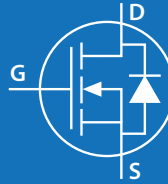


## EPC2044 – Enhancement Mode Power Transistor

$V_{DS}, 100\text{ V}$

$R_{DS(on)}, 10.5\text{ m}\Omega$

$I_D, 9.4\text{ A}$



Revised December 11, 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



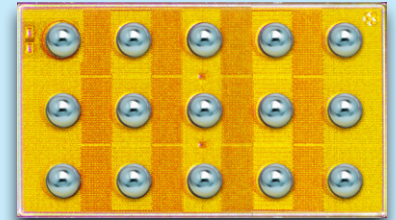
Maximum Ratings			
PARAMETER		VALUE	UNIT
$V_{DS}$	Drain-to-Source Voltage (Continuous)	100	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	120	
$I_D$	Continuous ( $T_A = 25^\circ\text{C}$ )	9.4	A
	Pulsed (25°C, $T_{PULSE} = 300\text{ }\mu\text{s}$ )	89	
$V_{GS}$	Gate-to-Source Voltage	6	V
	Gate-to-Source Voltage	-4	
$T_J$	Operating Temperature	-40 to 150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature	-40 to 150	

Thermal Characteristics			
PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	1.3	$^\circ\text{C/W}$
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	4.1	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	72	

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](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	$V_{GS} = 0\text{ V}, I_D = 0.2\text{ mA}$	100			V
$I_{DSS}$	Drain-Source Leakage	$V_{GS} = 0\text{ V}, V_{DS} = 80\text{ V}$		0.03	0.17	mA
$I_{GSS}$	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}$		0.01	0.17	
	Gate-to-Source Forward Leakage <sup>#</sup>	$V_{GS} = 5\text{ V}, T_J = 125^\circ\text{C}$		0.07	3.4	
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		0.03	0.33	
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}, I_D = 3\text{ mA}$	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}, I_D = 10\text{ A}$		7	10.5	m $\Omega$
$V_{SD}$	Source-Drain Forward Voltage <sup>#</sup>	$I_S = 0.5\text{ A}, V_{GS} = 0\text{ V}$		2.0		V

<sup>#</sup> Defined by design. Not subject to production test.



Die Size: 2.15 x 1.25 mm

EPC2044 eGaN® FETs are supplied only in passivated die form with copper pillars.

**Applications**

- 48 V servers
- Lidar/pulsed power
- Isolated power supplies
- Point of load converters
- Class-D audio
- LED lighting
- Low inductance
- Motor drive

**Benefits**

- Higher switching frequency – lower switching losses and lower drive power
- Higher Efficiency – lower conduction and switching losses, zero reverse recovery losses
- Ultra small footprint – higher power density

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



<https://l.ead.me/EPC2044>

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{ISS}$	Input Capacitance	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		503	664	pF
$C_{RSS}$	Reverse Transfer Capacitance			1.8		
$C_{OSS}$	Output Capacitance			196	294	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }50\text{ V}, V_{GS} = 0\text{ V}$		247		
$C_{OSS(TR)}$	Effective Output Capacitance, Energy Related (Note 3)			318		
$R_G$	Gate Resistance			0.5		$\Omega$
$Q_G$	Total Gate Charge	$V_{DS} = 50\text{ V}, V_{GS} = 5\text{ V}, I_D = 10\text{ A}$		4.3	5.5	nC
$Q_{GS}$	Gate-to-Source Charge	$V_{DS} = 50\text{ V}, I_D = 10\text{ A}$		1.3		
$Q_{GD}$	Gate-to-Drain Charge			0.5		
$Q_{G(TH)}$	Gate Charge at Threshold			1.0		
$Q_{OSS}$	Output Charge	$V_{DS} = 50\text{ V}, V_{GS} = 0\text{ V}$		15	23	
$Q_{RR}$	Source-Drain Recovery Charge			0		

All measurements were done with substrate connected to source.

# Defined by design. Not subject to production test.

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%  $BV_{DSS}$ .

