

EPC2039 – Enhancement Mode Power Transistor

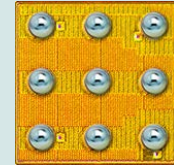
 $V_{DSS}, 80\text{ V}$ $R_{DS(on)}, 25\text{ m}\Omega$ $I_D, 6.8\text{ A}$ 

RoHS



Halogen-Free

Gallium Nitride is grown on Silicon Wafers and processed using standard CMOS equipment leveraging the infrastructure that has been developed over the last 60 years. GaN'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.



EPC2039 eGaN® FETs are supplied only in passivated die form with solder bumps
Die Size: 1.35 mm x 1.35 mm

Applications

- High Speed DC-DC conversion
- Wireless Power Transfer
- LiDAR/Pulsed Power Applications

Benefits

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

www.epc-co.com/epc/Products/eGaNfets/EPC2039.aspx

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 ($T_A = 25^\circ\text{C}$, $R_{\theta JA} = 70^\circ\text{C/W}$)	6.8	A
	Pulsed (25°C , $T_{PULSE} = 300\ \mu\text{s}$)	50	
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	

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
BV_{DSS}	Drain-to-Source Voltage	$V_{GS} = 0\text{ V}$, $I_D = 300\ \mu\text{A}$	80			V
I_{DSS}	Drain-Source Leakage	$V_{DS} = 64\text{ V}$, $V_{GS} = 0\text{ V}$		20	250	μA
I_{GSS}	Gate-to-Source Forward Leakage	$V_{GS} = 5\text{ V}$		0.2	2	mA
	Gate-to-Source Reverse Leakage	$V_{GS} = -4\text{ V}$		20	250	μA
$V_{GS(TH)}$	Gate Threshold Voltage	$V_{DS} = V_{GS}$, $I_D = 2\text{ mA}$	0.8	1.6	2.5	V
$R_{DS(on)}$	Drain-Source On Resistance	$V_{GS} = 5\text{ V}$, $I_D = 6\text{ A}$		20	25	$\text{m}\Omega$
V_{SD}	Source-Drain Forward Voltage	$I_S = 0.5\text{ A}$, $V_{GS} = 0\text{ V}$		2.5		V

All measurements were done with substrate shorted to source.

Thermal Characteristics

PARAMETER		TYP	UNIT
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case	3	°C/W
$R_{\theta JB}$	Thermal Resistance, Junction-to-Board	28	
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient (Note 1)	81	

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

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

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
C_{ISS}	Input Capacitance	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$		210	260	pF
C_{RSS}	Reverse Transfer Capacitance			2		
C_{OSS}	Output Capacitance			115	175	
$C_{OSS(ER)}$	Effective Output Capacitance, Energy Related (Note 2)	$V_{DS} = 0\text{ to }100\text{ V}, V_{GS} = 0\text{ V}$		155		pF
$C_{OSS(TR)}$	Effective Output Capacitance, Time Related (Note 3)			190		
R_G	Gate Resistance			0.5		Ω
Q_G	Total Gate Charge	$V_{DS} = 40\text{ V}, V_{GS} = 5\text{ V}, I_D = 6\text{ A}$		1910	2370	pC
Q_{GS}	Gate to Source Charge	$V_{DS} = 40\text{ V}, I_D = 6\text{ A}$		760		
Q_{GD}	Gate to Drain Charge			420		
$Q_{G(TH)}$	Gate Charge at Threshold			560		
Q_{OSS}	Output Charge	$V_{DS} = 40\text{ V}, V_{GS} = 0\text{ V}$		7640	11500	
Q_{RR}	Source-Drain Recovery Charge			0		

