

## EPC2014C – Enhancement Mode Power Transistor

 $V_{DS}$ , 40 V $R_{DS(on)}$ , 16 m $\Omega$  $I_D$ , 10 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)	40	V
	Drain-to-Source Voltage (up to 10,000 5 ms pulses at 150°C)	48	
$I_D$	Continuous ( $T_A = 25^\circ\text{C}$ , $R_{\theta JA} = 43^\circ\text{C/W}$ )	10	A
	Pulsed ( $25^\circ\text{C}$ , $T_{PULSE} = 300 \mu\text{s}$ )	60	
$V_{GS}$	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	3.6	$^\circ\text{C/W}$
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	9.3	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	80	

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	$V_{GS} = 0 \text{ V}$ , $I_D = 125 \mu\text{A}$	40			V
$I_{DSS}$	Drain-Source Leakage	$V_{GS} = 0 \text{ V}$ , $V_{DS} = 32 \text{ V}$		50	100	$\mu\text{A}$
$I_{GSS}$	Gate-to-Source Forward Leakage	$V_{GS} = 5 \text{ V}$		0.4	2	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4 \text{ V}$		50	100	$\mu\text{A}$
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$ , $I_D = 2 \text{ mA}$	0.8	1.4	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5 \text{ V}$ , $I_D = 10 \text{ A}$		12	16	m $\Omega$
$V_{SD}$	Source-Drain Forward Voltage	$I_S = 0.5 \text{ A}$ , $V_{GS} = 0 \text{ V}$		1.8		V

All measurements were done with substrate connected to source.



EPC2014C eGaN® FETs are supplied only in passivated die form with solder bumps

**Applications**

- High Frequency DC-DC conversion
- Class-D Audio
- Wireless Power Transfer
- Lidar

**Benefits**

- Ultra High Efficiency
- Ultra Low  $R_{DS(on)}$
- Ultra Low  $Q_G$
- Ultra Small Footprint

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
$C_{ISS}$	Input Capacitance	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$		220	300	pF
$C_{RSS}$	Reverse Transfer Capacitance			6.5	9.5	
$C_{OSS}$	Output Capacitance			150	210	
$R_G$	Gate Resistance			0.4		$\Omega$
$Q_G$	Total Gate Charge	$V_{DS} = 20\text{ V}, V_{GS} = 5\text{ V}, I_D = 10\text{ A}$		2	2.5	nC
$Q_{GS}$	Gate-to-Source Charge	$V_{DS} = 20\text{ V}, I_D = 10\text{ A}$		0.7		
$Q_{GD}$	Gate-to-Drain Charge			0.3	0.5	
$Q_{G(TH)}$	Gate Charge at Threshold			0.5		
$Q_{OSS}$	Output Charge	$V_{DS} = 20\text{ V}, V_{GS} = 0\text{ V}$		4	6	
$Q_{RR}$	Source-Drain Recovery Charge			0		