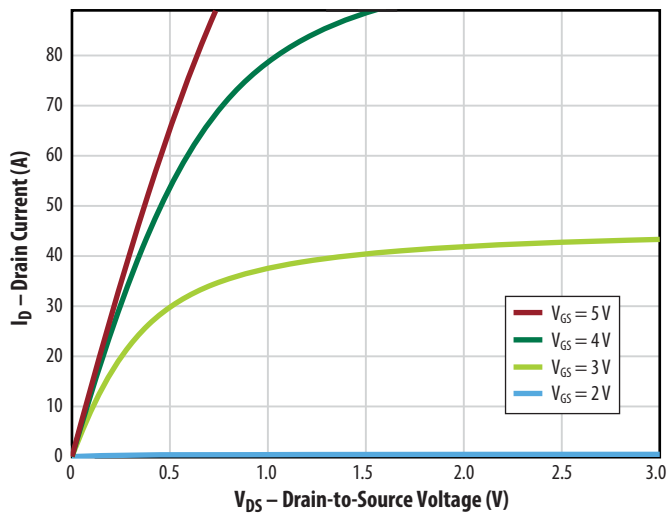
Figure 1: Typical Output Characteristics at  $25^\circ\text{C}$ 

Figure 2: Typical Transfer Characteristics

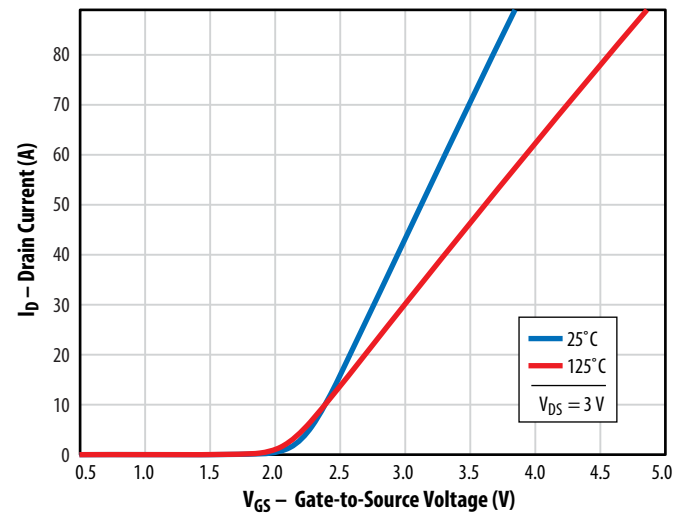
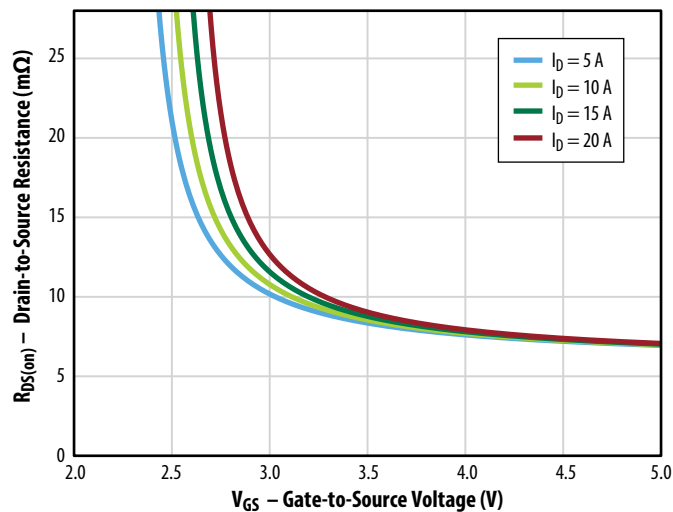
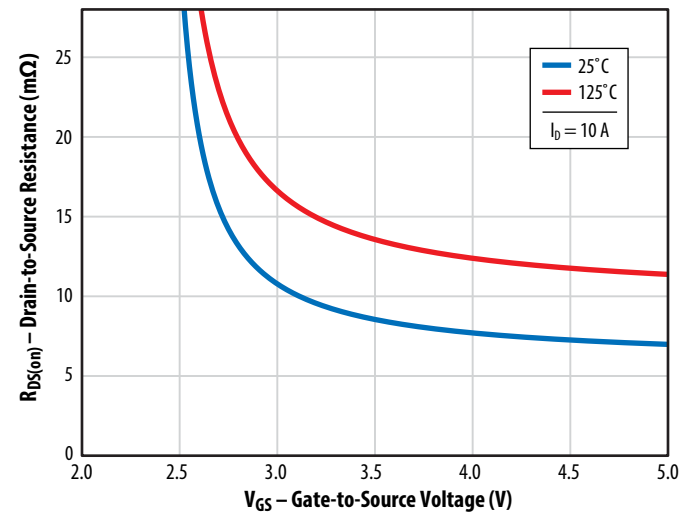
Figure 3: Typical  $R_{DS(on)}$  vs.  $V_{GS}$  for Various Drain CurrentsFigure 4: Typical  $R_{DS(on)}$  vs.  $V_{GS}$  for Various Temperatures

