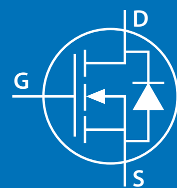
EPC2215 – Enhancement Mode Power Transistor

V_{DS} , 200 V
$R_{DS(on)}$, 8 mΩ
I_D , 32 A



EFFICIENT POWER CONVERSION

RoHS Halogen-Free

Revised December 18, 2023

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 = 5–5.25 V typical, OFF = 0 V (negative voltage not needed)
- Top of FET is electrically connected to source

Questions: Ask a GaN Expert

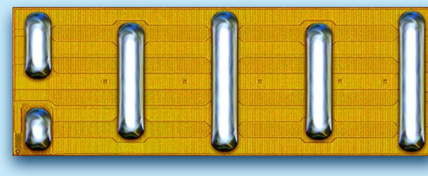
Maximum Ratings			
PARAMETER		**VALUE**	**UNIT**
V_{DS}	Drain-to-Source Voltage (Continuous)	200	V
I_D	Continuous (T_A = 25°C)	32	A
	Pulsed (25°C, T_{PULSE} = 300 µs)	162	
V_{GS}	Gate-to-Source Voltage	6	V
	Gate-to-Source Voltage	-4	
T_J	Operating Temperature	-40 to 150	°C
T_{STG}	Storage Temperature	-40 to 150	

Thermal Characteristics			
PARAMETER		**TYP**	**UNIT**
$R_{θJC}$	Thermal Resistance, Junction-to-Case	0.5	°C/W
$R_{θJB}$	Thermal Resistance, Junction-to-Board	2.5	
$R_{θJA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	52	

Note 1: $R_{θJA}$ 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°C unless otherwise stated)						
PARAMETER		**TEST CONDITIONS**	**MIN**	**TYP**	**MAX**	**UNIT**
BV_{DSS}	Drain-to-Source Voltage	V_{GS} = 0 V, I_D = 0.6 mA	200			V
I_{DSS}	Drain-Source Leakage	V_{GS} = 0 V, V_{DS} = 160 V		0.15	0.48	mA
I_{GSS}	Gate-to-Source Forward Leakage	V_{GS} = 5 V		0.03	3.8	
	Gate-to-Source Forward Leakage#	V_{GS} = 5 V, T_J = 125°C		0.5	8.7	
	Gate-to-Source Reverse Leakage	V_{GS} = -4 V		0.15	0.48	
$V_{GS(TH)}$	Gate Threshold Voltage	V_{DS} = V_{GS}, I_D = 6 mA	0.8	1.1	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	V_{GS} = 5 V, I_D = 20 A		6	8	mΩ
V_{SD}	Source-Drain Forward Voltage#	I_S = 0.5 A, V_{GS} = 0 V		1.6		V

Defined by design. Not subject to production test.



Die size: 4.6 x 1.6 mm

EPC2215 eGaN® FETs are supplied only in passivated die form with solder bars.

Applications

- DC-DC converters
- BLDC motor drives
- Sync rectification for AC/DC and DC-DC
- Multi-level AC/DC power supplies
- Wireless power
- Solar micro-inverters
- Robotics
- Class-D audio

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/EPC2215

Dynamic Characteristics# (T_J = 25°C unless otherwise stated)						
PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	V_{DS} = 100 V, V_{GS} = 0 V		1356	1790	pF
C_{RSS}	Reverse Transfer Capacitance			2.0		
C_{OSS}	Output Capacitance			390	585	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	V_{DS} = 0 to 100 V, V_{GS} = 0 V		556		
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			699		
R_G	Gate Resistance			0.4		Ω
Q_G	Total Gate Charge	V_{DS} = 100 V, V_{GS} = 5 V, I_D = 20 A		13.6	17.7	nC
Q_{GS}	Gate-to-Source Charge	V_{DS} = 100 V, I_D = 20 A		3.3		
Q_{GD}	Gate-to-Drain Charge			2.1		
$Q_{G(TH)}$	Gate Charge at Threshold			2.4		
Q_{OSS}	Output Charge	V_{DS} = 100 V, V_{GS} = 0 V		69	104	
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