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

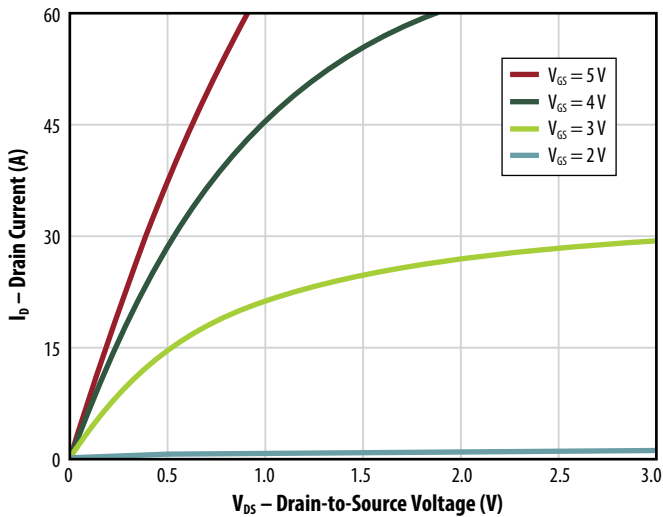


Figure 2: Transfer Characteristics

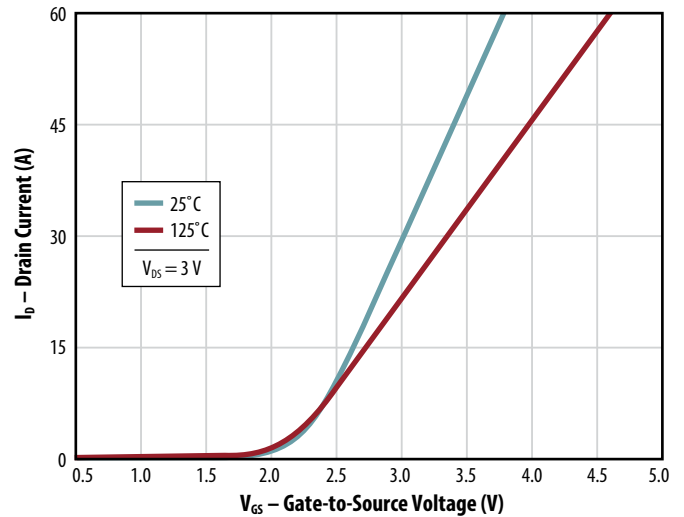


Figure 3:  $R_{DS(on)}$  vs.  $V_{GS}$  for Various Drain Currents

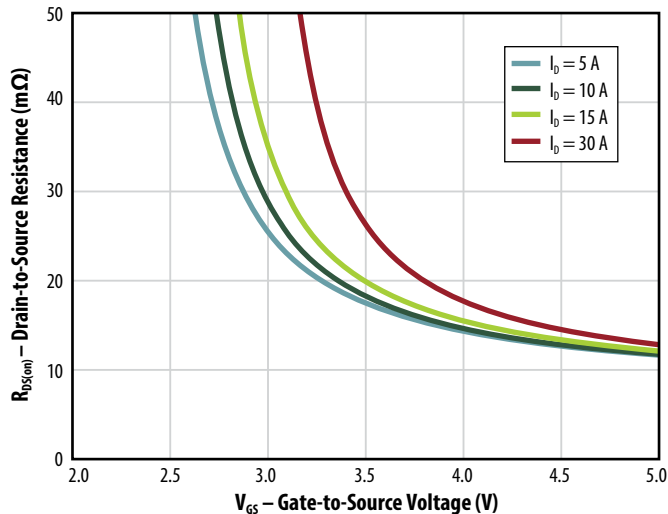