Figure 5a: Typical Capacitance (Linear Scale)

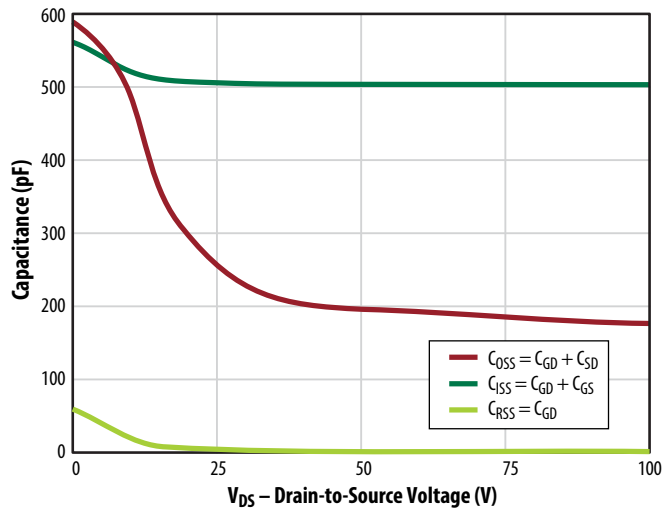


Figure 5b: Typical Capacitance (Log Scale)

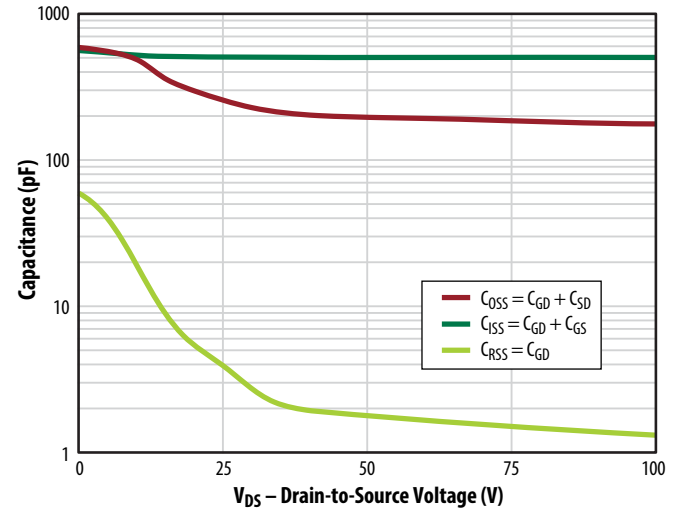
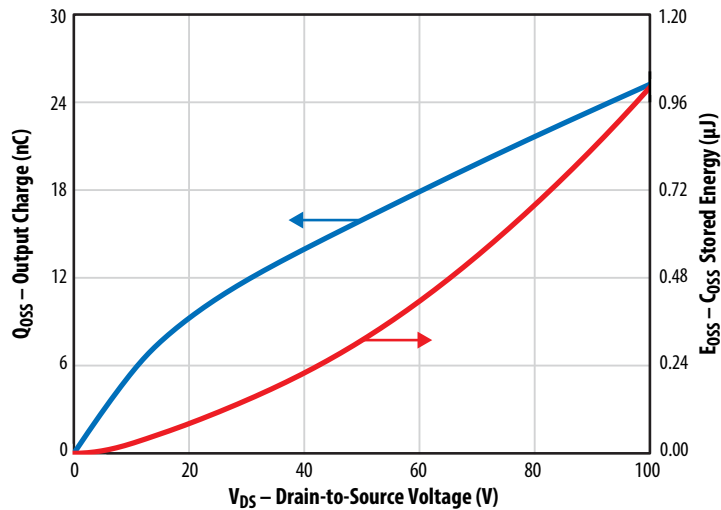
Figure 6: Typical Output Charge and  $C_{OSS}$  Stored Energy