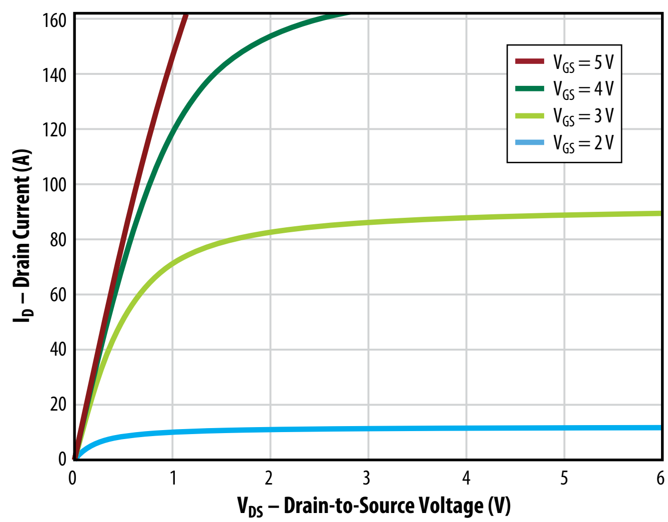


Figure 2: Typical Transfer Characteristics

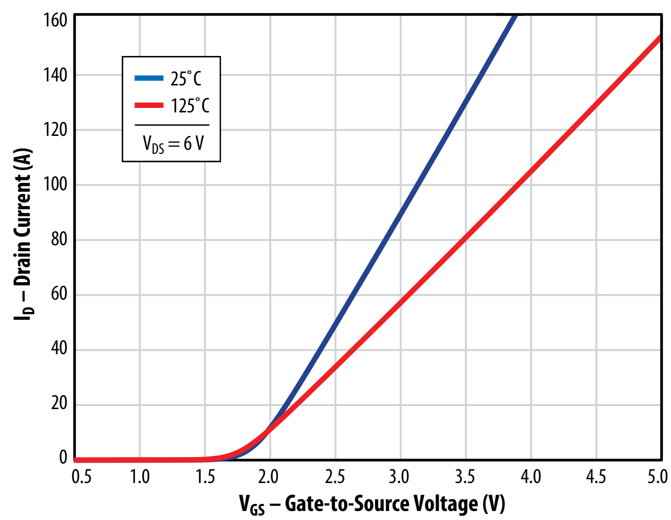


Figure 3: Typical $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

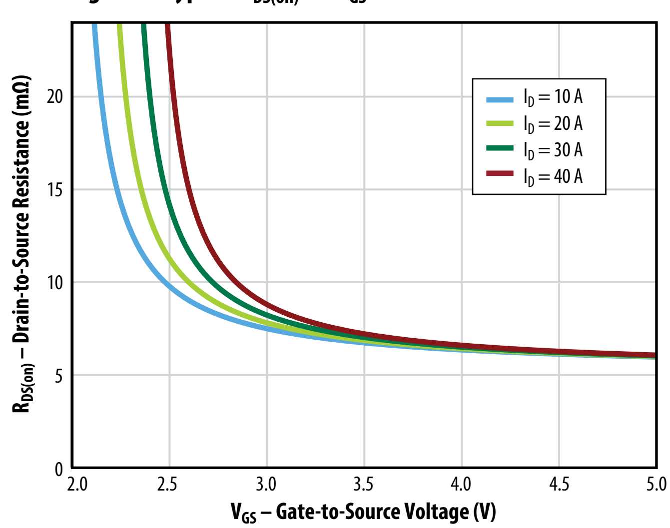


Figure 4: Typical $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

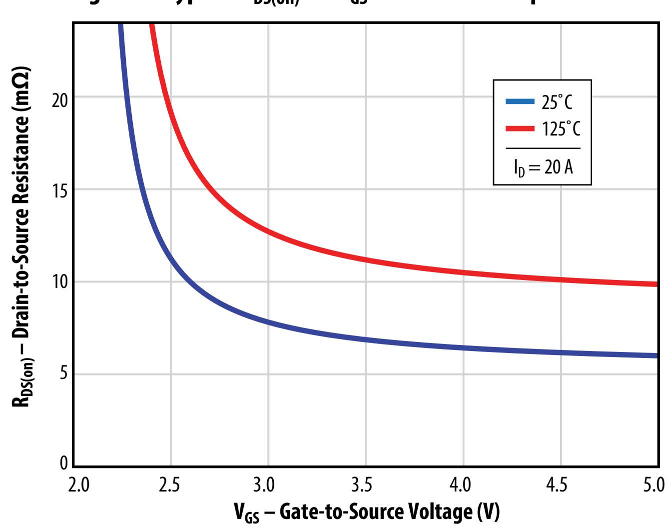


Figure 5a: Typical Capacitance (Linear Scale)

