device models, demo boards!



<https://l.ead.me/EPC2204A>

Dynamic Characteristics[#] (T_J = 25°C unless otherwise stated)

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C _{ISS}	Input Capacitance	V _{DS} = 50 V, V _{GS} = 0 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 to 50 V, V _{GS} = 0 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 V, V _{GS} = 5 V, I _D = 16 A		5.7	7.4	nC
Q _{GS}	Gate-to-Source Charge	V _{DS} = 50 V, I _D = 16 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 V, V _{GS} = 0 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*

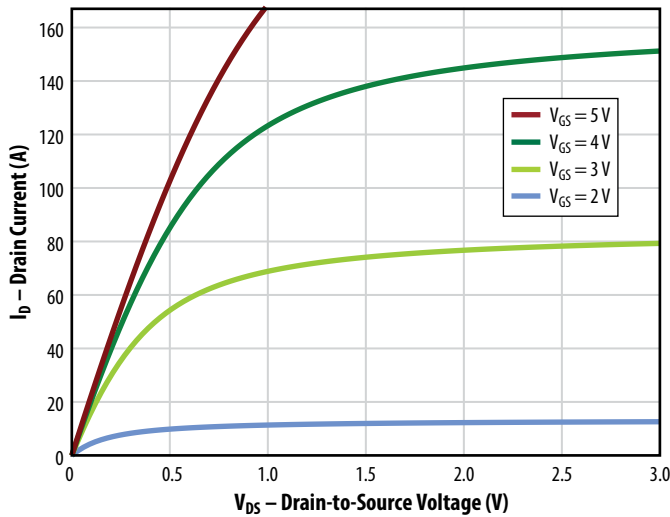


Figure 2: Typical Transfer Characteristics*

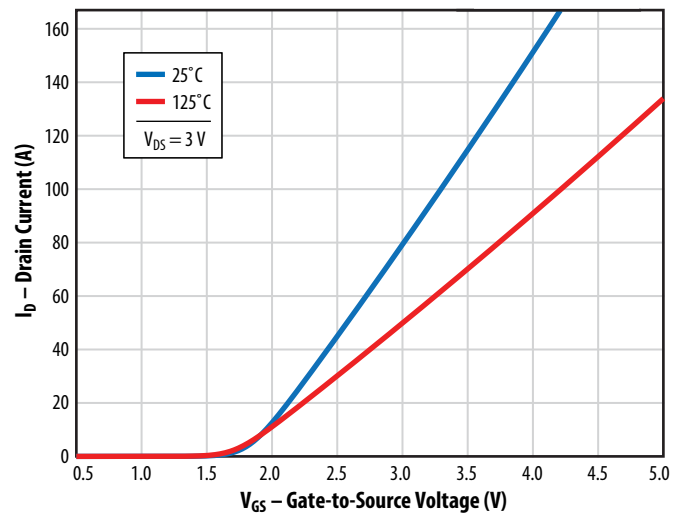


Figure 3: Typical R_{DS(on)} vs. V_{GS} for Various Drain Currents

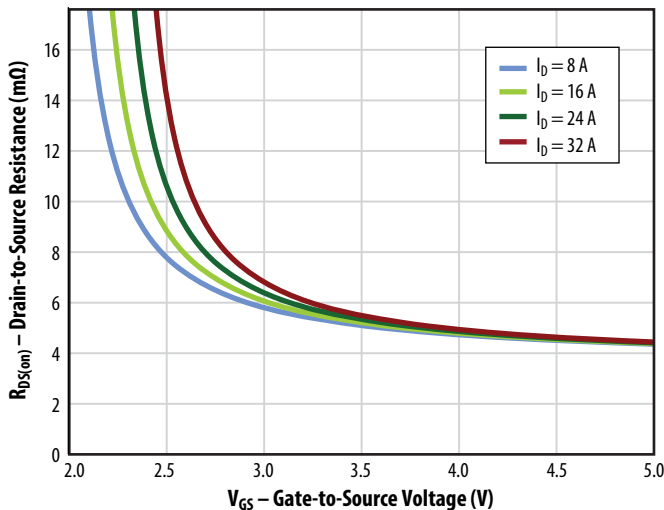
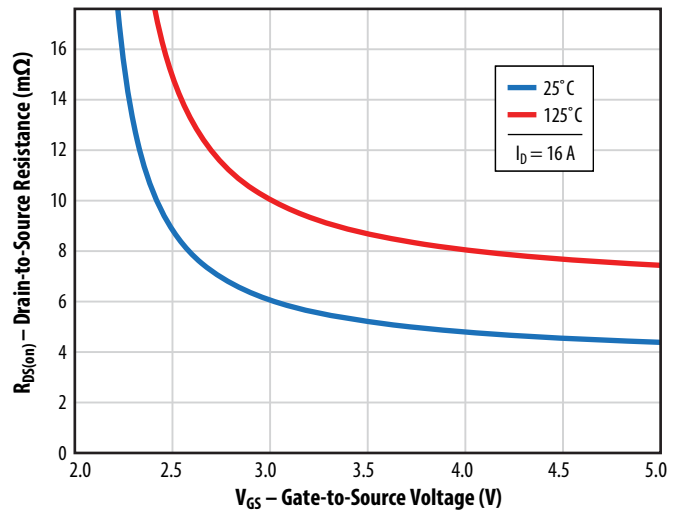


Figure 4: Typical R_{DS(on)} vs. V_{GS} for Various Temperatures



* Generated based on a pulse width of 300 μs.

Figure 5a: Typical Capacitance (Linear Scale)

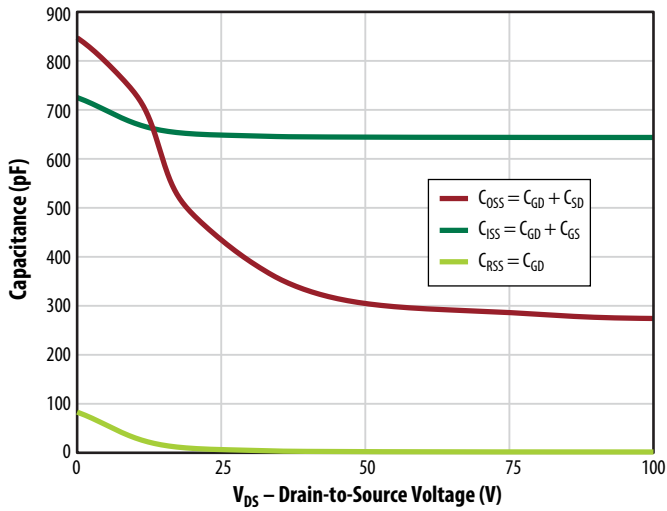


Figure 5b: Typical Capacitance (Log Scale)