Figure 7: Typical Gate Charge

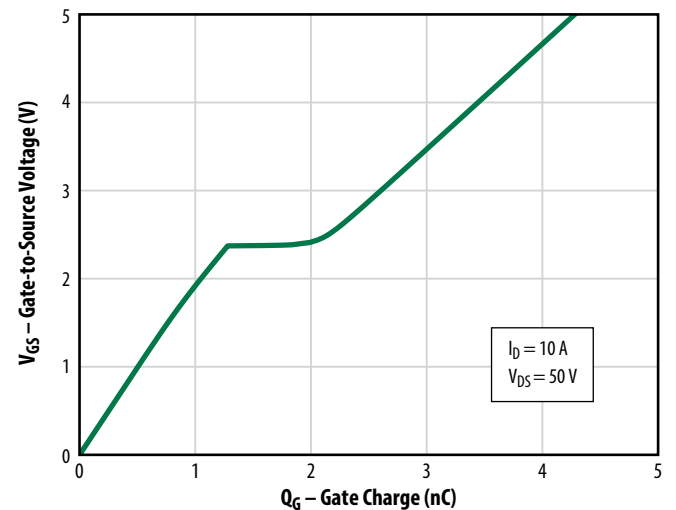


Figure 8: Typical Reverse Drain-Source Characteristics

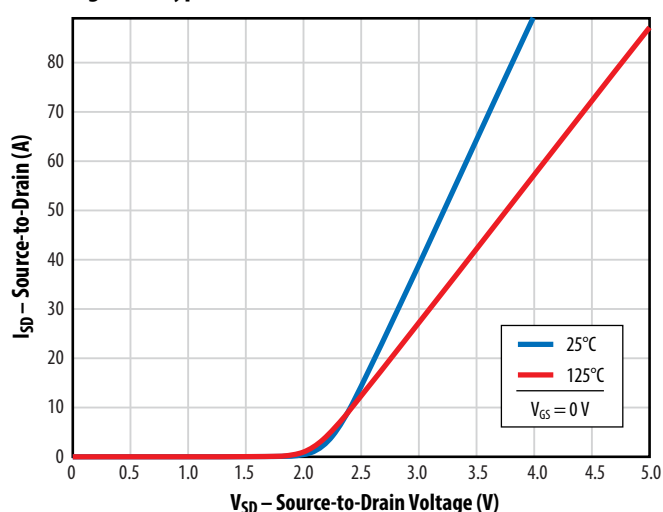
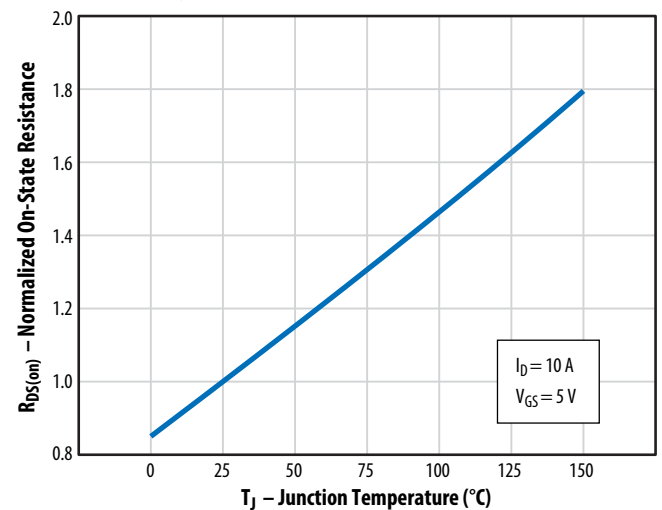


Figure 9: Typical Normalized On-State Resistance vs. Temp.