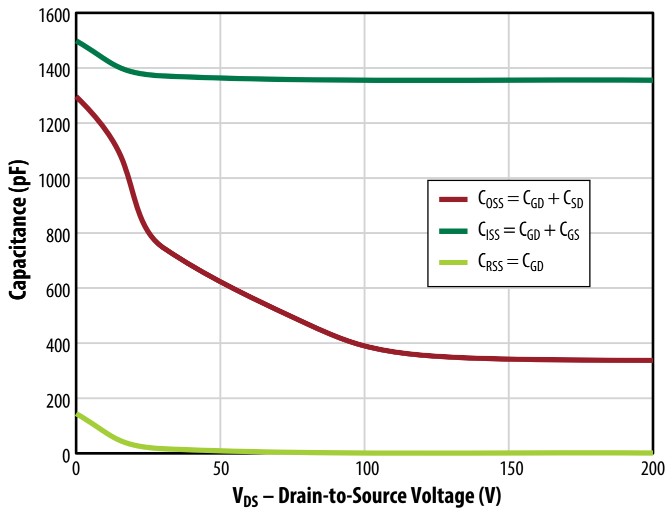


Figure 5b: Typical Capacitance (Log Scale)

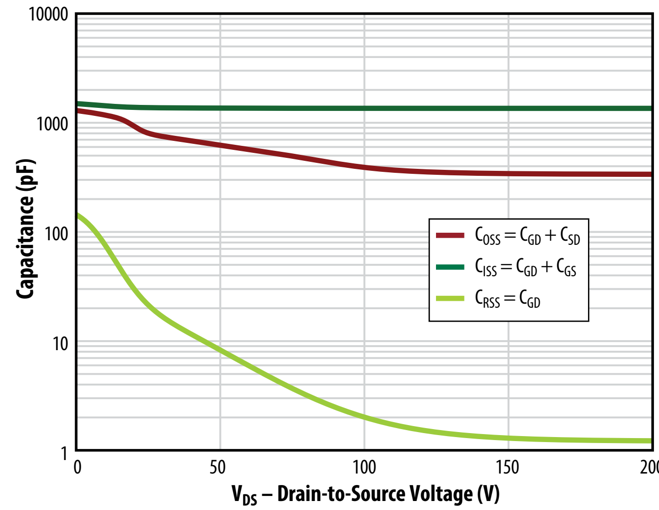


Figure 6: Typical Output Charge and C_{OSS} Stored Energy

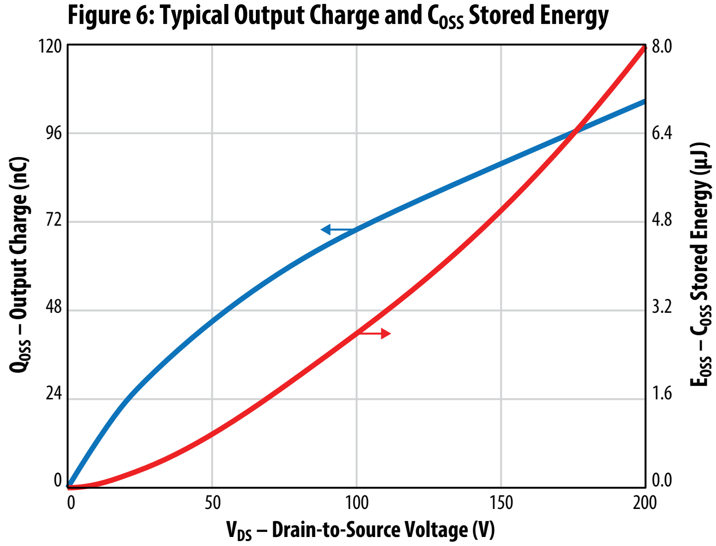


Figure 7: Typical Gate Charge

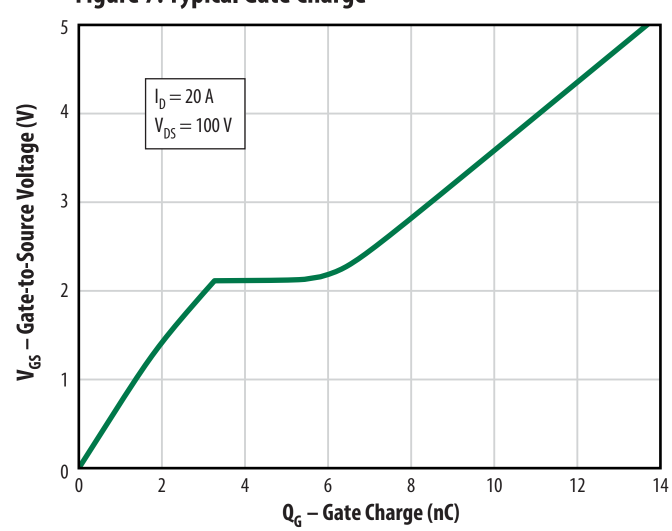
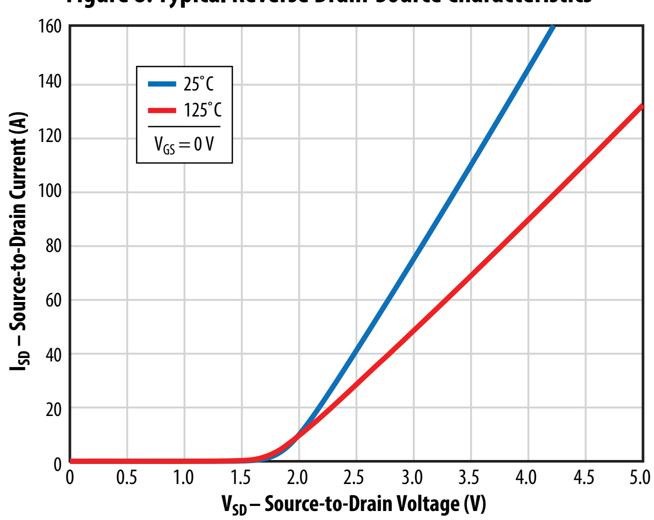