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

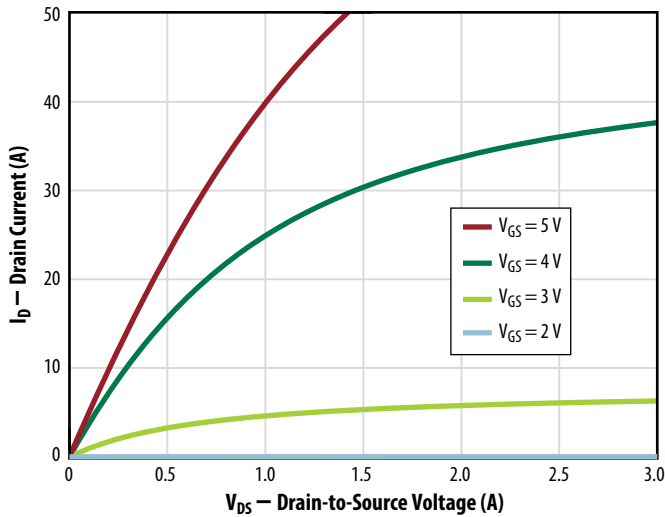


Figure 2: Transfer Characteristics

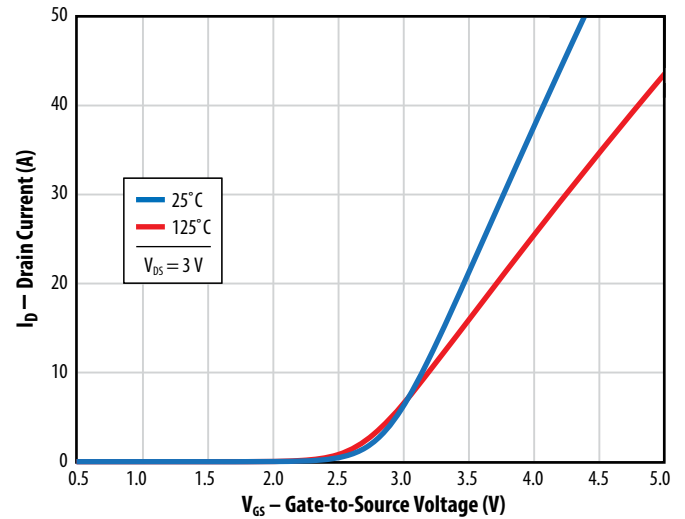


Figure 3: $R_{DS(on)}$ vs. V_{GS} for Various Drain Currents

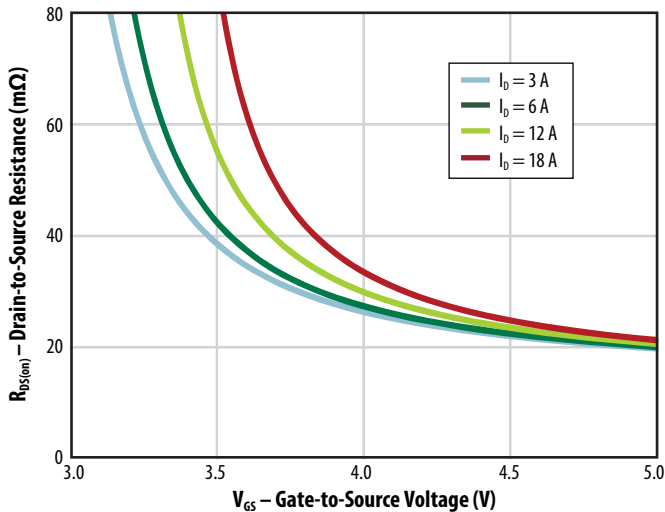


Figure 4: $R_{DS(on)}$ vs. V_{GS} for Various Temperatures

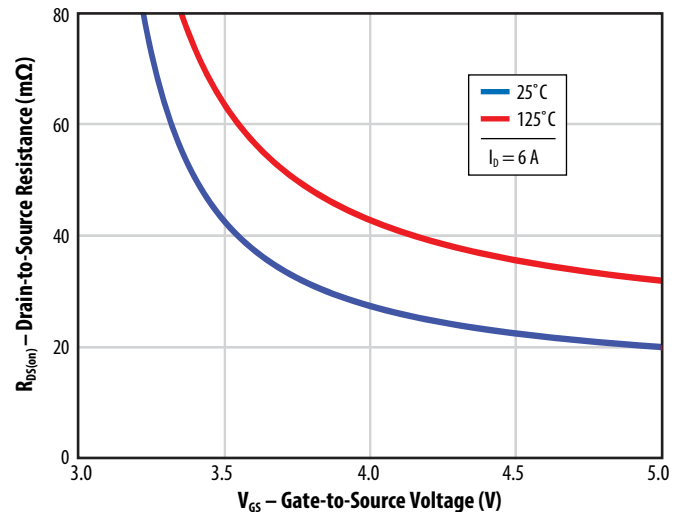


Figure 5a: Capacitance (Linear Scale)