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

Figure 10: Typical Normalized Threshold Voltage vs. Temp.

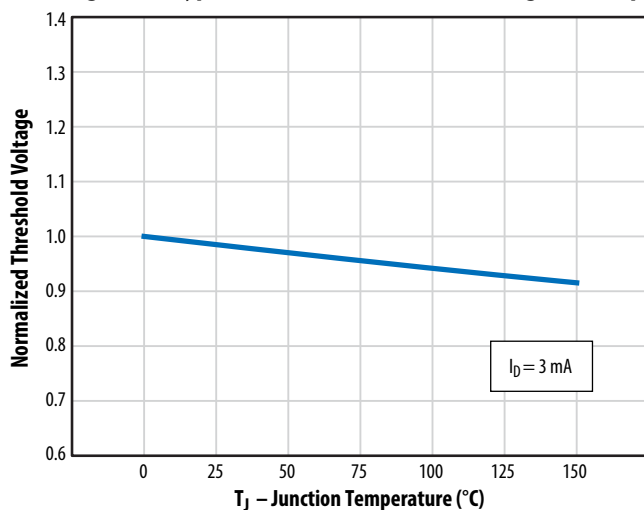


Figure 11: Typical Transient Thermal Response Curves

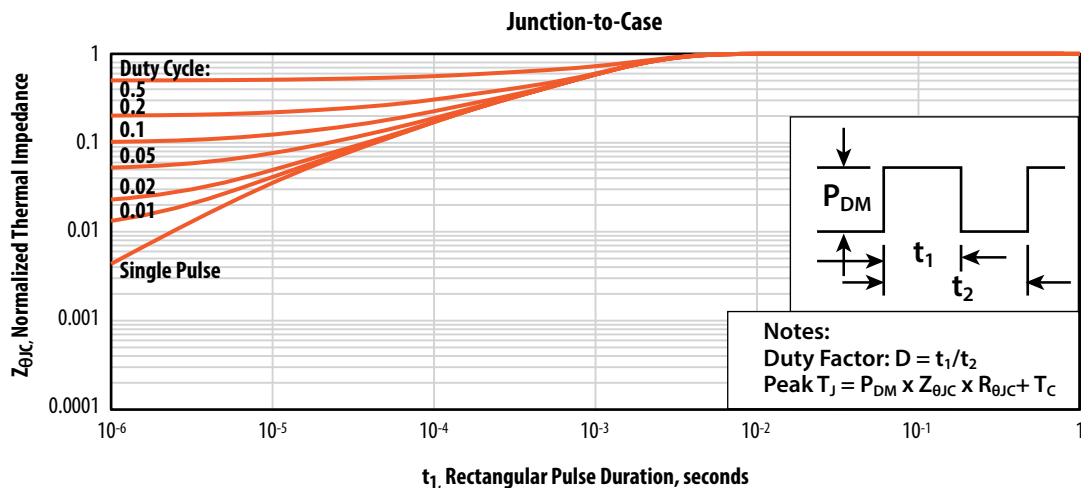
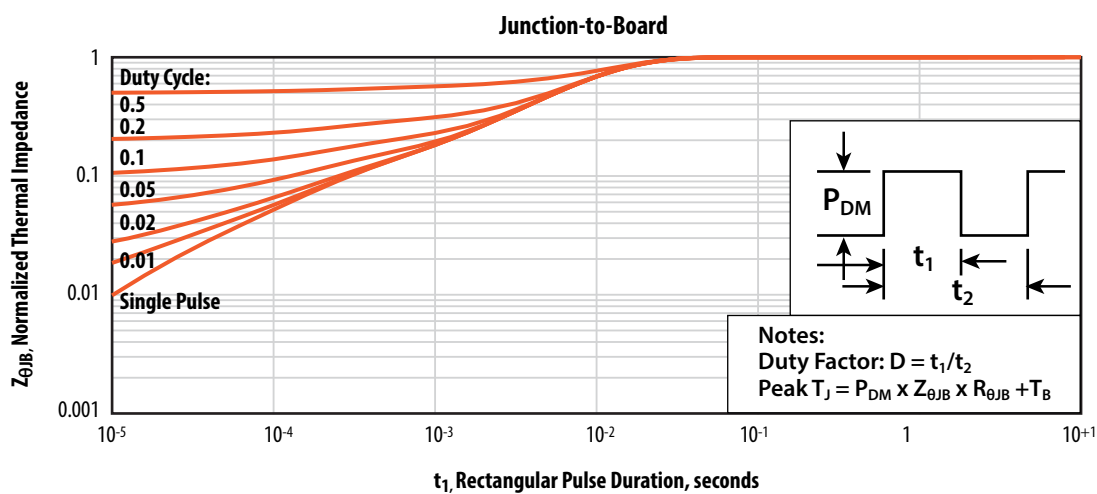
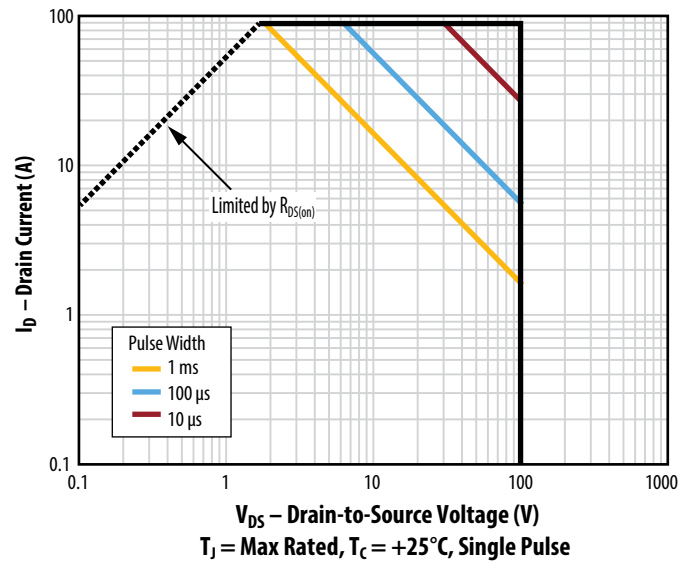


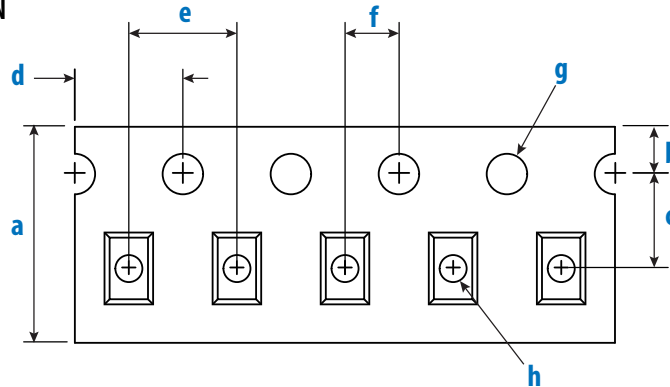
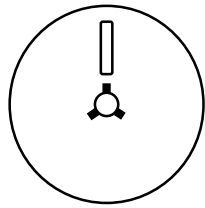
Figure 12: Safe Operating Area



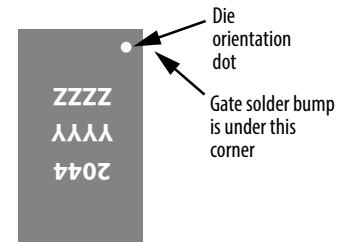
## TAPE AND REEL CONFIGURATION

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

7" inch reel



Loaded Tape Feed Direction →



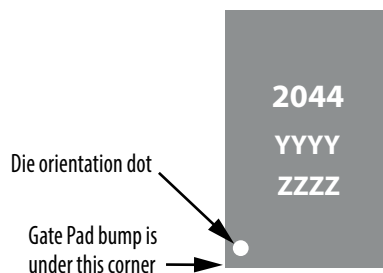
Die is placed into pocket  
solder bump side down  
(face side down)

EPC2044 (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

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.