Figure 8: Typical Reverse Drain-Source Characteristics



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

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

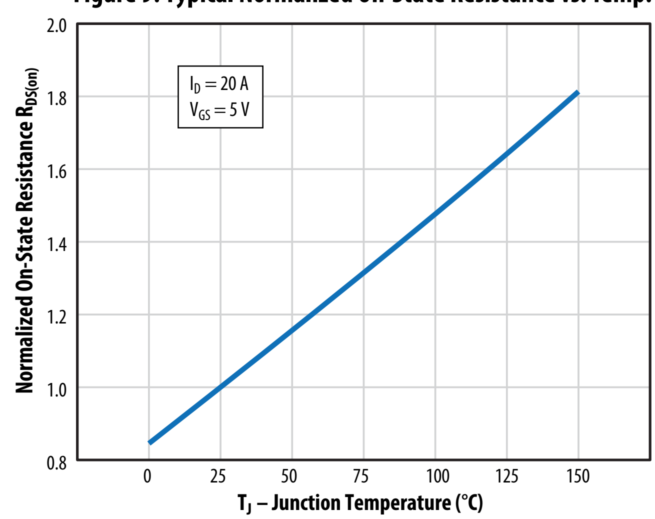


Figure 10: Typical Normalized Threshold Voltage vs. Temp.

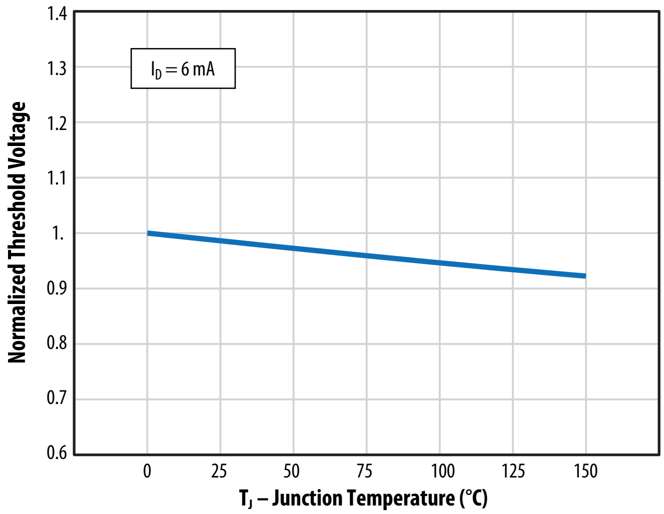
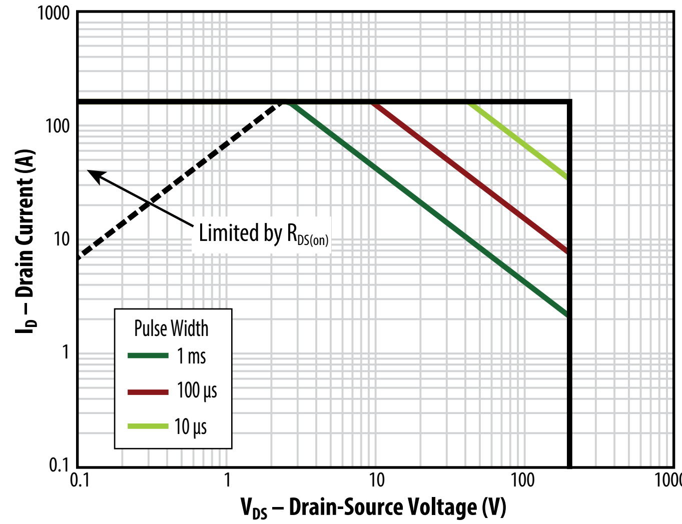