Figure 4:  $R_{DS(on)}$  vs.  $V_{GS}$  for Various Temperatures

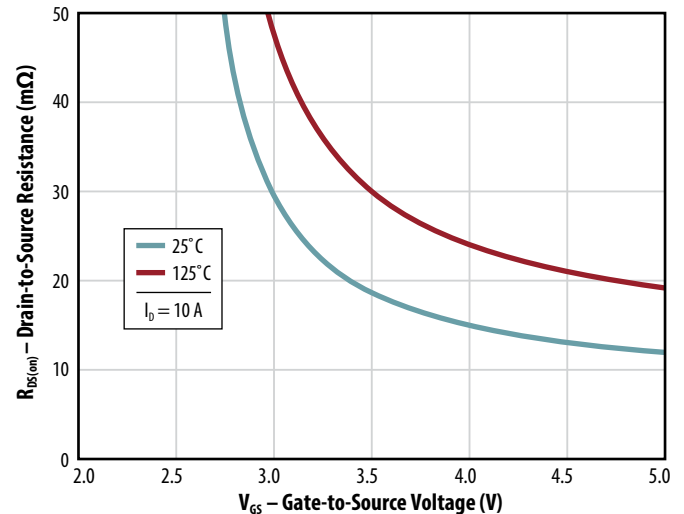


Figure 5a: Capacitance

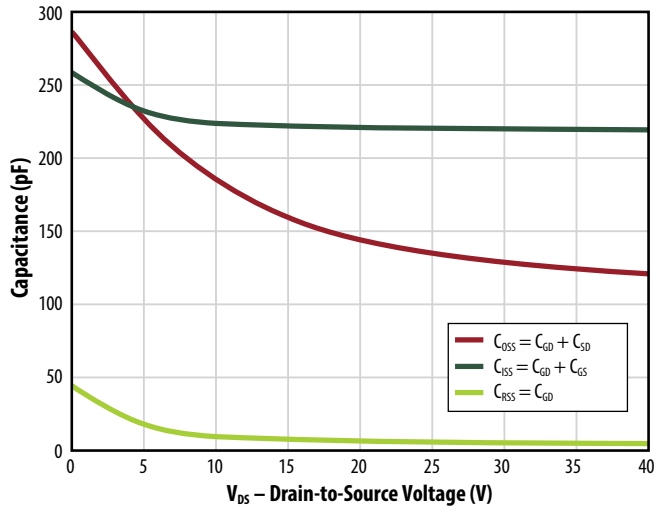


Figure 5b: Capacitance

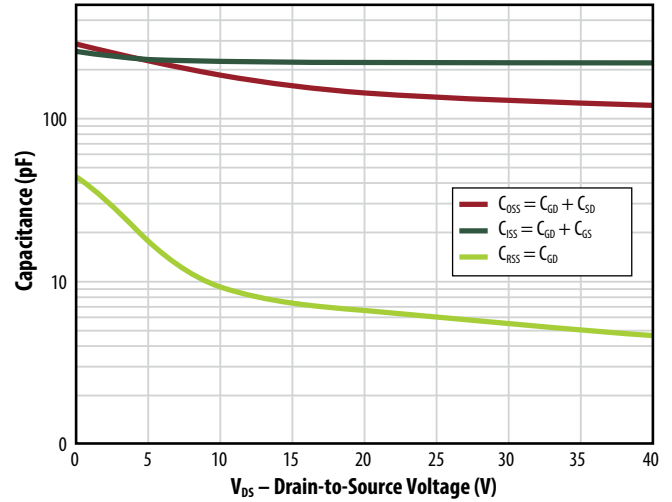


Figure 6: Gate Charge

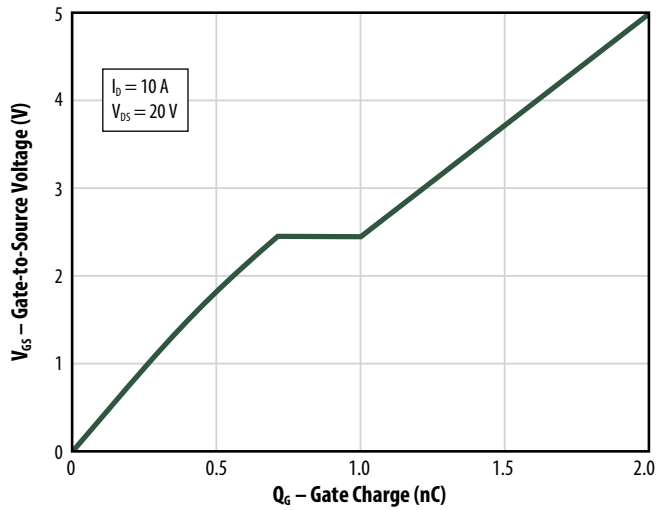


Figure 7: Reverse Drain-Source Characteristics