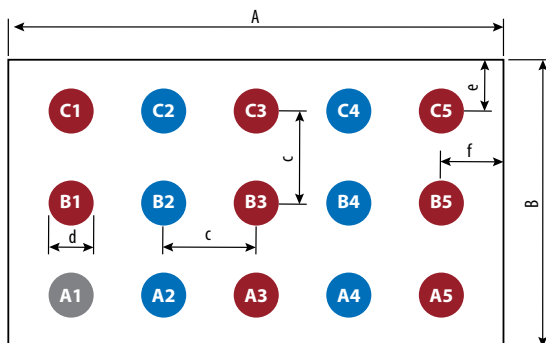
## DIE MARKINGS



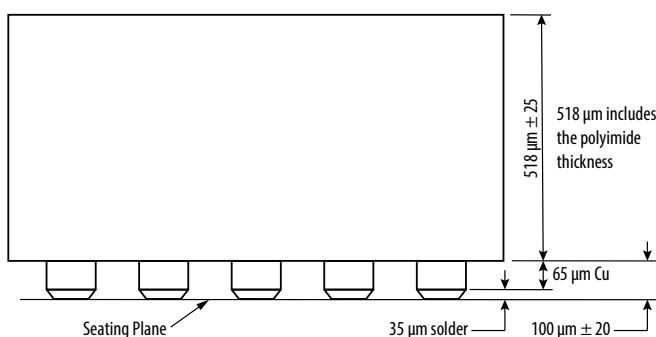
Part Number	Laser Markings		
	Part # Marking Line 1	Lot _Date Code Marking Line 2	Lot _Date Code Marking Line 3
EPC2044	2044	YYYY	ZZZZ

**DIE OUTLINE**

Solder Bar View



Side View

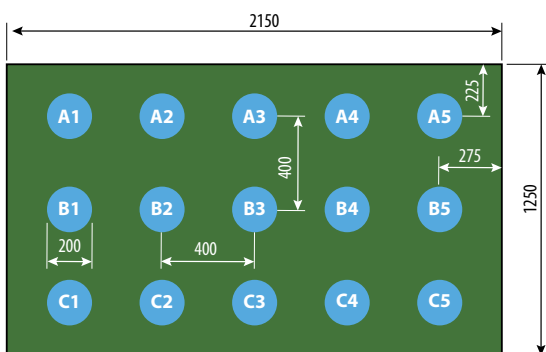


DIM	MICROMETERS		
	MIN	Nominal	MAX
A	2120	2150	2180
B	1220	1250	1280
c		400	
d	180	200	220
e	209	225	
f	259	275	

Pad A1 is Gate;

Pads B1, C1, A3, B3, C3, A5, B5, C5 are Source;

Pads A2, B2, C2, A4, B4, C4 are Drain.

**RECOMMENDED  
LAND PATTERN**(measurements in  $\mu\text{m}$ )

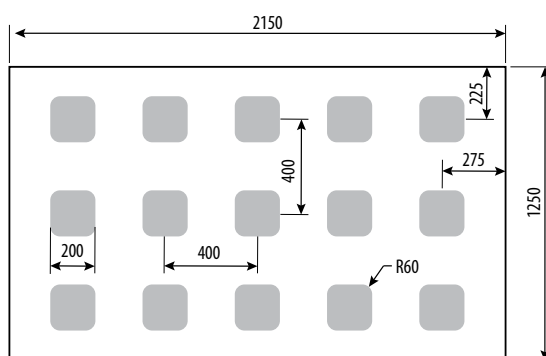
The land pattern is solder mask defined.