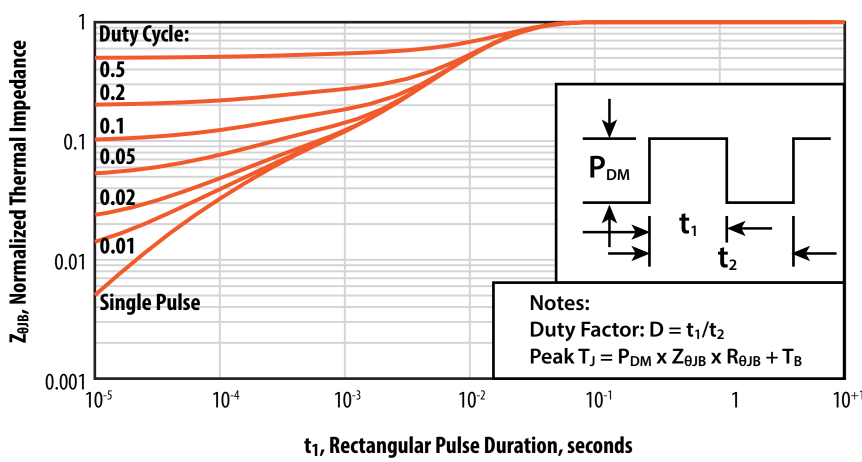
Figure 11: Safe Operating Area



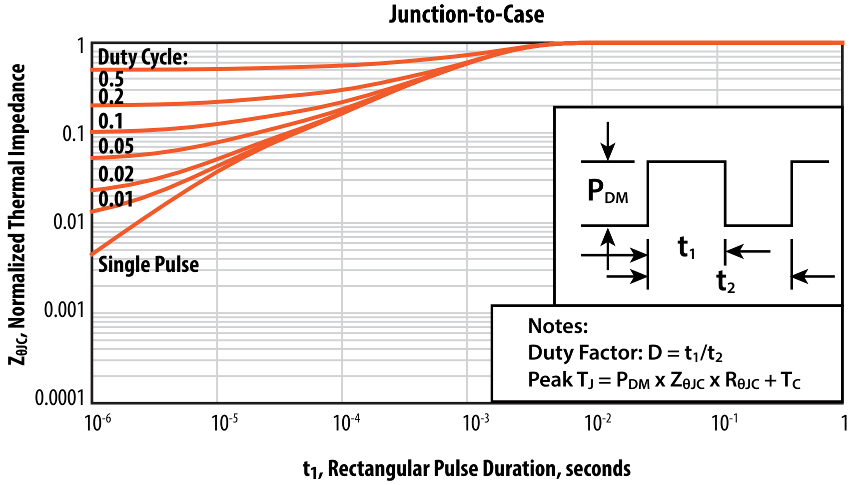
T_J = Max Rated, T_C = +25°C, Single Pulse