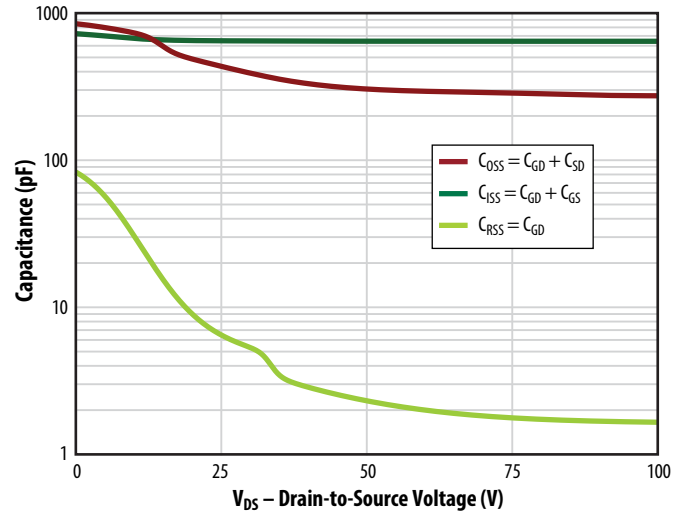


Figure 6: Typical Output Charge and C_{OSS} Stored Energy

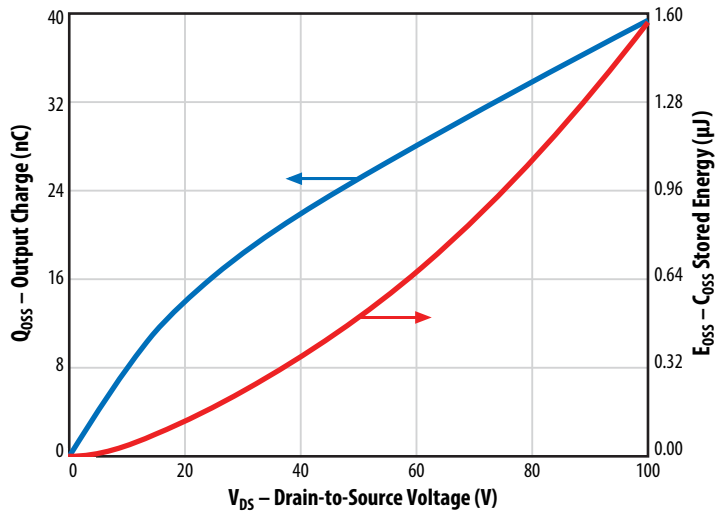


Figure 7: Typical Gate Charge

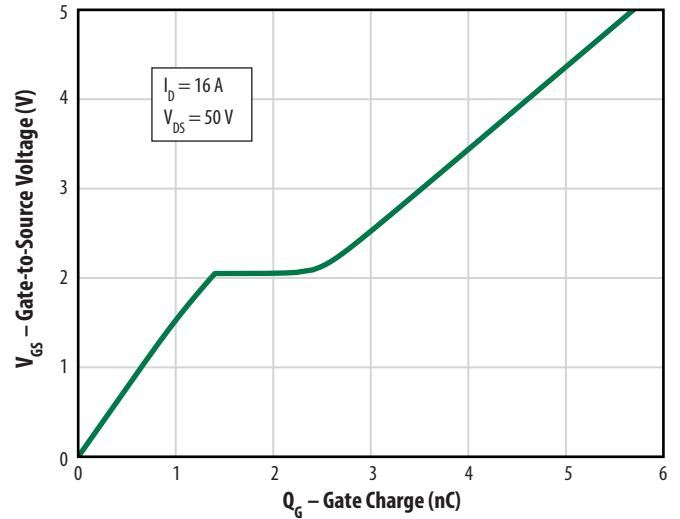


Figure 8: Typical Reverse Drain-Source Characteristics*

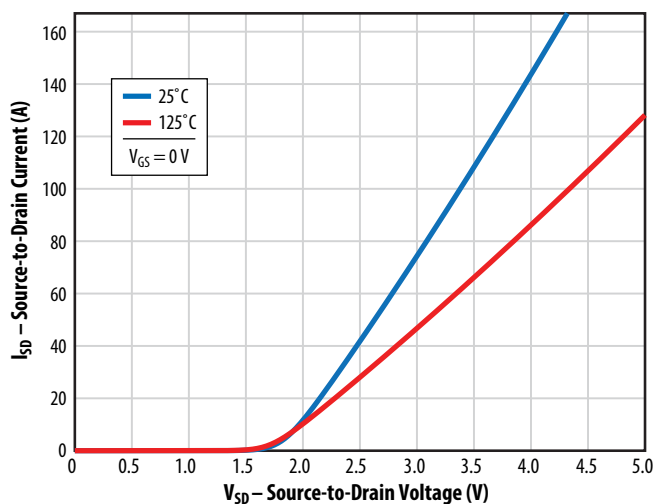
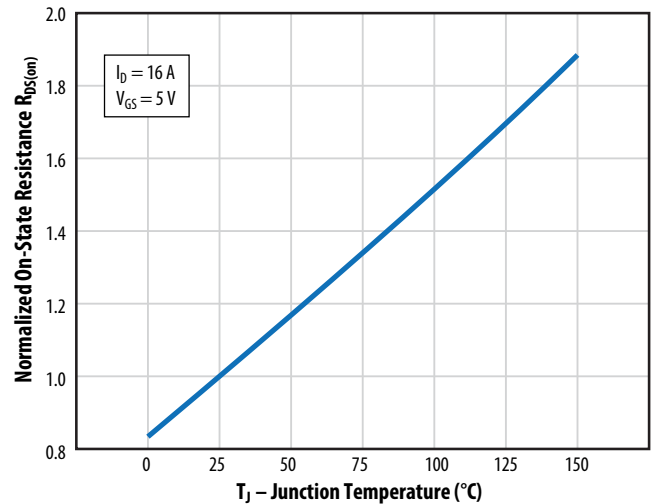


Figure 9: Typical Normalized On-State Resistance vs. Temp.