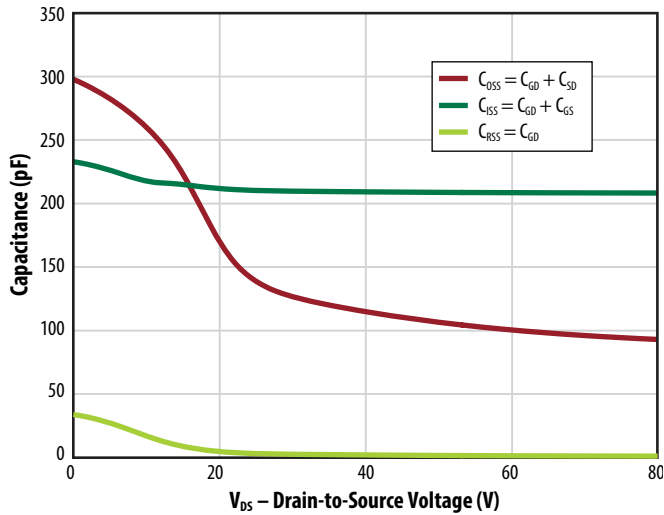


Figure 5b: Capacitance (Log Scale)

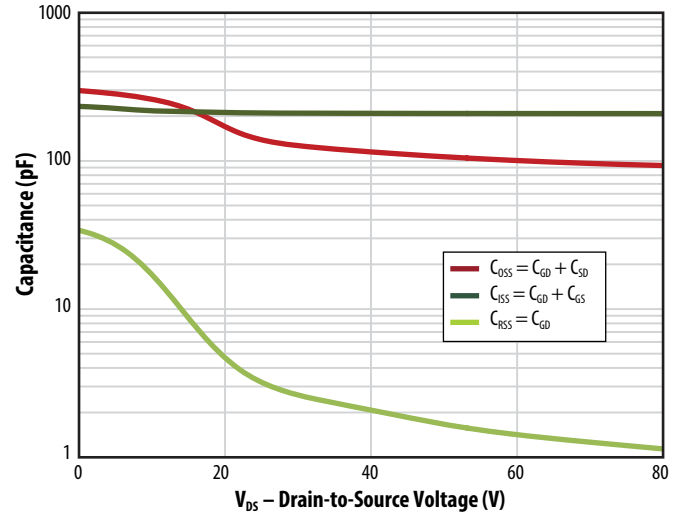


Figure 6: Gate Charge

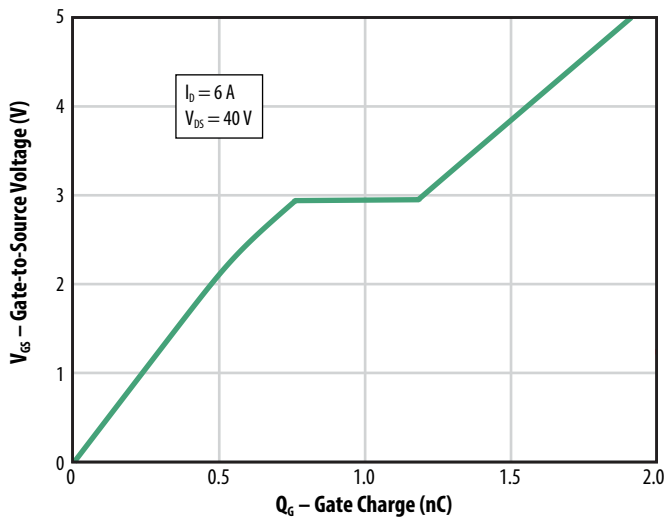


Figure 7: Reverse Drain-Source Characteristics

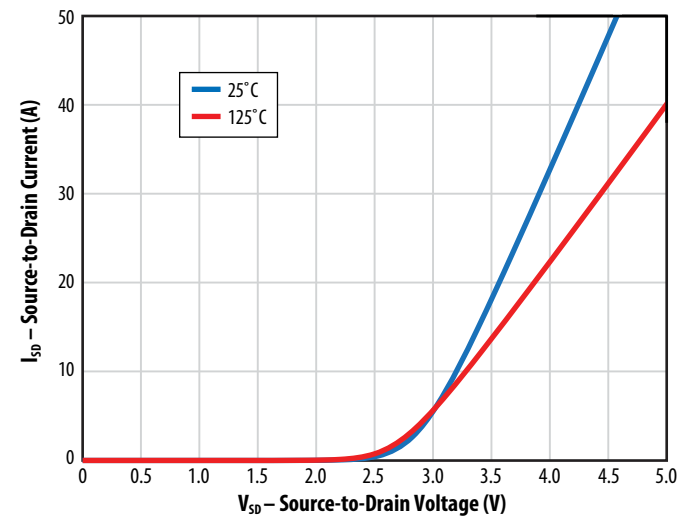