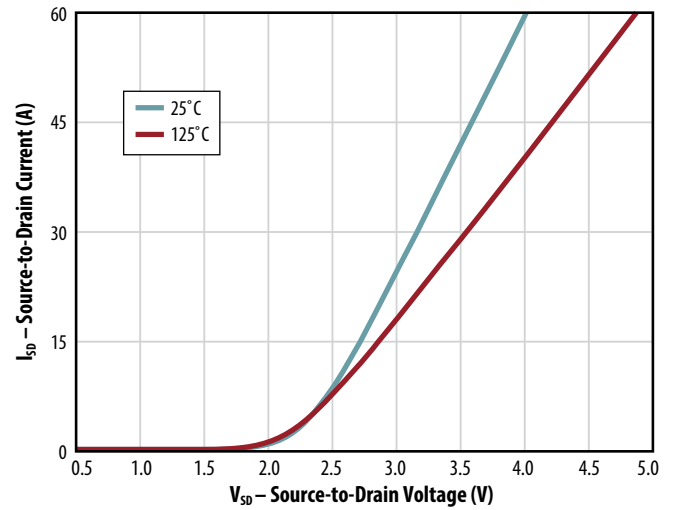


Figure 8: Normalized On Resistance vs. Temperature

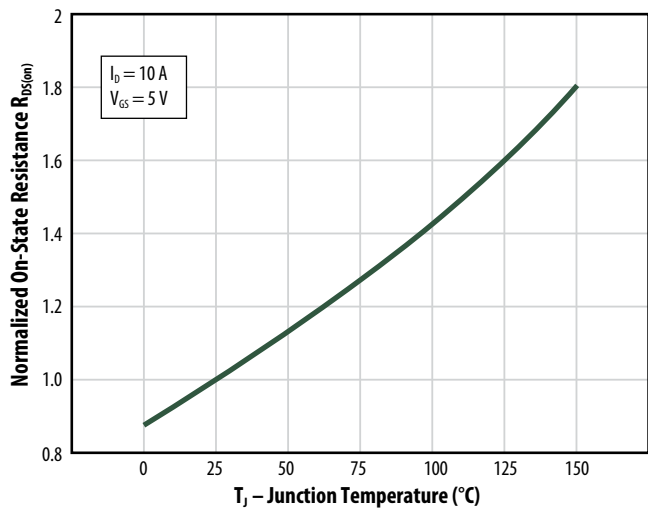
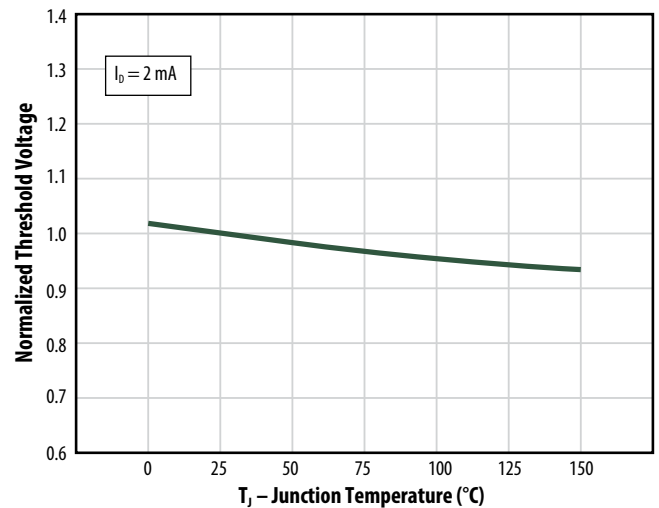


Figure 9: Normalized Threshold Voltage vs. Temperature



All measurements were done with substrate shorted to source.