Figure 12: Typical Transient Thermal Response Curves

Junction-to-Board



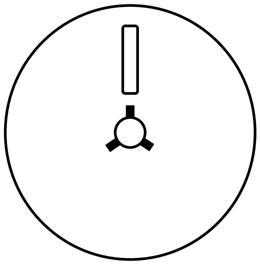
Junction-to-Case

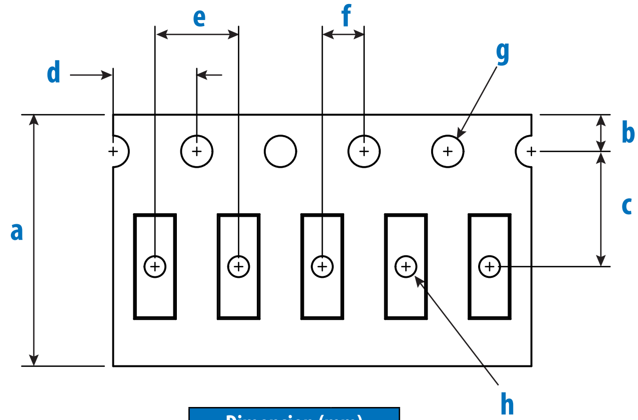


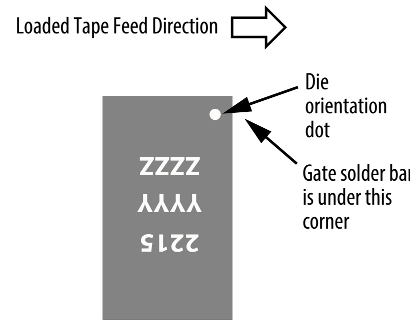
TAPE AND REEL CONFIGURATION

4 mm pitch, 12 mm wide tape on 7” reel

7” inch reel







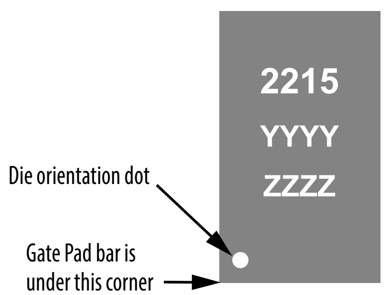
Die is placed into pocket solder bar side down (face side down)

	Dimension (mm)		
EPC2215 (Note 1)	Target	MIN	MAX
a	12.00	11.90	12.30
b	1.75	1.65	1.85
c (Note 2)	5.50	5.45	5.55
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	1.50	0.95	1.05

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.

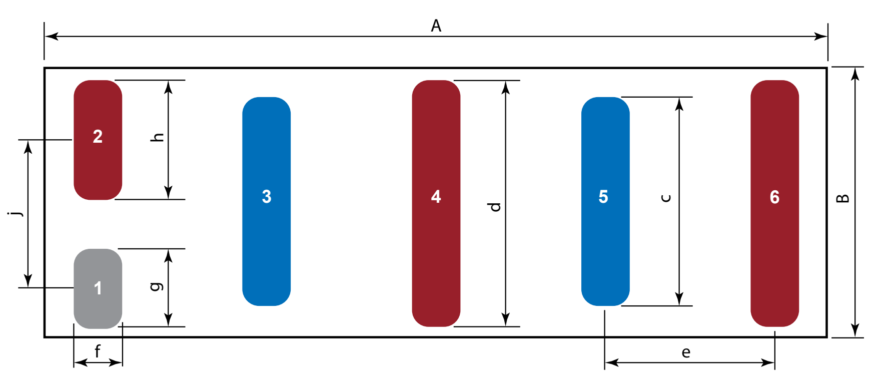
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2215	2215	YYYY	ZZZZ

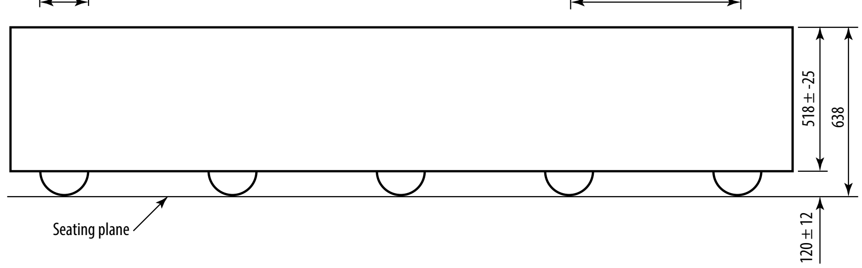
DIE OUTLINE

Solder Bump View



DIM	Micrometers		
	MIN	Nominal	MAX
A	4570	4600	4630
B	1570	1600	1630
c		1210	
d		1450	
e		1000	
f		275	
g		450	
h		700	
j		875	

Side View



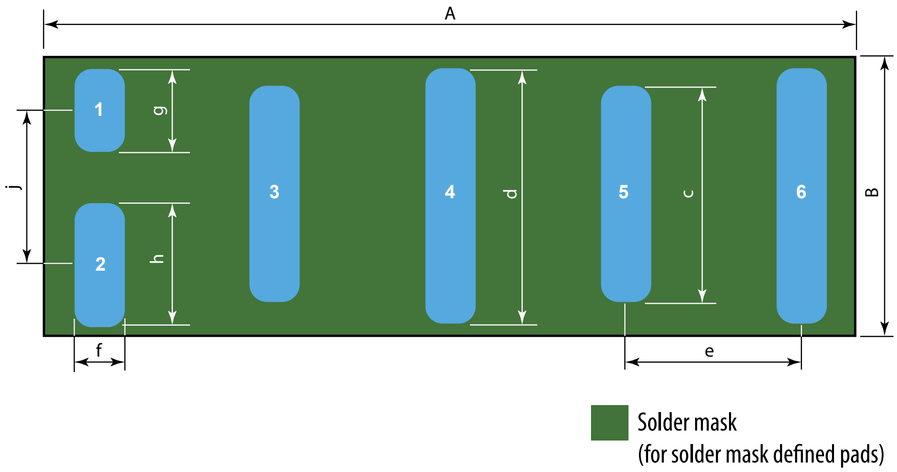
Pad 1 is Gate;