Figure 8: Normalized On Resistance vs. Temperature

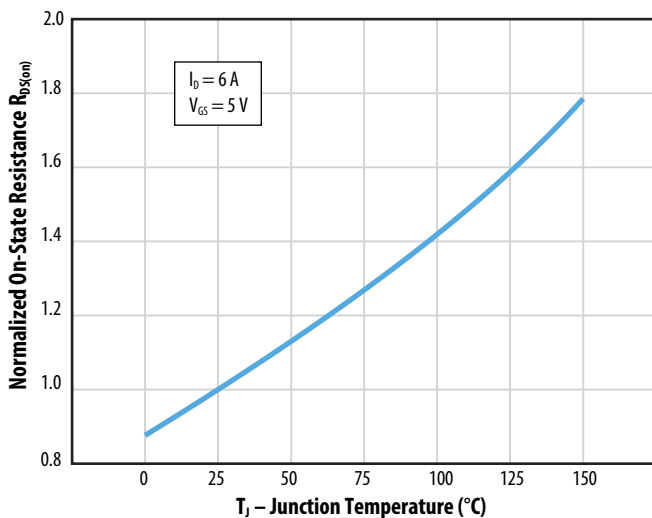
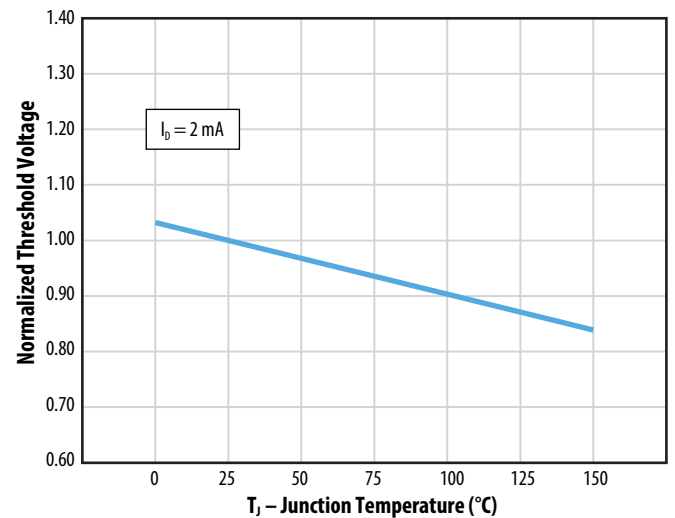


Figure 9: Normalized Threshold Voltage vs. Temperature



All measurements were done with substrate shorted to source.