Figure 10: Gate Current

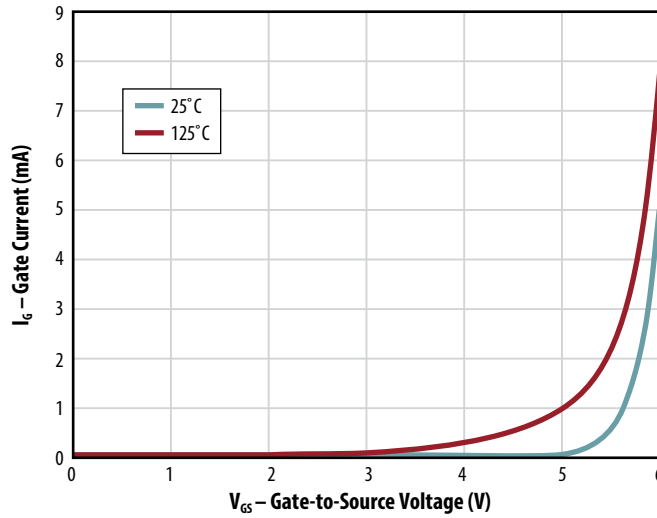


Figure 11: Transient Thermal Response Curves

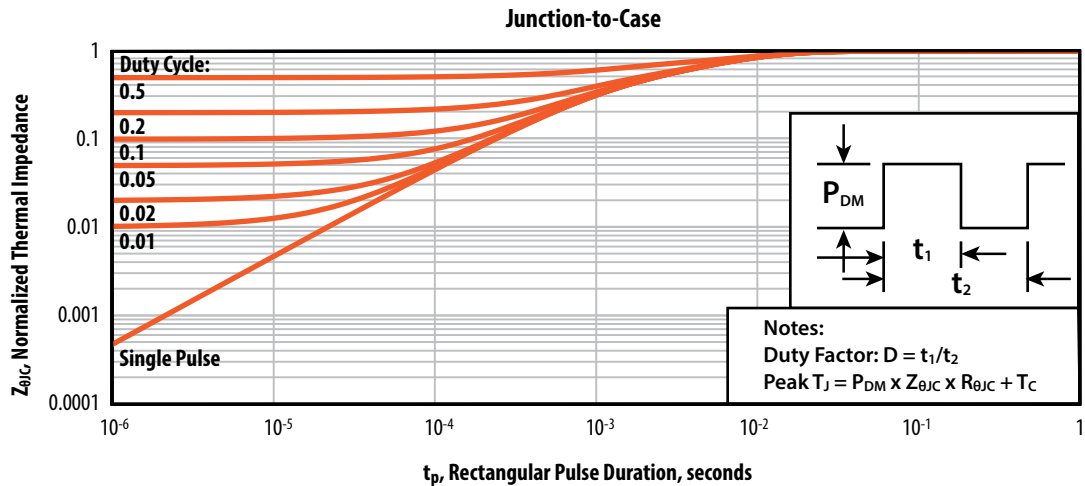