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

* Generated based on a pulse width of 300 μs .

Figure 10: Typical Normalized Threshold Voltage vs. Temp.

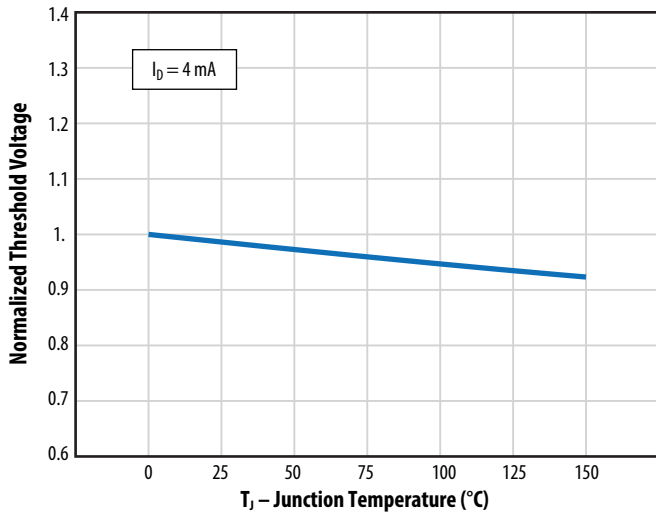


Figure 11: Safe Operating Area

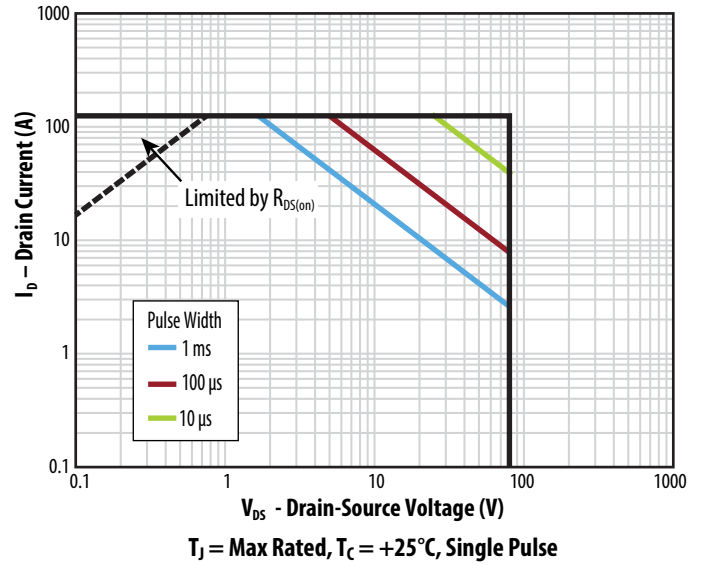
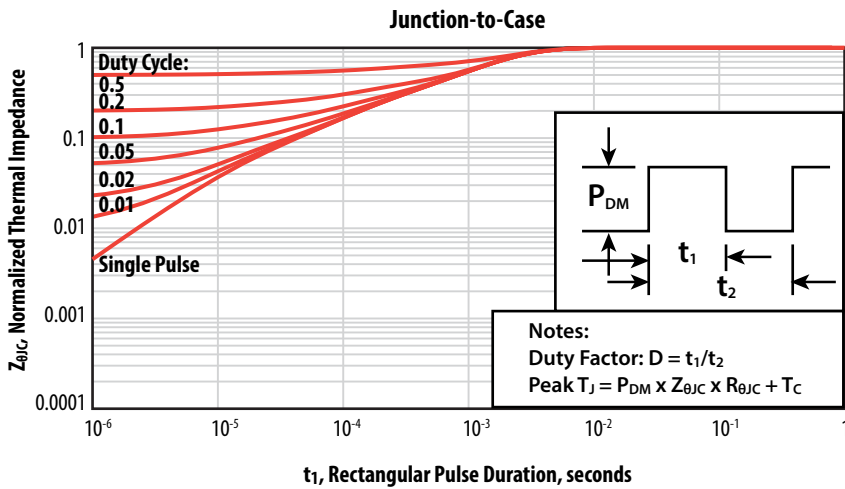
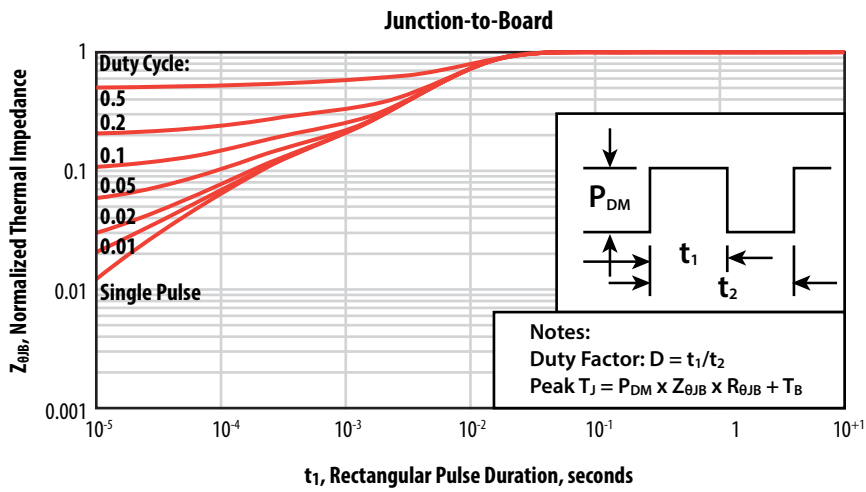