Figure 10: Transient Thermal Response Curves

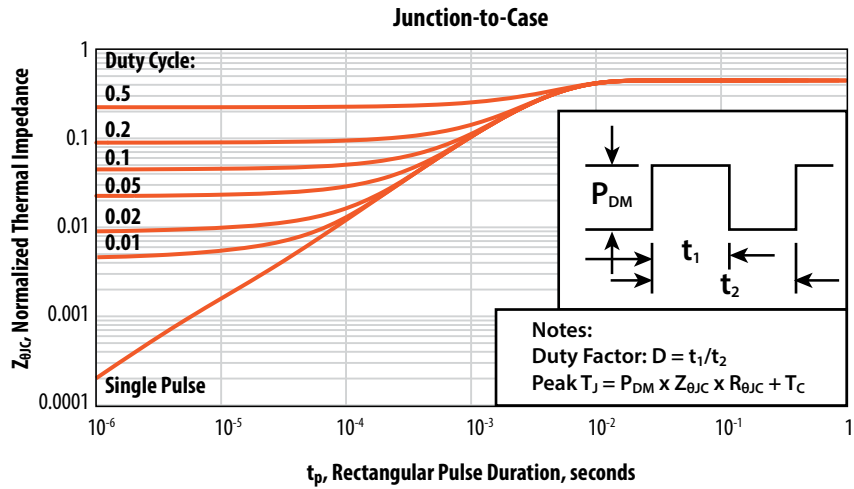
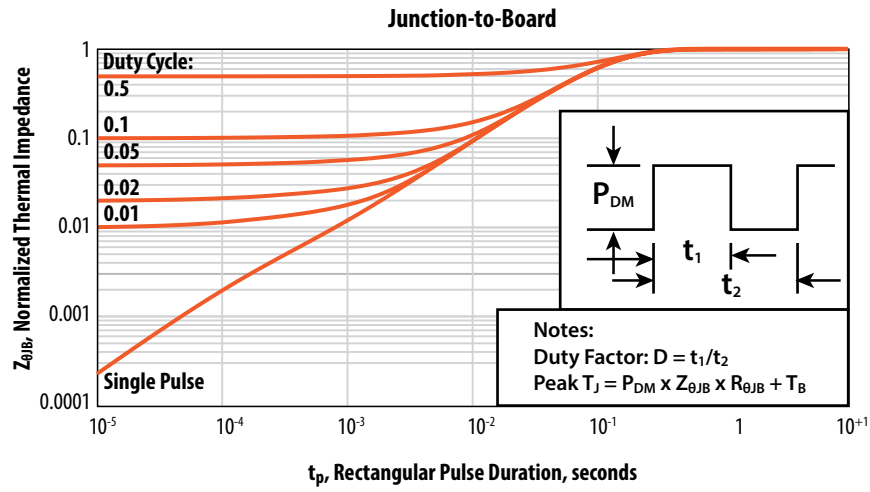
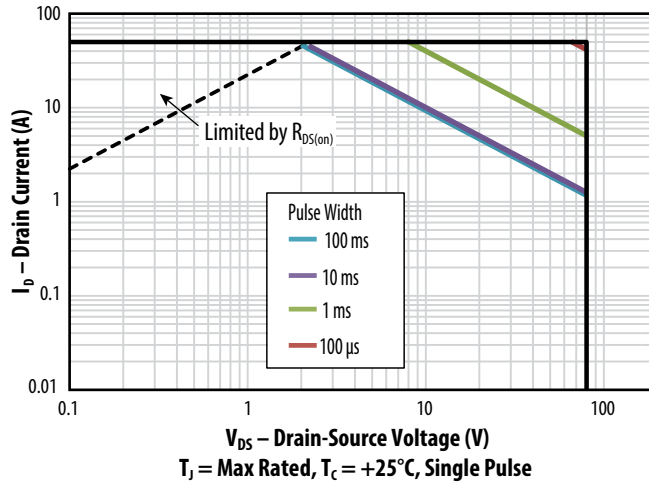
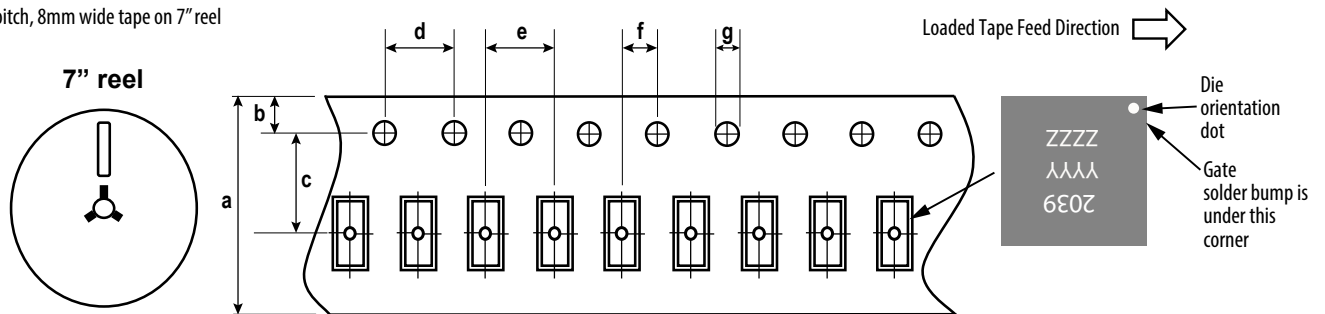