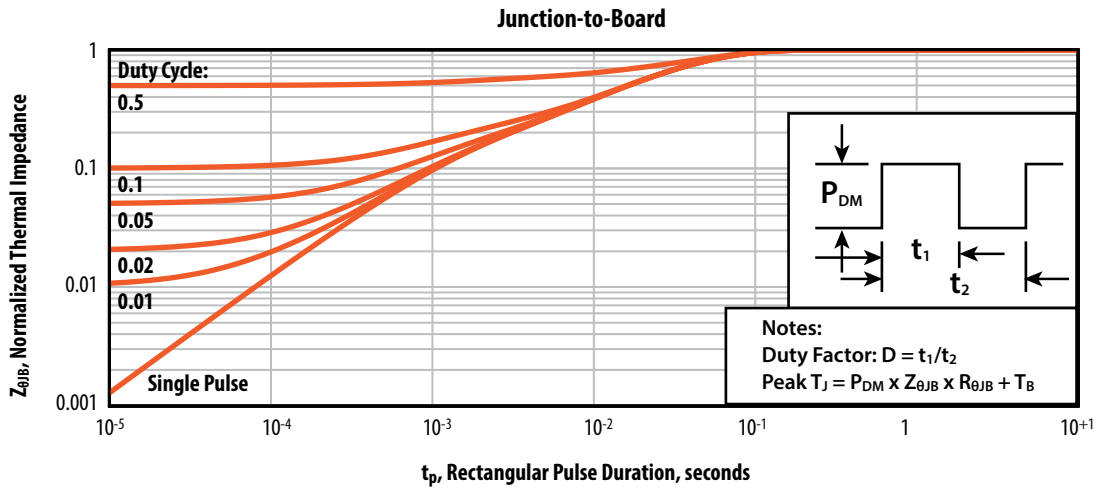
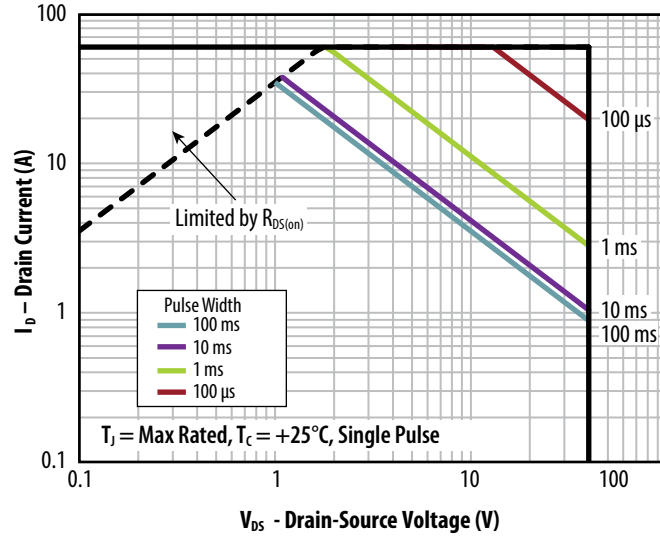
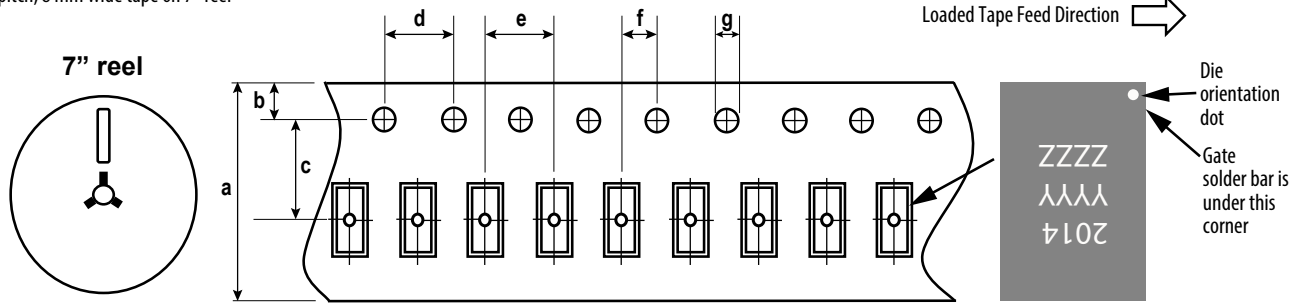