Pad A1 is Gate;

Pads B1, C1, A3, B3, C3, A5, B5, C5 are Source;

Pads A2, B2, C2, A4, B4, C4 are Drain.

Solder mask  
(for solder mask defined pads)

**RECOMMENDED  
STENCIL DRAWING**(units in  $\mu\text{m}$ )

Recommended stencil should be 4 mil (100  $\mu\text{m}$ ) thick, must be laser cut, opening per drawing. The corner has a radius of R60.

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

**Note:** Cu pillar dies are not intended for mounting on a PCB, they are intended for use in a package. Terms of die usage: The die represented by this data sheet are intended for initial evaluation for integration to buyer defined package. EPC does not guarantee reliability in the buyer specific package. To ensure reliability, the die may need redesign to be optimized to buyers specific package. NRE may apply.

Solder mask defined pads are recommended for best reliability.

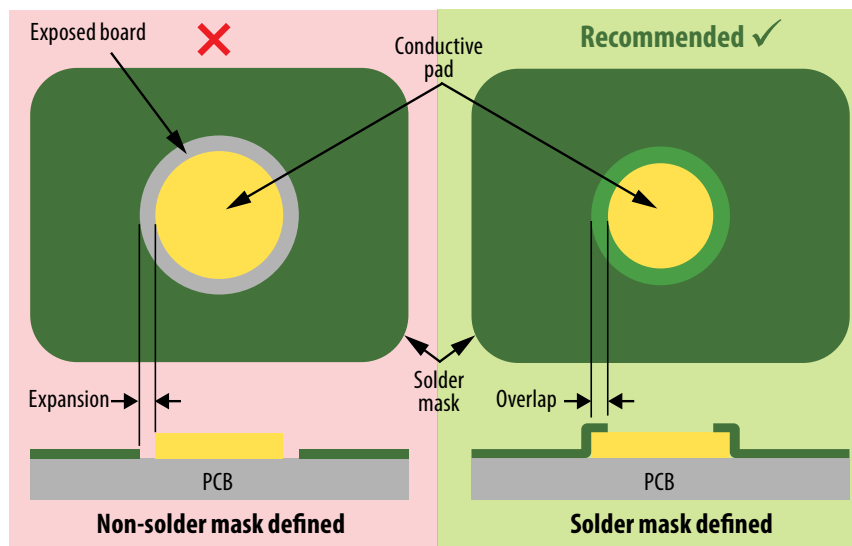


Figure 13: Solder mask defined versus non-solder mask defined pad

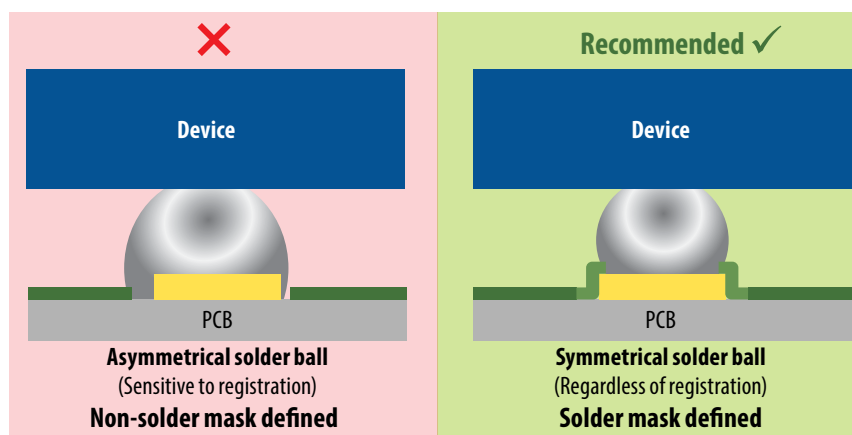


Figure 14: Effect of solder mask design on the solder ball symmetry

- Assembly resources – [https://epc-co.com/epc/Portals/0/epc/documents/product-training/Appnote\\_GaNAssembly.pdf](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)

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