Pads 2 ,4, 6 are Source;

Pads 3, 5 are Drain

RECOMMENDED LAND PATTERN

(units in µm)



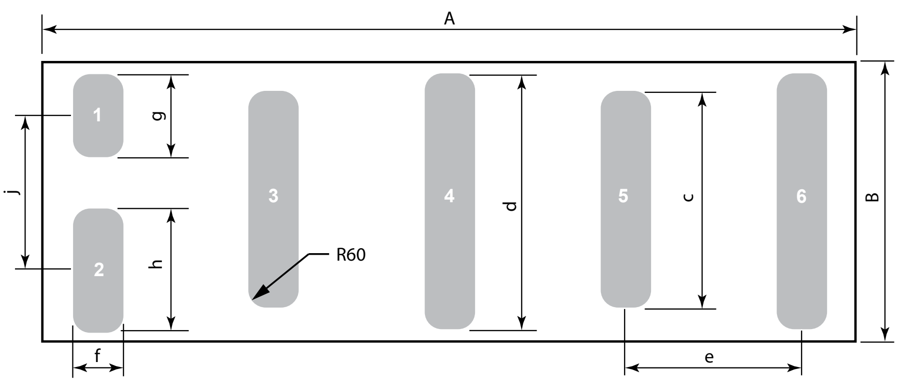
Land pattern is solder mask defined.

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

DIM	Nominal
A	4600
B	1600
c	1210
d	1450
e	1000
f	275
g	450
h	700
j	875

RECOMMENDED STENCIL DRAWING

(units in µm)



DIM	Nominal
A	4600
B	1600
c	1210
d	1450
e	1000
f	275
g	450
h	700
j	875

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.

TYPICAL THERMAL CONCEPT

The EPC2215 can take advantage of dual sided cooling to maximize its heat dissipation capabilities in high power density designs. ***Note that the top of EPC FETs are connected to source potential, so for half-bridge topologies the Thermal Interface Material (TIM) needs to provide electrical isolation to the heatsink.***

Recommended best practice thermal solutions are covered in detail in **How2AppNote012 - How to Get More Power Out of an eGaN Converter.pdf**.