Figure 12: Safe Operating Area



**TAPE AND REEL CONFIGURATION**

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

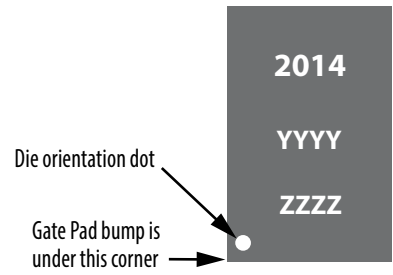


Dimension (mm)	EPC2014C (note 1)		
	target	min	max
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (note 2)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (note 2)	2.00	1.95	2.05
g	1.5	1.5	1.6

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

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.

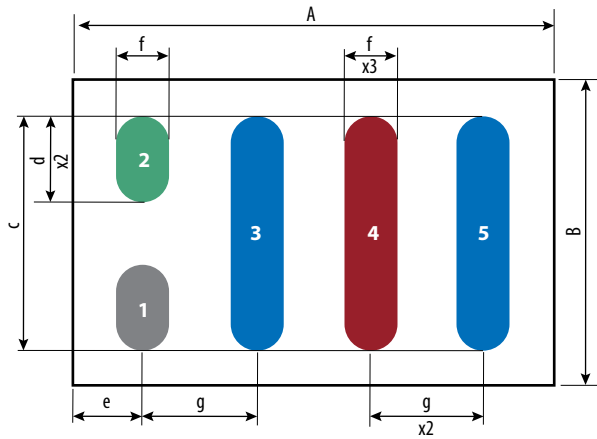
**DIE MARKINGS**



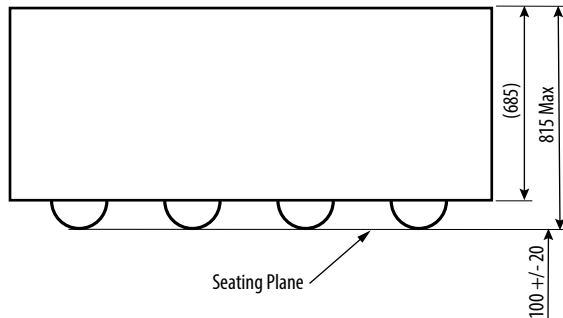
Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking line 2	Lot_Date Code Marking Line 3
EPC2014C	2014	YYYY	ZZZZ

**DIE OUTLINE**

Solder Bar View



Side View



DIM	MICROMETERS		
	MIN	Nominal	MAX
A	1672	1702	1732
B	1057	1087	1117
c	829	834	839
d	311	316	321
e	235	250	265
f	195	200	205
g	400	400	400

Pad no. 1 is Gate;

Pad no. 2 is Substrate;\*

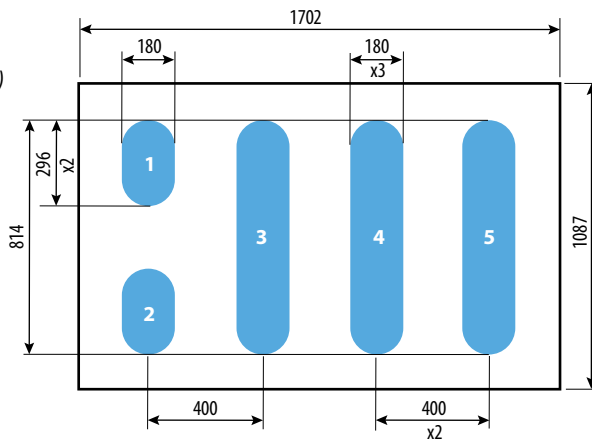
Pads no. 3 and 5 are Drain;

Pad no. 4 is Source

\*Substrate pin should be connected to Source

**RECOMMENDED LAND PATTERN**

(measurements in  $\mu\text{m}$ )



The land pattern is solder mask defined

Solder mask is 10  $\mu\text{m}$  smaller per side than bump

Pad no. 1 is Gate;

Pad no. 2 is Substrate;\*

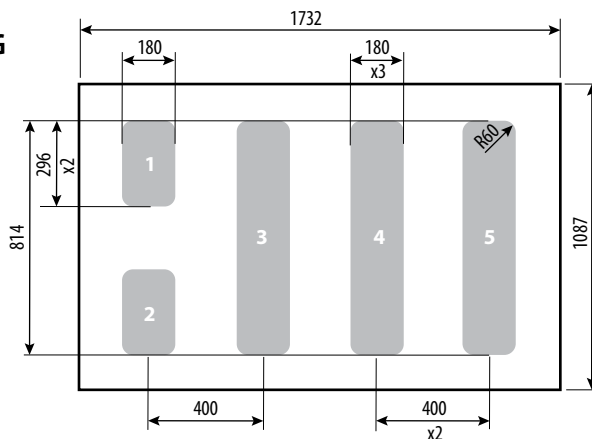
Pads no. 3 and 5 are Drain;

Pad no. 4 is Source

\*Substrate pin should be connected to Source

**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 3 solder,

reference 88.5% metals content.

Additional assembly resources available at

<https://www.epc-co.com/epc/DesignSupport/AssemblyBasics.aspx>

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