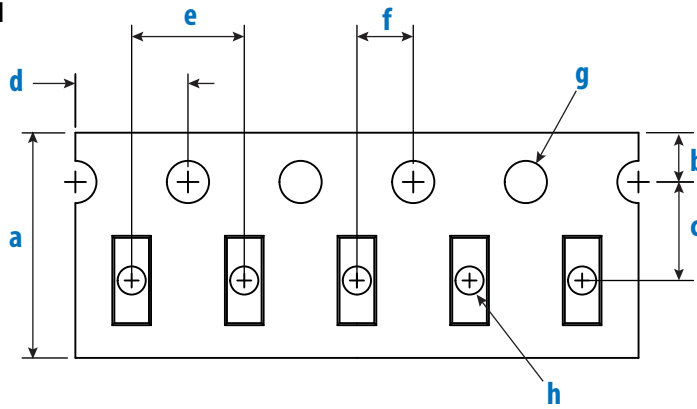
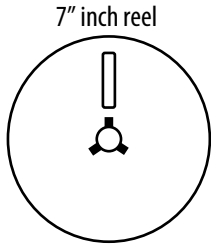


Figure 12: Typical Transient Thermal Response Curves



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

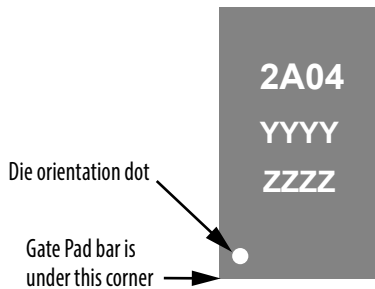
Die is placed into pocket solder bars side down (face side down)

EPC2204A (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.