Figure 11: Safe Operating Area



TAPE AND REEL CONFIGURATION

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

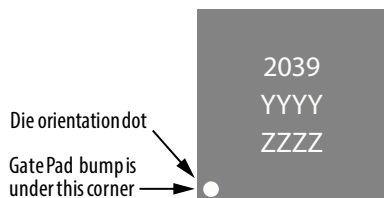


Die is placed into pocket solder bump side down (face side down)

Dimension (mm)	EPC2039 (note 1)		
	target	min	max
a	8.00	7.90	8.30
b	1.75	1.65	1.85
c (see note)	3.50	3.45	3.55
d	4.00	3.90	4.10
e	4.00	3.90	4.10
f (see note)	2.00	1.95	2.05
g	1.5	1.5	1.6

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.

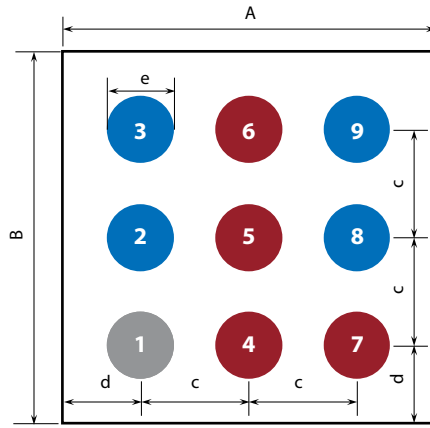
DIE MARKINGS



Part Number	Laser Markings		
	Part # Marking Line 1	Lot_Date Code Marking Line 2	Lot_Date Code Marking Line 3
EPC2039	2039	YYYY	ZZZZ

DIE OUTLINE

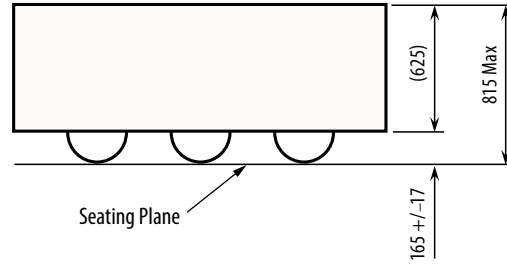
Solder Bump View



Pad 1 is Gate;
 Pads 4, 5, 6, 7 are Drain;
 Pads 2, 3, 8, 9 are Source

DIM	Micrometers		
	MIN	Nominal	MAX
A	1320	1350	1380
B	1320	1350	1380
C	450	450	450
D	210	225	240
E	187	208	229

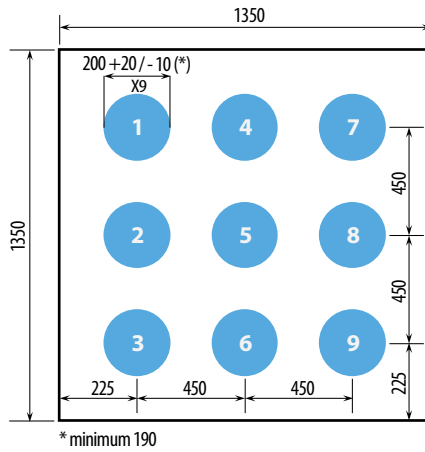
Side View



RECOMMENDED

LAND PATTERN

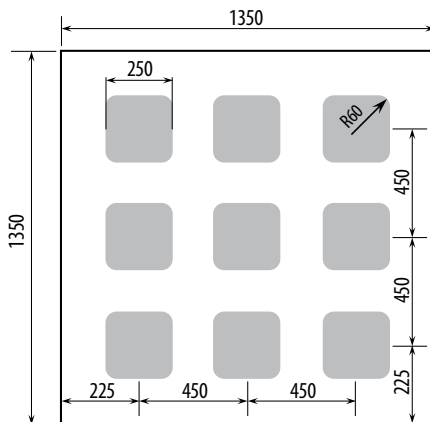
(measurements in μm)



The land pattern is solder mask defined
 Solder mask is 10 μm smaller per side than bump

RECOMMENDED
STENCIL DRAWING

(measurements in μm)



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

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

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

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Information subject to change without notice.

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