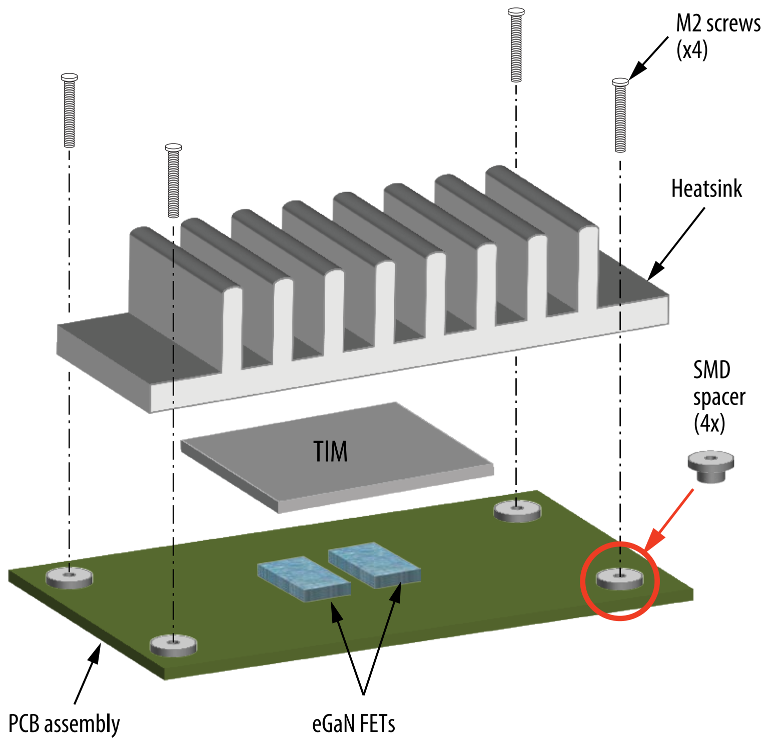


Figure 13: Exploded view of heatsink assembly using screws

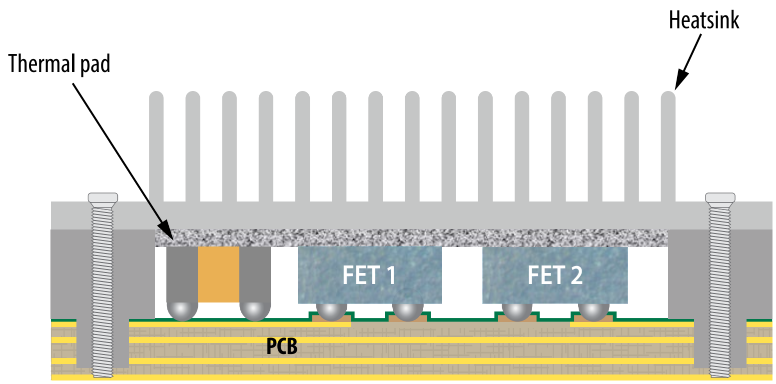


Figure 14: A cross-section image of dual sided thermal solution

Note: Connecting the heatsink to ground is recommended and can significantly improve radiated EMI

The thermal design can be optimized by using the ***GaN FET Thermal Calculator*** on EPC's website.

Solder mask defined pads are recommended for best reliability.

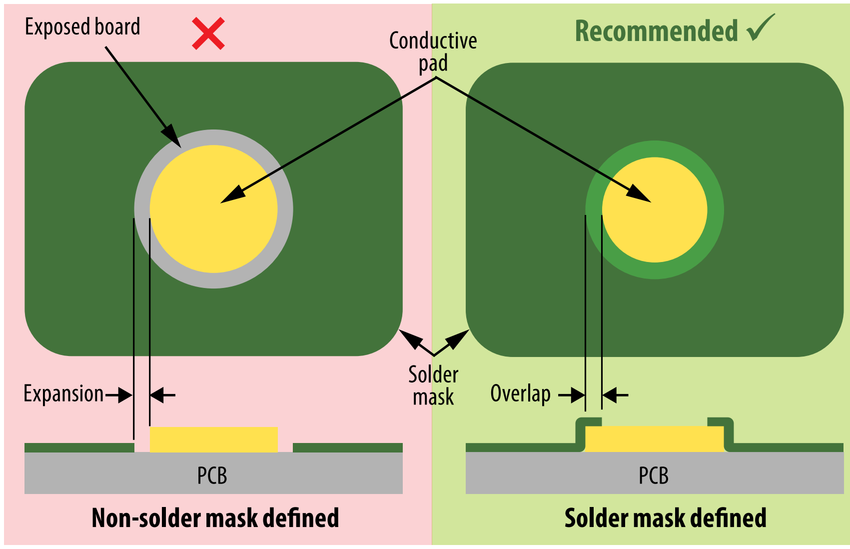


Figure 15: Solder mask defined versus non-solder mask defined pad

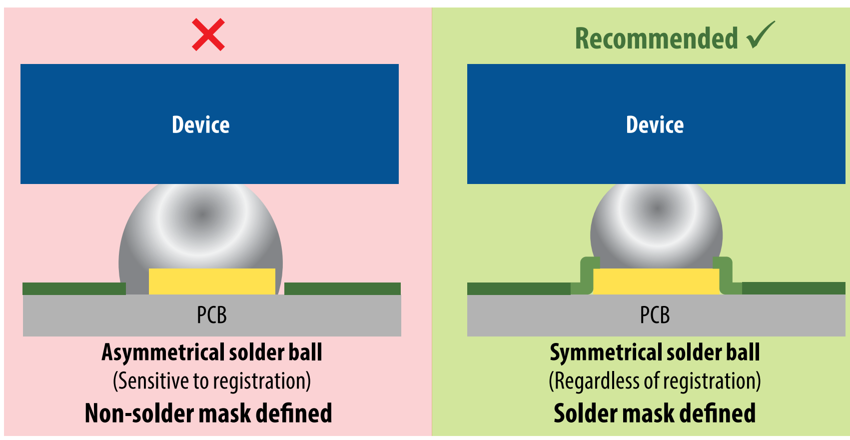


Figure 16: Effect of solder mask design on the solder ball symmetry

- Assembly resources – **https://epc-co.com/epc/Portals/0/epc/documents/product-training/Appnote_GaNassembly.pdf**
- Library of Altium footprints for production FETs and ICs – **https://epc-co.com/epc/documents/altium-files/EPC%20Altium%20Library.zip** (for preliminary device Altium footprints, contact EPC)