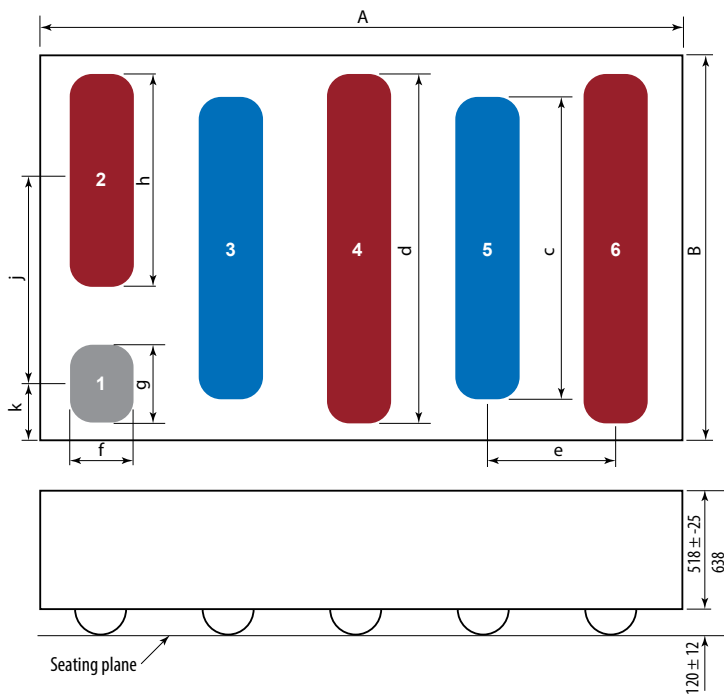
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2204A	2A04	YYYY	ZZZZ

DIE OUTLINE

Solder Bump View

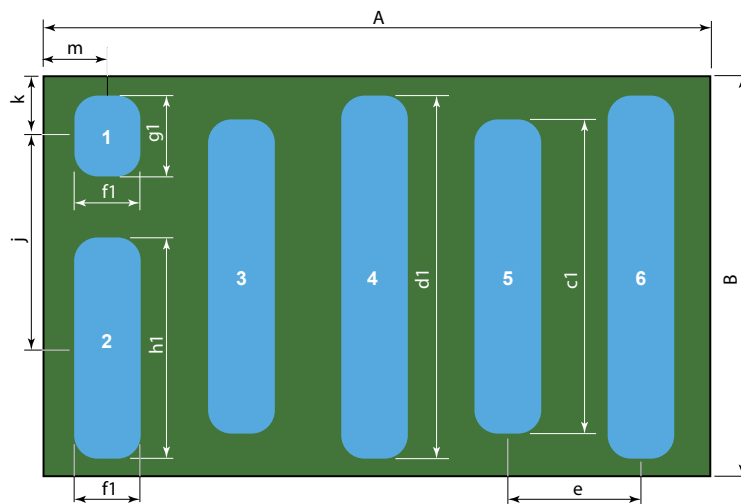


DIM	Micrometers		
	MIN	Nominal	MAX
A	2470	2500	2530
B	1470	1500	1530
c		1175	
d		1350	
e		500	
f		250	
g		300	
h		825	
j		787.5	
k		225	
m		250	

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

Note: Substrate (top side) connected to source

RECOMMENDED LAND PATTERN
(units in μm)

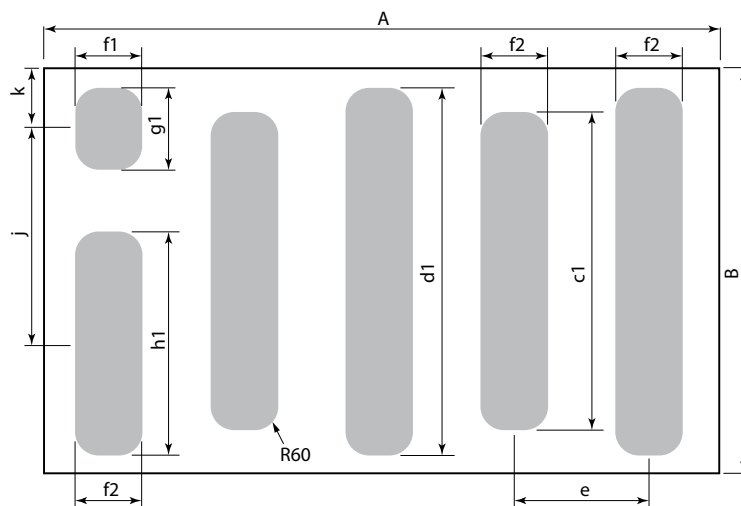


Land pattern is solder mask defined.

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

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/design-support>

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